National Park Service
U.S. Department of the Interior

Crater Lake National Park
Crater Lake, Oregon 97604

Crater Lake National Park

Wildland Fire Management Plan

September 2004

2010 Annual Update

An NPS Fire Effects Monitor collects data on a prescribed burn at Crater Lake National Park

Crater Lake National Park
Wildland Fire Management Plan

Compilation Date: October 2002 – September 2004

Reviewed:

_____ _____
Brad Reed Date
Fire Management Officer

_____ _____
Mac Brock Date
Chief, Resource Preservation and Research

_____ _____
Marsha McCabe Date
Chief, Interpretation & Cultural Resources

Recommended:

_____ _____
David Brennan Date
Chief, Resource & Visitor Protection

Approved:

_____ _____
Charles V. Lundy Date
Superintendent

Annual Fire Management Plan Review and Update
For Crater Lake National Park *ver.3-19-07*

The National Park Service (NPS) Director's Order (DO) 18, Wildland Fire Management, and the subsequent Reference Manual (RM) 18 provide wildland fire management guidelines. DO 18 states that "every park area with burnable vegetation must have a fire management plan approved by the Superintendent." Chapter 4 of RM 18 requires each NPS unit to review and update their fire management plan (FMP) annually, stating that "an annual updater is essential to ensure that the FMP continues to conform to current laws, objectives, procedures, and strategies."

Plan review and updates are intended to keep the fire management plan current; changes in terminology and cooperative agreements, and modifications of multi-year treatment plans are examples of appropriate annual revisions to a fire management plan using this plan review and update format.

The updates identified in this document will become effective upon signature by the NPS unit Superintendent. The updated information should be incorporated into the Park unit's FMP, and records kept in the park files. Please send a copy of this completed and signed document to the Pacific West Regional Fire Management Officer.

A comprehensive Fire Management Plan revision and NEPA compliance review of this plan is required every 5 years (DO 18, chapter 4). Thorough annual updates will facilitate this comprehensive revision. **The FMP for Crater Lake National Park was originally approved in September 2004. In September 2009, this plan and supporting NEPA compliance work will be comprehensively reviewed.**

Directions. Please review the following in the NPS unit FMP. If no updates are required, please check "no update"; if updates are required, please check "update included here", and identify the specific update(s) in the space provided. Some items may require discussions with park resources management personnel.

Terminology updates/revisions
_____ No update
___X___ Update included here:

- Changed terminology from Minimum Impact Suppression Techniques (MIST) to Minimum Impact Tactics (MIT)
- Removed references to Weather Information Management System (WIMS) or replaced with National Weather Service (NWS) for smoke forecasts.
- Changed references to SACS to either Wildland Fire Management Information (WFMI) or Fire Program Analysis (FPA) as appropriate.
- Replaced reference document from Wildland Fire Management Policy Guide to Wildland Fire Use implementation procedures reference guide.
- Change qualifications terminology to reflect current PMS310-1 changes.

Policy Change
_____ No update
___X___ Update included here (does this require additional compliance work?):

- **Update does not require additional compliance work.**
- Replace reference text for NPS Management Policy to reflect 2006 wording.
- Incorporated wording to reflect potential impacts from actions on wildland fire use fires.

Step-up Staffing Plan (Section IV. B 2 e. of the FMP)
_____ No update
___X__ Update included here:

- Staffing plan updated to incorporate NFDRS compliant RAWS station.
- Replaced reference to Panhandle RAWS to Seldom RAWS.
- Ensured Crosswalk between stations was reflective of park fire danger and management concerns. Previous step up plan used a non NFDRS compliant station on an unrepresentative site (lower, hotter, drier, and sheltered).
- Incorporated the 2003 South Central Oregon Fire Danger Operating Plan into step up levels. Step up levels now correspond with dispatch levels and climatological break points.

Delegation of Authority (Section IV. B 5 d. of the FMP)
_____ No update
___X__ Update included here:

- Updated incoming Incident Commander Delegation to include helispot improvement concerns in the preattack plan.

Wildland Fire Use (Section IV. C of the FMP)
_____ No update
____X__ Review to insure policies/procedures in this FMP are up to date with the newly approved "Wildland Fire Use – Implementation Procedures Reference Guide". Also, see Appendix B in the Guide, the WFU preplanning section.
_____ Update included here:

- See above

Organizational Responsibilities (Section V. A, and Appendix E. 1, 2 of FMP)
____X_ No update
_____ Update included here:

Agreements/Coordination/Contracts (Sections V. E, F, G, and Appendices E. 3, J and K of FMP)
_____ No update
____X_ Update included here:

- Annual South Central Oregon Fire Management Partnership (SCOFMP) operating plan is signed.

Multi-year Treatment Plan (Appendix H of the FMP)
___X__ No update
_____ Update included here:

Preattack Plan (Appendix G)
_____ No update
____X_ Update included here:

- Delegation of authority is current for Type 2 and 1 IC's, template is updated

Other Updates
___X__ No update
_____ Update included here:

Compliance (answer the next 4 questions yes or no; if any of the answers are 'yes', an update to compliance is necessary)

____ Do any of the above updates result in changes to the selected alternative in the original NEPA decision document for the FMP (FONSI, ROD or CE documentation)?

____ Have there been substantive changes in the environmental conditions evaluated in the original compliance document?

____ Are there new regulatory/policy requirements not considered in the original compliance document?

____ Do any of the above updates require new or additional agency consultation relative to Section 106 of NHPA or Section 7 of ESA?

___X__ No update
_____ Update included here (please attach a copy of the Environmental Screening Form):

Prepared by: _____ Date: _____
Fire Management Officer

Approved by: _____ Date: _____
Superintendent

2009
Fire Management Plan
Review and Update
Crater Lake National Park

This annual review of the Fire Management Plan (FMP) is a requirement of NPS Reference Manual – 18 (Wildland Fire Management), as specified in Chapter 4, stating that "an annual review is essential to ensure that the FMP continues to conform to current laws, objectives, procedures, and strategies." In addition, the 2009 Interagency Standards for Fire and Fire Aviation Operations states that the Park Superintendent will "identify resource management objectives to maintain a current FMP that identifies an accurate and defensible normal year readiness of funding and personnel". The activities defined in the FMP will be implemented in accordance with agency and departmental policy, including recent procedural updates contained in the following documents:

- ∞ Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide (September 2006)
- ∞ Wildland Fire Use Implementation Procedures Reference Guide (May 2005, as amended in March 2006)
- ∞ Interagency Standards for Fire and Fire Aviation Operations (January 2009)
- ∞ Federal Fire and Aviation Operations – 2007 Action Plan (Spring 2007)

The review and update process is intended to keep the FMP as current as possible. Changes in the step-up plan, terminology, cooperative agreements, and adjustments to the multi-year treatment plan are examples of appropriate revisions to a FMP using this review and update format. The updates identified in this document will become effective upon signature by the Park Superintendent.

Terminology Updates and Revisions

_____ No update
___x___ Update included here:

Terminology was updated throughout the Fire Management Plan to reflect the changes outlined in the *Guidance for Implementation of Federal Wildland Fire Management Policy* (February 13, 2009). Updated definitions of wildland fire terminology can be found in Appendix 13B. Primary changes include;

- Replacement of "wildland fire use" with "use of wildland fire."
- Replacement of "initial attack" with "initial response."
- "Suppression" replaced with "management."
- Replacement of "appropriate management response" with "fire management response."
- "Fire Use Manager" replaced with "Strategic Operational Planner."

Wildland Fire Management Strategies (Chapter 3)

_____ No update
___x___ Update included here:

The Wildland Fire Decision Support System (WFDSS) became available as a fire management decision analysis tool during the 2008 fire season. The 2009 FMP update adds WFDSS as an optional tool in addition to the approved Wildland Fire Situation Analysis (WFSA) and Wildland Fire Implementation Plan (WFIP). WFDSS will be the required decision analysis tool beginning in the 2010 fire season.

2009 Federal Wildland Fire Policy allows wildland fire to be concurrently managed for one or more objectives and objectives can change as the fire spreads across the landscape. Objectives are affected by changes in fuels, weather, topography; varying social understanding and tolerance; and involvement of other governmental jurisdictions having different missions and objectives.

Aerial ignition is now specified as a prescribed fire ignition technique.

Wildland Fire Management Program Components (Chapter 4)

_____ No update
___x___ Update included here:

WFDSS has been added as an optional fire management tool. The WFDSS process is described in detail and a flowchart added for clarification of the process.

Clarification of manual fuel treatments described. Manual fuel reduction in wilderness may be possible if determined to be the "minimum tool."

Step-up Plan (Chapter 4)

The Step-up Plan should include:

- **Accurate break-points between preparedness (staffing) levels**
- **Description of actions to be taken at each preparedness (staffing) levels**

___x___ No update
_____ Update included here:

Multi-year Fuels Treatment Plan (Appendix H)

___x___ No update
_____ Update included here:

Organizational Responsibilities (Chapter 5)

_____ No update
__x____ Update included here:

Update reflects changes in the structure of the fire management staff.

The Fire Ecologist and Prescribed Fire Specialist are shared positions with the Klamath Network.

The fire management budget is allocated through the National Fire Plan. Fire Pro funding has been changed to National Fire Plan Funding and a description of Fire Program Analysis (FPA) has been added to the FMP.

Pre-attack Plan (Appendix 13.G)

The park should ensure the following documents are in place for 2009:

- **Rental Equipment Agreements (including Service and Supply Plan)**
- **Contracts for Wildland Fire Suppression and Prescribed Fire Resources**
- **Fire Call-up list**
- **Agreements, Annual Operating Plans, and related local interagency coordination documents**
- **Delegation of Authority (as specified on page 03-2 in Interagency Standards for Fire and Fire Aviation Operations) from the Park Superintendent to Appropriate Individual(s) for wildland fire activities and operations**

_____ No update
__x____ Documents have been reviewed, updated, and are on file at the park.

Compliance (Appendix 13.D)

Confirm that the following three (3) environmental compliance documents are still valid:

- **NEPA**
  - **CE, EA, or EIS**
  - **Decision Document (CE, FONSI, or ROD)**
- **NHPA**
  - **Section 106**
  - **Concurrence letter from SHPO**
- **ESA**
  - **Section 7**
  - **Concurrence letter from USFWS for informal consultation or signed Biological Opinion from USFWS for formal consultation**

NOTE: If major changes in the wildland fire and/or fuels management program have occurred that do not conform to the existing environmental compliance documents, then the FMP may be suspended and a new compliance process required.

___x___ No update
_____ Update included here:

Additional Updates to Appendixes:

_____ No update
__x____ Update included here:

Appendix 13.B: Definitions
All definitions updated to meet 2009 Federal Wildland Fire Policy.

Appendix 13.D.2: Biological Assessment
Addition of the January 16, 2009 Extension Letter to the 2002 USF&WS Biological Opinion.

Appendix 13.M: Resource Advisor Guide
Addition of the stand alone Resource Advisor Guide implemented in 2007.

Appendix 13.R: WFDSS Template
New appendix added for the implementation of WFDSS.

Appendix 13.S: Guidance for Implementation of Federal Fire Policy
New appendix describes changes to Federal Fire Policies.

2009
Fire Management Plan Review and Update

Prepared by: _____ _____
Fire Management Officer Date

Approved by: _____ _____
Superintendent Date

2010
Fire Management Plan
Review and Update
Crater Lake National Park

This annual review of the Fire Management Plan (FMP) is a requirement of NPS Reference Manual – 18 (Wildland Fire Management), as specified in Chapter 4, stating that "an annual review is essential to ensure that the FMP continues to conform to current laws, objectives, procedures, and strategies." In addition, the 2009 Interagency Standards for Fire and Fire Aviation Operations states that the Park Superintendent will "identify resource management objectives to maintain a current FMP that identifies an accurate and defensible normal year readiness of funding and personnel". The activities defined in the FMP will be implemented in accordance with agency and departmental policy, including recent procedural updates contained in the following documents:

- Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide (September 2006)
- Wildland Fire Use Implementation Procedures Reference Guide (May 2005, as amended in March 2006)
- Interagency Standards for Fire and Fire Aviation Operations (January 2009)
- Federal Fire and Aviation Operations – 2007 Action Plan (Spring 2007)

The review and update process is intended to keep the FMP as current as possible. Changes in the step-up plan, terminology, cooperative agreements, and adjustments to the multi-year treatment plan are examples of appropriate revisions to a FMP using this review and update format. The updates identified in this document will become effective upon signature by the Park Superintendent.

Please review the following items from the FMP. If no updates are required, please indicate so; if updates are needed, please identify the specific update(s) in the space provided. This new information should be incorporated directly into the FMP as well as being included in this form. You are encouraged to include park resources management staff in this review process. Please send an e-copy of the review template, as well as a fax copy of the signature page to Robin Wills, Region Fire Ecologist, 510/817-1487.

Terminology Updates and Revisions

_____ No update
___x___ Update included here:

Terminology was updated throughout the Fire Management Plan to reflect the changes outlined in the *Guidance for Implementation of Federal Wildland Fire Management Policy* (February 13, 2009). Updated definitions of wildland fire terminology can be found in Appendix 13B.

Wildland Fire Management Strategies (Chapter 3)

_____ No update
___x___ Update included here:

The 2010 FMP update identifies the Wildland Fire Decision Support System (WFDSS) as the only fire management decision analysis tool available to NPS fire managers.

Organizational Responsibilities (Chapter 4)

___x___ No update
_____ Update included here:

Step-up Plan (Chapter 4)

The Step-up Plan should include:

- **Accurate break-points between preparedness (staffing) levels**
- **Description of actions to be taken at each preparedness (staffing) levels**

___x___ No update
_____ Update included here:

Protection of Sensitive Resources (Chapter 10)

_____ No update
___x___ Update included here:

The 2010 FMP update includes Annie Creek as USF&WS proposed Critical Habitat for Bull Trout.

Compliance (Appendix 13.D)

Confirm that the following three (3) environmental compliance documents are still valid:

- **NEPA**
  - **CE, EA, or EIS**
  - **Decision Document (CE, FONSI, or ROD)**
- **NHPA**
  - **Section 106**
  - **Concurrence letter from SHPO**
- **ESA**
  - **Section 7**
  - **Concurrence letter from USFWS for informal consultation or signed Biological Opinion from USFWS for formal consultation**

NOTE: If major changes in the wildland fire and/or fuels management program have occurred that do not conform to the existing environmental compliance documents, then the FMP may be suspended and a new compliance process required.

_____ No update

_x_____ Update included here:

The United States Fish and Wildlife Service granted an extension of the Biological Opinion through December 2010.

Pre-attack Plan (Appendix 13.G)
The park should ensure the following documents are in place for 2010:

- **Rental Equipment Agreements (including Service and Supply Plan)**
- **Contracts for Wildland Fire Suppression and Prescribed Fire Resources**
- **Fire Call-up list**
- **Agreements, Annual Operating Plans, and related local interagency coordination documents**
- **Delegation of Authority (as specified on page 03-2 in Interagency Standards for Fire and Fire Aviation Operations) from the Park Superintendent to Appropriate Individual(s) for wildland fire activities and operations**

_____ No update
__x____ Documents have been reviewed, updated, and are on file at the park.

Multi-year Fuels Treatment Plan (Appendix 13.H)
_____ No update
___x___ Update included here:

Multi-year fuels treatment plan amended to reflect changes due to the completion and postponement of projects, new fire effects information, prioritization of projects, and extension of the plan through 2014.

Fire Prevention Plan (Appendix 13.I)
_____ No update
___x___ Update included here:

Addition of Public Fire Use Restriction and Closure Procedures

2010
Fire Management Plan Review and Update

Prepared by: _____ 7/8/2010
Fire Management Officer Date

Approved by: _____ 7/8/10
Superintendent Date

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Chapter 1

Introduction

This document defines a program of wildland and prescribed fire management for Crater Lake National Park. It describes objectives and tasks covering a five year timeframe for utilizing the benefits of fire to achieve desired natural and cultural resource conditions, while also protecting park resources and adjacent lands and values at risk from the negative impacts of fire. The safety of firefighters and the public are the highest priority throughout the plan.

1.1 Background

Crater Lake National Park was established on May 22, 1902 and is the nation's sixth oldest national park. The park was created to insure the preservation of Crater Lake and its natural surroundings. The area is characterized by a long history of volcanic and glacial activity, and Crater Lake itself lies within the six-mile-wide caldera created by the eruption and collapse of Mt. Mazama about 7,700 years ago.

The park is located in the southern Cascade Mountains of Oregon and contains 183,224 acres. A 1974 National Park Service (NPS) wilderness proposal recommended wilderness designation for 122,400 acres of lands within the park. This proposal was transmitted to Congress for consideration as legislation, but has not been acted on. In 1994, park management recommended that 179,737 acres be included in an expanded wilderness proposal, but this recommendation has not become a formal wilderness proposal. Although none of the park has been officially designated as wilderness through legislation, the park currently manages these 179,737 acres as wilderness.

The park is bounded on the north by the Umpqua National Forest, on the northeast, east, and south by the Winema National Forest, on the southwest, west, and northwest by the Rogue River National Forest and Sky Lakes Wilderness Area. In addition, the park adjoins Sun Pass State Forest and an 80-acre block of private land on the southeastern corner (See Figure 1-1). These lands are managed for a variety of uses, including timber, grazing, watershed protection, recreation and wilderness.

1.2 Purpose and Need for this Plan

Fire regimes at Crater Lake National Park are similar to other forested areas in the southern portion of the Cascade Range with comparable plant communities and topography. Effective fire suppression at Crater Lake National Park for over a century has increased live and dead woody fuel accumulation on the forest floor and within the forest stands. Fire exclusion has unnaturally altered the landscape in some forest ecosystems. In the absence of fire, many forest communities have advanced successionally. This advancement has lead to greater stand densities, more insect/disease infestations, and greater tree mortality. In some cases, multi-storied conditions have formed continuous vertical fuel ladders. When combined with increased woody fuel, vertical fuel ladders increase the likelihood of extensive and possibly uncontrollable crown fires.

The NPS Wildland and Prescribed Fire Management Policy (DO-18, RM-18) directs that "all units with vegetation capable of sustaining fire will develop a Fire Management Plan". The purpose of this plan is to define and guide a program of wildland fire management that utilizes the benefits of fire to achieve desired natural and cultural resource conditions. This plan also describes how the program seeks to minimize the danger to the public, park resources, and adjacent lands from destructive fires resulting from hazardous fuel accumulations.

This plan will implement wildland fire management policies and help achieve resource management and fire management goals as defined in: 1) Federal Wildland Fire Management Policy and Program Review; 2) Managing Impacts of Wildfires on Communities and the Environment, and Protecting People and Sustaining Resources in Fire Adapted Ecosystems – A Cohesive Strategy; and 3) A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan(http://frames.nbii.gov).

1.3 Compliance

This plan has been prepared in compliance with:

- The National Environmental Policy Act (NEPA) of 1969 [42 United States Code (USC) 4321 et seq.], which requires an environmental analysis for major federal actions having the potential to impact the quality of the human environment.
- The National Historic Preservation Act (NHPA) (16 USC 470), which requires protection of historic properties significant to the Nation's heritage.
- The Wilderness Act (16 USC 1131 et seq.), because the park manages areas proposed for wilderness designation or that are potential wilderness.

- The Endangered Species Act of 1973 (ESA) [19 U.S.C. 1536 (c), 50 CFR 402], since this federal action involves several federally listed species and designated critical habitat.

This plan was developed over the course of four years with internal and external interdisciplinary input, and reviewed by appropriate subject matter experts in collaboration with adjacent communities, interest groups, state and federal agencies, and tribal governments within and adjacent to Klamath County, Oregon. This plan describes the implementation of the actions approved in the Environmental Assessment for Crater Lake National Park Fire Management Plan (DOI 2002) and the Crater Lake National Park Fire Management Plan Environmental Assessment - Finding of No Significant Impact (DOI 2003).

14 Legal Authorities for this Plan

The management of NPS programs is guided by the Constitution, public laws, treaties, proclamations, executive orders, regulations, and directives of the Secretary of the Interior and the Assistant Secretary for Fish, Wildlife and Parks.

NPS policy guidelines, planning documents, and actions plans, such as this Fire Management Plan, must be consistent with these higher authorities, and with appropriate delegations of authority. Authority to implement this plan is found in 16 USC 1 through 4 (National Park Service Organic Act), and delegations of authority found in Part 245 of the Department of the Interior Manual.

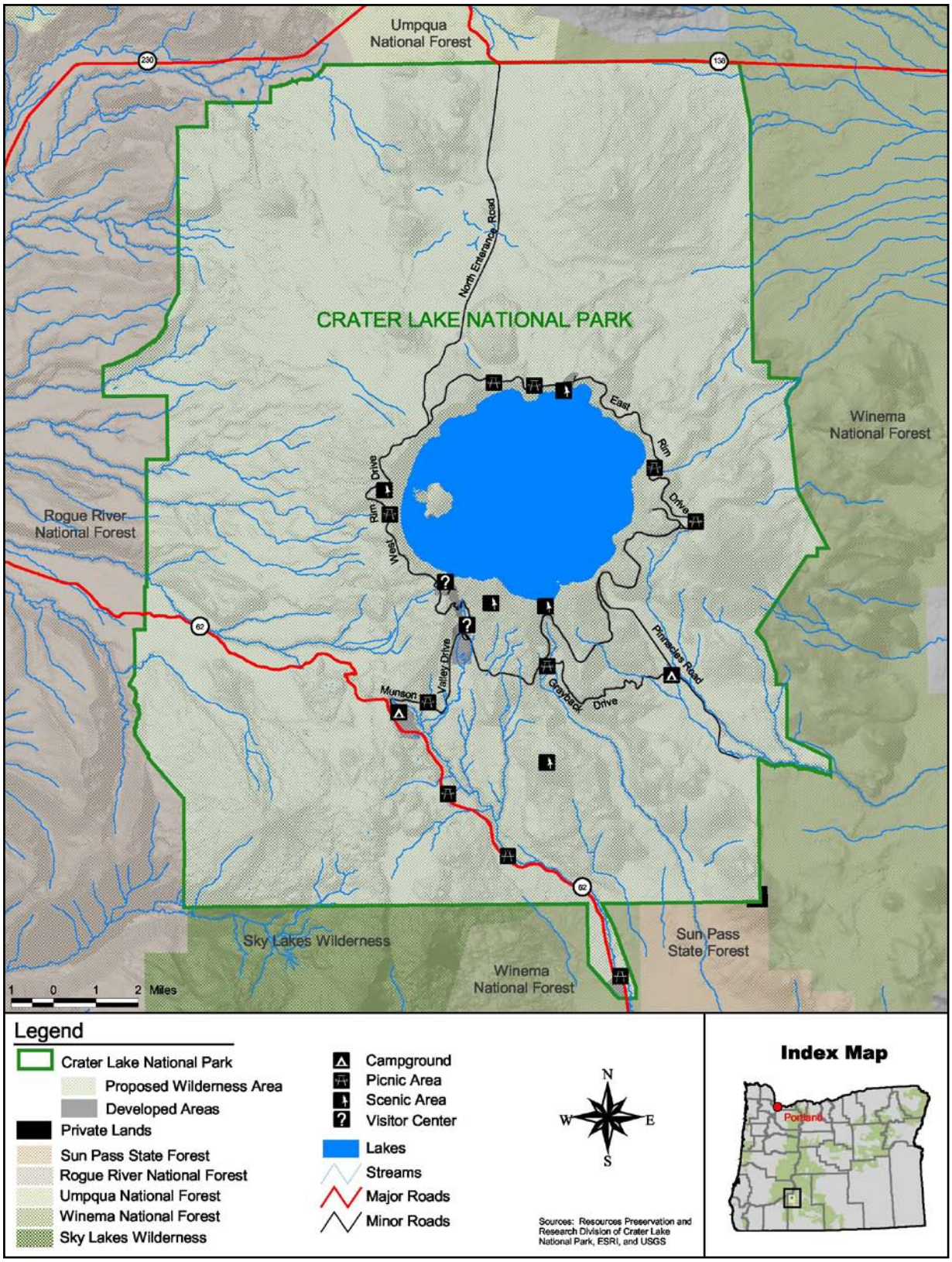

Figure 1-1 Crater Lake National Park and Vicinity

Chapter 10 Protection of Sensitive Resources

10.1 Summary of Cultural Resources Requiring Sensitive Treatment or Special Protection

Numerous cultural resources exist within the park that warrant special protection from the negative impacts of fire or certain fire management activities such as smoke, heat, ground disturbance, and fire retardants, etc.

There are 43 National Register historic resources, including the Watchman Lookout, several buildings in Rim Village, and 19 buildings in the Munson Valley administrative headquarters area. The Superintendent's Residence (House 19) is listed as a National Historic Landmark. Both Munson Valley and Rim Village are listed as historic districts.

There are two eligible historic roads - Rim Drive that circles the caldera rim and the Fort Klamath – Jacksonville Wagon Road. The wagon road crosses through the park in an east-west fashion, with a section that heads west and north from Highway 62 up to the caldera rim.

There are 13 individual designed landscapes on the Cultural Landscapes Inventory (CLI). A new property type, that of a logging railroad grade, was discovered as part of a pre-burn archeological survey in 2001. There is another grade, as yet unsurveyed, in the vicinity of Bear Butte.

Overall, less than 2% of Crater Lake National Park has been surveyed in accordance with professional standards in archeology. The amount of surveyed acreage grows each year as sites are recorded prior to prescribed fire or other management activities. To date, more than 40 archeological sites and/or isolated finds have been investigated in the park.

More than 80 plant species have been identified by the Klamath Tribes as culturally important. Forty-two of these species belong to the *Carex* genera, commonly known as sedge. Sedges are grass-like plants with long and narrow parallel-veined leaves and inconspicuous flowers. They are associated with both riparian and dry meadow habitats of the park. Other common species of importance include conifer trees, willows, huckleberries, and other shrubs, forbs, and hardwood trees that are widely distributed throughout the park.

<u>Protection Measures</u>
Compliance with section 106 of the National Historic Preservation Act is completed on a project specific basis for prescribed fire and hazardous fuel reduction activities. Project proposals and survey reports with recommendations, are sent to the Oregon

State Historic Preservation Office for review and concurrence prior to any ground-disturbing activities.

The following list of mitigations will be implemented for each fire management activity (as necessary) to protect cultural resource values within the park:

- Prior to all prescribed fire and non-fire fuel treatments, cultural resources in treatments areas will be surveyed, identified and avoided; and survey report recommendations will be implemented.
- Prior to all prescribed fire and non-fire fuel treatments, the park will consult with the Klamath Tribes.
- Prior to all wildland fire management fire use activities, cultural resources in affected areas will be identified and avoided; Where and when a wildland fire will occur is unpredictable. Identification and avoidance of cultural resources will be based on information contained on park maps of known and probable cultural resources, Newly discovered cultural resources will be documented and appropriate mitigations developed by the park historian or designated representative.
- No handlines exposing mineral soil will be allowed through cultural sites as defined or delineated in archeological survey reports.
- Fire retardant use will be prohibited in the vicinity of any historic structure, unless there is imminent threat from wildfire to the historic structure, as a last resort.
- The park historian, or a designated representative, will coordinate the inspection and development of plans to protect any existing or new cultural resources identified before and after prescribed fires.
- Camps and toilet facilities are restricted from being located within 200 feet of known cultural resource sites (e.g. along Dutton Creek).
- Within prescribed fire units, fire shelter fabric will be placed on all identified culturally modified trees (CMT's) for the duration of the burn.
- Crews will implement Minimum Impact Suppression Tactics (MIST) fire suppression guidelines to minimize and/or eliminate adverse soil impacts resulting from ground crew activities.
- Removal/reduction of vegetation within cultural landscapes and Historic Districts will be conducted as to minimize impacts to the historic scene.
- The park's cultural resource maps and Resource Advisor Guide will be updated or revised annually by April 15th, by the responsible divisions.
- The park historian or designated representative will coordinate cultural resources issues related to implementation of emergency stabilization (ESR) and burned area rehabilitation (BAR) following suppressed wildland fires.

10.2 Summary of Natural Resources Requiring Sensitive Treatment or Special Protection

Scenic Resources and Air Quality

The major scenic attraction at Crater Lake National Park, as the name implies, is the lake itself. However, the vegetation is clearly an important backdrop to the lake and forms the major landscape texture element on the many vistas within the park. The park offers scenic vistas and solitude in natural settings, clean air, and clear night skies. Scenic attractions include the lake, panoramic vistas at viewpoints and along 97 miles of hiking trails, wildflower viewing, and geologic land forms that include volcanic landscapes and glaciated features.

The summits of Mt. Scott, Watchman and Llao Rock offer views south to Mt. Shasta in California and north to the summits of the Three Sisters and beyond. State Highway 62 is open year-round, and from it, the Munson Valley Road can be used to access the rim for lake views. Rim Drive circles the caldera rim, and has pullouts along the side for viewing the lake. From Rim Drive, a spur road leads to the Pinnacles area of volcanic spires. Other roads include the North Entrance Road, which crosses the Pumice Desert, and the South Highway 62, which follows Annie Creek Canyon.

Crater Lake National Park is designated as a Class 1 Area and protecting visibility is a major concern to park management. This designation provides for the highest degree of regulatory protection from air pollution impacts. The primary means by which the protection and enhancement of air quality is accomplished is through implementation of National Ambient Air Quality Standards (NAAQS). These standards address six pollutants known to harm human health including ozone, carbon monoxide, particulate matter, sulfur dioxide, lead, and nitrogen oxides (USDA, 2000a).

The Environmental Protection Agency (EPA) further strengthened air quality protection of Class 1 areas in 1999 through the Regional Haze Rule. The rule specifies that States must review how pollution emissions within the State affect visibility at Class 1 areas across a broad region, not just those within the State. The Rule also requires States to make reasonable progress in reducing any effect this pollution has on visibility conditions in Class 1 areas and to prevent future impairment. States are required to analyze a pathway that takes the Class 1 areas from current conditions to "natural conditions" in 60 years. "Natural conditions" is a term used by the Clean Air Act, which means that no human-caused pollution can impair visibility (DOI, 2001b).

Protection Measures

Since federal land managers (National Park Service, Forest Service, Fish and Wildlife Service, and Bureau of Land Management) were required by the Clean Air Act to protect visibility at designated Class 1 areas, these agencies established the Interagency Monitoring of Protected Visual Environments (IMPROVE) particulate monitoring network. Among other measurements, IMPROVE gathers data on particulate matter of 2.5 micrometers and 10 micrometers ($PM_{2.5}$ and PM_{10}) (DOI, 2001c). In addressing air pollutant emissions from fire and wildland fire use, the EPA considers $PM_{2.5}$ and PM_{10} as the primary indicators of public health impacts (EPA, 1998). In general, IMPROVE uses scenery, optical, and aerosol monitoring (DOI, 2001d). Crater Lake National Park is a participant in the IMPROVE network and employs a nephalometer and fine particulate monitoring in its visibility program (DOI, 2001e).

Soil

There are five major soil series found within Crater Lake National Park: Timbercrater, Umak, Llaorock, Castlecrest, and Cleetwood. Timbercrater and Umak soils are composed of pumice fragments and volcanic ash and are typically over 60 inches in depth. The surface layer of these soils is a brown, very paragravelly, ashy, loamy sand, while the subsurface layer is a light brown, extremely paragravelly, ashy, loamy sand or ashy sand. They generally occur in the East and Northeast portions of the park, as well as in the Panhandle in the Southeast corner (Weinheimer, 2001).

Llaorock soil is composed of volcanic ash and bedrock fragments and is typically over 60 inches in depth. The surface layer of this soil type is a dark brown, cobbly, ashy sandy loam, while the subsurface is a brown, very stony, ashy sandy loam. It primarily occurs around the crater rim and in the Southwest area of the park (Weinheimer, 2001).

Castlecrest and Cleetwood soils are composed of volcanic ash with minor components of cinders and bedrock fragments, and are typically over 60 inches in depth. The surface layer of these soils is a gray, ashy, loamy sand, while the subsurface is a light gray, ashy, loamy sand or ashy sand. Castlecrest is typically found in the valleys throughout the park, including those areas that contain the campgrounds, park headquarters, and Rim Village. Cleetwood is located in the open desert areas of the park (Weinheimer, 2001).

The above soil types range from medium to slightly acidic throughout the park. With a few exceptions (glacial soils in the western portions of the park), the majority of the soils in the park are young soils that are not well-developed or highly productive. Soil permeability is rapid for all the major soils and runoff is

slow, resulting in little, if any, erosion where the soils are protected by forest cover (Weinheimer, 2001).

Protection Measures

- Heavy earth-moving equipment such as tractors, graders, bulldozers or other tracked vehicles will generally not be used for fire suppression. The Superintendent can authorize the use of heavy earth-moving equipment in extreme circumstances in the face of loss of human life and/or property.
- Crews will implement Minimum Impact Suppression Techniques (MIST) fire suppression guidelines to minimize and/or eliminate adverse soil impacts resulting from ground crew activities.
- When handline construction is required, construction standards will be issued requiring the handlines to be built with minimum impact. No handlines exposing mineral soil will be allowed through cultural sites, and all handlines will be rehabilitated. Erosion control methods will be used on slopes exceeding 10% where handline construction took place.
- All sites where improvements are made or obstructions removed will be rehabilitated to pre-fire conditions, to the extent practicable.
- Fire lines will be located outside of highly erosive areas, steep slopes, and other sensitive areas.

Water and Riparian Resources

Surface Water Resources

Waters from the slopes of Mt. Mazama flow into the Klamath, Rogue, and Umpqua River systems. Runoff channels are broad and poorly defined with rounded contours since surface runoff in the park from rain and melting snow is negligible. Water sinks almost immediately into the porous volcanic soils and glacial debris and is released only slowly through evaporation, plant use, seeps, and a few springs, some of which emerge within the caldera and flow directly into the lake.

At 1,943 feet, Crater Lake is the seventh deepest lake in the world and the deepest in the United States. It is noted for its extreme water clarity and deep blue color. The lake has no surface outflows and only minor surface ground water inflows as springs along the caldera walls. The main source of water for the lake is precipitation, averaging 70 inches per year.

Wetlands and Riparian Areas

The term "wetlands" includes wet environments such as marshes, swamps and bogs. Wetlands provide critical habitats for fish and wildlife, purify water, and help check the destructive power of floods, storms, and fires. Nutrients and plant material flushed from some wetland systems during storms provide essential food for plants, fish, and wildlife in downstream ecosystems.

Crater Lake National Park wetlands include Sphagnum Bog, Thousand Springs, Boundary Springs, seeps, and creeks. Permanent streambeds in the Park generally have steep-sided channels and relatively undeveloped riparian areas associated with the streams.

In the park, riparian areas along creeks, springs, and seeps represent specialized plant communities. These plant communities provide opportunities for increased biodiversity, as they are interfaces between wetlands and drier upland habitats. These communities provide increased cover and food resources to a greater variety of animal species than are found in the drier upland or wetlands habitats. Riparian communities act as filters for down-slope soil and nutrient movement for aquatic resources, and are considered important habitat components.

Fragile Wetland Environments

Several areas within the park contain important wetland communities. These include the following areas:

1. **Boundary Springs:** located in the northwest corner of the park, approximately ½ mile from the north boundary. This is one of the headwater sources of the Rogue River. The spring produces a reliable, year-round flow in an otherwise arid area, resulting in a lush moss and herb flora.
2. **The Sand Creek/Pinnacles Area:** located near the southeast corner of the park. The entire site is of unique geological importance, with Sand Creek passing through a wide canyon with sloping walls of scoria and pumice. Along those walls are numerous pinnacle formations, many 50 feet or more in height.
3. **Thousand Springs:** located approximately 1-1/2 miles south of the west entrance (HWY 62) of Crater Lake National Park. The Thousand Springs site is a complex of freshwater springs that flow west into Union Creek and eventually into the Rogue River.
4. **Sphagnum Bog:** located along the west-central boundary of the park, this 180-acre wetland is a designated Research Natural Area. It encompasses a broad basin at the head of Crater Creek where two large springs emerge. The springs flow through a shallow gradient stream reach between expanses of mire and open forest. The site consists of a series of interconnected openings containing bog communities ranging from *Carex rostrata* sedge wetlands to *Vaccinium occidentale* bog huckleberry thickets to *Salix barclayi* willow carrs.

Protection Measures

- Creek or river crossings will be limited to set and existing locations.
- Except for spot maintenance to remove obstructions, no improvements will be made to intermittent/perennial waterways, springs or seeps, trails, or clearings in forested areas.
- Riparian areas, which have been burned, may be seeded with native seed from native genotypes, as specified in a Burned Area Emergency Rehabilitation (BAER) plan.
- Fire control strategies will be sensitive to wetland values, and firelines will not "tie" into wetland or bog margins except when relying on those areas to naturally retard the fire without constructed line.
- Crews will implement MIST fire suppression guidelines to minimize and/or eliminate adverse impacts to surface water resources. These include:
    - Preferred use of water for aerial drops.
    - Prohibition of fire retardant use in the Sun Creek Drainage, Lost Creek Drainage, and the Crater Lake caldera.
    - Prohibition of Crater Lake, Sun Creek, and Lost Creek as water sources.
    - Restriction of camps and toilet facilities from being located within 200 feet of surface water resources.

Native Plants

Fire plays a role in the management of many rare, threatened and endangered plant species. Fire helps maintain open habitat, encourages sexual and vegetative reproduction, and affects competing or associated plant species. Although fire may injure or kill plants, long-term effects on species may be beneficial (Hessi and Spackman 1995).

Of the park's estimated 680 vascular plant species, 18 species are classified as "rare". Of those 18 rare species, 3 are species of management concern because their populations are in decline or have limited distribution to the degree that they have been listed as Federal Species of Concern:

Crater Lake rockcress (*Arabis suffrutescens* var. *horizontalis)* is found in dry and exposed rocky habitat that intermixes with sparse open forest at high elevations (Applegate, 1939).

Pumice grapefern (*Botrychium pumicola)* is an inconspicuous plant found in raw, pale pumice on rocky mountain slopes at high elevations or in frost pockets of montane lodgepole pine openings (USDA and BLM, 1999).

Mt. Mazama collomia (*Collomia mazama)* is a perennial species of phlox that inhabits open woods and meadows of the lodgepole pine and red fir/mountain hemlock forest zones (Baldwin & Brunsfield, 2001).

Protection Measures

- If threatened, endangered, or sensitive plant species are found in a treatment unit, a buffer surrounding the plants will be imposed that prohibits physical damage to the identified population. The assigned Resource Advisor will be consulted when determining the appropriate buffer.
- Any fires occurring in the area of the Sphagnum Bog, Thousand Springs, upper Castle Creek, Copeland Creek, and Trapper Creek would be monitored for post-fire impacts to Mt. Mazama collomia.

Quaking aspen (*Populus tremuloides*) is a rare tree species in the park. The tree is used by a variety of wildlife. These trees tend to create excellent cavity habitat. Birds such as Williamson's and yellow-bellied sapsuckers, screech owls, western flycatchers, mountain bluebirds, and violet-green swallows live in aspen cavities. Blue and ruffed grouse consume aspen buds. Deer and elk browse on aspen. Because grasses and forbs are able to thrive under aspen canopies, unlike dense conifer forest, ungulates find additional forage in aspen habitats. There is evidence in the park that black bears climb these trees to eat buds and catkins.

Aspen populations generally respond positively to fire. Although individual trees are very prone to fire-induced death, reproduction is positively linked to burning. In fact, fire is a critical catalyst in regeneration of aspen stands. Extensive root systems are able to sprout after fire. Furthermore, seedlings can become established via seed dispersal after fires which are followed by cool and moist weather conditions. In many places throughout the western United States, aspen stands are dwindling due to lack of fire.

Within the park, aspen are found in small pockets in the vicinity of Sun and Annie Creeks. Perhaps the largest stand is near the west boundary of the park, north of Castle Creek. This aspen stand is known as "Aspen Meadow." Scattered clumps are common elsewhere in the park below 6,000 feet elevation.

Protection Measures

Appropriate management responses will be aimed at facilitating fire spread through aspen habitat wherever feasible. Mitigations to protect the viability of aspen clumps or groves are:

- The felling of all size and health classes is prohibited except for imminent safety concerns.
- Felling for fire control purposes should not be necessary. By constructing control lines to avoid the vicinity of aspens, these trees will not present a threat of burning and falling over control lines.

Five-needled pines *(Pinus lambertiana, P. monticola, and P. albicaulis)* have been declining in the park for decades. A non-native fungal disease, white pine blister rust, kills all ages of these trees. They are called "five-needled pines" because their needles are in bundles of five. Another major attribute they share is their importance to wildlife. These three species have the largest seeds of all the park's trees. As such, a variety of animals benefit from the sustenance they provide: black bear, gray jay, chipmunks, golden-mantled ground squirrels, Clark's nutcrackers, and ravens.

Five-needled pines share a positive relationship with fire. They prefer open sites. In the absence of fire, they are easily out-competed by less fire-resistant tree species such as white fir, mountain hemlock, and Shasta red fir. At the highest elevations in the park, the whitebark pine is the only species able to thrive in the harsh conditions – forming a forest ecosystem where otherwise only sparsely vegetated ground would exist. As such, whitebark pine is considered a keystone species at places such as Mount Scott and The Watchman. Whitebark pine is also the most susceptible of the pines to the disease and is therefore the most critical of pines to manage carefully.

Similar to aspen management, fire spread through habitat of five-needled pines should be encouraged. However, unlike aspen which typically die in fires, the pines are naturally fire resistant. Where stand conditions are dense with other fire-susceptible species, unnatural crown fires threaten these five needle pines. Such conditions occur in the park and present a challenge in facilitating fire while protecting the crowns of these large pines.

Protection Measures

When fire occurs in the vicinity of five-needled pines, the resource advisor should ensure that the following is implemented:

- The felling of all size and health classes is prohibited except for imminent safety concerns.
- Constructing control lines to avoid the vicinity of five-needled pines, these trees will not present a threat of burning and falling over control lines.
- When safe and feasible, non-pine ladder trees (fir or mountain hemlock ≤ 15" dbh) directly beneath the pine canopy should be felled when torching is expected.

<u>Non-Native Plants</u>

Crater Lake National Park is home to 49 species of non-native vascular plants. They are found on fewer than 150 acres throughout the park and are associated with areas that have been disturbed primarily by construction activities in the park's developed zones. Highway 62 is a source of non-native plant introductions and the primary vector for their spread within the park. There are two species of non-native plants that pose the greatest threat of expanding their populations within the park: spotted knapweed (*Centaurea biebersteinii*) and St. Johnswort (*Hypericum perforatum*). Spotted knapweed is a state listed noxious weed. Annual efforts are made to manually control known infestations within park boundaries.

Protection Measures

- Prior to prescribed fires in the Panhandle Treatment Unit, park staff will treat the area adjacent to the highway using appropriate hand control methods to reduce chances of spreading known populations of non-native spotted knapweed and St. Johnswort. Park staff will monitor the area after prescribed fires for their occurrence and employ appropriate hand control methods to remove the noxious weeds if they are present;
- Park staff and contractors will clean fire management equipment prior to its use to prevent the spread of noxious weeds;
- Park staff and contractors will stage fire management operations away from known noxious weed infestations, and will construct fire lines away from known patches;
- Park staff will survey for noxious weeds in treatment units prior to ignition of prescribed fires.

Wildlife

Of the park's estimated 262 faunal species, 29 species are classified as rare. Of those 29 rare species, 17 are species of management concern because their populations are in decline. Three of these species are listed as threatened under the Endangered Species Act and the other 14 are listed as Federal Species of Concern. A brief description for each is provided below. A complete list is of the park's rare plants and animals are included in Appendix 13.C. Specific mitigations are included for the three threatened species, but at this time there is only general information for minimizing negative impacts to those species that are listed as Federal Species of Concern.

Threatened / Endangered Fauna

Bald eagles (*Haliaeetus leucocephalus*) are known to occasionally nest near Crater Lake and use it as a feeding area. A nesting pair was observed on the lakeshore during the 2001 nesting season. Eagles prefer large, old trees for nest sites. The

forest types most similar to the Klamath Basin nest sites are the white fir and ponderosa pine types.

Protection Measures

- No direct overflights of known T&E species nest sites will be allowed below 1500 Above Ground Level (AGL) from March 15 to August 30 each year;

Northern spotted owl (*Strix occidentalis caurina*) is an old-growth dependent species that prefers complex forest structure. It is at the eastern end of its range in Crater Lake National Park. All currently known nest locations have been found within areas identified as potential habitat, but occasional sightings have been documented outside of these areas. Potential habitat is found in patches throughout the park, with higher density of patches and larger patch sizes southwest of a diagonal line connecting the northwest and southeast corners of the park. In 2001, twelve active spotted owl nesting sites were identified in the park or immediately adjacent to it.

Protection Measures

- No direct overflights of known T&E species nest sites will be allowed below 1500 Above Ground Level (AGL) from March 15 to August 30 each year;
- All fires located within 100 acres of a known spotted owl nest or activity center, will be suppressed;
- Repetitive understory burning in spotted owl habitat will be limited to one occurrence per decade;
- During the spotted owl breeding season (March 15 to August 30), manual thinning and prescribed fire treatments will not be conducted in those portions of treatment units that are within 0.7 mile of spotted owl nest sites or activity centers;
- Prescribed fire and manual thinning treatments will be very limited in nature within 100 acres of a known spotted owl nest or activity center;
- Within 0.7 miles of any known spotted owl nest site or activity center, 40% of the area will be protected from extensive prescribed fire and manual thinning treatments, while 60% will be subject to such treatments;
- Within 1.2 miles of each known spotted owl nest site or activity center, at least 40% of the area will be protected from fire, and up to 60% will be subject to prescribed fire;

Bull trout (*Salvelinus confluentus*) are native to the Pacific Northwest and over the last 40 years has witnessed a radical decline in distribution and abundance. Bull trout probably reached maximum distribution and abundance after the last glaciation when clear cold-water streams were abundant. Habitat fragmentation, together with habitat degradation (particularly warming waters) and interspecific competition from the exotic brook trout, have led to major declines of the species.

The USF&WS has proposed Critical Habitat in the park through the entire reach of Sun Creek and Annie Creek below Annie Creek Falls.

Bull trout are found in two streams at the park: Sun Creek and Lost Creek. Non-native brook trout have been removed from the upper and middle reaches of Sun Creek to help stabilize the bull trout population. Bull trout were moved into Lost Creek following brook trout removal to reduce the risk of local extinction from a catastrophic event in Sun Creek. Annie Creek has been proposed as Critical Habitat below Annie Creek Falls.

Protection Measures

- To protect bull trout habitat, no more than one-half of the upper Sun Creek, Annie Creek and Lost Creek watersheds will be allowed to burn in any 20 year period.
- Prohibition of fire retardant use in the Sun Creek, Annie Creek and Lost Creek drainages.
- Prohibition on using Sun Creek, Annie Creek, and Lost Creek as water sources.
- Restriction of camps and toilet facilities from being located within 200 feet of surface water resources.

Federal Species of Concern

Amphibians

Tailed Frog (*Ascaphus truei*) This unique frog requires clear, cold swift-moving mountain streams primarily in older forest sites (Welsh 1990). They may be found on land during wet weather near water in humid forests or in more open habitat. During dry weather stays on moist stream-banks. This frog is sensitive to road building (Leonard et al. 1993). Disturbance that increases water temperatures and siltation may have an adverse effect on tailed frog populations (Nussbaum et al. 1983). Apparently low dispersal abilities may limit rate of recovery of depleted populations.

Cascades Frog (*Rana cascadae*) This rare frog prefers wet mountain meadows, sphagnum bogs, ponds, lakes, and streams in open coniferous forests. They hibernate in mud at the bottom of ponds and in spring-water saturated ground up to at least 75 m from pond (Briggs 1987). They also prefer quiet ponds for breeding and usually lay eggs in shallow open water. Declines in Lassen Volcanic National Park apparently are due to a combination of local factors, including (1) presence of non-native predatory fishes that have restricted available habitat and limited dispersal of frogs, (2) gradual loss of open meadows and associated aquatic habitats, and (3) loss of breeding habitat due to a five-year drought (Fellers and Drost 1993). These declines

may be related to sensitivity of eggs to increased levels of ultraviolet radiation resulting from ozone depletion (Blaustein et al. 1994). Increased solar radiation also may be damaging frog retinas (Fite et al. 1998).

Reptiles

Northern Sagebrush Lizard (*Sceloporus graciosus*) This lizard occupies sagebrush and conifer habitats. They require well-illuminated open ground near cover. Although this species is federally designated as a species of concern, it appears to be fairly widespread in southern Oregon (Csuti et al. 1997).

Mammals

Yuma myotis (*Myotis yumanensis*) This bat is more closely associated with water than most other North American bats. It is found in a wide variety of upland and lowland habitats, including riparian, desert scrub, moist woodlands and forests, but usually found near open water (NatureServe Explorer 2002). This bat is threatened by human disturbance of maternity colonies in caves and buildings (Schmidly 1991). It frequently occurs in human structures and is vulnerable to destructive pest control activities. Some riparian management practices may be detrimental and result in loss of potential roost sites (Western Bat Working Group 1998, Arizona Game and Fish Department 1993).

Long-legged Myotis (*Myotis volans*) Primarily occurs in montane coniferous forests but also riparian and desert (Baja California) habitats. These bats may change habitats seasonally. They use caves and mines as hibernacula, but winter habits are poorly known. They are known to roost in abandoned buildings, rock crevices, under bark, etc. In summer, long-legged myotis apparently do not use caves as daytime roost site. In some areas hollow trees are the most common nursery sites, but buildings and rock crevices are also used. May be affected detrimentally by human disturbance and certain forest management practices. Residues of DDT and its metabolites have been found in Oregon individuals (Western Bat Working Group 1998).

Long-eared Myotis (*Myotis evotis*) This bat inhabits forested areas, especially those with broken rock outcrops; also shrubland, over meadows near tall timber, and along wooded streams. Often roosts in buildings, also in hollow trees, mines, caves, fissures, etc. Small maternity colonies of 12-30 individuals have been found in buildings in British Columbia. Maternity colonies, hibernacula, and roosts are vulnerable to disturbance and destruction (Mexico Department of Game and Fish 1997). Cutting of large snags is of particular concern in Arizona. Roosts under exfoliating bark may be relatively short-lived resources (New Mexico Department of Game and Fish 1997).

Silver-haired Bat (*Lasionycteris noctivagans*) This rare bat prefers forested (frequently coniferous) areas adjacent to lakes, ponds, and streams. During migration, they sometimes occur in xeric areas. Summer roosts and nursery sites are in tree foliage, cavities, or under loose bark, sometimes in buildings. In Manitoba, migrants roosted typically in narrow crevices in tree trunks (Barclay et al. 1988). They rarely hibernate in caves and are relatively cold tolerant. Young are born and reared in tree cavities or similar situations. In South Dakota, maternity aggregations primarily were in woodpecker-created cavities in ponderosa pines (Mattson et al. 1996).

Pacific fisher (*Pennanti pacifica*) The assessment of small carnivore populations by Ruggiero and others (1994) suggests that we know little about the habitat requirements of small carnivores. However, old forest structure, including large woody debris for denning (both logs and snags), is an important structural characteristic of habitat for these animals. As they are found across a wide variety of forest types, specific forest types or dominant species are much less important than landscape structure.

Wildland fire use events at Crater Lake tend to be patchy in terms of fire severity. This patchiness historically was associated with habitat improvement for small carnivores, and will likely be associated with habitat maintenance for them in the future. High-severity patches will create prey concentration areas, moderate severity patches will create coarse woody debris, and unburned patches mixed with low severity fire patches will provide complex forest structure for these animals.

Birds

Olive-sided Flycatcher (*Contopus cooperi*) This bird breeds in forest and woodland, especially in burned-over areas with standing dead trees, subalpine coniferous forest and mixed coniferous-deciduous forest (AOU 1983). Nests are placed most often in conifers (Harrison 1978, 1979), on horizontal limbs from two to 15 m from the ground. During the non-breeding season, habitat includes a variety of forest, woodland, and open situations with scattered trees, especially where tall dead snags are present (AOU 1983). Primary habitat is mature, evergreen montane forest (Altman 1997). Causes of decline are not well known but may be related to fire exclusion. In western Oregon, nest success was substantially higher in postfire habitat than it was in several types of harvested forests (Altman and Sallabanks 2000). Fire suppression throughout the breeding range undoubtedly limits the acreage of available habitat; large areas of dense, second growth forests growing up following cutting or fires are being maintained as closed canopy forests through intensive fire control.

Willow Flycatcher (*Empidonax traillii*) As its name implies, this bird is strongly tied to brushy areas of willow and similar shrubs but is also found in thickets, open second growth with brush, swamps, wetlands, streamsides, open woodland mountain

meadows and along streams. The presence of water (running water, pools, or saturated soils) and willow, alder or other deciduous riparian shrubs are essential habitat elements (Sanders and Flett 1989). It apparently does not occur in dense tree cover but will use scattered trees for song and foraging perches and gleaning substrate (USDA Forest Service 1994). In the Sierra Nevada of California, broad, flat meadows with willows and water are essential (Sanders and Flett 1989). In the Northern Rockies, is apparently restricted to riparian areas with adequate shrub cover (Hutto and Young 1999). Riparian areas are particularly vulnerable to high-intensity livestock grazing, recreation and development pressure. In Oregon, populations increased after reduction in cattle grazing and cessation of poisoning and removal of riparian willows (Taylor and Littlefield 1986).

Lewis's Woodpecker (*Melanerpes lewis*) This woodpecker nests in open forest and woodland, often logged or burned, including oak and coniferous. Distribution is closely associated with open ponderosa pine forest in western North America, and is strongly associated with fire-maintained old-growth ponderosa pine (NatureServe Explorer 2002). Because this bird catches insects from air, perches near openings or in open canopy are important for foraging habitat (Bock 1970, Tobalske 1997). Suitability of postfire habitats varies with the age, size, and intensity of the burn, density of remaining snags, and the geographic region. Birds may move to unburned stands once young fledge (Block and Brennan 1987, Tobalske 1997, Saab and Dudley 1998). It has generally been considered a species of older burns rather than new ones, moving in several years post-fire once dead trees begin to fall and brush develops, five to thirty years after fire (Bock 1970, Block and Brennan 1987). However, on a two- to four-year-old burn in Idaho it was the most common cavity-nester, and occurred in highest nesting densities ever recorded for the species (Saab and Dudley 1998). Unlike other woodpeckers, it is not morphologically well-adapted to excavate cavities in hard wood and thus tends to nest in a natural cavity, abandoned northern flicker hole, or previously used cavity between 1 and 52 meters above ground (NatureServe Explorer 2002). It sometimes will excavate a new cavity in a soft snag (standing dead tree), dead branch of a living tree, or rotting utility pole (Harrison 1979, Tobalske 1997).

White-headed Woodpecker (*Picoides albalarvatus*) The primary habitat for this woodpecker is Montane coniferous forest of pine and fir (AOU 1983). Important habitat components are an abundance of mature pines of species that produce large cones and abundant large seeds, relatively open canopy of 50-70 percent closure, and numerous snags and stumps for nest cavities (Garrett et al. 1996). Ponderosa pine, sugar pine and white fir are common associates. In Oregon and Washington, this bird is positively associated with abundance of large-diameter ponderosa pine (Marshall 1997). Specifically, in central Oregon, it inhabits multi-storied old-growth ponderosa pine forests, with canopy cover less than 51 percent; more than 12 square meters per hectare basal area of live trees (more than 53 centimeter dbh); more than 32 meters maximum canopy height, and shrub cover more than 30 percent (Dixon 1995). The bird excavates a nest cavity usually in a dead tree trunk or stump,

1-8 meters above ground. In central Oregon, woodpeckers also nest in large broken-topped snags with a large number of cavities; usually in large-diameter ponderosa pine snags (average 61 centimeter dbh, range 19-115 centimeters dbh; average 14 meters tall), but also occasionally in ponderosa pine stumps, live or dead quaking aspen, or white fir snags (Dixon 1995). In Oregon, loss of large-diameter ponderosa pine poses a significant threat to the species.

Mountain Quail (*Oreortyx pictus*) This bird inhabits brushy mountainsides, coniferous forest, forest and meadow edges, dense undergrowth, and sagebrush (AOU 1983). It has been found to favor areas with tall dense shrubs, close to water (Brennan et al. 1987). These birds may move to areas with suitable mast crops in fall. Nests are created on the ground in a shallow scrape lined with plant material. It usually nests under protective cover of a tree, shrubs, fallen branches, etc., within a few hundred meters of water. Decline in west-central and southwestern Idaho perhaps has been due to competitive exclusion by California quail, disturbance from livestock and humans during the nesting season, predation by coyote, hunting, and heavy mortality during severe winters (Spahr et al. 1991).

Protection Measures

Specific protection measures do not exist in Crater Lake National Park for species of concern. The park will seek to stay current with any new information on protection measures for these species, and to incorporate them into fire management practices.

Research Natural Areas

Four Research Natural Areas (RNA) are designated in the park: Llao Rock, Desert Creek, Sphagnum Bog, and Pumice Desert. These Research Natural Areas were established in 1995 to allow natural processes to dominate and to preserve a given ecosystem or feature.

Llao Rock RNA

Llao Rock RNA covers approximately 435 acres near the gently sloped broad top of Llao Rock, and includes some steep terrain on the inner caldera of Crater Lake. Alpine conditions dominate most of the RNA, with small stringers of mountain hemlock forest on the north side and scattered whitebark pine in the alpine zone. The alpine zone habitat has a unique assemblage of wild flowers that are relatively few in number but are noted for their colorful blooms. Two rare plant species occur in the alpine zone. One of the largest populations of pumice grapefern (*Botrychium pumicola*), a sensitive species, is found at the site, growing in light-colored, loose pumice. The second species of concern is the endemic Crater Lake rockcress (*Arabis suffretescens* var. *horizontalis*), a sensitive species that has a small

population also growing in pumice substrate. Other flora and fauna are typical of the subalpine and alpine zones of the park and associated high country.

Pumice Desert RNA

The Pumice Desert RNA, a broad shallow basin surrounded by forest, is the largest RNA in the park at 3,053 acres. The site is deeply mantled by Mount Mazama pumice and has an average plant cover of only 4.5%. Only 14 plant species are recorded for the area. Occasional lodgepole pine invasion has occurred in disturbed areas across the desert.

Desert Creek RNA

The 1,870-acre Desert Creek RNA, located in the northeast area of the park, is the RNA most likely to be affected by fire. It has a central non-forested area with bitterbrush/long-stolon sedge, and is surrounded by three dry forest types: ponderosa pine/bitterbrush-manzanita/sedge, ponderosa pine/bitterbrush-snowbrush/sedge, and lodgepole pine/bitterbrush/sedge.

Sphagnum Bog RNA

Located along the west-central boundary of the park, this 180-acre wetland encompasses a broad basin at the head of Crater Creek where two large springs emerge. The springs flow through a shallow gradient stream reach between expanses of mire and open forest. The site consists of a series of interconnected openings containing bog communities ranging from *Carex rostrata* sedge wetlands to *Vaccinium occidentale* bog huckleberry thickets to *Salix barclayi* willow carrs.

Protection Measures

- Heavy earth-moving equipment is prohibited within all Research Natural Areas.
- Helispots or camps are prohibited within the boundaries of all Research Natural Areas.
- If fire needs to be stopped in the Desert Creek RNA, water and appropriate foams will be recommended over fire line construction at the meadow edge. Phosphorous/clay based retardants will be banned within the RNA boundaries. If fire line construction is necessary, it will be best achieved at the forest-meadow edge rather than through the middle of the meadow.
- Fire suppression activities, including the use of foams and retardants, are prohibited within the Llao Rock RNA.
- Foams and retardants will not be used in the Sphagnum Bog RNA or within 200 feet of the upstream surface waters.

Wilderness

The National Park Service wilderness management policies are based on statutory provisions of the 1916 NPS Organic Act (16 USC 1), the 1964 Wilderness Act, and legislation establishing individual units of the national park system (DOI, 1999b; DOI 2001f).

The park is located in the southern Cascade Mountains of Oregon and contains 183,224 acres. A 1974 National Park Service (NPS) wilderness proposal recommended wilderness designation for 122,400 acres of lands within the park. This proposal was transmitted to Congress for consideration as legislation, but has not been acted on. In 1994, park management recommended that 179,737 acres, excluding road and utility corridors and developed areas, be included in an expanded wilderness proposal. This recommendation has not yet become a formal wilderness proposal. Although none of the park has been officially designated as wilderness through legislation, the park currently manages these 179,737 acres as wilderness.

This decision is consistent with NPS policy for management of wilderness, which states "for the purposes of applying NPS wilderness policies, the term 'wilderness' includes the categories of suitable, study, proposed, recommended, and designated wilderness. NPS wilderness policies apply regardless of category" (DOI, 1999b).

Under the Wilderness Act, "there shall be no commercial enterprise and no permanent road within any wilderness area designated by this chapter and, except as necessary to meet minimum requirements for the administration of the area for the purpose of this chapter (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area" (16 USC 1133).

All management decisions affecting wilderness must be consistent with the "minimum requirement" concept as outlined in the Wilderness Act. The minimum requirement concept is intended to minimize adverse impacts on wilderness character and resources and must guide all management actions in wilderness. This requirement includes decisions concerning administrative practices, historic properties, proposed special uses, research, and equipment use in wilderness (DOI, 1999b).

Planned administrative actions that may result in an exception to a prohibited use (e.g. chainsaws, aircraft use, and mechanical equipment) or have the potential to

impact wilderness resources and values must be documented in accordance with the park's minimum requirements process.

Protection Measures

- Wildland fire operations within the proposed Wilderness Area will adhere to the requirements of the Wilderness Act, NPS Management Policies, and the NPS Director's Orders 18 and 41 (Wilderness Preservation and Management).
- All fire management activities within the proposed Wilderness Area will employ minimum actions and tools necessary based upon the Minimum Requirement and Minimum Tool Determination.
- All fire management activities within the proposed Wilderness Area will follow established MIST implementation guidelines.
- All fire management activities within the proposed Wilderness Area will follow established Rehabilitation Guidelines for Wilderness Fire Suppression Activities.
- A Resource Advisor should be available for advice and support with the crew(s) as well as for quality control.
- When Wilderness campsites or travel routes are closed during fire management activities, visitors will be rerouted to alternative travel routes or campsites.
- Educational/informational materials will be developed and distributed to the wilderness visitor on what to expect during fire management activities including potential noise from chainsaws during line construction, smoke dispersion, safety, helicopter and airplane use, and information on where and when these activities would occur.

10.3 Summary of Developments, Infrastructures, and In-holdings Requiring Protection

There are no private in-holdings within Crater Lake National Park. The majority of the administrative and visitor facilities and infrastructures are located in the developed zones of the park, including the Mazama Village, Munson Valley Headquarters, Rim Village, and South Yard areas. The park's structural fire program is employed to protect these features.

Utilities such as water, sewage, and electricity are housed in protected underground conduits. There are pump houses, gauging stations, and water tanks that are located above-ground in the Munson Valley, Annie Springs, Mazama Village, and Garfield Peak areas. A microwave tower site is located atop Garfield Peak. These are generally constructed of non-combustible materials.

The park has two campground facilities; Mazama and Lost Creek. Mazama Campground near the Annie Springs entrance station, has over 200 sites, running water, electricity hook-ups and a camper store. Lost Creek campground has sixteen camp sites located at the intersection of the Pinnacles and Grayback roads. Visitor campfires pose the highest threat to these resources.

There are two fire lookouts constructed of wood and stone: Watchman and Mt. Scott. Their respective locations on rocky, exposed, un-vegetated mountain peaks, make them unlikely to be damaged from wildfire. The Wineglass Cabin is a ranger patrol cabin located forty feet off of the East Rim Drive near the Palisades. It is located in a forest setting and could be threatened by wildland fire.

There are numerous vault toilets and information kiosks located at picnic areas and pullouts along the Rim Drive, North Entrance Road, and Highway 62. The vault toilets have a stone facade with shake roof, and are unlikely to be destroyed in the event of a wildland fire. Information signs along the roads are subject to burning, but could be replaced if damaged or consumed by fire. The structural fire program would be employed to protect these features.

Chapter 11 Fire Critiques and Annual Plan Review

Reviews and Investigations are described in the 'Interagency Standards for Fire and Fire Aviation Operations' (Red Book), and in RM-18 Chapter 3 (Investigations), and Chapter 13 (Reviews), Exhibit 3.

11.1 Annual Fire Summary Report

The FMO will be responsible for completing an annual fire summary report. The report will contain the number of fires by type, acres burned by fuel type, cost summary (prescribed burns and wildland fires) personnel utilized, and fire effects. This report is due annually to the Regional Office by the end of January.

11.2 Annual Fire Management Plan Review

The FMO will coordinate an annual review of the Fire Management Plan. The review will include an assessment of the ongoing implementation of the FMP, a review of proposed changes to the plan and evaluation of significant budgetary, social/political or environmental changes which could affect the validity of the FMP. The review will be conducted by April 15 and revisions to the FMP will be coordinated and implemented by June 15.

11.3 Wildland Fire After Action Reviews

After Action Reviews (AAR) of wildland fires are required as part of the USDA Forest Service Thirty Mile Fire Hazard Abatement Plan. AAR will be conducted for all wildland fires in Crater Lake National Park. AAR are intended to capture lessons learned from fire management activities, and to use these lessons to contribute to continuous improvement. AAR can range from brief, informal sessions following a day's work to longer, more formal incident reviews following significant fire management actions.

For less complex AAR, it is the responsibility of the NPS module leader or Incident Commander to conduct the AAR. The AAR will utilize the format presented in the Incident Response Pocket Guide. Documentation of the review will remain on file in the park fire management office for at least one year from the date of the incident.

The Chief Ranger will ensure that an after incident review is conducted for any type III or greater fire, or any fire where significant concerns are raised by park management. This critique will confirm effective decisions or correct deficiencies, identify new or improved procedures, improve and refine the fire management

program and review the cost-effectiveness of a fire operation. The Regional or National Office may choose to be part of the AIR depending on the complexity of the issues associated with the fire. Formats for conducting reviews are available in the Incident Response Pocket Guide, Red Book, and in RM-18.

11.4 Accident Investigations

Any fire may potentially include events that require the activation of an Interagency Investigation Team. As defined in the Redbook (Chapter 18-6, 2009 edition), three categories of events require the activation of a National team. These events are:

- Entrapment
- Fire Shelter Deployment
- Wildland fire serious accident

Should one or more of these events occur while an incident is under National Park Service command, during Unified Command involving the National Park Service, or during an incident involving park personnel, the Park Superintendent or designated representative will ensure that an Interagency Investigation Team will be activated.

Less serious accidents and near-misses will be investigated and documented via the Crater Lake National Park Superintendent's Directive 7.2, 'Accidents and Injuries'.

11.5 Preparedness Reviews

These reviews are essential to the effective operation and safety of our wildland personnel. As an annual program component, reviews help to ensure or improve safety and efficiency, determine if any policy or operational changes should be initiated, and identify any management system failures. An annual preparedness review will be conducted within 2 weeks of the park's June wildland fire refresher (but no later than July 15). These will be conducted in accordance with RM-18, the Interagency Standards for Fire and Fire Preparedness Review Guide.

11.6 Prescribed Fire Reviews

All prescribed fire operations will be reviewed using the AAR process described above. In addition, prescribed fires will be evaluated by the fire monitoring program described in Appendix 13.F to determine whether fire and resource management objectives are being met.

Chapter 12 Consultation and Coordination

12.1 List of Significant Contributors and Reviewers of this Plan

This plan was developed over the course of three years with internal and external interdisciplinary input, and reviewed by appropriate subject matter experts in collaboration with adjacent communities, interest groups, state and federal agencies, and tribal governments within and adjacent to Klamath County, Oregon (DOI 2002).

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Chapter 2

Relationship to Land Management Planning and Fire Policy

2.1 NPS Management Policies

NPS *Management Policies* (DOI 2006,) is the basic service wide policy document of the National Park Service. It is the highest of three levels of guidance documents in the NPS Directives System. The Directives System is designed to provide NPS management and staff with information on NPS policy and required and/or recommended actions, as well as any other information that will help them manage parks and programs effectively.

The *Management Policies* section on fire management recognizes that:

> "Naturally ignited fire, including the smoke it produces, is part of many of the natural systems that are being sustained in parks. Such natural systems contain plant and animal communities that are characterized as fire-adapted or fire dependent. They require periodic episodes of fire to retain their ecological integrity and, in the human-caused absence of fire, they can experience undesirable impacts that diminish their integrity—such as unnatural successional trends, loss of habitat for fire-adapted plant and animal species, or vulnerability to unnaturally intense wildland fire.

Management Policies also directs that:

> "All wildland fires will be effectively managed through application of the appropriate strategic and tactical management options as guided by the park's fire management plan. These options will be selected after comprehensive consideration of the resource values to be protected, firefighter and public safety, costs, availability of firefighting resources, weather, and fuel conditions. Naturally ignited and human-ignited fires managed to achieve resource management and fuel treatment objectives, and the smoke they produce, will both be managed to comply with applicable local, state, and federal air quality regulations. Such fires will also include monitoring programs that record fire behavior, smoke behavior, fire decisions, and fire effects to provide information on whether specific objectives are met and to improve future fire management strategies. All parks will use a systematic decision-making process identified in their fire management plans or other documents to determine the most appropriate management strategies for all unplanned ignitions and for any naturally or management-ignited fires that are no longer meeting resource management objectives."

The program of action outlined in this plan is in accordance with direction provided in the current version of *Management Policies*.

2.2 Enabling Legislation and Purpose

The mission of Crater Lake National Park is "to forever preserve the beauty of Crater Lake National Park, its unique ecological and cultural heritage, and to foster understanding and appreciation through enjoyment, education, and inspiration." The Act of Congress which established Crater Lake National Park (32 Stat. 202) on May 22, 1902, recognized the significance of the area's cultural and natural resources by stating that the Park is: "...dedicated and set apart forever as a public (park) or pleasure ground for the benefit of the people...and...for the preservation of the natural objects within said park...." This act, like the 1916 Organic Act, did not specify any one feature or ecosystem of Crater Lake National Park as being the most important. Rather, it recognized that all these resources are of value. Therefore, the purpose of Crater Lake National Park is to preserve all aspects of its history and ecological environment, including natural processes such as fire, unimpaired for future generations and to provide for visitor use and enjoyment consistent with its preservation mandate.

The program of action outlined in this plan is in accordance with the mission and the establishment purposes of Crater Lake National Park.

2.3 General Management and Resource Management Plan

Crater Lake National Park's General Management Plan (GMP) of 2005 gives broad direction for managing park resources. The preferred alternative, number 2, emphasis increased opportunities in recreation and resource education. Specifically, the Fire Management Plan and its corresponding EA address the impacts to Park resources from wildland fire.

The Park's Resource Management Plan (RMP) identifies several resource management objectives that can be linked directly to the use and management of fire (DOI 1999):

- Restore and maintain the natural terrestrial, aquatic and atmospheric ecosystem conditions and processes to the degree that is physically possible and politically practical so they may operate unimpaired from human influences.

- Maintain or restore indigenous flora, fauna, and natural communities to the extent possible, to achieve species diversity and community structure equivalent to pre-Columbian times or post-Columbian conditions which would have been created by natural events and processes.

- Protect rare species by measures aimed at preserving habitat and preventing extirpation but which minimize adverse influences on other indigenous species.

- Work cooperatively with other agencies to minimize, mitigate or prevent resource damaging human influences resulting from activities inside and outside of the park boundary.

- Protect, to the degree practical, and when it is not detrimental to park resources, the visiting public from known resource hazards by reducing hazards and/ or to advise the public of potential risks.

- In areas designated as "cultural zones", identify and preserve or restore elements of the landscape (historic landscape plantings, walkways and historic structures) to give an accurate representation of the historic period.

2.4 How this Plan Will Meet Objectives of the GMP and RMP

- This Fire Management Plan (FMP) is a detailed program of action to implement fire management policies and resource management objectives outlined in higher authority policies and plans (i.e. *Management Policies*, GMP, and RMP). It has been developed to:

- identify and protect values at risk through appropriate management response to fire events;

- take special precautions to preserve and perpetuate sensitive, rare, threatened, or endangered plant/ animal species;

- utilize prescribed fire to replicate natural conditions in all ecosystems including those where its exclusion has created unnatural fuel loadings;

- quantify fire behavior and efforts through monitoring and evaluations of all fires in order to refine prescriptions to achieve resource objectives;

- research the role of fire in the park's fire-adapted ecosystems. This effort will include monitoring of ecological effects of wildland fire and prescribed fire application, as well as acquisition of information on fuel accumulations,

forest insects and diseases, vegetation dynamics and other topics important to fire management and planning;

- implement a public information program that includes prevention, education, and interpretation, and ensures that socioeconomic considerations are included with ecological concerns when informing the visitor;

- comply with air pollution control regulations and smoke management concerns as required by the Clean Air Act and in cooperation with the Oregon Smoke Management Plan;

- maintain an active fire prevention program to reduce the incidence of human-caused wildland fire;

- prevent fire spread onto adjacent public and private lands by containing all fires within the park boundary; however, wildland fire use may be permitted to spread outside or inside of the park from adjacent, compatible fire management areas within the jurisdiction of involved agencies as allowed by Interagency Agreements.

This plan will help meet objectives of the GMP and RMP through an adaptive management framework that includes planning, research, interdisciplinary objective setting, execution, effects monitoring, evaluation, and recommendations for change.

Chapter 3

Wildland Fire Management Strategies

National Park Service wildland fire management activities are essential to the protection of human life, personal property and irreplaceable natural and cultural resources, and to the accomplishment of the NPS mission. High potential risks and expenses associated with fire management activities require exceptional skill and attention to detail when planning and implementing these activities. The following sections identify and summarize the wildland fire management strategies that will be implemented over the life of the plan. These strategies include discussions of general fire management considerations, specific fire management objectives, management options (strategies), and how these factors will be applied on the ground within a given Fire Management Unit (FMU).

3.1 General Management Considerations

As part of the NPS wildland fire management program, Crater Lake National Park embraces the goals established in the 10-Year Comprehensive Strategy (USDA and DOI 2001) which identifies the need to: 1) improve fire prevention and suppression; 2) reduce hazardous fuels; 3) restore fire adapted ecosystems; and 4) promote community assistance.

The park will administer its wildland fire program in a manner that will:

- Achieve maximum overall benefits and minimize damages of wildfires within the framework of land use objectives and resource management plans, while giving primary consideration to firefighter and public safety.
- Educate employees and the public about the scope and effect of wildland fire management, including fuels management, resource protection, prevention, hazard/risk assessment, mitigation and rehabilitation, and fire's natural role in forest ecosystems.
- Stabilize and prevent further degradation of natural and cultural resources lost in or damaged by impacts of wildland fires and/or fire management activities.
- Maintain the highest standards of professional and technical expertise in planning and safely implementing an effective wildland fire management program.
- Integrate fire management with all other aspects of park management.
- Manage wildland fire incidents in accordance with accepted interagency standards, using appropriate management strategies and tactics and maximize efficiencies realized through interagency coordination and cooperation.

- Scientifically manage wildland fire using best available technology as an essential ecological process to restore, preserve, or maintain ecosystems and use resource information gained through inventory and monitoring to evaluate and improve the program.
- Protect life and property and accomplish resource management objectives, including restoration of the natural role of fire in fire-dependent ecosystems.
- Effectively integrate the preservation of wilderness including the application of "minimum tool" management techniques into all activities fire management activities impacting this resource.

Wildland Fire is defined as any non-structure fire that occurs in the wildland. Two distinct types of wildland fire have been defined and include wildfire (unplanned ignition) and prescribed fire (planned ignition). All fires occurring in Crater Lake National Park will be classified as either unplanned ignitions or planned ignitions. All wildland fires will be effectively managed, considering resource values to be protected and firefighter and public safety, using the full range of strategic and tactical options as described in section 3.3.

"A wildland fire may be concurrently managed for one or more objectives and objectives can change as the fire spreads across the landscape. Objectives are affected by changes in fuels, weather, topography; varying social understanding and tolerance; and involvement of other governmental jurisdictions having different missions and objectives." *Guidance for Implementation of Federal Wildland Fire Management Policy (February 2009)*

A systematic decision-making process will be used to determine the most appropriate management strategies for all unplanned ignitions, and for any prescribed fires that are no longer meeting resource management objectives. The full range of suppression strategies will be considered, but any methods used to suppress wildland fires should minimize adverse impacts of the suppression action and the fire, commensurate with effective control and resource values to be protected. Decision support processes and analysis that help determine and document decisions regarding the management of individual ignitions will follow current national direction.

3.2 Wildland Fire Management Goals

The following goals provide the programmatic direction for the park's wildland fire management program for the next five to eight years. Each goal has one or more objectives by which the success of the program will be measured and evaluated:

- GOAL 1: Protect human life, property and designated resources.

Objective: Ensure all fire management activities sustain no injuries to the public and ensure that the number of fire mgmt. staff lost time injuries does not exceed 60% of the 1995-99 5-year average.

Objective: Within 80% of the park's developed zones, change fuel conditions so that predicted flame lengths under extreme weather conditions will be less than four feet, by 2009.

Objective: Complete a risk analysis for properties adjacent to the park by 2006.

- GOAL 2: Reduce fuel loadings, which have accumulated as a result of past fire exclusion, for the purpose of minimizing the chances of catastrophic wildfire.

  Objective: Identify areas having increased fuel loadings as a result of fire exclusion, and reduce fuels on at least 15% of those areas to levels within the range of natural variation, by 2009.

  Objective: Restore a normal distribution of historical forest structures and compositions to at least 10% of park areas identified by low or moderate-severity fire regimes, by 2009.

- GOAL 3: Recognize fire as a natural disturbance agent within the park and manage this ecosystem process through appropriate prescribed and wildland fire use.

  Objective: Use prescribed and wildland fire to restore historical fire regime characteristics to at least 10% of park areas identified by a low or moderate severity fire regime, by 2009.

  Objective: Every five years, identify and evaluate the changes in landscape patterns in and adjacent to the park that are the result of fires.

  Objective: Complete a burn severity analysis of every wildfire that exceeds 100 acres, within one year of the fire event.

- GOAL 4: Mitigate unacceptable environmental impacts on biotic communities and historical and cultural resources due to fire management operations.

  Objective: For every wildland fire and wildfire event, identify and implement appropriate management responses and strategies that address site-specific resource management concerns as described in the park's Resource Advisor Guide.

- GOAL 5: Minimize impacts to cultural resources as a result of fire management actions.

  Objective: Consult and coordinate with Native American groups to ensure protection of cultural resources. Develop project-specific protocols that minimize impacts to cultural resources. Monitor cultural resources for condition before, during, and after fire management actions.

  Objective: Utilize fire and other treatments to restore and maintain the setting at historic sites and reduce the possibility of extreme fire behavior. Maintain light fuel loads on and adjacent to cultural resources.

- GOAL 6: Provide for the safe, aggressive, and appropriate management response to all fires that do not meet resource management objectives by defining suppression responsibilities, organization levels, and decision-making processes.

  Objective: Maintain a fire management organization during fire season that will contain 95% of all unwanted fires in the park within one operational period.
  Objective: Develop branch organization chart with roles and responsibilities for each position. Review and update document annually to ensure efficient distribution of workload.

  Objective: For every wildland fire, conduct a "Wildland Fire Implementation Plan, Phase 1" within 2 hours of detection and size-up.

- GOAL 7: Promote an interagency approach to managing fires and minimizing costs of fire management activities.

  Objective: On an annual basis, review, update and initiate cooperative agreements to assure that interagency approaches to managing wildland fires are implemented.

  Objective: On an annual basis, review treatment projects with adjacent agencies to facilitate cooperative, cross-boundary treatments where possible.

  Objective: Annually review and revise as necessary the FMP with adjacent agencies.

- GOAL 8: Promote public understanding of fire management programs and objectives.

Objective: Revise and implement the "Public Fire Information Plan" and "Prevention Plan" annually.

- GOAL 9: Provide assertive and effective monitoring of all wildland fires.

  Objective: Record significant fire behavior and decisions, determine whether specific objectives are being met and assess fire effects of every wildland fire event.

  Objective: Update fire management program objectives and/or actions, based on the evaluations and results of fire effects monitoring information, annually.

- GOAL 10: Identify information gaps that hamper science-based decision-making and solicit fire research to help fill these gaps.

  Objective: Identify and prioritize fire research needs and develop at least one funding proposal, annually.

  Objective: Consult and coordinate with Native American groups to gather additional information regarding aboriginal burning and ethnobotanical resource use within the park.

- GOAL 11: Park staff and visitors are protected from unhealthy levels of air pollution from prescribed fires. Average visibility within Crater Lake National Park is not impaired to levels worse than the dirtiest 20th percentile as a result of prescribed or wildland use fires.

  Objective: Ambient concentrations of particulate matter (PM-10 and PM-2.5), as measured at critical receptor sites, will not exceed National Ambient Air Quality Standards as established by the U.S. Environmental Protection Agency.

  Objective: Visibility will not be allowed to degrade to levels within the worst 20th percentile for more than four consecutive days.

- GOAL 12: Provide a positive work environment for employees through an integrated program of mutual respect, recruitment and retention of high-quality employees, and opportunities for training and career development.

  Objective: Create and implement plans for each employee in which 100% of the performance standards are linked to appropriate goals from the park's strategic plan and annual performance plan.

Objective: Create and implement annual training and development plans for each employee.

3.3 Wildland Fire Management Options

Wildland Fire Suppression

The objective of wildland fire suppression, as an integral part of wildland fire management in the National Park Service, is to manage wildland fires safely and efficiently to accomplish protection objectives.

The actions to suppress unwanted wildland fires are varied and are applied in many different combinations to achieve control of destructive and potentially destructive wildfires. Tools used to suppress wildfires may include crews digging control lines with hand tools, removing fuels with hand and power tools to limit the spread of fire, portable pumps and hoselays to deliver water, wetting agents to increase the effectiveness of water, employing burn out and backfire strategies to reduce the availability of fuel, dropping fire retardant and water, and (in extreme rare cases) blading wide lines to mineral soil with heavy equipment.

Any one or a combination of tactical options may be chosen and specified by the manager, depending on the anticipated consequences and management objectives for the area that is likely to burn. This will be determined as part of the operational management plan for initial attack situations and as part of the Wildland Fire Decision Support System (WFDSS) process for incidents involving extended attack (see Appendix 13.P).
Initial action on human-caused wildfire will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety. The wildland fire suppression option is required for all ignitions occurring in the Developed Fire Management Unit (FMU); and for natural ignitions that unmitigated, may threaten resources to be protected in the other FMU.

Managing Wildland Fire for Multiple Objectives

Managing wildland fire for multiple objectives is the concept of using natural ignitions (e.g., lightning) to achieve goals appropriate for the area where the ignition occurred. The fire is assessed relative to very specific parameters of topography, weather, fuel types and resource risk, and if appropriate the fire is allowed to burn in a manner consistent with resource objectives while being monitored. The application of this strategy is very dependent on the natural ignition falling within established fire behavior parameters, seasonal conditions, resource management constraints, and health and safety issues. The random occurrence pattern of wildland fires, combined with the possibility that the fire may last for several weeks or even months, requires

more intensive planning and evaluation than for prescribed fires and wildland fire suppression actions, especially at the initial decision point when the fire is detected. Specific strategies, tactics, and mitigations will be specified in the Wildland Fire Decision Support System (WFDSS), but may include activities such as fireline construction, the application of fire (blacklining and firing control lines) and the application of water to create manageable boundaries.

The management of unplanned ignitions for multiple objectives is the desired option for maintaining fire occurrence where possible in Crater Lake National Park. Implementation of fires proximate to park boundaries, or with the potential to escape park boundaries, has the potential to require active management in directions of undesirable movement. Impacts from management actions will be mitigated and restored as soon as the fire area is controlled. Fire managers will ensure impacts from management actions are mitigated both during and immediately after the action.

The management of wildland fire for multiple objectives is particularly desirable for the High Severity FMU. This FMU corresponds to high-elevation forests where the historic fire regime involved infrequent fires and where the impacts of fire exclusion are negligible. Current fire regimes are within an historical range and the risk of losing key ecosystem components is low.

Management of wildland fire for multiple objectives is also an option that may be used in the Moderate Severity and Low Severity FMUs. Because these units have deviated further from their natural fire return intervals, the use of wildland fire for ecological benefit may have to be gradually implemented in conjunction with prescribed fire and/or non-fire applications.

Prescribed Fire

Prescribed fire is the planned use of fire to achieve specific goals related to reducing the impacts from unwanted wildfires and returning fire to an ecosystem that thrives best with fire as a natural component. Prescribed fire is aimed at specific resource management objectives and follows required FMP project design standards.

Prescribed fire is applied to small areas of the landscape (< 2,000 acres per unit) only when fuel and weather conditions fit a predetermined burn plan. These units may be prepared by digging handline to mineral soil around the perimeter, some pruning along the line with chainsaws (after wilderness minimum tool assessment) or using natural barriers such as snow, creeks, rock outcrops, roads and trails to enclose the unit in a controlled line. Personnel then ignite fuels in the unit using ignition devices such as fusees and drip torches, and with aerial ignition devices.

The fire is then monitored and "held" by a fire crew to ensure the fire is contained and controlled.

The prescribed fire option is particularly desirable in the Low Severity and Moderate Severity FMUs. These FMUs correspond to low-elevation forests where the historic fire regime involved frequent fires and the dominant vegetation species were adapted to low-intensity fire. Fire frequencies within these FMUs have departed from historical frequencies by one or more return intervals. The forests in these FMUs are in a fire condition classes 2 and 3. Prescribed fire is an appropriate tool to improve the fire condition classes of these forests by reducing fuel buildups and modifying forest structure to meet target conditions.

Prescribed fire is also an option that may be used in the High Severity FMU. In this FMU, prescribed fire is most often preceded by manual thinning.

Non-Fire Applications

Since a significant portion of fire risk is related to the amount and arrangement of fuels, risk can be managed by reducing or changing the amount, continuity and arrangement of fuels on the landscape. Manual thinning of live and dead brush and small diameter trees is accomplished by crews working with hand tools including chainsaws. Slash from these thinning treatments are lopped and scattered across the unit, burned utilizing prescribed fire, or disposed of outside of the project area.

Non-fire applications such as manual thinning are desirable in the Low Severity and Moderate Severity FMUs and in the other FMUs where there are resource values to be protected, and in the Developed Zone FMU where application of prescribed fire may not practical or acceptable. Non-fire applications are an appropriate tool to protect resource values by reducing fuel buildups and modifying forest structure to meet target conditions.

3.4 Description of Fire Management Units

Four Fire Management Units (FMU) were analyzed in an environmental assessment (DOI 2002) and are described by this plan. Three are based on historical forest fire regimes as characterized by Agee (1993). The fourth FMU is based on the Developed Management Zone identified in the park's draft 2004 General Management Plan (in prep.). A summary of FMU features is shown in the table on the next page.

A map of the park's FMU is shown in Figure 3-1 (page 30). Many areas of the park, particularly on the caldera rim, contain isolated areas of forest vegetation. Due to the scale of this FMU map, these areas do not appear within the "Non-forested" or

"Non-vegetated" areas. These isolated forest areas will be managed based on the FMU that the forest vegetation fits within.

Table 3-1 Summary of Crater Lake National Park Fire Management Units

FMU Identifier	Total Acres in FMU	% of Park Landbase	Mean Fire Return Interval	Annual Treatment Targets (acres) [2]	Target Acres to be Treated over 5 Years	Use of unplanned ignitions	Prescribed Fire Acres	Manual Thinning Acres [3]
Low Severity	19,539	11%	10-40 years	1,350-1,990	6,750-9,950	0-3,200	6,750	4,250
Moderate Severity	22,957	13%	40-60 years	383-563	1,915-2,815	0-900	1,915	190
High Severity	105,224	57%	80-100 years	500-1,300	2,500-6,500	0-4000	2,500	2,350
Developed	3,487	2%	varying	310	1,550	0	0	910
Total	**151,207[1]**			**2,543-4,163**	**12,715-20,815**	**0-8,100**	**11,165**	**7,700**

[1] The remaining 32,017 acres in the park contain non-forest vegetation, such as meadows, and non-combustible vegetation, e.g. Crater Lake, and are not included in fire management units. The acreage associated with non-forest vegetation and non-combustible vegetation is 21,111 acres and 13,293 acres respectively. Some areas of the park contain islands of forest vegetation within otherwise

[2] Yearly amounts may vary according to weather and other planning/implementation considerations.

[3] Manual thinning target acres are captured under those acres to be treated by prescribed fire (e.g. after 4,250 acres of manual treatments are conducted in the Low-Severity FMU, those same acres and up to another 2,500 acres would be treated with prescribed fire, for a total treatment in that FMU of 6,750 acres, at a minimum).

Features Common to all Fire Management Units

Fire Season

The typical fire season for the park occurs between June 10 and October 15 of each year, based on an historical fire weather analysis with data collected from the Panhandle and Desert Creek (Remote Automated Weather Stations (RAWS) and individual fire incident reports dating back to the 1930's. The highest incidence of lightning occurs during this time period, along with the highest mean daytime

temperatures and lowest mean daytime relative humidities. Before and after these dates, fuel moistures and persistent snowpack reduce the potential for fire growth to near zero.

Fuel Characteristics

A formal inventory of fuel conditions is lacking for the park. Based on a satellite classification of the park's forest cover completed in 1995, most (95%) of the fuels complex would be classified as timber litter (Anderson 1976). Within the timber litter fuel complex, most of the park's fuel types would fall under Fire Behavior Prediction System (FBPS) fuel model 8 (1978 NFDRS fuel model H) consisting of closed canopy stands of short-needle conifer; and FBPS fuel model 10 (1978 NFDRS fuel model G) which is short-needle conifer stands with heavy accumulations of dead/down material. There is a minor component of FBPS fuel model 9 (1978 NFDRS fuel model U) where there are stands dominated by ponderosa pines. The remaining 5% of the fuels are considered to fall into FBPS fuel models 2 (1978 NFDRS fuel model C) for the open pine stands with grass understory and FBPS fuel model 5 (1978 NFDRS fuel model F) for areas where low shrubs such as green-leaf manzanita and ceanothus dominant the understory.

Management Considerations

Much of Crater Lake National Park is managed as wilderness, and all fire management activities within areas managed as wilderness will employ minimum actions and tools necessary based upon the "Minimum Requirement" and "Minimum Tool" determinations. All fire management activities within areas managed as wilderness will follow the established Minimum Impact Tactics (MIT) guidelines described in the Crater Lake Resource Advisor Guide (Appendix 13.M).

Road access to areas within the park is limited to existing paved roads within the front country, and improved or unimproved unpaved roads on the adjoining National Forests. Access to backcountry areas of the park is by approximately 96 miles of recreational trails and former fire patrol roads, which form a network for accessing remote fires on foot.

Water sources are very limited in the park and are generally associated with steep canyon walls. Crater Lake, Sun Creek, and Lost Creek are prohibited from use as water sources due to their resource sensitivity. All other potential water sources must be approved by a resource advisor, or the Fire Management Officer if no resource advisor is available.

Radio and wireless telephone communications are limited in several areas of the park due to mountainous terrain creating dead spots. The park maintains two radio repeaters to minimize this limitation. Some of these communications dead spots coincide with blind spots experienced at the parks' two fire lookout towers.

These radio repeaters and fire lookouts are located atop The Watchman and Mt. Scott.

Specific Fire Management Objectives (resource target conditions)

The following table summarizes target conditions in terms of fuel reductions and forest structure for each of the Fire Management Units. The target conditions will change as management of these areas moves from a restoration phase to a maintenance phase. For additional information, see the FMP chapter on Monitoring and Evaluation (Chapter 6) or Appendix 13.F, which describes the wildland and prescribed fire monitoring program in detail.

Information used to develop the target conditions included research data where available, historic photos and written records, and expert opinion. These target conditions must be periodically evaluated to determine whether they are still realistic and desirable in light of a changing environment.

Table 3- 2 Resource Target Conditions by Fire Management Unit

FMU Identifier	Fuel Reduction Goal [Restoration phase]	Stand Density by diameter class and species composition [Restoration phase]	Fuel Load Distribution (% of landscape) [Maintenance phase]	Gap/Patch Size Distribution (% of landscape) [Maintenance phase]
Low Severity (White Fir, Ponderosa Pine)	60-90% total fuel reduction	20-50 trees/acre > 12" dbh * < 400 trees per acre 2-6" dbh (5-50% pine, 0-70% shrub, 0-25% grass/sedge)	20-40% 5-30 tons/acre 20-50% 30-60 tons/acre 5-20% >60 tons/acre	75-95%: 0.25 acre – 2.5 acres 5-25%: 2.5 – 25 acres < 1%: 25-250 acres
Moderate Severity (Shasta Red Fir)	60-90% total fuel reduction	30-80 trees per acre > 12" dbh < 600 trees/acre 2-6" dbh (30-70% fir 0-20% pine 0-20% other)	1-25% 5-30 tons/acre 30-70% 30-60 tons/acre 5-20% >60 tons/acre	70-95%: 0.25 – 10 acres 5-30%: 12.5 – 25 acres < 1%: 25 – 250 acres
Moderate Severity (Whitebark Pine)	35-55% total fuel reduction	Unknown density (40-90% pine, 0-50% hemlock, 0-10% fir)	Not yet developed	80-99%: 2.5 – 10 acres 1-20%: 12.5 – 750 acres < 1%: > 750 acres
High Severity (Mountain Hemlock, Lodgepole Pine)	35-55% total fuel reduction	Unknown density (15-60% hemlock, 0-40% fir 0-10% pine)	Not yet developed	80-99%: 0.25 – 250 acres 1-20%: 250 - 5000 acres < 1%: > 5000 acres

* dbh = diameter at breast height (tree trunk measured at 4.5 feet above the ground surface				

Description of Fire Management Units

The four Fire Management Units are described in more detail below.

1. Low Severity FMU

Physical and Biotic Characteristics

The boundaries of the Low Severity FMU coincide with the **ponderosa pine** and **white fir** forest communities located in the southeast, northeast and west-central portions of the park. This FMU is shown in yellow on the accompanying FMU map (See Figure 3-1) and comprises 19,539 acres or 11% of the park's total landbase.

Ponderosa Pine Forests

Environmental Characteristics

Ponderosa pine forests are found in the northeastern corner of the park, to the east of Timber Crater, at elevations up to 5500 feet. In this forest community, with a frequent return of fire, ponderosa pine would normally be the only conifer present. White fir is a common cohort in ponderosa pine stands due to fire exclusion, and lodgepole pine is found in association with ponderosa pine where coarse-textured pumice soils occur, or on topographic basins where cold-air drainage forms frost-pockets. In most pre-settlement ponderosa pine forests, there was a sizable herbaceous component, which together with pine needles created a flashy fuel that encouraged frequent, widespread burning.

The Fire Regime

Historically, fires tended to be of low intensity, rarely scorching the crowns of older, mature trees. Fires tended to be small, frequent, and patchy, in that they consumed too little fuel to scar trees. The historical mean fire return interval is 9-15 years. Fire is linked with other disturbance factors in ponderosa pine forests, most

notably post-fire insect attack. Scorched trees are more likely to be successfully attacked by western pine beetle *(Dendroctonus brevicomis)*, mountain pine beetle *(D. ponderosae)*, red turpentine beetle *(D. valens)*, or pine engraver beetles *(Ips spp.)*. Reduction in tree vigor during drought is also associated with insect attack and major losses in mature and old growth ponderosa pine occurred during the drought of the 1920's and 1930's in the Pacific Northwest. Fire may help control dwarf mistletoe infestation by pruning dead branches and consuming tree crowns that have low hanging brooms.

Stand Development Patterns

Soil moisture is more important than light for establishment of ponderosa pine seedlings. Available soil moisture is critical to seedling survival during the spring and early summer. Competition for soil water between trees and other understory plants is greatest in the 0-20 cm soil zone, within which ponderosa pine will be rooting in its first year. Presence of other understory vegetation, such as perennial grasses or mature trees, can reduce height growth of established ponderosa pine compared to open-grown trees, making the small pines more susceptible to thinning by periodic fire. Establishment on bare soil, historically provided by periodic fire, is higher than on micro sites covered by pine needles. The roots more quickly penetrate into the soil, and moisture availability may be enhanced on bare, open patches across the landscape. Shading of the seedlings can be important for protection from heat and frost by reducing incoming short-wave radiation during the day and long-wave radiation loss at night.

The process of stand development in ponderosa pine forests is a result of the shade intolerance of ponderosa pine, periodic good years for seedling establishment associated with years of above-normal precipitation, and frequent fire. Gaps in the forest, created by mortality of an existing small, even-aged group, allow the shade-intolerant pine to become established when a good seed year and appropriate climate coincide. In this opening, the stand of young trees will be protected from fire because of lack of fuel on the forest floor, while the fire will burn under mature stands and eliminate any reproduction there. As the trees in the opening continue to grow, they provide enough fuel to carry the fire and thin the stand. Within a group, relatively uniform spacing is the result of moisture competition and a tendency for closely spaced trees to be selectively killed by fire.

Fire normally maintains the forest as an aggregation of very small, even-aged or even-sized clumps. As one clump ages, it is attacked by western pine beetles and then decomposes by fire, scarifying the site for another clump to regenerate. Because of this interaction between fire and beetles, snags tend to be clustered on the landscape, and coarse woody debris is likely short-lived because of frequent fires. Consumption of coarse woody debris naturally inhibits rhizomatous grasses and shrubs and creates growing space for pine regeneration.

Management Implications

Ponderosa pine forests have experienced significant ecological change since fire suppression began. Fire exclusion has allowed a major increase in white fir density and the chances of stand-replacement fire, characteristic of high-severity fire regimes, are much greater now than historically.

Reintroducing fire within ponderosa pine forests needs careful prescription. Due to their altered fuel and forest structure, it is unlikely that fire-excluded forests can absorb the shock of naturally occurring fires during the summer months. Such fires would generally be far too intense, consume too much fuel, and cause the death of many of the older, presettlement forest trees. Prescribed fire is essential to restore such sites and can be done through a series of low intensity fires. Attempts to complete the restoration in a single fire are not realistic. Autumn fires appear to harm low vigor ponderosa pines less than spring fires in *Abies concolor* forests and it is assumed to be true for ponderosa pine forests as well. Once a series of prescribed fires has reduced surface fuel loads, fuel ladders to the overstory, and total tree density, either continued prescribed fires or natural fires can maintain the role of fire into the future of this forest type.

White Fir Forests

Environmental Characteristics

East of the Cascade Crest, white fir communities are a mix of ponderosa pine and white fir with lesser amounts of Douglas-fir, incense cedar, lodgepole pine and sugar pine. Historic fires favored the survival of pines over fir, and most of these stands, concentrated in the southeastern portion of the park, were historically dominated by ponderosa pine.

West of the Cascade Crest, white fir communities are found along the park's west boundary up to elevations of 5300 feet. These communities are a mix of white fir, incense cedar, and Douglas-fir as dominants with lodgepole pine, sugar pine and western white pine as minor cohorts.

The Fire Regime

Specific fire history information is available for the panhandle area of the park. Researchers studied an elevation gradient from the southern end of the panhandle up into the red fir forest types, and found an average fire return interval of 9-42 years along the gradient, with the lower average adjacent to the ponderosa pine type and the upper average adjacent to the red fir type. Variation in the return of fire was high, and that probably allowed fire-intolerant white fir (at least while it was young) to survive as a co-dominant in this classic low-severity fire regime type.

Stand Development Patterns

The forest stands in the southern portion of the park are generally one-storied, and composed of small clumps. However, these clumps tend to be comprised of only one of the major species in white fir communities: one clump of ponderosa pine, another of sugar pine, another of white fir, several more of ponderosa pine, etc. Fires are frequent enough to kill most understory trees invading the clumps, so that these forest stands remained relatively open.

Understory shrubs such as gooseberries, currants, and ceanothus would either sprout after burning or reproduce from seeds stimulated to germinate by heating as the fire passed over. As in the ponderosa pine type, frequent fires maintained a low shrub/grass understory. It was probably better developed under pine clumps than under relatively shadier true fir clumps.

Management Implications

White fir forests have been significantly affected by fire exclusion. These open, mixed conifer forests have been choked by white fir regeneration and, to some extent, lodgepole pine. Most of the regeneration ceased about 1950 when growing space in the stands was fully occupied by trees. Fire hazard has significantly increased in white fir communities, and these changed stand conditions have led to increased stand susceptibility to bark beetles. Density management (thinning) and understory burning are recommended to reduce fuel buildup, reduce stand susceptibility to insects and diseases, and reduce the probability of soil damage and erosion resulting from wildfire.

Sugar pine, as a component of mixed-conifer forests, is a species of management concern. With the encroachment of white fir, sugar pine densities have declined. While somewhat shade-tolerant, sugar pine can be damaged by fire when young; while at maturity it is generally very resistant to low- to moderate-severity fires that recur at 15-25 year intervals. Mature trees have a thick, fire-resistant bark and open canopy that retards aerial spread. Sugar pine, along with western white pine and whitebark pine are susceptible to the introduced white pine blister rust and will continue to be at risk throughout their respective ranges. The use of prescribed fire will facilitate the reduction of competing species (e.g. white fir) and create openings for sugar pine regeneration.

<u>Wildland Fire Management Situation Summary for Low Severity FMU</u>

Prescribed fire and Non-fire applications such as manual thinning are the most appropriate management options for this FMU. Fire regimes in this FMU have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals, resulting in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Forests in this FMU need aggressive amounts of restoration treatments (manual treatments) before fire can be used to maintain a more historical fire regime.

2. Moderate Severity FMU

Physical and Biotic Characteristics

The boundaries of the Moderate Severity FMU coincide with the **Shasta red fir** and **whitebark pine** forest communities located in the south, west and east central portions of the park. This FMU is shown in orange on the accompanying FMU map (See Figure 3-1) and comprises 22,957 acres or 13% of the park's total landbase.

Shasta Red Fir Forests

Environmental Characteristics

Shasta red fir forests occupy the mid-flanks of Mt. Mazama at elevations between 5300 and 6600 feet. These communities are dominated by red fir with varying amounts of lodgepole pine, with lesser amounts of western white pine and white fir. Shasta red fir is a hybrid between noble fir *(Abies procera)* and California red fir *(Abies magnifica).* Their ranges overlap between Mt. Shasta, California and the Calapooya divide, north of Crater Lake, Oregon.

The Fire Regime

Red fir ecosystems have a classic moderate-severity fire regime. Red fir, when mature, is relatively fire tolerant. Average fire frequencies of 40-70 years combined with a range of fire intensities leads to a patchy mosaic of different age structures across landscapes of this type. At Crater Lake, typical large fire sizes in red fir forests have been about 500 acres. Small patches of low, moderate, and high-severity fire typically occur, with high-severity fire often covering less than one-third of the landscape. Old-growth stands of red fir are least likely to burn with high severity.

Stand Development Patterns

Stand development patterns in red fir forests are complex because red fir is not only fire-tolerant but is also shade-tolerant. It does well with or without disturbance. Several stand development patterns are common. If no lodgepole pine is present when a stand replacement fire occurs, shrub dominance will occur (ceanothus and manzanita) with later, slow recolonization by red fir. In moderate-severity patches, some red fir dominants remain and provide seed for colonization by red fir, which does well in these partially shaded conditions, creating a multiple age class stand. In low-severity patches, understory trees are killed but little growing space is opened for regeneration, and red fir reproduces slowly in small gaps where sun flecks occur.

Management Implications

Although there has probably been some increase in older patches, red fir stands have not been affected substantially by fire exclusion over the past 80-100 years. Fire effects from natural fires appear to be within the natural range of variability.

Whitebark Pine Forests

Environmental Characteristics

Whitebark pine forests occur on several thousand acres in Crater Lake National Park and represent the most expansive and diverse aggregation in southern Oregon. The majority of whitebark pine stands occur around the caldera rim above Crater Lake which is the most heavily visited portion of the park. The distribution of whitebark pine is strongly influenced by the dispersal of seeds by Clark's nutcracker. Whitebark pine occurs on dry, rocky, subalpine slopes and exposed ridges.

Whitebark pine forests east of the Cascade Crest support diverse communities with lodgepole pine, Shasta red fir, and mountain hemlock often separately co-dominating stands. Stands are generally open with an undergrowth of low shrubs, forbs and grasses. Sites where whitebark pine occurs as climax are drier than those where it is seral, such as the flanks of Mt. Scott where pure stands of whitebark pine have been observed.

The Fire Regime

Moderately fire resistant, whitebark pine is favored by both creeping or intense surface and ground fires. Both types of fires kill most shade-tolerant and fire-sensitive species associated with whitebark pine such as mountain hemlock and subalpine fir. Hot surface fires that heat the cambium cause fire injury or death to these thin-barked trees. Fires of low to moderate severity can climb into trees if fuel ladders and downfall are present, thus increasing the potential of torching.

The vulnerability of whitebark pine to fire is reduced by the open structure of its stands and the dry, exposed habitats with meager undergrowth in which it grows.

Estimates of fire return intervals range from 50 to 300 years depending on location. Fire may stimulate the growth of currants and gooseberries, the alternate hosts for white pine blister rust, and thus the spread of the rust into whitebark pine trees.

Most fires occurring where whitebark pines grow are ignited by lightning and do not spread very rapidly or cause severe tree injury. In Crater Lake National Park, most fires in whitebark pine forests appear to be small and many burn only one clump of trees.

Stand Development Patterns

Whitebark pine exhibits high frost resistance and low shade tolerance. Fires create openings conducive to the planting of seeds by Clark's nutcrackers *(Nucifraga columbiana)* for seedling establishment. On moister sites however, mountain hemlock and subalpine fir may out-compete whitebark pine for light and nutrient resources and limit whitebark pine regeneration.

More information is needed on fire history and the resulting development of Cascadian whitebark pine communities in Oregon and Washington.

Management Implications

Whitebark pine forests in the park, and elsewhere in the Cascades, are dying from the introduced fungus (*Cronartium rubicola*), which causes blister rust. Blister rust has been documented in the park as early as 1935. Current estimates suggest that the disease results in an overall annual decline of 0.4% for mature whitebark pine trees within the park. At that rate of decline, it is anticipated that there would be an additional 20% decline in the current whitebark pine population within 50 years.

Fire exclusion may have also impacted the health and vitality of the whitebark pine stands in the park. Fire exclusion leads to less opportunity for regeneration coupled with successional advancement of competing trees. Fire exclusion has resulted in a much smaller acreage being exposed to moderate and high severity wildfires, where new opportunities for whitebark pine regeneration could occur. If misapplied, fire could damage existing stands of whitebark pine that provide future sources of seed including blister rust-resistant strains. Additional research is needed on the fire history of Cascadian whitebark pine before park managers consider using prescribed fire as a tool to help restore declining whitebark pine communities.

<u>Wildland Fire Management Situation Summary for Moderate Severity FMU</u>

The use of wildland fire for resource benefits option is an appropriate response to natural ignitions originating in this FMU. Fire regimes in this FMU are within an historical range and the risk of losing key ecosystem components is low.

Prescribed fire and Non-fire applications such as manual thinning may be desirable options for protecting specific resource values by reducing fuel buildups and modifying forest structure to reduce fire intensities if ignitions do occur.

3. High Severity FMU

Physical and Biotic Characteristics

The boundaries of the High Severity FMU coincide with the **lodgepole pine** and **mountain hemlock** forest communities located in the upper elevations throughout the park. This FMU is shown in red on the accompanying FMU map (See Figure 3-1) and comprises 105,224 acres or 57% of the park's total landbase.

Lodgepole Pine Forests

Environmental Characteristics

Climax lodgepole pine communities occur in the park where topo-edaphic influences result in areas with exceptionally low productivity, aggravated by continual cold air drainage. These forests are identified by the exclusive presence of lodgepole pine in both the overstory and understory, and a paucity of understory shrubs and herbs. Examples of climax lodgepole pine communities in the park include the edge surrounding the Pumice Desert, Pumice Flat, and the Wheeler and Sand Creek drainages.

These climax lodgepole communities are surrounded by others that also have lodgepole pine, such as the red fir and mountain hemlock communities. The occurrence of lodgepole pine in these communities is a good marker of past high-severity disturbances, which occurs infrequently (more than 100 years between fires) and usually replaces an entire stand with a high intensity fire. These events allow lodgepole pine to dominate sites otherwise dominated by other species. In the climax lodgepole pine forest, lodgepole pine is the dominant tree species, regardless of disturbance history.

The Fire Regime

Climax lodgepole pine forests have a moderate-severity fire regime. A combination of low, moderate, and high severity fires occurs through space and time. The magnitude of natural fires ranges from slowly burning logs across the forest floor to crown fires. Fires

of low to moderate severity encourage secondary disturbance by insects and pathogens. Most lodgepole stands at the park have a patchy history of fire occurrence and spread. The average fire-free interval is 60 - 80 years, with areas bordering higher productivity forest on the low end of the range. Strong winds are likely associated with the rare stand replacement fire in the lodgepole pine type.

Stand Development Patterns

Lodgepole pine trees are usually killed by fire because of their shallow root system and thin bark. Fire prepares an ideal seedbed and lodgepole pine functions as an early post-fire colonizer. The variety of lodgepole pine in this area has non-serotinous cones *(Pinus contorta var. murrayana)*. Stands reestablish after a disturbance from off-site sources delivered by wind-dispersed seed. Most stands surveyed in the park have multiple age classes resulting from mortality due to either mountain pine beetle (*Dendroctonus ponderosae*) or past fire events. Stems killed by either agent will fall within 5-10 years, and over a 40-50 year period they maintain hard sapwood but decayed heartwood, an ideal vector for fire spread. In the meantime, any clump of trees killed is colonized by a new generation of lodgepole pine, and this process, repeated over time, results in multiple age classes of the pines. Understory vegetation development is never substantial in these forests. Moisture competition restricts tree regeneration to gaps created after a tree falls and few herbs or shrubs tolerate these low productivity sites.

Management Implications

Climax lodgepole forests rarely grow for a century without a major disturbance by fire or insects. Within the park, both log-to-log and crown fire activity has been observed. The low productivity of these forests has limited the amount of fuel buildup and other changes due to past fire exclusion policies. These stands should be expected under most conditions to have slow-moving fires burning along logs created decades earlier by a past fire or insect disturbance. Fires moving into such stands from adjacent forest types will normally be extinguished on their own as fuels dissipate in the interior of the stand. Under most conditions, these forests will act as natural fuel breaks. However, the occurrence of past crown fires in this forest type (e.g., Prophecy Fire 1988), suggests that climax lodgepole stands cannot be considered fire barriers under all fire weather conditions.

The use of wildland fire may be implemented in this forest type to achieve natural values with the knowledge that human impact on such stands appears to have been minimal over the past 100 years. Under most conditions, these forests will act as natural fuel breaks, where fire suppression, if desired, will be relatively easy. Thinning treatments will enhance the effectiveness of these natural fuel breaks in areas where there are resource values at risk.

Mountain Hemlock Forests

Environmental Characteristics

Mountain hemlock stands are the highest elevation continuous forests at the park occurring at elevations between 5600 and 7900 feet. These forests are characterized by the presence of mountain hemlock as the major climax dominant. Discontinuous stands are transitional to alpine meadows or to a whitebark pine zone in the park and occur in a mosaic pattern. Lodgepole pine is a common early seral species in this forest community, indicative of past disturbance by fire. Other occasional ecotonal associates include whitebark pine, Shasta red fir, and subalpine fir. The forests in the subalpine zone have a prolonged winter snowpack and a short growing season that significantly affects both the fire regime and post fire successional patterns.

The Fire Regime

Mountain hemlock is not well adapted to fire. Its life history strategy towards fire is that of an avoider. Its relatively thick bark provides some protection at maturity, but low-hanging branches, highly flammable foliage and a tendency to grow in dense groups make it very susceptible to fire injury. Mountain hemlock sites are typically moist with annual average precipitation greater than 50 inches, making the probability of fire occurrence low. South-facing slopes are more likely to burn than north-facing slopes.

Fires in these cool wet forests generally occur as infrequent crown fires. When fires do occur, they are often severe stand-replacing events, with the majority of historic fire events resulting in burned patches less than 1200 acres each. Fire return intervals for mountain hemlock forests of the Oregon Cascades are not well documented. One study by Dickman and Cook suggest intervals greater than 500 years, while Atzet reports disturbance intervals of 115 years for mountain hemlock forests in the Klamath Mountain Province of southwest Oregon.

Stand Development Patterns

Fire is the primary large-scale disturbance agent in this forest type. Most other disturbances operate at the scale of individual tree gaps or small patches (insects, disease, and wind). Mountain hemlock is not adapted to grow well in open, recently burned environments. Young seedlings grow best in partial shade and early development is often slow. Mountain hemlock is very shade tolerant and often succeeds lodgepole pine when these species pioneer on drier sites. Where lodgepole pine is present, an even-aged stand of lodgepole pine will emerge from a fire disturbance, but where it is absent, the site may revert to shrubby, non-forest vegetation for more than a century after burning. Where whitebark pine is present, fires are often of moderate-severity, killing some pine but leaving other clumps intact, providing a source of seed for regeneration.

Management Implications

Fire injury makes mountain hemlock very susceptible to insects and disease. Mountain hemlock is particularly susceptible to laminated root rot *(Phellinus weirii).* This fungus spreads from infection centers along tree roots, killing infected trees in an expanding radial pattern. Active infection centers within mountain hemlock stands have been measured as large as 100 acres. These root rot pockets are characterized by numerous snags in various stages of decay with older-aged snags and downed woody debris at the center of spread.

Fire may play an important role in breaking up *Phellinus* centers, by creating conditions more suitable for the *Phellinus*-resistant lodgepole pine. The pine may then competitively exclude mountain hemlock from the site until the *Phellinus* inoculum is present only in large isolated stumps, remnants of the former stand that have not fully decayed. Dickman and Cook suggest three possible interactions between fire and fungus that depend on fire-return interval: 1) a fire-return interval of 200 years or less, resulting in dominance by lodgepole pine and disfavoring *Phellinus*; 2) a fire-return interval of 600 years, which may foster mountain hemlock stands infected with *Phellinus*; mixed with other stands dominated by lodgepole pine, much like the present landscape; and 3) absence of fire as a disturbance agent which disfavors lodgepole pine and increases the role of *Phellinus*; creating a forest landscape much different than the one seen today.

Although infrequent and unpredictable, fires have been an important force in shaping mountain hemlock forests, especially where they intermingle with subalpine meadows and whitebark pine woodlands. The use of wildland fire may be the best option to meet resource management objectives in this forest type, presuming that an assessment of the expected fire behavior and associated values at risk are conducted for each fire event.

<u>Wildland Fire Management Situation Summary for High Severity FMU</u>

The use of wildland fire for resource benefits option is an appropriate response for natural ignitions originating in this FMU. Fire regimes in this FMU are within an historical range and the risk of losing key ecosystem components is low.

Prescribed fire and Non-fire applications such as manual thinning may be desirable options for protecting specific resource values by reducing fuel buildups and modifying forest structure to reduce fire intensities if ignitions do occur.

4. Developed FMU

Physical and Biotic Characteristics

The boundaries of the Developed FMU coincide with the "Developed Management Zone" identified in the draft 2004 General Management Plan (in prep.). This FMU consists of discrete areas where administrative and visitor facilities are concentrated including South Maintenance Yard, Mazama Dormitory, Mazama Village and Campground, Park Headquarters and Munson Valley Residence area, Lost Creek Campground, and Rim Village. This FMU is shown in light blue on the accompanying FMU map (See Figure 3-1) and comprises approximately 3,487 acres or 2% of the park's total landbase.

In this FMU, natural and cultural resources have been modified for visitor and park operational needs. Sign of human activity are fairly obvious by the concentration of visitor centers, lodges, campgrounds, administrative offices, maintenance areas, and residences and their associated paved paths, roads, and parking areas. Mountain hemlock and Shasta red fir forests form a visual backdrop for these areas and pose a fire risk from the accumulation of fuels associated with these forest types.

Specific Fire Management Objectives

The desired future condition for this FMU is a series of visually pleasing landscapes that pose little risk of catastrophic crown fire and the resulting threat of fire damage to existing structures. To accomplish this goal, manual thinning treatments will be applied to maintain a minimum tree density of 108 trees per acre (e.g. 20 x 20 foot spacing between tree boles) and to reduce down dead fuel loads by 35 - 55%.

Wildland Fire Management Situation Summary for Developed FMU

The wildland fire suppression option is the only appropriate response for ignitions originating in this FMU because of the imminent threat to visitors and facilities. . Managing unplanned ignitions for resource benefit will not be considered for this FMU.

Prescribed fire and non-fire applications such as manual thinning are desirable options for protecting resource values by reducing fuel buildups and modifying forest structure to meet
target conditions.

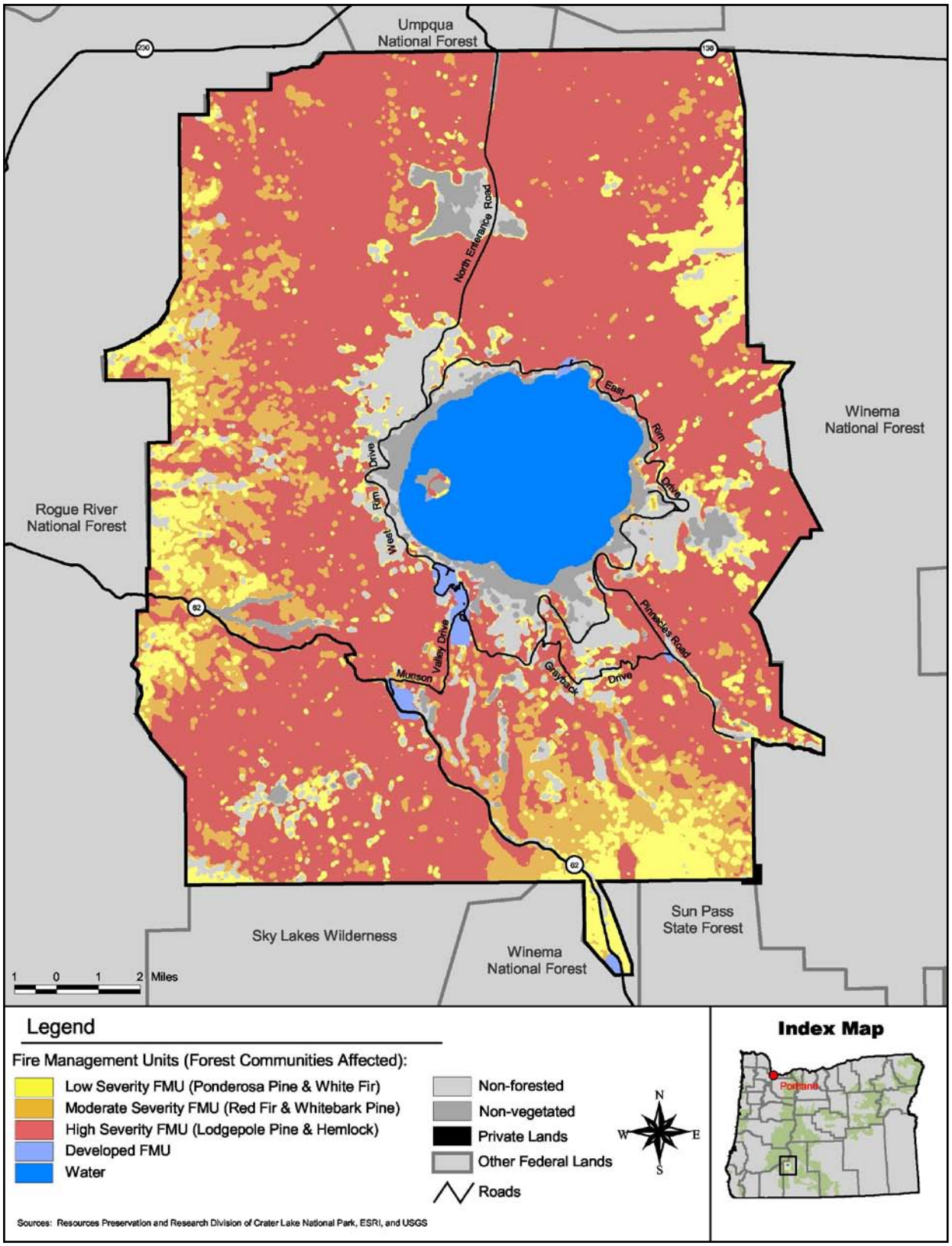

Figure 3-1 Crater Lake NP Fire Management Units (FMUs)

Chapter 4

Wildland Fire Management Program Components

4.1 General Management Considerations

GMP and NPS policy direction for Crater Lake National Park is summarized as the following:

1. Protect human life, property, and designated resources.
2. Allow fire to play its ecological role in the park to the greatest extent possible through the use of appropriate fire management techniques.
3. Suppress wildland fires in a safe, cost-effective, and environmentally sensitive manner commensurate with the values at risk.
4. Maintain an active fire prevention program.
5. Maintain or have access to fully qualified fire management staff to implement the fire management plan.
6. Maintain an interpretive and public information program that will educate the public on the ecological role of fire in the park and provide daily fire danger and situation information.

Crater Lake National Park will use all of the current fire management tools available to fire managers. As described in the accompanying Environmental Assessment, Crater Lake's Fire Management program will implement the following fire management strategies:

- Fire suppression with confine, contain or control tactics will be used throughout the park. Initial action on human-caused wildfire will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety. Suppression actions will be utilized for natural ignitions that fail to meet the requirements for viable use of wildland fire. The suppression strategy will be implemented in the park when protection of life and property is paramount.

- Where it is deemed appropriate, the management of wildland fire for multiple objectives will be considered for naturally occurring wildland fires. Natural ignitions occurring in the moderate and high severity FMUs may be managed as a benefit to the resource, but will need to meet specific criteria. The management of wildland fire for multiple objectives is designed to allow naturally-ignited wildland fires to operate across the park landscape, within

prescriptive parameters, thereby reintroducing beneficial fire effects to the park landscape while reducing long-term smoke impacts as well as reducing the total costs of fire suppression.

Management of wildland fire for multiple objectives is the desired option for maintaining fire occurrence where possible in Crater Lake National Park. Implementation of these fires proximate to park boundaries, or with the potential to escape park boundaries, has the potential to require active management in directions of undesirable movement. Impacts from management actions will be mitigated and restored as soon as the fire area is controlled. Fire managers will ensure that impacts from management actions are mitigated both during and immediately after the action.

- Prescribed fire will be used for the reduction of hazard fuels and for the benefit of other resources. Prescribed fire is prescriptive through design, therefore focused on a limited range of fire effects within a designated unit boundary, and cannot be implemented until all of the pre-burn requirements (mitigation measures and planning) have been met.

- Manual fuels reduction activities are appropriate in non-wilderness areas of the park. They may be appropriate for wilderness areas of the park when approved after undergoing a Minimum Tool Analysis. These projects will need to meet all mitigation measures prior to and during implementation. These projects can be used to step-down fuel loadings to a level that will allow maintenance burning to be implemented without significant damage to the remaining overstory stand structure.

Fire managers will use the above strategies to create a fire management program responsive to park management needs and keeping the protection of life and property as the number one priority for fire management activities and decisions. More in-depth discussion of these fire management actions follows.

4.2 General Implementation Procedures

A wildland fire may be concurrently managed for one or more objectives and objectives can change as the fire spreads across the landscape. Objectives are affected by changes in fuels, weather, topography; varying social understanding and tolerance; and involvement of other governmental jurisdictions having different missions and objectives.

All fire management responses in Crater Lake National Park will be managed using the Incident Command System, with opportunities for unified command when incidents extend across agency boundaries, at which time the primary cooperator will be determined according to the major impacted jurisdiction. The Klamath Falls

Interagency Fire Center (KIFC) is responsible for contacting the appropriate fire management or law enforcement personnel to respond to the report of a wildland fire, and for dispatching initial attack park wildland fire fighting resources. After-hours fire reporting or 911 calls are routed though Southern Oregon Regional Communications Center (SORC) which then contacts the appropriate wildland fire or law enforcement personnel.

Typically the Fire Management Officer assigns an Incident Commander for Type 3, 4 or 5 suppression fires within the park. For Type 1 or 2 fires, or fires that cross the park boundary, typically the Fire Management Officer or Chief Ranger responds to the Incident Command Post and serves as an Agency Representative.

The National Park Service Agency Representative is responsible for requesting a Resource Advisor directly through the Park Superintendent or through KIFC if qualified park personnel are not available.

A qualified Resource Advisor will be assigned to multi-day fires or fires that occur within sensitive areas within Crater Lake National Park or to fires that have potential to spread into the Park. The Resource Advisor anticipates impacts to sensitive resources during wildland fire operations; provides input an appropriate actions to minimize the impacts to these resources; communicates requirements for resource protection to the Incident Commander (IC) or Incident Management Team (IMT); ensures that planned mitigation measures are carried out effectively; and provides input in the development of short- and long term natural resource and cultural rehabilitation plans. Whenever possible, the resource advisor will be familiar with sensitive resources of the park and management issues affecting them.

The responsibilities of the Resource Advisor involve contact with the Agency Administrator, the IC, the Planning Section Chief, and operations personnel at all levels. The Resource Advisor is the Agency Administrator's representative and works directly for him/her. The Resource Advisor helps to implement the directions and standards that the Agency Administrator sets for the IC or IMT. However, the Resource Advisor position works within the incident command structure coordinating resource issues with the IC and IMT. While on the incident, operational direction comes from the IC or IMT.

Resource advisors will adhere to the same fireline safety standards as other fire personnel in Crater Lake National Park. Consistent with other park fire standards, resource advisors who are Single Resource Boss or higher may work unescorted, provided they maintain contact with the appropriate Division Supervisor or IC. Resource advisors qualified at less than the Single Resource Boss level will work in teams of at least two, with one qualified as a Firefighter One (FFT1) provided they maintain contact with the appropriate Division Supervisor or IC.

Every wildland fire will be assessed following a decision support process that examines the full range of potential responses. Decision support processes and analysis that help determine and document decisions regarding the management of individual ignitions will follow current national direction. The Wildland Fire Decision Support System (WFDSS) and analysis tools such as Farsite, RAVARAP, and FSPro are currently approved.

The Wildland Fire Decision Support System (WFDSS) may be used as an alternative decision-making process. WFDSS contains three Response Levels, RL1, RL2, and RL3 that equate to changing incident complexity. The process can be completed at any level, progress through multiple levels, or jump to an appropriate level and may be used for single or multiple fire situations. The WFDSS process incorporates geospatial analysis, fire behavior modeling, and fire management objectives into the decision-making process.

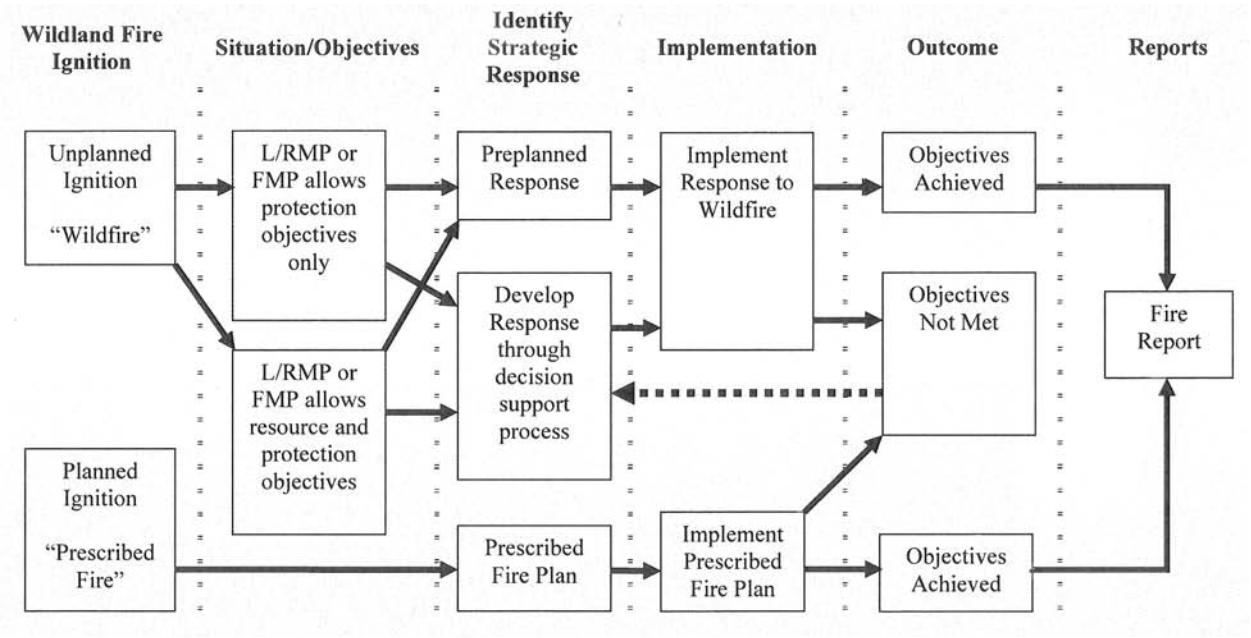

Figure 4. 2 Wildland Fire Flowchart Utilizing WFDSS.

Minimum Impact Tactics Requirement

All fire management activities in the park will rely on tactics that minimize resource damage while maintaining the safety of firefighters, personnel and the public as the highest priority. Superintendent approval is needed for off-road use of vehicles, bulldozers, and some mechanized equipment. The Minimum Impact Tactics (MIT) contained in the park's Resource Advisor Guide will be followed (Appendix 13.M).

4.3 Wildland Fire Suppression

The objective of wildland fire suppression, as an integral part of wildland fire management in the National Park Service, is to manage wildland fires safely and efficiently to accomplish protection objectives. It will be integrated into land and resource management plans and activities on a landscape scale, across agency boundaries, and will be based on best available science. Protection priorities are (1) human life and (2) property and natural/cultural resources (RM 18, 1999).

Because Crater Lake National Park has limited fire suppression resources, most suppression activities will be accomplished in conjunction with the other local fire agencies. Within the park boundary all wildland fires will be managed according to federal protocols. Federal actions will be consistent with direction provided in RM 18, DO 60 and *Interagency Standards for Fire and Fire Aviation Operations*.

<u>Range of Potential Fire Behavior</u>

Fire behavior in Crater Lake National Park is directly related to seasonal and long-term climatic variation. As a general trend, fuels become more available for combustion further into the fire season, tapering off as greater seasonal trends oscillate with atmospheric conditions leading to fire season ending events.

As a mechanism for ignition, multiple sources are available across the park. Natural ignitions are frequently caused by lightning. Human-caused wildland fires occur less frequently, with potential ignition sources including escaped campfires, discarding of burning cigarettes and administrative chainsaw use.

Seasonal variation ranges from early snowmelt, low precipitation years, to late snowmelt, high precipitation years. Larger-scale weather patterns will often create variations within the normal seasonal distribution of precipitation, but will generally result in a normal overall fire season.

Long-term climatological variation may lead the park into three primary fire behavior scenarios; extended drought, seasonal normality, or extended green-up. As mentioned

previously, the normal expectation is a fire season of mixed fire behavior (seasonal normality).

The extended drought scenario is expressed by fires with high fuel availability early in the fire season, with previous precipitation years well below the climatological average. This scenario is representative of stand-replacing fires experienced by both the lodgepole and mountain hemlock communities. Fuels may be extremely available during these events. Indicators of potential for this type of scenario are ERC above the 97th percentile, live fuel moistures below 100% and precipitation below the 75th percentile for the previous 9 months. The driving factor for large fire spread will be wind. As a disturbance element, wind will function to promote fire spread and extent. An expectation of low-intensity, low-severity fire behavior is unrealistic during these periods, but well within the natural range of variability for these ecosystems and fire behavior models.

The range of expected fire behavior for a seasonally normal precipitation year will be from smoldering to independent crown fire. Combinations of flanking, backing and head fires, within the variability of available fuels will exhibit the full range of fire behavior characteristics and effects. Fuels will be available as the season progresses with the ERC tracking the historical average, live fuel moistures exhibiting seasonal fluctuations, and precipitation within 1 standard deviation of the climatological average for the previous 9 months. Severity and intensity will be patchy, contributing to the spatial heterogeneity of fire effects across the landscape.

The extended green-up scenario is based either on very late snowmelt, anomalous precipitation events or extended periods of high precipitation. This scenario is represented by fires from all ignition sources failing to become established. Fuels are considered too moist for sustained combustion and will usually exhibit only smoldering fire behavior. Indicators of potential for this scenario are: ERC below the historical average, live fuel moistures above 150% (or failing to go into seasonal dormancy), and precipitation above the 90th percentile for the previous 9 months. Fire behavior and intensity may be expressed by smoldering and creeping with occasional patches of preheated fuels burning with higher intensity. Severity will usually be low to moderate, with fire duration being the primary factor influencing stand or species mortality.

General FBPS fuels models that exist in the park are as follows:

1. Fuel model 2: Open grass/shrublands under stands of pine
2. Fuel model 5: Stands of low-growing shrubs with a low percentage of deadwood
3. Fuel model 8: Closed conifer stands with low amounts of large down woody fuels
4. Fuel model 9: Closed ponderosa pine stands

5. Fuel model 10: Conifer stands with a high component of large down woody material

Preparedness Actions

Fire Prevention Activities

A Prevention Plan will be incorporated as an appendix to this Fire Management Plan (see Appendix 13.I).

Previous analysis of human-caused fires at Crater Lake has indicated that, in most cases, human-caused fires have occurred near camping areas. Most have been escaped campfires and have resulted in burned areas of less than 0.1 acre per incident. Efforts should continue toward education of the public regarding potential fire hazard, especially during periods of high or extreme fire danger. This will be accomplished through personal contacts, posters, interpretive programs and press releases.

During periods of high fire danger, certain high-risk areas may be closed to open fires or to public entry. Closures will be recommended by the Fire Management Officer in consultation with the Chief Ranger, and approved by the Superintendent. To the extent possible, such closures will be coordinated with similar actions by the U.S. Forest Service and the Oregon Department of Forestry on adjacent land. Closures will be announced by press releases, information provided at public contact stations, and on trailhead bulletin boards. Area closures may also be implemented to protect public and employee safety during wildland and prescribed fire operations (see Appendix 13.G).

Community Education

Crater Lake National Park fire management personnel will continue working with cooperators in disseminating wildland fire prevention messages to the public as well as communities and homeowners. Activities such as assisting in evaluations of communities at risk and "FIREWISE" programs for adjacent and park homes will continue as needed.

Community Risk Assessment

Crater Lake National Park has assisted in the evaluations of communities for determining the 'communities at risk' designation and where appropriate may assist

communities in obtaining Rural Fire Assistance Grants as well as other appropriate grants.

Community Assistance Education

Fire management personnel may assist communities where appropriate in wildland fire preparedness grants for equipment and training. Generally the local communities affected are outside of the fire management sphere of influence for the park.

Annual Training Activities

FirePro (the NPS fire management analysis program) was used to analyze the necessary level of fire qualification skills that must be available to manage the fire management program at Crater Lake National Park. Historic wildfire occurrence (based on a 10-year average), commensurate with values at risk, indicate that the park should train and staff in-park qualified personnel.

All personnel involved in wildland fire management, prescribed fire, or fire monitoring will meet national standards as determined by National Wildfire Coordinating Group (NWCG), PMS-310-1. All personnel involved in fire management operations will have their qualifications, training, and experience entered into the interagency Incident Qualification and Certification system (IQCS). Records will be updated annually and a master list of park personnel and their qualifications will be available in the fire management office and the park communications center for mobilization and dispatch purposes. Wildland fire training is the responsibility of the Fire Management Officer. Training is coordinated with the Regional Fire Management Office and updated yearly.

The requirements of the NPS Wildland Fire Management Qualification and Certification System as a part of National Incident Management System (NIMS) will be utilized. Red cards will be mandatory for all personnel engaged in wildland and prescribed fire activities as required. Until service-wide standards are promulgated for prescribed burning, the Park will utilize the NWCG "Prescribed Fire Qualifications Guide" for appropriate levels of experience and training. For fire monitoring, the Park will utilize the Pacific West Region Fire Monitoring Handbook.

The wildland fire training program developed by the fire management staff is reviewed annually to prioritize training opportunities, allocate training funding, nominate specific individuals for courses, and develop the annual park training schedule. Training information will be made available to all park employees. Nominations for these courses will be submitted for personnel who have met the

prerequisites and have identified these courses in their annual Employee Development Plan. Fire training, at various levels, will be available to all park personnel. The Basic Firefighter (S-130) and Basic Fire Behavior (S-190) courses will be offered each spring to all interested personnel to qualify at the firefighter level. Prospective Emergency Firefighter personnel (SCAs, VIPs, etc.) will be permitted to attend. This may be conducted in an interagency setting outside the park. Funding for non-fire positions to attend training may be provided if deemed essential to agency mission and park staffing levels. Additional training will be offered for standards for survival, pump and engine operation, power saws, fire lookout operation, fire weather, helicopter safety and fire ecological effects monitoring. Extensive on-the-job training is encouraged and conducted at the field level.

Additional courses may be offered in park as the need arises, and permanent personnel may be nominated to 300 and higher level courses at the regional and national level, based on park needs.

Each year all wildland fire qualified personnel will attend an approved wildland fire safety refresher course and pass the work capacity test (pack test) at the highest fitness level identified for a position on their red cards. This refresher and pack test will be valid for 12 months from the date taken. Completion of this training is a prerequisite before individuals will be sent to a wildland fire. In addition, all red-carded personnel may receive, and all park personnel may be offered, instruction in:

1. Purpose and objectives of the fire management program.
2. Fire ecology in ecosystems.
3. Information regarding appropriate considerations and constraints to protect wilderness values during fire fighting operations.
4. Identification of and impacts on cultural resources during fire management operations.

The Fire Management Officer will provide training to park communications center personnel in fire dispatch procedures.

The Park strives to develop individual Type I and II overhead personnel from among qualified and experienced park staff for assignment to interagency overhead teams at the local, regional, and national level.

Current training requirements are outlined in the Wildland Fire Qualifications Subsystem Guide (PMS 310-1) which establishes minimum interagency training and qualifications standards for wildland and prescribed fire assignments. Task books will be utilized to document trainee assignments.

Poor physical condition of crew members can endanger safety and lives during critical situations. Personnel expected to perform wildland and prescribed fire duties will maintain a high level of physical fitness. Work capacity testing as a condition of employment or assignment, has been approved by RM-18. The work capacity test and standard requirements of RM-18 will be utilized at Crater Lake. The Pacific Northwest Wildfire Coordinating Group (PNWCG) Publication "Fit to Work" published by Brian Sharkey, Ph.D., Physiologist, will be utilized as a reference tool. All park employees must meet current requirements for medical standards prior to testing.

All park employees with an arduous duty red card qualification are authorized three hours per week of work time to participate in physical fitness activities. Employees in FirePro funded positions whose full-time duties are 100% arduous-duty related will be allowed one hour per day for physical fitness training. Employees must have an approved individual physical fitness plan in place before engaging in fitness programs while on duty (5 USC 7901, RM-18, RM-57).

Annual Readiness Activities

As directed by the Fire Management Plan, wildland fire preparedness activities are carried out prior to a wildland fire occurrence to ensure that the appropriate response can be accomplished. Wildland fire preparedness activities include budget planning, equipment acquisition, equipment maintenance, equipment inventory, recruitment, and training. The objective of the preparedness effort is to have a well-trained and equipped fire management organization to manage all fire situations within Crater Lake National Park. Preparedness activities are outlined in RM-18 and are covered with FirePro funding which is the funding mechanism for fire management.

The fire season, as determined by the FirePro analysis for wildland fire preparedness planning, is from June 10 through October 15. Preparedness efforts are to be accomplished in the time frames outside the normal fire season dates. When periods of high fire danger occur outside the normal fire season dates, justification for severity funding will be sent in writing to the Regional Office FMO.

Off-Season Preparedness

During non-fire season periods (normally October 16 - June 9), preparedness action will be as follows:

1 The park Fire Management Officer (FMO) works a year-round, full-time schedule. The Engine Captain normally works 17 pay periods per year, March through October. Seasonally funded wildland fire personnel may be placed in intermittent status.

2. Fire cache normally is closed. Equipment is available, but chain saws, pumps and engines are winterized. Winterized equipment must be serviced before dispatch.

3. Lookouts are out of service.

4. The resource advisor guide, fire location map and dispatch record systems are operational. Park dispatch is operational during normal business hours.

5. Annual review of the previous fire season and current fire management plan occurs before May 15th.

6. Planning for current year fire management projects is completed by May 15th.

7. The FMO will annually, before July 15, complete a Fire Readiness Review based on direction found in the Interagency Standards for Fire and Fire Aviation Operations handbook. Checklists for the Readiness Review are located at; www.fire.blm.gov/ satndards/ prepcont.htm.

8. The FMO will obtain from the Pacific NW GACC predictive services group a long-term prediction for the upcoming fire season and present this information to park management team in a pre-fire season briefing.

Fire Season Preparedness

During fire season (normally June 10 - October 15), preparedness action will be as follows:

1 The Engine Captain normally works March through October. Seasonal wildland fire personnel are on duty status.

2. Fire cache is functional. Equipment is available.

3. Chain saws, pumps and engines are functional.

4. Lookouts are opened and placed in service as snow depths permit access. Staffing is dependent on staffing class.

5. The resource advisor guide, fire location map and dispatch record systems are operational.

6. The Step-Up Plan is implemented.

7. Initiate Severity Requests as needed.

Fire Weather and Fire Danger

Weather Stations

During the fire season weather observations are obtained from NFDRS compliant weather stations. The primary park NFDRS station is Seldom (#353339).

During fires, spot weather forecasts may be obtained from the Medford Fire Weather Office. Smoke management forecasts are available daily from the Klamath Interagency Fire Center. Table 4-1 shows weather stations used by Crater Lake National Park during fire season.

Table 4-1 Crater Lake National Park Fire Weather Stations

Station	Number	Lat.	Long.	Elev. (feet)	Site	Operating Period
Seldom	353339	42.41	122.19	4875	Valley	5/01-10-30
Cinnamon	353031	43:19	122:06	4834	Mid Slope	5/01-10-30

Cinnamon RAWS is representative of the northern plateau of the Park.

National Fire Danger Rating System

Crater Lake National Park uses the National Fire Danger Rating System (NFDRS) (Deeming et. al. 1978), which provides daily fire danger indices relating to potential and expected fire behavior for fires which begin or are burning on any particular day. The NFDRS indices provide a broad planning estimate of "worst-case" fire potential and are used as a broad preparedness tool, focusing on the Burning Index (BI), Energy Release Component (ERC), 1,000-hour time lag fuel moisture content,

and Lightning Activity Level (LAL). The system addresses fire danger and potential, with the components and indices being structured so that they are linearly related to the particular aspect of the fire being rated. Fire danger is rated for a worst-case scenario by fire weather observations that are taken during the heat of the day. The NFDRS does not predict how every fire will behave but is intended to provide guidance for long-range planning. It is the basis for daily fire planning in Crater Lake's fire management program. It evaluates the near upper limit of the behavior of fires expected in a rated area during the rated period.

The Burning Index (BI) is a number derived from the rate of spread (SC) and the energy released (ERC) in the flaming zone. This then provides a rating of the predicted difficulty of containment of a wildfire. The BI is linearly related to the length of flames at the head of the fire. It is calculated from the SC and ERC using the relationships developed by Byram (Byram 1959) for calculating flame length (Deeming et. al. 1978).

Crater Lake National Park's step-up plan (see Section I below) defines daily staffing classes and fire management actions and is tied to the NFDRS Burning Index output as directed by RM-18. The staffing classes are determined by graphing all BI predictions that have been archived in WIMS for the Seldom fire weather station under fuel model G3P2 (NFDRS fuel model G, slope class 1, herbaceous class perennial, climate class 1). The staffing class levels are noted with the 90th percentile and a BI of 50 (ERC of 53) (see Table 4) as the cutoff point for very high fire danger. The normal funding for the fire management program is predetermined; it is calculated to be adequate for managing fire activity during 90 percent of the fire season. The remaining 10 percent of days in the fire season is classified in the very high to extreme fire danger range. Extra measures are taken to be prepared for fire activity during these periods (those actions are outlined in the step-up plan). The Burning Index is very sensitive to wind and often over-predicts daily fire danger because most summer afternoons in Crater Lake tend to be windy. Wind is the critical and necessary factor in large fire spread, and the Burning Index is a good indicator of probable worst-case conditions 24 hours in advance of an expected fire situation. Historically, human-caused fires originating within the park have not burned significant acreage. Lightning-caused fires produce the greatest number of starts and burn the most acres. Therefore, the Lightning Activity Level (LAL) will be used as a factor in the step-up plan.

The Energy Release Component (ERC), which is related to the available energy as measured in British Thermal Units (BTU) per unit area (square foot) within the flaming front at the head of a surface fire, is a widely used indicator of fire danger. The ERC calculations do not consider wind as a factor and can be used as a cross-reference indicator along with the BI. Since wind is not a factor in ERC calculations, the daily variation will be small. ERC numbers become relatively stable and may be used for planning decisions 24 to 72 hours ahead of an expected fire

situation. The ERC is also a good indicator of drought conditions or long-term drying as dead and live fuel moisture are factors in the calculations.

The Ignition Component (IC) is the most sensitive of the components or indexes. The IC is driven by the SC and the 1-hour time lag fuel moisture. It is even more sensitive than the SC because the 1-hour fuel moisture, in a sense, is double-counted. So the IC is used when it is important that the fire-danger ratings reflect small-scale, short-period fluctuations of burning conditions. The IC is very time-site specific, and is very sensitive to errors made in the wind and relative humidity observations. It does a poor job of reflecting the seasonality of fire danger.

The NFDRS provides the fire management staff with information that can be used in both short-term and long-term planning; it is not designed for nor is it adequate for predicting real-time fire behavior. Real-time fire behavior calculations can be estimated by several methods such as nomograms found in General Technical Report INT-30 (Albini 1976), the tables in Section B of the Fireline Handbook, and computer fire modeling software such as BEHAVE, FARSITE and FSPro.

Utilizing both the NFDRS and fire behavior predictions, Crater Lake fire management staff will remain up-to-date on current fire danger and fire behavior and will be able to make planning decisions for the duration of each fire. NFRDS predictions will also be used to support fire severity funding requests.

Fire Danger Pocket Cards

As part of the USDA Forest Service 30-Mile Fire hazard mitigation plan, Crater Lake Fire Management has adopted many of the recommendations as Best Management Practices (BMP), including the use of Fire Danger Pocket Cards. The card will be developed prior to the start of fire season by the FMO.

The Fire Danger Pocket Card is a method of communicating information on fire danger to firefighters. The purpose of the card is to create greater awareness of fire danger and subsequently increased firefighter safety. The Pocket Card provides a description of seasonal changes in fire danger in a local area. It is therefore useful to both local and out-of-area firefighters.

The Pocket Card has an important day-to-day pre-suppression use. Firefighters can reference their card and see just where they are in the range of possible values for danger rating. This important information should be discussed at morning crew meetings, as well as tailgate safety meetings.

It is the responsibility of the Incident Commander to assure that all firefighters assigned to type 3, 4 and 5 incidents have had a briefing on the Pocket Card. It is

important to stress that the card relates only to potential fire danger and does not equate to daily fire behavior. Large fires and extreme fire behavior have been associated with days with Low or Moderate fire danger ratings.

Step-up Staffing Plan

The step-up plan is designed to outline the preparedness actions the park will take to meet predicted fire danger. This plan consists of five staffing classes. Each staffing class has a corresponding set of actions that the park will initiate to meet the expected potential fire behavior for the current planning period.

The NFDRS Burning Index (BI) is used to determine the staffing class level. The BI is calculated using data from the Seldom fire weather station and fuel model G3P3 (NFDRS fuel model G). This fuel model represents a mixed conifer stand with dead-down woody fuels. The calculated BI indicates a worst-case fire danger scenario.

The step-up plan is based on the South Center Oregon Interagency Fire Danger Operating Plan. Each one of the step-up levels corresponds with dispatch levels posted daily on the KIFC website, or as graphed based on observations from the Seldom weather station.

The wildland fire duty officer will initiate the step-up plan based on either the ERC or BI at his/her discretion. He/she may also increase or decrease staffing based on current or forecast conditions. Typically, if the surrounding forests are extending staffing, park resources will extend staffing in support of local fire control efforts.

Table 4.3 shows the correlation between Burning Index and Staffing Class Levels

Table 4-3 Staffing Class Matrix

Burning Index (percentile)	Energy Release Component	Staffing Class
0-20	0-19	I
31-34	20-42	II
35-49 (48th)	43-52	III
50-58 (90th)	53-59	IV
59+ (97th)	60+	V

Actions taken under staffing classes I - III are funded through the annual preparedness budget. Actions detailed under Staffing Classes IV and V may be funded by emergency preparedness (severity) funds. These funds are requested through the Regional Fire Management Office.

The following describes those actions associated with each of the Step-up Levels:

Staffing Class I

- A minimum of two firefighters on normal tour of duty.
- An Incident Commander Type V on normal tour of duty.

Staffing Class II

- A minimum of two firefighters on normal tour of duty.
- An Incident Commander Type IV on normal tour of duty.
- One fire lookout on normal tour of duty.

Staffing Class III

- A minimum of 3 firefighters scheduled each day.
- An Incident Commander Type III will be available each day.
- One fire lookout on normal tour of duty.
- Any of the following will raise the Staffing Class to IV:
    - Predicted Lightning Activity Level (LAL) of 5 or 6
    - Forecast of dry lightning
    - Lightning actually occurring

Staffing Class IV

- A minimum of four firefighters will be scheduled each day, with work restricted to within two hours of the fire cache.
- An Incident Commander Type III will be available each day.

- One fire lookout (either The Watchman or Mt. Scott) will be staffed. Both lookouts will be staffed if personnel are available.
- Any of the following will raise the Staffing Class to V:
    - Predicted Lightning Activity Level (LAL) of 5 or 6
    - Forecast of dry lightning
    - Lightning actually occurring
- Aerial reconnaissance may be requested (if lightning in the previous 7 days).
- Open fires may be restricted (see Appendix 13.G). Efforts will be made to coordinate restrictions and/or closures with U.S. Forest Service and Oregon Department of Forestry.

Staffing Class V

- A minimum of four firefighters will be scheduled each day, with work restricted to within one hour of the fire cache.
- An Incident Commander Type III will be on duty each day.
- Fire Management Committee members notified regarding fire danger.
- Both fire lookouts (The Watchman and Mt. Scott) will be staffed each day.
- Cancel lieu days and leave for eligible preparedness funded fire staff.
- Aerial reconnaissance may be requested (if lightning in the previous 7 days).
- Fire prevention patrols will be emphasized in areas with high visitor use.
- Open fires may be restricted (see Appendix 13.G). Efforts will be made to coordinate restrictions and/or closures with U.S. Forest Service and Oregon Department of Forestry. A severity request should be considered if extreme weather conditions are forecasted to persist.

Pre-attack Plan

A pre-attack plan is found in Appendix 13.G.

Initial Response

The initial response to a wildfire is used to locate and size up the new ignition. The incident commander will initiate a response commensurate with values to be protected and make recommendations to the duty officer regarding the potential resource benefits of the wildfire. This response is necessary to initiate the WFDSS analysis and to determine the appropriate response to a wildland fire event.

Wildland fires must receive appropriate initial action (IA) by the nearest available forces. As safety allows, Incident Commanders will assess the complexity of the fire to determine their capacities to manage the incident utilizing the Incident Complexity Guide contained in the *Incident Response Pocket Guide*. If the initial response Incident Commander (IC) is unable to initiate action due to the management complexity of the incident, forces will be staged in a safe location or modified tactics will be utilized until a fully qualified Incident Commander arrives on scene. Cooperating fire agencies may fill the role of IC on all initial response actions.

Initial Response Priority Criteria (suppression tactics)

Priority suppression areas are delineated in the fire management plan as the Developed FMU. This FMU contains important park infrastructure, and is further prioritized for fuels reduction treatment to modify fire behavior to levels commensurate with successful suppression by hand and engine crews. A list of park buildings is included in this plan, as well as other park features requiring protection from wildfire.

During periods of multiple ignitions the Park priority for suppression action is:

1. Protection of life, both employee and public.
2. Protection of facilities and cultural resources.
3. Perpetuation of natural resources and their associated processes.
4. Perpetuation of cultural and historic scenes.

Closest Forces

Fire Protection Agreements with adjacent agencies include the use of closest resources. The closest resource concept is a standard operating procedure for all cooperating fire protection agencies.

Initial Response (suppression actions required) based on GMP/ RMP Objectives

National and park policy require that any fire threatening human life be suppressed, using a control strategy, with the maximum available resources. Use of all fire resources would be appropriate given the life-threatening circumstances. Under this scenario bulldozers and other heavy equipment would be allowed in the suppression resource matrix, with prior approval of the Park Superintendent.

In all areas of the park, Minimum Impact Tactics (MIT) will represent normal suppression operating procedures. Under extreme conditions threatening to damage significant resources inside or outside of the park, the use of heavy mechanized equipment may be allowed by the Superintendent, or designated acting.

Further discussion of MIT occurs under Fire Use and in the Resource Advisor Guide (Appendix 13.M).

Over ninety percent of the park is being managed as wilderness. Fire managers engaged in fire management activities within this potential wilderness must use MIT for fire management actions. Any deviations from this must be approved by the Park Superintendent.

Confinement as a Suppression Strategy

Confinement can be used as a suppression strategy for initial attack to meet fire management objectives, i.e. safety of suppression personnel, firefighting cost savings or for prioritization of suppression resources. Confinement cannot be used to meet resource objectives.

Confinement can be a strategic selection through the WFDSS process when the fire is expected to exceed initial attack capability or planned management capability.

When confinement is selected as the initial action the same process applies as for use of wildland fire decisions. A long-term implementation plan is needed to guide the implementation of the confinement strategy. The WFDSS decision document, with supporting analysis, can meet this requirement.

Fire Suppression Resource Response Times

Fire management resources will work within 2 hours of the fire cache during Staffing Class IV, and within 1 hour of the cache during Staffing Class V. Actual response times to incidents will vary depending on incident location and access.

Restrictions and Special Concerns

Bulldozers

Bulldozers will not be used except where life and property are clearly threatened. The first priority choice for bulldozer use will be to widen existing dirt or paved roads to use as control lines. Second choices for bulldozer use are pre-existing lines or improvements. A Resource Advisor must be present and consulted whenever bulldozer use is contemplated. The Superintendent must approve bulldozer use.

Other Issues

Fire management activities within the park will be carried out in a manner that minimizes impacts to natural and cultural resources. Minimum Impact Tactics will

be used and incorporated into the Agency Administrators' Briefing and Delegation of Authority. Wildland fire management teams will use methods and equipment commensurate with land and resource needs, which will least alter the landscape or disturb park resources while meeting wildland fire management objectives. The Incident Commander is charged with incorporating Minimum Impact Tactics into wildland fire management efforts in all operational plans. Minimum Impact Tactics and logistic standards are contained in the Resource Advisor Guide (see Appendix 13.M).

Since 1984, a number of prehistoric and historic sites have been located within Crater Lake National Park. It is reasonable to expect that prehistoric resources (generally in the form of lithic scatter and rock cairns) will be found. In addition, some types of rock features could be associated with the religious practices of the region's Native American groups. Consequently, there is a possibility that such features within Crater Lake National Park may be impacted by fire management actions. Because of this possibility, the Chief of Interpretation and Cultural Resources or Park Historian will be notified regarding the location of all wildland and prescribed fires within the park. Notification and consultation under 36 CFR 800 will occur as appropriate with staff from the State Historic Preservation Office. Additional consultation with the Klamath Tribes, Cow Creek Band of Umpqua Indians, or Siletz Confederation may be required under 36 CFR 800 and/or other regulations pertaining to the Archaeological Resources Protection Act (ARPA) and the Native American Graves Protection and Repatriation Act (NAGPRA). The Chief of Interpretation and Cultural Resources will make this determination.

Maps of threatened and endangered species habitat that could be negatively impacted by wildland fire effects or fire management activities are found in the park communications center. The Resource Preservation and Research Division is responsible for updating these maps annually, or more often as needed.

Maps of known cultural resource sites needing protection from wildland fire effects or fire management activities are are also located in the park communications center. The Interpretation and Cultural Resources Division is responsible for updating these maps annually, or more often as needed.

Extended Attack and Large Fire Management

Extended attack occurs when a fire has not been confined, contained or controlled by initial attack forces. The extended attack continues until either the transition to a higher level incident management team is completed or the wildfire has been contained or controlled.

Wildland Fire Decision Support System (WFDSS) Development

A Wildland Fire Decision Support System (WFDSS) will be completed by the FMO when wildland fire objectives are not achieved during the initial response. Current and predicted fire activity will be determined, alternatives for management actions offered, the effects of wildland fire suppression efforts analyzed, and specific direction to the Incident Commander provided.

Complexity Decision Process for Incident Management Transition

The Fire Complexity Assessment checklist will be completed when a wildfire escapes initial response resources. Necessary resources will be documented on a Resource Order Form (NFES-1470) and processed by the Klamath Falls Interagency Fire Center (KIFC).

When an Incident Management Team is assigned, the team will be briefed by the Superintendent (Agency Administrator's Briefing) and current IC. The team will be given a written delegation of authority and will have an Agency Administrator's Representative assigned as a staff member to the incoming IC. The delegation of authority will provide the IC with the Agency Administrator's priorities, specific constraints, and other guidelines necessary to implement the Delegation of Authority. A sample Crater Lake National Park Delegation of Authority form is found in Appendix 13.G. The Redbook format will be used for all IC inbriefings.

Minimum Impact Tactics (MIT)

The goal of MIT is to minimize fire impacts on the land while ensuring the actions taken are safe, timely and effective. Strategies for fire management will be planned to have the least long-term impact to the resource. All fire management activities within Crater Lake NP will adhere to MIT unless there are specific and compelling reasons not to.

Fire Management Record Keeping

Permanent Park Records

The following will be held as permanent historic resource records:

- Fire reports (DI-1202, supplementary reports, ICS forms).
- Fire weather records.
- Fire spread projections.
- Historic records of the park, including photos or maps showing vegetative cover, etc.
- Monthly reports or other records which document fire

occurrence or behavior.

- Maps or records pertinent to fire management.
- After-Action Review documentation.

Situation Reports

Situation reports contain current information about fire danger, fire status, and resource availability. Parks prepare situation reports during the fire season (1) when fire danger is very high or extreme, (2) when a fire has occurred or is in progress, or (3) when otherwise required. The FMO or IC of type 3 incidents will prepare and transmit this information to KIFC in the form of the ICS-209.

Fire Report Records

The fire reporting process is a critical element used in determining annual preparedness budgets. Fire reports must be accurate and timely to better represent the resources necessary to manage wildfire at Crater Lake National Park. An Individual Fire Report (DI-1202) will be completed for all fires that occur within the park, and for all wildland fire management actions in which the park supports nearby cooperators.

Completion of the DI-1202 report is the responsibility of the IC for each fire. These reports will be submitted to the Fire Management Officer within 48 hours after the fire is declared out. DI-1202 reports will be entered into the Wildland Fire Management Information system (WFMI) within 10 days after the fire is declared out.

Each fire of significance (1 acre or greater) within Crater Lake NP will be reported immediately to the Superintendent by name, location and size. An ICS-209 report will be accomplished daily for fires >100 acres in timber and > 300 acres in grass and brush.

The IC will maintain a complete accountability of fire costs for each fire.

An NWCG qualified wildland fire cause and origin fire investigator will investigate all human-caused wildland fires within Crater Lake NP. Any investigations involving potential claims against the government, trespass fires, or other illegal activities in the park will be immediately turned over to the Ranger Operations Branch of the Resource & Visitor Protection Division. Investigations and law enforcement actions will be documented via normal case reporting procedures. A trespass report is required for all human-caused fires and is necessary to complete the WFMI fire report.

4.4 Management of Wildland Fire for Multiple Objectives

Management Objectives

A primary management objective at Crater Lake National Park are to allow naturally ignited wildland fire to function in its natural role as a disturbance agent. As a management tool, implementation will help promote fire-enhanced ecological conditions for fire adapted species, reduce fuel loads in the park, reduce overall costs, and eventually reduce smoke impacts on air quality.

Management of Wildland Fire Decision Parameters

With the exception of the Developed FMU, naturally ignited wildland fires may qualify for management with multiple objectives. Fires will receive responses that give consideration to values, hazards, and risks. Wildland fire projects are the preferred means for achieving resource management objectives in the FMU's where restoration and ecological values dominate considerations. If unnatural fuel loads exist, it may be necessary to use fuels management techniques initially to restore an area to a natural range of conditions prior to the use of wildland fire in these areas.

Implementation of the management of wildland fire for multiple objectives is the desired option for maintaining fire occurrence where possible in Crater Lake National Park. Implementation of these fires proximate to park boundaries, or with the potential to escape park boundaries, has the potential to require active management in directions of undesirable movement. Impacts from management actions will be mitigated and restored as soon as the fire area is controlled. Fire managers will ensure that impacts from management actions are mitigated both during and immediately after the action.

Fires must meet the following criteria before they will be managed for multiple objectives:

1. The fire must stay within a delineated area defined in the Wildland Fire Decision Support System (WFDSS).
2. Predicted vegetation changes are within an accepted ecological range of values for the affected ecosystem.
3. No identifiable, unmitigated threats will occur to significant historic or cultural resources.
4. No identifiable, unmitigated threat to human life or property.
5. State and federal air quality guidelines will be complied with. The current Oregon Smoke Management Plan (1997) exempts wildland fire smoke from the compliance requirements for smoke management, but the park will seek to

manage smoke in compliance with Oregon prescribed fire smoke management guidelines.

6. Concurrence from local cooperators if the Planning Area has the potential to impact their resources.
7. Concurrence of NPS regional fire staff during national preparedness level 4 and NPS national fire staff during national preparedness level 5.

Procedures ensuring the parameters above are met:

1. The Fire Management Officer or acting FMO will ensure the policies and procedures in the Wildland and Prescribed Fire Policy Implementation Guide are followed (see Appendix 13.P).
2. The procedures outlined in the monitoring section of this fire management plan will be followed.
3. Consultation with the U.S. Fish and Wildlife service will occur if impacts to threatened and endangered species are possible. This may be as an emergency consultation or otherwise. Safety of public and personnel is paramount, with management decisions reflecting this.
4. The public and park employees will be adequately informed regarding the status and potential impacts to their visit and work.
5. Implement the fire(s) using the appropriate management type and level, using only qualified personnel.
6. Continued reassessment of the WFIP or WFDSS and validation will be made by the Strategic Operational Planner (SOPL) and Superintendent or delegate.
7. The fire(s) will be managed accordingly until declared out. The level of monitoring or action taken will be based from current and expected fire behavior.

The Fire Management Officer will be responsible, using appropriately qualified personnel, for the completion of the WFDSS Assessment for new fire starts. Each fire will be analyzed on the basis of fuels, potential spread, predicted fire weather, natural barriers, time of fire season (early or late), management goals for the particular area, as well as the regional and national fire preparedness levels.

Criteria for Evaluating the Management of Wildland Fire

The following criteria, based on fire research at Crater Lake National Park and the experience gained from previous fires, can be used during development of strategies for managing fires that have multiple objectives in the WFDSS.

Season

Due to the short length of the Crater Lake National Park fire season, and the importance of natural fire in accomplishing the goals of this plan, all ignitions in

identified FMU's will receive due consideration for management to help achieve the Park's resource objectives. The Park will use a negative validation method of compelling implementation. If there is no substantive reason for the suppression of an ignition, it will be managed for resource benefit. This in no means relaxes the revalidation process and future appropriate responses.

Fire starts occurring early in a normal fire season present challenges to fire managers. As these early-season ignitions managed for resource objectives progress, seasonal drying of fuels occurs, and prolonged fire events can lead to unmanageable incidents from the standpoint of fire size, intensity or smoke production. The continued demands on management personnel and available funding may become unacceptable.

Fires beginning late in the season often have better potential for low complexity and ease of management. Progressively shorter daylight hours, cooler maximum temperatures, increased humidity recovery at night and a greater chance of precipitation significantly increase fuel moisture and reduce rate of spread and ultimate fire size.

Location

Fires originating within the Developed FMU will be suppressed. Fires which may enter the Developed FMU from the Low, Moderate or High severity FMU, may require some confinement or suppression action to exclude them from the Developed FMU. Confinement on specific flanks may be necessary to limit spread and/or to protect structures, administrative facilities, cultural or natural resource sites, or other developments. Actions on fires in remote locations, without potential to enter the Developed Fire Management Unit or escape the park, can usually be limited to confinement and observation.

Fires originating near the park boundary, or which have the potential to approach or cross the boundary, can complicate the decision-making process since adjacent land management agencies may not accept a fire managed for multiple objectives. It is critically important to maintain and strengthen collaboration with fire managers from these agencies, and to seek their input in the wildland fire decision process, in order to build support and acceptance for the park's wildland fire program.

Topography

Areas of the park that contain discontinuous fuels, (e.g., Pumice Desert, tree islands along the caldera rim) will not exhibit large-scale fire growth. Areas of heavy fuel loadings, as well as the drier aspects, will exhibit potential for high rates of fire spread. Ridges, rivers, side drainages, avalanche chutes and riparian zones can be effective barriers to fire spread. High severity fire regimes, by their nature, will exhibit the potential for large, fast spreading fires, given the proper environmental conditions.

Fuels

Fuel loadings in Crater Lake National Park are diverse. Within a short distance, areas can range from FBPS fuel model 2 (short to medium grass) to unnaturally dense crowded stands of fuel model 10 (tree stands with heavy down woody fuel components). During periods of high fire danger the heavy fuels of FBPS fuel model 10 will burn readily and with tremendous energy. Fires under these conditions will have long residence times and be very resistant to control. Such fires may be expected when the 1,000-hour fuel moisture is less than 10%. FBPS fuel model 5 exists where there is a layer of shrubs on the site. Many of the closed-canopy hemlock and Shasta red fir stands exhibit a FBPS fuel model 8 (closed canopy stands with minimal down woody fuels), these fuels typically produce fires of low intensity and spread rates under seasonally normal conditions.

Weather

The largest fires generally occur during years with below normal precipitation. On a short-term basis, below normal precipitation in the winter and spring months leading into the fire season historically results in the highest incidence of large fires.

East winds in Crater Lake National Park generally form when high pressure builds on the east side of the Cascades and a low-pressure trough forms off the coast of Oregon. East winds cause drier environmental conditions. There is a correlation between strong east winds and more severe fire weather on the west side of the Cascade Crest. Any fire burning under the influence of an east wind is potentially serious. West winds also can create periods of high fire danger. West winds are associated with frontal passages and increased firefighter hazards. Generally, west wind impacts are heightened during the frontal passage period, giving way to more moderate conditions of lower temperatures and higher relative humidities.

Fire Danger

The rapidly changing weather patterns experienced in the park can cause fire danger to fluctuate rapidly. Rated fire danger may go from Staffing Class III to V within 24 hours. This is a direct result of the influence of wind on the Burning Index (BI).

Planning strategies for wildland fire use should consider that fires in Crater Lake National Park which start during fire danger levels permitting suppression by ground forces with hand tools (BI <40, flame length <4 feet) are not likely to become larger than Class C (>10 acres) incidents.

Fire Behavior

The majority of fires in Crater Lake are ignited by lightning storms. If not extinguished by rain, these fires can smolder undetected, burning deeply into the duff layer. On succeeding days, such fires may be impossible to detect from patrol aircraft and have the potential to become "sleepers." Warming weather conditions can bring these latent fires to life. The largest lightning fires have historically burned in an uneven pattern influenced primarily by site topography, fuels distribution and local winds.

As noted in section 4.3, wildfires burning within the park will exhibit behavior based on greater climatological conditions as well as localized effects.

Available Resources

All wildfires will be staffed with qualified personnel as defined by NWCG-PMS-310-1 and RM-18. The period of highest fire occurrence coincides with the peak visitor use season in the park and high fire occurrence throughout much of the United States. This has the potential to affect resource availability for contingency actions related to wildfire mitigation actions. As regional and national preparedness levels increase, the availability of resources will correspondingly decrease.

Since actions involved with the use of wildland fire may require eventual containment or suppression action, the regional preparedness level should be carefully assessed during completion of the WFDSS. The situation must be reassessed at designated intervals throughout the course of the fire and a recertification of contingency resources assured.

Wildland Fire Decision Support System (WFDSS)

WFDSS incorporates pre-loaded information and objectives from the Crater Lake Fire Management Plan and General Management Plan. The pre-planned decision criteria and spatial data files help to determine response actions on unplanned ignitions. Response actions are continuously assessed to determine if they are meeting objectives. If objectives are not being met, new response actions will be developed and implemented. WFDSS Response Levels will be determined by the complexity of the incident.

The WFDSS form is located in Appendix 13.R

Periodic Assessment of WFDSS

Scheduling of the periodic assessment of the WFDSS will be assigned by the Superintendent and will be based on the expected fire behavior for the next 24 to 48 hours. Fires of low spread potential do not need a new validation on a daily basis (e.g., a burning snag surrounded by rock). In this case the Superintendent may decide a weekly revalidation is sufficient.

In the case of a wildland fire that has exceeded the approved planning area to a limited degree, there are two management options available to determine if the fire should have a WFDSS developed to handle the area of exceedance.

1. Constrain the fire spread with available holding crews within two burning periods.
2. If the area of exceedance is due to long-range spotting, and the new burning area is an isolated spot, treat the new burned area as a separate fire, thereby initiating a new response to wildland fire.

Potential Impacts From Managing Fires Using Multiple Objectives

Air Quality – Health and Visual

Public health may be affected directly by smoke emissions. This short term impact is usually the result of a high pressure air mass over the park creating a lack of smoke dispersal. Mitigations may include public notification, closure of the area to public use, and containment of the fire.

Smoke can by itself or in combination with other airborne pollutants create regional or local haze. Haze can reduce scenic vistas for park visitors. At Crater Lake the most significant visual impact possible is decreased lake viewing opportunities. This impact may be mitigated through public education and notification, and possible containment of the fire. Haze events are usually short term in the park and will seldom require mitigation actions.

The Fire Management Officer or Strategic Operational Planner (SOPL) may utilize the daily NWS management forecast for decision making in managing fire. It may be necessary to suppress fire managed with multiple objectives when smoke affects a sensitive area or creates a significant public response, and it is determined that these factors outweigh other gains.

Public opinion regarding smoke levels will also be considered. Complaints regarding smoke will be documented by the park communication center and forwarded to the Fire Management Officer or Incident Commander for daily consideration and inclusion into the periodic fire assessment document.

Visitor Use

Areas of the park may be closed to public use, for safety reasons, during the duration of the incident. (e.g., anticipated fire spread across backcountry trails, fire perimeter holding operations near visitor use areas). This has the potential to reduce the quality or duration of visitor experience.

Other impacts to visitor use may include cancelled boat tours and reduced opportunities for lake viewing that result from smoke accumulations. These factors will be considered as a part of the revalidation process. Mitigations may include increased education and notification, recommendations for other usable areas, and containment actions on the fire.

Smoke Dispersal

Close communication with the Oregon Department of Forestry (ODF) will be required when managing a fire for multiple objectives. Though wildland fires are currently exempt from the provisions of the Oregon State Implementation Plan (SIP), the park is not exempt from the requirement to manage the smoke from these fires. Most critical smoke sensitive areas are east, southwest and southeast of the park, and long-term incidents have the potential to create a significant public response. Smoke management and dispersal is a highly politicized issue, and should be carefully considered in any strategy to manage wildland fire. Communication with ODF is critical for effective wildfire management and other fire management applications.

The daily fire weather smoke management forecast issued by the National Weather Service Fire Weather Office and weather data from its web site can serve as a general guide to atmospheric stability and expected behavior of the smoke column, and is the recommended planning tool in combination with direct observations.

More in-depth information regarding potential impacts on issues facing the park can be found in the Environmental Assessment found in Appendix 13D.

Required Staff Positions

Management of the incident will be in accordance with Federal Wildland Fire Management Policy, depending upon the complexity of the wildland fire project. The Superintendent has responsibility for implementation decisions based on the WFIP or WFDSS. The FMO or acting FMO is responsible to make sure that qualified individuals are present to deliver information to the Superintendent. An Incident Command Team may be ordered if deemed necessary due to the complexity of the project.

Management of Wildland Fire and the Step-up Staffing Plan

The management of wildland fire for multiple objectives will be allowed during all staffing levels in the park and up to national preparedness level 3. During national preparedness level 4, notification of the project and concurrence from the Regional Office is required. During Preparedness Level 4 a risk analysis, which includes the Pacific Northwest Multi-Agency Coordination Group (MAC) group information and perspective, is developed by the region, and the Regional Office will make a recommendation or decision. During Preparedness Level 5 the National MAC has

an input recommendation inserted into the decision with the National MAC Agency Representative providing information. The National Fire Program Management Office then will make a recommendation or decision. If approved at any level, the Superintendent's final approval is required to initiate the plan.

Permanent Project Record Contents

The following items will be part of the permanent record for the incident:

- WFDSS, WFIP and/ or WFSA
- All monitoring reports
- All certification and revalidation documents
- A list of funding codes and a cost accounting summary
- Maps of the project (GIS – electronic)
- After-action Review documentation
- ICS documentation

4.5 Prescribed Fire

Annual activities

Annual preparatory activities for the prescribed fire program are as follows:

- Assessment and completion of all prescribed fire mitigation measures as determined in the environmental compliance document. Includes review of compliance document(s) for currency

- Equipment maintenance, done in conjunction with wildland fire preparedness maintenance

- Determination of budget for prescribed fire projects, including NFPORS database maintenance

- Assessment of state of completion of all site preparation activities for budgeted projects.

- Notification of project to Oregon Department of Forestry smoke management program.

- Verify plan completion and approval by Superintendent of prescribed fire plan(s) scheduled for implementation.

- Implementation of prescribed fire monitoring plan(s) completed, or verification that monitoring strategies are ready for implementation prior to ignition.

Long-term Strategy for each FMU

A multi-year list of planned prescribed fire treatments and objectives for each FMU, by fire regime group and condition class, is located in Appendix 13.H.

Evaluation Format for Prescribed Fire Projects

The success in achieving objectives for all prescribed fire projects will be documented on the "Post-Project Evaluation Form" (see Appendix 13.Q)

Reporting and Documentation

All prescribed fires will be documented with the following information:

- Original signed prescribed fire plan
- Checklist of Pre-burn prescribed fire activities
- All Reviewer comments
- All Maps
- Notification checklist
- Permits needed
- Monitoring data
- Weather forecasts
- Agency administrator GO/ No Go Pre-ignition Approval
- Operational Go/ No Go checklist
- Incident Action Plan(s)
- Unit Logs, Daily validation or other unit leader documentation
- Press releases, Public comments and Public complaints
- Smoke Dispersal information
- Post Fire Analysis
- Fire occurrence Report
- Historic fuel treatment map

Prescribed Burn Plan Format

The format for a prescribed fire plan is listed in Appendix H and will be modified to current format when necessary.

Exceeding Existing Prescribed Fire Burn Plan

In the event that a prescribed fire exceeds prescription and cannot be brought back into prescription in a timely manner WFDSS will be developed for the project and it will be declared a wildfire.

Air Quality and Smoke Management

Air quality issues include visibility concerns, human health concerns, and health impacts to threatened/endangered species. These issues are more fully discussed in the FMP compliance document found in Appendix 13.D.

Crater Lake National Park will follow Oregon State Smoke Implementation Plan (SIP) current guidelines for reporting and monitoring smoke impacts. Crater Lake National Park is designated a Class I airshed by the 1977 Amendments to the Clean Air Act. Atmospheric pollutants, including smoke, must be managed accordingly. The Fire Management Plan will be in compliance with the Clean Air Act, Oregon State Smoke Management Plan, and the Oregon Visibility Protection Plan.

NPS Management Policies state:

> "The National Park Service has a responsibility to protect air quality under both the 1916 Organic Act and the Clean Air Act (CAA). Accordingly, the Service will seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas. Vegetation, visibility, water quality, wildlife, historic and prehistoric structures and objects, cultural landscapes, and most other elements of a park environment are sensitive to air pollution and are referred to as "air quality-related values." The Service will actively promote and pursue measures to protect these values from the adverse impacts of air pollution. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the Service will err on the side of protecting air quality and related values for future generations. (Chapter 4.17, 2006)

The Fire Management Officer will utilize the daily NWS fire management forecast as a decision support aide. It may be necessary to suppress prescribed fires when smoke effects in sensitive areas create hazardous health conditions or create a significant public response. These factors will be weighed with ecosystem benefits gained and the management response may be to cease the prescribed fire operation.

Public opinion regarding smoke levels will also be considered. Complaints regarding prescribed fire generated smoke will be documented by the park communications center and forwarded to the Fire Management Officer for daily consideration and inclusion into the prescribed fire documentation file.

4.5 Non-Fire Fuel Treatment Applications

Non-fire fuel treatment applications are restricted over most of the park by wilderness resource concerns. Minimum requirement and fuel treatment operating restrictions will be incorporated upon completion of the park's wilderness management plan. Until that plan is complete, large-scale hazardous fuels projects will be limited to areas outside of potential wilderness. Where appropriate, collaboration with other agencies and landowners will occur, with the intent of developing joint projects for the benefit of all parties.

Annual activities required to prepare for implementation of non-fire fuel treatment applications will include ensuring that monitoring projects are in place prior to implementation, as well as checking for all other mitigation measures developed through compliance procedures.

Verification of contracts for work to be accomplished, as well as issuance of new contracts, will need to be completed prior to the field season. NPS equipment will be maintained and ready for work by field season.

Equipment restrictions and seasonal use restrictions are found in the compliance document under mitigation measures.

Monitoring requirements are fully discussed in the monitoring plan. The format for the critique of the project is the same as that listed for prescribed fire. Cost accounting will be accomplished through AFS3 and Isuite accounting systems, with implementation of contracts through IDEAS and project development through NFPORS. Those individuals chosen to operate mechanical equipment in time for project initiation will complete all equipment qualification standards.

Reporting requirements will be as follows:

- Original plan
- All Maps
- Copies of Contract(s) if applicable
- Permits needed
- Monitoring data
- Unit Logs of COR/CO if applicable
- Press releases, public comments and public complaints when appropriate
- Post project review and monitoring report(s)

4.6 Rehabilitation and Restoration

<u>Post-fire Rehabilitation</u>

Every effort should be made to prevent excessive human-caused impacts during fire

events through careful planning and supervision, individual education and commitment, and the use of Minimum Impact Tactics.
Rehabilitation is divided into two distinct parts - Emergency Stabilization and Rehabilitation (ESR) and Burned Area Rehabilitation (BAR). The former is used to account for emergency efforts related to resource protection needs, whereas BAR is related to non-urgent, longer term rehabilitation efforts. Each has its own set of plans, funding sources, criteria, etc. Additional information is provided in an update to 620 DM 3 dated May 20, 2004.

On May 5, 2003 the Department of the Interior issued an interim policy for wildland fire Emergency Stabilization and Rehabilitation (ESR) in a memorandum titled *"Wildland Fire Emergency Stabilization and Rehabilitation Policy and Procedures."* This interim policy is to remain in effect until a new 620 Departmental Manual (DM) Chapter 3 is issued. The interim policy also provides direction for rewriting the DM, funding of wildland ESR projects, and provides changes to the funding and documentation of projects in FY 2004.

For every fire, the incident commander or burn boss, in consultation with the FMO and a Resource Advisor, will address the need for a rehabilitation plan. Generally, staff will not be released until rehabilitation has been accomplished. Further guidance may be found in RM-18 (Section III, Chapter 8). For wildland fire suppression events, emergency rehabilitation and restoration will be accomplished in accordance with current policy and through the use of the Interagency Burned Area Stabilization and Rehabilitation Handbook (see Appendix 13.L).

When rehabilitation is necessary, efforts will be initiated by the Incident Commander as the incident progresses and through mop-up. If performed after the incident, the Fire Management Officer will designate an employee, usually a Resource Management Specialist, to organize and direct rehabilitation efforts. However, it is not the intent of ESR to stop all erosion or eradicate all non-native species that may appear following a fire. The ESR program should focus only on mitigating significant damage (RM-18, 1999). ESR plans must be submitted to the regional office within five (5) calendar days following control of a wildland fire (RM-18 1999).

Burned area rehabilitation is the long-term application of rehabilitation efforts towards fire recovery. If ESR efforts require long term planning, implementation, or monitoring, funds will be requested from the region along with submission of a BAR plan. This plan outlines the criteria for long term rehabilitation implementation, monitoring checklists, and cessation of implementation through success measurement. In coordination with the FMO a resource advisor will be the primary contact and IC for BAR management.

<u>Specific Rehabilitation Guidelines</u>

If revegetation or seeding is required, only native plant genotypes of appropriate genetic stock will be utilized as prescribed by the Park's Fire Ecologist or Terrestrial Ecologist. Rehabilitation planning for each fire will be the responsibility of the Incident Commander in consultation with the resource advisor. Rehabilitation of fire suppression damage should be performed prior to complete demobilization.

Chapter 5

Organizational and Budgetary Parameters

5.1 Description of Organization

The fire management program at Crater Lake National Park includes fire management operations, fire ecology, fire effects monitoring, research coordination, planning, and fiscal management. Fire management operations, preparedness, training, planning and fiscal management is organized within the Division of Resource and Visitor Protection, supervised by the Chief Ranger. Fire ecology, fire effects monitoring and research coordination are organized within the Division of Resource Preservation and Research (RP & R), supervised by the Chief, RP&R.

The current fire management program includes two permanent full-time and one permanent subject-to-furlough employee. Five temporary positions are approved for preparedness activities and are funded for eight pay periods each. These positions provide augmented staffing to a Type VI and a Type III engine during the designated fire season. Staffing for the fuels crew is currently being provided through project money and Wildland Urban Interface (WUI) funding; there are two Hazard Fuels funded employees working in temporary positions.

Two permanent full-time employees (Fire Management Officer & Fire Management Program Assistant) and one permanent subject-to-furlough employee (Engine Captain) work under the direction of the Chief Ranger. A Fire Ecologist is shared with the Klamath Network and works under the direction of the Pacific West Regional Fire Ecologist. A Prescribed Fire/Fuels Specialist is shared with Lava Beds NM and Oregon Caves NM and works under the direction of the Lava Beds NM Fire Management Officer. These positions are funded exclusively through the National Fire Plan and are required to spend a minimum of 80% of their time working on fire-related projects.

The fire management program maintains two Department of Interior Vehicles, a Type III engine and a Type VI engine. Fire Management also maintains two GSA fleet vehicles. These vehicles are used for transportation of personnel to and from the field.

5.2 Fire Management Organization and Responsibilities

Fire Management Committee

The Fire Management Committee will consist of the following:

- Chief, Resource & Visitor Protection (Chair)
- Chief, Resource Preservation & Research
- Chief, Interpretation and Cultural Resources Management
- Fire Management Officer
- Fire Ecologist (Klamath Network Shared Position)
- Prescribed Fire/Fuels Specialist (Klamath Network Shared Position)

The Fire Management Committee is responsible for providing an interdisciplinary approach to fire management planning and operations in Crater Lake National Park. Specific responsibilities of the committee include:

- Meet annually before December 15 each year to review fire management actions from the previous fire season and consider areas for improvement.
- Meet annually prior to June 15 to discuss areas of responsibility, review and update the Fire Management Plan, and to discuss/evaluate fire management projects and capabilities for the upcoming fire season.
- During extended attack wildland fire suppression incidents, collaborate as needed to guide suppression decisions and actions through the WFSA and delegation of authority processes.
- During wildland fire use incidents, collaborate as needed to guide wildland fire management decisions and actions through the Wildland Fire Decision Support System (WFDSS) and delegation of authority processes.
- Meet monthly throughout the year to discuss fire management actions and issues.

As needed, the committee may request technical assistance from other individuals. Each team member will designate an alternate to serve in the event that the normal representative is unavailable. A quorum will consist of the Chief-Resource & Visitor Protection, Fire Management Officer, and Chief-Resource Preservation & Research or Fire Ecologist. Critical operational decisions for wildland fire suppression and wildland fire use incidents will not be delayed in the event that a committee quorum is not available.

In addition, the following individuals will perform the duties listed below:

Chief of Resource and Visitor Protection

- Carry out fire management activities called for in this plan.
- Manage wildland fire management plan implementation, review, and revision.
- Directly supervise the Fire Management Officer.
- Approve filling vacant permanent fire management positions within the Resource & Visitor Protection Division.
- Provide input and recommendations for filling vacant network-shared positions.
- Make at least an annual inspection, with the FMO, of fire suppression, detection,

dispatch, and training facilities and procedures.

- Direct the park fire suppression and preparedness program.
- Review and recommend prescribed fire and non-fire-treatment project plans.

Fire Management Officer (FMO)

- Has immediate responsibility for overseeing all aspects of fire management operations, preparedness, training, planning and fiscal management.
- Collaborates with Fire Ecologist in reviewing and translating scientific information into fire management operations and policies
- Develops short and long-range plans for network parks' wildland fire management programs.
- Establish liaison with cooperating agencies, and coordinate and maintain cooperative agreements.
- Prepares and/or revises annually, cooperative agreements concerning wildfire management, prescribed fire, smoke management, and cross-agency fiscal matters.
- Formulates and directs the budget accountability program for preparedness, hazard fuels operations, emergency fire accounts and approves all expenditures.
- Responds to regional and national office information requests.
- Coordinate park-wide fire training and equipment acquisition.
- Maintain park-wide crew lists and equipment records.
- Advise the Klamath Falls Interagency Fire Center Manager on fire dispatch and reporting responsibilities.
- Ensure fire reports (DI-1202) are properly prepared and submitted to the Pacific West Regional Office and/or entered into WFMI.
- Maintain qualification and training records.

Chief of Resource Preservation and Research

- Provides scientific expertise, technical advice, and review regarding:
    - Ecological effects of fire and fire suppression activities.
    - Distribution of vegetation, fuels, and natural and cultural resources, including sensitive resources.
    - Park and resource management alternatives related to fire.
    - Resource, fire management, and site-specific burn plans.
- Supervises the Fire Ecologist

Fire Ecologist

- Directs the Fire Ecology and Fire Effects Monitoring program
- Coordinates fire-related research activities

- Collaborates with Fire Management Officer in reviewing and translating scientific information into fire management policies

Chief of Interpretation and Cultural Resources

- Provide scientific expertise, technical advice, and review regarding the effects of fire and suppression activities on cultural resources

Geographic Information System Specialist

- Develop and maintain geographic information system (GIS) databases and analysis options, and produce GIS maps and other products

Incident Commanders

- Use strategies and tactics that are as resource sensitive as possible while maintaining the first priority of firefighter and public safety.
- A Delegation of Authority will be provided to each non-park incident commander (Type III or greater) prior to assuming responsibility for an incident.
- Major duties of the Incident Commander are given in the NWCG Fireline Handbook and include:
  - Brief subordinates, direct their actions and provide work tools.
  - Ensure that safety standards identified in the Standard Firefighting Orders, 18 Watch Out Situations, and agency polices are followed at all times.
  - Personally scout and communicate with others to be knowledgeable of fire conditions, fire weather, tactical progress, safety concerns and hazards, condition of personnel, and needs for additional resources.
  - Order resources to implement the management objectives for the fire.
  - Inform appropriate dispatch of current situation and expected needs.
  - Coordinate mobilization and demobilization with dispatch and FMO, or designee.

5.3 Relationship of Fire Management Organization to NPS Unit

The fire management organization in Crater Lake National Park is within the Division of Visitor Protection, supervised by the Fire Management Officer. He or she works for the Chief Ranger, who works for the Crater Lake National Park Superintendent. The Superintendent has ultimate responsibility and accountability for all fire and fuels management activities.

5.4 National Fire Plan Funding

The National Fire Plan is the funding mechanism for fire management programs at the park level. The Fire Management Officer is responsible for the development of

an annual operating budget for the fire management program. Budget development occurs in the Fire Planning Data System (PDS) and management occurs in the Administrative Financial System (AFS3).

Hazardous Fuels, Wildland-Urban Interface projects and Community Assistance programs, including Rural Fire Assistance, are currently funded based on inputs into the National Fire Program Operations System (NFPORS). The Fire Management Officer is responsible for the scheduling and identification of fuels related projects. The schedule for inputs into NFPORS for project funding does not coincide with the PDS schedule. The Regional Fuels Specialist provides an annual call letter for inputs.

Emergency fire suppression accounts will be created by the CRLA Budget Analyst as incidents occur and are established within the FIRECODE system. Step-up and Severity accounts are requested through the Regional Office as needed based upon. The FMO and FMPA are responsible for tracking all expenditures associated with this account and will maintain a file that verifies the fire danger condition or specific event that authorized the expenditure of E-11 funds.

The program receives its budget in four primary Project Work Elements (PWE's), Preparedness, (P11), Hazardous Fuels (H12 and H22), Compliance (H13), Fire Effects (H14), and Wildland/Urban Interface (W13). The park also receives W12 and W22 funding for specific hazardous fuels treatment projects. A breakout of the funding structure is shown in Table 5.1

Table 5.1 Fire Management Funding Structure (Fiscal Year 2004)

Position	PWE	Pay Periods	Comment
Fire Management Officer	P11	26	Funded at GS-11
Engine Captain	P11	17	Funded at GS-7
Fire Program Management Assistant	P11	26	Funded at GS-6
Prescribed Fire/Fuels Spec.	H11	26	Funded at GS-11 (Shared)
Fire Ecologist	H14	26	Funded at GS-11 (Shared)
Temporary Firefighters	P11 H12	8 8	Five suppression employees Two HF funded employees

5.5 Superintendent's Responsibility

The Superintendent has the overall responsibility for the execution of the fire management program at CRLA. His/her responsibilities in the fire management program:

- Approve the park's Fire Management Plan and any revisions.
- Be informed of all wildland fire starts in the park, and receive fire status updates daily or when significant changes occur.
- Be the sole authority to approve any prescribed fire or non-fire treatment projects.
- Provide delegation of authority to non-park Incident Commanders working in the park, or designate a representative to do so.
- Serve as approving official for all WFDSS decision documents, and associated daily validations. The Superintendent will delegate this signature authority to an Acting Superintendent during his/her absence.

5.6 Interagency Coordination

Crater Lake National Park is dependent on the support of other federal, state, and local agencies to support the fire management program.

The park will maintain close working relations with surrounding fire agencies, including the Oregon Department of Forestry, Fremont-Winema National Forests, Rogue River National Forest, Umpqua National Forest and the surrounding local Ranger Districts on these forests.

Klamath Falls Interagency Fire Center (KIFC) provides wildland firefighting dispatch services for the area.

Additionally, Crater Lake maintains an operational relationship with South Central Oregon Fire Management Partnership which consists of the following agencies: USFS Fremont-Winema National Forests, Oregon Department of Forestry Klamath-Lake District, Bureau of Land Management (Lakeview District), US Fish and Wildlife Service Sheldon-Hart Mountain National Wildlife Refuge

The Klamath Network national parks (Lassen Volcanic National Park, Lava Beds National Monument, Redwood National and State Parks, Whiskeytown National Recreation Area, and Oregon Caves National Monument) are also key cooperators in the park's prescribed and wildland fire operations.

Fuels management activities could not occur without the support of the cooperators. The cooperators provide overhead and personnel for staffing of prescribed fires. It is the responsibility of the FMO, with the assistance of the Fire

Management Program Assistant, to develop task orders under the auspices of the DOI/USDA Cooperative agreement to allow for reimbursement when necessary. These should be established prior to actual assistance.

5.7 List of Key Interagency Contacts by Function

See Appendix 13.E for a list of key interagency contacts.

5.8 List of Fire-Related Agreements

The park is a signatory to a Master Agreement for Wildland Firefighting Agencies in the Pacific Northwest (2004). A list of other agreements can be found in Appendix 13.G.

Chapter 6 Monitoring and Evaluation

6.1 Introduction

Fire program monitoring at Crater Lake National Park is a critical task assigned to the Klamath Network Fire Ecology Program (Crater Lake National Park, Lava Beds National Monument, Whiskeytown National Recreation Area, Redwoods National Park, Oregon Caves National Monument and Lassen Volcanic National Park). As directed by NPS fire management policy (DO-18), a program of fire monitoring has been developed to: 1) determine whether fire and resource management objectives are being met (as measured at a landscape scale); and 2) to document unexpected consequences to fuels and vegetation from fire management activities. This chapter summarizes the components of program monitoring for Crater Lake National Park.

6.2 Purpose and Need

Recent policy and fire/fuels program initiatives recognize that fire re-introduction is important to fire-adapted landscapes to sustain diverse, functioning ecosystems and to prevent damage from uncharacteristically severe fire that is likely to occur with fire exclusion in fire prone areas. Information about the results of fire restoration efforts supplied by the monitoring program is critical feedback needed by land managers, policy-makers, and the public.

Because environmental and fire condition monitoring is essential background information needed for effective decision making, the success or failure of a wildland fire could very well depend on the proper and timely collection and transmission of these data. When properly executed, feedback from the monitoring of environmental and fire conditions will directly affect how a wildland fire is managed. For use of wildland fire incidents, the park's fire managers will use the information to prioritize fires for assignment of critical resources. For example, a wildland fire that is being suppressed might receive more resources quickly if the information relayed indicates that the fire is about to spread into a different fuel type that will result in a higher resistance to control. For use of wildland fire incidents, the environmental and fire conditions information will be used to help determine the level of monitoring needed for each fire.

The accomplishment of hazard reduction and restoration goals depends upon having a monitoring program that is sufficient to determine whether specific fuel reduction and restoration objectives are met. The vegetation and fuels monitoring results provide the information needed to assess whether specific objectives for prescribed and wildland fire use programs are met with the level of certainty required. The monitoring program provides a consistent and dependable method of documenting the wildland and prescribed fire program's objective achievement. If the objectives are not achieved, managers must determine whether management

actions need to be adjusted in order to attain objectives or if the management objectives need to be revised given the current situation. The analysis of some additional data not specifically related to management objectives is used to determine if any unexpected consequences of prescribed fire applications are occurring.

Fire Monitoring Framework

The NPS Fire Monitoring Handbook (NPS 2001) identifies four monitoring levels to guide fire effects monitoring efforts:

Table 6-1. NPS Fire Monitoring Handbook - Minimum Recommended Standards

Monitoring Level	Minimum Recommended Monitoring Standards
Level 1 – Reconnaissance	Fire cause, location, size, fuel and vegetation types, relative fire activity, potential for spread, current and forecasted weather, resource or safety threats and constraints, and smoke volume and movement.
Level 2 – Fire Conditions	Fire monitoring period, ambient conditions – topographic and fire weather, fuel model, fire characteristics, and smoke characteristics .
Level 3 – Immediate Post Fire Effects	Fuel reduction, burn severity, vegetative change or other objective dependent variables within 1 to 5 year post-burn.
Level 4 – Long-term Change	Continued monitoring of Level 3 variables to measure trends and change over time.

Use of Monitoring Levels 1 and 2

The first two monitoring levels provide information to guide fire management strategies for both wildland and prescribed fires.

<u>Monitoring Goal:</u> Environmental monitoring and fire observations provide the basic background information needed for decision-making before, during, and after fire events.

Monitoring Objectives: Collect information on environmental conditions (current and forecasted weather, and fuel models) and fire conditions (name, location, slope, aspect, spread, intensity, smoke transport and dispersal) for all wildland and prescribed fires. Use the information collected in a timely manner to adapt to changing conditions and successfully manage each fire.

Use of Monitoring Levels 3 and 4

Monitoring levels 3 and 4 describe short- and long-term monitoring of the effects of fire on fuels and vegetation to guide wildland fire (prescribed and fire use) and can also be applied to non-fire fuel treatment activities such as thinning, shaded fuel-breaks and slash-busting.

Monitoring Goal: Specific fire-related management objectives guide fire program activities to achieve desired resource target conditions. Vegetation and fuels monitoring provides information needed to determine whether the fuels- and vegetation-related management objectives are being met and to detect any unexpected consequences of prescribed burning or other treatments.

Monitoring Objectives: Collect information on fuels and vegetation to determine if specific fire- and fuels-related management objectives have been achieved. Use the information collected to determine if progress is being made towards the desired resource target conditions for each monitoring type as shown in Table 6-2 below.

The following table summarizes the resource target conditions for each forest type found in the park. The desired target conditions vary with the state of the ecosystem and the management phase (restoration versus maintenance).

Table 6-2.Resource Target Conditions by Forest Type
(Restoration and Maintenance phases)

Forest Series and (Monitoring Type Code) ↓	Target Condition Categories			
	Restoration Phase		Maintenance Phase	
	Fuel Reduction	Stand Density by diameter class and (species composition)	Fuel Load Distribution (% of landscape)	Gap/ Patch Size Distribution (% of landscape)
Ponderosa Pine (PIPO)	Reduce 60-90% of existing dead & down fuels	20-50 trees/ acre > 12" dbh* < 400 trees/ acre 2-6" dbh (5-50% pine,0-70% shrub, 0-25% grass/ sedge)	20-40% 5-30 tons/ acre 20-50% 30-60 tons/ acre 5-20% >60 tons/ acre	75-95%: 0.25 acre – 2.5 acres 5-25%: 2.5 – 25 acres <1%: 25-250 acres
White Fir (ABCO)	Reduce 60-90% of existing dead & down fuels	30-80 trees/ acre > 12" dbh < 600 trees/ acre 2-6" dbh (40-80% fir,15-40% pine, 0-20% other)	20-40% 5-30 tons/ acre 20-50% 30-60 tons/ acre 5-20% >60 tons/ acre	75-95%: 0.25 acre – 2.5 acres 5-25%: 2.5 – 25 acres <1%: 25-250 acres
Shasta Red Fir (ABMAS)	Reduce 60-90% of existing dead & down fuels	30-80 trees/ acre > 12" dbh < 600 trees/ acre 2-6" dbh (30-70% fir 0-20% pine 0-20% other)	1-25% 5-30 tons/ acre 30-70% 30-60 tons/ acre 5-20% >60 tons/ acre	70-95%: 0.25 – 10 acres 5-30%: 12.5 – 25 acres < 1%: 25 – 250 acres
Mountain Hemlock (TSME)	Reduce 35-55% of existing dead & down fuels	Unknown density (15-60% hemlock, 0-40% fir, 0-10% pine)	Unknown	80-99%: 0.25 – 250 acres 1-20%: 250 - 5000 acres <1%: > 5000 acres
Lodgepole Pine (PICO)	Reduce 35-55% of existing dead & down fuels	Unknown density (80-90% pine, 0-10% fir, 0-10% hemlock)	Unknown	80-99%: 0.25 – 250 acres 1-20%: 250 - 5000 acres <1%: > 5000 acres
Whitebark Pine (PIAL)	Reduce 35-55% of existing dead & down fuels	Unknown density (40-90% pine, 0-50% hemlock, 0-10% fir)	Unknown	80-99%: 2.5 – 10 acres 1-20%: 12.5 – 750 acres <1%: > 750 acres

* dbh = diameter at breast height (tree trunk measured at 4.5 feet above the ground surface

Table 3- 2 Resource Target Conditions by Fire Management Unit

Monitoring Framework

The following sections summarize when, where and how monitoring data will be collected for each of the fire management options. Additional information on fire regimes, resource objectives, and monitoring objectives can be found in the park's Wildland and Prescribed Fire Monitoring Plan (See Appendix F).

The following levels of monitoring are necessary and recommended for the fire management options available with the current Fire Management Plan:

Table 6-3. Necessary monitoring levels by Fire Management Option

	Wildland Fire	Prescribed Fire	Non-Fire Treatment
Level 1 – Reconnaissance	Yes	Yes	Yes
Level 2 – Fire Conditions	Yes	Yes	No
Level 3 – Post Treatment Effects	Maybe	Yes	Yes
Level 4 – Long-term Change	Maybe	Yes	Maybe

Wildland Fire Monitoring

Field Measurements

The following information will be collected for all wildland fires regardless of management strategy: fire name, location, cause, current size, air temperature, relative humidity, wind speed, wind direction, percent slope, aspect, representative Fire Behavior Prediction System (FBPS) fuel model(s) and description, current fire activity (smoldering, creeping, running, torching), rate of spread, direction of spread, flame length, perimeter and area growth, and smoke transport and dispersal.

All wildland fire incidents will have a Wildland Fire Decision Support System (WFDSS) prepared. In addition to the data listed above, the following information may be collected: canopy cover, tree inventory (seedling/sapling/overstory), shrub inventory, non-native plant frequency, dead and down fuels inventory, and photo record.

Timing of Monitoring

Weather conditions for all wildland fires will be monitored regularly from the time of discovery/ignition and throughout the duration of the fire. The monitoring frequency will be specified in the WFDSS.

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Wildland fire incidents may be monitored with permanent sampling plots placed in a safe location in relation to the approaching flame front for pre-burn data. Post-burn data will be collected within one-year post-burn as a minimum; and there after as needed. If plots cannot be installed safely, they will be precluded from the monitoring plan.

Monitoring Site Locations

On-site environmental, weather and fire conditions for all wildland fires will be monitored as indicated in WFDSS.

Vegetation and fuels data should be sampled at a density determined by the Fire Ecologist at the time of the incident, depending on current and predicted fire activity and vegetation/ fuel types.

All plot locations will be located using a handheld GPS. In addition, accurate documentation of plot locations for ease of relocation will be maintained by the Fire Ecology Program office.

Sampling Design

Sampling unit shapes and sizes are described in the CRLA Wildland and Prescribed Fire Monitoring Plan. A combination of variable and fixed plots, and planar transects are specified.

Intended Data Analysis Approach

The following data summaries will be compiled: tree density - both grouped by species or dbh grouping, or crown code, live vs. dead; tree height and height to live crown will be used to calculate percent crown; percent canopy cover; percent shrub cover by species, percent live versus dead for shrubs as a group and by species, average height by shrub group and species; tons per acre by fuel class; percent frequency by herbaceous species, and by native and exotic, and rare vs. common.

Data Sheet Examples

See the Vegetation/ Fuels Rapid Assessment monitoring guidelines (Appendix 13.F)

Information Management

Data will be entered, checked for errors, and managed by the Fire Ecology Program staff and supervised by the Fire Ecologist. Original copies of all data will be kept by the Fire Ecology Program office and disseminated as requested.

Responsible Party

The person in charge of the fire (incident commander or fire use manager) is responsible for ensuring that the fire monitoring data is collected, transmitted, acted upon, and filed according to established protocols.

The Fire Ecologist is responsible for collecting, analyzing, and managing vegetation and fuels data collected on fires managed for resource benefits.

Prescribed Fire Monitoring

Field Measurements

The following information will be collected for all prescribed fires: fire name, location, ignition type (aerial, hand), planned size, air temperature, relative humidity, wind speed, wind direction, percent slope, aspect, National Fire Danger Rating System (NFDRS) fuel model appropriate index (energy release component (ERC) or burning Index (BI)), representative Fire Behavior Prediction System (FBPS) fuel model, rate of spread, direction of spread, flame length, perimeter and area growth, and smoke transport and dispersal.

In addition to the data listed above, the following information will be collected: live fuel moisture (if applicable), dead fuel moisture (1 hour, 10 hour, 100 hour, 1000 hour, litter, duff) as indicated in the site specific burn plan prescriptions, road or sensitive site visibility, smoke column mixing height, smoke transport and dispersal direction. Smoke particulate data may be collected at smoke sensitive locations as indicated in the site-specific burn plan.

The field measurement protocols follow those found in the NPS Fire Monitoring Handbook (NPS 2001) to acquire standardized information on fire behavior and the effects of fire on fuels and vegetation. Exceptions to the standard protocols are noted in the park-wide fire monitoring plan (appendix of fire management plan). This monitoring plan offers a complete description of the monitoring design (measurements, timing, location, objectives, etc.) that will be used to monitor short- and long-term changes that result from prescribed fire.

Timing of Monitoring

All prescribed fires will have the environmental conditions monitored at least two weeks in advance of the planned ignition date. On-site weather and fire conditions monitoring will occur throughout all active ignition phases of each fire on a schedule determined by the burn boss with consultation from the lead monitor (FEMO) assigned to the fire.

All prescribed fires will have short-term and long-term fuels and vegetation data collected prior to the ignition date. Timing of data collection will be coordinated through the Fire Ecologist. Generally, data will be collected at the peak of flowering season. Depending on elevation and aspect, this time may vary from early June through mid-August.

Monitoring Site Locations

On-site environmental conditions for all prescribed fires will be monitored at a representative location within the burn area, as determined by the burn boss with consultation from the lead monitor assigned to the burn.

Permanent sampling points for vegetation and fuels data collected as part of the short-term and long-term monitoring effort will be located using stratified random techniques coordinated by the Fire Ecologist.

No monitoring plots will be established on slopes greater than 60%, or on any areas identified by specialists as having significant resource value (e.g., cultural resource isolated finds).

All plot locations will be located using a handheld GPS. In addition, accurate documentation of plot locations for ease of relocation will be maintained by the Fire Ecology Program office.

Sampling Design

Sampling unit shapes and sizes will conform to specifications described in the NPS National Fire Monitoring Handbook or other approved protocols. Pilot sampling may be used during the establishment of plots in previously un-sampled monitoring types.

A minimum sample size will be calculated as soon as data from the initial 10 plots per monitoring type is available. Minimum sample size will be calculated for each objective variable in a monitoring type, based on pre-burn or pre-treatment data and then recalculated post-treatment to determine final sample sizes.

Intended Data Analysis Approach

Data will be analyzed by running minimum sample size equations after all plots have reached one-year postburn. Tests will be performed to determine if the data fit a normal distribution or if data are skewed. If normal, we will use a paired t-test to determine if objectives have been met. If the data is skewed we will consult a statistician for assistance.

Data Sheet Examples

See the National Fire Monitoring Handbook and/or the Crater Lake Wildland Fire Monitoring Plan.

Information Management

Data will be entered, checked for errors, and managed by the Fire Ecology Program staff and supervised by the Fire Ecologist. Original copies of all data will be kept by the Fire Ecology Program office and disseminated as requested.

Responsible Party

The person in charge of the fire (burn boss) is responsible for ensuring that the fire monitoring data is collected, transmitted, acted upon, and filed according to established protocols.

The Lead Biological Technician (Fire Effects), in coordination with the Area Fire Ecologist, is responsible for collecting field data, storing data electronically, performing data quality checks, and assisting with data analysis as needed.

Non-Fire Treatment Monitoring

Field Measurements

The following information will be collected for all non-fire treatments: project name, location, treatment objectives, project size, treatment prescription, and methods.

Additional data collection may include all or some of the following, based on treatment objectives and resource monitoring needs: canopy cover, tree inventory (seedling/sapling/overstory), shrub inventory, non-native plant frequency, dead and down fuels inventory, and photo record.

Timing of Monitoring

All non-fire treatments (thinning, shaded fuel breaks, etc.) will have short-term and long-term fuels and vegetation data collected prior to treatment. Timing of data collection will be coordinated through the Fire Ecologist. Generally, data will be collected at the peak of flowering season. Depending on elevation and aspect, this time may vary from early June through mid-September or as necessary for effective project completion.

Monitoring Site Locations

Permanent sampling points for vegetation and fuels data collected as part of the short-term and long-term monitoring effort will be located using stratified random techniques coordinated by the Fire Ecologist.

No monitoring plots will be established on slopes greater than 60%, or on any areas identified by specialists as having significant resource value (e.g., isolated cultural resource finds).

All plot locations will be located using a handheld GPS. In addition, accurate documentation of plot locations for ease of relocation will be maintained by the Fire Ecology Program office.

Sampling Design

Sampling unit shapes and sizes are described in the Vegetation/Fuels Rapid Assessment Protocols guidelines for the Southern Cascades Fire Effects Monitoring Program. A combination of variable and fixed plots, and planar transects are specified.

Intended Data Analysis Approach

The following data summaries will be compiled for data if collected: tree density - both grouped by species or dbh grouping, or crown code, live vs. dead; tree height and height to live crown will be used to calculate percent crown; percent canopy

cover; percent shrub cover by species, percent live versus dead for shrubs as a group and by species, average height by shrub group and species; tons per acre by fuel class; percent frequency by herbaceous species, and by native and exotic, and rare vs. common.

Data Sheet Examples

See the Vegetation/Fuels Rapid Assessment Protocols guidelines for the Southern Cascades Fire Effects Monitoring Program.

Information Management

Data will be entered, checked for errors, and managed by the Fire Ecology Program staff and supervised by the Fire Ecologist. Original copies of all data will be kept by the Fire Ecology Program office and disseminated as requested.

Responsible Party

The Fire Ecologist is responsible for collecting, analyzing, and managing vegetation and fuels data collected on non-fire treatment projects in coordination with the project manager (Fire Management Officer and/or Contracting Officer's Technical Representative).

Chapter 7 Fire Research

7.1 Summary of Existing Fire Research

The forests and landscapes of Crater Lake National Park have been studied since the late nineteenth century, when Frederick Coville first explored the area and discovered several species of rare, endemic vascular plants. Esther Applegate followed in Coville's footsteps, collecting herbarium specimens and completing the Park's first comprehensive botanical survey in 1939. In the 1940's, Henry Hansen completed a study of forest succession and climate, and Lyle Wynd observed the botanical features of the life zones found within the Park.

The park initiated a prescribed fire program in the mid- 1970's, and soon after questions arose about the effects of fire on old growth ponderosa pine found in the park's mixed-conifer forests. In the early 1980's, researchers associated with the National Park Service Cooperative Studies Unit at the University of Washington, began forest and fire ecology studies of the various forest types found in the park. This strong legacy of applied research continues today.

7.2 Published Research at Crater Lake National Park

Below is a list of published research articles which contain specific references to Crater Lake National Park or forest vegetation types and fire regimes found in the park:

Agee, J.K. 2003. Monitoring post-fire tree mortality in mixed conifer forests of Crater Lake, Oregon, USA. Natural Areas Journal 23:114-120.

Agee, J.K. 1998. The landscape ecology of western forest fire regimes. Northwest Sci. 72:24-34.

Agee, J.K. 1993. Fire Ecology of Pacific Northwest Forests. Island Press, Washington, D.C. pp. 238-350.

Agee, J.K. 1990. The historical role of fire in Pacific Northwest Forests. In Walstad, J., et al. (eds.), Natural and prescribed fire in Pacific Northwest forests: pp. 25-38. Corvallis: Oregon State University Press.

Agee, J.K. 1983. Fuel weights of understory-grown conifers in southern Oregon. Can. J. For. Res. 13:648-656.

Agee, J.K. 1981. Initial effects of prescribed fire in a climax *Pinus contorta* forest: Crater Lake National Park. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 81-4. University of Washington, Seattle. 12 pp.

Agee, J.K. 1981. Biomass of coniferous understory trees in Crater Lake National Park, Oregon. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 82-1. University of Washington, Seattle.

Agee, J.K. 1979. Prescribed fire effects at Crater Lake National Park. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 79-?. University of Washington, Seattle. 8 pp.

Agee, J.K. and M.H. Huff. 2000. The role of prescribed fire in restoring ecosystem health and diversity in southwest Oregon: part 1 ecological conditions. Rep. to Pacific Northwest Research Station Director's Office, Northwest Forest Plan Issue.

Agee, J.K. and M.H. Huff. 1986. Structure and process goals for vegetation in wilderness areas. In Proceedings: National wilderness research conference: pp. 17-25. USDA For. Serv. Gen. Tech. Rep. INT-212.

Agee, J.K. and T.L. Thomas. 1982. Forest restoration at Sun Creek, Crater Lake National Park.
Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 82-?. University of Washington, Seattle. 38 pp.

Applegate, E.I. 1939. Plants of Crater Lake National Park. Amer. Mid. Natur. 22:225-314.

Atzet, Thomas, 1996. Fire regimes and restoration needs in Southwest Oregon, In: Hardy, Colin.; Arno, Stephen F., eds. The Use of Fire in Forest Restoration. Gen. Tech. Rep. INT-GTR-341. Ogden UT: US Department of Agriculture, Forest service, Intermountain Research Station, 86 p.

Atzet, T., D.E. White, L.A. McCrimmon, and others. 1996. Field guide to the forested plant associations of southwestern Oregon. USDA Forest Service, Pacific Northwest Region, Tech. Rep. R6-NR-ECOL-TP-17-96. Portland, OR.

Baldwin, C.T. and S.J. Brunsfeld. 2001. Genetics, demography, monitoring and restoration of Mt. Mazama collomia (*Collomia mazama* Coville). Unpublished report on file at Crater Lake National Park, Division of Resource Preservation and Research. 66 pp.

Chappell, C.B. 1991. Fire ecology and seedling establishment in Shasta red fir *(Abies magnifica* var. *shastensis)* forests of Crater Lake National Park, Oregon. M.S. thesis, University of Washington, Seattle. 133 pp.

Chappell, C.B. and J.K. Agee. 1996. Fire severity and tree seedling establishment in *Abies magnifica* forests, southern Cascades, Oregon. Ecological Applications 6(2):628-640.

Coville, F.V. 1901. The home of *Botrychium pumicola*. Bulletin of the Torrey Botanical Club 28:109-112.

Coville, F.V. 1897. *Collomia mazama*, a new plant from the vicinity of Crater Lake Oregon. Biological Society of Washington. 1897; XI:35-37.

Coville, F.V. 1896. *Ribes erythrocarpum*, a new current from the vicinity of Crater Lake, Oregon. Biological Society of Washington. 1896; X:131-132.

Coville, F.V. and J.B. Leiberg. 1897. Two new plants from Mount Mazama, Oregon. Biological Society of Washington. 1897; XI:169-171.

Gara, R.I., W.R. Littke, J.K. Agee, D.R. Geiszler, J.D. Stuart, and C.H. Driver. 1985. Influence of fires, fungi, and mountain pine beetles on development of a lodgepole pine forest in south-central Oregon. In Baumgartner, D.M. et al. (eds.), Lodgepole pine: The species and its management: pp 153-62. Pullman: Washington State University.

Geiszler, D.R., R.I. Gara, C.H. Driver, V.F. Gallucci, and R.E. Martin. 1980. Fire fungi, and beetle influences on a lodgepole pine ecosystem of south-central Oregon. Oecologia 46:239-43.

Hansen, H.P. 1946. Postglacial forest succession and climate in the Oregon Cascades, Amer. J. Sci. 244:710-734.

Huff, M.H. and J.K. J.K. Agee. 1991. Subalpine forest dynamics after fire in the Pacific Northwest National Parks. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 91-?, University of Washington, Seattle.

Huff, M.H. and J.K. Agee. 1989. Fuel and fire behavior predictions in subalpine forests of Pacific Northwest National Parks. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 89-4. University of Washington, Seattle. 67 pp.

Horn, E.M. 1968. Ecology of the Pumice Desert, Crater Lake National Park. Northwest Sci. 42(4):141-147.

Kerle, E.A. 1985. The ecology of lupines in Crater Lake National Park, Oregon. M.S. thesis, Oregon State University, Corvallis. 76 pp.

McNeil, R.C. and D.B. Zoebel. 1980. Vegetation and fire history of a ponderosa pine-white fir forest in Crater Lake National Park. Northwest Science 54:30-46.

McNeil, R.C. 1975. Vegetation and fire history of a ponderosa pine-white fir forest in Crater Lake National Park. M.S. thesis, Oregon State University, Corvallis. 171 pp.

Murray M.P. and M.C. Rasmussen. 2003. Non-native blister rust disease on whitebark pine at Crater Lake National Park. Northwest Science 77(1):87-91.

Rasmussen, M.C. and W.J. Ripple. 1998. Retrospective analysis of forest landscape patterns in western Oregon. Nat. Areas Journal 18(2):151-163.

Schaaf, D.V. 1993. Inventory for Crater Lake rockcress, *Arabis suffrutescens* var. *horizontalis* (Green), a rare endemic plant species. Portland, OR: The Nature Conservancy. 23 pp.

Seyer, S.C. 1980. Vegetative ecology of a montane mire, Crater Lake National Park, Oregon. M.S. thesis, Oregon State University, Corvallis. 187 pp.

Seyer, S.C. 1979. New mosses from Crater Lake National Park, Oregon: *Bryum weigelii, Helodium blandowii blandowii, Drepanocladus vernicosus*. Bryologist 82(1):82-83.

Stuart, J.D. 1984. Hazard rating of lodgepole pine stands to mountain pine beetle outbreaks in south-central Oregon. For. Ecol. And Manage. 5:207-14.

Stuart, J.D. 1983. Stand structure and development of a climax lodgepole pine forest in south-central Oregon. Ph.D. diss., University of Washington, Seattle.

Swezy, D.M. and J.K. Agee. 1991. Prescribed fire effects on fine root and tree mortality in old growth ponderosa pine. Can. J. For. Res. 21:626-34.

Swezy, D.M. 1988. Mortality and stress of ponderosa pine after low intensity prescribed fire at Crater Lake, Oregon. M.S. thesis, University of Washington, Seattle. 92 pp.

Taylor, A.H. and C.B. Halpern. 1991. The structure and dynamics of *Abies magnifica* forests in the southern Cascade Range, USA. J. Veg. Sci. 2:189-200.

Thomas, T.L. and J.K. Agee. 1986. Prescribed fire effects on mixed conifer forest structure at Crater Lake, Oregon. Can. J. For. Res. 16(5):1082-87.

Thomas, T.L. 1982. Forest restoration of Sun Creek, Crater Lake National Park. M.S. thesis, University of Washington, Seattle. 113 pp.

Volland, L.A. 1976. Plant communities of the central Oregon pumice zone. R-6 Area Guide 4-2. USDA For. Serv., Pacific Northwest region, Portland, OR.

Vrilakas, S. 1987. Species management guide for *Botrichium pumicola*. Portland, OR: The Nature Conservancy. 24 pp.

Wickman, B.E. 1990. The battle against bark beetles in Crater Lake National Park, 1925-34. Gen. Tech. Rep. PNW GTR-259. 40 pp.

Wynd, F.L. 1941. The botanical features of the life zones of Crater Lake National Park, Amer. Mid. Natur. 25:324-347.

Yocum, C.F. 1964. Shrubs of Crater Lake National Park. Crater Lake Natural History Association, San Francisco. 82 pp.

Zeigler, R.S. 1978. The vegetation dynamics of *Pinus contorta* forest, Crater Lake National Park. M.S. thesis, Oregon State University, Corvallis.

Zika, Peter F. 1995. An annotated checklist of vascular plants in Crater Lake National Park, Oregon. Final report from The Nature Conservancy, Portland, OR.

7.3 Current Research

Current fire research topics are focused on two management concerns: 1) correcting the negative impacts of former fire exclusion policies (especially in the Eastern Cascade mixed-conifer forest ecosystems); and 2) determining effective guidelines and tools for the long-term management of five-needle pines especially whitebark pine. The following is a list of currently funded forest and fire ecology related research being completed at the park:

Title: "Seasonal effects of prescribed fire at Crater Lake."
Principal Investigator(s): J.K. Agee and D. Perakis, University of Washington, Seattle.
Study objectives: Quantify the effects of spring versus fall burning on standard fire response variables such as fuel consumption and understory effects, and to quantify the effects of such fires on vigor and mortality of large ponderosa pine, the most important structural element in these mixed conifer forests.
Study duration: (36 months) 2001- 2003
Funding source and amount: Joint Fire Science Program, $103,500

Title: "The role of dwarf mistletoe in broom development, fire susceptibility and fire behavior in mature ponderosa pine."
Principal Investigator(s): Helen Maffei, USFS Forest Insect and Disease Tech. Center, Bend, OR and Sharon Stanton, Portland State University, Portland, OR.
Study objectives: Determine the interactions between dwarf mistletoe and fire in old growth ponderosa pine stands, specifically; 1) Are brooms more flammable than healthy limbs? 2) Are heavily infected trees more susceptible to post-fire mortality? And 3) Does mistletoe influence bark thickness?
Study duration: (24 months) 2002 - 2004
Funding source and amount: USDA Forest Service Forest Insect and Disease Research Fund, $53,000

Title: "The effects of fire suppression, fuels treatment, and wildfire on bird distribution and abundance in the Klamath ecoregion of southern Oregon and northern California."
Principal Investigator(s): John Alexander, Klamath Bird Observatory, Ashland, OR and C.J. Ralph, USDA Forest Service, Redwoods Sciences Laboratory, Arcata, CA.

Study objectives: The Klamath Bird Observatory and its partners propose to study the local biological effects of wildland fire, fuel treatments, and post-fire stabilization and rehabilitation actions on the distribution and abundance of breeding landbirds, by implementing three interrelated studies: 1) Determine the effects of fire history on landbird species across the landscape; 2) Determine the effects of various fuels treatments on birds; and 3) Determine the effects of wildfire occurrence and rehabilitation on bird community composition.
Study duration: (36 months) 2002 - 2004
Funding source and amount: Joint Fire Science Fire Program, $395,750

Title: "Indicators of ecosystem decline for subalpine forest systems at Crater Lake National Park: Effects of fire and anthropogenic disturbance on vegetation and mycorrhizal fungi."
Principal Investigator(s): J.B. Kauffman, and J. Trappe, Oregon State University, Corvallis.
Study objectives: Describe relationships between mycorrhizal fungi and ecosystem attributes (vegetation composition, structure, and soils) in intact subalpine forests and determine the degree and manner in which these relationships are disrupted by heavy disturbance.
Study duration: (36 months) 2001- 2003
Funding source and amount: NPS NRPP Research, $210,000

Title: "Effects of prescribed burning on mycorrhizal fungi in Crater Lake National Park"
Principal Investigator(s): Kermit Cromack Jr., James Trappe, Efren Cazares, and Matt Trappe, Oregon State University, Corvallis and Mary Rasmussen, NPS Fire Ecologist.
Study objectives: Mycorrhizal fungi are essential for the survival and growth of all woody terrestrial plants in western North America. The fruit-bodies of these fungi are also important food resources for most forest mammals. Objective 1) Determine and interpret the seasonal effects of prescribed burning on the abundance and distribution of epigeous and hypogeous fungal species. Objective 2) Provide managers information to minimize damage to mycorrhizal fungi from prescribed burning.
Study duration: (36 months) July 2003 – June 2006
Funding source and amount: Joint Fire Science Fire Program, $160,317

Title: "Whitebark Pine Mapping Project"
Principal Investigator(s): Michael Murray, CRLA Terrestrial Ecologist and Mary Rasmussen, NPS Fire Ecologist.
Study objectives: Map the whitebark pine distribution in the Park. These locations will be visited, documented, and mapped for boundaries. The combined data and maps will be added to the Park's GIS data. In addition, an exhibit-quality map will be produced for visitor education and enjoyment.
Study duration: (3 months) 2001
Funding source and amount: CRLA Natural History Association, $5,268

Title: "Fire Knowledge for Managing Cascadian Whitebark Pine Forests"

Principal Investigator(s): Michael Murray, CRLA Terrestrial Ecologist.
Study objectives: 1) Gain an understanding of fire regimes associated with whitebark pine forests in the Cascade Range; 2) Describe historic and current stand conditions and estimate potential ecological effects of fire exclusion policies; and 3) Articulate findings and management guidelines with a report and presentations.
Study duration: (36 months) 2002 - 2004
Funding source and amount: Joint Fire Science Fire Program, $93,079

7.4 Summary of Immediate Fire Research Needs

Park staff has identified several natural and cultural resource management concerns related to fire that need to be researched as funds become available. Each concern has been summarized in the problem statements below.

Problem Statement 1: Whitebark pine forests are an important feature of Cascadian National Parks. Park managers are mandated to maintain key ecosystem characteristics in an unimpaired state for future generations. As a species, whitebark pine is dramatically declining due to an introduced disease and possibly fire exclusion. Although current Fire Management Plans are calling for increased prescribed fire in whitebark pine, they lack any science-based predictions of fire effects in these forests. Prescribed fire can benefit fire-dependent whitebark pine but also presents a risk of killing mature cone-bearing trees which are increasingly rare. It is imperative that managers possess a degree of confidence and caution in re-introducing fire in these forests. It is our objective to predict fire hazard within different whitebark pine fuel types of Crater Lake, Mount Rainier, and North Cascades National Parks. This will be accomplished through fuel inventory and computer modeling. By appending this study to a separately funded field study of whitebark pine, we will combine field efforts and amplify our gained knowledge. Final products will be: 1) site specific fuel data and mortality predictions, 2) Park hazard maps, 3) a technical report aimed at guiding managers to better plan and apply fire in these forests, and 4) a masters thesis.

Problem Statement 2: A definitive set of values that describe the historical range of variability for the mixed conifer forests of Crater Lake National Park is needed to develop meaningful target conditions for the effective use of prescribed fire. The park currently relies on information from one point in time (1900) to determine burn prescriptions parameters. It is our objective to determine a range of natural variation for tree density at spatial (stand level) and temporal scales (several centuries) appropriate for evaluating the effectiveness of prescribed burn prescriptions. Dendro-ecological techniques would be used to describe the past and present structure of forests by age classes, seral stages, and tree density for areas of the park that are characterized by a low severity fire regime. The highest priority location is the lower portion of Sun Creek watershed. As a result of human activities, this portion of the park has experienced more change than other mixed

conifer forests in the park. Historical range of variability can serve as a useful tool for understanding the causes and consequences of change in ecosystem characteristics over time. It provides context for interpreting natural processes, especially disturbance, and it allows variability in patterns and processes to be understood in terms of a dynamic system. Study of past ecosystem behavior can provide the framework for understanding the structure and behavior of contemporary ecosystems, and is the basis for predicting future conditions.

Problem Statement 3: Effective monitoring methods for an active wildland fire use program at the park have not been established. CRLA has more than 151,000 acres of combustible vegetation. Of that total, more than 105,000 acres (70%) are identified as acceptable for wildland fire use. Effective methods are needed to collect information on fuels and forest structure in a rapid manner ahead of the flaming front of these fires.

Problem Statement 4: The park lacks information about aboriginal burning methods and patterns. Aboriginal peoples influenced the frequency and distribution of fire in the vicinity of Crater Lake. There is a need to determine the role and frequency of aboriginal fire in relation to natural fire and ethnobotanical resource use.

Problem Statement 5: The conservation of northern spotted owls has been a focal point in the debate over forest management in the Pacific Northwest for three decades. In southern Oregon, the range of spotted owls includes federal lands managed by the National Park Service and the Forest Service. Historically the forest landscape of the area has been strongly influenced by wildland fire. The fire regime in Pre-European times was dominated by frequent (every 10-40 years), low-intensity fires, particularly in the white fir zone. Wildland fire suppression and forest management practices have altered both the intensity and frequency of disturbance in the eastern portion of the southern Cascade Range in Oregon. There is a general lack of knowledge on the relationship of wildland fire and nesting habitat for spotted owls in the eastern Cascades of southern Oregon. The effect of alterations in fire patterns on spotted owl nesting habitats has been examined on the eastern slope of the Washington and north/central Oregon Cascades, but it is not well understood in southern Oregon. Short- and long-term impacts of changes to the natural fire regime, as well as the consequences of fire suppression on habitat suitability and spotted owl nesting success, needs additional study in southern Oregon.

Chapter 8 Public Safety

8.1 Description of Public Safety Issues and Concerns

Crater Lake National Park is committed to managing its wildland and prescribed fire program in a manner which ensures the safety of all visitors, employees and residents, as well as property in and adjacent to the park.

8.2 Procedures for Mitigating Safety Issues

The park will inform visitors, employees and residents of all fire activity on a daily basis through normal information channels. A fire activity report will be updated daily, or when significant change warrants, to inform park personnel of potential threats. Areas of fire activity will be clearly signed at trail heads and along roadways. Park personnel will inform visitors obtaining backcountry use permits of the exact location of fire activity. Nearby residents adjacent to the park will be notified if any fire poses a threat to burn outside the park's boundaries, or if smoke generated within the park poses potential safety hazards.

During wildland fire management operations, or periods of very high or extreme fire danger, public fire use restrictions and emergency closures may be needed to ensure public safety (see Appendix 13.I). These restrictions can also reduce the possibility of human- caused fires during seasonal drought or extreme fire conditions. Emergency closures (e.g., trails in a fire area) may be declared by an incident commander to prevent imminent danger. Consultation with the Chief Ranger will occur as soon as possible. For longer term restrictions or closures (e.g., Stage I, II or III fire use restrictions), a special order will be approved by the Superintendent and given wide distribution. For all restrictions and closures, signs will be posted and maintained in appropriate areas.

The Superintendent may close all or some portions of Crater Lake National Park (including roads and trails) when a planned or unplanned ignition may pose a threat to public safety. Prescribed fires that exceed prescription or extend beyond the predetermined area will be immediately suppressed. Mitigation for any public safety concerns are addressed in the site-specific prescribed fire plan or WFDSS.

If wildland fires pose sufficient threat to public safety, emergency evacuations of all or part of the park may be implemented. Such evacuations will be recommended by the Chief Ranger and approved by the Superintendent. Emergency evacuations will be managed as a branch of the existing fire Incident Command System. The park's Emergency Operations Plan contains evacuation pre-plans.

Chapter 9 Public Information and Education

9.1 Description of Public Safety Information Capabilities and Needs

Education is essential in order to gain public understanding of and support for the fire management program at Crater Lake National Park. The public must be aware of the natural role of fire in the ecosystem in order to preserve it; they must also understand basic concepts about fire issues in order to provide for their own safety. Through a collaborative effort, the Fire Management Branch, the Division of Interpretation and Cultural Resources, the park's Public Information Officer, and incident Fire Information Officers will ensure that timely and accurate information is effectively disseminated to the public.

The Fire Management Branch will provide technical expertise, educational emphases and informational message subjects. The Division of Interpretation and Cultural Resources will provide expertise and guidance in the development of interpretive and educational activities, and will supervise dedicated interpretive and educational staff. The Public Information Officer will coordinate the development and dissemination of media releases. During fire activities in which Fire Information Officers (FIO) are assigned to the park, the FIO will be responsible for developing and disseminating all fire-related information and education. The park's agency representative will serve as a liaison between the FIO and the park staff to ensure that information released is consistent with the park's core interpretive and educational themes.

Crater Lake National Park receives approximately 500,000 visitors annually, with the Division of Interpretation and Cultural Resources having the primary role in visitor information and education. Interpretive park rangers present interpretive programs, provide informal roving interpretation, and staff the visitor centers. This division is an integral component of fire education at Crater Lake National Park. The fire education program consists of:

- An annual article related to a fire concept will be written and published in each summer edition of "Reflections," Crater Lake National Park's official newspaper.

- As space permits, an area in each visitor center will be dedicated to fire education. This area will include the pamphlets, "Wildland Fire in National Parks" and "Fire: in Pacific Northwest National Parks." Additionally, a bulletin on the summer's upcoming fire season is written annually and posted in this area.

- During annual interpretive ranger training, the Fire Management Branch will give a presentation on the concepts of prescribed fire, wildland fire, and fire

ecology to interpretive rangers to ensure correct information is presented to the public.

- During annual interpretive ranger training, rangers are encouraged to conduct regular programs on the role of fire during their "Hot Topics" and "Circle of Life" discussions with Park visitors. These programs are thirty-minute long discussions led by an interpretive ranger with the visiting public.

- At least one evening program on fire ecology is developed and presented on a regular basis during the summer months.

- The Fire Management Branch will conduct an annual mailing to the residents of Fort Klamath, Union Creek and Diamond Lake. This mailing will inform residents of the park's planned prescribed fires, how to obtain current local information on wildland and prescribed fires, and a contact phone number at Crater Lake National Park to address additional questions and/or concerns. This mailing list will be updated annually prior to distribution.

- Interpretive rangers will be provided with Fire Information Officer training as time and funding permit.

9.2 Future Education Goals

Crater Lake National Park has identified the following fire education goals as vital for educating the public and creating knowledgeable citizens that make well-informed decisions. Staff from the Fire Management Branch and the Division of Interpretation & Cultural Resources may develop the following programs as funding and staffing are available:

- Junior Lookout/Junior Firefighter program. Children between the ages of six and twelve would earn a special badge once completing this program. This program would be similar to the Junior Ranger program currently held at the Park, and would entail visiting The Watchman fire lookout and learning about fire-related issues.

- Outreach programs in surrounding area schools would be developed. During the school year, interpretive rangers and/or fire educators would present a science-based fire program founded on state standards in classrooms in the surrounding area.

- Short programs on the role of fire in the ecosystem, with times and locations posted at visitor centers, would be offered during times of poor visibility due to smoke and fire in the area.

- A slide program on fire ecology for use in the classroom and/or during evening programs would be created.

- A fire education program would be considered for development and implementation at the park's Science and Learning Center. A program related to fire issues may be developed and implemented for use dependent upon Oregon State Standards and curriculum requirements.

9.3 Description of Step-Up Public Information Activities

Crater Lake National Park is dedicated to providing accurate and timely public information with regard to its fire management program. The park has a system to inform visitors, residents, and neighbors of all prescribed and wildland fire activity, This includes:

- Listing the daily fire danger with the current weather on the Crater Lake National Park Website and in visitor centers

- Posting press releases regarding current fire issues on the Crater Lake National Park Website and in locations throughout the Park

- Hosting public information meetings in nearby towns to inform residents of prescribed fire and wildland fire issues

- Providing information releases to the media and surrounding agencies.

- Disseminating fire updates during the evening program held nightly at the Mazama Amphitheater during the summer season.

- As appropriate, park personnel may lead programs and/or discuss fire issues with the public inside and outside of the Park's boundaries.

- Information on current fire status and locations within the park may be posted at the following locations in and around the park:

  - *Inside Crater Lake National Park*
    - Ponderosa Picnic Area information kiosk, Highway 62
    - Old West information kiosk, Highway 62
    - Annie Springs Entrance Station
    - Mazama Campground bulletin board
    - Mazama Camper Store cashier counter
    - Mazama Village Motor Inn registration desk
    - Mazama Campground amphitheater bulletin board

- Xanterra Mazama Dormitory
- Community Center
- Fitness Center
- Steel Information Center front desk
- Post Office bulletin board, Steel Information Center
- Park Communications Center
- Llao Rock Café bulletin board
- Rim Visitor Center front desk
- Crater Lake Lodge bulletin board
- Xanterra Rim Dormitory
- The Watchman trailhead overlook informational sign
- North Junction bulletin board
- North Entrance Station
- Cleetwood Cove trailhead informational sign
- Mt. Scott trailhead informational sign
- Lost Creek Campground bulletin board
- Trailheads as needed
- Incident Command Posts as needed

- *Fort Klamath*
  - General Store
  - U.S. Post Office
  - Wilson's Cottages
  - Crater Lake Resort
  - Kimball State Park

- *Union Creek*
  - Becky's Restaurant
  - Union Creek Resort
  - Ice Cream Shop
  - Natural Bridge information kiosk

- *Diamond Lake*
  - General Store
  - Lodge
  - Diamond Lake Campground kiosk
  - South Shore Pizza

- *Chemult Area*
  - Informational kiosk on Forest Road 70, off Highway 97

- During Prescribed Fires
  - Prior to prescribed fire ignition, persons and agencies on the parks "Prescribed Fire Notification List" will be notified (see Appendix 13.N).
  - The Division of Interpretation & Cultural Resources will be sent press releases in a timely manner for posting on the official National Park Service website.
  - Local news media will be contacted prior to prescribed fire ignition, with updates of any significant changes, using the park's master public information fax contact list (see Appendix 13.O).

- During Wildland Fires, Types IV-V
  - Information on the current status of all fires and their locations inside the park will be posted inside of the park in the areas previously noted. Park employees will be notified by email and the park morning report.
  - The Division of Interpretation & Cultural Resources will be sent press releases in a timely manner for posting on the official National Park Service website.
  - Cooperating fire agencies, law enforcement agencies, emergency medical services providers, and other agencies outside of the park will be notified as deemed appropriate by the Fire Management Officer.
  - Information will be released to the media based upon interest and need.

- During Wildland Fires, Types I-III
  - In addition to those items listed above, media releases will be prepared and sent using the park's master public information fax contact list (see Appendix 13.O).

Appendix 13.A References Cited

Adams, R., and D. Simmons. (1999) Ecological effects of fire fighting foams and retardants. Proceedings – Australian bushfire conference. Albury. Charles Sturt University, School of Environmental & Information Sciences.

Agee, J.K. (2003) Monitoring post-fire tree mortality in mixed-conifer forests of Crater Lake, Oregon, USA. Natural Areas Journal 23:114-120.

Agee, J.K. (1998) The landscape ecology of western forest fire regimes. Northwest Sci. 72:24-34.

Agee, James K. (1994) Fire and Weather Disturbances in Terrestrial Ecosystems of the Eastern Cascades. U.S. Department of Agriculture, Forest Service. Pacific Northwest Research Station. General Technical Report PNW-GTR-320.

Agee, J.K. (1993) Fire Ecology of Pacific Northwest Forests. Island Press, Washington, D.C.

Agee, J.K. (1990) The historical role of fire in Pacific Northwest Forests. In Walstad, J., et al. (eds.), Natural and prescribed fire in Pacific Northwest forests: pp. 25-38. Corvallis: Oregon State University Press.

Agee, J.K. (1983) Fuel weights of understory-grown conifers in southern Oregon. Can. J. For. Res. 13:648-656.

Agee, J.K. (1981) Biomass of coniferous understory trees in Crater Lake National Park, Oregon. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 82-1. University of Washington, Seattle.

Agee, J.K. (1981) Initial effects of prescribed fire in a climax *Pinus contorta* forest: Crater Lake National Park. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 81-4. University of Washington, Seattle. 12 pp.

Agee, J.K. (1979) Prescribed fire effects at Crater Lake National Park. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 79-?. University of Washington, Seattle. 8 pp.

Agee, J.K. and M.H. Huff. (2000) The role of prescribed fire in restoring ecosystem health and diversity in southwest Oregon: part 1 ecological conditions. Rep. to Pacific Northwest Research Station Director's Office, Northwest Forest Plan Issue.

Agee, J.K. and M.H. Huff. (1986) Structure and process goals for vegetation in wilderness areas. In Proceedings: National wilderness research conference: pp. 17-25. USDA For. Serv. Gen. Tech. Rep. INT-212.

Agee, J.K. and T.L. Thomas. (1982) Forest restoration at Sun Creek, Crater Lake National Park. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 82-?. University of Washington, Seattle. 38 pp.

Alexander (2002). Klamath Bird Observatory, Ashland, Oregon. 01 April 2002. Personal communication with John Alexander.

Altman, B. (1997) Olive-sided Flycatcher in western North America: Status review. Prepared for U.S. Fish and Wildlife Service, Oregon State Office, Portland. 59 pp.

Altman, B., and R. Sallabanks. (2000) Olive-sided Flycatcher (*Contopus cooperi*). No. 502 IN A. Poole and F. Gill (eds.), The birds of North America. The Birds of North America, Inc., Philadelphia, PA. 28pp.

American Ornithologists' Union (AOU), Committee on Classification and Nomenclature. (1983) Check-list of North American Birds. Sixth Edition. American Ornithologists' Union, Allen Press, Inc., Lawrence, Kansas.

Anderson, D. W. (1988) Dose-response relationship between human disturbance and brown pelican breeding success. Wildlife Society Bulletin 16: 339-345.

Anderson, (1976). Aids for determining fire behavior ....

Applegate, E.I. (1939). Plants of Crater Lake National Park. Amer. Mid. Natur. 22:225-314.

Applegate, Elmer I. (1939). Plants of Crater Lake National Park. *The American Midland Naturalist*. University of Notre Dame, Notre Dame, Indiana. pp. 225-271.

Arizona Game and Fish Department. (1993). Bats of Arizona. Arizona Wildlife Views, Special Heritage Edition. Vol. 36(8). 36 pp.

Atzet, Thomas, (1996). Fire regimes and restoration needs in Southwest Oregon, In: Hardy, Colin.; Arno, Stephen F., eds. The Use of Fire in Forest Restoration. Gen. Tech. Rep. INT-GTR-341. Ogden UT: US Department of Agriculture, Forest service, Intermountain Research Station, 86 p.

Atzet et al., (1996). Atzet, T., D.E. White, L.A. McCrimmon, P.A. Martinez, P.R. Fong, V.D. Randall, 1996. Field guide to the forested plant associations of southwestern Oregon. Tech Paper R6-NR-ECOL-TP-17-96. Portland, OR: USDA Forest Service Pacific Northwest Region.

Baldwin, Calib T. and Steven J. Brunsfeld. (2001). Genetics, Demography, Monitoring, and Restoration of Mt. Mazama Collomia (*Collomia mazama* Coville). University of Idaho, Department of Forest Resources.

Banci, V. (1994). Wolverine, pp. 99-127 In: Ruggiero, L, K.B. Aubry, S.W.Buskirk, L.J. Lyon, and W.J. Zielinski. (tech eds). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine.

Barclay, R. M. R., P. A. Faure, and D. R. Farr. (1988). Roosting behavior and roost selection by migrating silver-haired bats (*Lasionycteris noctivagans*). J. Mamm. 69:821-825.

Bart, J. (1995). Amount of suitable habitat and viability of northern spotted owls. Conservation Biology 9 (4): 943-946.

Bart, J. and E. D. Forsman. (1992). Dependence of northern spotted owls *Strix occidentalis caurina* on old-growth forests in the western USA. Biological Conservation 62: 95-100.

Belanger, L., and J. Bedard. (1989). Response of staging snow geese to human disturbance. Journal of Wildlife Management 53: 713-719.

Bingham, B. B., and B. R. Noon. (1997). Mitigation of habitat Atake@: Application to habitat conservation planning. Conservation Biology 11(1): 127-138.

Blaustein, A.R., J.J. Beatty, D.H. Olson, and R.M. Storm. (1995). The biology of amphibians and reptiles in old-growth forests in the Pacific Northwest. USDA Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-337.

Block, W.M., and L.A. Brennan. (1987). Characteristics of Lewis' Woodpecker habitat on the Modoc Plateau, California. Western Birds 18:209-212.

Bock, C. E. (1970). The ecology and behavior of the Lewis' woodpecker (*Asyndesmus lewis*). Univ. California Pub. Zool. No. 92.

Brennan, L. A., W. M. Block, and R. J. Gutierrez. (1987). Habitat use by mountain quail in northern California. Condor 89:66-74.

Briggs, J. L., Sr. (1987). Breeding biology of the Cascade frog, *Rana cascadae*, with comparisons to R. AURORA and R. PRETIOSA. Copeia 1987:241-245.

Brown and Smith. (2000). Brown, J.K. and J.K. Smith (eds.). 2000. Wildland Fire in Ecosystems: Effects of Fire on Flora. United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. Ogden, Utah. General Technical Report. RMRS-GTR-42-Vol. 2.

Brown et al., (2001). Brown, J.K., E.D. Reinhardt, and K.A. Kramer. 2001. *Coarse Woody Debris and Succession*.

Brown, T.C., and T.C. Daniel (1984). Modeling forest scenic beauty: concepts and application to ponderosa pine. USDA Forest Service Research Paper RM-256.

Buchanan, J., E. Hanson, D. Hays and L. Young. (1994). An evaluation of the Washington Forest Practices Board Wildlife Committee preferred alternative for a spotted owl protection rule. Washington Forest Practices Board Spotted Owl Scientific Advisory Group. Olympia, Washington.

Buktenica (2002). United States Department of the Interior, National Park Service. 16 April 2002. Personal communication with Mark Buktenica.

Buktenica (2001). United States Department of the Interior, National Park Service. 06 August 2001. Personal communication with Mark Buktenica.

Buskirk, S.W., and L. Ruggiero. (1994). American marten, pp. 7-37 In: Ruggiero, L., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech eds).The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine. USDA Forest Service General Technical Report RM-254.

California Department of Forestry and Fire Protection (CDF). (2001). California Forest Practices Rules: 2001. Title 14, California Code of Regulations, Chps. 4, 4.5, and 10. Sacramento, CA.

Chappell, C.B. and J.K. Agee. (1996). Fire severity and tree seedling establishment in *Abies magnifica* forests, southern Cascades, Oregon. Ecological Applications 6(2):628-640.

Chappell, Christopher. (1991). Fire Ecology and Seedling Establishment in Shasta Red Fir *(Abies magnifica* var. *shastensis*) forests of Crater Lake National Park, Oregon, M.S. thesis. University of Washington, Seattle.

Coville, F.V. (1901). The home of Botrychium pumicola. Bulletin of the Torrey Botanical Club 28:109-112.

Coville, F.V. (1897). *Collomia mazama*, a new plant from the vicinity of Crater Lake Oregon. Biological Society of Washington. 1897; XI:35-37.

Coville, F.V. and J.B. Leiberg. (1897). Two new plants from Mount Mazama, Oregon. Biological Society of Washington. 1897; XI:169-171.

Coville, F.V. (1896). *Ribes erythrocarpum*, a new current from the vicinity of Crater Lake, Oregon. Biological Society of Washington. 1896; X:131-132.

Csuti, B., A.J. Kimerling, T.A. O'Neil, M.M. Shaughnessy, E.P. Gaines, and M.M.P. Huso. (1997). Atlas of Oregon Wildlife: distribution, habitat, and natural history. Oregon State University Press. 492 pp.

Dambacher et al. (1992). Dambacher, J., M.W. Buktenica, and G.L. Larson. 1992. Distribution, abundance, and habitat utilization of bull trout and brook trout in Sun Creek, Crater Lake National Park, Oregon. Pages 30-36 *in* Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop Oregon Chapter, American Fisheries Society, Corvallis, OR.

DOD (1978). United States Department of Defense. 1978. *Environmental Planning in the Noise Environment*. Technical Manual 5-830-2. NAVFAC P-970.

Department of the Interior, National Park Service. January (2001). *Conservation Planning, Environmental Impact Analysis, and Decision Making*. Director's Order #12 and Handbook.

Department of the Interior, National Park Service. What the Parks Should Know About the EPA's New Regional Haze Rule. Web page. Date accessed: 18 June 2001. Accessed at: http://www2.nature.nps.gov/ard/vis/rhr.html

Department of the Interior, National Park Service. IMPROVE Particulate Monitoring Network Standard Operating Procedures. Web page. Date accessed: 18 June 2001. Accessed at: http://www2.nature.nps.gov/ard/vis/sop/sopintro.html

Department of the Interior, National Park Service. Visibility Protection. Web page. Date accessed: 18 June 2001. Accessed at: http://www2.nature.nps.gov/ard/vis/visprot.html

Department of the Interior, National Park Service. Air Resources Programs at Crater Lake National Park. Web page. Date accessed: June 18, 2001. Accessed at: http://www2.nature.nps.gov/ARD/parks/crla/crla.htm

Department of the Interior, National Park Service. 27 December 2000. *2001 Management Policies*.

Department of the Interior, National Park Service. 1999. Director's Order #41 Wilderness Preservation and Management.

DOI (2002). United States Department of the Interior, National Park Service. 2001. *Director's Order - 18* Web page. Date accessed: 10 February 2003. Accessed at http://www.nps.gov/refdesk/policies.html

DOI (2002). United States Department of the Interior, National Park Service, Crater Lake National Park. June 2002. *Environmental Assessment for Crater Lake National Park Fire Management Plan.*

DOI (2003). United States Department of the Interior, National Park Service, Crater Lake National Park. February 2003. *Crater Lake National Park Fire Management Plan – Environmental Assessment Finding of No Significant Impact. .*

DOI (2001). United States Department of the Interior, National Park Service. 2001. *Management Policies* Web page. Date accessed: 9 July 2002. Accessed at http://www.nps.gov/policy/mp/policies.pdf

DOI (2001). United States Department of the Interior, National Park Service. 2001. Web page. Date accessed: 9 July 2002. Accessed at http://www.nps.gov/policy/mp/policies.pdf

DOI (2001). United States Department of the Interior, National Park Service. 2001. Web page. Date accessed: 18 June 2002. Accessed at http://www.nps.gov/fire/fmh/FEMHandbook.pdf

DOI (2001). United States Department of the Interior, National Park Service. 2001. Web page. Date accessed: 18 April 2002. Accessed at http://www.nps.gov/fire/fmh/FEMHandbook.pdf

DOI (2001). United States Department of the Interior, National Park Service. 08 January 2001. *Conservation Planning, Environmental Impact Analysis, and Decision Making.* Director's Order #12 and Handbook.

DOI (2001). United States Department of the Interior, National Park Service. 2001. Web page. Date accessed: 9 July 2002. Accessed at http://www.nps.gov/policy/mp/policies.pdf

DOI (2001). United States Department of the Interior, National Park Service. 2001. Web page. Date accessed: 18 June 2002. Accessed at http://www.nps.gov/fire/fmh/FEMHandbook.pdf

DOI (2001). United States Department of the Interior, National Park Service. What the Parks Should Know About the EPA's New Regional Haze Rule. Web page. Date accessed: 18 June 2001. Accessed at: http://www2.nature.nps.gov/ard/vis/rhr.html

DOI (2001). United States Department of the Interior, National Park Service. IMPROVE Particulate Monitoring Network Standard Operating Procedures. Web page. Date accessed: 18 June 2001. Accessed at: http://www2.nature.nps.gov/ard/vis/sop/sopintro.html

DOI (2001). United States Department of the Interior, National Park Service. Visibility Protection. Web page. Date accessed: 18 June 2001. Accessed at: http://www2.nature.nps.gov/ard/vis/visprot.html

DOI (2001). United States Department of the Interior, National Park Service. Air Resources Programs at Crater Lake National Park. Web page. Date accessed: June 18, 2001. Accessed at: http://www2.nature.nps.gov/ARD/parks/crla/crla.htm

DOI (2001). United States Department of the Interior, National Park Service. July 2001. Crater Lake-Animals/Wildlife. Web page. Accessed at: http://www.nps.gov/crla/ani.htm

DOI(2001). United States Department of the Interior, Fish and Wildlife Service. July 2001. The Canada Lynx. Web page. Accessed at: http://www.r6.fws.gov/endspp/lynx

DOI(2001). United States Department of the Interior, National Park Service. July 2001. Recreation Information-Crater Lake. Web page. Date accessed: May 2001. Accessed at: http://www.nps.gov/crla/brochures/index.htm

DOI (2001). United States Department of the Interior, National Park Service, Public Use Statistics Office. Park Visitation Report: Statistics for the Year 2000. Web page. Date accessed: 09 June 2001. Accessed at: http://www.adq.nps.gov/stats

DOI (2001). United States Department of the Interior, National Park Service. 2001. Web page. Date accessed: 08 June 2001. Accessed at: http://www.nps.gov/crla/feedemo.htm

DOI (2001). United States Department of the Interior, National Park Service. 2001. Public Use Statistics Office. Web page. Date accessed: 08 June 2001. http://www.aqd.nps.gov/stats

DOI (2001). United States Department of the Interior, National Park Service. 2001. Web page. Date accessed: 18 April 2002. Accessed at http://www.nps.gov/fire/fmh/FEMHandbook.pdf

DOI (1999). United States Department of the Interior, National Park Service, Crater Lake National Park. August 1999. *Revised Fire Management Plan*.

DOI (1999). United States Department of the Interior, National Park Service. August 1999. Director's Order #41 Wilderness Preservation and Management.

DOI (1999). United States Department of the Interior, National Park Service, Crater Lake National Park. September 1999. *Resource Management Plan*.

DOI (1997). United States Department of the Interior, National Park Service, Crater Lake National Park. September 1997. *Supplemental Environmental Assessment and Revised Fire Management Plan*.

DOI (1996). United States Department of the Interior, National Park Service. July 1996. *Crater Lake National Park, Resource Advisor Guide,Fire Management Plan*.

DOI (1992). United States Department of the Interior, Secretary of the Interior. Recovery Plan for the Northern Spotted Owl – Draft.

DOI (1975). United States Department of the Interior, National Park Service, Crater Lake National Park. August 1995. *General Management Plan.*

Dixon, R. D. (1995). Ecology of White-headed woodpeckers in the central Oregon Cascades. M. Sc. thesis, University of Idaho, Moscow, ID.

Environmental Protection Agency. (April 23, 1998). *Interim Air Quality Policy on Wildland and Prescribed Fires*.

Federal Committee on Ecological Reserves. (1977). A directory of Research Natural Areas on Federal lands of the United States of America. USDA Forest Service. Washington, D.C.

Fellers, G.M. and C.A. Drost. (1993). Disappearance of the Cascades frog RANA CASCADAE at the southern end of its range, California, USA. Biological Conservation 65:177-181.

Fite, K. V., A. Blaustein, L. Bengston, and H. E. Hewitt. (1998). Evidence of retinal light damage in *Rana cascadae*: a declining amphibian species. Copeia 1998:906-914.

Forest Practices Board. (1996). Permanent rules for the northern spotted owl. Washington Department of Natural Resources, Olympia, Washington.

Forsman, E. D., E. C. Meslow, and H. M. Wight. (1984). Distribution and biology of the spotted owl in Oregon. Wildlife Monographs 87:1-64.

Forsman, E.D., S. DeStefano, M.G. Raphael and R.J. Gutierrez, Editors. (1996). Demography of the northern spotted owl. Studies in avian biology no.17, Cooper Ornithological Society. Fort Collins, CO.

F. Franklin, A. B., K. P. Burnham, G. C. White, R. J. Anthony, E. D. Forsman, C. Sanchez, J. D. Nicols and J. Hines. (1999). Range-wide status and trends in northern spotted owl

populations. Colorado Coop. Fish and Wildl. Res. Unit, Fort Collins, Colorado and Oregon Coop. Fish and Wildl. Res. Unit, Corvallis, OR. Unpublished report.

Franklin, A. B., D. R. Anderson, R. J. Gutierrez, and K. P. Burnham. (2000). Climate, habitat quality, and fitness in northern spotted owl populations in Northwestern California. Ecological Monographs 70(4): 539-590.

Galiliano and Loeffler. (2000). Scenery Assessment: Beauty at the Ecoregion Scale. United States Department of Agriculture, Pacific Northwest Research Station. General Technical Report. PNW-GTR-472.

Gara, R.I., W.R. Littke, J.K. Agee, D.R. Geiszler, J.D. Stuart, and C.H. Driver. (1985). Influence of fires, fungi, and mountain pine beetles on development of a lodgepole pine forest in south-central Oregon. In Baumgartner, D.M. et al. (eds.), Lodgepole pine: The species and its management: pp 153-62. Pullman: Washington State University.

Garrett, K.L., M.G. Raphael, and R.D. Dixon. (1996). White-headed Woodpecker *(Picoidesa albolarvatus)*. In A. Poole and F. Gill, editors, The Birds of North America, No. 252. Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, DC. 24 pp.

GBC (2001). Government of British Columbia, Ministry of Forestry. June 2001. Fire-Related Ecosystems. Web page. Accessed at: http://www.gov.bc.ca/for

Geiszler, D.R., R.I. Gara, C.H. Driver, V.F. Gallucci, and R.E. Martin. (1980). Fire fungi, and beetle influences on a lodgepole pine ecosystem of south-central Oregon. Oecologia 46:239-43.

Girdner (2002). United States Department of the Interior, National Park Service. 03 April 2002. Personal communication with Scott Girdner.

Girdner (2002). United States Department of the Interior, National Park Service. 10 April 2002. Personal communication with Scott Girdner.

Hamilton, S., D. Larson, S. Finger, B. Poulton, N. Vyas, and E. Hill. (1998). Ecological effects of fire retardant chemicals and fire suppressant foams. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page.
http://www.npwrc.usgs.gov/resource/othrdata/fireweb/fireweb.htm

Hanson, E., Hays, D., Hicks, L. Young. L., and J. Buchanan. (1993). Spotted Owl Habitat in Washington: A Report to the Washington Forest Practices Board. Washington Forest Practices Board, Spotted owl Advisory Group. Final Report: December 20, 1993. Olympia, Washington. 116 pp.

Henson, P., and T. A. Grant. (1991). The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19:248-257.

Harrison, H. H. (1979). A field guide to western birds' nests. Houghton Mifflin Company, Boston. 279 pp.

Harrison, C. (1978). A Field Guide to the Nests, Eggs and Nestlings of North American Birds. Collins, Cleveland, Ohio.

Hessi, A. and S. Spackman. (1995). Effects of fire on threatened and endangered plants: An annotated bibliography. USDI National Biological Service Information and Technology Report 2. Washington, DC.

Hickenbottom, et al. (1999). Hickenbottom, J. Randall, et al. December 1999. *Biological Assessment of the Effects of National Forest Land and Resource Management Plans and Bureau of Land Management Land Use Plans on Canada Lynx*. 149pp.

Horn, E.M. (1968). Ecology of the Pumice Desert, Crater Lake National Park. Northwest Sci. 42(4):141-147.

Huff, M.H. and J.K. J.K. Agee. (1991). Subalpine forest dynamics after fire in the Pacific Northwest National Parks. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 91-?, University of Washington, Seattle.

Huff, M.H. and J.K. Agee. (1989). Fuel and fire behavior predictions in subalpine forests of Pacific Northwest National Parks. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 89-4. University of Washington, Seattle. 67 pp.

HUD (1991). United States Department of Housing and Urban Development. 1991. *The Noise Guidebook.*

Hutto, R. L., and J. S. Young. (1999). Habitat relationships of landbirds in the Northern Region, USDA Forest Service. USDA Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-32

Jensen and Ross (1999). Jensen , Edward C. and Charles R Ross. August 1999. *Trees to Know in Oregon*. Oregon State University. 128 pp.

Johnson W.W., and H.O. Sanders. (1977). Chemical forest fire retardants: Acute toxicity to five freshwater fishes and a scud. USD! Fish and Wildlife Service Technical Paper 91. Washington, D.C.

Kelly, Elizabeth. (2001). The Range Expansion of the Northern Barred Owl: An Evaluation of the Impacts on Spotted Owls. M.S. Thesis. Oregon State University,

Kelton, J and E. Arnett. (1995). Bald eagle habitat improvement project, Klamath Basin National Wildlife Refuge Complex. USDI Fish and Wildlife Service, Tulelake, CA.

Kerle, E.A. (1985). The ecology of lupines in Crater Lake National Park, Oregon. M.S. thesis, Oregon State University, Corvallis. 76 pp.

Klamath (2001). The City of Klamath Falls, Oregon. City Profile. Web page. Date accessed: 27 July 2001. Accessed at: http://www.ci.klamath-falls.or.us

Klamath (2001). Oregon Chamber of Commerce, Klamath County. 2001 Unemployment Rates. Web page. Date accessed: June 2001. Accessed at: http://www.klamath.org

Knight, R.L., and S.K. Knight Skagen. (1988). Effects of recreational disturbance on birds of prey: a review. Pages 355-359 *in* R.L. Glinski et al., Technical Editors. Proceedings of the Southwest Raptor Management Symposium and Workshop. Natl. Wildl. Fed., Washington, D.C.

Knowles, C.J., and R.G. Gurntow. (1996). Saving the Bull Trout: An analysis of a candidate species. The Thoreau Institute. Oak Grove, OR.

LaHaye, W. S. (1988). Nest site selection and nesting habitat of the northern spotted owl (*Strix occidentalis caurina*) in northwestern California. M. S. Thesis. Humboldt State University, Eureka, CA.

Lapomardo, Trish. (2001). Biologist for Klamath Falls Resource Area of the Bureau of Land Management

Laye (2001). United States Department of the Interior, Fish and Wildlife Service. 23 July 2001. Personal communication with Douglas Laye.

Lentz, S.C., J.K. Gaunt, and A.J. Willmer. (1996). Fire effects on archeological resources. Phase I: The Henry fire. Holiday Mesa, Jernez Mountains, New Mexico. USDA Forest Service General Technical Report RM-GTR-273.

Leonard, W.P. et. al. (1993). Amphibians of Washington and Oregon. Seattle Audubon Society. 168 pp.

Lint, J.B., B.R. Noon, R.G. Anthony, E.D. Forsman, M.G. Raphael, M. Collopy, and E.E. Starkey. (1999). Northern spotted owl effectiveness monitoring plan for the Northwest

Forest Plan. Gen. Tech. Rep. PNW-GTR-440. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR.

Mark (2002). United States Department of the Interior, National Park Service. 10 April 2002. Personal communication with Steve Mark.

Marshall, D. B. (1997). Status of the White-headed woodpecker in Oregon and Washington. Audubon Society of Portland. 5151 N. W. Cornell Road. Portland, OR 97210. 20 pp.

Mattson, T. A., S. W. Buskirk, and N. L. Stanton. (1996). Roost sites of the silver-haired bat (*Lasionycteris noctivagans*) in the Black Hills, South Dakota. Great Basin Naturalist 56:247-253.

McNeil, R.C. and D.B. Zoebel. (1980). Vegetation and fire history of a ponderosa pine-white fir forest in Crater Lake National Park. Northwest Science 54:30-46.

McNeil, R.C. (1975). Vegetation and fire history of a ponderosa pine-white fir forest in Crater Lake National Park. M.S. thesis, Oregon State University, Corvallis. 171 pp.

Michigan (2001). Michigan State University, Department of Park, Recreation, and Tourism Resources. 2001. Computer Model. Date accessed: 07 June 2001. Available at: http://www.prr.msu.edu/mgm2/MGM2short/htm

Miller, G.S. (1989). Dispersal of juvenile northern spotted owls in western Oregon. M.S. Thesis. Oregon State University, Corvallis, Oregon. 139 pages.

Morrison, P., and F.J. Swanson. (1990). Fire history and pattern in a Cascade Range landscape. USDA Forest Service General Technical Report PNW-GTR-254.

Murray M.P. and M.C. Rasmussen. (2003). Non-native blister rust disease on whitebark pine at Crater Lake National Park. Northwest Science 77(1):87-91.

Murray and Rasmussen (2002). Murray, Michael P. and M. Rasmussen. 2002. Fire Knowledge for Managing Cascadian Whitebark Pine Forests – Research Funding Proposal.

Murray and Rasmussen (2000). Murray, Michael P. and M. Rasmussen. September 2000. Status of Whitebark Pine in Crater Lake National Park. Unpublished Final Report, Cooperative Cost-Share Agreement No. H9320000035. 13 pp.

NPS (2001). United States Department of the Interior, National Park Service. 2001. *Fire Effects Monitoring Handbook* Web page. Date accessed: 18 June 2002. Accessed at http://www.nps.gov/fire/fmh/FEMHandbook.pdf

NPS (2001). United States Department of the Interior, National Park Service. 27 December 2000. *2001 Management Policies*.

NatureServe Explorer: An online encyclopedia of life [web application]. (2002). Version 16. Arlington, Virginia, USA: NatureServe. Available: http://www.natureserve.org/explorer. (Accessed: May 12, 2003).

New Mexico Department of Fish and Game. (1997). Fish and Wildlife Information Exchange--VA Tech. Online. Available: http://www.fw.vt.edu/fishex/nm.htm. Accessed 14 April 1998, last update 29 October 1997.

NYDEC (2000). New York Department of Environmental Conservation, Office of Environmental Permits. Issuance date 06 October 2000. *Assessing and Mitigating Noise Impacts*. Program Policy, DEP-00-3. Revised 02 February 2001.

NIFC (1998). National Interagency Fire Center. 1998. *Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide*.

NWCG (2009) National Wildfire Coordinating Group. 2009. Guidance *for Implementation of Federal Wildland Fire Management Policy.*

Nussbaum, R. A., E. D. Brodie, Jr., and R. M. Storm. (1983). Amphibians and Reptiles of the Pacific Northwest. University Press of Idaho. 332 pp.

O'Halloran, K. (1989). Spotted owl inventory and monitoring: Annual report for 1989. U.S. Forest Service, Pacific Northwest Region, Portland, OR. Unpublished report.

Oregon, (1996). Oregon Department of Fish and Wildlife. Oregon Wildlife Diversity Program 1996 Report. Web page. Date accessed: July 26, 2001. Accessed at: http://www.dfw.state.or.us/ODFWhtml/InfoCntrWild/Diversity/1996RPT.html

Oregon Department of Forestry (ODF). (2000). Forest Practices Administrative Rules and Forest Practices Act. Salem, OR.

Oregon State University (OSU). (2001). Data on Site Occupancy and Reproduction of Northern Spotted Owls in Winema National Forest. Unpublished Data. Oregon State University, Corvallis, OR.

Pacific Meridian Resources. (1996). Vegetation maps for Crater Lake National Park. Portland, OR.

Piatt, J. F., B. D. Roberts, W. W. Lidster, J. L. Wells, and S. A. Hatch. (1990). Effects of human disturbance on breeding least and crested auklets at St. Lawrence Island, Alaska. Auk 107:342-350.

Powell, R.A., and W.J. Zielinski. (1994). Fisher, pp. 38-73 In: Ruggiero, L., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech eds). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine. USDA Forest Service General Technical Report RM-254.

Pyne, S.J., P.L. Andrews, and R.D. Laven (1996). Introduction to wildland fire. John Wiley. New York.

Rasmussen (2001a). United States Department of the Interior, National Park Service. 03 July 2001. Personal communication with Mary Rasmussen.

Rasmussen (2001b). United States Department of the Interior, National Park Service. 27 June 2001. Personal communication with Mary Rasmussen.

Rasmussen (2001c). United States Department of the Interior, National Park Service. 25 July 2001. Personal communication with Mary Rasmussen.

Rasmussen, M.C. and W.J. Ripple. (1998). Retrospective analysis of forest landscape patterns in western Oregon. Nat. Areas Journal 18(2):151-163.

Ruggiero, L., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech eds). (1994). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine. USDA Forest Service General Technical Report RM-254.

Saab, V. A. and J. G. Dudley. (1998). Responses of cavity-nesting birds to stand-replacement fore and salvage logging in ponderosa pine/ Douglas-fir forests of southwestern Idaho. USDA Forest Service Rocky Mountains Research Station Research Paper RMRS-RP-11, Ogden, ID.

Sanders, S. D. and M. A. Flett. (1989). Montane riparian habitat and willow flycatchers: threats to a sensitive environment and species. IN: Proceedings of the California riparian systems conference: protection, management, and restoration for the 1990's. Sept. 22-24, 1988, Davis, CA. Berkeley, CA: U. S. Forest Service, Pacific Southwest Forest and Range Experiment Station; June 1989. 544 p. GTR-PSW-110.

Schmidly, D. J. (1991). The bats of Texas. Texas A & M Univ. Press, College Station. 188 pp.

Schaaf, D.V. (1993). Inventory for Crater Lake rockcress, *Arabis suffrutescens* var. *horizontalis* (Green), a rare endemic plant species. Portland, OR: The Nature Conservancy. 23 pp.

Scientific Assessment Team (SAT). (1993). Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific Northwest. USDA Forest Service Pacific Northwest Region/ Pacific Northwest Research Station. Portland, OR.

Seyer, S.C. (1980). Vegetative ecology of a montane mire, Crater Lake National Park, Oregon. M.S. thesis, Oregon State University, Corvallis. 187 pp.

Seyer, S.C. (1979). New mosses from Crater Lake National Park, Oregon: *Bryum weigelii, Helodium blandowii blandowii, Drepanocladus vernicosus*. Bryologist 82(1):82-83.

SCORP (1999). South Central Oregon Regional Partnership. Strategic Plan 1999. Web page. Date accessed: 08 June 2001. Accessed at: http://www.sobusi.com/scorp

Simon-Jackson, T. (1989). Spotted owl inventory and monitoring program: Annual report for 1989. U.S. Forest Service, Pacific Southwest Region, San Francisco, CA. Unpublished report.

Sitter, G. (2000). Wildlife Biologist, Bureau of Land Management, Klamath Falls Resource Area, Klamath Falls, OR.

Spahr, R., L. Armstrong, D. Atwood, and M. Rath. (1991). Threatened, endangered, and sensitive species of the Intermountain Region. U.S. Forest Service, Ogden, Utah.

Stuart, J.D. (1984). Hazard rating of lodgepole pine stands to mountain pine beetle outbreaks in south-central Oregon. For. Ecol. And Manage. 5:207-14.

Stuart, J.D. (1983). Stand structure and development of a climax lodgepole pine forest in south-central Oregon. Ph.D. diss., Univeristy of Washington, Seattle.

Swezy, D.M. and J.K. Agee. (1991). Prescribed fire effects on fine root and tree mortality in old growth ponderosa pine. Can. J. For. Res. 21:626-34.

Swezy, D.M. (1988). Mortality and stress of ponderosa pine after low intensity prescribed fire at Crater Lake, Oregon. M.S. thesis, University of Washington, Seattle. 92 pp.

Switzer, R. (1974). The effects of forest fire on archeological sites in Mesa Verde National Park, Colorado. Artifact 12: 1-8.

Taylor, A.H. and C.B. Halpern. (1991). The structure and dynamics of *Abies magnifica* forests in the southern Cascade Range, USA. J. Veg. Sci. 2:189-200.

Taylor, D. M., and C. D. Littlefield. (1986). Willow flycatcher and yellow warbler response to cattle grazing. American Birds 40:1169-1173.

Thomas, J.W., M.G. Raphael, R.G. Anthony, E.D. Forsman, A.G. Gunderson, R.S. Holthausen, B.G. Marcot, G.H. Reeves, J.R. Sedell, and D.M. Solis. (1993). Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific Northwest. Portland, Oregon. U. S. Department of Agriculture, Forest Service. 523 pp.

Thomas, J.W., E. D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. (1990). A conservation strategy for the northern spotted owl: a report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Portland, OR: U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management, Fish and Wildlife Service, and National Park Service.

Thomas, T.L. and J.K. Agee. (1986). Prescribed fire effects on mixed conifer forest structure at Crater Lake, Oregon. Can. J. For. Res. 16(5):1082-87.

Thomas, T.L. (1982). Forest restoration of Sun Creek, Crater Lake National Park. M.S. thesis, University of Washington, Seattle. 113 pp.

Tobalske, B.W. (1997). Lewis' Woodpecker (*Melanerpes lewis*). In A. Poole and F. Gill, editors, The Birds of North America, No. 284. Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, DC. 28 pp.

Tremblay, J. and L. N. Ellison. (1979). Effects of human disturbance on breeding black-crowned night herons. Auk 96:364-369.

U.S. Department of Agriculture (2000). Forest Service, Rocky Mountain Research Station. January 2000. Wildland Fire in Ecosystems: Effects of Fire on Fauna. General Technical Report. RMRS-GTR-42-Vol 1.

United States Department of Agriculture, Forest Service. (April 2000). *Incorporating Air Quality Effects of Wildland Fire Management into Forest Plan Revisions – A Desk Guide (Draft)*.

U.S. Department of Agriculture, U.S. Department of the Interior (1994a). Final Supplemental Environmental Impact Statement on management of habitat for late-

successional and old-growth forest related species within the range of the northern spotted owl. Office of the Secretary, U. S. Department of Agriculture and Office of the Secretary, U. S. Department of the Interior, Washington, D.C. 2 Volumes and Appendices.

U.S. Department of Agriculture, U.S. Department of Interior. (1994b). Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. Forest Service, Bureau of Land Management. Portland, Oregon.

USDA Forest Service. (1994). Neotropical Migratory Bird Reference Book. USDA Forest Service, Pacific Southwest Region. 832 pp.

U.S. Department of Agriculture, U.S. Department of the Interior, U.S. Department of Commerce and the Environmental Protection Agency. (1993). Forest ecosystem management: an ecological, economic, and social assessment. Report of the Forest Ecosystem Management Assessment Team. U.S. Forest Service, U.S. Fish and Wildlife Service, National Marine Fisheries Service, National Park Service, Bureau of Land Management, and the Environmental Protection Agency, Portland, OR.

United States Department of Agriculture, Forest Service and United States Department of the Interior, Bureau of Land Management. (1999). Conservation Strategy for *Botrychium Pumicola* (Pumice Grape Fern) on the Deschutes, Fremont, and Winema National Forests, and Prineville District, Oregon.

USDA (2000b). United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. January 2000. Wildland Fire in Ecosystems: Effects of Fire on Fauna. General Technical Report. RMRS-GTR-42-Vol 1.

USDA and DOI (2001). United States Departments of Agriculture and Interior. *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: A 10-Year Comprehensive Strategy.* 27 pp.

USDA (2000b). United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. January 2000. Wildland Fire in Ecosystems: Effects of Fire on Fauna. General Technical Report. RMRS-GTR-42-Vol 1.

USDA and BLM (1999). United States Department of Agriculture, Forest Service and United States Department of the Interior, Bureau of Land Management. 1999. Conservation Strategy for *Botrychium Pumicola* (Pumice Grape Fern) on the Deschutes, Fremont, and Winema National Forests, and Prineville District, Oregon.

USFWS (1997). United States Department of the Interior, Fish and Wildlife Service. September 1997. U.S. Fish and Wildlife Service Invites Public Comments on Draft Recovery Plan for Applegate's Milk-Vetch. Web page. Date accessed: July 2001. Accessed at: http://pacific.fws.gov/news/1997/9799nr.htm

USFWS (1998) United States Department of the Interior, Fish and Wildlife Service. September 1998. Biological Opinion for the Crater Lake National Park Supplemental Environmental and Biological Assessment Fire Plan, May 1998. Southwest Oregon Field Office, Roseburg, OR..

USCB (2001a). United States Census Bureau. Census 2000 Quick Facts. Web page. Date accessed: 08 June 2001. Accessed at:
http://factfinder.census.gov/qfd/states/41/41035.html

USCB (2001b). United States Census Bureau. 1990 Census of Population and Housing. Web page. Date accessed: 08 June 2001. Accessed at: http://factfinder.census.gov

USDA (1998a). United States Department of Agriculture, Forest Service, Deschutes, Fremont, and Winema National Forests.. September 1998. *Crown Pacific Land Exchange Final Environmental Impact Statement*.

USDA (1998b). United States Department of Agriculture, Forest Service, Winema National Forest. October 1998. *Pelican Butte Ski Area Master Development Plan Draft Environmental Impact Statement*.

USDA (2000a). United States Department of Agriculture, Forest Service. April 2000. *Incorporating Air Quality Effects of Wildland Fire Management into Forest Plan Revisions – A Desk Guide (Draft)*.

USDA (2000b). United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. January 2000. Wildland Fire in Ecosystems: Effects of Fire on Fauna. General Technical Report. RMRS-GTR-42-Vol 1.

USDA (2000c). United States Department of Agriculture, Forest Service, Pacific Northwest Research Station. July 2000. Smoke Exposure at Western Wildfires. Research Paper. PNW-RP-525.

USDA Forest Service (1994). Scientific framework for ecosystem management in the interior Columbia River basin. USDA Forest Service Eastside Ecosystem Management Project. Walla Walla, WA.

USDA Forest Service General Technical Report RM-254.Botti, S.J., G. Thomas

USDA (2001). United States Department of Agriculture, Forest Service. Wildland Fire Suppression Chemicals Toxicity and Environmental Issues and Concerns. Web page. Date accessed: 06 June 2001. Accessed at:
http://www.fs.fed.us/rm/fire/The_Environment.html

USDA and BLM (1999). United States Department of Agriculture, Forest Service and United States Department of the Interior, Bureau of Land Management. 1999. Conservation Strategy for *Botrychium Pumicola* (Pumice Grape Fern) on the Deschutes, Fremont, and Winema National Forests, and Prineville District, Oregon.

United States Department of the Interior, Fish and Wildlife Service. (September 1997). U.S. Fish and Wildlife Service Invites Public Comments on Draft Recovery Plan for Applegate's Milk-Vetch. Web page. Date accessed: July 2001. Accessed at:
http://pacific.fws.gov/news/1997/9799nr.htm

U.S. Department of the Interior, Fish and Wildlife Service. (1992a). Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Northern Spotted Owl. Federal Register Vol. 57, No. 10:1796-1838. January 15, 1992.

U.S. Department of the Interior, Fish and Wildlife Service. (1992b). The Northern Spotted Owl Recovery Plan-Final Draft. Fish and Wildlife Service, Portland, Oregon

U.S. Department of the Interior, Fish and Wildlife Service. (1987). The Northern Spotted Owl status review. Fish and Wildlife Service. Portland, Oregon. 47 pp.

U.S. Department of the Interior, Fish and Wildlife Service. (1989). The Northern Spotted Owl; a status review supplement. Fish and Wildlife Service. Portland, Oregon. 113 pp.

U.S. Department of the Interior, Fish and Wildlife Service. (1990a). 1990 Status Review: Northern Spotted Owl; *Strix occidentalis caurina*. Report to the Fish and Wildlife Service. Portland, Oregon. 95 pp.

U.S. Department of the Interior, Fish and Wildlife Service. (1990b). Endangered and threatened wildlife and plants; determination of threatened status for the Northern Spotted Owl; final rule. 50 CFR Part 17, Federal Register, June 26, 1990. Pages 26114-26194.

U.S. Department of the Interior, Fish and Wildlife Service. (2001a). A range wide baseline summary and evaluation of data collected through section 7 consultation for the northern spotted owl and its critical habitat: 1994-2001. U.S. Fish and Wildlife Service. Portland, OR.

U.S. Department of the Interior, Fish and Wildlife Service. (2001b). Biological opinion on timber harvest activities for FY2002-2003 for the Siskiyou and Rogue River National Forests and the Medford BLM.

U.S. Department of Interior, Fish and Wildlife Service. (2002a). Biological opinion on Umpqua National Forest activities. Portland, OR.

U.S. Department of the Interior, Fish and Wildlife Service. (2002b). Environmental baseline update for the northern spotted owl on the Klamath Falls Resource Area. U.S. Fish and Wildlife Service. Klamath Falls, OR.

U.S. Department of the Interior, Fish and Wildlife Service. (2001c). Biological opinion on Knob timber sale. Yreka, CA.

U.S. Department of the Interior, Fish and Wildlife Service. (1994). Final biological opinion for the preferred alternative of the Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. Portland, Oregon.

Vogl (1979). Vogl, R.J. Some basic principles of grassland fire management. *Environmental Management* 3(1):51-57, 1979.

Volland, L.A. (1976). Plant communities of the central Oregon pumice zone. R-6 Area Guide 4-2. USDA For. Serv., Pacific Northwest region, Portland, OR.

Vrilakas, S. (1987). Species management guide for *Botrichium pumicola*. Portland, OR: The Nature Conservancy. 24 pp.

Weinheimer (2001). United States Department of Agriculture, Natural Resources Conservation Service. 20 July 2001. Personal communication with Jerry Weinheimer.

Welsh, H. H., Jr. (1990). Relictual amphibians and old-growth forests. Conservation Biology 4:309-19.

Western Bat Working Group. (1998). Ecology, conservation and management of western bat species, bat species accounts (draft). Unpublished document prepared as

preliminary information for a group workshop conducted in February 1998. Obtained from Bill Austin, U.S. Fish and Wildlife Service, 520-527-0849

Wickman, B.E. (1990). The battle against bark beetles in Crater Lake National Park, 1925-34. Gen. Tech. Rep. PNW GTR-259. 40 pp.

Wolverine (2001). The Wolverine Foundation. Life History Species Account. Web page. Date accessed: 25 July 2001. Accessed at: http://www/wolverinefoundation.org/specacct.htm

Wright and Bailey, (1980). Wright, H.A. and A.W. Bailey. 1980. Fire ecology and prescribed burning in the Great Plains – A research review. United States Department of Agriculture, Forest Service, Intermountain Forest Range Experiment Station, Ogden, Utah. General Technical Report. INT-77.

Wynd, F.L. (1941). The botanical features of the life zones of Crater Lake National Park, Amer. Mid. Natur. 25:324-347.

Yocum, C.F. (1964). Shrubs of Crater Lake National Park. Crater Lake Natural History Association, San Francisco. 82 pp.

Zeigler, R.S. (1978). The vegetation dynamics of *Pinus contorta* forest, Crater Lake National Park. M.S. thesis, Oregon State University, Corvallis.

Zika, Peter F. (1995). An annotated checklist of vascular plants in Crater Lake National Park, Oregon. Final report from The Nature Conservancy, Portland, OR.

Zimmerman, H.T. Nichols, and J.W. van Wagtendonk. (1994). Fire management and ecosystem health in the National Park System. National Park Service, Branch of Fire and Aviation Management.

Ziolko (2002). Oregon Department of Forestry. 25 February 2002. Personal communication with Michael Ziolko.

Appendix 13.B Definitions

Appropriate Management Response – Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Appropriate Management Strategy – A plan or direction selected by an agency administrator to guide wildland fire management actions and meet protection and fire use objectives.

Contain – To surround a fire, and any spot fires there from, with control line as needed, which can reasonably be expected to check the fire's spread under prevailing and predicted conditions.

Confine – To limit fire spread within a predetermined area principally by use of natural and pre-constructed barriers or environmental conditions. Suppression action may be minimal and limited to surveillance or monitoring under appropriate conditions.

Control – To complete a control line around a fire, any spot fires there from, and any interior islands to be saved and cool down all hot spots that are immediate threats to the control line.

Disputed Fire Management Responsibility – Any wildland fire where responsibility for management is not agreed upon due to lack of agreements or different interpretations, etc.

Disputed fire policy – Differing fire policies between suppression agencies when the fire involves multiple ownership is an example.

Energy Release Component – A number that expresses the rate of heat release (in BTUs / sec) per unit area (in square feet) within the flaming zone of the fire.

Escaped Prescribed Fire – A prescribed fire that has exceeded or is expected to exceed prescription parameters or otherwise meets the criteria for conversion to wildfire. Criteria is specified in "Interagency Prescribed Fire – Planning and Implementation Procedures Reference Guide."

Expected Weather Conditions – Weather conditions indicated as common, likely, or highly probable based on current and expected trends and their comparison to historical weather records. These are the most probable weather conditions for this location and time.

Experienced Severe Weather Conditions - Weather conditions that occur infrequently, but have been experienced during the period of weather records. For example, rare weather conditions that significantly influence fires may have occurred only once, but their record can be used to establish a baseline for worst case scenario.

Extended Exposure to Unusually Hazardous Line Conditions – Extended burnout or backfire situations, rock slides, cliffs, extremely steep terrain, abnormal fuel situations such as frost-killed foliage, etc.

Fire Frequency – The historic return interval of fire in a defined environment.

Fire Management Area (FMA) – A geographic area within a Fire Management Unit that represents a pre-defined ultimate acceptable management area for a fire managed for resource benefits. This pre-define area can constitute a Maximum Manageable Area (MMA)n and is useful for those units having light fuel types conducive to rapid fire spread rates.

Fire Management Plan (FMP) – a plan that identifies and integrates all wildland fire management and related activities within the context of approved land/ resource management plans. It defines a program to manage wildland fires (wildfire and prescribed fire). The plan is supplemented by operational plans, including but not limited to preparedness plans, preplanned dispatch plans, prescribed fire burn plans and prevention plans. Fire Management Plan's assure that wildland fire management goals and components are coordinated.
Fire Management Plan (FMP) – A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational plans such as preparedness plans, preplanned dispatch plans, prescribed fire plans and prevention plans.

Fire Management Unit (FMU) – Any land management area definable by objectives, topographic features, access, values to be protected, political boundaries, fuel types, major fire regimes, etc., that sets it apart from the management characteristics of an adjacent unit. FMU's are delineated in Fire Management Plans.

Holding Actions – Planned actions required to achieve wildland and prescribed fire management objectives.

Initial Action – the actions taken by the first resources to arrive at a wildfire.

Land/Resource Management Plan (L/RMP) – a document prepared with public participation and approved by an agency administrator that provides general guidance and direction for land and resource management activities for an

administrative area. The L/RMP identifies the need for fire's role in a particular area and for a specific benefit. The objectives in the L/RMP provide the basis for the development of fire management objectives and the fire management program in the designated area.

Management Action Points – (also called "Trigger Points")-Either geographic points on the ground or specific points in time where an escalation or alteration of management actions is necessitated. These points are defined and the management actions taken are clearly described in an approved Wildland Fire Plan(WFIP) or Prescribed Fire Plan. Timely implementation of the actions when the fire reached the action point is generally critical to successful accomplishment of the objectives.

Maximum Manageable Area (MMA) – The firm limits of management capability to accommodate the social, political, and resource impacts of a wildland fire. Once established as part of an approved plan, the general impact area is fixed and not subject to change.

Mitigation Actions – On-the-ground activities that will serve to increase the defensibility of the Maximum Manageable Area, check, direct, or delay the spread of fire, and minimize threats to life, property, and resources. They can include mechanical and physical non-fire tasks, specific fire applications and limited suppression actions. These actions will be used to construct firelines, reduce excessive fuel concentrations, reduce vertical fuel continuity, create fuel breaks or barriers around critical or sensitive sites or resources, create "blacklines" through controlled burnouts, and to limit fire spread and behavior.

Planned Ignition –the intentional initiation of a wildland fire by hand-held, mechanical or aerial device where the distance and timing between ignition lines or points and the sequence of igniting them is determined by environmental conditions (weather, fuel, topography), firing technique, and other factors which influence fire behavior and fire effects (see prescribed fire).

Potential for Blow-up Conditions – Any combination of fuels, weather and topography excessively endangering personnel.

Preparedness – Activities that lead to a safe, effective, and cost effective fire management program in support of land and resource management objectives through appropriate planning and coordination. This term replaces pre-suppression.

Pre-existing controversies – These may or may not be fire management related. Any controversy drawing public attention to an area may present unusual problems to the fire overhead and local management.

Prescribed Fire—is a wildland fire originating from a planned ignition to meet specific objectives identified in a written, approved, prescribed fire plan for which

NEPA requirements (where applicable) have been met prior to ignition (see planned ignition).

Prescribed Fire Plan – A plan required for each fire ignited by managers. It must be prepared by qualified personnel and approved by appropriate Agency Administrator prior to implementation.

Prescription – Measurable criteria which guide the selection of appropriate management responses and actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social or legal considerations.

Protection - the actions taken to limit the adverse environmental, social, political, and economical effects of fire (FEC Briefing Paper, 3/14/2008).

Response to wildland fire - the mobilization of the necessary services and responders to a fire based on ecological, social, and legal consequences, the circumstances under which a fire occurs, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected.

Smoke Management – Any situation which creates a significant public response, such as smoke in a metropolitan area or visual pollution in high-use scenic areas.

Suppression - all the work of extinguishing a fire or confining fire spread.

Threatened and Endangered Species – Threat to habitat of such species, or in the case of flora, threat to the species itself.

Unplanned Ignition – the initiation of a wildland fire by lightning, volcanoes, unauthorized and accidental human-caused fires (see wildfire).

Use of Wildland Fire - management of either wildfire or prescribed fire to meet resource objectives specified in Land/Resource Management Plans.

Wildfire – unplanned ignition of a wildland fire (such as a fire caused by lightning, volcanoes, unauthorized and accidental human-caused fires) and escaped prescribed fires.
(See unplanned ignition and escaped prescribed fire).

Wildland Fire – a general term describing any non-structure fire that occurs in the wildland.

Wildland Fire Decision Support System (WFDSS) - This system is intended to assist fire managers and analysts in making strategic and tactical decisions for fire incidents. It is designed to replace the WFSA (Wildland Fire Situation Analysis), Wildland Fire Implementation Plan (WFIP), and Long-Term Implementation Plan (LTIP) processes with a single process that is easier to use, more intuitive, linear, scalable, and progressively responsive to changing fire complexity. WFDSS was conceived as a way of integrating the various applications used to manage incidents into a single system, which streamlines the analysis and reporting processes.
Wildland Fire Implementation Plan (WFIP) – A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response to a wildland fire. A full WFIP consists of three stages. Different levels of completion may occur for differing management strategies; i.e., fires managed for resource benefits will have two-three stages of the WFIP completed while some fires that receive a suppression response may have only a portion of Stage I completed.

Wildland Fire Management Program – The full range of activities and functions necessary for planning, preparedness, emergency suppression operations, and emergency rehabilitation of wildland fires, and prescribed fire operations including non-activity fuels management to reduce risks to public safety and restore and sustain ecosystem health.

Wildland Fire Situation Analysis (WFSA) – A decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economic, political, and resource management objectives.

Wildland Urban Interface (WUI) – The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetation fuels.

Appendix 13.C Species Lists for Crater Lake National Park

Table 13.1 Rare Species of Crater Lake NP

Common Name	Scientific Name	Federal Listing	Federal Species of Concern	March 2003 State Rank*
Animals				
Northern spotted owl	*Strix occidentalis caurina*	Threatened		1
Bull trout	*Salvelinus confluentus*	Threatened		1
Crater Lake newt	*Taricha granulosa ssp. mazamae*			1
Crater Lake tightcoil (snail)	*Pristiloma arcticum crateris*			1
Bald eagle	*Haliaeetus leucocephalus*	Threatened		2
Tailed frog	*Ascaphcs truei*		Y	2
Cascade frog	*Rana cascadae*		Y	2
Northern goshawk	*Accipiter gartilis*		Y	2
Peregrine falcon	*Falco peregrinus anatcm*			2
Pacific fisher	*ennanti pacifica*		Y	2
California wolverine	*Gulo gulo luteus*			2
Western gray squirrel	*Sciurus griseus*			3
Yuma Myotis	*Myotis yumanensis*		Y	4
Long-legged Myotis	*Myotis volans*		Y	4
Long-eared Myotis	*Myotis evotis*		Y	4
Silver-haired bat	*Lasionycteris noctivagans*		Y	4
Olive-sided flycatcher	*Contopus cooperi*		Y	4
Willow flycatcher	*Empidonax traillii*		Y	4
Lewis' woodpecker	*Melanerpes lewis*		Y	4
White-headed woodpecker	*Picoides albolarvatus*		Y	4
Northern sagebrush lizard	*Sceloporus graciosus*		Y	4
Mountain quail	*Oreortyx pictus*		Y	4
American marten	*Martes americana*			4
Bufflehead	*Bucephala albeola*			4
Barrow's goldeneye	*Bucephala islandica*			4
Black-backed woodpecker	*Picoides arcticus*			4
Three-toed woodpecker	*Picoides tridactylus*			4
Great gray owl	*Strix nebulosa*			4
Ringtail	*Bassariscus astutus*			4

Legend:
*1=Threatened or Endangered Throughout Range, 2=Threatened, Endangered or Extirpated from Oregon but Secure Elsewhere, 3=In Review, 4=Watch List

Table 13.1 Rare Species of Crater Lake NP (cont.)

Common Name	Scientific Name	Federal Listing	Federal Species of Concern	State Rank*
Plants				
Crater Lake rockcress	*Arabis suffrutescens horizontalis*		Y	1
Pumice grapefern	*Botrychium pumicola*		Y	1
Mt. Mazama collomia	*Collomia mazama*		Y	1
Shasta arnica	*Arnica viscosa*			2
Lance-leaved/ triangle	*Botrychium lanceolatum var. lanceolatum*			2
Abrupt-beaked sedge	*Carex abrupta*			2
Crawford's sedge	*Carex crawfordii*			2
Lesser bladderwort	*Utricularia minor*			2
Swamp willow-herb	*Epilobium palustre*			3
Greene's hawkweed	*Hieracium greenei*			3
Shaggy hawkweed	*Hieracium horridum*			3
White stem gooseberry	*Ribes inerme var. klamathense*			3
Few-flowered mannagrass	*Torreyochloa erecta*			3
Bolander's bluegrass	*Poa bolanderi*			3
Oarleaf buckwheat	*Eriogonum pyrolifolium var. pyrolifolium*			3
California mountain ash	*Sorbus californica*			3
Pine woods cryptantha	*Cryptantha simulans*			3
Bolander's hawkweed	*Hieracium bolanderi*			4

Legend:
*1=Threatened or Endangered Throughout Range, 2=Threatened, Endangered or Extirpated from Oregon but Secure Elsewhere, 3=In Review, 4=Watch List

Table 13.2 Ethno-botanically Significant Plant Species

Family	Scientific Name	Common Name
EQUISETACEAE	Equisetum hyemale var. Affine	scouring rush
CUPRESSACEAE	Calocedrus decurrens	incense-cedar
PINACEAE	Abies concolor var. lowiana	white fir
PINACEAE	Pinus contorta var. murrayana	Sierra lodgepole pine
PINACEAE	Pinus lambertiana	sugar pine
PINACEAE	Pinus ponderosa var. ponderosa	ponderosa pine
PINACEAE	Pseudotsuga menziesii var. menziesii	Douglas-fir
TAXACEAE	Taxus brevifolia	Pacific yew
APIACEAE	Heracleum maximum	cow parsnip
ASTERACEAE	Achillea millefolium	yarrow, milfoil
ASTERACEAE	Artemisia tridentata ssp. Vaseyana	big sage, mountain sagebrush
ASTERACEAE	Ericameria bloomeri	Bloomer's rabbitbrush, goldenweed
BETULACEAE	Corylus cornuta var. californica	hazelnut
BRASSICACEAE	Descurainia incana ssp. Incana	mountain tansy mustard
ERICACEAE	Arctostaphylos nevadensis	pinemat manzanita
ERICACEAE	Arctostaphylos patula	green-leaf manzanita
ERICACEAE	Vaccinium membranaceum	thin-leaved or big huckleberry
ERICACEAE	Vaccinium scoparium	grouseberry, whortleberry
FAGACEAE	Castanopsis chrysophylla var. chrysophylla	golden or giant chinquapin
LINACEAE	Linum lewisii var. lewisii	wild blue flax
NYMPHAEACEAE	Nuphar lutea ssp. Polysepala	spaterdock, wokas, or yellow pond lily
HYDRANGEACEAE	Philadelphus lewisii	mock-orange
POLEMONIACEAE	Ipomopsis aggregata ssp. Formosissima	scarlet gilia, skyrocket
POLYGONACEAE	Eriogonum umbellatum var. umbellatum	sulfurflower, sulfur buckwheat
POLYGONACEAE	Polygonum douglasii ssp. Douglasii	Douglas' knotweed
POLYGONACEAE	Polygonum douglasii ssp. Majus	wiry knotweed
POLYGONACEAE	Polygonum douglasii ssp. Spergulariiforme	fall or spurry knotweed
RHAMNACEAE	Frangula purshiana	cascara, chittam bark
ROSACEAE	Amelanchier alnifolia var. semiintegrifolia	western serviceberry
ROSACEAE	Prunus emarginata	bitter cherry
ROSACEAE	Purshia tridentata	bitter brush, antelope brush
ROSACEAE	Rosa woodsii var. ultramontana	pearhip or interior rose
ROSACEAE	Rubus leucodermis	black raspberry, blackcap
SALICACEAE	Populus balsamifera ssp. Trichocarpa	black cottonwood
SALICACEAE	Populus tremuloides	quaking aspen
SALICACEAE	Salix exigua	coyote or slender willow
SALICACEAE	Salix lemmonii	Lemmon's willow
SALICACEAE	Salix lucida ssp. Lasiandra	Abram's or shining willow
SALICACEAE	Salix prolixa	Mackenzie willow

Table 13.2 Ethno-botanically Significant Plant Species (cont.)

Family	Scientific Name	Common Name
SALICACEAE	Salix scouleriana	Scouler's willow
SALICACEAE	Salix sitchensis	Sitka willow
CYPERACEAE	Carex abrupta	abrupt-beaked sedge
CYPERACEAE	Carex angustata	well-fruited sedge
CYPERACEAE	Carex aquatilis var. aquatilis	water sedge
CYPERACEAE	Carex aquatilis var. dives	Sitka sedge
CYPERACEAE	Carex athrostachya	slender-beaked sedge
CYPERACEAE	Carex heteroneura var. epapillosa	blackened sedge
CYPERACEAE	Carex brainerdii	Brainerd's sedge
CYPERACEAE	Carex breweri	Brewer's sedge
CYPERACEAE	Carex canescens	silvery sedge
CYPERACEAE	Carex crawfordii	Crawford's sedge
CYPERACEAE	Carex cusickii	Cusick's sedge
CYPERACEAE	Carex leptopoda	shorter-scaled sedge
CYPERACEAE	Carex disperma	soft-leaved sedge
CYPERACEAE	Carex echinata ssp echinata	western stellate sedge
CYPERACEAE	Carex fracta	fragile-sheathed sedge
CYPERACEAE	Carex halliana	Oregon sedge, Hall's sedge
CYPERACEAE	Carex hoodii	Hood's sedge
CYPERACEAE	Carex illota	small-headed sedge
CYPERACEAE	Carex inops ssp. Inops	long-stoloned sedge
CYPERACEAE	Carex jonesii	Jones' sedge
CYPERACEAE	Carex laeviculmis	smooth-stemmed sedge
CYPERACEAE	Carex lenticularis var. impressa	nerveless sedge
CYPERACEAE	Carex lenticularis var. lipocarpa	Kellogg's sedge
CYPERACEAE	Carex leporinella	Sierra hare sedge
CYPERACEAE	Carex limosa	shore sedge
CYPERACEAE	Carex luzulina	rush sedge
CYPERACEAE	Carex mertensii	Merten's sedge
CYPERACEAE	Carex microptera	small-winged sedge
CYPERACEAE	Carex multicostata	many-ribbed or thick-fruited sedge
CYPERACEAE	Carex neurophora	alpine nerved sedge
CYPERACEAE	Carex nigricans	blackish sedge
CYPERACEAE	Carex pachystachya	thick-headed sedge
CYPERACEAE	Carex phaeocephala	mountain hare sedge
CYPERACEAE	Carex preslii	Presl sedge
CYPERACEAE	Carex rossii	Ross' sedge
CYPERACEAE	Carex scopulorum var. bracteosa	Sierra alpine sedge
CYPERACEAE	Carex spectabilis	showy sedge
CYPERACEAE	Carex straminiformis	Mt. Shasta sedge
CYPERACEAE	Carex macloviana ssp. Subfusca	rusty sedge
CYPERACEAE	Carex utriculata	beaked sedge
CYPERACEAE	Carex exsiccata	inflated sedge
CYPERACEAE	Carex whitneyi	Whitney's sedge

LILIACEAE	Camassia leichtlinii ssp. Suksdorfii	great camas

Appendix 13.D NEPA, NHPA, and ESA Compliance Documents

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2) Biological Opinion (USFWS BO)
3) Environmental Assessment (EA)
4) Finding of No Significant Impact (FONSI)

1) Biological Assessment

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Introduction

Purpose and Need for a Biological Assessment

Forest stand histories and fire regimes at Crater Lake National Park are similar to other areas in the southern portion of the Cascade Range with comparable plant communities and topography. Effective fire suppression at Crater Lake National Park over the last 90 years has increased dead woody fuel accumulation on the forest floor and within the forest stands. Fire exclusion has unnaturally altered the landscape in some forest ecosystems. In the absence of fire, many forest communities have advanced successionally towards stand compositions that favor shade-loving and fire-intolerant species. This advancement has lead to greater stand densities, more insect/ disease infestations, and greater tree mortality. In some cases, multi-storied conditions have formed continuous vertical fuel ladders. When combined with increased woody fuel, vertical fuel ladders increase the likelihood of extensive, and possibly uncontrollable crown fires.

National Park Service Wildland Fire Management Guidelines (DO-18) state "all parks with vegetation that can sustain fire must have a fire management plan." The purpose of the proposed federal action is to develop a fire management plan and program that utilizes the benefits of fire to achieve desired natural resource conditions while minimizing the fire danger to park resources and adjacent lands from hazardous fuel accumulations.

Because this proposed federal action involves several Federally listed species and designated critical habitat, this biological assessment was prepared in conformance with the requirements set forth under Section 7 of the Endangered Species Act (19 U.S.C. 1536 (c), 50 CFR 402).

Location of the Proposed Federal Action

Crater Lake National Park was established on May 22, 1902 and is the nation's fifth oldest national park. The park was created to insure the preservation of Crater Lake and its natural surroundings. The area is characterized by a long history of volcanic and glacial activity, and Crater Lake itself lies within the 6 mile-wide caldera created by the eruption and collapse of Mt. Mazama more than 7,000 years ago.

It is located in the Southern Cascade Mountains of Oregon and contains 183,224 acres. The park proposed that 179,737 of these acres be designated as wilderness in its 1994 Wilderness Designation proposal. Pending Congressional approval of that proposal, the park manages that acreage as wilderness.
The Park is bounded on the north by Umpqua National Forest, on the northeast, east, and south by Winema National Forest, on the southwest, west, and northwest by Rogue River National Forest and Sky Lakes Wilderness Area. In addition, the

Park adjoins Sun Pass State Forest and an 80-acre block of private land on the southeastern corner (See Figure 1-1). These lands are managed for a variety of uses, including timber, grazing, watershed protection, recreation and wilderness.

Consultation History of this Proposed Action to Date

Several informal consultations have occurred between the National Park Service, Crater Lake National Park (CRLA) and the U.S. Fish and Wildlife Service (USFWS), Klamath Basin Field Office, since the environmental analysis of the proposed actions began in January 2001.

A meeting between Doug Laye of the Klamath Basin Field Office, U.S. Fish and Wildlife Service and members of the Crater Lake National Park Fire Management Plan Interdisciplinary Team was held on January 19, 2001. Topics of discussion included new listed species (Canada lynx) and information about USFWS timelines for concurrence with biological assessments. Doug agreed to provide Mary Rasmussen with examples of some current assessments to streamline her work and also offered to provide the park with a format for annual reports to the USFWS.

A meeting between Doug Laye of the Klamath Basin Field Office, U.S. Fish and Wildlife Service, Craig Letz and Mary Rasmussen of Crater Lake National Park, and Jim Mangi of Mangi Environmental Group (EA contractor), was held in May 2001, to discuss proposed fire management plan alternatives, environmental assessment timelines, and contract deliverables.

An emergency consultation was initiated on August 15, 2001 between Mary Rasmussen, Crater Lake National Park and Doug Laye of the Klamath Basin Field Office, U.S. Fish and Wildlife Service, regarding a 65-acre wildfire (Border Fire) within critical habitat for the northern spotted owl. Information on spotted owl habitat and pair activity was provided. Post-fire owl surveys were conducted and a "no effect " determination was made for that fire event and owl pair #3409.

Identification of Species List Used

The species list referred to in completing this biological assessment is dated April 2001. The file designation on this list is #1-10-00-SP-063, for species in the vicinity of Crater Lake National Park (Klamath County).

An updated list was requested and received in March 2002. The file designation of the updated list is #1-10-02-SP-033, which includes one additional candidate species, the yellow-billed cuckoo (Coccyzus americanus). This biological assessment includes a determination for the yellow-billed cuckoo.

Species of Concern

The Federal Endangered Species Act prohibits harm to any species of fauna or flora listed by the USFWS as being either threatened or endangered. Such harm includes not only direct injury or mortality, but also disrupting the habitat on which these species depend. Based on Federal species list #1-10-02-SP-033, there are seven listed species and two candidate species that may occur in Klamath County, Oregon. Of these nine species, only three are known or likely to reside within Crater Lake National Park. These three species, as listed in Table 1-1, are evaluated in this biological assessment.

Table 1-1 List of Species Evaluated in this Biological Assessment

Species	Status	Description
Haliaeetus leucophalus (Bald eagle)	Federal Threatened	Bird of prey that is an occasional resident of the park. One known nest site occurs within the caldera, near the lakeshore.
Strix occidentalis caurina (Northern spotted owl)	Federal Threatened	Old-growth dependent species found in lower-elevation mixed conifer forests, on west and south sides of park.
Salvelinus confluentus (Bull trout)	Federal Threatened	This is the only native fish found in the park's cold fresh-water streams. An active restoration program is in progress.

The other six species on the list (Canada lynx, shortnose sucker, Lost River sucker, Oregon spotted frog, yellow-billed cuckoo, and Applegate's milk vetch) occur in habitats not found within the Park or have not been observed in presence/absence surveys over the last eight years. A "No Effect" determination has been assigned to these species.

Other sensitive species evaluated in the environmental assessment of the proposed action (USDI 2002) are listed in the tables 1-2 and 1-3 below. A "No Effect" determination has been assigned to these species because they do not occur within the park, or occur in areas not affected by the proposed action.

Table 1-2. Plant Species Not Affected by the Proposed Actions

Species	Status	Description
Astragalus applegatei (Applegate's milk vetch)	Federal Endangered	Perennial plant species found in flat, seasonally moist, strongly alkaline soils in the Klamath River Basin (USFWS, 1997). Not known to occur within park (Zika, 1995).
Arabis suffrutescens var. *horizontalis* (Crater Lake rockcress)	Federal Sensitive, State Candidate	Plant found in dry and exposed rocky habitat at high elevations (Appelgate, 1939 and Rasmussen, 2001a). Occurs in isolated populations around caldera rim only.
Botrychium pumicola (pumice grape fern)	Federal Sensitive, State Threatened	Inconspicuous plant found in raw, pale pumice on rocky mountain slopes at high elevations or in frost pockets of montane lodgepole pine openings (USDA and BLM, 1999). Isolated park populations found at Llao Rock RNA.
Collomia mazama (Mount Mazama collomia)	Federal Sensitive	Perennial species that inhabits open woods and meadows of the lodgepole pine and red fir/mountain hemlock forest zones. Several populations occur on the park's west side, outside of proposed treatment areas.

Table 1-3. Wildlife Species Not Affected by the Proposed Actions

Species	Status	Description
Coccyzus americanus (Yellow-billed cuckoo)	Federal Candidate	Primarily associated with riparian habitats containing willow and/or cottonwood and has been found in Klamath county. Possible, but not likely to occur at CRLA. Not observed over the past five years in point count surveys of the Klamath Basin and the park (Alexander, 2002).
Lynx canadensis (Canada lynx)	Federal Threatened	Solitary species found in boreal forests with high annual snowpack. Primary prey species is snowshoe hare and small rodents. Three years of surveys have failed to provide evidence of presence within or adjacent to park.
Gulo gulo (wolverine)	State Threatened	Low-density species that occupies isolated montane cirques and talus slopes above tree line.

		Opportunistic hunter. No confirmed sitings in the park over the last 10 years. Surveys over the last 5 years have failed to provide evidence of presence within or adjacent to the park.
Rana pretiosa (Oregon spotted frog)	Federal Candidate	Possible occurrence in isolated west-side riparian habitats. No survey evidence to conclude presence within park.

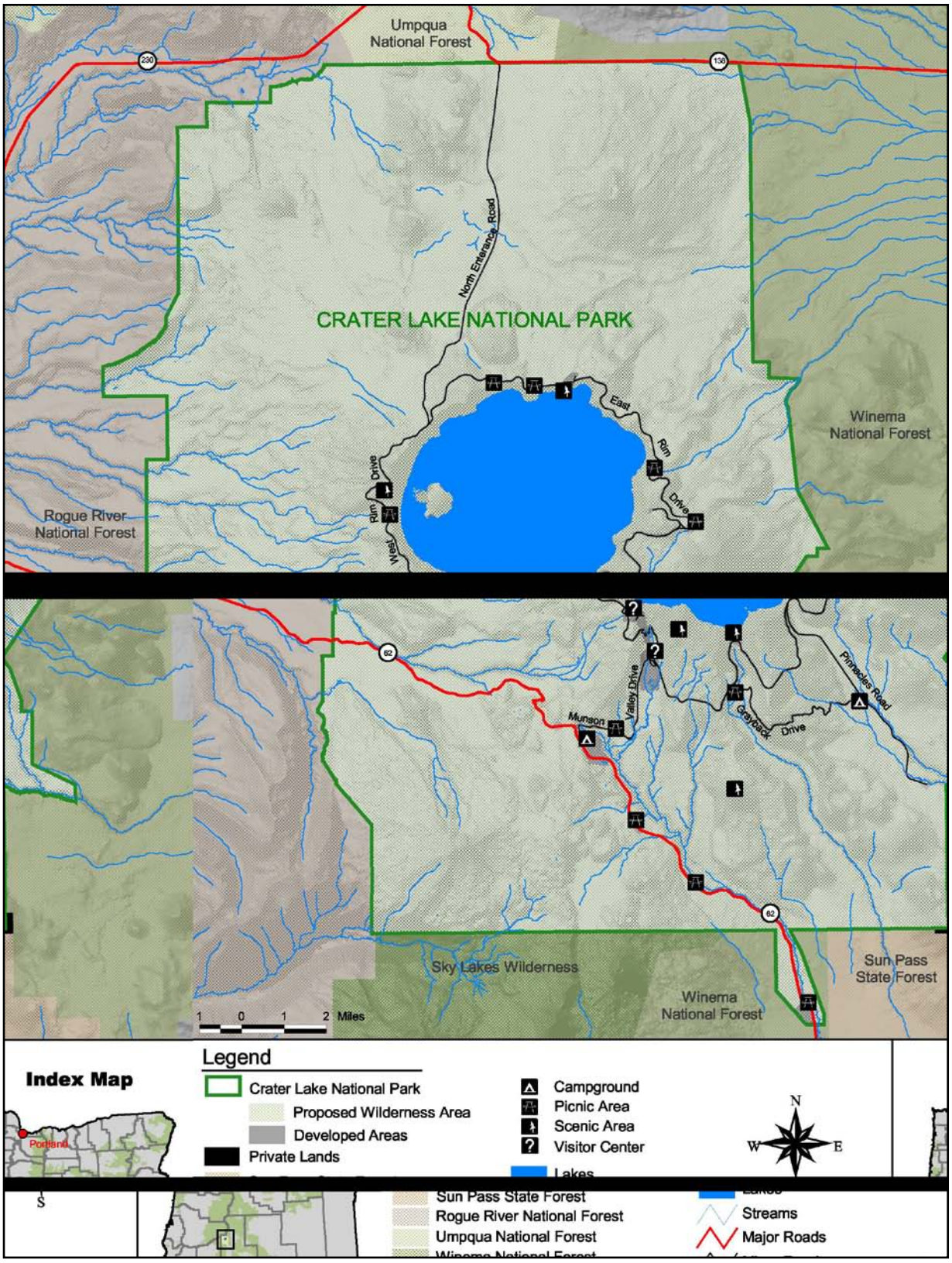


Figure 1-1. Location of the Proposed Federal Action

Descriptions of the Proposed Federal Action

This Chapter describes the range of alternatives, including the Proposed Action and No Action Alternatives, formulated to address the purpose of and need for the proposed project. These alternatives were developed through evaluation of the comments provided by individuals, organizations, governmental agencies, and the park's fire management planning interdisciplinary team.

Alternative 1 (No Action) - Implement the 1999 Fire Management Plan

This alternative meets the purpose and need by continuing the fire program according to the Fire Management Plan approved in 1999. The No Action Alternative, as defined by Fire Management Units based largely on administrative boundaries, would include the suppression of wildland fires, provide for prescribed fires, and allow for management of wildland fire (wildland fire use).

Under this alternative, Crater Lake National Park is divided into three Fire Management Units (FMUs), each of which follows a set of management strategies. The FMUs include the Crater Lake Fire Management Unit (115,107 acres), the Boundary Fire Management Unit (51,032 acres), and the Exclusion Fire Management Unit (2,972 acres). The FMUs were primarily based on administrative boundaries.

A majority of the park is designated as the Crater Lake FMU. Unwanted fires are suppressed in a manner that minimizes negative environmental impacts of suppression activities. Prescribed fires and wildland fire use may be implemented within this FMU.

The Boundary FMU exists because the administrative boundary of Crater Lake National Park does not coincide with natural barriers to fire. Fires originating in the park could cross administrative boundaries if left unchecked, and vice versa. Depending on the management objectives of the park's neighbors for particular areas, such an occurrence could complicate or jeopardize the neighbor's ability to meet its objectives. Accordingly, in some cases, fires are suppressed before they jump administrative boundaries. In other cases where management objectives for the park and its neighbor complement one another, prescribed and wildland fires would be allowed to cross the administrative boundary. Such an act would require that Interagency Agreements be in place between the park and the neighboring land management agencies.

The Exclusion FMU includes scattered clusters of human developments in the Park. These include:

- Mazama Village
- Munson Valley
- Rim Village

- Lost Creek Campground
- Governors Bay developed area
- Cleetwood Cove developed area

Most of these regions contain structures of high monetary and cultural value. For these reasons, all wildland fires are suppressed in these areas. Normal suppression considerations, as well as sensitivity to the particular areas that are threatened, will dictate the exact location of control lines and the choice of appropriate techniques during the suppression of a wildland fire.

The Fire Management Plan targets a total of 2,181 acres for prescribed fire, however, since some treatment units will be burned more than once, the total number of acres burned would be 3,437 acres over a 5-year period (see Table 2-1). While specifically allowed for the in the FMP, there are no acreages assigned for wildland fire use. Except in the case of emergencies where there is the potential for loss of human life and/or property, manual and mechanical thinning treatments are not addressed in the FMP.

Table 2-1 Crater Lake National Park 5-Year Treatment Plan (Alternative 1)

FMU	Total Acres in FMU	Mean Fire Return Interval	Annual Prescribed Fire Targets (acres)	Target Acres to be Treated over 5 Years
Crater Lake	115,107	N/A	N/A	N/A
Boundary	51,032	10-15 years	687	3,437
Exclusion	2,972	N/A	N/A	N/A
Total	**169,111**		**687**	**3,437**

Alternative 2 - Ecology Based Program Excluding Wildland Fire Use

This alternative meets the purpose and need through the designation of fire management units determined by wildland fire regimes and resource values at risk. This approach recognizes the ecological role of fire and provides a framework for developing fire management objectives, similar to those contained in the 1999 FMP, across agency boundaries. This alternative would include suppression of wildland fires, provide for prescribed fires, and allow for manual and mechanical fuel treatments as fire surrogates. The particular mix of strategies implemented would be based on ecological needs and resource values at risk. In response to concerns by the public regarding the potential for catastrophic fire, the park does not propose wildland fire use in this alternative.

Under this alternative, the FMP would be amended to include the following four fire management units within Crater Lake National Park: Low Severity, Moderate Severity, High Severity, and Developed (see Figure 2-1). All FMUs, with the exception of

Developed, are based upon fire regimes, which describe the character of the fire as well as the effects of fire on the dominant vegetation. The following are descriptions of each FMU and its associated fire regime (Agee 1993, Brown and Smith 2000):

- *Low Severity* – Fires are generally non-lethal to the dominant vegetation and do not substantially change the structure of the dominant vegetation. Approximately 80% or more of the aboveground dominant vegetation survives fire. This FMU applies to the ponderosa pine and white fir series;
- *Moderate Severity* – Fire severity either causes selective mortality in dominant vegetation, depending on different tree species' susceptibility to fire, or varies between understory and stand replacement fires. This FMU applies to the Shasta red fir and whitebark pine series;
- *High Severity* – Fires kill aboveground parts of the dominant vegetation, changing the aboveground structure substantially. Approximately 80% or more of the aboveground dominant vegetation is either consumed or dies as a result of fires. This FMU applies to the mountain hemlock and lodgepole pine series;
- *Developed* – This FMU includes the developed areas identified under the No Action Alternative. All the developed areas share similar/identical needs and treatment objectives.

Table 2-2 summarizes the total number of acres in each FMU, mean fire return intervals, and the approximate number of acres targeted for treatment in each FMU using prescribed fire and manual and mechanical thinning. Table 2-3 illustrates the proposed treatment activity by calendar year and FMU. Within the Fire Management Units, the park has identified 16 treatment units where it would conduct prescribed fire, manual, and/or mechanical fuel treatments (See Figure 2-2). Table 2-4 identifies the treatments units within their respective FMU, depicts the proposed acreages and timing of treatments, and provides descriptions of the various treatment units.

Table 2-2 Crater Lake National Park 5-Year Treatment Plan (Alternative 2)

FMU	Total Acres in FMU	Mean Fire Return Interval	Annual Treatment Targets (acres)[2]	Target Acres to be Treated over 5 Years	Breakdown of 5-year Target Acres to be Treated by		
					Prescribed Fire	Manual Thinning	Mech. Thinning
Low	19,539	10-15 years	1,350	6,750	6,750	4,250[3]	
Moderate	22,957	40-60 years	383	1,915	1,915	190[3, 4]	
High	105,224	80-100 years	500	2,500	2,500	2,350[3]	
Developed	3,487	n/a	310	1,550		910[5]	640[5]
Total	**151,207[1]**		**2,543**	**12,715**	**11,165**	**7,700**	**640**

[1] The remaining 32,017 acres in the park contain non-forest vegetation (meadows) and non-combustible vegetation, i.e. Crater Lake, and are not included as a separate fire management unit.
[2] Yearly amounts may vary according to fire weather and other planning and implementation considerations.
[3] Manual thinning target acres are captured under those acres to be treated by prescribed fire (e.g. after 4,250 acres of manual treatments are conducted in the Low-Severity FMU, those same acres and up to another 2,500 acres would be treated with prescribed fire, for a total treatment in that FMU of 6,750 acres).
[4] Manual thinning in the moderate severity FMU would be very minor, would only be employed to help prepare sites for prescribed fire. It would not be conducted solely to modify forest structure as is contemplated in the other FMUs.
[5] Manual and mechanical thinning treatments would be employed as fire surrogates.

Table 2-3 Proposed Treatment Activity by Calendar Year and Fire Management Unit

FMU	2002	2003	2004	2005	2006	2007
Low	1,500	0	1,500	1,500	750	1,500
Moderate	0	0	0	615	600	700
High	0	1,500	1,000	0	0	0
Developed	0	270	640	260	380	0
Total Acres[1]	1,500	1,770	3,140	2,375	1,730	2,200

[1] Total acres include those acres to be treated by prescribed fire and mechanical thinning. Manual thinning is already captured in those acres targeted for prescribed fire treatments since hand thinning will often be followed up with prescribed fire.

Table 2-4 Crater Lake National Park Treatment Units and Descriptions (Alternative 2)

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
Low Severity FMU			
Panhandle	1,000 acres 2002-2003	Manual thin, prescribed fire	Treatment unit is composed of mixed patches of mature ponderosa pine with younger white fir and lodgepole pine and scattered mature sugar pine along Hwy 62. Portions of the area were treated with prescribed fire in the mid '70s and '80's.
Upper Pan	500 acres 2002-2003	Manual thin, prescribed fire	Treatment unit includes mature ponderosa pine and white fir with minor amounts of Shasta red fir and aspen located between highway 62 and the south park boundary above the panhandle.
Sun Creek	1,500 acres 2004	Manual thin, prescribed fire	Treatment unit consists of mixed-conifer stands of ponderosa pine, white fir and sugar pine in the Sun Creek drainage near the park's south boundary.
Sharp Desert	1,000 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary between Desert Creek and Sharps Peak.
TC South	500 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary north and west of Desert Creek.
Red Blanket	750 acres 2006	Manual thin, prescribed fire	Treatment unit includes mixed conifer forests with a Douglas fir component on the south facing slopes of upper Red Blanket canyon.
Crater Creek Ridge	1,500 acres 2007	Manual thin, prescribed fire	Treatment unit consists of mixed conifer forests above Crater Creek along the west park boundary.

Table 2-4 Crater Lake National Park Treatment Units and Descriptions (Alternative 2 cont)

Moderate Severity FMU			
PIAL Research	200 acres 2007	Prescribed fire	Treatment unit consists of pure stands of whitebark pine (both upright and krummholtz forms) with less than 5% lodgepole pine and mountain hemlock present on the flanks of Mt. Scott.
West 62	1,215 acres 2005-2006	Prescribed fire	Treatment unit contains mixed conifer forest with patches of variable age-classes found between the west park boundary and hwy 62 west.
Crater Peak	500 acres 2007	Prescribed fire	Treatment unit is composed of mostly Shasta red fir with some mountain hemlock and minor amounts of lodgepole pine along the SW, S, and SE flanks of Crater Peak.
High Severity FMU			
Phoenix	1,500 acres 2003	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component.
Cornerstone	1,000 acres 2004	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component
Developed Zone FMU			
Mazama	270 acres 2003	Manual thin, pile burn	Treatment unit is composed of mountain hemlock, lodgepole and Shasta red fir forests in the Mazama Village Area including campground, dormitory, and sewage treatment facilities
Munson Valley-Rim Village	640 acres 2004	Manual thin, pile burn	Treatment unit includes mountain hemlock, Shasta red fir and lodgepole pine forests and sedge meadows associated with Park Headquarters, Munson Valley residential area, and visitor facilities at Rim Village.
Hwy 62 Fuel break	260 acres 2006	Mechanical thin	Treatment unit is centered along the highway 62 road corridor from park's west boundary to the intersection with Munson Valley road. Mixed conifer stands near the west boundary grade into pure stands of mountain hemlock and lodgepole pine above 5500 ft elevation.
Grayback-Pinnacles Fuel break	380 acres 2005	Mechanical thin	Treatment unit includes a mixed mosaic of mountain hemlock and lodgepole pine forests with dispersed sedge meadows along Grayback Motor-Nature Road and Pinnacles Valley Road, including Lost Creek Campground and

			facilities.

Under this alternative, areas previously treated by manual thinning would be subject to prescribed fire at a later date. This would eliminate the ground fuels accumulation (slash) as a result of the thinning process and begin to restore the natural fire regime to the treated stands. Manual thinning would involve the use of chainsaws. For mechanical fuel treatments, the park envisions the use of tracked/tired vehicles – a "harvester" and a "forwarder". Following the mechanical treatment, slash would be piled and burned, scattered, scattered and burned, or simply removed from the area.

As part of this alternative, the park would investigate the possibility of granting people "fuel wood collection permits." The permit would allow a person to access stockpiles and remove limited amounts of pre-cut wood for non-commercial purposes.

Park management would increase efforts to secure Memorandums of Understanding with neighboring land management agencies, including the National Forest Service, in order to manage wildland fires and prescribed fire across administrative boundaries. This approach reflects the understanding of the ecological role of fire in Crater Lake National Park and surrounding areas by the National Park Service, and its intent to replace the existing administrative boundaries of fire management with ecosystem-related boundaries.

Alternative 3 (Proposed Action) - Ecology Based Program Including Wildland Fire Use

This alternative meets the purpose and need through the designation of fire management units determined by broad wildland fire regimes and resource values at risk. This approach recognizes the ecological role of fire and provides a framework for developing fire management objectives, similar to those contained in the 1999 FMP, across agency boundaries. This alternative would include suppression of wildland fires, provide for prescribed fires and wildland fire use, and allow for manual and mechanical fuel treatments as fire surrogates. The particular mix of strategies implemented would be based on ecological needs and resource values at risk.

Fire management activities and FMUs would be similar to those described under Alternative 2. In addition, the park would allow for wildland fire use to help meet its fire management goals and objectives. Earth moving equipment such as tractors, graders, bulldozers or other tracked vehicles will generally not be used for fire management activities. The Superintendent can authorize the use of heavy equipment in extreme circumstances in the face of loss of human life and/or property.

Table 2-5 summarizes the total number of acres in each FMU, mean fire return intervals, and the approximate number of acres targeted for treatment in each FMU using prescribed fire, manual and mechanical thinning, and wildland fire use. Table 2-6 illustrates the proposed treatment activity by calendar year and FMU. Within the Fire Management Units, the park has identified 16 treatment units where it would conduct prescribed fire, manual, and/or mechanical fuel treatments. Table 2-7 identifies the treatments units within their respective FMU, depicts the proposed acreages and timing of treatments, and provides descriptions of the various treatment units. Table 2-8 summarizes the components of each alternative for comparison.

Table 2-5 Crater Lake National Park 5-Year Treatment Plan (Alternative 3 – Proposed Action)

FMU	Total Acres in FMU	Mean Fire Return Interval	Annual Treatment Targets (acres)[2]	Target Acres to be Treated over 5 Years	Breakdown of 5-year Target Acres to be Treated by			
					Fire Use[3] (per event)	Prescribed Fire	Manual Thinning	Mech. Thinning
Low	19,539	10-15 years	1,350-1,990	6,750-9,950	0-3,200	6,750	4,250[4]	
Moderate	22,957	40-60 years	383-563	1,915-2,815	0-900	1,915	190[4]	
High	105,224	80-100 years	500-1,300	2,500-6,500	0-4000	2,500	2,350[4]	
Developed	3,487	n/a	310	1,550	n/a		910[5]	640[5]
Total	**151,207[1]**		**2,543-4,163**	**12,715-20,815**	**0-8,100**	**11,165**	**7,700**	**640**

[1] The remaining 32,017 acres in the park contain non-forest vegetation, such as meadows, and non-combustible vegetation, e.g. Crater Lake, and are not included in fire management units. The acreages associated with non-forest vegetation and non-combustible vegetation are 21,111 acres and 13,293 acres respectively.
[2] Yearly amounts may vary according to weather and other planning/implementation considerations.
[3] The acres to be treated annually and under the 5-year treatment plan are equal to or greater than those displayed in Alternative 2 since wildland fire use is contemplated.
[4] Manual thinning target acres are captured under those acres to be treated by prescribed fire (e.g. after 4,250 acres of manual treatments are conducted in the Low-Severity FMU, those same acres and up to another 2,500 acres would be treated with prescribed fire, for a total treatment in that FMU of 6,750 acres, at a minimum).
[5] Manual and mechanical thinning treatments would be employed as fire surrogates.

Table 2-6 Proposed Treatment Activity by Calendar Year and Fire Management Unit (Alternative 3 – Proposed Action)

FMU	2002	2003	2004	2005	2006	2007
Low	1,500	0	1,500	1,500	750	1,500

Moderate	0	0	0	615	600	700
High	0	1,500	1,000	0	0	0
Developed	0	270	640	260	380	0
Total Acres[1]	1,500	1,770	3,140	2,375	1,730	2,200

[1] Total acres include those acres to be treated by prescribed fire and mechanical thinning. Manual thinning is already captured in those acres targeted for prescribed fire treatments since hand thinning will often be followed up with prescribed fire.

Table 2-7 Crater Lake National Park Treatment Units and Descriptions
(Alternative 3 – Proposed Action)

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
Low Severity FMU			
Panhandle	1,000 acres 2002-2003	Manual thin, prescribed fire	Treatment unit is composed of mixed patches of mature ponderosa pine with younger white fir and lodgepole pine and scattered mature sugar pine along Hwy 62. Portions of the area were treated with prescribed fire in the mid '70s and '80's.
Upper Pan	500 acres 2002-2003	Manual thin, prescribed fire	Treatment unit includes mature ponderosa pine and white fir with minor amounts of Shasta red fir and aspen located between highway 62 and the south park boundary above the panhandle.
Sun Creek	1,500 acres 2004	Manual thin, prescribed fire	Treatment unit consists of mixed-conifer stands of ponderosa pine, white fir and sugar pine in the Sun Creek drainage near the park's south boundary.
Sharp Desert	1,000 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary between Desert Creek and Sharps Peak.
TC South	500 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary north and west of Desert Creek.
Red Blanket	750 acres 2006	Manual thin, prescribed fire	Treatment unit includes mixed conifer forests with a Douglas fir component on the south facing slopes of upper Red Blanket canyon.
Crater Creek Ridge	1,500 acres 2007	Manual thin, prescribed fire	Treatment unit consists of mixed conifer forests above Crater Creek along the west park boundary.
Moderate			

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
Severity FMU			
PIAL Research	200 acres 2007	Prescribed fire	Treatment unit consists of pure stands of whitebark pine (both upright and krummholtz forms) with less than 5% lodgepole pine and mountain hemlock present on the flanks of Mt. Scott.
West 62	1,215 acres 2005-2006	Prescribed fire	Treatment unit contains mixed conifer forest with patches of variable age-classes found between the west park boundary and hwy 62 west.
Crater Peak	500 acres 2007	Prescribed fire	Treatment unit is composed of mostly Shasta red fir with some mountain hemlock and minor amounts of lodgepole pine along the SW, S, and SE flanks of Crater Peak.

Table 2-7 Crater Lake National Park Treatment Units and Descriptions
(Alternative 3 – Proposed Action Cont)

High Severity FMU			
Phoenix	1,500 acres 2003	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component.
Cornerstone	1,000 acres 2004	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component
Developed Zone FMU			
Mazama	270 acres 2003	Manual thin, pile burn	Treatment unit is composed of mountain hemlock, lodgepole and Shasta red fir forests in the Mazama Village Area including campground, dormitory, and sewage treatment facilities
Munson Valley-Rim Village	640 acres 2004	Manual thin, pile burn	Treatment unit includes mountain hemlock, Shasta red fir and lodgepole pine forests and sedge meadows associated with Park Headquarters, Munson Valley residential area, and visitor facilities at Rim Village.
Hwy 62 Fuel break	260 acres 2006	Mechanical thin	Treatment unit is centered along the highway 62 road corridor from park's west boundary to the intersection with Munson Valley road. Mixed conifer stands near the west boundary grade into pure stands of mountain hemlock and lodgepole pine above 5500 ft elevation.
Grayback-Pinnacles Fuel break	380 acres 2005	Mechanical thin	Treatment unit includes a mixed mosaic of mountain hemlock and lodgepole pine forests with dispersed sedge meadows along Grayback Motor-Nature Road and Pinnacles Valley Road, including Lost Creek Campground and facilities.

Environmentally Preferred Alternative

The National Park Service is required to identify the environmentally preferred alternative(s) for any of its proposed projects. That alternative is the alternative that will promote the national environmental policy expressed in NEPA (Section 101 (b)). This includes alternatives that:

1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2) ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

3) attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;

4) preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;

5) achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and

6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

In essence, the environmentally preferred alternative would be the one(s) that "causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (DOI, 2001a).
For this suite of alternatives, Alternative 3 (Proposed Action) is the environmentally preferred alternative for Crater Lake National Park since it meets goals 1, 2, 3, and 4 described above. Under this alternative, fire management activities would reduce hazardous fuel loadings in the park, and help restore natural ecological processes, including native vegetation function and structure. In addition, the alternative helps protect park resources and adjacent lands from the threat of future wildfires. Finally, the alternative best protects and helps preserve the historic, cultural, and natural resources in the park for current and future generations.

Table 2-8 Comparison of Fire Management Activities by Alternative

	Fire Suppression	Wildland Fire Use	Prescribed Fire	Manual Thinning	Mechanical Thinning	Fire Effects Monitoring	Research
Alt. 1	X	X	X			X	X
Alt. 2	X		X	X	X	X	X
Alt. 3	X	X	X	X	X	X	X

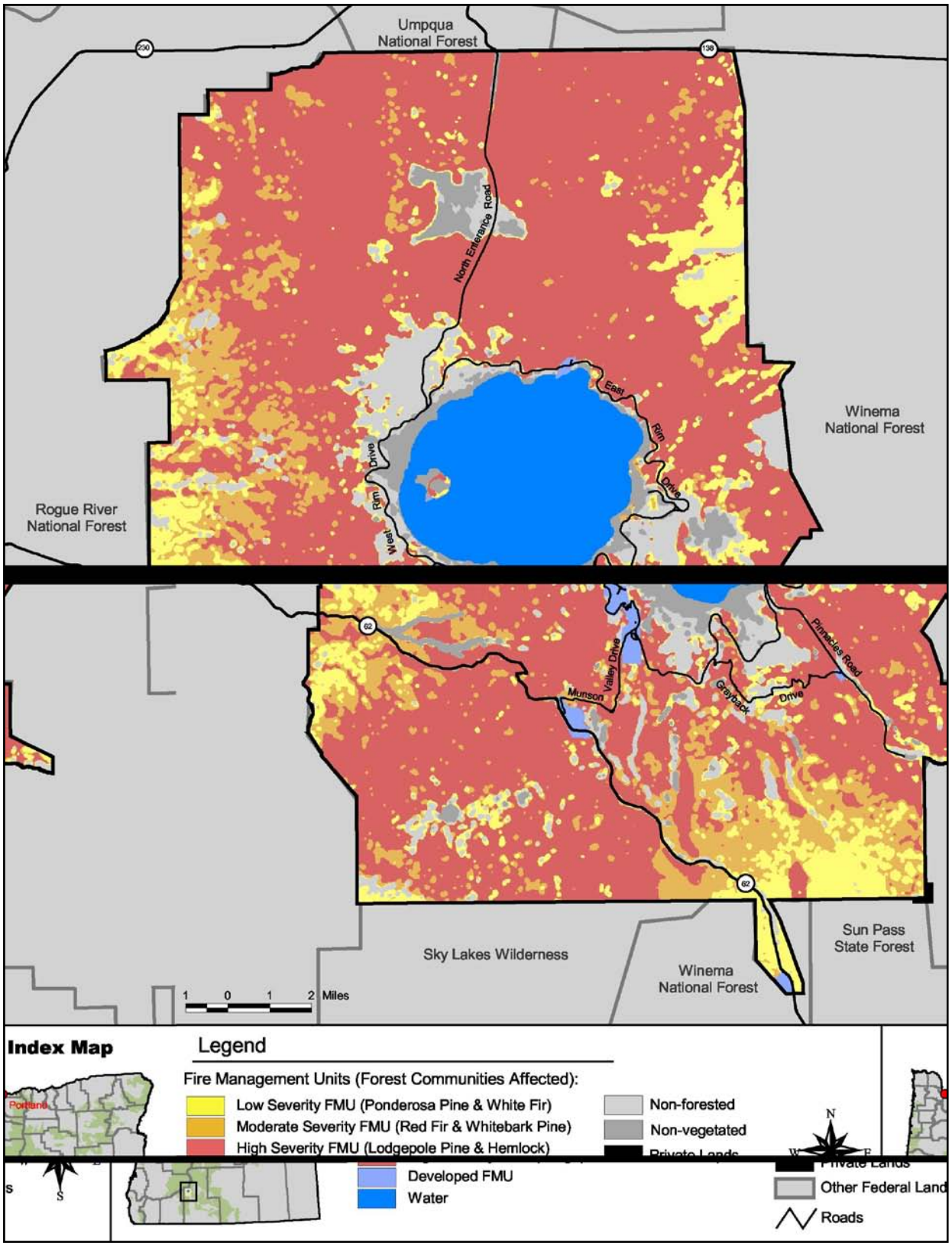


Figure 2-1 Fire Management Units for Alternatives 2 & 3

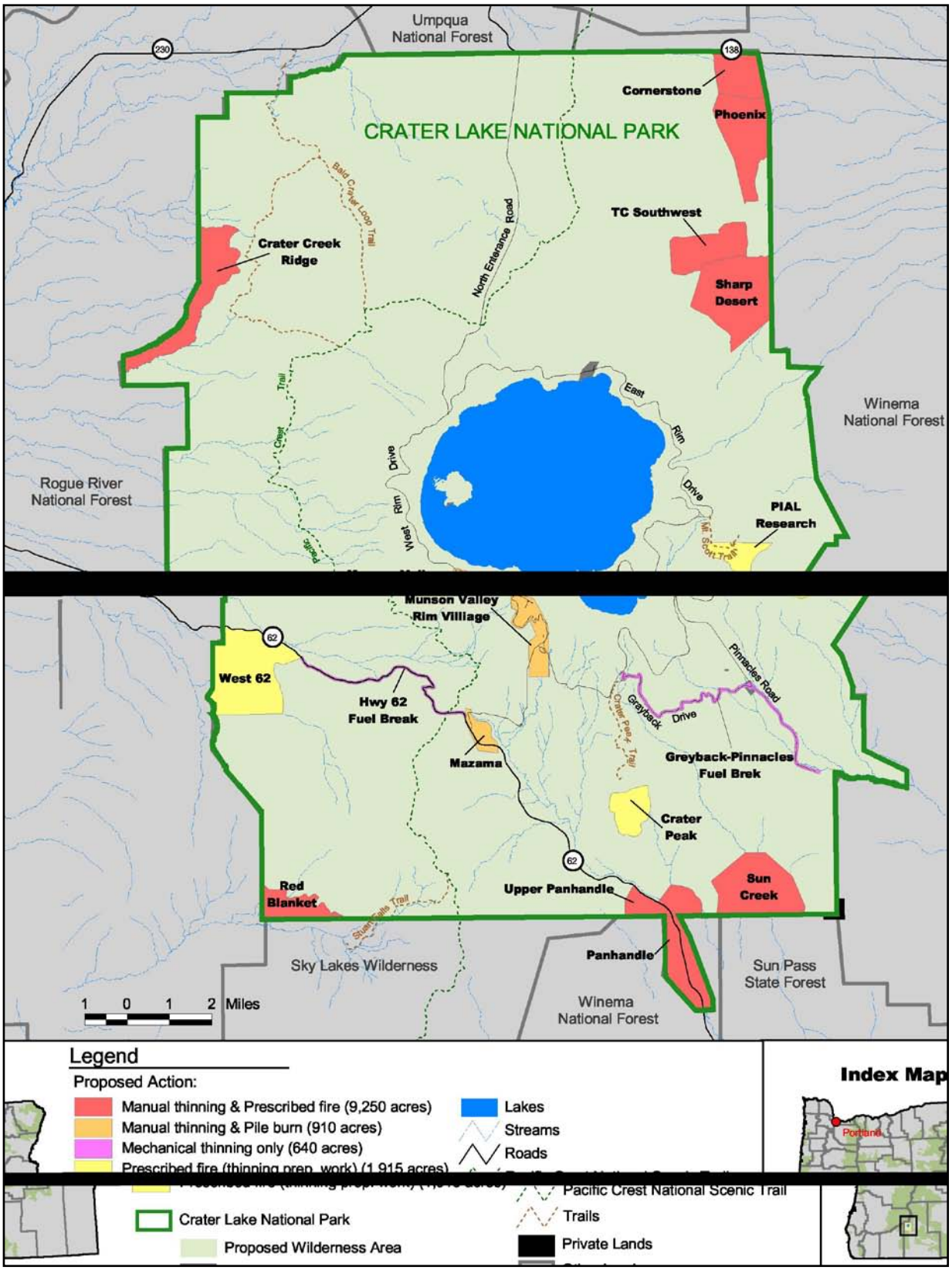


Figure 2-2 Proposed Treatment Units for Alternatives 2 & 3

Existing Environment

Species Accounts

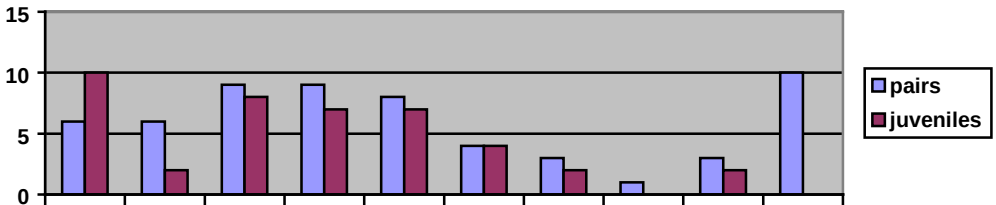
Bald eagle

Bald eagles are infrequent, seasonal residents at the park. One nesting pair of bald eagles was observed within the caldera along the shore of Crater Lake during the summer of 2001 (Buktenica 2001). No nesting pairs were observed between 1997 and 2000. There is one, unconfirmed observation of eagles historically nesting on Wizard Island. When encountered, they are most often seen roosting and foraging on or near the lake and streams of the park. Bald eagles are observed in the park from early spring, April or May, to fall, usually sometime in October. None are present during the winter months (USFWS 1998).

Northern spotted owl

In 2001, 12 of the 17 historic spotted owl activity centers were verified as being occupied. 10 pairs were observed, in addition to 1 adult male and one unknown adult at separate sites. None of the pairs produced any offspring. Surveys to determine nesting and reproductive status have been conducted annually since 1992, and using USFWS protocols since 1994. Park biologists have modified these protocols in only a limited way. Extensive snowpack at the park prevents access to owl habitat before mid-May, so surveys are not conducted between March 1 and May 15. This limits the park's ability to determine "nesting" status. In addition to surveying known sites, unoccupied suitable habitat is surveyed annually to detect dispersal and new occupation. All spotted owl activity centers have been found within areas identified as suitable habitat. The following figure summarizes reproductive history of owls at the park since surveys began.

Figure 3-1. Spotted Owl Reproductive History at Crater Lake National Park



	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
pairs	6	6	9	9	8	4	3	1	3	10
juveniles	10	2	8	7	7	4	2	0	2	0

Bull trout

Bull trout are found in two streams at the park: Sun Creek and Lost Creek. Park and Oregon Department of Fish and Wildlife (ODFW) stocking records indicate repeated stocking of rainbow trout and brook trout in Sun Creek, between 1926 and 1971 (USFWS 1998).

A survey of Sun Creek was initiated in the summer of 1989 to investigate the distribution and abundance of fish relative to habitat characteristics (Dambacher et al. 1992). Bull trout were only found in a limited reach of Sun Creek with a total population estimate of 150.

Beginning in 1992, non-native brook trout were removed from the upper and middle reaches of Sun Creek to help stabilize the bull trout population. Additionally, bull trout were introduced into Lost Creek following brook trout removal to reduce the risk of local extinction from a catastrophic event in Sun Creek (Girdner, 2002).

Results of single-pass snorkel surveys in 2001, indicate the total population of bull trout in both Sun Creek and Lost Creek at about 800 to 900 individuals (Buktenica, 2002).

Habitat Status

Bald eagle

Bald eagles are known to occasionally nest near Crater Lake but use it primarily as a feeding area. Eagles prefer large, old trees for nest sites. The forest types most similar to the Klamath Basin nest sites are the white fir and ponderosa pine types found at the park's lower elevations, away from the caldera. The park contains approximately 19,540 acres of white fir and ponderosa pine forests having a mosaic of age and size classes across the landscape. The majority of these acres are not within 1-mile of a permanent water body.

Northern spotted owl

The northern spotted owl is an old-growth dependent species that prefers complex forest structure. It is at the eastern end of its range in Crater Lake National Park. Potential suitable habitat is found in patches throughout the park, with a majority of the patches occurring southwest of a diagonal line running from the northwest to the southeast corners of the park. These habitat patches are comprised of closed-canopy, late-successional stands of

mountain hemlock *(Tsuga mertensiana),* Shasta red fir *(Abies amabilis v. shastensis)*, and white fir *(Abies concolor)* with minor amounts of western white pine *(Pinus monticola)*, lodgepole pine *(Pinus contorta)*, and incense cedar *(Calocedrus decurrens)* as understory cohorts. Stands contain numerous large snags and woody debris on the ground.

There are approximately 15,126 acres of suitable owl habitat in the park. Suitable habitat was delineated using a GIS analysis of satellite-derived land cover imagery dated 1995. Canopy closure and tree size-class data layers were used to identify forested areas with tree diameters greater than 21" and single or multi-storied stands with canopy closure greater than 70%. Approximately 5,719 acres of this suitable habitat is classified as nesting habitat where tree diameters exceed 32" and canopy closure is greater than 70%.

The park is located immediately to the northeast of a category 1, designated conservation area (OD-18). This DCA is located in the Western Oregon Cascades province and contains a total of 66,504 acres (DOI, 1992). The park contributes 960 acres of suitable habitat towards this conservation area and includes the Red Blanket owl activity center. The following table summarizes the amount of suitable habitat within a 12- mile diameter provincial home range (2,895 acres) of each owl activity center, that occur on NPS administered lands.

Table 3-1. Suitable Habitat Near Spotted Owl Activity Centers.

Spotted Owl Master Site Number	Site Identifier	Total Acres of Nesting Habitat w/ in 0.7 miles of Activity Center	Total Acres of Suitable Habitat w/ in 0.7 miles of Activity Center	Total Acres of Nesting Habitat w/ in 1.2 miles of Activity Center	Total Acres of Suitable Habitat w/ in 1.2 miles of Activity Center
2246	Sand Ridge	18	152	65	373
2939	Annie Creek	49	255	141	753
3408	Maklaks Crater	18	97	45	298
3409	Boundary Spring	15	60	44	216
3410	Crater Peak	54	171	93	335
3622	Red Blanket	81	511	165	960
3843	Little Copeland	61	289	129	614
3938	Castle Creek	61	359	133	741
3939	Crater Creek	38	201	84	445
4056	Crescent Ridge	24	116	58	317
4057	Bybee Creek	46	239	128	616
4386	Grayback Ridge	23	73	71	211

Bull trout

Sun Creek occupies a glacial valley that was inundated with hot ash and pumice, hundreds of feet deep, during Mount Mazama's climactic eruption more than 7,000 years ago. The creek originates from headwater springs, several hundred meters from the rim of the Mt. Mazama Caldera at approximately 2,200-m in elevation. In the upper reaches, Sun Creek meanders through sub-alpine meadows (Sun Meadow) and forest, and varies in width from 0.1m to 15 m. Stream discharge increases at the confluence of Vidae Creek, and Sun Creek

cascades down a series of natural waterfalls, some of which preclude upstream fish passage. Downstream from the waterfalls, the creek is incised into deep pumice deposits and meanders across a narrow valley floor. Fourteen kilometers downstream from its headwaters where Sun Creek leaves the park (elev. 1,400-m), it is 3 m to 6 m in width and seasonal flows vary between 20 and 63 cfs. Because of downstream water diversions for field irrigation, Sun Creek flows into Annie Creek and the Wood River, tributaries of the Upper Klamath Lake Watershed.

Old-growth mountain hemlock and Shasta red fir communities are the dominant vegetation types in the basin and in much of the riparian zone. Canopy closure, stream elevation, and the spring-fed nature of the stream maintain low daily water temperatures in the bull trout reach during low flow periods in summer and fall. For example, in August the water temperatures typically range from 3.3 to 11.7°C, whereas outside of the park boundary the temperature typically ranges from 6.0 to 15.1°C. Conductivity typically ranges between 30 and 46 S/cm in the bull trout reach. Sun Creek is commonly covered by snow from December through May.

Sun Creek actively erodes the base of adjacent hill slopes, which stand near their angle of repose, thus supplying large amounts of pumice sediment to the stream. Sand-sized and smaller sediment are actively transported during seasonal periods of low flow. Most substrate crevices are filled with pumice fines. In-stream structure is dominated by large wood, undercut banks, and pumice, with very little bedrock and boulder substrates (Dambacher et al. 1992). Outside Crater Lake National Park, Sun Creek crosses Oregon State Forestry land where lodgepole pine and ponderosa pine *(Pinus ponderosa)* are harvested. The lowermost reaches of Sun Creek cross private land in the Wood River Valley and are impacted by channelization, water withdrawal, and cattle grazing.

Lost Creek is a small spring-fed system that originates at 1,900 m in elevation and flows for approximately 2.5 km before it disappears into the pumice soil. There are no tributaries. The creek meanders through sub-alpine meadow and forest where it varies in width between 0.5 m and 15 m. August water temperatures vary between 3.3 and 9.7 °C.

Effects of the Proposed Actions

Direct and Indirect Effects

Bald eagle

Prescribed burning in white fir and ponderosa pine would likely reduce the threat of catastrophic fire while maintaining adequate nest trees for bald eagles. Hunting territories would be unchanged or enhanced. There is the expectation prescribed fire would have a positive effect, if any, on the hydrologic complex feeding wetlands in reducing evapo-transpirational area by killing some vegetation, and increasing annual water flow through wetlands; and a positive effect by creating a variety of successional stages that should result in an increase in habitat for small mammals and birds, on which eagles feed.

No fire management activities are planned for the inner walls of the lake caldera, where the active bald eagle nest site occurs. Fire suppression actions, if necessary on Wizard Island, would prohibit direct overflights of the nest site between March 15 and August 30 each year.

Northern spotted owl

Fire has the potential to degrade habitat for northern spotted owls, particularly if high severity fires occur on a wide scale and in old growth forest stands. When fire historically occurred, owl habitat may have been damaged for a decade or two and destroyed for longer times only in limited areas. The wildfires of today, burning in higher fuel loads and more uniform multi-layered canopies, have resulted in an increased proportion of stand replacement fire, which can destroy owl habitat. Hazard fuel treatments, including the use of prescribed fire and wildland fire use, would increase landscape diversity relative to fire, so that the potential for catastrophic fire would be reduced. Monitoring of owls on the Yakima Indian Nation in eastern Washington indicated that radio-telemetered owls continued to forage in light-to moderate-severity patches created by wildfire, but only unburned nest sites continued to be used.

Understory burning reduces dead fuel loads and vertical fuel continuity within a treatment area. Although this reduces catastrophic fire potential for some time, the elimination of a multi-layered understory may result in sub-optimum owl habitat at that site, so it would not be done over wide areas in the same decade.

Wildland fire use would be allowed in spotted owl habitat. Over most of the habitats where fire and owls may both occur, the fire regimes are primarily mixes of low and moderate severity, with patches of high severity and unburned islands also occurring. Annual surveys conducted by the park locate spotted owl nest sites

and activity centers, so that suppression strategies would be used to protect these areas during prescribed fires or wildland fire use.

Hazardous fuels reduction activities in the Crater Creek, Crater Peak, Highway 62, and Red Blanket Treatment Units would have the potential to impact spotted owl activity centers and interrupt nesting activity. Up to 20% of the suitable habitat could be altered around four of the activity centers, assuming low to moderate severity effects to the vegetation (See Table 4-1). To maximize habitat benefits from thinning, prescribed fire, and wildland fire use in or near spotted owl activity centers, and to eliminate the potential for disturbing nesting owls, several mitigation measures would be employed (see Section 5.0 – *Conservation Measures/ Mitigation*). Among these measures would be a prohibition of treatment activities during the breeding season. Owl nesting and foraging behavior would be the focus of post-fire monitoring to help guide future spotted owl and fire management activities.

Table 4-1. Summary of Habitat Acres Effected by the Proposed Action

Spotted Owl Master Site Number	Suitable Habitat Acres w/ in 12 mi. before implementation	Suitable Habitat Acres w/ in 12 mi. after implementation	Percent change
2246	373	373	0%
2939	753	753	0%
3408	298	298	0%
3409	216	216	0%
3410	335	268	20%
3622	960	768	20%
3843	614	614	0%
3938	741	593	20%
3939	445	356	20%
4056	317	317	0%
4057	616	616	0%
4386	211	211	0%

Bull trout

The event most likely to affect upper Sun Creek or Lost Creek, and in turn the bull trout, is a high-severity forest fire. The Sun Creek watershed near the caldera is in the mountain hemlock type, but it grades quickly into the red fir type, characteristic of a moderate-severity fire regime. Past fire activity appears to be moderate severity for the most part. The Lost Creek watershed is comprised mostly of lodgepole pine with a minor presence of the mountain hemlock type. Past fire activity has been high severity in nature.

Management of bull trout in Sun Creek and Lost Creek over the long run would depend on avoiding catastrophic disturbance. Catastrophic disturbance is more likely to occur the longer a fire exclusion policy is implemented in these watersheds. Currently, wildland fire use is projected to create patchy effects and would prevent large-scale stand replacement fire in the Sun Creek and Lost Creek watersheds.

Fire suppression actions would totally avoid the use of fire retardant/ foam in the Lost Creek and upper Sun Creek watersheds. The chemical toxicity of retardant and foam would be a major risk to a fish population constrained to one or two waterways. Fireline construction by hand outside of the riparian corridor would not have any effect on the population. Fire camps within riparian corridors would not be constructed.

In the lower Sun Creek watershed, past fire suppression has led to abnormally large increases in woody fuels that would also limit the application of prescribed fire unless predicated by manual fuel treatments.

Wildland fire use would be allowed in the Sun Creek treatment unit, but the amount of terrain affected by high-severity burning from such fires would be constrained. Usually in the red fir zone, high-severity burns affect less than 1/3 of the burned area. If no more than 1/2 of the upper watershed is burned in any 20 year period (this includes low, moderate, and high severity patches), this would keep "opened" areas of high severity fire to 20 % or less of the potentially forested area of the upper watershed during any time period. Suppression strategies would be employed when the projected size for any single wildland fire use reached the cumulative limit of 1/2 of the total acreage of the upper watershed in any 20-year period. Otherwise wildland fire use would be allowed to burn in this area over time until they are projected to meet these limits. In this way, fire would approximate a natural role while not placing the bull trout population at risk.

Moderate severity fire would maintain a source of snags and coarse woody debris for the stream channel. It may reduce shading effects on the stream channel from current levels, but upper Sun Creek is an incised channel, oriented in a north-south direction, in parent material created from volcanic avalanche deposits. Upland burning with less than 20% high severity fire would minimally change shading effects on stream temperature.

Prescribe fire treatments are planned for 1,500 acres surrounding the lower reaches of Sun Creek.

Riparian area buffers of appropriate width would be implemented along Sun Creek to ensure that stream shading and coarse woody debris sources are maintained.

Interdependent and Interrelated Effects

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have independent utility apart from the action under consideration. Interdependent and interrelated activities are assessed by applying the 'but for" test, which asks whether any action and its associated impacts would occur "but for" the proposed action.

There are no interrelated and interdependent activities identified for the proposed action beyond those associated with a specific alternative for the fire management program.

Cumulative Effects

The cumulative effects analysis for the Fire Management Plan environmental assessment considered the past, present, and reasonably foreseeable future actions on land uses that could add to (intensify) or offset (compensate for) the effects on the resources and that may be affected by the Fire Management Plan alternatives. These effects are summarized in table 4-1.

As the ESA defines cumulative effects, there are no future State or private activities not involving Federal activities that are reasonably certain to occur within the action area of this federal action that is the subject of consultation.

Conservation Measures

Crater Lake National Park follows the methods outlined in the NPS National Fire Monitoring Handbook (DOI, 2001) to acquire standardized information on fire behavior and the effects of fire on park resources, especially vegetation. This allows the park to document basic information, to detect trends, and to ensure that fire and resource management objectives are being met in areas that are subject to burning by wildland or prescribed fire. This monitoring program is reviewed annually by regional- and park-level fire ecology program staff.

Every fire event within Crater Lake National Park will be monitored, and each mitigation measure listed below will be evaluated to determine 1) if it was implemented as stated, and 2) to evaluate if it was effective at mitigating the impact to the resource it was designed to protect. Monitoring reports will become part of the permanent record of each fire event.

Mitigation measures are prescribed to prevent and/or mitigate adverse environmental impacts that may occur from fire management activities. The following mitigation measures are common to all three alternatives.

Fire Management Activities Mitigation

- Whenever consistent with safe, effective suppression techniques, the use of natural barriers will be used as extensively as possible;
- Fire retardant agents must be on an approved list for use by the Forest Service and Bureau of Land Management;
- Heavy earth-moving equipment such as tractors, graders, bulldozers or other tracked vehicles will generally not be used for fire suppression. The Superintendent can authorize the use of heavy earth-moving equipment in extreme circumstances in the face of loss of human life and/or property;
- When handline construction is required, construction standards will be issued requiring the handlines to be built with minimum impact. No handlines exposing mineral soil will be allowed through cultural sites, and all handlines will be rehabilitated. Erosion control methods will be used on slopes exceeding 10% where handline construction took place;
- All sites where improvements are made or obstructions removed will be rehabilitated to pre-fire conditions, to the extent practicable;
- Heavy earth-moving equipment will use multiple entry and exit points within a treated area;
- Heavy earth-moving equipment will be prohibited in all Research Natural Areas;
- Helispots or camps are prohibited within the boundaries of all Research Natural Areas;
- If fire needs to be stopped in the Desert Creek RNA, water and appropriate foams will be recommended over fire line construction at the meadow edge. Phosphorus/clay based retardants will be banned within the RNA boundaries. If fire line construction is necessary, it will be best achieved at the forest-meadow edge rather than through the middle of the meadow;
- Fire suppression activities, including the use of foams and retardants, will be barred from Llao Rock RNA;
- Educational/informational materials will be developed and distributed to the wilderness visitor on what to expect during fire management activities including potential noise from chainsaws during line construction, smoke dispersion, safety, helicopter and airplane use, and information on where and when these activities would occur;
- A rehabilitation plan as required by NPS-18, with the use of a Burned Area Emergency Rehabilitation (BAER) Team, will be formulated and implemented in advance of demobilization from major fire events.

Soil and Water Resources (Including Wetlands) Mitigation

- Creek or river crossings will be limited to set and existing locations;

- Except for spot maintenance to remove obstructions, no improvements will be made to intermittent/perennial waterways, springs or seeps, trails, or clearings in forested areas;
- Riparian areas, which have been burned, may be seeded with native seed from native genotypes, as specified in a Burned Area Emergency Rehabilitation (BAER) plan;
- Fire lines will be located outside of highly erosive areas, steep slopes, and other sensitive areas;
- Fire control strategies will be sensitive to wetland values, and firelines will not "tie" into wetland or bog margins except when relying on those areas to naturally retard the fire without constructed line;
- Foams and retardants will not be used in the Sphagnum Bog RNA or within 200 feet of the upstream surface waters.
- Heavy earth-moving equipment will not be used in the Sphagnum Bog RNA or in any "fragile environment";
- Mechanical fuel treatments will not be conducted within 200 feet of any surface water resource;
- Crews will implement Minimum Impact Suppression Techniques (MIST) fire suppression guidelines to minimize and/or eliminate adverse soil impacts resulting from ground crew activities;
- Heavy equipment associated with mechanical fuel treatments will scatter the slash generated from its operation on site to provide a buffer between the soils and equipment;
- Mechanical equipment will use multiple entry and exit points within a treated area to minimize concentrated soil compaction or soil disturbance impacts resulting from continued use of a single entrance and/or exit;
- Crews will implementation MIST fire suppression guidelines to minimize and/or eliminate adverse impacts to surface water resources. These include:
    - Preferred use of water for aerial drops
    - Prohibition of fire retardant use in the Sun Creek Drainage, Lost Creek Drainage, and the caldera
    - Prohibition of Crater Lake, Sun Creek, and Lost Creek as water sources
    - Restriction of camps and toilet facilities from being located within 200 feet of surface water resources;

Wildlife and Plants Mitigation

- All fires located within 100 acres of a known spotted owl nest or activity center, will be suppressed;
- Repetitive understory burning in spotted owl habitat will be limited to one occurrence per decade;

- No direct overflights of known T&E species nest sites will be allowed below 1500 Above Ground Level (AGL) from March 15 to August 30 each year;
- During the spotted owl breeding season (March 15 to August 30), manual thinning and prescribed fire treatments will not be conducted in those portions of treatment units that are within 0.7 mile of spotted owl nest sites or activity centers;
- Mechanical fuel treatments will be prohibited within 100 acres of a known spotted owl nest or activity center;
- Prescribed fire and manual thinning treatments will be very limited in nature within 100 acres of a known spotted owl nest or activity center;
- Within 0.7 miles of any known spotted owl nest site or activity center, 40% of the area will be protected from extensive prescribed fire and manual thinning treatments, while 60% will be subject to such treatments;
- Within 12 miles of each known spotted owl nest site or activity center, at least 40% of the area will be protected from fire, and up to 60% will be subject to prescribed fire;
- To protect bull trout habitat, no more than one-half of the upper Sun Creek and Lost Creek watersheds will be allowed to burn in any 20 year period;
- If threatened, endangered, or sensitive plant species are found in a treatment unit, a buffer surrounding the plants will be imposed that prohibits physical damage to the identified population. The assigned Resource Advisor will be consulted when determining the appropriate buffer;
- Prior to prescribed fires in the Panhandle Treatment Unit, park staff will treat the area adjacent to the highway using appropriate hand control methods to reduce chances of spreading known populations of non-native spotted knapweed and St. Johnswort. Park staff will monitor the area after prescribed fires for their occurrence and employ appropriate hand control methods to remove the noxious weeds if they are present;
- Park staff will clean fire management equipment prior to its use to prevent the spread of noxious weeds;
- Park staff will stage fire management operations away from known noxious weed infestations, and will construct fire lines away from known patches;
- Park staff will survey for noxious weeds in treatment units prior to ignition of prescribed fires;
- Any fires occurring in the area of the Sphagnum Bog, Thousand Springs, upper Castle Creek, Copeland Creek, and Trapper Creek would be monitored for post-fire impacts to *Collomia mazama*.

Determination of Effects

A determination of effect has been assigned to each alternative based on the planned and foreseeable actions associated with implementing a fire program as described in section 2.0. The determinations are summarized in Table 6-1.

Table 6-1 Determination of Effect by Alternative

Species	Alt 1(No Action)	Alt 2	Alt 3 (Proposed Action)
Haliaeetus leucophalus (Bald eagle)	NLAA	NLAA	NLAA
Strix occidentalis caurina (Northern spotted owl)	LAA	LAA	LAA
Salvelinus confluentus (Bull trout)	NLAA	NLAA	NLAA

NLAA = Not Likely to Adversely Affect LAA = Likely to Adversely Affect

Determination for Federally Listed Species and Critical Habitat

"It is my determination that implementation of any of the proposed actions *May Affect, But is Not Likely to Adversely Affect* bald eagles."
"It is my determination that implementation of any of the proposed actions *May Affect, And is Likely to Adversely Affect* northern spotted owls or its designated critical habitat."
"It is my determination that implementation of any of the proposed actions *May Affect, But is Not Likely to Adversely Affect* bull trout."

Rationale for the Determinations

Bald eagle

There are limited occurrences of bald eagles in the park. Annual surveys of eagle occurrence and nesting status are provided to fire management staff in a way that ensures protection to bald eagles by allowing appropriate management responses to planned and unplanned fire events.

Northern spotted owl

Fuel reduction projects (wildland fire use and prescribed fire) will modify forest stand structure near existing owl activity centers and habitat in the short-term. The threat of catastrophic fire or an escaped fire from planned ignitions exists and will likely persist for one to two decades into the future. Annual surveys of spotted owl occurrence and nesting status are provided to fire management staff in a way that maximizes protection to spotted owls by allowing appropriate management responses to planned and unplanned fire events. In the long-term, forest landscapes

occupied by spotted owls will be less threatened by catastrophic fire with the re-introduction of fire-created and fire-maintained forest patches.

Bull trout

Bull trout occurrence is limited to two known creeks in the park. An active recovery program has been in place for 10 years and population estimates show a positive trend. Bull trout protection is ensured using appropriate management responses to planned and unplanned fire events based on bull trout distribution and habitat information. Fuel reduction projects (wildland fire use and prescribed fire) will reduce the threat of catastrophic fire within the Sun Creek and Lost Creek drainages.

United States Department of the Interior
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Klamath Falls, Oregon 97603-9365
(541) 885-8481 FAX: (541) 885-7837

In Reply Refer To:
1-10-02-F-213

August 16, 2002

Memorandum

To: Superintendent, Crater Lake National Park, Crater Lake, Oregon

From: Project Leader, Klamath Falls Fish and Wildlife Office,
U.S. Fish and Wildlife Service, Klamath Falls, Oregon

Subject: Crater Lake National Park's Fire Management Plan - Biological Opinion and Concurrence Memorandum for Proposed Fire Management Plan, Crater Lake, Oregon.

This memorandum includes a concurrence statement and transmits a biological opinion issued in response to a request by Crater Lake National Park (CRLA). The May 24, 2002, request is for formal consultation with the U.S. Fish and Wildlife Service (Service) for the proposed Fire Management Plan (FMP) for CRLA. The request is pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 et. seq.) (Act), as amended.

After reviewing the potential impacts of the proposed project, CRLA reached a "**no effect**" determination for the endangered (Applegate's milk vetch (*Astragalus applegatei*), endangered Lost River sucker *(Deltistes luxatus),* shortnose sucker (*Chasmistes brevirostris*) and the threatened Canada lynx (*Lynx canadensis*). The Service has no information that is contrary to CRLA's determination and those species will not be addressed further in this document.

CRLA has also determined that the proposed action "**may affect**" but "**is not likely to adversely affect**" the bald eagle *(Haliaeetus leucocephalus)* and bull trout (Salvelinus confluentus). Both species are federally listed as threatened. The Service concurs with your determination and outlines the reasons for that concurrence in this memorandum.

An effects determination of "**likely to adversely affect**" was made on the northern spotted owl (*Strix occidentalis caurina*) and the Biological Opinion that considers the effects that the FMP may have on that species is attached.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Klamath Falls Fish and Wildlife Office
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(541) 885-8481 FAX (541)885-7837

In Reply Refer To:
8-10-09-TA-080062

JAN 16 2009

Memorandum

To: Superintendent, Crater Lake National Park,
Crater Lake, Oregon

From: Field Supervisor, Klamath Falls Fish & Wildlife Office
Klamath Falls, Oregon

Subject: Request for a one-year extension to the 2002 Biological opinion on Crater Lake National Park's Fire Management Plan

On January 12, 2009, the U.S. Fish and Wildlife Service (Service) received the Crater Lake National Park's (Park) memorandum requesting an extension of the Service's 2002 Biological Opinion (BO) on the Fire Management Plan (FMP) on lands administered by the Park. The 2002 BO addressed proposed mechanical and manual fuel treatment activities in the Park, including wildland fire use, through 2007. The Park has requested that the 2002 BO be extended until October 31, 2009, at which point the Park will enter into a new consultation on a new FMP for the next five years. The extension would satisfy consultation requirements under section 7 of the Endangered Species Act of 1973, as amended, and its implementing regulations, for the Park's activities during the 2009 field season.

To date, the Park has implemented 2,253 acres of the approximately 12,700 acres consulted on in 2002 and two wildland fire use fires have occurred in the Park (D. Paulson, pers. comm., September 11, 2008). In the 2009 field season, the Park plans to continue to implement those proposed manual and mechanical fuels treatments identified in their FMP as previously reviewed and consulted in the 2002 BO. Both the Service and the Park have reviewed the 2002 Biological Assessment (BA) and BO and believe that the effects to bull trout *(Salvelinus confluentus)* and the northern spotted owl (*Strix occidentalis caurina)* and their associated habitats will be generally the same and of the same magnitude. Proposed treatments in 2009 will follow the activities and Conservation Measures outlined in the 2002 BA and BO.

Based on the review of effects of the proposed action and proposed Conservation Measures within the 2002 BA and BO, the Service has determined that the 2009 fuels treatments are not likely to adversely affect bull trout, but are likely to adversely affect the northern spotted owl.

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FISH AND WILDLIFE SERVICE

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In Reply Refer To:
8-10-10-81450-08-TA-0062

JUN - 8 2010

Memorandum

To: Superintendent, Crater Lake National Park,
Crater Lake, Oregon

From: Field Supervisor, Klamath Falls Fish & Wildlife Office
Klamath Falls, Oregon

Subject: Extension of the 2002 Biological Opinion for Crater Lake National Park's Fire Management Plan

On June 1, 2010, the U.S. Fish and Wildlife Service (Service) received the Crater Lake National Park's (Park) memorandum requesting an extension of the Service's 2002 Biological Opinion (BO) on the Fire Management Plan (FMP) on lands administered by the Park. The 2002 BO addressed proposed mechanical and manual fuel treatment activities in the Park, including wildland fire use, through 2007. The Park was most recently granted an extension for the 2002 BO through October 31, 2009. The Park has requested that the 2002 BO be extended through December 2010, at which point the Park will enter into a new consultation on a new FMP. The extension would satisfy consultation requirements under section 7 of the Endangered Species Act (ESA) of 1973, as amended, and the ESA's implementing regulations, for the Park's activities during the 2010 field season.

In the 2010 field season, the Park plans to continue to implement those proposed manual and mechanical fuels treatments identified in their FMP as previously reviewed and consulted upon in the 2002 BO. Both the Service and the Park have reviewed the 2002 Biological Assessment (BA) and BO. The effects to bull trout (*Salvelinus confluentus*) and northern spotted owl (*Strix occidentalis caurina*) and their associated designated and/or proposed critical habitats will be generally the same and of the same magnitude as previously consulted upon. Proposed treatments in 2010 will follow the activities and Conservation Measures outlined in the 2002 BA and BO. As such, the Service believes an extension of the BO through December 2010, is warranted.

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DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the implementation of the FMP for CRLA. The FMP recognizes the ecological role of fire in natural habitats and provides a framework for developing fire management objectives. It provides strategies for suppression of wildland fires, use of prescribed fires and some wildfires, and proposes manual and mechanical fuel treatments as fire surrogates.

Under the FMP, the following four fire management units (FMUs) are described for CRLA: Low Severity, Moderate Severity, High Severity, and Developed (see Figure 2-1 of the BA). All FMUs, with the exception of Developed, are based upon broad fire regimes and resource values at risk. These fire management units provide the context with which to chose the most suitable strategy to achieve CRLA goals. The particular mix of strategies implemented in each unit would be based on ecological needs and resource values at risk.

Prescribed Fire

Prescribed fire is the use of fire to achieve specific goals related to reducing the risk of catastrophic wildfires and returning fire to an ecosystem that thrives best with fire as a natural component. Prescribed fire is aimed at specific FMP objectives and will follow required FMP project design standards.

Prescribed fire is applied to small units of lands only when fuel and weather conditions fit a predetermined burn plan. These units are prepared by digging handline to mineral soil around the perimeter, some pruning along the line with chainsaws (after wilderness minimum tool assessment) or using natural barriers such as snow, creeks, roads and trails to enclose the unit in a controlled line. Personnel then light fuels in the unit using fusees or drip torches. The fire is then monitored and Aheld@ by a fire crew to ensure the fire is contained and controlled.

Wildland Fire Use

Wildland fire use is the concept of using a naturally ignited fire (e.g. lightning) to achieve goals appropriate for the area where the ignition occurred. The fire is assessed relative to very specific parameters of topography, weather, fuel types and resource risk, and if appropriate the fire is allowed to burn in a low intensity manner to achieve resource objectives while being monitored. The application of this strategy is very dependent on the natural ignition falling within strict burn parameters.

Manual Thinning

Since a significant portion of fire risk is related to the amount and arrangement of fire fuels, risk can be managed by reducing or changing the arrangement of fuels on the landscape. Manual thinning of live and dead brush and small diameter trees is accomplished by crews working with hand tools including chainsaws. Slash from these thinnings will be lopped and scattered or burned in small piles.

Mechanical Thinning

For mechanical fuel treatments, the park envisions the use of tracked/tired vehicles B a Aharvester@ and a Aforwarder@ to remove fuels. Following the mechanical treatment, slash would be piled and burned, scattered, scattered and burned, or simply removed from the area. The possibility of allowing the public to use some of the wood for firewood is also under consideration.

Wildfire Suppression

The actions performed to suppress wildfires are varied and are applied in many different combinations to achieve control of destructive and potentially destructive wildfires. Tools used to suppress wildfires range from large crews digging hand line with hand tools to (in extreme cases) bulldozers blading wide lines to mineral soil, setting backfires to reducing the availability of fuel, and aircraft dropping fire retardant and water.

STATUS OF SPECIES IN THE ACTION AREA

<u>Bald eagles</u>

CRLA currently has one known bald eagle nest and territory. It is located within the caldera, near the lakeshore.

<u>Bull trout</u>

Bull trout are found in two streams in CRLA: Sun Creek and Lost Creek. CRLA=s BA states that single-pass snorkel surveys in 2001 found a total population of bull trout in both Sun Creek and Lost Creek of about 800 to 900 individuals (CRLA=s BA).

EFFECTS OF THE PROPOSED ACTION

Bald eagle

Nesting eagles can be disturbed by noise, vehicles or human activity in the area of the nest. If disturbance is significant enough it can cause abandonment of the nest, eggs and premature fledging of young. Adult eagles tend to be most sensitive during early periods of the nesting season (Jan - March). Fledglings are most vulnerable in late June - July. No prescribed fire activities are planned for areas near the one known nest.

In the case of a wildfire within the caldera or on Wizard Island aircraft used for suppression activities would be prohibited from direct overhead flights (less than 1,500 feet above ground level) from March 15 - August 30. Nesting eagles may still experience some low level or noise from aircraft activity in the caldera. It is possible that wildfire suppression noise and activities may preclude eagles from some temporary roosts or flush eagles from temporary perches, these effects will be reduced by the implementation of the nesting area restriction and if affects occur they are expected to be insignificant.

Bull trout

The most likely manner in which bull trout could be affected would be by prescribed fire or other ground disturbing activities causing a loss of riparian vegetation leading to increased sedimentation inputs to bull trout habitat and/or chemical fire retardant being introduced into the habitat. Sediment can smother fish eggs and affect fishes ability to breathe. Fire retardant is lethal to fish.

Activities such as fire camps and use of ground disturbing mechanical suppression or thinning techniques which can damage riparian areas adjacent to bull trout habitats would not be allowed in the riparian area. Any thinning operations in preparation for prescribed fire would use manual techniques.

Wildfire suppression actions would prohibit the use of fire retardant/foam in the Lost Creek and upper Sun Creek watersheds (unless deemed necessary for protection of life, property or firefighter safety by the Incident Commander and Command Staff).

Wildland fire use would be allowed in the Sun Creek treatment unit, but the amount of terrain affected by high-severity burning from such fires would be constrained. Suppression strategies would be employed when the projected size for any single wildland fire use reached the cumulative limit of 1/2 of the total acreage of the upper watershed in any 20-year period.

During prescribed fire treatments near Sun Creek, riparian area buffers of appropriate width would be implemented along Sun Creek to ensure that stream shading, sufficient ground cover and coarse woody debris sources are maintained.

DETERMINATION

Based on the Service=s review of the BA of May 24, 2002, the type of project and the project design features that reduce the effects to listed species, we concur with your determination that the proposed project, may affect, but is not likely to adversely affect bald eagles and bull trout. Consequently, further consultation, pursuant to section 7(a)(2) of the Act is not required.
The primary reason for this concurrence includes project design features that will avoid most impacts of the project to this species or its habitat. These include:

1) Restrictions on operations of aircraft around active bald eagle nests.

2) Planning fire use, prescribed fire and thinning operations in the bull trout watersheds to ensure that even though a maximum treated area limit of 50% is acceptable, that the burns and treatments making up that maximum are distributed widely over the 20 year period both temporally and spatially to reduce cumulative impacts to the watershed.

The authority and decision to implement or not implement conservation measures/ project design features during wildfire suppression is always retained by the Incident Commander in consultation with command staff and is made with the protection of life, property and firefighter safety as the priority concern above ESA considerations.

No take of bald eagles or bull trout are authorized under this informal consultation. If the proposed action changes in any manner that may affect a listed species or critical habitat, you must contact us immediately to determine if additional consultation is required. If you have any questions please contact Doug Laye of my staff at (541) 885-8481.

Attachment:

Biological Opinion for Crater Lake National Park=s Fire Management Plan

cc:
Craig Tuss, FWS, Roseburg, OR

BIOLOGICAL OPINION

1.0 INTRODUCTION

This biological opinion was prepared using: 1) the 1999 Crater Lake National Park Fire Management Plan; 2) a Biological Assessment (BA) for the FMP (2002); 3) previous biological opinions, file information, and reference materials located at the Service=s Klamath Falls Fish and Wildlife Office; 4) the Forest Ecosystem Management Assessment Team Report (FEMAT) (USDA et al. 1993); 5) the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the NSO (FSEIS) (USDA and USDI 1994a); 6) the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the NSO (also known as ANorthwest Forest Plan@ or NWFP) (USDA and USDI 1994a and 1994b); and 7) the Service=s BO for Alternative 9 (USDI 1994) of the FSEIS.

The FMP is intended to serve as a long-term planning document. The estimates for acreage treated and the impact analysis is set in a six year framework. Therefore this biological opinion will be valid until December 31, 2007. At that time CRLA will meet with the Service to review the FMP and determine how to proceed in future years.

1.1 Consultation History

111 Northwest Forest Plan (NWFP)

On October 8, 1993, the Secretaries of Agriculture and Interior (Secretaries) initiated formal consultation on the preferred alternative (Alternative 9) in the final Supplemental Environmental Impact Statement on Management for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (FSEIS) (USDA and USDI 1994a). On February 10, 1994, the Service issued a biological opinion determining that implementation of the proposed action was not likely to jeopardize the continued existence or cause adverse modification of critical habitat of any listed species. The NWFP is programmatic in nature and did not address site specific activities and their effects on NSO and critical habitat. These specific assessments were deferred to future consultations in which more specific information on baseline conditions and the proposed project actions and impacts could be incorporated. The NWFP amended the management plans of the affected Bureau of Land Management and Forest Service lands. National parks were reserved by act of Congress for specific resource purposes. The NWFP describes them as Congressionally Reserved Areas. The decision on the NWFP did not alter any of

Congressionally Reserved Areas=s land management plans. However since the NWFP forms the backbone upon which the NSO is to be conserved, consultations on the NSO must be performed within the context of the NWFP.

1.12 Local Coordination

On September 23, 1998 the Service (Southwest Oregon Field Office) delivered a BO on CRLA=s supplemental BA for their 1987 FMP. Then in July of 2000, CRLA contacted the Service about how to treat the newly listed Canada lynx in their FMP. By this time the Klamath Falls Fish and Wildlife Office had become the office responsible for threatened and endangered species consultation for CRLA.

CRLA began development of a revised FMP shortly after that initial contact. The Service was given a draft EA in November of 2000 and the Serviced reviewed it for endangered species issues. In December a Interdisciplinary Team (IDT) of specialists from CRLA, and personnel of the Service and the Winema, Deschutes, and Umpqua National Forests was assembled to develop a new FMP. Meetings were held on January 19, 2001, February 6, 2001, March 6, 2001, April 17, 2001, and July 23, 2001. Changes in IDT personnel, fire season and planning issues slowed the plan development. A consulting firm, Mangi and associates was contracted to work through the National Environmental Policy Act issues and documents and finally in May of 2002 a BA was delivered to the Service.

2.0 DESCRIPTION OF THE PROPOSED ACTION

General

The proposed action is the implementation of the FMP for CRLA. The FMP recognizes the ecological role of fire in natural habitats and provides a framework for developing fire management objectives. It provides strategies for suppression of wildland fires, use of prescribed fires and some wildfires, and proposes manual and mechanical fuel treatments as fire surrogates.

Under the FMP the following four fire management units (FMUs) are described for CRLA: Low Severity, Moderate Severity, High Severity, and Developed. (see Figure 2-1 of the BA). All FMUs, with the exception of Developed, are based upon broad fire regimes and resource values at risk. These fire management units provide the context with which to chose the most suitable strategy to achieve CRLA goals. The particular mix of strategies implemented in each unit would be based on ecological needs and resource values at risk.

Prescribed Fire

Prescribed fire is the use of fire to achieve specific goals related to reducing the risk of catastrophic wildfires and returning fire to an ecosystem that thrives best with fire as a

natural component. Prescribed fire is aimed at specific FMP objectives and will follow required FMP project design standards.

Prescribed fire is applied to small units of lands only when fuel and weather conditions fit a predetermined burn plan. These units are prepared by digging handline to mineral soil around the perimeter, some pruning along the line with chainsaws (after wilderness minimum tool assessment) or using natural barriers such as snow, creeks, roads and trails to enclose the unit in a controlled line. Personnel then light fuels in the unit using fusees or drip torches. The fire is then monitored to ensure the fire is contained and controlled.

Wildland Fire Use

Wildland fire use is the concept of using a naturally ignited fire (e.g. lightning) to achieve goals appropriate for the area where the ignition occurs. The fire is assessed relative to very specific parameters of topography, weather, fuel types and resource risk, and if appropriate the fire is allowed to burn in a low intensity manner to achieve resource objectives while being monitored. The application of this strategy is very dependent on the natural ignition falling within strict parameters.

Manual Thinning

Since a significant portion of fire risk is related to the amount and arrangement of fire fuels, risk can be managed by reducing or changing the arrangement of fuels on the landscape. Manual thinning of live and dead brush and small diameter trees is accomplished by crews working with hand tools including chainsaws. Slash from these thinnings will be lopped and scattered or burned in small piles.

Mechanical Thinning

For mechanical fuel treatments, the park envisions the use of tracked/tired vehicles B a Aharvester@ and a Aforwarder@ to remove fuels. Following the mechanical treatment, slash would be piled and burned, scattered, scattered and burned, or simply removed from the area. The possibility of allowing the public to use some of the wood for firewood is also under consideration.

Wildfire Suppression

Wildfires are unplanned events and FMPs can only describe the tools and methods that could commonly be applied to lands in response to wildfires. The FMP, nor an analysis of effects of the FMP can accurately predict where a wildfire will take place. Nonetheless, as requested, the general effects of wildfire suppression methods that could commonly be applied to contain wildfires were analyzed in the BA to: 1) provide a generic set of Minimum Impact Suppression Techniques (MIST) and other conservation measures most compatible with threatened and endangered species that may or may not be used as deemed by fire suppression personnel as appropriate to the emergency conditions present at the time; and 2) to limit the need for multiple consultations on wildfires that have common suppression methods and result in a discountable risk of adverse effects or effects which are insignificant.

The actions performed to suppress wildfires are varied and are applied in many different combinations to achieve control of destructive and potentially destructive wildfires. Tools used to suppress wildfires range from large crews digging hand line with hand tools to (in extreme cases) bulldozers blading wide lines to mineral soil, setting backfires to reducing the availability of fuel and may include the use of aircraft dropping fire retardant and water.

The FMP includes a strategy for suppressing wildfires (page 28-30 of the BA) and CRLA has requested consultation on wildfire suppression as a part of the FMP,. Included in the FMP is an extensive list of conservation/mitigation measures designed to reduce or eliminate impacts to sensitive habitats, plants and wildlife. Among these conservation/mitigation measures are MIST strategies. These techniques were developed to reduce or minimize impacts to natural resources, listed species and their habitats. In the event CRLA suppression actions employ MIST and the conservation measures as analyzed in the BA, additional after-the-fact consultation on suppression actions via 50CFR 402.05 is not likely to be necessary.

However, the authority and decision to implement or not implement MIST or conservation measures during wildfire suppression is always retained by the Incident Commander in consultation with command staff and is made with the protection of life, property and firefighter safety as the priority concern above ESA considerations.

Any suppression actions or portions of actions that did not utilize MIST and the conservation measures **and** may have affected threatened and endangered species or their habitat (as determined by CRLA biologists) would require consultation with the Service using the emergency consultation process of 50CFR 402.05.

Summary of Proposed Impacts

The FMP proposes to treat approximately 12,700 acres over the next six calendar years (Table 1). That is approximately six percent of the total area of the park.

Table 1 Acreage Proposed for Treatment by Calendar Year and Fire Management Unit (adapted from Table 2-6 of the BA)

FMU	2002	2003	2004	2005	2006	2007
Low	1,500	0	1,500	1,500	750	1,500
Moderate	0	0	0	615	600	700
High	0	1,500	1,000	0	0	0
Developed	0	270	640	260	380	0
Total Acres[1]	1,500	1,770	3,140	2,375	1,730	2,200

[1] Total acres include those acres to be treated by prescribed fire and mechanical thinning. Manual thinning is already captured in those acres targeted for prescribed fire treatments since hand thinning will often be followed up with prescribed fire.

Table 2 shows the locations of the proposed treatments, descriptions of the areas and methods used to achieve the objectives.

Table 2 Crater Lake National Park Treatment Units and Descriptions
(adapted from Table 2-7 of the BA)

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
Low Severity FMU			
Panhandle	1,000 acres 2002-2003	Manual thin, prescribed fire	Treatment unit is composed of mixed patches of mature ponderosa pine with younger white fir and lodgepole pine and scattered mature sugar pine along Hwy 62. Portions of the area were treated with prescribed fire in the mid >70s and >80=s.
Upper Pan	500 acres 2002-2003	Manual thin, prescribed fire	Treatment unit includes mature ponderosa pine and white fir with minor amounts of Shasta red fir and aspen located between highway 62 and the south park boundary

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
			above the panhandle.
Sun Creek	1,500 acres 2004	Manual thin, prescribed fire	Treatment unit consists of mixed-conifer stands of ponderosa pine, white fir and sugar pine in the Sun Creek drainage near the park's south boundary.
Sharp Desert	1,000 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary between Desert Creek and Sharps Peak.
TC South	500 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary north and west of Desert Creek.
Red Blanket	750 acres 2006	Manual thin, prescribed fire	Treatment unit includes mixed conifer forests with a Douglas fir component on the south facing slopes of upper Red Blanket canyon.
Crater Creek Ridge	1,500 acres 2007	Manual thin, prescribed fire	Treatment unit consists of mixed conifer forests above Crater Creek along the west park boundary.
Moderate Severity FMU			
PIAL Research	200 acres 2007	Prescribed fire	Treatment unit consists of pure stands of whitebark pine (both upright and krummholtz forms) with less than 5% lodgepole pine and mountain hemlock present on the flanks of Mt. Scott.
West 62	1,215 acres 2005-2006	Prescribed fire	Treatment unit contains mixed conifer forest with patches of variable age-classes found between the west park boundary and hwy 62 west.
Crater Peak	500 acres 2007	Prescribed fire	Treatment unit is composed of mostly Shasta red fir with some mountain hemlock and minor amounts of lodgepole pine along the SW, S, and SE flanks of Crater Peak.
High Severity FMU			
Phoenix	1,500 acres 2003	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component.

Cornerstone	1,000 acres 2004	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component
Developed Zone FMU			
Mazama	270 acres 2003	Manual thin, pile burn	Treatment unit is composed of mountain hemlock, lodgepole and Shasta red fir forests in the Mazama Village Area including campground, dormitory, and sewage treatment facilities
Munson Valley-Rim Village	640 acres 2004	Manual thin, pile burn	Treatment unit includes mountain hemlock, Shasta red fir and lodgepole pine forests and sedge meadows associated with Park Headquarters, Munson Valley residential area, and visitor facilities at Rim Village.
Hwy 62 Fuel break	260 acres 2006	Mechanical thin	Treatment unit is centered along the highway 62 road corridor from park=s west boundary to the intersection with Munson Valley road. Mixed conifer stands near the west boundary grade into pure stands of mountain hemlock and lodgepole pine above 5500 ft elevation.
Grayback-Pinnacles Fuel break	380 acres 2005	Mechanical thin	Treatment unit includes a mixed mosaic of mountain hemlock and lodgepole pine forests with dispersed sedge meadows along Grayback Motor-Nature Road and Pinnacles Valley Road, including Lost Creek Campground and facilities.

2.1 Project Design Features to Reduce Effects to NSO

The following conservation measures for NSOs and NSO habitat are proposed by CRLA as a standard part of all projects (page 30 of BA).

> All fires located within 100 acres of a known spotted owl nest or activity center, will be suppressed;
>
> Repetitive understory burning in spotted owl habitat will be limited to one occurrence per decade;

No direct overflights of known T&E species nest sites will be allowed below 1500 Above Ground Level (AGL) from March 15 to August 30 each year;

During the spotted owl breeding season (March 15 to August 30), manual thinning and prescribed fire treatments will not be conducted in those portions of treatment units that are within 0.7 mile of spotted owl nest sites or activity centers;

Mechanical fuel treatments will be prohibited within 100 acres of a known spotted owl nest or activity center;

Prescribed fire and manual thinning treatments will be very limited in nature within 100 acres of a known spotted owl nest or activity center;

Within 0.7 miles of any known spotted owl nest site or activity center, 40% of the area will be protected from extensive prescribed fire and manual thinning treatments, while 60% will be subject to such treatments;

Within 12 miles of each known spotted owl nest site or activity center, at least 40% of the area will be protected from fire, and up to 60% could be subject to prescribed fire;

If threatened, endangered, or sensitive plant species are found in a treatment unit, a buffer surrounding the plants will be imposed that prohibits physical damage to the identified population. The assigned Resource Advisor will be consulted when determining the appropriate buffer.

To provide information for implementation of the above measures, CRLA will conduct surveys each year to acquire information on the nesting status of owls in the area.

3.0 STATUS OF THE NORTHERN SPOTTED OWL - RANGEWIDE

3.1 Species description and life history

The NSO, one of three subspecies of spotted owls, occupies late-successional and old-growth habitats from southern British Columbia through western Washington, Oregon, and California as far south as Marin County (USDI 1990b). Northern spotted owls rely on these older forest habitats because they generally contain the structures required for nesting, roosting, foraging, and dispersal. These structures include: a multi-layered, multi-species canopy dominated by large overstory trees; moderate to high canopy closure; a high incidence of trees with large cavities and limb deformities for use in nesting; numerous large snags; an abundance of large, dead wood on the ground; and open space within and below the upper canopy for owls to fly (Thomas et al. 1990, USDI and 1990a). Forested stands with high canopy closure also provide thermal cover and protection from predation. Mostly nocturnal, NSOs eat small mammals such as flying squirrels (*Glaucomys* spp.), mice (*Peromyscus* spp.) and woodrats (*Neotoma* spp.) (Thomas et al. 1990). Also birds and insects comprise a small portion of their diet (Forsman et al. 1984). The NSO=s dietary species composition varies geographically and by forest type. Forsman et al. (1984) found that flying squirrels (*Glaucomys sabrinus*) and red tree voles (*Arborimus longicaudus*) were generally more prominent in Douglas-fir and western hemlock forests, while dusky-footed woodrats (*Neotoma fuscipes*) dominated the diet in the Klamath Mountains Province.

During daylight hours, NSOs prefer to roost in older forests that provide cool temperatures during hot weather and protection from weather during rainy months (Forsman et al. 1984, USDI 1990b). Forsman et al. (1984) found roosting NSOs close to the ground in small trees, shrubs and on downed logs during hot weather, although the individuals were often on south facing slopes which are warmer than north facing slopes.Northern spotted owls generally lay two eggs (range 1-4) and nest in cavities and on

platforms, primarily in Douglas-fir trees (Forsman et al. 1984, LaHaye 1988). Reproductive behavior starts in March and continues into June, although elevation influences the exact timing of nesting (USDI 1990b). After the young fledge from the nest, they are still dependent on their parents until they are able to fly and hunt on their own. This parental care continues post-fledging into September (USDI 1990b), and sometimes into October (Forsman et al. 1984). During this time the adults may not roost with the young during the day, but they will respond to begging vocalizations by bringing food to the young (Forsman et al. 1984). Juvenile NSOs experience extremely high mortality rates (USDI 1990b, Miller 1989). Miller (1989) reported a first year survival rate for juvenile NSOs of 23 percent, an indication that juvenile owls are extremely vulnerable during their first year. Leading known causes of mortality are starvation and predation by great horned owls (Miller 1989, USDI 1990b). Competition with barred owls (*Strix varia*) may be a significant threat to NSOs as barred owls increase in numbers throughout the range of the NSO. Barred owls are also thought to impact NSOs through displacement (Kelly 2001).

Northern spotted owl home range size varies by physiographic province and generally increases from south to north, which is likely in response to decreasing habitat quality (USDI 1990b). While there are differences in the natural stand characteristics that influence provincial home range size, habitat loss and forest fragmentation caused by timber harvest effectively reduce home range habitat quality. Data indicate that a reduction in the amount of available NSO suitable habitat reduces NSO abundance and nesting success (Bart and Forsman 1992).

Several demographic studies are ongoing within the range of the NSO and data analysis recurs every three years. The most recent analysis indicates that, while still declining, the degree and extent of the decline may be less severe than previously thought (Forsman et al. 1996, Franklin et al. 1999).

A detailed account of the taxonomy, ecology, and reproductive characteristics of the NSO is found in the 1987 and 1990 U. S. Fish and Wildlife Service Status Reviews (USDI 1987, USDI 1990a); the 1989 Status Review Supplement (USDI 1989); the Interagency Scientific Committee (ISC) Report (Thomas et al. 1990); and the final rule designating the NSO as a threatened species (USDI 1990b).

3.2 Listing Status

The spotted owl was Federally listed as a threatened species in Washington, Oregon and California on July 23, 1990, primarily due to a loss of nesting habitat (USDI 1990b). Critical habitat was designated for the spotted owl on February 14, 1992 (USDI 1992a).

3.3 Distribution and abundance of Northern Spotted Owls

There are approximately 7,265,000 acres of suitable spotted owl habitat across the species= range (USDI 2001a) Table 2. Recent demography studies (Burnham et al. 1996, Franklin et al. 1999) indicate that the NSO population is declining. Franklin et al. (1999) analyzed data from 15 individual demographic study areas throughout the range of the northern spotted owl between 1985 and 1998 and estimated that there was a 3.9 percent average annual decline in the population of territorial female owls. However, rates of decline varied among individual study areas from stationary populations to substantial declines. These demographic studies are ongoing and data analysis indicates that while still declining, the degree and extent of the decline is less severe than previous analysis indicated. It is currently unknown whether the changes in population trends reflect responses to reduction in timber harvest on Federal lands or simply more years of data (Franklin et al. 1999). While this decline is expected to continue to occur as spotted owl sites with severely degraded habitat conditions become inactive, implementation of the Northwest Forest Plan is expected to abate the decline by protecting all spotted owl sites within Late-Successional Reserves (USDI 1994). The NWFP is expected to provide for the conservation of the species by allowing non-suitable, but capable habitat to regenerate within the LSRs to allow the population to increase and stabilize across its range.

Table 3: Suitable Owl Habitat Evaluation Baseline for Northwest Forest Plan Lands (in acres and rounded to nearest 1000)

RESERVES	Late Successional Reserves (LSRs) and Managed Late Successional Areas (MLSAs)	3,250,000
	Congressionally Reserved Areas (CRAs)	1,634,000
CONNECTIVITY	Administratively Withdrawn Areas (AWAs)	299,000
	Adaptive Management Areas (AMAs)	363,000

	Matrix	1,853,000
TOTAL		7,399,00

Source: USDI 2001a

3.4 Critical Habitat

Designation of critical habitat identifies lands that are considered essential for the conservation of a listed species. As such, NSO critical habitat was based upon the conservation principles emphasized by the ISC strategy (Thomas et al. 1990) as represented by the primary constituent elements of 1) suitable habitat to support population clusters, and 2) support for dispersal (USDI 1992a). One hundred and ninety Critical Habitat Units (CHU), encompassing about 3.1 million acres of suitable NSO habitat (Table 4), were identified using NSO habitat maps available in the early 1990s. Critical habitat units were intended to identify a network of habitats that provided the functions considered important to maintaining a stable, self-sustaining, and interconnected population over the NSO range with each CHU having a local, provincial, and a range-wide role in NSO conservation. Most CHUs were expected to provide suitable habitat for population support, while some were designated primarily for connectivity (or both).

Table 4: Critical Habitat Baseline within the Boundaries of the Northwest Forest Plan (in acres and rounded to nearest 1000)

Data Type	Washington	Oregon	California	Total
Evaluation Baseline	1,030,000	1,694,000	406,000	3,130,000

Source: USDI 2001a

The Service's approach to designating critical habitat was based on the expectation that a long-term plan would be developed to provide for conservation of the NSO. The final rule designating critical habitat (USDI 1992a) states that ACritical habitat is primarily intended to identify the habitat that meets the criteria for the primary constituent elements. Designation will help retain recovery options and reduce the near-term risk until

a long-term conservation plan is implemented.@ The rule also states that ADesignation of critical habitat does not offer specific direction for managing owl habitat. That type of direction will come ... through the development of land management plans that address management of the owl.@ The rule also expressed the expectation that the physiographic province be the primary scale of analysis for evaluating project-related effects to critical habitat to determine if the range-wide conservation goals are being met.

Since the designation of spotted owl critical habitat, the Departments of Interior and Agriculture developed a conservation strategy (the Northwest Forest Plan) for all late-successional forest species, including the spotted owl. The NWFP was based upon the work of the Interagency Scientific Committee (ISC) and the spotted owl draft recovery plan and establishes a network of Late Successional Reserves (LSR) which generally overlap critical habitat. The Federal government adopted the NWFP to serve as the Federal contribution to spotted owl recovery. The special management considerations afforded to designated LSRs, and other land allocations under the NWFP also provide for the establishment and maintenance of the primary constituent elements of spotted owl critical habitat.

Since both the NWFP and critical habitat applied the same ISC principles, and both efforts used similar habitat data and maps, it is not unexpected that the results of identifying large blocks of habitat would be similar. As such, about 70 percent of the acres in CHUs are included in LSRs, with NSO habitat in other Land Unit Allocations (LUA) and in the Matrix also contributing to connectivity (and some population support). Although the NWFP was designed using the ISC principles, it also incorporated recommendations from the NSO recovery team (USDI 1992b), used more recent and complete data, and was further strengthened to address the needs of other late-successional forest-associated species. Therefore, the Service concluded in its 1994 BO on the NWFP that the reserve/connectivity strategy of that plan (as described in the preceding sections) was a reasonable match for critical habitat and would perform the habitat/dispersal functions of critical habitat. The Service also concluded (as noted above) that the NWFP would provide the basis for the Federal contribution to recovery of this species. The redundancy of function between critical habitat and the NWFP reduces the significance of adverse effects to CHUs for this species and, as a result, consultations conducted on critical habitat since 1994 have considered effects to critical habitat in the context of NWFP=s ability to support the biological functions of the constituent elements intended by the critical habitat designation.

3.5 Changes to Habitat 1994 - 2001- Rangewide

3.5.1 Changes to suitable habitat - Rangewide

Since 1994, the Service has consulted on many actions associated with implementation of the NWFP and other Federal activities that may affect the spotted owl or its suitable and critical habitat. The geographic scale of these consultations varies from individual timber sales or habitat conservation plans (HCPs) to multiple actions covering multiple administrative units. In general, the analytical framework of these consultations is based on the reserve/connectivity goals, achieved through the NWFP LUAs designed specifically to provide for those functions (USDI 2001a:4), and is expressed in terms of changes in suitable owl habitat within those LUAs. As such, the role of consultation is to assess whether actions preclude the reserve/connectivity goals (owl conservation needs) of the NWFP, not the adequacy of the NWFP. The success of the NWFP reserve/connectivity functions will primarily be based on whether they are meeting these goals as verified through a monitoring and research program, and is predicated on the expectation that management changes would occur through an active adaptive management process (USDA/USDI 1994a and b; Lint et al. 1999).

Since the NWFP was signed, there has been a range-wide reduction in the amount of suitable spotted owl habitat of approximately 134,000 acres (Table 5). This loss of acres (through removal and downgrading) equates to a 1.8 percent reduction in the amount of available Nesting, Roosting and Foraging (NRF) habitat across the range of the spotted owl. The majority of those 134,000 acres (95.5 %) were harvested in either the Matrix or Adaptive Management Area (AMA) land allocation where the NWFP anticipated that the majority of timber harvest would occur.

Table 5: Suitable Owl Habitat Baseline on Northwest Forest Plan Lands and Summary of Effects (in acres and rounded to nearest 1000)

Data Type	Reserves		Connectivity			Total
	LSR/MLSA	CRAs	AWAs	AMAs	Matrix	
Evaluation Baseline	3,250,000	1,634,000	299,000	363,000	1,853,000	7,399,000
Removed/ Downgraded	6,000	0	400	9,000	119,000	134,000
Difference	3,244,000	1,634,000	299,000	354,000	1,734,000	7,265,000

Percent Change	<0.2%	0	0	2.5%	6.4%	18%

Source: USDI 2001a

3.5.2 Changes to Critical Habitat - Rangewide

Since the NWFP, approximately 35,000 acres of suitable spotted owl habitat have been removed from the critical habitat network across the range of the spotted owl. This is a reduction of approximately 1.1 percent of the total critical habitat acres (Table 6). Within Oregon, 28,000 acres of suitable spotted owl habitat have been removed from CHUs since the NWFP; this is a 17 percent reduction in the state=s 169 million acres of suitable spotted owl habitat in critical habitat.

Table 6: Critical habitat baseline and summary of effects (in acres and rounded to nearest 1000)

Data Type	Washington	Oregon	California	Totals
Evaluation Baseline	1,030,000	1,694,000	406,000	3,130,000
Removed/ Downgraded	6,000	28,000	500	35,000
Difference	1,024,000	1,666,000	405,000	3,095,000
Percent Change	0.6%	17%	0.1%	1.1%

Source: USDI 2001a

Recently, the Service completed a range-wide spotted owl baseline evaluation of the spotted owl and its critical habitat based on data from consultations completed from 1994 to present (USDI 2001a). This range-wide report is based on a year-long effort to better compile and evaluate information reported in all BOs involving effects to the spotted owl or its critical habitat that have been issued since 1994. In brief, this evaluation found that consulted-on effects regarding the removal and downgrading of suitable spotted owl habitat are below the 2.5 percent estimated by the NWFP to be removed from Federal lands each decade, that not all consulted-on effects have actually occurred on the ground as of this time, that the range-wide effects to critical habitat are minimal, and that HCPs are generally providing demographic support and/or connectivity with NWFP lands. The report concludes that consulted-on effects from 1994 to present are consistent with the assumptions for the first decade of NWFP implementation as identified in the Service=s 1994 biological opinion, and that effects to critical habitat do not impair its ability to contribute to recovery of the owl across its range.

3.6 Non-Federal Lands

Although all previous efforts to develop conservation plans for the spotted owl identified the importance of contributions from non-federal (including State, Tribal, and private) lands, specific expectations for these lands have never been finalized. As a result, most interactions with these landowners rely on the recommendations in the ISC plan (Thomas et al. 1990), the final draft recovery plan (USDI 1992b), Forest Ecosystem Management Assessment Team (FEMAT) (USDA et al 1993), and the NWFP (USDA/USDI 1994a) as general guidance. Since implementation of the NWFP in 1994, consistency with and support to the NWFP (for the spotted owl) has been the primary focus of conservation efforts with non-federal landowners. The Service=s primary expectations for these lands are for contributions to demographic support (pair or cluster protection) or to provide connectivity with NWFP lands. A review of the 13 HCPs issued to date that address the owl indicates that they are generally providing those functions across the landscape (USDI 2001a). However, there is a considerable time scale difference between HCPs and actions consulted on for the NWFP and other agencies; the term of most large-scale HCPs covers periods of 20 to 100 years (and more) whereas the term of actions on NWFP lands is from 1 to 5 years. Therefore, their effects and contributions need to be considered over a longer time frame. As such, the primary evaluation question focuses on the long-term contribution of these plans (i.e., consistency with NWFP expectations).

State Forest Practice Regulations

- Washington: In 1993 the State Forest Practices Board adopted rules (Forest Practices Board 1996) that would Acontribute to conserving the northern spotted owl and its habitat on non-federal lands,@ based on recommendations from a Science Advisory Group (SAG) which identified important non-federal lands and recommended roles for those lands in owl conservation (Hanson et al. 1993, Buchanan et al. 1994). Owl-related HCPs in Washington (USDI 2001a) generally provide the demographic support and connectivity support that are recommended in these reports, and the draft recovery plan (USDI 1992b), and provide support to the Forest Plan.

- Oregon: The Oregon Forest Practices Act provides for protection of 70-acre owl core areas around known nest sites, but does not provide for protection of owl habitat beyond these areas (ODF 2000). In general, there is no large-scale spotted owl habitat protection strategy or mechanism currently present on non-federal lands in Oregon. The four owl-related HCPs currently in effect address relatively few acres of land; however, they will provide some nesting habitat and connectivity over the next few decades (USDI 2001a).

- California: In 1990 State Forest Practice Rules (FPRs), which govern timber harvest on private lands, were amended to require surveys for northern spotted owls in suitable habitat and to provide protection around activity centers (CDF 2001). Under the FPRs, no timber harvesting plan (THP) can be approved if it is likely to result in incidental take of federally-listed species, unless authorized by a Federal HCP. The California Department of Fish and Game reviewed all THPs to ensure that take was not likely to occur, and the Service took over that review function in 2000. Several large industrial owners operate under Spotted Owl Management Plans, concurred in by the Service, in which they=ve specified the basic measures they will undertake for owl protection. Three HCPs, authorizing take of northern spotted owls, have been approved (NWFP). Implementation of these plans will provide for owl demographic and connectivity support to NWFP lands.

3.7 Conservation Needs of the Species

The NSO was listed as threatened in 1990 due to the loss of suitable habitat from timber harvest, which had been exacerbated by catastrophic events (USDI 1990b). Since listing, there have been numerous efforts to address NSO conservation, beginning with the ISC=s Conservation Strategy (Thomas et al. 1990), continuing with the designation of critical habitat (USDI 1992a), the draft recovery plan (USDI 1992b), and the Scientific Advisory Team report (Thomas et al. 1993), and culminating with the NWFP (USDA and USDI

1994a). Each of these conservation strategies were based upon the conservation principles first articulated in the ISC=s report and summarized as follows:

1. Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range; large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs;

2. Blocks of habitat that are close together are better than blocks far apart;

3. Habitat that occurs in less fragmented (that is, contiguous) blocks is better than habitat that is more fragmented; and

4. Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

As in the ISC=s Conservation Strategy, the NWFP emphasizes protection of large blocks of a habitat (LSRs) to provide for clusters of breeding pairs of NSOs (and other late-successional forest species) that are connected by habitat (Matrix) to support survival and movement across the landscape between reserves. The NWFP reserve network is designed to protect late-successional forest species, such as the NSO. While the scientists expected NSO populations to decline in the Matrix over time, populations were expected to stabilize and eventually increase within LSRs as habitat conditions improved over the next 50-100 years (USDA et al.1993, USDA and USDI 1994a and b). Hence, the NWFP is expected to provide for a more stable and better distributed population of late-successional forest species, including the NSO, over time.

The 1990 Spotted Owl Status Review Committee stated that population size is primarily a function of the amount and distribution of available habitat (USDI 1990a). The system of reserves set up under the NWFP is distributed range-wide in order to capture the variety of ecological conditions within the 12 different physiographic provinces to which NSOs are adapted and to reduce the potential for loss of the entire population due to large catastrophic events in a single province. Multiple, large LSRs in each province reduce the potential that NSOs will be lost in any individual province and reduce the potential that large wildfires or other events will eliminate all habitat within a LSR. In addition, LSRs are generally arranged and spaced so that NSOs may disperse to two or more adjacent LSRs. This network of reserves, distributed across the landscape, reduces the likelihood that catastrophic events will impact the meta-population connection between portions of a province or between provinces. However, FEMAT (USDA et al. 1993) noted the ability to

form an extensive reserve network to meet NSO conservation needs was constrained by limited Federal ownership and the natural limitations in such areas as the Eastern Oregon and Northern California Cascades.

For implementing the system of reserves and connectivity between reserves, the NWFP included standards and guidelines (S&Gs) for managing all agency actions, and provided for an annual timber harvest program that would be consistent with the conservation principles of the NWFP (USDA and USDI 1994a and b). In 1994, the Service issued a BO on the NWFP that assessed the effects of adopting this comprehensive management plan on Federal lands. In that opinion, we concluded that the NWFP would provide for a stable and self-sustaining NSO population on Federal lands and, on that basis, provide the Federal contribution to NSO recovery (USDA and USDI 1994a). This conclusion was based on the assumption that the provinces would provide the building blocks for conserving this species. As such, the Service concluded that if the NWFP was implemented as the FEMAT scientists intended, it would provide the basis for evaluating actions under the Act.

3.8 Evaluation and Aggregation of Additional Effects Since the Rangewide Report of June 2001

In June 2001, the Service completed a range-wide baseline update for the spotted owl (USDI 2001a). The report concludes that consulted-on effects from 1994 to present are consistent with the assumptions for the first decade of Northwest Forest Plan implementation as discussed in our 1994 biological opinion on that plan, and that effects to critical habitat have not impaired the Northwest Forest Plan=s contribution to recovery of the owl across its range.

From June 2001 to January 18, the Service has issued 21 BOs and one concurrence letter covering habitat loss and/or incidental take of spotted owls (Table 7).

Table 7. BOs issued by the Service with effects to spotted owls, June 26, 2001 to January 18, 2002

PROJECT NAME	BO LOG #	PHYSIOGRAPHIC PROVINCE/ ADMINISTRATIVE UNIT	ACTIVITY TYPE
Reinitiation of Umpqua NF FY2000 program of activities	1-15-01-F-705	Western Oregon Cascades/ Umpqua NF	Precommercial thinning
FY2002- 2003 timber sale projects for the Siskiyou and Rogue River National Forests and Medford BLM	1-7-01-F-032	Oregon Klamath / Medford BLM, Rogue River NF, Siskiyou NF	Timber harvest
Umpqua NF 2001 activities	1-15-01-F-112	Western Oregon Cascades/ Umpqua NF	Prescribed fire, cell tower construction
Extension of USFS road 3200-650	1-7-02-F-233	Oregon Coast Range/ Siuslaw NF	Road construction
Knob timber sale	1-11-00-F-36	California Klamath/ Klamath NF	Timber sale
Road Maintenance, trail maintenance, facilities and campground repair projects on the Klamath National Forest	1-11-00-F-14	California Klamath/ Klamath NF, Six Rivers NF	Road/ trail maintenance, campground repair
Tacoma Green River HCP	1-3-01-FW-0101	Western Washington Cascades	HCP
Confederated Tribes of Warm Springs - Northside timber sales	1-7-01-F-207	Eastern Oregon Cascades	Timber sales

PROJECT NAME	BO LOG #	PHYSIOGRAPHIC PROVINCE/ ADMINISTRATIVE UNIT	ACTIVITY TYPE
Confederated Tribes of Grand Ronde - 2001 timber sales	1-7-01-F-471	Oregon Coast Range	Timber sales
Confederated Tribes of Siletz Indians -Sam Creek Logging Unit	1-7-01-F-1037	Oregon Coast Range	Timber sales
Confederated Tribes of Warm Springs	1-7-02-F-047	Eastern Oregon Cascades	Timber sales
Round Valley Indian Reservation- Roadside brushing project	1-14-01-1025	California Coast	Roadside brushing
Barclay timber haul permit	1-7-01-F-251	Oregon Coast Range/ Siuslaw NF	Private timber harvest via Federal right-of-way permit
Josephine County/ High Point timber sale road use pemit	1-7-01-F-141	Oregon Klamath/ Medford BLM	Private timber harvest via Federal right-of-way permit
Timber Products Co. road use grant	1-7-01-F-779	Oregon Klamath/ Medford BLM	Private timber harvest via Federal right-of-way permit
Silver Butte Timber Co./ Applegate Creek road use permit	1-7-01-F-037	Western Oregon Cascades/ Umpqua NF	Private timber harvest via Federal right-of-way permit
Rail America road use permit	1-7-01-F-148	Oregon Klamath/ Medford BLM	Private timber harvest via Federal right-of-way permit
Lone Rock Timber/ Willow Creek timber sale road use permit	1-7-01-F-316	Western Oregon Cascades/ Rogue River NF	Private timber harvest via Federal right-of-way permit
Josephine County / CP6 timber sale road use permit	1-7-01-F-225	Oregon Klamath/ Medford BLM	Private timber harvest via Federal right-of-way permit
Josephine County / Mad Dog timber sale road use permit	1-7-01-F-226	Oregon Klamath/ Medford BLM	Private timber harvest via Federal right-of-way permit
Superior Lumber/ Hell=s Peak timber sale road use permit	1-7-01-F-519	Oregon Klamath/ Rogue River NF	Private timber harvest via Federal right-of-way permit

Table 8 displays the aggregate totals of data reported from consultations issued by the Service since the range-wide report to January 18, 2002. These figures represent the actual numbers reported in those biological opinions and as such, should be viewed as representing only anticipated effects to owls. Actual effects to owls as a result of these actions will be obtained through monitoring reports. The effects are displayed by type and by ownership. Total potential effects to owls are identified by the acres reported in Ahabitat effects;@ effects to critical habitat and incidental take are subsets of these totals.

Table 8: Aggregate Effects from Consultations from June 26, 2001 to January 18, 2002 (in acres)

Ownership	Incidental Take (Harm)		Habitat Effects (NRF)		Critical Habitat Effects (NRF)	
	Acres	Activity Centers [1]	Removed/ Downgraded	Degraded	Removed/ Downgraded	Degraded
Northwest Forest Plan						
Forest Service/BLM	23,174		23,229	5,764	5,398	2,216
NPS	0		0	0		
Subtotal	23,174		23,229	5,764	5,398	2,216
Other Management and Conservation Plans						
BIA/Tribes	152	17	7,033	2,217		
HCPs	393		393	0		
Subtotal	545	17	7,396	2,217		

Other Agencies and Lands						
Other[2]	546		736	192		
TOTALS	24,265	17	31,391	8,173	5,398	2,216

[1] Activity centers are included only from biological opinions where no acres were recorded to reduce double counting; therefore they represent effects in addition to the incidental take acres.
[2] Includes effects on private lands from right-of-way permits across Forest Service and BLM lands.

3.81 Northwest Forest Plan

Most (>96%) of the proposed NRF habitat loss consulted on since the range-wide update is distributed in SW Oregon in Matrix or AMA land use allocations. The amount of NRF habitat loss that has been consulted on since 1994 represents 2.1 percent of the extant suitable habitat range-wide which is within the expected 2.5 percent harvest rate per decade (Table 9).

Table 9. Suitable NSO Habitat Baseline on NWFP Lands and Summary of Effects as of January 18, 2002 (in acres)

Data Type	Reserves		Connectivity			Total
	LSR/MLSA	CRAs	AWAs	AMAs	Matrix	
Evaluation Baseline[1]	3,250,000	1,634,000	299,000	363,000	1,853,000	7,399,000
Removed/ Downgraded (1994- June 2001)[2]	6,000	0	400	9,000	119,000	134,000
Removed/ Downgraded (June 2001 - January 2002)	51	0	0	4,696	18,482[3]	23,229[3]
Difference	3,243,949	1,634,000	298,600	349,30	1,715,518	7,241,771

				4		
Percent Change since 1994	<0.2%	0	<0.1%	3.8%	7.4%	2.1%

[1] 1994 FSEIS baseline.
[2] USDI 2001a.
[3] 833 acres of total are from prescribed burning, not timber harvest, and are not subject to the 2.5 percent harvest rate per decade.

Although the distribution of the range-wide effects is most concentrated in the SW Oregon administrative units, the Service concluded in its recent BO involving those units and the harvest of 22,227 acres of NRF habitat that the amount of spotted owl habitat removed would not significantly reduce the amount of NRF habitat available within LSRs and was not likely to preclude spotted owl movements between LSRs or between physiographic provinces (USFWS 2001b). The Service came to these conclusions because the proposed projects involve minor impacts to LSRs and will not occur in dispersal areas of concern without Service review and approval. In addition, the proposed projects will be dispersed throughout this area minimizing any localized impacts.

Incidental take authorized since the range-wide update has been primarily in the form of harm as a result of the removal and downgrading of NRF habitat (see Table 8 above). However, in one BO (Yakama Nation 2001-2002 Timber Sales), incidental take by harm was identified as activity centers affected instead of acres. In addition, the Service has authorized the incidental take by harassment of owls due to noise. In the BO involving pre-commercial thinning (PCT) on the Umpqua National Forest, the Service anticipated some take of owls nesting within 1/4 mile of the proposed 154 acres of PCT. In the BO for the Siskiyou and Rogue River National Forests and Medford BLM=s 2002-2003 timber harvest program, the Service anticipated some take by harassment of nesting owls associated with the harvest of 41,799 acres of NRF and/or dispersal habitat. Seasonal restrictions on these activities within 1/4 mile of activity centers minimize any effects. Lastly, the BO for road and trail maintenance and campground repairs on the Klamath and Six Rivers National Forests anticipated the take by harassment due to the disturbance of 19,426 acres of NRF habitat over 5 years (about 3,885 acres annually). Although a few owls may actually be disturbed to the level of harassment by the above-mentioned actions, the Service believes that noise effects, in general, have a substantially lessor impact on owls than does removal of its habitat.

3.8.2 Critical Habitat

Effects to critical habitat since the range-wide update are displayed by State in Table 9.

In three recent BOs (since the June 2001 report), an additional 5,400 acres of suitable spotted owl habitat have been consulted on for removal from the critical habitat network in three physiographic provinces across the range of the spotted owl. This is a total (1994 through June 2001 + July 2001 through January 2002) reduction of approximately 13 percent of the total critical habitat acres since 1994 (Table 10).

Table 10. Critical Habitat Baseline and Summary of Effects, June 26, 2001 to January 18, 2002 (in acres)

Data Type	Washington	Oregon	California	Totals
Evaluation Baseline[1]	1,030,000	1,694,000	406,000	3,130,000
Removed/Downgraded (1994- June 2001)	6,000	28,000	500	35,000
Removed/Downgraded (June 2001 - January 2002)	0	5,384	14	5,398
Difference	6,000	1,660,616	405,486	3,089,602
Percent Change	0.6%	2.0%	0.1%	13%

[1] Baseline is based on the 1992 rule (USDI 1992a) as calculated using FSEIS data (Mayfield, pers. comm.).

Within two BOs, there were only nominal impacts to critical habitat: 14 acres of suitable habitat were consulted-on for removal in CA-25 in the California Klamath Province (USDI 2001c) and one acre of suitable habitat was consulted for removal in OR-28 in the western Oregon Cascades province (USDI 2002a). The majority of the consulted on impacts to critical habitat involved the SW Oregon administrative units, which occur in both the Oregon Klamath and western Oregon physiographic provinces, where 5,383 acres of suitable habitat were consulted-on for removal within 11 of 22 CHUs (USDI 2001b). The Service=s BO concluded that the removal of those acres of NRF would not preclude the connectivity goals of the SW Oregon CHUs because adequate habitat to support dispersal still remains within these CHUs. In addition, the Service concluded that the redundancy built into the NWFP of well-distributed clusters of breeding habitat connected by dispersal habitat would adequately provide the intended functions of critical habitat such that spotted owl recovery goals would continue to be met within the SW Oregon administrative units (USDI 2001b).

3.8.3 Non Federal Lands

Tribal lands

Since the range-wide report, the Service has issued approximately five BOs and one concurrence letter involving NRF habitat loss on non-Federal tribal lands within the range of the spotted owl (see Table 6 above). The Round Valley Indian Reservation, in the California Coast Physiographic Province, informally consulted on a road brushing project that will result in the degradation of 17 acres of NRF (Table 11). Incidental take of owls was not anticipated for this project.

Table 11: Aggregate effects from consultations from June 26, 2001 to January 18, 2002

Ownership	Incidental Take (Harm)		Habitat Effects (NRF)		Critical Habitat Effects (NRF)	
	Acres	Activity Centers[1]	Removed/ Downgraded	Degraded	Removed/ Downgraded	Degraded
Northwest Forest Plan						
Forest Service/BLM	23,174		23,229	5,764	5,398	2,216
NPS	0		0	0		
Subtotal	23,174		23,229	5,764	5,398	2,216
Other Management and Conservation Plans						
BIA/Tribes	152	17	7,033	2,217		
HCPs	393		393	0		
Subtotal	545	17	7,396	2,217		
Other Agencies and Lands						
Other[2]	546		736	192		
TOTALS	24,265	17	31,391	8,173	5,398	2,216

[1] Activity centers are included only from biological opinions where no acres were recorded to reduce double counting; therefore they represent effects in addition to the incidental take acres.
[2] Includes effects on private lands from right-of-way permits across Forest Service and BLM lands.

The Confederated Tribes of the Warm Springs (CTWS), located within the Eastern Oregon Physiographic Province, consulted on two timber harvests that removed 1,378 acres of

suitable habitat and degraded 2,200 acres of suitable habitat (Table 10). There was no incidental take associated with this habitat loss and degradation because all suitable habitat had been surveyed and no known spotted owl pair home ranges had suitable habitat reduced to below the 40 percent take threshold. Mapping of suitable habitat before and after the timber sales shows a continued capability of the habitat to support dispersal. In addition, seasonal restrictions were placed on activities that could disturb nesting owls. CTWS lands will continue to provide demographic support, with 54 known activity centers, and connectivity with NWFP lands.

The Confederated Tribes of the Grande Ronde (CTGR) consulted on a timber harvest to remove 68 acres of unoccupied suitable habitat. Incidental take was not anticipated for the habitat loss, but was authorized for the disturbance of 148 acres of unsurveyed suitable habitat along portions of the haul route (Table 10). The Confederated Tribes of the Siletz Indians (CTSI) consulted on a timber harvest to remove 152 acres of unsurveyed suitable habitat for which the Service also authorized incidental take (harm) (Table 10). Both of these Tribal entities are located in the central Oregon Coast Range province. In the short-term, these lands provide for some demographic support (there are two active owl sites on CTGR lands) and connectivity with NWFP lands. In the long-term, there will be little NRF habitat on these lands given the 70-year and 80-year harvest rotations prescribed for these lands. However, any remaining forested lands consisting of dispersal habitat (approximately 40 years to 80 years old) will allow for owl movement in these areas.

The Yakama Indian Reservation, in the eastern Washington Cascades Physiographic Province, consulted on their 2001-2002 timber sale program which involves the removal of 5,435 acres of NRF habitat and the anticipated take of 17 owl pairs (Table 10). These Tribal lands are located on the eastern periphery of the owl=s range. Much of the current suitable habitat occurs as a result of fire exclusion practices and would not have developed under natural fire regimes. The proposed harvest is aimed at treating current forest health problems, particularly an ongoing spruce budworm outbreak which is causing a loss of suitable habitat within these same owl sites.
The Service concluded that these areas would not sustain nesting spotted owls or occupied owl sites over the long-term and as such, did not consider this habitat to be essential to the survival and recovery of the species (USFWS 2001a).

HCPs

Since the range-wide update, one HCP has been issued: the Tacoma Green River HCP. Over the 50-year term of this HCP, 393 acres of NRF will be available for harvest within 18 mi of one or more owl activity centers. Minimization and mitigation measures for

spotted owls include the protection and establishment of mature and late-seral coniferous forest conditions suitable for nesting. Over the life of the HCP, the amount of mature coniferous forest (106 to 155 years old) on Tacoma lands is anticipated to increase from 268 acres to 4,027 acres. In addition, the total amount of late-seral coniferous forest (>155 years old) is expected to increase from 41 acres to 292 acres.

Private Lands

Since the range-wide update, nine Federal road use/ right-of-way permits have been issued in Oregon which will provide access to private lands for the purpose of timber harvest. These actions occur in three physiographic provinces (Klamath, Western Cascades, Coast Range) and will result in the removal or downgrade of 736 acres of NRF habitat and the degradation of 192 acres of NRF habitat. Incidental take by harm of spotted owls, associated with the removal/ downgrade of 546 acres of NRF habitat, was anticipated in 7 of the 9 BOs. In addition, incidental take by harassment of spotted owls, associated with the disturbance of 1,251 acres of NRF habitat, was authorized in 3 BOs. In the long-term, it is unlikely that these lands will contribute to owl conservation given the short harvest rotations practiced on most of these private lands.

Conclusions

The basic conclusions reached in the range-wide update about the owls= current status (USDI 2001a) have not changed with the additional effects consulted on since that report. Overall consultation effects from incidental take (harm) and habitat loss are consistent with expectations in amount (about 2.1 percent) across the owls= range for the first decade of NWFP implementation. Although consulted-on effects in Southwest Oregon are somewhat disproportional to the distribution of Matrix lands in the area, analysis indicates that the conservation needs of the owls (through NWFP reserves and connectivity) are being met (USDI 2001b). Also, the additional consulted-on effects to critical habitat which have occurred almost entirely in Southwest Oregon will not preclude the connectivity goals of the SW Oregon CHUs because adequate habitat to support dispersal still remains within these CHUs (USDI 2001b). As such, the CHU network within the affected provinces and across the range will continue to provide for owl recovery at the range-wide level.

4.0 ENVIRONMENTAL BASELINE

4.1 Definition of the action area

The action area is defined at 50 CFR 402.02 to mean Aall areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.@ For the purpose of this consultation, the Service describes the project area to include all lands under the management of the CRLA because the proposed action will occur within an area that is important to maintaining connectivity to the LSR network to the north and south (Eastern Cascades) and west (Southwest Oregon) LSR network.

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area, but does not include the effects of Federal actions that have not yet undergone section 7 consultation. Thus, the environmental baseline does not include the future effects of the proposed action addressed by this opinion.

4.2 Status of the Suitable (NRF) habitat - Project area

CRLA is located at the eastern edge of the range for the NSO. Conservation of the NSO in this portion of its range is important for the viability of the species. Individuals and populations at the edge of a species range may possess genetic and behavioral characteristics that enhance the adaptive capability of the species and these characteristics may increase the probability of a species= chance of persistence after large-scale disturbance.

The project area is considered within NWFP lands and is designated as Congressionally Reserved lands. These lands are managed by plans developed by each entity consistent with their enacting legislation and were not amended to include the standards and guidelines of the NWFP.

CRLA covers approximately 183,000 acres and ranges from approximately 3,900 - 8,900 feet in elevation. Major tree species include ponderosa pine (*Pinus ponderosa*), sugar pine *(Pinus lambertiana*), Douglas fir (*Pseudotsuga menziesii*), white fir *(Abies concolor)*, Shasta red fir *(Abies amabilis v. shastensis)*, lodgepole pine *(Pinus contorta*), and mountain hemlock *(Tsuga mertensiana)*. Annual precipitation is 67 inches with most coming in the form of snow. Approximately 500 inches of snow falls from November to March.

Potential NRF habitat is found in patches throughout CRLA, with a majority of the patches occurring southwest of a diagonal line running from the northwest to the southeast corners of the park. These habitat patches are comprised of closed-canopy, late-successional stands of mountain hemlock, Shasta red fir, and white fir with minor amounts of western white pine *(Pinus monticola*), lodgepole pine, and incense cedar *(Calocedrus*

decurrens) as understory. Stands contain numerous large snags and woody debris on the ground.

There are approximately 15,126 acres of NRF owl habitat in the park. NRF habitat was delineated using a GIS analysis of satellite-derived land cover imagery dated 1995. Canopy closure and tree size-class data layers were used to identify forested areas with tree diameters greater than 21@ and single or multi-storied stands with canopy closure greater than 70%. Approximately 5,719 acres of this NRF habitat is classified as nesting habitat where tree diameters exceed 32@ and canopy closure is greater than 70%.

4.3 Status of Critical Habitat - project area

CRLA is located largely in the Eastern Oregon Cascades Physiographic Province (EOCPP). The other Administrative Units in the province are the Deschutes National Forest, Mount Hood National Forest, Winema National Forest, and the Klamath Falls Resource Area of the Bureau of Land Management (USDA and USDI 1994a and b). The EOCPP provides connectivity for spotted owls along the east slope of the Cascade Mountains from the Columbia River south to the California-Oregon border. There are nine CHUs that occur within the province. No CHUs overlay CRLA, therefore CRLA contains no designated critical habitat for NSOs.

Near CRLA on the Winema National Forest approximately 3.1 percent of NRF within designated critical habitat has been removed (Table 11). In the nine critical habitat units combined within the Eastern Oregon Cascades Physiographic Province approximately 1,800 acres (approximately 0.5 %) of NRF have been lost from all causes including wildfire (Table 12) (USDI 2002b).

Table 12. Critical Habitat Baseline (FSEIS) and Effects on the Eastern Oregon Cascades Physiographic Province, 1994 to 2001 (in acres)

CHU ID	CHU Suitable Acres[1]	CHU Suitable Removed/ Downgraded	Pecent CHU Suitable Removed/ Downgraded	Suitable Degraded	Percent CHU Suitable Degraded
Eastside Mount Hood National Forest					
OR-1	31,377	437	14	1,350	4.3
OR-2	16,994	836	4.9	1,675	9.9
Deschutes National Forest					
OR-3	7,745				
OR-4	7,390	300	4.1		
OR-5	2,844				
OR-6	6,637	189	2.9		
OR-7	9,485	2	0.02	1,419	15.0
Winema National Forest and Bureau of Land Management Klamath Resource Area					
OR-8	18,453	55	0.2	583	3.1
OR-37	50,748 (10,542) [10,626]	536 (425) [0]	11 (4.0) [0]	1,825 (512) [0]	3.6 (4.9) [0]

Source: G. Mayfield, USFWS, pers. comm., 2001. Spatial data were overlaid based on FSEIS data (USDA and USDI 1993, 1994) for Land Allocations, northern spotted owl habitat, LSRs, ownership and USFWS data for CHU boundaries (USFWS 1994) to produce these data.
1: U.S. Department of Agriculture, and U.S. Department of Interior (1994).
( ): This is the CHU OR-37 acreage and percentage within the Winema National Forest boundary.

[ ]: This is the CHU OR-37 acreage and percentage within the Klamath Falls Resource Area boundary.

The Service's Provincial-level Analysis of Consulted-On Effects to Northern Spotted Owl Critical Habitat in Oregon (USDI 2001b) reported that localized effects have had an impact on the quality and amount of NRF NSO habitat and dispersal habitat within the CHU network. However, the amount of NRF NSO habitat removed from CHUs within this province is less than 0.5 percent of the total NRF acres available in CHUs. The provincial level analysis also indicates that these effects have been dispersed over the province and have been buffered by adjacent and overlapping LSRs and adjacent wilderness areas. This report concluded that consulted-on effects to NSO critical habitat within this province have not compromised the function of CHUs at this scale.

4.3 Status of Spotted Owls - project area

In 2001, 12 of the 17 historic spotted owl ACs were verified as being occupied. Ten pairs were observed, in addition to 1 adult male and one unknown adult at separate sites. None of the pairs produced any offspring. Surveys to determine nesting and reproductive status have been conducted annually since 1992, and using USFWS protocols since 1994. Park biologists have modified these protocols in only a limited way. Extensive snowpack at the park prevents access to owl habitat before mid-May, so surveys are not conducted between March 1 and May 15. This limits the park=s ability to determine Anesting@ status. In addition to surveying known sites, unoccupied NRF habitat is surveyed annually to detect dispersal and new occupation. All spotted owl activity centers have been found within areas identified as NRF habitat.

Table 13 displays the current condition of the ACs in the project area and the maximum change that could take place as a result of the proposed action. All of the ACs are considered deficit in amount of total habitat within their home range. The anticipated changes are substantially below the maximum listed.

Table 13. Summary of Suitable/NRF Habitat Near Spotted Owl Activity Centers (adapted from Table 3-1 in BA)

Spotted Owl Master Site Number	Site Identifier	Total Acres of Nesting Habitat w/in 0.7 miles of Activity Center	Total Acres of Roosting and Foraging Habitat w/in 0.7 miles of Activity Center	Total Acres of Nesting Habitat w/in 1.2 miles of Activity Center	Total Acres of Roosting and Foraging Habitat w/in 1.2 miles of Activity Center
2246	Sand Ridge	18	152	65	373
2939	Annie Creek	49	255	141	753
3408	Maklaks Crater	18	97	45	298
3409	Boundary Spring	15	60	44	216
3410	Crater Peak	54	171	93	335
3622	Red Blanket	81	511	165	960
3843	Little Copeland	61	289	129	614
3938	Castle Creek	61	359	133	741
3939	Crater Creek	38	201	84	445
4056	Crescent Ridge	24	116	58	317
4057	Bybee Creek	46	239	128	616
4386	Grayback Ridge	23	73	71	211

4.4 Conservation Needs of the Species at the Project Level

At the scale of this project, adequate habitat is needed for NSOs consistent with the conservation strategy of the NWFP. This would include foraging and dispersal habitat, as well as nesting and roosting habitat.

5.0 EFFECTS OF THE PROPOSED ACTION ON SPOTTED OWLS

5.1 General

In past consultations, the Service has determined that timber harvest may adversely affect northern spotted owls by removing or degrading habitat, or, when the action occurs near nesting sites, by directly killing or injuring owls, or by disrupting reproductive behavior. The Service has also determined that creating noise above ambient levels during the breeding season within 0.25 miles of active nests has the potential to disrupt essential breeding behaviors. Such adverse effects were determined not likely to jeopardize the continued existence of the species when they occurred in a manner consistent with conservation strategies designed to ensure the maintenance of owl populations. The proposed FMP has included several project design features consistent with conservation strategies and their minimization effects are discussed below.

5.2 Direct Mortality

In extreme cases, timber thinning activities can result in direct mortality of adults, eggs, or young. The potential for NSOs to be struck and killed or injured by falling trees during harvesting is confined to the area close to the nest tree. During timber operations, adult NSOs can reasonably be expected to move from the area and avoid injury; however, adult NSOs tenaciously tending to reproductive activities such as incubation or brooding young may be reluctant to leave the area, thus remaining vulnerable. Potential effects to eggs range from abandonment to destruction during tree falling. Young-of-the-year, whether in or out of the nest, may also be vulnerable to the effects of tree falling, and might disperse prematurely in response to the disturbance. These types of effects are only possible during the breeding season, and then only if active breeding activities are underway.

As part of the project design CRLA has placed a limited operating period on thinning projects. Between March 15st and August 15th no prescribed fire or thinning activities would take place within 0.7 miles of an active nest. Therefore the probability of direct mortality will be discountable.

5.3 Effects of Northern Spotted Owl Habitat Removal and Degradation.

The spotted owl was listed primarily due to habitat loss and habitat modification largely from timber harvest (55 FR 26114). Timber management can potentially affect NSOs in several ways. These include removal or degradation of nesting or foraging habitat within the home range of an owl pair, causing direct injury or mortality, disturbing nesting behavior, reducing special habitat components, fragmenting habitat on a wide scale, or impeding dispersal movements of owls across the landscape. Each of these potential effects is discussed in more detail below, as well as measures that are expected to minimize these effects.

Removal of habitat within home ranges, and especially close to the nest site, can reasonably be expected to have negative effects on NSOs; however, the varying results of research on the species do not indicate a precise point at which these negative effects become a substantial detriment. For instance, Bart (1995) reported a linear reduction in NSO productivity and survivorship as the amount of suitable habitat within a NSO home range declined. In northwestern California, Franklin et al. (2000) found that survivorship of adult owls was greater where greater amounts of older forest were present around the activity center, but in a somewhat confounding result, also found increased reproductive success where the amount of edge between older and younger forest was relatively high. The extent to which the results of these studies may be directly applied to CRLA is unknown, but they do support the general conclusion that habitat loss probably results in negative effects to NSO.

Because the actual home range size of a given owl pair cannot be determined without expensive and time-consuming radio-telemetry studies, the Service estimates the size of home ranges to be equivalent to the median size calculated from available data. The average home range size for owls in the Eastern Cascades Province is a 1.2 mile radius from the activity center (Thomas et al. 1990). The Service has developed recommendations to provide a minimum of 50 percent NRF habitat within a 0.7 mile radius home range (500 acres) and a minimum of 40 percent NRF habitat within a 1.2 mile radius home range (1182 acres) of the activity center. Activity centers that do not provide the minimum NRF habitat levels within the 0.7 or 1.2 mile radius home range are considered deficit home ranges. The deficit home range concept is used by the Service to evaluate the impacts of proposed projects.

Based on analysis of radio-telemetry data, Bingham and Noon (1997) reported that a sample of NSOs in northern California focused their activities in heavily-used Acore areas@ that ranged in size from about 167 to 454 acres, with a mean of about 409 acres. These core areas, which included 60 to 70 percent of the owl telemetry locations during the breeding season, typically comprised only about 20 percent of the area of the wider home

range. This suggests that habitat removal within core areas could have disproportionately important effects on owls. Other studies have demonstrated that spotted owl abundance and productivity significantly decrease when the proportion of suitable habitat within 0.7 miles of an activity center falls below 500 acres (50 percent of the total 1,000 acres within 0.7 miles) (O=Halloran 1989, Simon-Jackson 1989, Thomas et al. 1990).

Through the implementation of the FMP approximately 2,500 acres of occupied NRF habitat may be subject to various fuels treatment over the next six years. Some of those treatments will result in the loss of some occupied NRF habitat. But that acreage will be limited to no more than a total of 500 acres and will not be from just one AC. Because of the design of the fuel treatments and the distribution of the NRF habitat, habitat loss is likely to be small patches widely scattered throughout the treatment areas.

The habitat loss estimates used by CRLA and the Service in the analysis below are maximums based, to some degree, on impacts from each project being the most adverse possible within the project design limits. This is partially related to the scale of a project. Prescribed fire and wildland use fire are predictable on a burn unit scale but the effects at scales of one to two acres are much less predictable. While a fire may be well within the burn parameters and project design features and attain the desired goal, there can be portions of the burn area that cause a loss of habitat. These types of small losses may not reduce the functionality of the habitat as a whole though the Aloss@ is measurable using acreage figures. Therefore the estimate of maximum habitat loss is substantially greater than the planned or anticipated habitat loss and loss of functionality. The chance of the maximum habitat loss being reached in every unit, project and event is very low but is not discountable, thus it must be considered.

Table 14 displays the amount of habitat within the ACs that meets the definition of NRF and the maximum change anticipated from the proposed action. No nest core will be impacted to a significant degree as a result of fuel treatment activities.

Table 14. Summary of Habitat Acres within Activity Centers and Maximum Effects by the Proposed Action (adapted from Table 4-1 in BA)

Spotted Owl Master Site Number	NRF Habitat Acres w/in 1.2 mi. before implementation	NRF Habitat Acres w/in 1.2 mi. after implementation	Acres of NRF Habitat downgraded	Percent change
2246	373	373	0	0

2939	753	753	0	0
3408	298	298	0	0
3409	216	216	0	0
3410	335	268	67	20
3622	960	768	192	20
3843	614	614	0	0
3938	741	593	148	20
3939	445	356	89	20
4056	317	317	0	0
4057	616	616	0	0
4386	211	211	0	0

Several studies have demonstrated reduced NSO population performance where lower amounts of habitat exist (Bart and Forsman 1992, Bart 1995, Franklin et al. 2000). It is therefore reasonable to believe that the FMP will have some short and longterm adverse affects on NSO habitat.

5.4 Effects to Unoccupied NRF Habitat

In addition to occupied habitat, approximately 1,200 acres of unoccupied NRF habitat that will be subject to low intensity burns and an additional 100 acres that will be manually thinned. The proposed project will reduce some of that habitat to a non-NRF condition. But that acreage will be limited to 240 acres and is anticipated to be much less than that. Any habitat loss that does occur will most likely be in small patches and widely distributed across the treated area.

5.5 Effects of Nest Site Disturbance on Northern Spotted Owl Nesting Success

Thinning operations will employ some mechanized equipment and chainsaws, which introduce high levels of noise into NSO habitat. The effects on the NSO from noise are largely unknown, and whether noise is a concern has been a controversial issue. The effects of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of these variables: 1) timing of the disturbance in relation to nesting chronology; 2) type, frequency and proximity of human disturbance; 3) clutch size; 4) health of individual birds; 5) food supply; and 6) outcome of previous interactions

between birds and humans (Knight and Skagen 1988). Additional factors that confound the issue of disturbance include the individual bird=s tolerance level, the type and frequency of human activity, physical parameters of sound and how it reacts with different geographical characteristics, vegetation, ambient sound levels, and differences in how species perceive noise. Although quantifying disturbance effects is difficult and little detailed information specific to the vulnerability of NSOs to disturbance effects exists, research does suggest that disturbance can have a negative impact on reproductive success on a variety of other bird species (Tremblay and Ellison 1979, Anderson 1988, Belanger and Bedard 1989, Piatt et al. 1990, Henson and Grant 1991). Such studies have shown that disturbance can affect productivity in a number of ways: nest abandonment, egg and hatchling mortality due to exposure and predation, longer periods of incubation, premature fledgling or nest evacuation, depressed feeding rates of adults and offspring, reduced body mass or slower growth of nestlings, and avoidance of otherwise suitable habitat.

As part of the project design CRLA has placed a limited operating period on the project area. Between March 15th and August 15th no thinning activities would take place within 0.7 miles of the active nest. The limited operating period should make the chance of disturbance creating an adverse affect to NSOs discountable.

5.6 Effects to Northern Spotted Owl Critical Habitat

CRLA does not include any designated critical habitat for NSOs. Therefore the proposed action will have no impact on critical habitat.

5.7 Effects to Special Habitat Components

Since owls do not build nests but depend upon cavities, broken-topped trees, naturally occurring platforms, and nests built by other species, retaining snags and green snag recruitment trees is an important method of reducing the impacts of timber harvest on spotted owls. Besides providing nest sites, snags are also important in the life histories of several known spotted owl prey species. The FMP contains provisions for retention of most snags and large dead and down material, but a small net loss is anticipated by the Service. The minimal loss should have little effect on the potential nest sites for northern

spotted owls. Therefore, it is anticipated that impacts to NSOs from changes to snags and coarse wood material will be insignificant.

5.8 Effects to Habitat Fragmentation

NRF habitat for spotted owls is already fragmented on CRLA=s lands. This is largely the result of elevation, soil types and rock fields. The proposed action may in a very small way increase fragmentation. Fragmentation of contiguous blocks of NRF habitat can increase the vulnerability of spotted owls to predators, such as great horned owls (*Bubo virginianus*), and encourage encroachment of competitors like barred owls (*Strix varia*). Recent data shows that barred owls occur on the CRLA and barred owls may have supplanted NSOs from historical nest sites. The proposed project will not increase fragmentation noticeably. Any incremental increase in the probability that owls may be lost to predation or may suffer a competitive disadvantage to barred owls will likely be very small.

5.9 Effects to Spotted Owl Movement

The NWFP assumes spotted owl dispersal needs will be provided across the landscape by a combination of prescriptions and standards and guidelines. These include maintenance of riparian reserves, retention of 15 percent of each watershed in late-successional forest, and 100 acre areas around owl activity sites. On CRLA lands habitat reducing activities are limited just as strongly by CRLA=s management plan and project design features of the FMP. The implementation of the proposed project is not expected to reduce connectivity between or within LSRs and is not anticipated to preclude dispersal of spotted owls.

SUMMARY OF CONSULTED-ON EFFECTS SINCE 1994

Northern Spotted Owl

CRLA has not proposed or completed any projects that have resulted in a loss of NRF. Less than 50 acres of NRF have been lost to wildfires since 1994.

The amount of NRF habitat that is likely to be removed from this project is not significant enough to change the percent of NRF habitat removed on a range-wide basis.

Northern Spotted Owl Critical Habitat
No designated critical habitat exists on CRLA.

6.0 CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Under the NWFP, Federal lands contribute significantly toward protecting nesting habitat, and serve as the cornerstone for spotted owl recovery. In particular, many of the Federal lands within the action area are primarily managed for late-successional forest development. The project area is surrounded almost entirely by lands managed by federal agencies. There are some small private timber lands adjacent to CRLA but most do not contain NRF habitat for owls.

7.0 CONCLUSION

After reviewing the current status of the NSO, the environmental baseline, the cumulative effects, and the effects of the proposed actions on the NSO and NSO critical habitat, it is our biological opinion that implementation of the proposed actions discussed herein is not likely to jeopardize the continued existence of the NSO or result in adverse modification of critical habitat for this species. The Service reached these conclusions based on the following factors:

1. The amount of habitat removed by the proposed project is small. The amount of habitat in reserves as defined by the NWFP will not be affected. LSRs RO 227 and LSR 226 which are the largest LSRs near the project area, have had few impacts to their habitat structure and are assumed to be functioning sufficiently for NSOs. Therefore, the proposed actions will not affect the reserves= ability to support clusters of owls or preclude NSO movements between LSRs or between physiographic provinces.

2. No NRF habitat will be removed from any CHU.

8.0 INCIDENTAL TAKE

The habitat loss estimates used by CRLA and the Service in the above analysis (740 acres) are maximums based, to some degree, on impacts from each project being the most adverse possible within the project design limits. Therefore the maximum habitat loss estimates are not reasonably certain to occur. Even when impacts occur and are adjacent to occupied owl activity centers the impacts will be small and spread over a large spatial area and over a minimum six year period.

Therefore, the Service does not anticipate that the adverse affects described in this consultation will reach the level of take and no exemption from the prohibition of take under section 9 of the Act is granted. If during the implementation of this project, CLRA believes take will occur, all activities must cease and the Service must contact the Service regarding reinitiating consultation.

8.1 Reporting Requirements

1 Any dead or injured spotted owls must be reported to the Service=s Law Enforcement Division (541-885-6900) as soon as possible, and turned over to the Law Enforcement Division for care or analysis. The Service is to be notified in writing within three working days of the accidental death of, or injury to, a spotted owl, or of the finding of any dead or injured spotted owl(s) during implementation of the proposed action. Notification must include the date, time and location of the incident or discovery of a dead or injured spotted owl, as well as any pertinent information on circumstances surrounding the incident or discovery. The Service contact for this written information is the Project Leader Steve Lewis at 6610 Washburn Way, Klamath Falls, Oregon 97603.

2. In January of each year (until project activities are finished) CRLA will provide a brief report on the progress and results from activities proposed as part of this project.

9.0 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities

to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service offers the following conservation recommendations:

1. Continue to survey and identify owl pairs to assist in monitoring of take with this and other proposed actions, and to limit the need for seasonal restrictions.

2. Compile and summarize the data that has been collected on CRLA to provide a more complete understanding of the impacts of fires and forest health treatments to NSOs.

10.0 REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the actions outlined in the request for consultation. As provided in 50 CFR '402.16, reinitiation of formal consultation is required if: (1) any take of NSO occurs; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

If you have any questions regarding this biological opinion, please contact Doug Laye of my staff at (541) 885-8481.

References Cited

Anderson, D. W. 1988. Dose-response relationship between human disturbance and brown pelican breeding success. Wildlife Society Bulletin 16: 339-345.

Bart, J. and E. D. Forsman. 1992. Dependence of northern spotted owls *Strix occidentalis caurina* on old-growth forests in the western USA. Biological Conservation 62: 95-100.

Bart, J. 1995. Amount of suitable habitat and viability of northern spotted owls. Conservation Biology 9 (4): 943-946.

Belanger, L., and J. Bedard. 1989. Response of staging snow geese to human disturbance. Journal of Wildlife Management 53: 713-719.

Bingham, B. B., and B. R. Noon. 1997. Mitigation of habitat Atake@: Application to habitat conservation planning. Conservation Biology 11(1): 127-138.

Buchanan, J., E. Hanson, D. Hays and L. Young. 1994. An evaluation of the Washington Forest Practices Board Wildlife Committee preferred alternative for a spotted owl protection rule. Washington Forest Practices Board Spotted Owl Scientific Advisory Group. Olympia, Washington.

California Department of Forestry and Fire Protection (CDF). 2001. California Forest Practices Rules: 2001. Title 14, California Code of Regulations, Chps. 4, 4.5, and 10. Sacramento, CA.

Forest Practices Board. 1996. Permanent rules for the northern spotted owl. Washington Department of Natural Resources, Olympia, Washington.

Forsman, E. D., E. C. Meslow, and H. M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs 87:1-64.

Forsman, E.D., S. DeStefano, M.G. Raphael and R.J. Gutierrez, Editors. 1996. Demography of the northern spotted owl. Studies in avian biology no.17, Cooper Ornithological Society. Fort Collins, CO.

F. Franklin, A. B., K. P. Burnham, G. C. White, R. J. Anthony, E. D. Forsman, C. Sanchez, J. D. Nicols and J. Hines. 1999. Range-wide status and trends in northern spotted owl

populations. Colorado Coop. Fish and Wildl. Res. Unit, Fort Collins, Colorado and Oregon Coop. Fish and Wildl. Res. Unit, Corvallis, OR. Unpublished report.

Franklin, A. B., D. R. Anderson, R. J. Gutierrez, and K. P. Burnham. 2000. Climate, habitat quality, and fitness in northern spotted owl populations in Northwestern California. Ecological Monographs 70(4): 539-590.

Hanson, E., Hays, D., Hicks, L. Young. L., and J. Buchanan. 1993. Spotted Owl Habitat in Washington: A Report to the Washington Forest Practices Board. Washington Forest Practices Board, Spotted owl Advisory Group. Final Report: December 20, 1993. Olympia, Washington. 116 pp.

Henson, P., and T. A. Grant. 1991 The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19:248-257.

Kelly, Elizabeth. 2001 The Range Expansion of the Northern Barred Owl: An Evaluation of the Impacts on Spotted Owls. M.S. Thesis. Oregon State University,

Knight, R.L., and S.K. Knight Skagen. 1988. Effects of recreational disturbance on birds of prey: a review. Pages 355-359 *in* R.L. Glinski et al., Technical Editors. Proceedings of the Southwest Raptor Management Symposium and Workshop. Natl. Wildl. Fed., Washington, D.C.

LaHaye, W. S. 1988. Nest site selection and nesting habitat of the northern spotted owl (*Strix occidentalis caurina*) in northwestern California. M. S. Thesis. Humboldt State University, Eureka, CA.

Lapomardo, Trish. 2001 Biologist for Klamath Falls Resource Area of the Bureau of Land Management

Lint, J.B., B.R. Noon, R.G. Anthony, E.D. Forsman, M.G. Raphael, M. Collopy, and E.E. Starkey. 1999. Northern spotted owl effectiveness monitoring plan for the Northwest Forest Plan. Gen. Tech. Rep. PNW-GTR-440. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR.

Miller, G.S. 1989. Dispersal of juvenile northern spotted owls in western Oregon. M.S. Thesis. Oregon State University, Corvallis, Oregon. 139 pages.

O'Halloran, K. 1989 Spotted owl inventory and monitoring: Annual report for 1989. U.S. Forest Service, Pacific Northwest Region, Portland, OR. Unpublished report. Oregon State University (OSU). 2001 Data on Site Occupancy and Reproduction of Northern Spotted Owls in Winema National Forest. Unpublished Data. Oregon State University, Corvallis, OR.

Oregon Department of Forestry (ODF). 2000. Forest Practices Administrative Rules and Forest Practices Act. Salem, OR.

Piatt, J. F., B. D. Roberts, W. W. Lidster, J. L. Wells, and S. A. Hatch. 1990. Effects of human disturbance on breeding least and crested auklets at St. Lawrence Island, Alaska. Auk 107:342-350.

Simon-Jackson, T. 1989 Spotted owl inventory and monitoring program: Annual report for 1989. U.S. Forest Service, Pacific Southwest Region, San Francisco, CA. Unpublished report.

Sitter, G. 2000. Wildlife Biologist, Bureau of Land Management, Klamath Falls Resource Area, Klamath Falls, OR.

Thomas, J.W., E. D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl: a report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Portland, OR: U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management, Fish and Wildlife Service, and National Park Service.

Thomas, J.W., M.G. Raphael, R.G. Anthony, E.D. Forsman, A.G. Gunderson, R.S. Holthausen, B.G. Marcot, G.H. Reeves, J.R. Sedell, and D.M. Solis. 1993. Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific Northwest. Portland, Oregon. U. S. Department of Agriculture, Forest Service. 523 pp.

Tremblay, J. and L. N. Ellison. 1979. Effects of human disturbance on breeding black-crowned night herons. Auk 96:364-369.

U.S. Department of Agriculture, U.S. Department of the Interior, U.S. Department of Commerce and the Environmental Protection Agency. 1993. Forest ecosystem management: an ecological, economic, and social assessment. Report of the Forest Ecosystem Management Assessment Team. U.S. Forest Service, U.S. Fish and Wildlife Service, National Marine Fisheries Service, National Park Service, Bureau of Land Management, and the Environmental Protection Agency, Portland, OR.

U.S. Department of Agriculture, U.S. Department of the Interior 1994a. Final Supplemental Environmental Impact Statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Office of the Secretary, U. S. Department of Agriculture and Office of

the Secretary, U. S. Department of the Interior, Washington, D.C. 2 Volumes and Appendices.

U.S. Department of Agriculture, U.S. Department of Interior. 1994b. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. Forest Service, Bureau of Land Management. Portland, Oregon.

U.S. Department of the Interior, Fish and Wildlife Service. 1987. The Northern Spotted Owl status review. Fish and Wildlife Service. Portland, Oregon. 47 pp.

U.S. Department of the Interior, Fish and Wildlife Service. 1989. The Northern Spotted Owl; a status review supplement. Fish and Wildlife Service. Portland, Oregon. 113 pp.

U.S. Department of the Interior, Fish and Wildlife Service. 1990a. 1990 Status Review: Northern Spotted Owl; *Strix occidentalis caurina*. Report to the Fish and Wildlife Service. Portland, Oregon. 95 pp.

U.S. Department of the Interior, Fish and Wildlife Service. 1990b. Endangered and threatened wildlife and plants; determination of threatened status for the Northern Spotted Owl; final rule. 50 CFR Part 17, Federal Register, June 26, 1990. Pages 26114-26194.

U.S. Department of the Interior, Fish and Wildlife Service. 1992a. Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Northern Spotted Owl. Federal Register Vol. 57, No. 10:1796-1838. January 15, 1992.

U.S. Department of the Interior, Fish and Wildlife Service. 1992b. The Northern Spotted Owl Recovery Plan-Final Draft. Fish and Wildlife Service, Portland, Oregon

U.S. Department of the Interior, Fish and Wildlife Service. 1994. Final biological opinion for the preferred alternative of the Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. Portland, Oregon.

U.S. Department of the Interior, Fish and Wildlife Service. 2001a. A range wide baseline summary and evaluation of data collected through section 7 consultation

for the northern spotted owl and its critical habitat: 1994-2001. U.S. Fish and Wildlife Service. Portland, OR.

U.S. Department of the Interior, Fish and Wildlife Service. 2001b. Biological opinion on timber harvest activities for FY2002-2003 for the Siskiyou and Rogue River National Forests and the Medford BLM.

U.S. Department of the Interior, Fish and Wildlife Service. 2001c. Biological opinion on Knob timber sale. Yreka, CA.

U.S. Department of Interior, Fish and Wildlife Service. 2002a. Biological opinion on Umpqua National Forest activities. Portland, OR.

U.S. Department of the Interior, Fish and Wildlife Service. 2002b. Environmental baseline update for the northern spotted owl on the Klamath Falls Resource Area. U.S. Fish and Wildlife Service. Klamath Falls, OR.

Crater Lake National Park
Fire Management Plan – Environmental Assessment

National Park Service
U.S. Department of the Interior

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Purpose and Need

INTRODUCTION

This Environmental Assessment (EA) documents the results of a study of the potential environmental impacts of an action proposed by the National Park Service to amend the Crater Lake National Park Fire Management Plan.

This EA has been prepared in compliance with:

- The National Environmental Policy Act (NEPA) of 1969 (42 United States Code (USC) 4321 et seq.), which requires an environmental analysis for major Federal Actions having the potential to impact the quality of the human environment;
- Council of Environmental Quality Regulations at 40 Code of Federal Regulations (CFR) 1500-1508, which implement the requirements of NEPA;
- National Park Service Conservation Planning, Environmental Impact Analysis, and Decision Making; Director's Order #12 and Handbook.

The Purpose of an Environmental Assessment (EA)

An EA study is performed by a Federal agency, such as the National Park Service, to determine if an action they are proposing to implement would significantly affect any portion of the environment.

The intent is to provide project planners and Federal decision-makers with relevant information on a Proposed Action's potential impacts to the environment.

If the study finds no significant impacts, then the agency can publish a Finding of No Significant Impact (FONSI) and can proceed with the action. If the study finds there would be significant impacts, then the agency must prepare and publish a detailed Environmental Impact Statement to help determine how to proceed with the action.

Key objectives of NEPA are to help Federal agency officials make well-informed decisions about agency actions and to provide a role for the general public in the decision-making process. The study and documentation mechanisms associated with NEPA seek to provide decision-makers with sound knowledge of the comparative environmental consequences of the several courses of action available to them. NEPA studies, and the documents recording their results, such as this EA, focus on providing input to the particular decisions faced by the relevant officials. In this case, the Superintendent of the Crater Lake National Park is faced with a decision to amend the park's Fire Management Plan as described below. This decision will be made within the overall management framework already established in the Crater Lake National Park General Management Plan. The alternative courses of action to be considered at this time are, unless otherwise noted, crafted to be consistent with the concepts established in the General Management Plan (copies of the General Management Plan can be obtained from NPS personnel at the park).

In making decisions about National Park Service administered resources, the Park Service is guided by the requirements of the 1916 Organic Act and other laws, such as the Clean Air Act, Clean Water Act, and Endangered Species Act. The authority for the conservation and management of the National Park Service is clearly stated in the Organic Act, which states the agency's purpose: " to promote and regulate the use of national parks in conformance with their fundamental purpose which is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." This authority was further clarified in the National Parks and Recreation Act of 1978: "Congress declares that...these areas, though distinct in character, are united...into one national park system.... The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress."

The mission of Crater Lake National Park is "to forever preserve the beauty of Crater Lake National Park, its unique ecological and cultural heritage, and to foster understanding and appreciation through enjoyment, education, and inspiration." The Act of Congress which established Crater Lake National Park (32 Stat. 202) on May 22, 1902, recognized the significance of the area's cultural and natural resources by stating that the Park is: "...dedicated and set apart forever as a public (park) or pleasure ground for the benefit of the people...and...for the preservation of the natural objects within said park...." This act, like the 1916 Organic Act, did not specify any one feature or ecosystem of Crater Lake National Park as being the most important. Rather, it recognized that all these resources are of value. Therefore, the purpose of Crater Lake National Park is to preserve all aspects of its history and ecological environment, including natural processes, i.e. fire, and to provide for visitor use, unimpaired for future generations.

The requirements placed on the National Park Service by these laws, especially the Organic Act and, in this specific case, Crater Lake National Park's enabling legislation, mandate that resources are passed on to future generations "unimpaired" (DOI, 2001a). This EA addresses whether the actions of the various alternatives proposed by Crater Lake National Park significantly impact, and possibly impair, resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents (see
Chapter 3 – Environmental Consequences).

PURPOSE AND NEED

Fire regimes at Crater Lake National Park are similar to other areas in the southern portion of the Cascade Range with comparable plant communities and topography.

Effective fire suppression at Crater Lake National Park over a period of more than 90 years has increased live and dead woody fuel accumulation on the forest floor and within the forest stands. Fire exclusion has unnaturally altered the landscape in some forest ecosystems. In the absence of fire, many forest communities have advanced successionally. This advancement has lead to greater stand densities, more insect/ disease infestations, and greater tree mortality. In some cases, multi-storied conditions have formed continuous vertical fuel ladders. When combined with increased woody fuel, vertical fuel ladders increase the likelihood of extensive, and possibly uncontrollable crown fires.
National Park Service Wildland Fire Management Guidelines (DO-18) states that "all parks with vegetation that can sustain fire must have a fire management plan." The purpose of this federal action is to develop a fire management plan and program that utilizes the benefits of fire to achieve desired natural and cultural resource conditions while minimizing the fire danger to the public, park resources, and adjacent lands from hazardous fuel accumulations.

BACKGROUND

Crater Lake National Park was established on May 22, 1902 and is the nation's fifth oldest national park. The park was created to insure the preservation of Crater Lake and its natural surroundings. The area is characterized by a long history of volcanic and glacial activity, and Crater Lake itself lies within the 6 mile-wide caldera created by the eruption and collapse of Mt. Mazama more than 7,000 years ago.

It is located in the Southern Cascade Mountains and contains 183,224 acres. The park proposed that 179,737 of these acres be designated as wilderness in its 1994 Wilderness Designation proposal. Pending Congressional approval of that proposal, the park manages that acreage as wilderness.

The Park is bounded on the north by Umpqua National Forest, on the northeast, east, and south by Winema National Forest, on the southwest, west, and northwest by Rogue River National Forest and Sky Lakes Wilderness Area. In addition, the Park adjoins Sun Pass State Forest and an 80-acre block of private land on the southeastern corner (See Figure 1-1). These lands are managed for a variety of uses, including timber, grazing, watershed protection, recreation and wilderness.

FIRE MANAGEMENT OBJECTIVES

National Park Service Wildland Fire Management Guidelines (DO-18) requires that all parks with vegetation capable of sustaining fire develop a wildland fire management plan that will meet the specific resource management objectives for that

Wildfires are any non-structure fires, other than prescribed fires, that occur in the wildland. This term encompasses fires previously called both wildfires and prescribed natural fires.

Prescribed Fires are any fires ignited by management actions in defined areas under predetermined weather and fuel conditions to meet specific objectives.

park and to ensure that firefighter and public safety are not compromised. This guideline identifies fire as the most aggressive natural resource management tool employed by the National Park Service. The guideline further states that all fires are classified as either wildland or prescribed fires. Prescribed fires and wildland fire use may be authorized by an approved wildland fire management plan and contribute to a park's resource management objectives. Human-caused wildfires are unplanned events and may not be used to achieve resource management objectives.

DO-18 identifies three paramount considerations for each Park's fire management program. They are:

- protect human life and property both within and adjacent to Park areas;
- perpetuate, restore, replace, or replicate natural processes to the greatest extent practicable; and
- protect natural and cultural resources and intrinsic values from unacceptable impacts attributable to fire and fire management activities

In the on-going effort to improve its fire management policy, Crater Lake National Park proposes to manage fire based on ecosystem boundaries, not administrative ones. This approach relies extensively on communication and coordination with its neighbors, particularly the Forest Service. The park also proposes to restore natural fire regimes in the park while protecting human life and property with prescribed fires, wildland fire use, and manual and mechanical fuel treatments to help meet its fire management goals and objectives.

The overall objectives of the Crater Lake Fire Management Plan are the following:

- prevent fire spread onto adjacent public and private lands by containing all fires within the park boundary; however, wildland fire use may be permitted to spread outside or inside of the park from adjacent, compatible fire management areas within the jurisdiction of involved agencies as allowed by Interagency Agreements;
- take special precautions to preserve historical and cultural resources;
- expand the prescribed burning program to all ecosystems where fire exclusion has created unnatural fuel loadings;
- quantify fire behavior and efforts through monitoring and evaluations of all fires in order to refine prescriptions to achieve objectives;
- continue to research the role of fire in various Crater Lake ecosystems. This effort will include monitoring of ecological effects of wildland fire use and prescribed fires, as well as acquisition of information on fuel accumulations, forest insects and diseases, vegetation dynamics and other topics important to fire management and planning;
- implement a public information program that includes prevention, education, and interpretation, and ensures that socioeconomic considerations are included with ecological concerns when informing the visitor;

- comply with air pollution control regulations and smoke management concerns as required by the Clean Air Act and in cooperation with the Oregon Smoke Management Plan;
- maintain an active fire prevention program to reduce the incidence of human caused wild fires;
- identify and protect values at risk through appropriate management responses to fire events;
- take special precautions to preserve and perpetuate sensitive, rare, threatened, or endangered plant/animal species.

Specific goals and objectives in relation to the fire management program include the following:

- Protect human life, property and designated resources.

  Objective: Ensure all fire management activities sustain no injuries to the public and ensure that the number of fire mgmt. staff lost time injuries does not exceed 60% of the 1995-99 5-year average.

  Objective: Within 80% of the park's developed zones, change fuel conditions so that predicted flame lengths under extreme weather conditions will be less than four feet, by 2008.

  Objective: Complete a risk analysis for properties adjacent to the park by 2004.

- Reduce fuel loadings, which have accumulated as a result of past fire exclusion, for the purpose of minimizing the chances of catastrophic wildfire.

  Objective: Identify areas having increased fuel loadings as a result of fire exclusion, and reduce fuels on at least 15% of those areas to levels within the range of natural variation, by 2008.

  Objective: Restore a normal distribution of historical forest structures and compositions (i.e. target conditions) to at least 10% of park areas identified by low or moderate-severity fire regimes, by 2008.

- Recognize fire as a natural disturbance agent within the park and manage this ecosystem process through appropriate prescribed and wildland fire use.

  Objective: Use prescribed and wildland fire to restore historical fire regime characteristics to at least 10% of park areas identified by a low or moderate severity

fire regime, by 2008 (historical fire characteristics are described in Section 3.3.1-Vegetation).

Objective: Every five years, identify and evaluate the changes in landscape patterns in and adjacent to the park that are the result of fires.

Objective: Complete a burn severity analysis of every wildfire that exceeds 100 acres, within one year of the fire event.

- Mitigate unacceptable environmental impacts on biotic communities and historical and cultural resources due to fire management operations.

  Objective: For every wildland fire and wildfire event, identify and implement appropriate management responses and strategies that address site-specific resource management concerns as described in the park's Resource Advisor's Guide.

- Minimize impacts to cultural resources as a result of fire management actions.

  Objective: Consult and coordinate with American Indian groups to ensure protection of cultural resources. Develop project-specific protocols that minimize impacts to cultural resources. Monitor cultural resources for condition before, during, and after fire management actions.

  Objective: Utilize fire and other treatments to restore and maintain the setting at historic sites and reduce the possibility of extreme fire behavior. Maintain light fuel loads on and adjacent to cultural resources.

- Provide for the safe, aggressive, and appropriate management response to all fires that do not meet resource management objectives by defining suppression responsibilities, organization levels, and decision-making processes.

  Objective: Maintain a fire management organization during fire season that will contain 95% of all unwanted fires in the park within one operational period.

  Objective: Develop branch organization chart with roles and responsibilities for each position. Review and update document annually to ensure efficient distribution of workload.

  Objective: For every wildland fire, conduct a "Wildland Fire Implementation Plan, Phase 1" within 2 hours of detection and size-up.

- Promote an interagency approach to managing fires and minimizing costs of fire management activities.

Objective: On an annual basis, review, update and initiate cooperative agreements to assure that interagency approaches to managing wildland fires are implemented.

Objective: On an annual basis, review treatment projects with adjacent agencies to facilitate cooperative, cross-boundary treatments where possible.

Objective: Annually review and revise as necessary the FMP with adjacent agencies.

- Promote public understanding of fire management programs and objectives.

  Objective: Revise and implement the "Public Fire Information Plan" and "Prevention Plan" annually.

- Provide assertive and effective monitoring of all wildland fires.

  Objective: Record significant fire behavior and decisions, determine whether specific objectives are being met and assess fire effects of every wildland fire event.

  Objective: Update fire management program objectives and/or actions, based on the evaluations and results of fire effects monitoring information, annually.

- Identify information gaps that hamper science-based decision-making and solicit fire research to help fill these gaps.

  Objective: Identify and prioritize fire research needs and develop at least one funding proposal, annually.

  Objective: Consult and coordinate with American Indian groups to gather additional information regarding aboriginal burning and ethnobotanical resource use within the park.

- Park staff and visitors are protected from unhealthy levels of air pollution from prescribed fires. Average visibility within Crater Lake National Park is not impaired to levels worse than the dirtiest 20th percentile as a result of prescribed or wildland use fires.

  Objective: Ambient concentrations of particulate matter (PM-10 and PM-2.5), as measured at critical receptor sites, will not exceed National Ambient Air Quality Standards as established by the U.S. Environmental Protection Agency.

  Objective: Visibility will not be allowed to degrade to levels within the worst 20th percentile for more than four consecutive days.

- Provide a positive work environment for employees through an integrated program of mutual respect, recruitment and retention of high-quality employees, and opportunities for training and career development.

  Objective: Create and implement plans for each employee in which 100% of performance standards are linked to appropriate goals from the park's strategic plan and annual performance plan.

  Objective: Create and implement annual training and development plans for each employee

1.5 SCOPING ISSUES AND IMPACT TOPICS

The National Park Service held two public meetings to discuss proposed amendments to the Fire Management Plan and gather the public's concerns or issues with the proposal. The first meeting took place on April 30, 2001 in Medford, Oregon and the second meeting took place on
May 1, 2001 in Klamath Falls. The major issues and concerns that came from the open house and other public input (e.g. email, written correspondence) were evaluated and sorted. Issues determined to be significant were those related to the effects of the proposed action, and those not already adequately addressed by laws, regulations, and policies. Significant issues were considered in developing and evaluating the alternatives to the Proposed Action discussed in this EA.

SIGNIFICANT ISSUES

Issue: The threat to human health and safety from catastrophic fires that occur near developed areas. There was particular concern regarding evacuation preparations.

IMPACT TOPICS EVALUATED IN THIS ENVIRONMENTAL ASSESSMENT

Impact topics are derived from issues raised during internal and external scoping. Not every conceivable impact of a proposed action is substantive enough to warrant analysis. The following topics, however, do merit consideration in this environmental assessment:

Soils: Soils can potentially be adversely affected by intense fires as well as by suppression activities, therefore, impacts to soils are analyzed in this analysis.

Water Resources: NPS policies require protection of water resources consistent with the Federal Clean Water Act. Both wildfires and fire suppression efforts can affect water

resources by exposing soils, which leads to erosion during storm events and subsequent suspended solids and turbidity in downstream surface waters. Therefore, impacts to water resources are analyzed in this analysis.

Wetlands: Presidential Executive Orders mandate the protection of wetlands. Fire suppression activities can influence wetlands, and therefore impacts are analyzed in this analysis.

Vegetation: Since the plant associations in the park are heavily influenced by fire regimes, this environmental assessment considers the impacts of the proposed FMP alternatives on the park's vegetation.

Ecologically Critical Areas: The Council on Environmental Quality regulations require consideration of the severity of impact on unique characteristics of the geographic area such as proximity to ecologically critical areas (e.g. biosphere reserve, world heritage site, wild & scenic rivers). In 1995, four Research Natural Areas (RNA) were designated in the park: Llao Rock, Desert Creek, Sphagnum Bog, and Pumice Desert. These are ecologically critical areas. The park has establishment records on file that describe each RNA's unique features (see *Chapter 3, section 3 – Vegetation* for descriptions of each RNA).

Wildlife: There are resident populations of various species of reptiles, amphibians, birds, mammals, and invertebrates in the park, therefore, impacts of the FMP alternatives on wildlife are evaluated in this analysis.

Threatened and Endangered Species: The Federal Endangered Species Act prohibits harm to any species of fauna or flora listed by the U. S. Fish and Wildlife Service (USFWS) as being either threatened or endangered. Such harm includes not only direct injury or mortality, but also disrupting the habitat on which these species depend. There are several threatened or endangered species that reside within Crater Lake National Park, including the northern spotted owl. Therefore, this impact topic is included in this analysis.

Noise: Noise is defined as unwanted sound. Fuels reduction, prescribed burns and fire suppression efforts can all involve the use of noise-generating mechanical tools and devices with engines, such as chain saws, trucks, helicopters, and airplanes. Each of these devices, in particular helicopters and chain saws at close range, are quite loud. Therefore, this impact topic is included in this analysis.

Air Quality: The Federal 1970 Clean Air Act stipulates that Federal agencies have an affirmative responsibility to protect a park's air quality from adverse air pollution impacts. Moreover, Crater Lake National Park is designated as a Class I area. All types of fires generate smoke and particulate matter, which can impact air quality within the park and surrounding region to some extent. All of these considerations warrant the inclusion of impacts to air quality in this analysis.

Visitor Use and Experience (Recreation and Visual Resources): The 1916 NPS Organic Act directs the Service to provide for public enjoyment of the scenery, wildlife and natural and historic resources of national parks "in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations." Fire management activities can result in the temporary closure of certain areas and/or result in visual impacts that may affect the visitor use and experience of the park. Therefore, the potential impacts of the proposed FMP on visitor use and experience are addressed in this analysis.

Human Health and Safety: Fires can be extremely hazardous, even life-threatening, to humans, and current federal fire management policies emphasize that firefighter and public safety is the first priority; all FMP's must reflect this commitment (NIFC, 1998). Therefore, impacts to human health and safety are addressed in this analysis.

Cultural Resources: Section 106 of the National Historic Preservation Act of 1966 provides the framework for Federal review and protection of cultural resources, and ensures that they are considered during Federal project planning and execution. The park contains many cultural resource sites. These cultural resources can be affected both by fire itself and fire suppression activities, thus potential impacts to cultural resources are addressed in this analysis.

Socio-economics: NEPA requires an analysis of impacts to the "human environment" which includes economic, social and demographic elements in the affected area. Therefore, this impact topic is included for further analysis in this analysis.

Environmental Justice: Presidential Executive Order 12898 requires Federal agencies to identify and address disproportionate impacts of their programs, policies and activities on minority and low-income populations. Therefore, this topic is addressed in this analysis.

Park Operations: Severe fires can potentially affect operations at national parks, especially in more developed sites like visitor centers, campgrounds, administrative and maintenance facilities. These impacts can occur directly from the threat to facilities of an approaching fire, and more indirectly from smoke and the diversion of personnel to firefighting. Fires have caused closures of facilities in parks around the country. Thus, the potential effects of the FMP alternatives on park operations will be considered in this analysis.

Wilderness: According to National Park Service Management Policies (2001), proposals having the potential to impact wilderness resources must be evaluated in accordance with National Park Service procedures for implementing the National Environmental Policy Act. Because Crater Lake National Park has proposed wilderness, this impact topic is evaluated in this environmental assessment.

IMPACT TOPICS CONSIDERED BUT NOT EVALUATED IN THIS ENVIRONMENTAL ASSESSMENT

NEPA and the CEQ Regulations direct agencies to "avoid useless bulk…and concentrate effort and attention on important issues" (40 CFR 1502.15). Certain impact topics that are sometimes addressed in NEPA documents on other kinds of proposed actions or projects have been judged to not be substantively affected by any of the FMP alternatives considered in this environmental assessment. These topics are listed and briefly described below, and the rationale provided for considering them, but dropping them from further analysis.

Waste Management: None of the FMP alternatives would generate noteworthy quantities of either hazardous or solid wastes that need to be disposed of in hazardous waste or general sanitary landfills. Therefore this impact topic is dropped from additional consideration.

Transportation: None of the FMP alternatives would substantively affect road, railroad, water-based, or aerial transportation in and around the park. One exception to this general rule would be the temporary closure of nearby roads during fire suppression activities or from heavy smoke emanating from wildland fires or prescribed burns. Over the long term, such closures would be very infrequent and would not significantly impinge on local transportation. Therefore, this topic is dismissed from any further analysis.

Utilities: Generally, some kinds of projects, especially those involving construction, may temporarily impact above and below-ground telephone, electrical, natural gas, water, and sewer lines and cables, potentially disrupting service to customers. Other proposed actions may exert a substantial, long-term demand on telephone, electrical, natural gas, water, and sewage infrastructure, sources, and service, thereby compromising existing service levels or causing a need for new facilities to be constructed. None of the FMP alternatives will cause any of these effects to any extent, and therefore utilities are eliminated from any additional analysis.

Land Use: Fire management activities would not affect land uses within the park or in areas adjacent to it. Therefore, this impact topic is not included for further analysis in this environmental assessment.

Prime and Unique Agricultural Lands: Prime farmland has the best combination of physical and chemical characteristics for producing food, fed, forage, fiber, and oilseed crops. Unique land is land other than prime farmland that is used for production of specific high-value food and fiber crops. Both categories require that the land is available for farming uses. Lands within Crater Lake National Park are not available for farming and, therefore, do not meet these definitions. This impact topic is not evaluated further in this environmental assessment.

Indian Trust Resources: Indian trust assets are owned by Native Americans but held in trust by the United States. Indian trust assets do not occur within Crater Lake National Park and, therefore, are not evaluated further in this environmental assessment.

Resource Conservation, Including Energy, and Pollution Prevention: The National Park Service's *Guiding Principles of Sustainable Design* provides a basis for achieving sustainability in facility planning and design, emphasizes the importance of biodiversity, and encourages responsible decisions. The guidebook articulates principles to be used such as resource conservation and recycling. Proposed project actions would not minimize or add to resource conservation or pollution prevention within Crater Lake National Park and, therefore, this impact topic is not evaluated further in this environmental assessment.

Table 1-1 Impact Topics for Crater Lake National Park
Fire Management Plan Environmental Assessment

Impact Topic	Retained or Dismissed from Further Evaluation	Relevant Regulations or Policies
Soils	Retained	NPS *Management Policies 2001*
Water Resources	Retained	Clean Water Act; Executive Order 12088; NPS *Management Policies*
Wetlands	Retained	Executive Order 11988; Executive Order 11990; Rivers and Harbors Act; Clean Water Act; NPS *Management Policies*
Vegetation	Retained	NPS *Management Policies*
Ecologically Critical Areas	Retained	Wild and Scenic Rivers Act; 36 CFR 62 criteria for national natural landmarks; NPS *Management Policies*
Wildlife	Retained	NPS *Management Policies*
Threatened and Endangered Species and their Habitats	Retained	Endangered Species Act; NPS *Management Policies*
Noise	Retained	NPS *Management Policies*
Air Quality	Retained	Federal Clean Air Act (CAA); CAA Amendments of 1990; NPS *Management Policies*
Visitor Use and Experience (Recreation and Visual Resources)	Retained	NPS *Management Policies*
Human Health & Safety	Retained	NPS *Management Policies*
Cultural Resources	Retained	Section 106; National Historic Preservation Act; 36 CFR 800; NEPA; Executive Order 13007; Director's Order #28; NPS *Management Policies*
Park Operations	Retained	NPS *Management Policies*
Socioeconomics	Retained	40 CFR Regulations for Implementing NEPA; NPS *Management Policies*
Environmental Justice	Retained	Executive Order 12898
Wilderness	Retained	The Wilderness Act; Director's Order #41; NPS *Management Policies*
Waste Management	Dismissed	NPS *Management Policies*
Transportation	Dismissed	NPS *Management Policies*

Impact Topic	Retained or Dismissed from Further Evaluation	Relevant Regulations or Policies
Utilities	Dismissed	NPS *Management Policies*
Land Use	Dismissed	NPS *Management Policies*
Prime and Unique Agricultural Lands	Dismissed	Council on Environmental Quality 1980 memorandum on prime and unique farmlands
Indian Trust Resources	Dismissed	Department of the Interior Secretarial Orders No. 3206 and No. 3175
Resource Conservation, Including Energy, and Pollution Prevention	Dismissed	NEPA; NPS *Guiding Principles of Sustainable Design*; NPS *Management Policies*

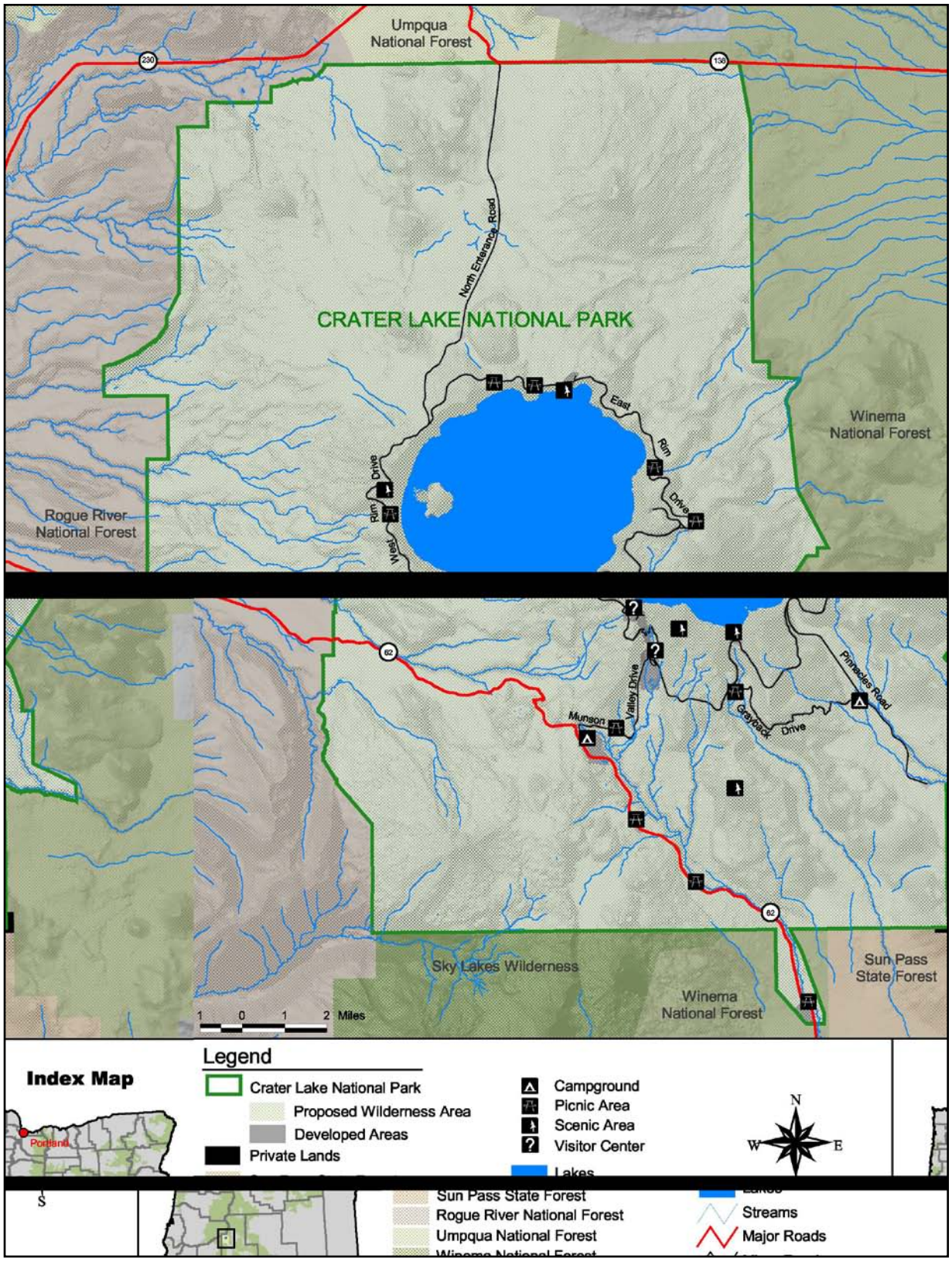


Figure 1-1 Crater Lake National Park Vicinity

Alternatives

This Chapter describes the range of alternatives, including the Proposed Action and No Action Alternatives, formulated to address the purpose of and need for the proposed project. These alternatives were developed through evaluation of the comments provided by individuals, organizations, governmental agencies, and the park's fire management planning interdisciplinary team (IDT).

ALTERNATIVES CONSIDERED BUT NOT ANALYZED FURTHER IN THIS ENVIRONMENTAL ASSESSMENT

Suppression of All Fires

Under this alternative, the FMP would be amended to require that all fires within Crater Lake National Park be suppressed with available resources. In addition, prescribed fires would not be permitted. This alternative reflects the fire management strategy of the Crater Lake National Park prior to 1976. The park did not consider this alternative because current National Park Service policy 1) recognizes the necessary and beneficial role that fire plays in many ecosystems, and 2) promotes the use of fire as one of many tools to meet management objectives.

No Suppression of Wildland Fires

Under this alternative, the FMP would be amended to require that all wildland fires be allowed to burn unchecked. In addition, prescribed fire would be permitted. This alternative recognizes the beneficial role that fire can play in ecosystems.

The park did not consider this alternative for several reasons. Failure to suppress wildland fires would conflict with the DO-18 Wildland Fire Management Guidelines and the Crater Lake National Park Resource Management Plan. Both documents identify the protection of human life, property, and designated resources from unacceptable impacts attributable to fire and fire management activities as a key objective. Unchecked wildland fires could pose a threat to human health and safety, property, cultural resources, air quality, and other environmental resources. In addition, wildland fires left to burn could result in stand replacement fires within the park, and could cross administrative boundaries into neighboring land management areas. Wildland fires that burn into neighboring areas may be unwanted, and could also pose a threat to human health and safety and property.

ALTERNATIVES CONSIDERED AND ANALYZED IN THIS ENVIRONMENTAL ASSESSMENT

Alternative 1 (No Action) - Implement the 1999 Fire Management Plan

This alternative meets the purpose and need by continuing the fire program according to the Fire Management Plan approved in 1999. The No Action Alternative, as defined by Fire Management Areas based largely on administrative boundaries, would include the suppression of wildland fires, provide for prescribed fires, and allow for management of wildland fire (wildland fire use).

Under this alternative, Crater Lake National Park is divided into three Fire Management Areas (FMAs), each of which follows a set of management strategies. The FMAs include the Crater Lake Fire Management Area (115,107 acres), the Boundary Fire Management Area (51,032 acres), and the Exclusion Fire Management Area (2,972 acres). The FMAs were primarily based on administrative boundaries.

A majority of the park is designated as the Crater Lake FMA. Unwanted fires are suppressed in a manner that minimizes negative environmental impacts of suppression activities. Prescribed fires and wildland fire use may be implemented within this FMA.

The Boundary FMA exists because the administrative boundary of Crater Lake National Park does not coincide with natural barriers to fire. Fires originating in the park could cross administrative boundaries if left unchecked, and vice versa. Depending on the management objectives of the park's neighbors for particular areas, such an occurrence could complicate or jeopardize the neighbor's ability to meet its objectives. Accordingly, in some cases, fires are suppressed before they jump administrative boundaries. In other cases where management objectives for the park and its neighbor complement one another, prescribed and wildland fires would be allowed to cross the administrative boundary. Such an act would require that Interagency Agreements be in place between the park and the neighboring land management agencies.

The Exclusion FMA includes scattered clusters of human developments in the Park. These include:

- Mazama Village
- Munson Valley
- Rim Village
- Lost Creek Campground
- Governors Bay developed area
- Cleetwood Cove developed area

Most of these regions contain structures of high monetary and cultural value. For these reasons, all wildland fires are suppressed in these areas. Normal suppression considerations, as well as sensitivity to the particular areas that are threatened, will dictate the exact location of control lines and the choice of appropriate techniques during the suppression of a wildland fire.

The Fire Management Plan targets a total of 2,181 acres for prescribed fire, however, since some treatment units will be burned more than once, the total number of acres burned would be 3,437 acres over a 5-year period (see Table 2-1). While specifically allowed for the in the FMP, there are no acreages assigned for wildland fire use. Although the 1999 plan allows for manual thinning treatments within the Exclusion FMA (to reduce hazardous fuels in order to protect life and property), no specific thinning projects are described.

Table 2-1 Crater Lake National Park 5-Year Treatment Plan (Alternative 1)

FMA	Total Acres in FMA	Mean Fire Return Interval	Annual Prescribed Fire Targets (acres)	Target Acres to be Treated over 5 Years
Crater Lake	115,107	N/A	N/A	N/A
Boundary	51,032	10-15 years	687	3,437
Exclusion	2,972	N/A	N/A	N/A
Total	**169,111**		**687**	**3,437**

Alternative 2 - Ecology Based Program Excluding Wildland Fire Use

This alternative meets the purpose and need through the designation of fire management units determined by wildland fire regimes and resource values at risk. This approach recognizes the ecological role of fire and provides a framework for developing fire management objectives, similar to those contained in the 1999 FMP, across agency boundaries. This alternative would include suppression of wildland fires, provide for prescribed fires, and allow for manual and mechanical fuel treatments as fire surrogates. The particular mix of strategies implemented would be based on ecological needs and resource values at risk. In response to concerns by the public regarding the potential for catastrophic fire, the park does not propose wildland fire use in this alternative.

Under this alternative, the FMP would be amended to include the following four fire management units within Crater Lake National Park: Low Severity, Moderate Severity, High Severity, and Developed (see Figure 2-1). All FMUs, with the exception of Developed, are based upon fire regimes, which describe the character of the fire as well as the effects of fire on the dominant vegetation. The following are descriptions of each FMU and its associated fire regime (Agee 1993, Brown and Smith 2000):

- *Low Severity* – Fires are generally non-lethal to the dominant vegetation and do not substantially change the structure of the dominant vegetation. Approximately 80%

or more of the aboveground dominant vegetation survives fire. This FMU applies to the ponderosa pine and white fir series;

- *Moderate Severity* – Fire severity either causes selective mortality in dominant vegetation, depending on different tree species' susceptibility to fire, or varies between understory and stand replacement fires. This FMU applies to the Shasta red fir and whitebark pine series;
- *High Severity* – Fires kill aboveground parts of the dominant vegetation, changing the aboveground structure substantially. Approximately 80% or more of the aboveground dominant vegetation is either consumed or dies as a result of fires. This FMU applies to the mountain hemlock and lodgepole pine series;
- *Developed* – This FMU includes the developed areas identified under the No Action Alternative. All the developed areas share similar/identical needs and treatment objectives.

Table 2-2 summarizes the total number of acres in each FMU, mean fire return intervals, and the approximate number of acres targeted for treatment in each FMU using prescribed fire and manual and mechanical thinning. Table 2-3 illustrates the proposed treatment activity by calendar year and FMU. Within the Fire Management Units, the park has identified 16 treatment units where it would conduct prescribed fire, manual, and/or mechanical fuel treatments (See Figure 2-2). Table 2-4 identifies the treatments units within their respective FMU, depicts the proposed acreages and timing of treatments, and provides descriptions of the various treatment units.

Table 2-2 Crater Lake National Park 5-Year Treatment Plan (Alternative 2)

FMU	Total Acres in FMU	Mean Fire Return Interval	Annual Treatment Targets (acres)[2]	Target Acres to be Treated over 5 Years	Breakdown of 5-year Target Acres to be Treated by		
					Prescribed Fire	Manual Thinning	Mech. Thinning
Low	19,539	10-15 years	1,350	6,750	6,750	4,250[3]	
Moderate	22,957	40-60 years	383	1,915	1,915	190[3, 4]	
High	105,224	80-100 years	500	2,500	2,500	2,350[3]	
Developed	3,487	N/A	310	1,550		910[5]	640[5]
Total	**151,207[1]**		**2,543**	**12,715**	**11,165**	**7,700**	**640**

[1] The remaining 32,017 acres in the park contain non-forest vegetation (meadows) and non-combustible vegetation, i.e. Crater Lake, and are not included as a separate fire management unit.
[2] Yearly amounts may vary according to fire weather and other planning and implementation considerations.
[3] Manual thinning target acres are captured under those acres to be treated by prescribed fire (e.g. after 4,250 acres of manual treatments are conducted in the Low-Severity FMU, those same acres and up to another 2,500 acres would be treated with prescribed fire, for a total treatment in that FMU of 6,750 acres).
[4] Manual thinning in the moderate severity FMU would be very minor, would only be employed to help prepare sites for prescribed fire. It would not be conducted solely to modify forest structure as is contemplated in the other FMUs.
[5] Manual and mechanical thinning treatments would be employed as fire surrogates.

Table 2-3 Proposed Treatment Activity by Calendar Year and Fire Management Unit

FMU	2002	2003	2004	2005	2006	2007
Low	1,500	0	1,500	1,500	750	1,500
Moderate	0	0	0	615	600	700
High	0	1,500	1,000	0	0	0
Developed	0	270	640	260	380	0
Total Acres[1]	1,500	1,770	3,140	2,375	1,730	2,200

[1] Total acres include those acres to be treated by prescribed fire and mechanical thinning. Manual thinning is already captured in those acres targeted for prescribed fire treatments since hand thinning will often be followed up with prescribed fire.

Table 2-4 Crater Lake National Park Treatment Units and Descriptions

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
erity FMU			
Panhandle	1,000 acres 2002-2003	Manual thin, prescribed fire	Treatment unit is composed of mixed patches of mature ponderosa pine with younger white fir and lodgepole pine and scattered mature sugar pine along Hwy 62. Portions of the area were treated with prescribed fire in the mid '70s and '80's.
Upper Pan	500 acres 2002-2003	Manual thin, prescribed fire	Treatment unit includes mature ponderosa pine and white fir with minor amounts of Shasta red fir and aspen located between highway 62 and the south park boundary above the panhandle.
Sun Creek	1,500 acres 2004	Manual thin, prescribed fire	Treatment unit consists of mixed-conifer stands of ponderosa pine, white fir and sugar pine in the Sun Creek drainage near the park's south boundary.
Sharp Desert	1,000 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary between Desert Creek and Sharps Peak.
TC South	500 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary north and west of Desert Creek.
Red Blanket	750 acres 2006	Manual thin, prescribed fire	Treatment unit includes mixed conifer forests with a Douglas fir component on the south facing slopes of upper Red Blanket canyon.
Crater Creek Ridge	1,500 acres 2007	Manual thin, prescribed fire	Treatment unit consists of mixed conifer forests above Crater Creek along the west park boundary.
Moderate Severity FMU			
PIAL Research	200 acres 2007	Prescribed fire	Treatment unit consists of pure stands of whitebark pine (both upright and krummholtz forms) with less than 5% lodgepole pine and mountain hemlock present on the flanks of Mt. Scott.
West 62	1,215 acres 2005-2006	Prescribed fire	Treatment unit contains mixed conifer forest with patches of variable age-classes found between the west park boundary and hwy 62 west.
Crater Peak	500 acres 2007	Prescribed fire	Treatment unit is composed of mostly Shasta red fir with some mountain hemlock and minor amounts of lodgepole pine along the SW, S, and SE flanks of Crater Peak.
High Severity FMU			
Phoenix	1,500 acres	Manual thin,	Treatment unit borders the NE park

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
	2003	prescribed fire	boundary, containing mixed-conifer forest stands with a heavy lodgepole component.
Cornerstone	1,000 acres 2004	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component
Developed Zone FMU			
Mazama	270 acres 2003	Manual thin, pile burn	Treatment unit is composed of mountain hemlock, lodgepole and Shasta red fir forests in the Mazama Village Area including campground, dormitory, and sewage treatment facilities
Munson Valley-Rim Village	640 acres 2004	Manual thin, pile burn	Treatment unit includes mountain hemlock, Shasta red fir and lodgepole pine forests and sedge meadows associated with Park Headquarters, Munson Valley residential area, and visitor facilities at Rim Village.
Hwy 62 Fuel break	260 acres 2006	Mechanical thin	Treatment unit is centered along the highway 62 road corridor from park's west boundary to the intersection with Munson Valley road. Mixed conifer stands near the west boundary grade into pure stands of mountain hemlock and lodgepole pine above 5500 ft elevation.
Grayback-Pinnacles Fuel break	380 acres 2005	Mechanical thin	Treatment unit includes a mixed mosaic of mountain hemlock and lodgepole pine forests with dispersed sedge meadows along Grayback Motor-Nature Road and Pinnacles Valley Road, including Lost Creek Campground and facilities.

Under this alternative, areas previously treated by manual thinning would be subject to prescribed fire at a later date. This would eliminate the ground fuels accumulation (slash) as a result of the thinning process and begin to restore the natural fire regime to the treated stands. Manual thinning would involve the use of chainsaws. For mechanical fuel treatments, the park envisions the use of tracked/tired vehicles, such as harvesters, forwarders or feller-bunchers. Following the mechanical treatment, slash would be piled and burned, scattered, scattered and burned, or simply removed from the area.

As part of this alternative, the park would investigate the possibility of granting people "fuel wood collection permits." The permit would allow a person to access stockpiles and remove limited amounts of pre-cut wood for non-commercial purposes. The feasibility of contracting for the removal of hazardous fuels would also be explored, and in some cases the trees removed might be part of the compensation for the services provided by the contractor.

Park management would increase efforts to secure Memorandums of Understanding with neighboring land management agencies, including the National Forest Service, in order to

manage wildland fires and prescribed fire across administrative boundaries. This approach reflects the understanding of the ecological role of fire in Crater Lake National Park and surrounding areas by the National Park Service, and its intent to replace the existing administrative boundaries of fire management with ecosystem-related boundaries.

Alternative 3 (Proposed Action) – Ecology Based Program Including Wildland Fire Use

This alternative meets the purpose and need through the designation of fire management units determined by broad wildland fire regimes and resource values at risk. This approach recognizes the ecological role of fire and provides a framework for developing fire management objectives, similar to those contained in the 1999 FMP, across agency boundaries. This alternative would include suppression of wildland fires, provide for prescribed fires and wildland fire use, and allow for manual and mechanical fuel treatments as fire surrogates. The particular mix of strategies implemented would be based on ecological needs and resource values at risk.

Fire management activities and FMUs would be similar to those described under Alternative 2. In addition, the park would allow for wildland fire use to help meet its fire management goals and objectives. Earth moving equipment such as tractors, graders, bulldozers or other tracked vehicles will generally not be used for fire management activities. The Superintendent can authorize the use of heavy equipment in extreme circumstances in the face of loss of human life and/or property.

Table 2-5 summarizes the total number of acres in each FMU, mean fire return intervals, and the approximate number of acres targeted for treatment in each FMU using prescribed fire, manual and mechanical thinning, and wildland fire use. Table 2-6 illustrates the proposed treatment activity by calendar year and FMU. Within the Fire Management Units, the park has identified 16 treatment units where it would conduct prescribed fire, manual, and/or mechanical fuel treatments. Table 2-7 identifies the treatments units within their respective FMU, depicts the proposed acreages and timing of treatments, and provides descriptions of the various treatment units.

Table 2-5 Crater Lake National Park 5-Year Treatment Plan (Alternative 3 – Proposed Action)

FMU	Total Acres in FMU	Mean Fire Return Interval	Annual Treatment Targets (acres)[2]	Target Acres to be Treated over 5 Years	Breakdown of 5-year Target Acres to be Treated by			
					Fire Use[3] (per event)	Prescribed Fire	Manual Thinning	Mech. Thinning
Low	19,539	10-15 years	1,350-1,990	6,750-9,950	0-3,200	6,750	4,250[4]	
Moderate	22,957	40-60 years	383-563	1,915-2,815	0-900	1,915	190[4]	
High	105,224	80-100 years	500-1,300	2,500-6,500	0-4000	2,500	2,350[4]	
Developed	3,487	n/a	310	1,550	n/a		910[5]	640[5]
Total	**151,207[1]**		**2,543-4,163**	**12,715-20,815**	**0-8,100**	**11,165**	**7,700**	**640**

[1] The remaining 32,017 acres in the park contain non-forest vegetation, such as meadows, and non-combustible vegetation, e.g. Crater Lake, and are not included in fire management units. The acreages associated with non-forest vegetation and non-combustible vegetation are 21,111 acres and 13,293 acres respectively.
[2] Yearly amounts may vary according to weather and other planning/implementation considerations.
[3] The acres to be treated annually and under the 5-year treatment plan are equal to or greater than those displayed in Alternative 2 since wildland fire use is contemplated.
[4] Manual thinning target acres are captured under those acres to be treated by prescribed fire (e.g. after 4,250 acres of manual treatments are conducted in the Low-Severity FMU, those same acres and up to another 2,500 acres would be treated with prescribed fire, for a total treatment in that FMU of 6,750 acres, at a minimum).
[5] Manual and mechanical thinning treatments would be employed as fire surrogates.

Table 2-6 Proposed Treatment Activity by Calendar Year and Fire Management Unit (Alternative 3 – Proposed Action)

FMU	2002	2003	2004	2005	2006	2007
Low	1,500	0	1,500	1,500	750	1,500
Moderate	0	0	0	615	600	700
High	0	1,500	1,000	0	0	0
Developed	0	270	640	260	380	0
Total Acres[1]	1,500	1,770	3,140	2,375	1,730	2,200

[1] Total acres include those acres to be treated by prescribed fire and mechanical thinning. Manual thinning is already captured in those acres targeted for prescribed fire treatments since hand thinning will often be followed up with prescribed fire.

Table 2-7 Crater Lake National Park Treatment Units and Descriptions
(Alternative 3 – Proposed Action)

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
verity FMU			
Panhandle	1,000 acres 2002-2003	Manual thin, prescribed fire	Treatment unit is composed of mixed patches of mature ponderosa pine with younger white fir and lodgepole pine and scattered mature sugar pine along Hwy 62. Portions of the area were treated with prescribed fire in the mid '70s and '80's.
Upper Pan	500 acres 2002-2003	Manual thin, prescribed fire	Treatment unit includes mature ponderosa pine and white fir with minor amounts of Shasta red fir and aspen located between highway 62 and the south park boundary above the panhandle.
Sun Creek	1,500 acres 2004	Manual thin, prescribed fire	Treatment unit consists of mixed-conifer stands of ponderosa pine, white fir and sugar pine in the Sun Creek drainage near the park's south boundary.
Sharp Desert	1,000 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary between Desert Creek and Sharps Peak.
TC South	500 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary north and west of Desert Creek.
Red Blanket	750 acres 2006	Manual thin, prescribed fire	Treatment unit includes mixed conifer forests with a Douglas fir component on the south facing slopes of upper Red Blanket canyon.
Crater Creek Ridge	1,500 acres 2007	Manual thin, prescribed fire	Treatment unit consists of mixed conifer forests above Crater Creek along the west park boundary.
Moderate Severity FMU			
PIAL Research	200 acres 2007	Prescribed fire	Treatment unit consists of pure stands of whitebark pine (both upright and krummholtz forms) with less than 5% lodgepole pine and mountain hemlock present on the flanks of Mt. Scott.
West 62	1,215 acres 2005-2006	Prescribed fire	Treatment unit contains mixed conifer forest with patches of variable age-classes found between the west park boundary and hwy 62 west.
Crater Peak	500 acres 2007	Prescribed fire	Treatment unit is composed of mostly Shasta red fir with some mountain hemlock and minor amounts of lodgepole pine along the SW, S, and SE flanks of Crater Peak.
High Severity FMU			
Phoenix	1,500 acres	Manual thin,	Treatment unit borders the NE park

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
	2003	prescribed fire	boundary, containing mixed-conifer forest stands with a heavy lodgepole component.
Cornerstone	1,000 acres 2004	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component
Developed Zone FMU			
Mazama	270 acres 2003	Manual thin, pile burn	Treatment unit is composed of mountain hemlock, lodgepole and Shasta red fir forests in the Mazama Village Area including campground, dormitory, and sewage treatment facilities
Munson Valley-Rim Village	640 acres 2004	Manual thin, pile burn	Treatment unit includes mountain hemlock, Shasta red fir and lodgepole pine forests and sedge meadows associated with Park Headquarters, Munson Valley residential area, and visitor facilities at Rim Village.
Hwy 62 Fuel break	260 acres 2006	Mechanical thin	Treatment unit is centered along the highway 62 road corridor from park's west boundary to the intersection with Munson Valley road. Mixed conifer stands near the west boundary grade into pure stands of mountain hemlock and lodgepole pine above 5500 ft elevation.
Grayback-Pinnacles Fuel break	380 acres 2005	Mechanical thin	Treatment unit includes a mixed mosaic of mountain hemlock and lodgepole pine forests with dispersed sedge meadows along Grayback Motor-Nature Road and Pinnacles Valley Road, including Lost Creek Campground and facilities.

Environmentally Preferred Alternative

The National Park Service is required to identify the environmentally preferred alternative(s) for any of its proposed projects. That alternative is the alternative that will promote the national environmental policy expressed in NEPA (Section 101 (b)). This includes alternatives that:

1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2) ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

3) attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;

4) preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;

5) achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and

6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

In essence, the environmentally preferred alternative would be the one(s) that "causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (DOI, 2001a).

In this case, Alternative 3 (Proposed Action) is the environmentally preferred alternative for Crater Lake National Park since it meets goals 1, 2, 3, and 4 described above. Under these alternatives, fire management activities would reduce hazardous fuel loadings in the park, and help restore natural ecological processes, including native vegetation function and structure. In addition, the alternative helps protect park resources and adjacent lands from the threat of future wildfires. Finally, the alternative best protects and helps preserve the historic, cultural, and natural resources in the park for current and future generations.

IMPACT DEFINITIONS

Table 2-8 depicts the impact definitions used in this Environmental Assessment. Significant impact thresholds for the various key resources were determined in light of compliance with existing state and federal laws, and with existing Crater Lake National Park planning documents.

Table 2-8 Impact Definitions

	"Minor" Impact	"Significant" Impact
Key Resources		
Soils	Minor damage to or loss of the litter/humus layers that causes minor localized increases in soil loss from erosion; fire severe enough to cause minor harm to soil community; minor, temporary surface sterilization of soils that does not cause long term loss of soil productivity that would alter or destroy vegetation community; short-term and localized compaction of soils that does not prohibit re-vegetation	Damage to or loss of the litter/ humus layers that would increase soil loss from erosion on a substantial portion of the burn area; fire severe enough to damage soil community; substantial surface sterilization of soils that may cause long term loss of soil productivity and that may alter or destroy a portion of the vegetation community; long-term and widespread soil compaction that affects a large number of acres and prohibits re-vegetation
Water Resources (Including Wetlands)	Minor damage to or loss of the litter/humus layers that increases sedimentation on no more than 0.1% of a subwatershed; localized and indirect riparian impact that does not substantively increase stream temperatures or affect stream habitats; no alteration of natural hydrology of the wetlands	Damage to or loss of the litter/ humus layers that increases sedimentation on greater than 0.1% of a subwatershed; localized and indirect riparian impact that may substantively increase stream temperatures or affect stream habitats; alteration of natural hydrology of the wetlands
Vegetation	Short-term changes in plant species composition and/or structure, consistent with expected successional pathways of a given plant community from a natural disturbance event; thinning of small diameter understory trees	Violation of the Endangered Species Act of 1973; removal of numerous large diameter or old growth trees greater than 80cm at breast height;
Ecologically Critical Areas	Short-term and local impacts that do not threaten the unique resources for which the Research Natural Areas were established	Long-term and area-wide impacts that threaten the unique resources for which the Research Natural Areas were established
Wildlife	Temporary displacement of localized individuals or groups of animals; isolated mortality of individuals not afforded special protection by state and/or federal law	Violation of the Endangered Species Act of 1973; mortality of species that jeopardize the resident population
Noise	<65 dBA at sensitive receptors; temporary noise levels <90 dBA	>65 dBA noise level at occupied sensitive receptors (campgrounds, wilderness areas, hiking trails, Threatened & Endangered species); continued exposure to noise levels > 90 dBA for workers/general public

	"Minor" Impact	"Significant" Impact
Key Resources		
Air Quality	Minimal to negligible air emissions and temporary smoke accumulation; temporary and limited smoke exposure to sensitive resources	Violation of state and federal air quality standards; violation of Class I air quality standards; prolonged smoke exposure to sensitive receptors
Visitor Use & Experience (Including Recreation, Visual Resources, and Park Operations)	Temporary displacement of recreationists or closure of trails, and recreation areas during off-peak recreation use; temporary or short-term alteration of the vista, or temporary presence of equipment/structures in localized area; smoke accumulation during off-peak recreation use	Permanent closure of trails and recreation areas; conflict with peak recreation use; long-term change in scenic integrity of the vista; substantive smoke accumulation during peak recreation use
Human Health & Safety	Minor injuries to any worker; limited exposure to hazardous compounds or smoke particulates at concentrations below health-based levels	Serious injury to any worker or member of the public; exposure to hazardous compounds or smoke particulates at concentrations above health-based levels.
Cultural Resources	Temporary, non-adverse effects to registered heritage sites, eligible heritage sites, sites with an undetermined eligibility, and traditional cultural properties	Long-term adverse impacts to registered heritage sites, eligible heritage sites, sites with an undetermined eligibility, and traditional cultural properties
Park Operations	Temporary suspension of non-critical park operations; negligible impact to park buildings and structures	Prolonged suspension of all park operations; adverse impacts to park buildings and structures
Socio-economics	Minimal to no short or long-term economic impact on local or regional economy (>2%); proportionate impact on poor or minority communities	A change in local or regional economy greater than 2%; disproportionately high and adverse impact on poor or minority communities
Wilderness	Short-term and local impacts that conflict with wilderness values but are of limited duration and scope	Long-term and regional impacts that conflict with wilderness values or are of unlimited duration or scope

MITIGATION MEASURES AND MONITORING

Crater Lake National Park follows the methods outlined in the NPS National Fire Monitoring Handbook (DOI, 2001) to acquire standardized information on fire behavior and the effects of fire on park resources, especially vegetation. This allows the park to document basic information, to detect trends, and to ensure that fire and resource management objectives are being met in areas that are subject to burning by wildland or prescribed fire. This monitoring program is reviewed annually by the regional fire monitoring coordinator and the park's fire ecology program staff.
Every fire event within Crater Lake National Park will be monitored, and each mitigation measure listed below will be evaluated to determine 1) if it was implemented as stated, and 2) to evaluate if it was effective at mitigating the impact to the resource it was designed to protect. Monitoring reports will become part of the permanent record of each fire event.

Mitigation measures are prescribed to prevent and/or mitigate adverse environmental impacts that may occur from fire management activities. The following mitigation measures are common to all three alternatives.

Fire Management Activities

- Whenever consistent with safe, effective suppression techniques, the use of natural barriers will be used as extensively as possible;
- Fire retardant agents must be on an approved list for use by the Forest Service and Bureau of Land Management;
- Heavy earth-moving equipment such as tractors, graders, bulldozers or other tracked vehicles will generally not be used for fire suppression. The Superintendent can authorize the use of heavy earth-moving equipment in extreme circumstances in the face of loss of human life and/or property;
- When handline construction is required, construction standards will be issued requiring the handlines to be built with minimum impact. No handlines exposing mineral soil will be allowed through cultural sites, and all handlines will be rehabilitated. Erosion control methods will be used on slopes exceeding 10% where handline construction took place;
- All sites where improvements are made or obstructions removed will be rehabilitated to pre-fire conditions, to the extent practicable;
- Heavy earth-moving equipment will use multiple entry and exit points within a treated area;
- Heavy earth-moving equipment will be prohibited in all Research Natural Areas;
- Helispots or camps are prohibited within the boundaries of all Research Natural Areas;
- If fire needs to be stopped in the Desert Creek RNA, water and appropriate foams will be recommended over fire line construction at the meadow edge. Phosphorus/clay based retardants will be banned within the RNA boundaries. If

fire line construction is necessary, it will be best achieved at the forest-meadow edge rather than through the middle of the meadow;

- Fire suppression activities, including the use of foams and retardants, will be barred from Llao Rock RNA;
- Educational/informational materials will be developed and distributed to the wilderness visitor on what to expect during fire management activities including potential noise from chainsaws during line construction, smoke dispersion, safety, helicopter and airplane use, and information on where and when these activities would occur;
- A rehabilitation plan as required by NPS-18, with the use of a Burned Area Emergency Rehabilitation (BAER) Team, will be formulated and implemented in advance of demobilization from major fire events.

Soil and Water Resources (Including Wetlands)

- Creek or river crossings will be limited to set and existing locations;
- Except for spot maintenance to remove obstructions, no improvements will be made to intermittent/perennial waterways, springs or seeps, trails, or clearings in forested areas;
- Riparian areas, which have been burned, may be seeded with native seed from native genotypes, as specified in a Burned Area Emergency Rehabilitation (BAER) plan;
- Fire lines will be located outside of highly erosive areas, steep slopes, and other sensitive areas;
- Fire control strategies will be sensitive to wetland values, and firelines will not "tie" into wetland or bog margins except when relying on those areas to naturally retard the fire without constructed line;
- Foams and retardants will not be used in the Sphagnum Bog RNA or within 200 feet of the upstream surface waters.
- Heavy earth-moving equipment will not be used in the Sphagnum Bog RNA or in any "fragile environment";
- Mechanical fuel treatments will not be conducted within 200 feet of any surface water resource;
- Crews will implement Minimum Impact Suppression Techniques (MIST) fire suppression guidelines to minimize and/or eliminate adverse soil impacts resulting from ground crew activities;
- Heavy equipment associated with mechanical fuel treatments will scatter the slash generated from its operation on site to provide a buffer between the soils and equipment;
- Mechanical equipment will use multiple entry and exit points within a treated area to minimize concentrated soil compaction or soil disturbance impacts resulting from continued use of a single entrance and/or exit;
- Crews will implementation MIST fire suppression guidelines to minimize and/or eliminate adverse impacts to surface water resources. These include:
    - Preferred use of water for aerial drops

- Prohibition of fire retardant use in the Sun Creek Drainage, Lost Creek Drainage, and the caldera
- Prohibition of Crater Lake, Sun Creek, and Lost Creek as water sources
- Restriction of camps and toilet facilities from being located within 200 feet of surface water resources;

Visitor Experience and Use

- Fire management activities (excluding fire suppression) will not be conducted near developed areas and trails during holidays;

Wildlife and Plants

- All fires located within 100 acres of a known spotted owl nest or activity center, will be suppressed;
- Repetitive understory burning in spotted owl habitat will be limited to one occurrence per decade;
- No direct overflights of known T&E species nest sites will be allowed below 1500 Above Ground Level (AGL) from March 15 to August 30 each year;
- During the spotted owl breeding season (March 15 to August 30), manual thinning and prescribed fire treatments will not be conducted in those portions of treatment units that are within 0.7 mile of spotted owl nest sites or activity centers;
- Mechanical fuel treatments will be prohibited within 100 acres of a known spotted owl nest or activity center;
- Prescribed fire and manual thinning treatments will be very limited in nature within 100 acres of a known spotted owl nest or activity center;
- Within 0.7 miles of any known spotted owl nest site or activity center, 40% of the area will be protected from extensive prescribed fire and manual thinning treatments, while 60% will be subject to such treatments;
- Within 12 miles of each known spotted owl nest site or activity center, at least 40% of the area will be protected from fire, and up to 60% will be subject to prescribed fire;
- To protect bull trout habitat, no more than one-half of the upper Sun Creek and Lost Creek watersheds will be allowed to burn in any 20 year period;
- If threatened, endangered, or sensitive plant species are found in a treatment unit, a buffer surrounding the plants will be imposed that prohibits physical damage to the identified population. The assigned Resource Advisor will be consulted when determining the appropriate buffer;
- Prior to prescribed fires in the Panhandle Treatment Unit, park staff will treat the area adjacent to the highway using appropriate hand control methods to reduce chances of spreading known populations of non-native spotted knapweed and St. Johnswort. Park staff will monitor the area after prescribed fires for their

occurrence and employ appropriate hand control methods to remove the noxious weeds if they are present;

- Park staff will clean fire management equipment prior to its use to prevent the spread of noxious weeds;
- Park staff will stage fire management operations away from known noxious weed infestations, and will construct fire lines away from known patches;
- Park staff will survey for noxious weeds in treatment units prior to ignition of prescribed fires;
- Any fires occurring in the area of the Sphagnum Bog, Thousand Springs, upper Castle Creek, Copeland Creek, and Trapper Creek would be monitored for post-fire impacts to *Collomia mazama*.

Cultural Resources

- No handlines exposing mineral soil will be allowed through cultural sites;
- Prior to all prescribed fire and non-fire fuel treatments, cultural resources in treatments areas will be surveyed, identified and avoided;
- Prior to all wildfire and wildland fire use activities, cultural resources in affected areas will be identified and avoided;
- Fire retardant use will be prohibited in the vicinity of any historic structure, unless there is imminent threat from wildfire to the historic structure;
- The park Historian or a designated representative will conduct an inspection and develop a plan to protect any existing or new cultural resources identified before and after prescribed fires.

Wilderness Resources

- Wildland fire operations within the proposed Wilderness Area will adhere to the requirements of the Wilderness Act, NPS Management Policies, and the NPS Director's Orders 18 and 41 Wilderness Preservation and Management;
- All fire management activities within the proposed Wilderness Area will employ minimum actions and tools necessary based upon the Minimum Requirement and Minimum Tool Determination;
- All fire management activities within the proposed Wilderness Area will follow established MIST implementation guidelines;
- All fire management activities within the proposed Wilderness Area will follow established Rehabilitation Guidelines for Wilderness Fire Suppression Activities;
- A Resource Advisor should be available for advice and support with the crew(s) as well as for quality control;
- When Wilderness campsites or travel routes are closed during fire management activities, visitors will be rerouted to alternative travel routes or campsites;

- Mechanical thinning will be restricted to areas of the park that are not proposed for wilderness designation.

Research Natural Areas

- Heavy earth-moving equipment is prohibited within all Research Natural Areas;
- Helispots or camps are prohibited within the boundaries of all Research Natural Areas;
- If fire needs to be stopped in the Desert Creek RNA, water and appropriate foams will be recommended over fire line construction at the meadow edge. Phosphorous/clay based retardants will be banned within the RNA boundaries. If fire line construction is necessary, it will be best achieved at the forest-meadow edge rather than through the middle of the meadow;
- Fire suppression activities, including the use of foams and retardants, are prohibited within the Llao Rock RNA;
- Foams and retardants will not be used in the Sphagnum Bog RNA or within 200 feet of the upstream surface waters.

COMPARISON OF ALTERNATIVES

Table 2-9 compares the fire management activities employed under the three alternatives, while Table 2-10 briefly summarizes the environmental effects of the various alternatives. It provides a quick comparison of how well the alternatives respond to the project need, objectives and key resources. Chapter 3 discusses the environmental consequences of the proposed alternatives in detail.

Table 2-9 Comparison of Fire Management Activities by Alternative

	Fire Suppression	Wildland Fire Use	Prescribed Fire	Manual Thinning	Mechanical Thinning	Fire Effects Monitoring	Research
Alt. 1	X	X	X			X	X
Alt. 2	X		X	X	X	X	X
Alt. 3	X	X	X	X	X	X	X

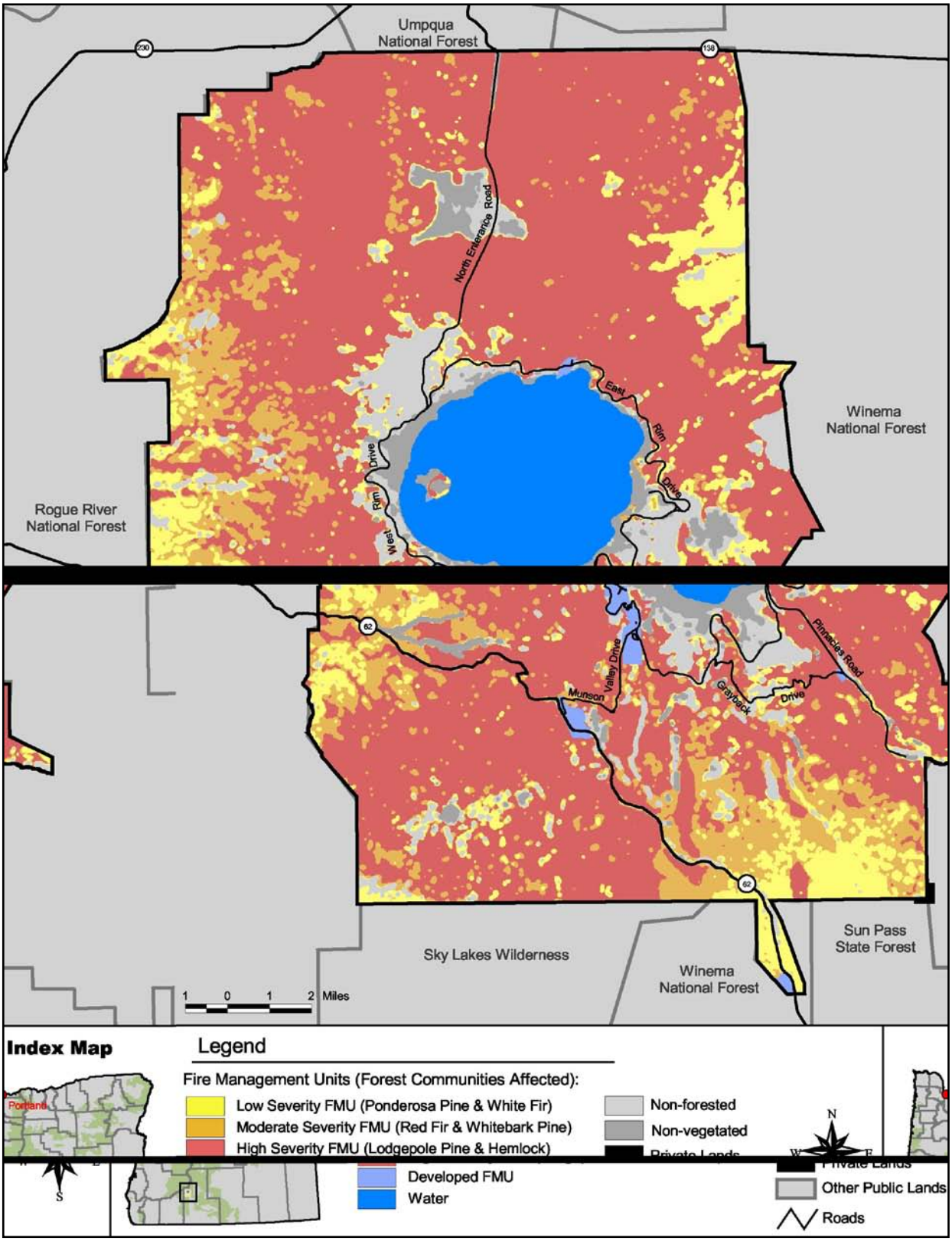


Figure 2-1 Fire Management Units for Alternatives 2 & 3

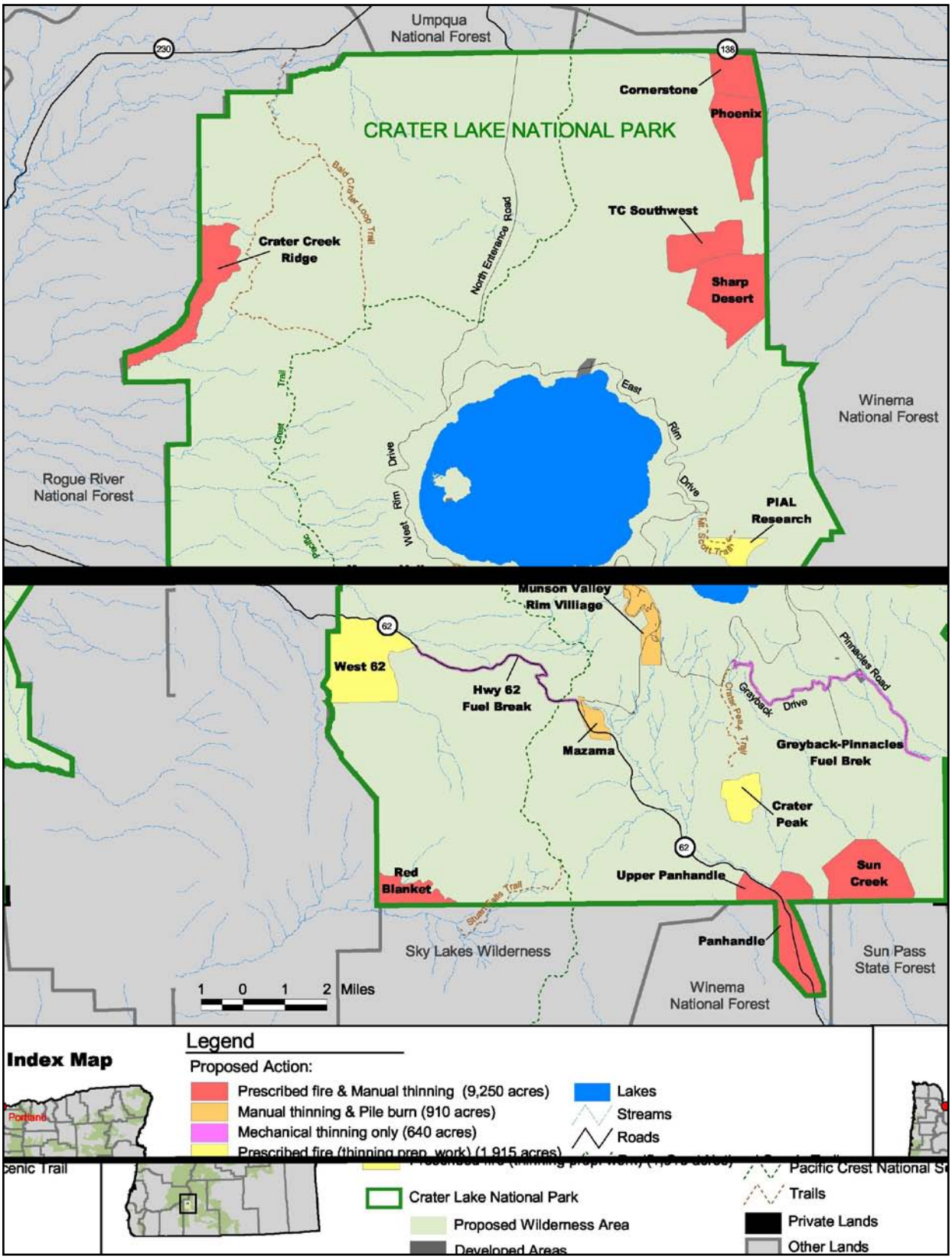


Figure 2-2 Proposed Treatment Units for Alternatives 2 & 3

Table 2-10 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Key Resources

	Alternative 1 - No Action Alternative	Alternative 2 – Ecology-Based Program (Excluding Wildland Fire Use)	Alternative 3 – Ecology-Based Program (Including Wildland Fire Use)
t Need			
Reduces hazardous fuels	Yes, hazardous fuels reduction over time on 2,181 acres of the park This alternative provides **the least hazardous fuels reduction**	Yes, hazardous fuels reduction over time on 12,715 acres of the park This alternative provides **less hazardous fuels reduction** than Alternative 3 in the absence of wildland fire use	Yes, hazardous fuels reduction over time on 12,715-20,815 acres of the park This alternative provides the **greatest hazardous fuels reduction**
Restoration of fire regime, plant and wildlife habitat diversity	Yes, natural fire regimes favoring fire-adapted plant and animal species would result on 2,181 acres of the park This alternative would aid in the restoration of natural fire regimes and plant and wildlife habitat diversity; however, the **degree of restoration would be less than that achieved under Alternatives 2 and 3**	Yes, natural fire regimes favoring fire-adapted plant and animal species would result on 12,715 acres of the park This alternative would aid in the restoration of natural fire regimes and plant and wildlife habitat diversity; however, the **degree of restoration would be less than that achieved under Alternative 3 in the absence of wildland fire use**	Yes, natural fire regimes favoring fire-adapted plant and animal species would result 12,715-20,815 acres of the park With the additional acreage to be treated with wildland fire use, this alternative would **best contribute to the restoration of historic fire regimes and best contribute to plant and wildlife habitat diversity**
Project Objectives			
Reduces the likelihood of unwanted wildfires crossing jurisdictional boundaries	Yes, fire management activities would help prevent unwanted wildfires from crossing jurisdictional boundaries This alternative provides a **lesser degree of reduction in likelihood than that provided by Alternatives 2 and 3**	Yes, fire management activities would help prevent unwanted wildfires from crossing jurisdictional boundaries This alternative provides a **lesser degree of reduction in likelihood than that provided by Alternative 3 in the absence of wildland fire use**	Yes, fire management activities would help prevent unwanted wildfires from crossing jurisdictional boundaries This alternative provides the **greatest degree of reduction in likelihood**

Table 2-10 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Key Resources

	Alternative 1 - No Action Alternative	Alternative 2 – Ecology-Based Program (Excluding Wildland Fire Use)	Alternative 3 – Ecology-Based Program (Including Wildland Fire Use)
Protect human life and property within and adjacent to the park	Yes, fire management activities would protect human life and property within and adjacent to the park This alternative provides **less protection than that provided by Alternatives 2 and 3**	Yes, fire management activities would protect human life and property within and adjacent to the park This alternative provides **less protection than that provided by Alternative 3 in the absence of wildland fire use**	Yes, fire management activities would protect human life and property within and adjacent to the park This alternative provides the **greatest degree of protection**
Significant Issues			
Human health and safety concerns from catastrophic fire	This alternative reduces hazardous fuel loadings and promotes the restoration of natural fire regimes in the park, which would lessen the chance that a wildfire would damage park structures and threaten human health and safety This alternative provides **less protection than that provided by Alternatives 2 and 3**	This alternative reduces hazardous fuel loadings and promotes the restoration of natural fire regimes in the park, which would lessen the chance that a wildfire would damage park structures and threaten human health and safety This alternative provides **less protection than that provided by Alternative 3 in the absence of wildland fire use**	This alternative reduces hazardous fuel loadings and promotes the restoration of natural fire regimes in the park, which would lessen the chance that a wildfire would damage park structures and threaten human health and safety This alternative provides the **greatest protection**
Impact Topics			
Soils	Minor short-term soil erosion impacts resulting from prescribed fire activities and wildland fire use; benefits to soil development and soil nutrification from prescribed fire and wildland fire use	Minor short-term soil erosion impacts resulting from manual and mechanical thinning and prescribed fire activities; benefits to soil development and soil nutrification from prescribed fire	Minor short-term soil erosion and compaction impacts resulting from manual and mechanical thinning and prescribed fire activities; benefits to soil development and soil nutrification from prescribed fire and wildland fire use
Water Resources	Minor short-term indirect surface water resource impacts (creeks); no	Minor short-term indirect surface water resource impacts (creeks); no impact on	Minor short-term indirect surface water resource impacts (creeks); no

Table 2-10 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Key Resources

	Alternative 1 - No Action Alternative	Alternative 2 – Ecology-Based Program (Excluding Wildland Fire Use)	Alternative 3 – Ecology-Based Program (Including Wildland Fire Use)
(including wetlands and fragile environments)	impact on wetlands or fragile environments	wetlands or fragile environments	impact on wetlands or fragile environments
Vegetation	Plant habitat and diversity improved; native plant and fire-tolerant species favored; noxious weed species reduced; fuel loadings reduced on 2,181 acres; promotes the restoration of natural fire regimes in all six major forest series in the park	Plant habitat and diversity improved; native plant and fire-tolerant species favored; noxious weed species reduced; fuel loadings reduced on 12,715 acres; promotes the restoration of natural fire regimes in all six major forest series in the park	Plant habitat and diversity improved; native plant and fire-tolerant species favored; noxious weed species reduced; fuel loadings reduced on 12,715-20,815 acres; promotes the restoration of natural fire regimes in all six major forest series in the park
Ecologically Critical Areas	Minor impacts to Llao Rock and Desert Creek RNAs from wildland fire use; minor impacts to Llao Rock, Desert Creek, and Sphagnum Bog RNAs during wildfire suppression efforts	Minor impacts to Llao Rock, Desert Creek, and Sphagnum Bog RNAs during wildfire suppression efforts	Minor impacts to Llao Rock and Desert Creek RNAs from wildland fire use; minor impacts to Llao Rock, Desert Creek, and Sphagnum Bog RNAs during wildfire suppression efforts
Wildlife	Prescribed fire and wildland fire use activities would temporary displace some wildlife species; isolated mortality of individuals likely; very minor short-term impact on T&E or Sensitive species habitat; general wildlife habitat and T&E habitat improved in the long-term with restoration of natural fire regimes and suppression of unwanted wildfires	Thinning and prescribed fire activities would temporary displace some wildlife species; isolated mortality of individuals likely; very minor short-term impact on T&E or Sensitive species habitat; general wildlife habitat and T&E habitat improved in the long-term with restoration of natural fire regimes and suppression of unwanted wildfires	Thinning, prescribed fire, and wildland fire use activities would temporary displace some wildlife species; isolated mortality of individuals likely; very minor short-term impact on T&E or Sensitive species habitat; general wildlife habitat and T&E habitat improved in the long-term with restoration of natural fire regimes and suppression of unwanted wildfires
Air Quality	Minor and temporary effects resulting from prescribed fires, wildland fire use, and slash pile burning; minor smoke	Minor and temporary effects resulting from prescribed fires, slash pile burning; minor smoke impacts on sensitive wildlife	Minor and temporary effects resulting from prescribed fires, wildland fire use, and slash pile burning; minor

Table 2-10 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Key Resources

	Alternative 1 - No Action Alternative	Alternative 2 – Ecology-Based Program (Excluding Wildland Fire Use)	Alternative 3 – Ecology-Based Program (Including Wildland Fire Use)
	impacts on sensitive wildlife receptors	receptors	smoke impacts on sensitive wildlife receptors
Noise	Minor noise impacts to fire crews, as well as the public; minor noise impacts to sensitive wildlife receptors and wilderness during wildfire suppression efforts	Minor noise impacts to thinning crews and fire crews, as well as the public; minor noise impacts to sensitive wildlife receptors and wilderness	Minor noise impacts to thinning crews and fire crews, as well as the public; minor noise impacts to sensitive wildlife receptors and wilderness
Visitor Use and Experience (including Recreation, Visual Resources, and Park Operations)	Minor and short-term impacts during wildfire suppression and prescribed fire activities (e.g. trail or road closures, presence of work crews in the vista); no effect on park operations; wildland fire use would result in minor and longer-term visual impacts from smoke emissions	Minor and short-term impacts during manual thinning, wildfire suppression, and prescribed fire activities (e.g. trail or road closures, presence of work crews in the vista); no effect on park operations	Minor and short-term impacts during manual and mechanical thinning, wildfire suppression and prescribed fire activities (e.g. trail or road closures, presence of work crews in the vista); no effect on park operations; wildland fire use would result in minor and longer-term visual impacts from smoke emissions
Human Health & Safety	Human health and safety improved by reducing fire danger to the park and adjacent lands; potential for injury from prescribed fire and wildfire suppression activities; minor exposure to smoke by workers and the public during prescribed fires and wildland fires	Human health and safety improved by reducing fire danger to the park and adjacent lands; potential for injury from thinning activities; minor exposure to smoke by workers and the public during prescribed fires and wildland fires	Human health and safety improved by reducing fire danger to the park and adjacent lands; potential for injury from thinning activities; minor exposure to smoke by workers and the public during prescribed fires and wildland fires
Socio-economics	Very minor effects on local and regional economy; no adverse impact to poor and/ or minority populations	Very minor effects on local and regional economy; no adverse impact to poor and/ or minority populations	Very minor effects on local and regional economy; no adverse impact to poor and/ or minority populations

Table 2-10 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Key Resources

	Alternative 1 - No Action Alternative	Alternative 2 – Ecology-Based Program (Excluding Wildland Fire Use)	Alternative 3 – Ecology-Based Program (Including Wildland Fire Use)
Cultural Resources	No impact to known cultural resources; potential for impacts to un-recorded sites; minor impact to ethnobotanicals	No impact to known cultural resources; potential for impacts to un-recorded sites; minor impact to ethnobotanicals	No impact to known cultural resources; potential for impacts to un-recorded sites; minor impact to ethnobotanicals
Wilderness	Minor impact to wilderness resources and values (noise-related)	Minor impact to wilderness resources and values (noise-related)	Minor impact to wilderness resources and values (noise-related)

Environmental Analysis

This chapter summarizes the existing environmental conditions and the probable environmental consequences (effects) of implementing the action and No Action alternatives. This chapter also provides the scientific and analytical basis for comparing the alternatives. The probable environmental effects are quantified where possible; where not possible, qualitative descriptions are provided.

SOILS

Affected Environment

There are five major soil series found within Crater Lake National Park: Timbercrater, Umak, Llaorock, Castlecrest, and Cleetwood. Timbercrater and Umak soils are composed of pumice fragments and volcanic ash and are typically over 60 inches in depth. The surface layer of these soils is a brown, very paragravelly, ashy, loamy sand, while the subsurface layer is a light brown, extremely paragravelly, ashy, loamy sand or ashy sand. They generally occur in the East and Northeast portions of the park, as well as in the Panhandle in the Southeast corner (Weinheimer, 2001).

Pumice soils – composed of gravel to cobble size tan pararock fragments that are vesicular (filled with small cavities formed by entrapment of gases) and porous, filtering water rapidly. Pumice soils are volcanic in origin.

Bedrock Soils – Gray andesite rock fragments intermixed with volcanic ash.

Loamy Sands – Volcanic ash that tends to be light to dark gray with red to black cinders and andesite fragments.

Llaorock soil is composed of volcanic ash and bedrock fragments and is typically over 60 inches in depth. The surface layer of this soil type is a dark brown, cobbly, ashy sandy loam, while the subsurface is a brown, very stony, ashy sandy loam. It primarily occurs around the crater rim and in the Southwest area of the park (Weinheimer, 2001).

Castlecrest and Cleetwood soils are composed of volcanic ash with minor components of cinders and bedrock fragments, and are typically over 60 inches in depth. The surface layer of these soils is a gray, ashy, loamy sand, while the subsurface is a light gray, ashy, loamy sand or ashy sand. Castlecrest is typically found in the valleys throughout the park, including those areas that contain the campgrounds, park headquarters, and Rim Village. Cleetwood is located in the open desert areas of the park (Weinheimer, 2001).

The above soil types range from medium to slightly acidic throughout the park. With a few exceptions (glacial soils in the western portions of the park), the majority of the soils in the park are young soils that are not well-developed or highly productive. Soil permeability is rapid for all the major soils and runoff is slow, resulting in little, if any, erosion where the soils are protected by forest cover (Weinheimer, 2001; DOI, 1999a).

Environmental Consequences

Soil impacts were qualitatively assessed using soil characteristics, literature reviews, and mitigation measures.

Alternative 1- No Action

Implementation of the current Fire Management Plan would have minor effects on soils (soil erosion and compaction). The low fire intensities from prescribed burns would not significantly increase soil erosion since most of the targeted areas are low gradient and contain very coarse-textured soils. Direct soil impacts are more likely to occur from ground crew activities during fire suppression activities. In particular, the creation of fire lines and removal of vegetation in high gradient areas could result in soil erosion. Minimum Impact Suppression Tactics (MIST) fire suppression guidelines outlined would minimize and/ or eliminate any adverse soil impacts resulting from ground crew activities.

Prescribed fire would release nutrients into the soil and the fertilization effects of ash would provide an important source of nutrition for vegetation in the area. In addition to increasing nitrification of the soils and increasing minerals and salt amounts in the soil, the ash and charcoal residue resulting from incomplete combustion would aid in soil buildup and soil enrichment by being added as organic matter to the soil profile. The added material works in combination with dead and dying root systems to make the soil more porous, better able to retain water, and less compact while increasing needed sites and surface areas for essential microorganisms, mycorrhiza, and roots (Vogl, 1979; Wright and Bailey, 1980).

Following the suppression of a very large or catastrophic fire (including ones that may have begun as prescribed fire or wildland fire use), the potential for direct soil impacts rises with the increased number of fire lines constructed to suppress it. In addition, the extensive loss of vegetation could also lead to increased soil erosion. While most natural fires or moderate severity fires are likely to enhance soil development and fertility over the long term due to periodic release of nutrients, extremely severe fires are likely to be detrimental to soils. Soil organic matter can be removed or destructively altered, nutrients volatized, water capacity decreased, and living plants and microorganisms killed (Brown et.al, 2001).

In the aftermath of a large or catastrophic fire, rehabilitation efforts, such as reseeding and filling in fire lines, would minimize soil impacts.

Alternative 2 – Ecology-Based Program Excluding Wildland Fire Use

The use of mechanical fuel treatments could lead to soil impacts in addition to those general soil impacts already described under the No Action Alternative. The most likely impact would be soil compaction. Defined as an increase in bulk density and a decrease in porosity resulting from the application of mechanical forces, soil compaction can reduce the productivity of land and increase the potential for soil runoff (USDA, 1998). Under this alternative, tracked/tired vehicles would perform the mechanical fuel treatments up to 200 feet away from several park roads (see Figure 2-2).

Castlecrest and the pumice soils are susceptible to soil compaction, and the use of mechanical equipment would result in soil compaction. A study in the Plumas National Forest in California found that multiple passes from logging vehicles in unburned forest stands produced an average of about 20% reduction in soil porosity in the top 10cm (about 4 inches) during logging operations on 18 parcels (Brown et.al., 2001). In light of the soil characteristics at Crater Lake National Park, the compaction would not result in significant erosion unless the mechanical treatments were performed on steep slopes. Rather, compaction would retard the re-vegetation of some understory areas. Natural frost heave and the herbaceous vegetation response would help compensate for surface compaction within 5-10 years (Weinheimer, 2001).

While the track design of the equipment helps distribute its weight and reduce the degree of soil compaction, it can cut into soils (rutting) while maneuvering. To reduce soil disturbance, the Park will require that the mechanical equipment scatter the slash generated from its operations on site. This effort would effectively provide a vegetative buffer between the soils and the equipment and minimize direct disturbance to the soils from the operation of the mechanical equipment and help reduce soil compaction by distributing the weight of the equipment. In addition, the park will require that the mechanical equipment use multiple entry and exit points within a treated area to minimize concentrated compaction or soil disturbance impacts resulting from the continued use of a single entrance and/or exit.

High temperatures resulting from pile burning to remove downed woody debris can also result in localized soil impacts underneath the pile. Soil organic matter can be removed or destructively altered, nutrients volatized, water capacity decreased, and living plants and microorganisms killed (Brown et al., 2001).

<u>Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use</u>

Soil impacts under the Proposed Action would be similar to those described under Alternative 2 and the No Action Alternative. In addition, the inclusion of wildland fire use would increase the number of acres in the park whose soils would benefit from low and moderate severity fires.

Conclusion

The implementation of any of the alternatives would not impair geologic and soil resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

WATER RESOURCES

Affected Environment

The following surface water resource descriptions were detailed in the park's Revised Fire Management Plan (1999) and are still applicable for this environmental assessment.

Surface Water Resources

Waters from the slopes of Mt. Mazama flow into the Klamath, Rogue, and Umpqua River systems. Runoff channels are broad and poorly defined with rounded contours since surface runoff in the park from rain and melting snow is negligible. Water sinks almost immediately into the porous volcanic soils and glacial debris and is released only slowly through evaporation, plant use, seeps, and a few springs, some of which emerge within the caldera and flow directly into the lake.

At 1,943 feet, Crater Lake is the seventh deepest lake in the world and the deepest in the United States. It is noted for its extreme water clarity and deep blue color. The lake has no surface outflows and only minor surface ground water inflows as springs along the caldera walls. The main source of water for the lake is precipitation, averaging 70 inches per year.

Wetlands and Riparian Areas

The term "wetlands" includes wet environments such as marshes, swamps and bogs. Wetlands provide critical habitats for fish and wildlife, purify water, and help check the destructive power of floods, storms, and fires. Nutrients and plant material flushed from some wetland systems during storms provide essential food for plants, fish, and wildlife in downstream ecosystems.

Crater Lake National Park wetlands include Sphagnum Bog, Thousand Springs, Boundary Springs, seeps, and creeks (see Figure 3-1). Permanent streambeds in the Park generally have steep-sided channels and relatively undeveloped riparian areas associated with the streams.

In the park, riparian areas along creeks, springs, and seeps represent specialized plant communities. These plant communities provide opportunities for increased biodiversity, as they are interfaces between wetlands and drier upland habitats. These communities provide increased cover and food resources to a greater variety of animal species than are found in the drier upland or wetlands habitats. Riparian communities act as filters for down-slope soil and nutrient movement for aquatic resources, and are considered important habitat components.

Fragile Environments

Several areas within the park contain important wetland communities. These include the following areas:

1. *Boundary Springs*: located in the northwest corner of the park, approximately ½ mile from the north boundary. This is one of the headwater sources of the Rogue River. The spring produces a reliable, year-round flow in an otherwise arid area, resulting in a lush moss and herb flora.
2. *The Sand Creek/ Pinnacles Area*: located near the southeast corner of the park. The entire site is of unique geological importance, with Sand Creek passing through a wide canyon with sloping walls of scoria and pumice. Along those walls are numerous pinnacle formations, many 50 feet or more in height.
3. *Thousand Springs*: located approximately 1-1/2 miles south of the west entrance (HWY 62) of Crater Lake National Park. The Thousand Springs site is a complex of freshwater springs that flow west into Union Creek and eventually into the Rogue River.
4. *Sphagnum Bog*: located along the west-central boundary of the park, this 180-acre wetland is a designated Research Natural Area. It encompasses a broad basin at the head of Crater Creek where two large springs emerge. The springs flow through a shallow gradient stream reach between expanses of mire and open forest. The site consists of a series of interconnected openings containing bog communities ranging from *Carex rostrata* sedge wetlands to *Vaccinium occidentale* bog huckleberry thickets to *Salix barclayi* willow carrs.

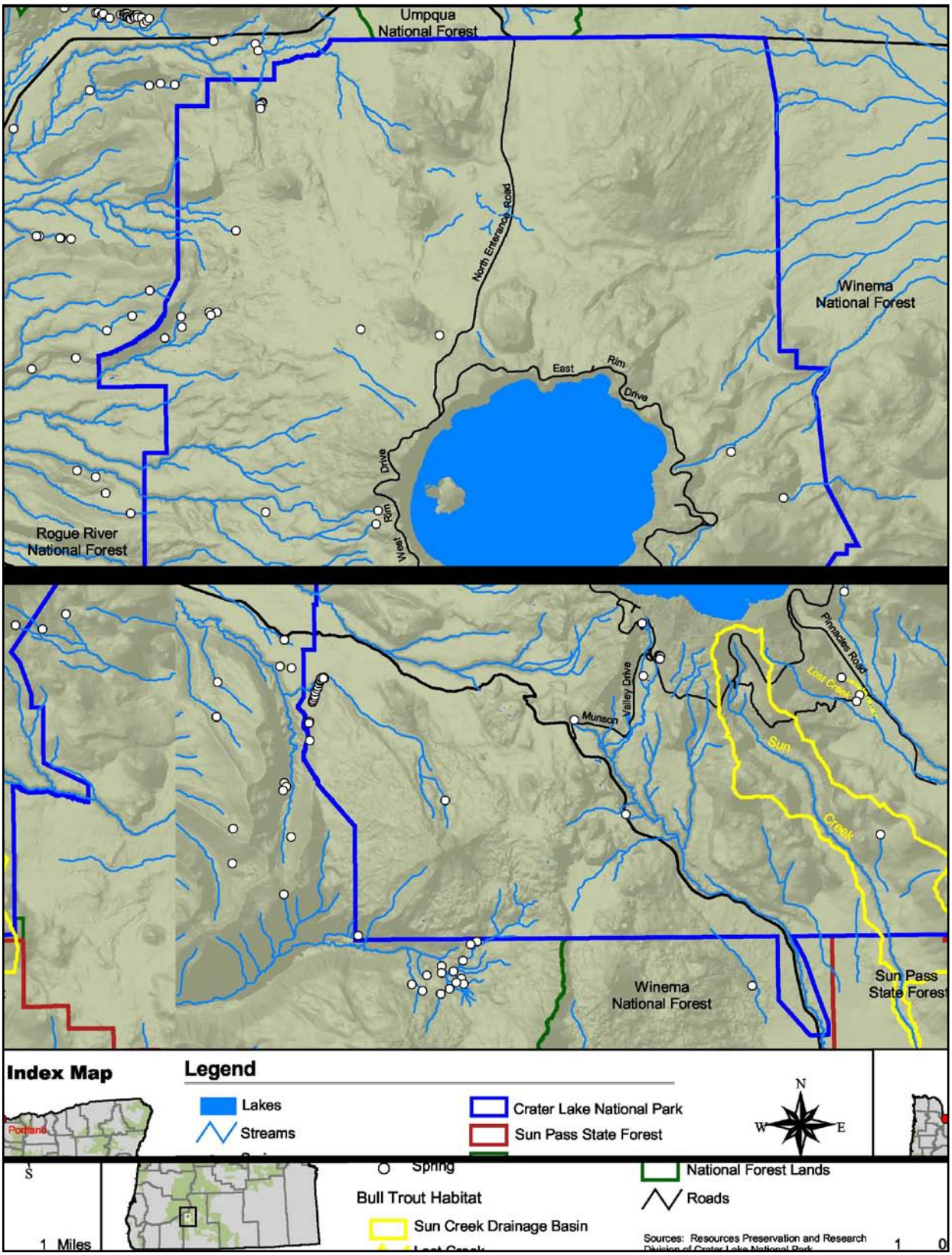

Umpqua
National Forest
North Entrance Road
Winema
National Forest
East Rim Drive
West Rim Drive
Rogue River
National Forest
Pinnacles Road
Lost Creek
Sun
Creek
Munson Valley Drive
Winema
National Forest
Sun Pass
State Forest
Index Map
Portland
Legend
Lakes
Streams
Crater Lake National Park
Sun Pass State Forest
N
W
E
S
Spring
Bull Trout Habitat
Sun Creek Drainage Basin
National Forest Lands
Roads
1 Miles
Sources: Resources Preservation and Research
1
0

Figure 3-1 Water Resources in Crater Lake National Park

Environmental Consequences

Water resource impacts were qualitatively assessed using presence/absence, literature reviews, and mitigation measures.

Alternative 1– No Action

Implementation of the current Fire Management Plan would result in minor impacts to surface water resources.

Increased soil erosion, resulting from ground crew activities, and loss of vegetation from fire could lead to sediment loading in surface water resources in the park. Sediment loading can alter the hydrologic regime of surface waters and adversely impact aquatic habitats and wildlife. Adherence to MIST fire suppression guidelines would minimize the potential for impacts resulting from soil erosion. These guidelines include the backfilling and scarification of deep and/or wide fire lines, as well as the installation of water bars and construction of drain dips. The soil characteristics of the park also greatly reduce the potential for soil erosion and sedimentation of the surface waters. After a very large or catastrophic fire, the implementation of rehabilitative efforts contained in the BAER plan would further minimize the potential for soil erosion and subsequent sediment loading of water resources.

The use of fire retardants or foams could potentially cause significant short and long-term impacts to water resources if misapplied or mishandled, however adherence to MIST guidelines would minimize and/or eliminate accidental spills or applications. Retardants contain ammonia and phosphate or sulfate ions, which can change the chemistry of a water body, thus making it lethal to fish and other aquatic organisms. Foams contain detergents that can interfere with the ability of fish gills to absorb oxygen. The degree of impact would depend on the volume of retardant/foam dropped into the water body, the size of the water body, and the volume of flow in the stream or river. For example, if a 800-gallon drop is made into a fast flowing river, it is likely that the lethal effects to aquatic resources will be short-lived as dilution below the toxic level is quickly achieved. On the other hand, a 3,000-gallon drop in a stagnant pond would likely cause toxic levels to persist for some time (USDA, 2001).

Several MIST suppression guidelines address the potential for retardant impacts on surface water resources. They include: 1) a preference for water drops over fire retardant drops, 2) the prohibition of fire retardant use in the Sun Creek Drainage, the Lost Creek Drainage, and the caldera, and 3) the prohibition of Crater Lake, Sun Creek, and Lost Creek as water sources. In addition, fire management officials must evaluate the potential for adverse impacts to cultural and natural resources prior to authorizing fire retardant drops.

There always exists the possibility of an accidental spill or aerial delivery of fire retardant, or other hazardous material such as gasoline. For smaller spills, the park has a spill response program that would help contain spills and clean up sites.

Another integral component of fire suppression is the use of existing natural barriers, rock outcroppings, trails, wetlands, and streams. Fire suppression activities may use the Sphagnum Bog complex and other wetlands as firebreaks since these areas rarely burn. However, the construction of fire lines near them could adversely impact riparian areas and near-shore habitats. For example, the forested communities within the Sphagnum bog complex contain the rare plant *Collomia mazama*. To mitigate this potential impact, fire control strategies will be sensitive to wetland values, and firelines will not "tie" into wetland or bog margins except when relying on those areas to naturally retard the fire without constructed line. In addition, foams and retardants will not be used in Sphagnum Bog RNA or within 200 feet of the upstream surface waters.

Fire managers do not plan to conduct prescribed fires in the Sphagnum bog area of the park; however, they may allow for wildland fire use in the vicinity of the bog. Fire could have a short-term effect on the hydrologic complex feeding the bogs. With a reduction of vegetation and, subsequently, evapotranspiration, annual water flows through the bog complex may increase. Unless virtually the entire drainage area was burned, this effect would be indistinguishable from the annual hydrologic variation due to climate variability (DOI, 1997). Wildland fire use near wetlands would result in similar hydrologic impacts.

During fire suppression activities, fire crews would employ MIST guidelines that restrict camps and toilet facilities from being located within 200 feet of surface water resources.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

The types of impacts to surface water resources would be similar to those described under the No Action Alternative. The use of mechanical fuel treatments would increase the potential for soil impacts and subsequent sediment loading in surface waters. In addition, mechanical fuel treatments near surface waters, including RNAs and "fragile environments", could significantly impact those resources. Potential impacts would include direct damage to riparian habitats, a change in water temperatures from lack of shade trees and vegetation, and bank erosion and sediment loading in surface waters.

To minimize and/or eliminate potential direct impacts to surface waters, the park will prohibit mechanical equipment from being operated within 200 feet of surface water resources. In addition, mechanical equipment will not be used in the Sphagnum Bog RNA or in any "fragile environment".

The exclusion of wildland fire use in the park would not have any significant effect on surface water resources.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

Impacts to surface water resources under the Proposed Action would be similar to those described under Alternative 2 and the No Action Alternative. The addition of wildland fire use would not significantly increase the extent or severity of those impacts.

Conclusion

The implementation of any of the alternatives would not impair water resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

VEGETATION

Affected Environment

Classification and Description of Forest Fire Regimes

Effective management of fire in a specific ecosystem is aided by classification of the fire regimes of that ecosystem. Fire regimes can be classified through the characteristics of the fire or the effects produced on the landscape by the fire. Fire frequency, fire periodicity, fire intensity, size of fire, pattern on the landscape, season of burn, and depth of burn have all been used to describe such fire regimes. Each of these factors relates to their effect(s) on the plant community of the impact area, which varies considerably. Fire severity is another key component to consider in fire management planning. Fire severity is a qualitative measure of the immediate effects of fires on the ecosystem. It relates to the extent of mortality and survival of plant and animal life both aboveground and belowground and to loss of organic matter. It is determined by heat released aboveground and belowground (Brown and Smith, 2000). The following classification scheme is used for Crater Lake National Park:

Understory fire regime (low-severity) - Fires of this type apply to forests and woodlands. These fires are generally non-lethal to the dominant vegetation and do not significantly alter the structure of the dominant vegetation. It has been estimated that at least 80 percent of the aboveground vegetation survives fires of this regime.

Mixed severity fire regime (moderate-severity) - Fires of this type apply to forests and woodlands. These fires cause selective mortality in dominant vegetation, depending on the species, or may vary between understory and stand-replacement.

Stand-replacement fire regime (high-severity) - Fires of this type apply to forests, woodlands, shrublands, and grasslands. These fires kill aboveground parts of the dominant vegetation, which changes its structure significantly. It has been estimated that at least 80 percent of the dominant vegetation is either consumed or dies from fires.

Nonfire regime (non-forest) – These regimes have little or no occurrence of natural fire. Fires of this type apply to meadows and other areas with little or no combustible vegetation (Agee, 1993, Brown and Smith, 2000).

Ecosystems can be placed into categories related to the presence or absence of fire and its influence:

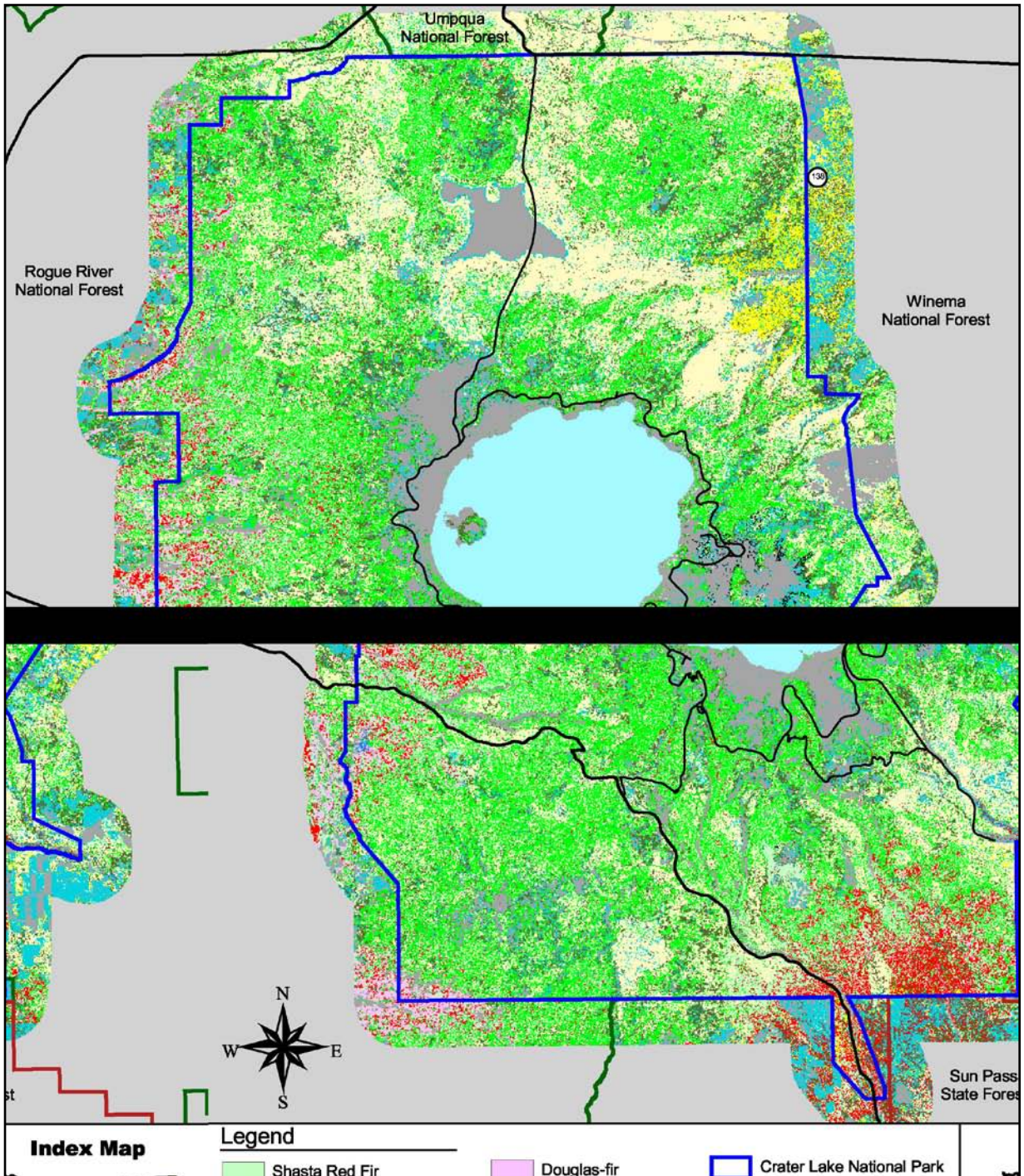
Fire independent ecosystems – Those ecosystems virtually free from fire. Species possess no adaptations to fire; when fire occurs, the effects are long-lasting and recovery is slow.

Fire dependent ecosystems – Fire is common and fuel conditions are conducive to fire spread. Plant species are adapted to fire and require it for survival and continuance. Post-fire recovery is immediate and fire exclusion is unnatural.

Fire-initiated ecosystems – Fire is infrequent and catastrophic. It both terminates and initiates long-lived species. These ecosystems are common in temperate and boreal regions, and include some pioneer species that are shade intolerant. These pioneer species die out and are replaced by other species if the fire interval is too long. Initial re-vegetation is rapid but post-fire recovery period is lengthy, up to hundreds of years.

Fire-maintained ecosystems – Fire is frequent (one to 10 years), usually as surface fires. Intensity is light and crown fires are uncommon. Fire decreases fuel buildups and controls plant succession, often keeping out invading species. Fire favors faster growing trees with thicker bark while the fire intolerant species are selected out. The exclusion of fire from these types leads to fuel buildup and vegetative change, with fire intolerant species becoming more abundant. Ponderosa pine is included in this ecosystem type (GBC, 2001).

Historic fire regime characteristics have been estimated for the forest types found within Crater Lake National Park, based on local ands regional fire history studies (Agee, 1993; Agee and Huff, 2000; and Brown and Smith, 2000). The six forest types or forest series recognized within Crater Lake National Park include: ponderosa pine (*Pinus ponderosa*), white fir (*Abies concolor*), lodgepole pine (*Pinus contorta*), red fir (*Abies magnifica var.*), mountain hemlock (*Tsuga mertensiana*), and whitebark pine (*Pinus albicaulis*). These forest series are identified at a coarse level by the dominant, most shade-tolerant regenerating tree species that is present on a given site (see Figure 3-2). At a finer level, sites can be identified by their understory plant associations. Plant associations are described by the presence or absence, and abundance of understory plant species (Atzet et al., 1996). For this environmental analysis, only the coarser forest series level of classification was used, because a complete and accurate classification of the park's understory (e.g. plant associations) is not available. Table 3-1 describes the estimated historic fire regime characteristics of these forest series.


Umpqua
National Forest
Rogue River
National Forest
Winema
National Forest
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Sun Pass
State Fores
Index Map
Legend
Shasta Red Fir
Douglas-fir
Crater Lake National Park

Figure 3-2 Vegetation in Crater Lake National Park

Table 3-1 Estimated historic fire regime characteristics found at Crater Lake National Park

Series Name	Fire Regime/ Characteristics BA = basal area of trees	Fire Severity (% of landscape effected)	Fire Return Interval	Seasonality (% of area burned)
Ponderosa pine	Low Understory/ surface fires < 20 % BA removed	Low: 60-95% Mod: 5-35% High: 5-10%	10 - 15 years	May- Jun: 0-30% Jul-Sep: 50-70% Oct-Nov: 0-30%
White fir	Low Understory/ surface fires < 20% BA removed	Low: 60-90% Mod: 5-35% High: 5-10%	9 - 42 years	May- Jun: 0-30% Jul-Sep: 50-70% Oct-Nov: 0-30%
Lodgepole pine	High Stand replacing/ crown fires > 70% BA removed	Low: 0-10% Mod: 10-40% High: 60-90%	60 - 80 years	May-Jun: 0-5% Jul-Sep: 90-99% Oct-Nov: 0-5%
Shasta red fir	Moderate Mix of crown/ surface fires 20 – 70% BA removed	Low: 30-60% Mod: 20-40% High: 0-15%	40 - 65 years	May-Jun: 0-20% Jul-Sep: 70-90% Oct-Nov: 0-20%
Mountain hemlock	High Stand replacing/ crown fires > 70% BA removed	Low: 0-10% Mod: 10-40% High: 60-90%	30-115 years	May-Jun: 0-5% Jul-Sep: 90-99% Oct-Nov: 0-5%
Whitebark pine	Moderate Mix of crown/ surface fires 20 – 70% BA removed	Low: 60-90% Mod: 5-20% High: 5-20%	30-180 years	May-Jun: 0-5% Jul-Sep: 90-99% Oct-Nov: 0-5%

Table 3-2 describes the distribution of common tree species by forest series at the park.

Table 3-2 Forest tree series of Crater Lake National Park

Forest Series	Ponderosa pine	White fir	Shasta red fir	Mountain hemlock	Lodgepole pine	Whitebark pine
Tree Species						
Ponderosa pine	M	M				
Douglas-fir	m	M				
Incense cedar		M				
Sugar pine		m				
White fir	m	M	m	m		
Subalpine fir				m		
Western white pine		m	m	m		
Lodgepole pine			M	M	M	m
Shasta red fir			M	m		
Mountain hemlock		m	m	M		m
Whitebark pine				m		M

"M" = Major species present, "m" = Minor species present

Description of Forest Communities (Forest Series)

Ponderosa Pine

Ponderosa pine at Crater Lake is primarily found in the northeastern corner of the park. In this forest community, ponderosa pine is the potential (climax) vegetation and would normally be the only conifer present. Lodgepole pine may be found in association with ponderosa pine along the margins of ponderosa pine communities, particularly at meadow edges.

The structure of the ponderosa community is naturally open and park-like (i.e., grassy understory) with a stable overstory of pure ponderosa pine. Fire normally maintains the forest as an aggregation of very small, even-aged or even-sized clumps. As one clump ages, it is attacked by western pine beetles and then decomposes by fire, scarifying the site for another clump to regenerate. Because of this interaction between fire and beetles, snags tend to be clustered on the landscape, and coarse woody debris is likely short-lived because of frequent fires. Consumption of coarse woody debris naturally inhibits rhizomatous grasses and sedges and creates growing space for pine regeneration.

Elsewhere, a stable pattern of one-storied mature forest in clumps with a grassy understory is normally maintained by frequent fires. The clumped pattern is still very evident across most of the northeast section of the park in this type. Each fire would naturally decrease the chance of a subsequent fire becoming intense by consuming needle litter and shrubs. Consequently, weak sprouting species such as bitterbrush would not normally be as widespread through the ponderosa pine forest as they are today due to past fire suppression activities.

Fire exclusion has allowed a major increase in white fir density in the ponderosa pine communities. Chances of stand-replacement fire, characteristic of high-severity fire regimes, are much greater now than historically. The park has identified the need to restore fuel and stand structure in ponderosa pine communities to more natural, low-severity fire regime conditions. Without allowing fire to play an ecological role, the historical low-severity fire regime will increasingly be replaced with moderate to high-severity fire regimes.

White fir

The white fir communities have a major component of ponderosa pine, as well as sugar pine. Historic fires favored the survival of pines over white fir, and most of these stands, concentrated in the southern portion of the park, were historically dominated by ponderosa pine. Specific fire history information is available for the panhandle area of the park. Researchers studied an elevation gradient from the southern end of the panhandle up into

the red fir forest types, and found an average fire return interval of 9-42 years along the gradient, with the lower average adjacent to the ponderosa pine type and the upper average adjacent to the red fir type. Variation was high, and that probably allowed fire-intolerant white fir (at least while it was young) to survive as a co-dominant in this classic low-severity fire regime type.

The forest stands in the southern portion of the park are generally one-storied, and composed of small clumps. However, these clumps tend to be comprised of only one of the major species in white fir communities: one clump of ponderosa pine, another of sugar pine, another of white fir, several more of ponderosa pine, etc. Fires are frequent enough to kill most understory trees invading the clumps, so that these forest stands remained relatively open.

Understory shrubs such as gooseberries, currants, and ceanothus would either sprout after burning or reproduce from seeds stimulated to germinate by heating as the fire passed over. As in the ponderosa pine type, a low shrub/grass understory was maintained by frequent fires. It was probably better developed under pine clumps than under relatively shadier true fir clumps.

White fir forests have been significantly affected by fire exclusion. The open forest has been choked by white fir regeneration and, to some extent, lodgepole pine. Most of the regeneration ceased about 1950 when growing space in the stands was fully occupied by trees. Fire hazard has significantly increased in white fir communities, and the park has identified the need to restore these communities to a low-severity fire regime.

Lodgepole pine

The lodgepole pine ecosystem is defined, like the ponderosa pine type, on the basis of a single species present: lodgepole pine. This type of forest community is sometimes called climax lodgepole, and is associated with sites of exceptionally low productivity, and typically, cold air pockets. It is identified by the presence of lodgepole pine only in the overstory, little to no understory, and a dearth of understory shrubs and herbs. It is sometimes intermixed with other forests that also have lodgepole pine, such as the red fir and mountain hemlock communities. The occurrence of lodgepole pine in these communities is a good marker of past high-severity disturbances, which occurs very infrequently (more than 100 years between fires) and usually replaces an entire stand with a high intensity fire. These events allow lodgepole pine to dominate sites otherwise dominated by other species. In the climax lodgepole pine forest, lodgepole pine is the dominant, regardless of disturbance history.

Climax lodgepole pine forests have a moderate-severity fire regime. Most stands show an origin from a more widespread stand replacement-type fire and most have a patchy history of fire occurrence and spread. The average fire-free interval is probably around 60 - 80 years, with areas bordering higher productivity forest on the low end of the range. Strong winds are likely associated with the rare stand replacement fire in the lodgepole pine type.

Mature lodgepole pines are quite resistant to fire damage. Under most conditions, these forests will act as natural fuel breaks, where fire suppression, if desired, will be relatively easy.

Most stands surveyed in the park have multiple age classes resulting from mortality due to either mountain pine beetle (*Dendroctonus ponderosae*) or past fire events. Stems killed by either agent will fall within 5-10 years, and over a 40-50 year period they maintain a hard sapwood but decayed heartwood, an ideal vector for fire spread. In the meantime, any clump of trees killed is colonized by a new generation of lodgepole pine, and this process, repeated over time, results in multiple age classes of the pines. Understory development is never substantial in these forests. Moisture competition restricts tree regeneration to gaps created after a tree falls and few herbs or shrubs tolerate these low productivity sites.

Red fir

Red fir ecosystems have a classic moderate-severity fire regime. Red fir, when mature, is relatively fire tolerant. Average fire frequencies of 40-70 years combined with a range of fire intensities leads to a patchy mosaic of different age structures across landscapes of this type. At Crater Lake, typical large fire sizes in red fir forests have been about 500 acres. Small patches of low, moderate, and high-severity fire typically occur, with high-severity fire often covering less than one-third of the landscape. Old-growth stands of red fir are least likely to burn with high severity. Although there has probably been some increase in older patches, red fir stands have not been affected substantially by fire exclusion over the past 80-100 years. Fire effects from natural fires appear to be within the natural range of variability.

Stand development patterns in red fir forests are complex because red fir is not only fire-tolerant but is also shade-tolerant. It does well with or without disturbance. Several stand development patterns are common. If no lodgepole pine is present when a stand replacement fire occurs, shrub dominance will occur (ceanothus and manzanita) with later, slow recolonization by red fir. In moderate-severity patches, some red fir dominants remain and provide seed for colonization by red fir, which does well in these partially shaded conditions, creating a multiple age class stand. In low-severity patches, understory trees are killed but little growing space is opened for regeneration, and red fir reproduces slowly in small gaps where sunflecks occur.

Mountain hemlock

Mountain hemlock stands are the highest elevation continuous forests at Crater Lake. Discontinuous stands of hemlock or whitebark pine are transitional to the alpine zone and occur in a mosaic pattern. Lodgepole pine is a common early seral species in the mountain hemlock zone, indicative of past disturbance by fire. Many of these stands are difficult to differentiate from the climax lodgepole pine forests mentioned earlier, but usually have an understory component of mountain hemlock.

Mountain hemlock and/or young lodgepole pine are thin-barked species susceptible to fire damage, so fires, regardless of fire intensity, are often of stand replacement severity. Where lodgepole pine is present, an even-aged stand of lodegpole pine will emerge from the fire, but where it is absent, the site may revert to shrubby, non-forest vegetation after burning. Where whitebark pine is present, fires are often of moderate-severity, killing some pine but leaving other clumps intact.

Almost a century of fire exclusion has had little impact on the behavior of fires today in mountain hemlock forests.

Whitebark Pine

Whitebark pine forests occur on approximately 8,000 acres in Crater Lake National Park and represent the most expansive and diverse agglomeration in the Southern Cascades. The majority of whitebark pine occurs in the most heavily visited portions of the park – the rim of Crater Lake and Mount Scott. The Rim Village and historic Rim Drive are surrounded by whitebark pine dominated stands. Whitebark pine forests east of the Cascade Crest support diverse communities with lodgepole pine, Shasta red fir, and mountain hemlock often separately co-dominating stands. Pure whitebark pine stands thrive on the flanks of Mount Scott (Murray and Rasmussen, 2002).

Whitebark pine forests in the park, and elsewhere in the Cascades, are dying from the introduced fungus (*Cronartium rubicola*), which causes blister rust. Blister rust has been documented in the park as early as 1935. Current estimates suggest that the disease results in an overall annual decline of 0.4% for mature whitebark pine trees within the park. At that rate of decline, it is anticipated that there would be an additional 20% less whitebark pine within 50 years (Murray and Rasmussen, 2000).

Fire exclusion may have also impacted the health and vitality of the whitebark pine stands in the park. Fire exclusion leads to less opportunity for regeneration coupled with successional advancement of competing trees. The success of whitebark pine regeneration is closely tied with seed dispersal by the Clark's nutcracker. The nutcracker feeds on seeds within the pinecones and usually stores some seeds underground for later use. Some of these cached seeds sprout forming the basis for a new population of pine trees (Jensen and Ross, 1999). Fire exclusion has resulted in a much smaller acreage being exposed to moderate and high severity wildfires, where new opportunities for whitebark pine regeneration could occur.

Threatened/ Endangered/ Sensitive Plant Species

As of 2001, Oregon had 14 federally listed threatened and endangered plants, of which only one may occur in CRLA. Several Sensitive species (an informal designation) occur in the park, and one State Threatened species occurs.

Table 3-3 Threatened, Endangered, and Sensitive Plant Species

Species	Status	Description
Astragalus applegatei (Applegate's milk vetch)	Federal Endangered	Perennial plant species found in flat, seasonally moist, strongly alkaline soils in the Klamath River Basin (USFWS, 1997).
Arabis suffrutescens var. *horizontalis* (Crater Lake rockcress)	Federal Sensitive, State Candidate	Plant found in dry and exposed rocky habitat at high elevations (Appelgate, 1939 and Rasmussen, 2001a)
Botrychium pumicola (pumice grape fern)	Federal Sensitive, State Threatened	Inconspicuous plant found in raw, pale pumice on rocky mountain slopes at high elevations or in frost pockets of montane lodgepole pine openings (USDA and BLM, 1999)
Collomia mazama Mount Mazama collomia	Federal Sensitive	Perennial species that inhabits open woods and meadows of the lodgepole pine and red fir/ mountain hemlock forest zones (Baldwin & Brunsfield, 2001).

Exotic Species and Noxious Weeds

Crater Lake National Park is home to 49 species of non-native vascular plants. They are found on fewer than 150 acres throughout the park and are associated with areas that have been disturbed primarily by construction activities in the park's developed zones. Highway 62 is a source of non-native plant introductions and the primary vector for their spread within the park (Rasmussen, 2001b). There are two species of non-native plants that pose the greatest threat of expanding their populations within the park: spotted knapweed (*Centaurea biebersteinii*) and St. Johnswort (*Hypericum perforatum*). Spotted knapweed is a state listed noxious weed. Annual efforts are made to manually control known infestations within park boundaries.

Environmental Consequences

Vegetation impacts were qualitatively assessed using literature reviews and quantitatively assessed by acres impacted.

Alternative 1– No Action

Under this alternative 2,181 acres would be treated with prescribed fires. Additional acres would be also be subjected to wildland fire use. Generally, hazard fuel treatments would result in the removal of understory vegetation and trees, and would help restore natural fire regimes to several of the forest stand communities in the park. Restoration of fire regimes in the park through prescribed fire and wildland fire use would positively benefit those forest stand communities whose health and biologic diversity rely on the presence of fire. The transformation of some forest stand communities to natural fire regimes would result in an increase of fire-tolerant species, while those fire-intolerant vegetative species would decrease.

More specifically, the benefits of prescribed fire and wildland fire use include reduction of duff material, recycling of nutrients, reduction of accumulating fuels, pruning of trees which reduce ladder fuels into the canopy, thinning of regenerating pines, and minimizing the encroachment of young conifers into grasslands and meadows.

Forest Communities

Ponderosa pine

Hazardous fuels reduction through prescribed fires and wildland fire use would help reduce fuel loadings in this forest type to their pre-suppression levels, thus reducing the chance of stand-replacement fires. These actions would also help return the low-severity fire regime to ponderosa pine forests, which is essential for the health of the species. Suppression activities in ponderosa pine could be beneficial if the forests contain heavy fuel loadings and ladder fuels that could result in stand replacement fires.

White fir

Similar to ponderosa pine, hazardous fuels reduction through prescribed fires and wildland fire use would help reduce fuel loadings in this forest type to their pre-suppression levels, thus reducing the chance of stand-replacement fires. These actions would also help return the low-severity fire regime to white fir forests. Suppression activities in white fir could be beneficial if the forests contain heavy fuel loadings and ladder fuels that could result in stand replacement fires.

Lodgepole pine

While prescribed fire is not a high priority in these stands because of the lack of demonstrated ecological change due to fire exclusion, hazardous fuel would help maintain the mixed-severity fire regime in some stands.

Red fir

Hazard fuels reduction would help maintain the mixed-severity fire regime, which would in turn improve the diversity of habitats typical in this forest community.

Mountain hemlock

Hazard fuels reduction through the use of prescribed fire use would create natural fuel breaks, and provide for safer implementation of wildland fire use, which would benefit this forest community by maintaining its high-severity fire regime.

Whitebark pine

The application of prescribed fire would likely benefit regeneration of whitebark pine stands in the park and help control the blister rust infections. Prescribed fire is currently being employed in the Northern Rocky Mountains to limit the deleterious effects of blister rust and fire exclusion (Murray and Rasmussen, 2002). Prior to any prescribed fires, however, the park would conduct research to help determine science-based targets for the forest community, such as fire frequency, severity, and size for the forests.

Threatened/ Endangered/ Sensitive Plant Species

Fire plays a role in the management of many threatened/ endangered/ sensitive plant species. Fire helps maintain open habitat, encourages sexual and vegetative reproduction, and affects competing or associated plant species. Although fire may injure or kill individual plants, long-term effects on species may be beneficial.

The federally-endangered Applegate's milk-vetch (*Astragalus applegate*) is not known to inhabit the Park, and thus, ground crew activities and fire effects associated with the implementation of the 1999 Fire Management Plan would not impact this species. Sensitive plant surveys will be conducted prior to any ground disturbing activities associated with prescribed burns or manual thinning treatments. If species are identified within proposed treatment areas, physical buffers will be employed around each sensitive plant population to protect plants from physical harm.

Most of the sensitive species within Crater Lake National Park are found in environments that are unlikely to burn, so that fire suppression activities rather than fire presence is likely the greater hazard to these plants. Crater Lake rockcress (*Arabis suffrutescens* var. *horizontalis*) is found in dry, rocky pumice and intermixed with sparse, open, mountain hemlock forest. Pumice grapefern (*Botrychium pumicola*) is a pumice-related species that grows where no humus exists, so it is not threatened at all by fire. Mount Mazama collomia (*Collomia mazama*) occurs in alpine wet meadow habitats. It may burn if fires in adjacent forests move into adjacent non-forested areas. Long-term effects of fire on this

species are not known. Any fires occurring in the area of Sphagnum Bog, Thousand Springs, upper Castle Creek, Copeland Creek, and Trapper Creek would be monitored for post-fire impacts to *Collomia*.

Exotic Species and Noxious Weeds

Ground crew activities and fire can result in temporary or permanent invasion of non-native species. Fire management at Crater Lake National Park has not, to date, been associated with the spread of exotic plants. Although fires do temporarily remove vegetation, post fire recovery of native vegetation usually out-competes exotic plants (DOI, 1997). In addition, park staff conducts yearly surveys of those areas adjacent to roads and remove noxious weeds (Rasmussen, 2001b).

Pre- and post-fire surveys conducted by park staff would involve, among other objectives, identifying and hand-removing exotic species. Among fire suppression actions, fire lines, camps, or helispots would be highest priority spots for monitoring. Since shading reduces the potential for exotic encroachment, potentially forested terrain is less likely to be a problem than places on the landscape where shrub/herb vegetation is the potential vegetation. During rehabilitation efforts following large or catastrophic fires, any re-seeding of burned areas would be accomplished using native plant genotypes.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

Manual and mechanical thinning, and prescribed fire would be employed on 12,715 acres. General vegetation impacts under Alternative 2 would be similar to those described under the No Action Alternative, with some exceptions. The exclusion of wildland fire use would delay the restoration of fire regimes to some forest stand communities since fire managers would have to rely solely on prescribed fire. Since some forest stands would experience a delay in hazardous fuels reduction without the use of wildland fire, the potential exists for an increase in stand replacement fires in those forest stands as ground and ladder fuels continue to accumulate to unnatural levels. This potential would be greatest in ponderosa pine and white fir communities.

Minor vegetation impacts from the use of mechanical equipment would not be significantly different than manual fuels treatment. Where mechanical equipment use is envisioned, the initial survey of the area would help identify any federally listed or sensitive species. If any listed and/or sensitive species are found, appropriate measures and/or mitigation would be developed by the park to protect them. These measures would include actions such as establishing a restriction buffer for the mechanical equipment or allowing for manual fuel treatment only.

Active coordination and consultation with the Forest Service and other neighbors would benefit forest communities in park boundary areas since the management of these areas would focus on treating the forest communities as a whole, not simply those parts that fell

within the National Park Service's jurisdiction. By managing fire cooperatively, whether it be prescribed fire or wildland fire use, the park and its neighbors can improve forest health while, at the same time, reduce the likelihood of unwanted, high-severity wildfires from entering or exiting the park's boundaries.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

Under this alternative, manual and mechanical thinning, prescribed fire, and wildland fire use would be employed on 12,715-20,815 acres. General vegetation impacts under the Proposed Action would be similar to those described under the No Action Alternative and Alternative 2; however, the ability to employ wildland fire use as a fire management strategy would maximize the park's ability to restore and/or maintain the natural fire regimes to its forest stand communities.

Conclusion

Implementation of any of the alternatives would not impair vegetation resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

ECOLOGICALLY CRITICAL AREAS

Affected Environment

Research Natural Areas

In 1995, four Research Natural Areas (RNA) were designated in the park: Llao Rock, Desert Creek, Sphagnum Bog, and Pumice Desert. These Research Natural Areas were established to allow natural processes to dominate and to preserve a given ecosystem or feature. In national parks, RNA's are focal locations for research.

Llao Rock RNA

Llao Rock RNA covers approximately 435 acres near the gently sloped broad top of Llao Rock, and includes some steep terrain on the inner caldera of Crater Lake. Alpine conditions dominate most of the RNA, with small stringers of mountain hemlock forest on the north side and scattered whitebark pine in the alpine zone. The alpine zone habitat has a unique assemblage of wild flowers that are relatively few in number but are noted for their colorful blooms. Two rare plant species occur in the alpine zone. One of the

largest populations of pumice grapefern (*Botrychium pumicola*), a sensitive species, is found at the site, growing in light-colored, loose pumice. The second species of concern is the endemic Crater Lake rockcress (*Arabis suffretescens* var. *horizontalis*), a sensitive species that has a small population also growing in pumice substrate. Other flora and fauna are typical of the subalpine and alpine zones of the park and associated high country.

Pumice Desert RNA

The Pumice Desert RNA, a broad shallow basin surrounded by forest, is the largest RNA in the park at 3,053 acres. The site is deeply mantled by Mount Mazama pumice and has an average plant cover of only 4.5%. Only 14 plant species are recorded for the area. Occasional pine invasion has occurred in disturbed areas across the desert.

Desert Creek RNA

The 1,870-acre Desert Creek RNA, located in the northeast area of the park, is the RNA most likely to be affected by fire. It has a central non-forested area with bitterbrush/long-stolon sedge, and is surrounded by three dry forest types: ponderosa pine/bitterbrush-manzanita/sedge, ponderosa pine/bitterbrush-snowbrush/sedge, and lodgepole pine/bitterbrush/sedge.

Sphagnum Bog RNA

A description of the Sphagnum Bog RNA can be found in Section 3.2.1- Surface Water Resources.

Environmental Consequences

Alternative 1– No Action

Natural fires that occur in Research Natural Areas are generally consistent with the designation intent. However, prescribed fire and wildland fire use in RNAs may not be consistent with other resource objectives, so fire suppression is a possibility for some fires in RNA's. In each case, a far greater possible impact on RNA's is from poorly conducted fire control operations rather than from actual fire effects. Each RNA is unique in terms of its potential to burn and potential fire effects. To minimize and/or eliminate potential impacts to all RNAs, the following mitigation measures will be employed: 1) helispots or camps are prohibited within the boundaries of all Research Natural Areas, and 2) heavy equipment use will be prohibited in all Research Natural Areas.

Llao Rock RNA

Fire suppression activities, including aerial retardants or foam, could have an adverse impact considering the occurrence of rare plant species within the RNA. In particular, fire lines tied to "open ground", trampling effects from ground crews, and the fertilizer contained in fire retardants may directly damage these rare plants. Excessive fertilizer can cause a temporary "burn" on exposed vegetation and, in some cases, kill the plants (USDA, 2001). To eliminate potential impacts to this RNA, prescribed fire and wildifire suppression would not be employed in this RNA.

Pumice Desert RNA

Pumice Desert RNA is not capable of carrying fire. The largest fire management impact is likely to be fire suppression activities directed towards surrounding forested areas. The Pumice Desert itself acts as a firebreak, so fire line construction at the edge of the desert is not likely. Prescribed fire would not be employed in this RNA. Wildland fire is not possible due to the scarcity of fuels.

Desert Creek RNA

Fire suppression activities, including the use of foams and retardants and construction of fire lines, could result in adverse impacts to the vegetative communities in the meadow located in the center of the RNA.

Prescribed fires may be employed in this RNA. The construction of fire lines, particularly through the meadow, could adversely impact the vegetative communities in the RNA. Early season burns would probably not need line construction at the edge of the open meadow located in the RNA because fires would naturally extinguish there. Late season prescribed fires would employ blacklining with water or foam at the edge of the meadow provided that the meadow edge was the control line.

If fire needs to be stopped in the Desert Creek RNA, water and appropriate foams will be recommended over fire line construction at the meadow edge. Phosphorous/clay based retardants will be banned within the RNA boundaries. If fire line construction is necessary, it will be best achieved at the forest-meadow edge rather than through the middle of the meadow.

Wildland fire use would also be allowed in this area since the meadow likely burned in historic fires. It's expected that allowing fire to return to this RNA will have short and long term benefits by increasing forb/grass cover relative to bitterbrush cover.

Sphagnum Bog RNA

Vegetation impacts in this RNA from implementation of the Fire Management Plan are described in section 3.2.2 – Surface Water Resources.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

General impacts under Alternative 2 would be similar to those described under the No Action Alternative. In order to minimize and/or eliminate impacts in RNAs from mechanical treatments, heavy earth-moving equipment will be prohibited within all RNAs.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

General impacts under Alternative 3 would be similar to those described under the No Action Alternative. In addition, wildland fire use may be allowed in the Llao Rock and Desert Creek RNAs under acceptable conditions as outlined in the FMP. After wildland fire use in or near the RNA, fire monitors will seek out the rare plant populations and evaluate before and after effects on these populations. It is very unlikely that the rare plants would burn, because of their preference for open, barren-ground pumice conditions. Under extreme fire conditions during wildland fire use in the RNA, fire suppression could be warranted. In such an event, MIST suppression techniques, taking care that line construction did not tie into open ground within the RNA, would be strictly followed.

Conclusion

Implementation of any of the alternatives would not impair ecologically critical areas that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

WILDLIFE

Affected Environment

A wide variety of animals can be found in the forest, meadow and aquatic habitats at Crater Lake National Park (more than 260 vertebrate species have been identified to date). Fauna likely to be seen in the summer include the black bear, elk, and mule deer. The exact population of bear is unknown, but has been estimated at approximately 30 to 40 animals. A migratory herd of about 150 elk bases itself near Union Peak and grazes in the meadows on the south side of the park. Elk are most common in open areas near timber stands, where they graze on grasses and shrubs. Pronghorn antelope are also known to graze the park in summer in the open ponderosa pine forests along the park's east boundary.

Rodent species make up the majority of mammals present in the park, such as voles, ground squirrels, pikas and yellow-bellied marmots. Golden-mantled ground squirrels are commonly seen by visitors near the rim of Crater Lake in the summer, while the carnivorous pine marten (a member of the weasel family) is often seen by winter visitors. A total of 74 mammals are known to the park.

Several species of fish are found in the park's streams and lake, which were stocked between the late 1800's and early 1940's. Of the five species reported, only one, the bull trout, is native. Approximately a dozen species of amphibians have been identified in the park's scattered riparian habitats. More than 155 species of birds have been reported within the park, though relatively few, among them gray jays, Stellar's jays, Clark's nutcrackers, ravens, and great horned owls, are reported as common on a year-round basis (DOI, 2001f).

Each of the species listed below may occur in the park and could be influenced by fire management activities. The park also contains suitable habitat for the federally endangered gray wolf (*Canis lupis*), however, the species is extirpated from the park. In addition, the federally endangered shortnose sucker (*Chasmistes brevirostris*) and Lost River sucker (*Deltistes luxatus*) are found in the Klamath Falls Basin but do not occur or have any habitat within the Park (Laye, 2001).

Table 3-4 Threatened, Endangered and Sensitive Wildlife Species

Species	Status
Lynx canadensis (Canada lynx)	Federally Threatened
Gulo gulo (wolverine)	State Threatened
Haliaeetus leucocephalus (Bald eagle)	Federally Threatened
Strix occidentalis caurina (Northern spotted owl)	Federally Threatened
Salvelinus confluentus (Bull trout)	Federally Threatened

The Canada lynx requires older and mature forests with downed trees and windfalls to provide adequate cover for denning sites, escape, and protection from severe weather (DOI, 2001g). The lynx is more commonly found in the Northern Cascade Mountains, however, suitable habitat is also present in the Park and surrounding National Forests (Hickenbottom, et al., 1999). Park-wide surveys conducted between 1999-2001 failed to

detect the presence of Canada lynx. More than 80 hair samples were collected for DNA analysis, which detected the presence of bobcat, cougar, and domestic felines, among other mammals (Rasmussen, 2001c).

The wolverine predominantly uses montane coniferous forests and areas of wilderness refugia, where human presence and activities are minimal (Wolverine, 2001). Old forest structure, including wood debris for denning (both logs and snags), is an important structural characteristic of habitat for small carnivores (DOI, 1996). There have been no recent records of wolverine sightings in Southern Oregon (Oregon, 1996). Annual survey efforts, both aerial and ground-based, by federal biologists between 1997 and 2002, have failed to produce any evidence to confirm the presence of wolverine within or adjacent to the park (Rasmussen, 2001c)

Bald eagles (*Haliaeetus leucocephalus*) are known to occasionally nest near Crater Lake and use it as a feeding area. A nesting pair has been reported by the lake during the 2001 nesting season (Rasmussen, 2001b). Eagles prefer large, old trees for nest sites. The forest types most similar to the Klamath Basin nest sites are the white fir and ponderosa pine types.

The northern spotted owl (*Strix occidentalis caurina*) is an old-growth dependent species that prefers complex forest structure. It is at the eastern end of its range in Crater Lake National Park. All currently known nest locations have been found within areas identified as potential habitat, but occasional sightings have been documented outside of these areas. Potential habitat is found in patches throughout the park, with higher density of patches and larger patch sizes southwest of a diagonal line connecting the northwest and southeast corners of the park. In 2001, twelve active spotted owl nesting sites were identified in the park or immediately adjacent to it (Rasmussen, 2001c).

The bull trout (*Salvelinus confluentus*) is a native Pacific Northwest trout that has a radically smaller distribution and abundance than it had even 40 years ago. Bull trout probably reached maximum distribution and abundance after the last glaciation when clear cold-water streams were abundant. Habitat fragmentation, together with habitat degradation (particularly warming waters) and interspecific competition from the exotic brook trout, have led to major declines of the species (DOI, 1997).

Bull trout are found in two streams at the park: Sun Creek and Lost Creek. Non-native brook trout have been removed from the upper and middle reaches of Sun Creek to help stabilize the bull trout population. Bull trout were moved into Lost Creek following brook trout removal to reduce the risk of local extinction from a catastrophic event in Sun Creek (Girdner, 2002).

Environmental Consequences

Wildlife impacts were qualitatively assessed using presence/absence determinations, GIS overlays of treatment units and protected species and their habitats, and mitigation measures.

Alternative 1– No Action

Animal species, like plant species, evolved through a series of "coarse filters" of environment and habitat. Fire was one of the coarse filters that "managed" habitat through time before the park was established. Prescribed fire and wildland fire use would have short-term impacts on animal populations by eliminating cover, food sources, and habitat. Injury and mortality are possible outcomes for some individuals. In addition, heavy smoke may temporarily force animals to temporarily vacate some areas. In the long term, habitat changes resulting from fire have a greater impact on animal populations and communities than the fire itself (USDA, 2000b).

Understory fires generally change habitat structure less severely than mixed-severity or stand replacement fires. Stand-replacement fires reduce habitat quality for species that require dense cover and improve it for species that prefer open sites. Re-introduction of fire as a management tool in the park would have beneficial impacts to fire-dependent faunal species and adverse impacts to fire-intolerant ones. Landscape-scale fire affects on fauna also include changes in availability of habitat patches and heterogeneity within them; changes in the composition and structure of larger areas, such as watersheds, which provide the spatial context for habitat patches; and changes in connections among habitat patches (USDA, 2000b).

Fire can cause a short-term increase in productivity, availability, or nutrient content of forage and browse. These in turn may contribute to an increase in herbivore populations, although such increases may be moderated by animals' ability to thrive in an altered environment. Small carnivores are affected by fire's affect on their prey; effects can be positive or negative. Large carnivores and omnivores have extensive home ranges and their populations may change little in response to fire; however, they thrive where their preferred prey is most plentiful, often in areas of recent burns. Fire may benefit raptors by reducing cover and exposing prey. Other bird species, such as woodpeckers, may benefit from population explosions of wood-boring insects. Birds that prefer interior, closed-canopy forest may be negatively impacted by stand-replacement fires. (USDA, 2000b)

In the long term, it is expected that reintroducing fire would provide for greater habitat diversity and less catastrophic habitat loss. Fire management provides for the least amount

of disturbance overall by reducing the chance of catastrophic fires and allowing for incremental changes over time.

Unlike the plant species, none of the threatened/ endangered/ sensitive animal species are endemic to Crater Lake National Park, and the "threats" to their existence have largely occurred due to land management activities elsewhere (habitat loss affecting northern spotted owls, etc.).

The nearest suitable habitat for the shortnose sucker and Lost River sucker is several miles outside the boundary of the park. Implementation of any alternative by Crater Lake National Park would not have an adverse impact of these two federally endangered species (Laye, 2001).

Threatened/ Endangered/ Sensitive Animal Species

Canada lynx

Fire exclusion that changes the vegetation mosaic maintained by natural disturbance processes is cited as one of several risks to the Canada lynx in the Cascade Mountains. In addition, foraging habitat for the lynx is likely to be maintained at a level less than what would be provided under natural disturbance regimes (Hickenbottom, et al., 1999). Prescribed fire and wildland use fire would likely benefit the lynx and its habitat requirements in the park.

Wolverine

Hazardous fuel treatments would not adversely affect the wolverine. Prescribed fire and wildland fire use would consume ground fuels, including potential snags and logs, that may be suitable for denning purposes, however, the effect on the wolverine is unknown.

Wildland fire use at Crater Lake tends to be patchy in terms of fire severity. This patchiness historically was associated with habitat improvement for small carnivores, and would likely be associated with habitat maintenance for them in the future. High severity patches would create prey concentration areas; moderate severity patches would create coarse woody debris; and unburned patches mixed with low severity patches would provide complex forest structure for small carnivores, including the wolverine (DOI, 1996).

Bald eagle

Prescribed burning in white fir and ponderosa pine would likely reduce the threat of catastrophic fire while maintaining adequate nest trees for bald eagles. Hunting territories would be unchanged or enhanced. There is the expectation prescribed fire would have a positive effect, if any, on the hydrologic complex feeding wetlands in reducing

evapotranspirational area by killing some vegetation, and increasing annual water flow through the wetland; and a positive effect by creating a variety of successional stages that should result in an increase in habitat for small mammals and birds, on which eagles feed.

Northern spotted owl

Fire has the potential to degrade habitat for northern spotted owls, particularly if high severity fires occur on a wide scale and in old growth forest stands. When fire historically occurred, owl habitat may have been damaged for a decade or two and destroyed for longer times only in limited areas. The wildfires of today, burning in higher fuel loads and more uniform multi-layered canopies (resulting from fire suppression), have resulted in an increased proportion of stand replacement fire, which can destroy owl habitat. Hazard fuel treatments, including the use of prescribed fire and wildland fire use, would increase landscape diversity relative to fire, so that the potential for catastrophic fire would be reduced. Monitoring of owls on the Yakima Indian Nation in eastern Washington indicated that radio-telemetered owls continued to forage in light-to moderate-severity patches created by wildfire, but only unburned nest sites continued to be used.

Understory burning reduces dead fuel loads and vertical fuel continuity within a treatment area. Although this reduces catastrophic fire potential for some time, the elimination of a multi-layered understory may result in suboptimum owl habitat at that site, so it would not be done over wide areas in the same decade.

Wildland fire use would be allowed in spotted owl habitat. Over most of the habitats where fire and owls may both occur, the fire regimes are primarily mixes of low and moderate severity, with patches of high severity and unburned islands also occurring. Annual surveys conducted by the park locate spotted owl nest sites and activity centers, so that suppression strategies would be used to protect these areas during prescribed fires or wildland fire use.

Hazardous fuels reduction activities in the Crater Creek, Crater Peak, Highway 62, and Red Blanket Treatment Units would have the potential to impact spotted owl activity centers and interrupt nesting activity. To maximize habitat benefits from thinning, prescribed fire, and wildland fire use in or near spotted owl activity centers, and to eliminate the potential for disturbing nesting owls, several mitigation measures would be employed (see Section 2.4 - *Mitigation Measures and Monitoring*). Among these measures would be a prohibition of treatment activities during the breeding season. Owl nesting and foraging behavior would be the focus of post-fire monitoring so that fire management and spotted owl behavior can be better understood and can better help to guide future spotted owl and fire management.

Bull trout

The event most likely to affect upper Sun Creek or Lost Creek, and in turn the bull trout, is a high-severity forest fire. The Sun Creek watershed near the caldera is in the mountain

hemlock type, but it grades quickly into the red fir type, characteristic of a moderate-severity fire regime. Past fire activity appears to be moderate severity for the most part. The Lost Creek watershed is comprised mostly of lodgepole pine with a minor presence of the mountain hemlock type. Past fire activity has been high severity in nature.

Management of bull trout in Sun Creek and Lost Creek over the long run would depend on avoiding catastrophic disturbance. Catastrophic disturbance is more likely to occur the longer a fire exclusion policy is implemented in these watersheds. Currently, wildland fire use is projected to create patchy effects and would prevent large-scale stand replacement fire in the Sun Creek and Lost Creek watersheds.

Fire suppression actions would totally avoid the use of fire retardant/foam in the Lost Creek and upper Sun Creek watersheds. The chemical toxicity of retardant and foam would be a major risk to a fish population constrained to one or two waterways. Fireline construction by hand outside of the riparian corridor would not have any effect on the population. Fire camps within riparian corridors would not be constructed.

In the lower Sun Creek watershed, past fire suppression has led to abnormally large increases in woody fuels that would also limit the application of prescribed fire unless predicated by manual fuel treatments.

Wildland fire use would be allowed in the Sun Creek treatment unit, but the amount of terrain affected by high-severity burning from such fires would be constrained. Usually in the red fir zone, high-severity burns affect less than 1/3 of the burned area. If no more than 1/2 of the upper watershed is burned in any 20 year period (this includes low, moderate, and high severity patches), this would keep "opened" areas of high severity fire to 20 % or less of the potentially forested area of the upper watershed during any time period. Suppression strategies would be employed when the projected size for any single wildland fire use reached the cumulative limit of 1/2 of the total acreage of the upper watershed in any 20-year period. Otherwise wildland fire use would be allowed to burn in this area over time until they are projected to meet these limits. In this way, fire would approximate a natural role while not placing the bull trout population at risk.

Moderate severity fire would maintain a source of snags and coarse woody debris for the stream channel. It may reduce shading effects on the stream channel from current levels, but upper Sun Creek is an incised channel, oriented in a north-south direction, in parent material created from volcanic avalanche deposits. Upland burning with less than 20% high severity fire would minimally change shading effects on stream temperature.

<u>Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use</u>

General impacts to wildlife would be similar to those described in the No Action Alternative. The exclusion of wildland fire use would delay the restoration of natural fire regimes to some areas of the park and reduce the habitat benefits derived from applications of fire in forest communities. In addition, those areas deprived of wildland fire

use would continue to accumulate ground and ladder fuels, thus increasing the potential for stand replacement fires. Stand replacement fires, depending on their locations, could directly impact bald eagles and spotted owls and their preferred habitats, and indirectly impact bull trout.

Mechanical fuel treatments could result in the mortality of small wildlife and the destruction of ground habitats. To reduce potential impacts to the spotted owl, mechanical fuel treatments would be prohibited within 100 acres of a nesting site and any activity center of the owls. Similarly, its use would be prohibited within 200 feet of any surface water resource, including Sun and Lost Creeks. This restriction would minimize and/or eliminate potential impacts to bull trout. Mechanical fuel treatments in the Grayback-Pinnacles unit would also benefit the Lost Creek watershed and help protect bull trout in Lost Creek through fuels reduction. The mechanical treatments would reduce the potential of a large catastrophic fire from spreading upstream from the Lost Creek campground.

A concerted effort by the park and its surrounding neighbors to manage fire across ecosystem boundaries would improve habitat conditions for those wildlife species that rely on fire-maintained ecosystems by treating and restoring the entirety of forest stands, not simply parts contained in one jurisdiction.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

General impacts to wildlife would be similar to those described in the No Action Alternative and Alternative 2. The inclusion of wildland fire use would facilitate the restoration of natural fire regimes to forest stands in the Park and result in the habitat benefits associated with that change.

Conclusion

Implementation of any of the Alternatives would not impair wildlife resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

NOISE

The loudest sounds that can be detected comfortably by the human ear have intensities that are 1 trillion (1,000,000,000,000) times larger than those of sounds that can just be detected. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes very unwieldy. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level.

Although the dB scale accurately reflects the sound pressure level of a given sound, it does not accurately reflect the sound exposure levels heard by a human observer. The human ear is progressively reduced in sensitivity to sounds in the lower and upper ranges of our audible frequency spectrum. To more accurately assess the loudness of sounds as heard by the human ear, sound levels are measured on the A-weighted decibel (dBA) scale. This sound level scale is progressively reduced in sensitivity to very low and very high-pitched sounds. This method of sound measurement mimics our own sense of hearing, and therefore more accurately assesses the effects of different sound levels on a human observer.

Normal speech has a sound level of approximately 60 dBA. Sound levels above about 120 dBA begin to be felt inside the human ear as discomfort and eventually pain at still higher levels (DOD, 1978). Sound level examples can be found in Table 3-5.

Table 3-5 Common Noise Levels and Their Effects on the Human Ear

Source	Decibel Level (dBA)	Exposure Concern
Soft Whisper	30	Normal safe levels.
Quiet Office	40	
Average Home	50	
Conversational Speech	60	
Busy Traffic	75	May affect hearing in some individuals depending on sensitivity, exposure length, etc.
Noisy Restaurant	80	
Average Factory	80-90	
Pneumatic Drill	100	Continued exposure to noise over 90 dBA may eventually cause hearing impairment
Automobile Horn	120	

(DOD, 1978)

To accurately assess the impacts of noise exposure on an entire community, dBA sound levels are commonly expressed with a measure that describes the cumulative effects of noise levels over time. The most commonly employed cumulative noise measure for environmental analysis is the Day-Night Sound Level (Ldn). This measure (expressed in dBA) describes the cumulative noise exposure expected from all major noise sources over a 24-hour period. Using the Ldn system, 10 dB is added to the assessment of sound produced by activities occurring between 10 PM and 7 AM. This addition places greater weight on the noise produced by nighttime activities due to the higher sensitivity of communities to noise during these hours.

Certain facilities, communities, and land uses are more sensitive to a given level of noise than others. Such "sensitive receptors" include schools, churches, hospitals, retirement

homes, campgrounds, wilderness areas, hiking trails, and species of threatened or endangered wildlife. Impacts from noise production are generally assessed with respect to changes in noise levels experienced at sensitive receptors. Different types of sensitive receptors vary in their acceptance of noise disturbance. As a result, noise impacts for different receptors are often assessed using different noise level standards. Recommended land use and associated noise levels are illustrated in Table 3-6.

Table 3-6 Recommended Land Use Noise Levels

Land Use Category	Noise Levels (Ldn)			
	Clearly Acceptable	Normally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential	< 60	60-65	65-75	> 75
Commercial, Retail	< 65	65-75	75-80	> 85
Commercial, Wholesale	< 70	70-80	80-85	> 85
Manufacturing	< 55	55-70	70-80	> 80
Agricultural, Animal Breeding	< 60	60-75	75-80	> 80
Natural Recreation Areas	< 60	60-65	65-75	> 75
Hospitals	< 60	60-65	65-75	> 75
Schools	< 60	60-65	65-75	> 75
Libraries	< 60	60-65	65-75	> 75
Churches	< 60	60-65	65-75	> 75
Nursing Homes	< 60	60-65	65-75	> 75
Playgrounds	< 55	55-65	65-75	> 75

(HUD, 1991)

Affected Environment

There are several potential noise sources associated with fire management activities under the No Action Alternative. These include vehicular traffic, engines, chainsaws, and aircraft. Under the Proposed Action and Alternative 2, mechanical equipment would also be employed for fuels reduction efforts. The dB sound levels from the equipment at a distance of 50' includes the following: Chainsaw (78 dB), Harvester/Forwarder (86 dB) Engine/Truck (91 dB), and Wood Chipper (89 dB). In addition, there are several sensitive receptors near or within the treatment areas of the proposed project. These include campgrounds, wilderness areas, and federally listed animal species and their habitat.

Environmental Consequences

Noise levels were quantitatively determined using the Highway Construction Noise Measurement, Prediction, and Mitigation methodology (Federal Highway Administration). Noise impacts were then assessed with respect to the location of sensitive receptors. Noise impacts on a person's wilderness experience were assessed in relation to the presence/absence of people recreating in the proposed wilderness areas.

<u>Alternative 1– No Action</u>

Noise has the potential to impact both humans and wildlife. For humans, noise can affect recreational experiences and the enjoyment of wilderness values. For wildlife, noise may disrupt activities such as hunting, breeding, and nesting. This is of particular concern for Threatened and Endangered Species.

Noise disturbance is one of the primary impacts of both fixed wing aircraft and helicopters. With the use of helicopters, the potential for noise impacts increases, as flight frequency normally increases dramatically and missions expand to include landings.

To reduce the impact of noise from overflights, the Fire Management Officer would review any fire suppression activities or wildland fire use within three miles of known Threatened and Endangered Species locations. No direct overflights of known spotted owl nest sites would be allowed below 1,500 feet above ground level from March 15-August 30 each year. No direct overflights of known peregrine falcon nests sites would be allowed below 1,500 feet above ground level from January 1-July 31 each year. Aerial overflights associated with fire management operations should be restricted to 1,500 feet above ground level whenever possible.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

General noise impacts under Alternative 2 would be similar to those described under the No Action Alternative.

Noise calculations for the project sites and sensitive receptor locations were performed using the Federal Highway Administration's Construction Noise Measurement, Prediction, and Mitigation methodology. Noise level calculations were performed assuming that obstructions that may impede the propagation of sound (buildings, vegetation, etc.) were not present, and that the land between the source of the sound and the receiver was flat. Thus the noise level calculations should be considered a "worst-case" measure. Based on the noise modeling calculations, ambient noise levels of 65 dBA would be reached at a distance of approximately 1,500 feet from the source of manual and mechanical thinning activities. Sound levels would be reduced even further if noise-generating activities occurred within dense vegetation, especially conifer forests. Dense vegetation that is at least 100' in depth would reduce the sound levels by 3 to 7 dBA (NYDEC, 2000). Thus, ambient noise levels of 65 dBA could be reached within 750' of project operations with the previous assumptions.

The park would consider whether the use of chainsaws in wilderness areas would be the "minimum tool" necessary to conduct its hazardous fuels reduction activities. If the use of chainsaws was authorized after completing a minimum requirement assessment (see Section 4.12 – *Wilderness*), thinning treatments would have the potential to impact trail use in or adjacent to the PIAL Research, Crater Creek, and Red Blanket Treatment Units. Manual and mechanical thinning would also have the potential to impact campgrounds in Mazama Village and at Lost Creek. Lastly, thinning treatments would have the potential to impact spotted owls in the Crater Peak, Crater Creek, Red Blanket, and West 62 Treatment Units.

To minimize noise impacts to the campgrounds and trail users in the proposed wilderness, the park would prohibit thinning operations during holidays and, in some instances, would temporarily close access to the affected trails (Mount Scott Trail, Bald Crater Loop Trail, Boundary Spring Trail, and Stuart Falls Trail) and redirect recreationists to other trails for their wilderness experience. To eliminate potential noise impacts to nesting owls, thinning treatments would be prohibited in the areas of those treatment units within 0.7 miles of a nest during the owl's breeding season.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

General noise impacts under the Proposed Action would be similar to those described under Alternative 2.

Conclusion

Following the completion of a "minimum requirements" process that authorized the use of chainsaws in proposed wilderness areas, implementation of any of the Alternatives would not impair sensitive receptors or park resources and values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

AIR QUALITY

Affected Environment

Under the 1977 Clean Air Act amendments, Crater Lake National Park and other wilderness, national parks and wildlife refuges were designated Class 1 areas. This designation provides for the highest degree of regulatory protection from air pollution impacts. The primary means by which the protection and enhancement of air quality is accomplished is through implementation of National Ambient Air Quality Standards (NAAQS). These standards address six pollutants known to harm human health including ozone, carbon monoxide, particulate matter, sulfur dioxide, lead, and nitrogen oxides (USDA, 2000a).

The Environmental Protection Agency (EPA) further strengthened air quality protection of Class 1 areas in 1999 through the Regional Haze Rule. The rule specifies that States must review how pollution emissions within the State affect visibility at Class 1 areas across a broad region, not just those within the State. The Rule also requires States to make reasonable progress in reducing any effect this pollution has on visibility conditions in Class 1 areas and to prevent future impairment. States are required to analyze a pathway that takes the Class 1 areas from current conditions to "natural conditions" in 60 years.

"Natural conditions" is a term used by the Clean Air Act, which means that no human-caused pollution can impair visibility (DOI, 2001b).

Since federal land managers (National Park Service, Forest Service, Fish and Wildlife Service, and Bureau of Land Management) were required by the Clean Air Act to protect visibility at designated Class 1 areas, these agencies established the Interagency Monitoring of Protected Visual Environments (IMPROVE) particulate monitoring network. Among other measurements, IMPROVE gathers data on particulate matter of 2.5 micrometers and 10 micrometers ($PM_{2.5}$ and PM_{10}) (DOI, 2001c). In addressing air pollutant emissions from fires managed for resource benefits (prescribed fire and wildland fire use), the EPA considers $PM_{2.5}$ and PM_{10} as the primary indicators of public health impacts (EPA, 1998). In general, IMPROVE uses scenery, optical, and aerosol monitoring (DOI, 2001d). Crater Lake National Park is a participant in the IMPROVE network and employs a nephalometer and fine particulate monitoring in its visibility program (DOI, 2001e).

Environmental Consequences

Air quality impacts were qualitatively assessed upon review of National Park Service best management practices to reduce air emissions, State of Oregon prescribed fire permit specifications and requirements, and the extent of proposed prescribed fire activities under all the alternatives.

Alternative 1– No Action

Smoke consists of dispersed airborne solids and liquid particles, called particulates, which could remain suspended in the atmosphere for a few days to several months. Particulates can reduce visibility and contribute to respiratory problems. Very small particulates can travel great distances and add to regional haze problems. Regional haze can sometimes result from multiple burn days and/ or multiple owners burning within an airshed over too short a period of time to allow for dispersion.

The Oregon Department of Forestry prepares prescribed fire burning instructions each day regarding weather conditions and recommended conditions for burning (e.g. maximum number of acres to be burned at a particular site, minimum spacing between fire sites, maximum tonnage of fuels to be burned, etc). The instructions are developed to help effectively manage smoke and resulting air quality impacts, as well as to provide information on fire conditions and danger. Recognition of the cumulative effects from multiple prescribed fires on any particular day(s) is embedded in the instructions. The advisories also discuss weather conditions and the potential for adequate smoke dispersion (Ziolko, 2002). The National Park Service is responsible for preparing its own smoke management plan to ensure adequate smoke dispersion and to ensure no impacts to sensitive receptors (campgrounds, threatened and endangered species). Crater Lake

National Park will comply with the Oregon Smoke Management Plan requirements during all its prescribed fire and wildland fire use events.

For prescribed fires, there are three principle strategies to manage smoke and reduce air quality effects. They include:

1. Avoidance - This strategy relies on monitoring meteorological conditions when scheduling prescribed fires to prevent smoke from drifting into sensitive receptors, or suspending burning until favorable weather (wind) conditions;

2. Dilution – This strategy ensures proper smoke dispersion in smoke-sensitive areas by controlling the rate of smoke emissions or scheduling prescribed fires when weather systems are unstable, not under conditions when a stable high-pressure area is forming with an associated subsidence inversion. An inversion would trap smoke near the ground; and

3. Emission Reduction – This strategy utilizes techniques to minimize the smoke output per unit area treated. Smoke emission is affected by the number of acres burned at one time, pre-burn fuel loadings, fuel consumption, and the emission factor. Reducing the number of acres that are burned at one time would reduce the amount of emissions generated by that burn. Reducing the fuel beforehand, e.g. removing firewood, reduces the amount of fuel available. Prescribed burning when fuel moistures are high can reduce fuel consumption. Emission factors can be reduced by pile burning or by using certain firing techniques such as mass ignition.

Wildland fire use generally occurs over longer periods of time than prescribed fires and is characterized by periods of lesser or greater smoke emissions depending on fuel consumption and rate of spread. Wildland fire use would generally cause minor degradation in air quality or visibility except for short periods. If the impact of smoke does become significant, several actions may be taken: additional wildland fires may be classified as wildfires and suppressed; the current fire(s) may be suppressed; or the current fire(s) may be allowed to continue with smoke warnings posted for visitors and daily re-evaluations made.

Fires designated as wildfires and on which suppression strategies are employed, are exempt from air quality regulations. In addition to complying with the burning instructions prepared by the Oregon Department of Forestry, park staff would also follow the decision tree of the Fire Management Plan to guide decisions about effects of current fires and whether new ignitions should be classified as management fires or wildfires. Under this alternative, the park would employ prescribed fire on 2,181 acres. There would not be any significant air quality impacts with the use of mitigation measures and adherence to state burning instructions, and in light of the limited number of acres to be burned each year. If weather conditions changed unexpectedly during a prescribed fire or wildland fire use, and there was a potential for violating air quality standards or for adverse smoke impacts

on sensitive receptors, the park would implement a contingency plan, including the option for immediate suppression.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

General air quality impacts under Alternative 2 would be similar to those described under the No Action Alternative, however, the exclusion of wildland fire use would minimize the amount of emissions generated in the park in the short term. In the long-term, the delay in treating some areas with fire may result in those same areas having high levels of smoke in the event of a moderate to high-severity wildfire. The park would apply prescribed fire to 12,075 acres over a 5-year period, with no more than 3,200 acres being burned in any given year.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

General air quality impacts under Alternative 1 would be similar to those described under the No Action Alternative. Over a 5-year period, between 12,075 acres and 20,175 acres would be subjected to prescribed fire and wildland fire use. In any given year, the park would not likely conduct fire treatments (prescribed fire and wildland fire use) on more than 5,000 acres.

Conclusion

The implementation of any of the alternatives would not impair air quality resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

RECREATION

Affected Environment

There are numerous recreational activities available at Crater Lake National Park, including hiking, bicycling, bus tours, camping, boat tours, stock use (horses, mules, burros, and llamas), fishing, scuba diving, skiing, snowshoeing, snowmobiling, ranger talks, and guided walks/tours. Hunting and mushroom picking are prohibited within park boundaries. In total, Crater Lake averages approximately 500,000 visitors per year (DOI, 2001h).
The park has over 96 ½ miles of maintained hiking trails, most of which are day hikes. The hikes vary in length and level of difficulty. Bicycling and bus tours are permitted on the 33-mile Rim Drive as well as other park roads; bicycling is prohibited on park trails. Crater Lake National Park maintains two campgrounds, Mazama Campground and Lost Creek Campground. Mazama is open from June through early October, Lost Creek is open from July through early October, both pending weather. In total, there are 216 campsites between

the two campgrounds for both tent and RV camping. Boat tours take place on Crater Lake from late June or early July through mid-September. The tours run 7 days a week, between the hours of 10 a.m. and 6:15 p.m. Stock use by horses, mules, burros, and llamas is permitted in a few backcountry areas of Crater Lake, including the Pacific Crest Trail, Bald Crater Loop Trail, West Boundary Trail, Stuart Falls Spur Trail, Lightning Springs Trail, and Bybee Creek Stock Camp (DOI, 2001h).

Fishing is allowed in all streams and the lake, except Sun Creek and Lost Creek. Provided there is safe access for fishing points, the lake is open to fishing year-round. Streams are open to fishing from late May through late October and may begin ½ hour before sunrise and continue until ½ hour after sunset. Crater Lake is open to scuba diving from mid-June through mid-September. The park has nearly 50 miles of ski trails located in the Rim Village area and the Park Headquarters areas, ranging from easy to difficult. Backcountry areas and Rim Drive are also open to skiing, as well as to snowshoeing. Snowmobile use is allowed at the park only on the North Entrance Road from the park boundary to North Junction, where the entrance road meets Rim Drive (DOI, 2001h).

Ranger talks and guided walks/talks are scheduled from early July through early September. While some of the activities take place only a few days a week, others run up to 7 days a week. Talks and walks start as early as 10 a.m. and run as late as 10 p.m. They take place in various places across the park: Sinnott Memorial Overlook, Rim Village Visitor Center, Mazama Campground (amphitheater), Discovery Point, Garfield Peak, Annie Creek Canyon, Godfrey Glen area, and the Sun Notch area (DOI, 2001h).

Environmental Consequences

Recreation impacts were qualitatively assessed in light of the timing, intensity, and duration of fuel treatment activities as they related to visitor use and experience.

<u>Alternative 1– No Action</u>

Possible factors impacting recreation include smoke, noise, changes in scenic vistas, and visitor use restrictions.

Smoke from prescribed fires and wildland fire use near developed areas may impact recreation in a number of ways. Recreationists may experience temporary discomfort or decreased visibility if woodland smoke moves into developed areas or near trails. If portions of the park were closed to tourists because of smoke-related health and safety reasons, recreation would be adversely impacted. Any use restrictions imposed by the park would be temporary, except in the case of nearby stand replacement and/or

catastrophic fires. Restoration of natural fire regimes to forest stands in the park would lessen the potential for stand replacement fires in some forest types.

If located near developed areas or within viewsheds of the park, prescribed fire and wildland fire use would also have short-term impacts on foreground scenic quality through the killing of small understory trees. Over time, as the areas green up and larger residual trees become more visible, scenic quality would improve above pre-fire levels. Wildland fire use would have effects on background long-distance vistas. However, after the first year, when dead trees brown and shed their foliage, they would add visual texture to an already heavily textured landscape created by the effects of topography, soil, and different species composition and age classes of trees (DOI, 1996).

Depending on the location of fires in other parts of the park, visitors might be required to make adjustments to activities, such as altering hiking routes. Under normal circumstances, prescribed fire and wildland fire use would not affect visitors' ability to enjoy a full range of recreational activities.

Hazard fuels reduction activities near developed areas, highly frequented trails and in wilderness areas, or during times of special park events or holidays, could impact the recreational experience of some visitors. To minimize these potential noise and visual impacts, the park would not initiate hazardous fuels reduction activities, such as prescribed fire, near developed areas and trails during holidays. In addition, the park would limit, to the extent practicable, fire prevention and hazard fuels reduction efforts near developed areas and trails to periods of low recreation visits, or temporarily prohibit access to certain areas where treatments were being undertaken. In addition, educational/informational materials will be developed and distributed to the wilderness visitor on what to expect during fire management activities including potential noise from chainsaws during line construction, smoke dispersion, safety, helicopter and airplane use, and information on where and when these activities would occur;

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

General impacts to recreation would be similar to those described in the No Action Alternative, with the following exception. Noise and visual impacts arising from the use of mechanical equipment alongside Highway 62 and Grayback Drive/Pinnacles Road, may adversely impact the recreational experience of campers or tourists. Similarly, manual thinning efforts in the Mazama and the Munson Valley-Rim Village units may have a minor impact on the recreational experience of campers or tourists. Since the visual experience of a majority of park visitors would equate with the views of Crater Lake and the other viewsheds of the park, manual thinning activities in the villages would not significantly impact their experience.

The exclusion of wildland fire use could result in a decrease in use restrictions to park visitors and positively benefit recreation in the short term; however, delay in restoring

natural fire regimes to the park would increase the likelihood of a future stand replacement or catastrophic fire near developed areas and or hiking trails.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

General impacts to recreation would be similar to those described in the No Action Alternative and in Alternative 2. The inclusion of wildland fire use would indirectly benefit recreation by reducing the chance of temporary and long-term use restrictions that could arise from a stand replacement and/or catastrophic fire near developed areas and recreation trails. In the short term, however, temporary use restrictions may be implemented during times of wildland fire use.

Conclusion

The implementation of any of the alternatives would not impair visitor use and experience (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

VISUAL RESOURCES

Affected Environment

The major scenic attraction at Crater Lake National Park, as the name implies, is the lake itself. However, the vegetation is clearly an important backdrop to the lake and forms the major landscape texture element on the many vistas within the park (DOI, 1997). The park offers scenic vistas and solitude in natural settings, clean air, and clear night skies. A majority of the park is managed as wilderness. Scenic attractions include the lake, panoramic vistas at viewpoints and along 96 ½ miles of hiking trails, wildflower viewing, and geologic land forms that include volcanic landscapes and glaciated features (DOI, 1999a).

The summits of Mt. Scott, Watchman and Llao Rock offer views south to Mt. Shasta in California and north to the summits of the Three Sisters and beyond (DOI, 1999a). State highway 62 is open year-round, and from it, the Munson Valley Road can be used to access the rim for lake views. This access is year round, but is subject to temporary closures during and after winter storms. Rim Drive circles the caldera rim, and has pullouts along the side for viewing the lake. From Rim Drive, a spur road leads to the Pinnacles area of volcanic spires. Other roads include the North Entrance Road, which crosses the Pumice Desert, and the South Access Road, which follows Annie Creek Canyon.

Crater Lake National Park is designated as a Class 1 airshed and protecting visibility is a major concern to park management.

Environmental Consequences

Visual resource impacts in this environmental assessment were assessed in terms of scenic integrity, visual wholeness, and unity of the landscape. A view with high scenic integrity is ecologically intact; it has few if any discordant elements in sight and contains only positive human elements. In contrast, a view of low scenic integrity has discordant and contrasting features such as geometric shapes (e.g. clearcuts), structures that do not blend with their surroundings, or roads that create large cut and fill slopes (Galliano and Loeffler, 2000).

Alternative 1– No Action

Implementation of the Fire Management Plan would have minimal effects on scenic resources. Those factors most likely to impact visual quality are smoke, mixed to high severity fires, and the presence and activities of ground crews.

Smoke generation during wildland fire use would generally be longer in duration when compared to prescribed fires since wildland fire use can last up to several months. In both cases, fire severity would be predominantly of low severity and affect the understory through a slow burn. On occasion, prescribed fire and wildland fire use can also be of mixed severity where smoke generation may increase as more fuel is consumed during a shortened period of time.

Prescribed fires and wildland fire use would have short-term negative impacts on foreground scenic quality by killing small understory trees and creating dead fuel. Blackened and scorched larger trees may also be expected. Over time, as the areas green up, and larger residual trees are more visible, scenic impressions would improve above the pre-fire levels. Wildland fire use would have effects primarily on background, long-distance vistas. After the first year, when most of the killed trees have browned and shed their foliage, these fires, mostly moderate severity ones, would simply add minor texture to an already heavily textured landscape created by effects of topography and soil, and different forest species composition and age classes. If wildland fire use occurs in the vicinity of the Rim Road, mountain hemlock are likely to die as a result, and foreground snag patches are likely to occur. For the first year or two, as the trees shed their leaves and bark, they would be perceived by many as unattractive, but would soon become attractive "ghost trees" and add to the diversity of the landscape along the highway.

Other visible effects include work crews and areas near developed regions, which would be seen by passers-by. Fire suppression activities through MIST techniques would not be

noticeable to park visitors once operations and rehabilitation are complete. To limit visual impacts of fire management activity from roads, fire lines would be curved when the approach road corridors available for visitor travel.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

Alternative 2 would have similar impacts as those listed under the No Action Alternative, with the following exception. Mechanical fuel treatments utilized would result in heavy equipment use, which could be seen by visitors. Park officials could limit these activities to off-peak times of visitation to reduce and/eliminate any visual quality impacts and implement its educational campaign about fire management activities. Manual thinning efforts in the Mazama and the Munson Valley-Rim Village units may have minor visual impacts on campers or tourists. Since the visual experience of a majority of park visitors would equate with the views of Crater Lake and the other viewsheds of the park, manual thinning activities in the villages would not significantly impact that experience.

Alternative 3 - Ecology-Based Program Including Wildland Fire Use

Alternative 3 would have similar visual quality impacts as those listed under the No Action Alternative and Alternative 2.

Conclusion

The implementation of any of the alternatives would not impair visitor use and experience (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

HUMAN HEALTH AND SAFETY

Affected Environment

Crater Lake National Park has a comprehensive fire management program dedicated to ensuring the safety of the public and Park employees. Numerous safety measures are followed to maintain the highest safety standards possible for park visitors, employees, and residents, and also for the nearby population living outside park boundaries.

There are several safety standards currently followed in the park area. Park personnel are informed of potential threats on a daily basis through a fire activity report. If wildland fires or wildland fire use pose an imminent threat to human health or safety, the park Superintendent will close all or a portion of the park, including trails and roads.
Public information and education pertaining to fire management is presented through normally scheduled activities throughout the year, as well as through focused activities

when fires are in progress. Year round activities include distribution of handouts, brochures, and publications pertaining to the prescribed fire program. Information on this program is also incorporated into visitor contacts, interpretive talks, and campfire programs. Off-site programs and talks also include discussions of the role of natural fire in the Crater Lake ecosystem.

Informational and educational activities when fires are in progress are major factors in ensuring the public is appropriately informed when fires are burning. During these periods, handouts specific to the on-going fire may be prepared and distributed to visitors entering the park, or at primary viewing areas. Areas of fire activity are clearly marked with signs at trail heads and along roadways. Visitors obtaining permits for backcountry use are notified of the exact location of fire activity by personnel. Also, nearby residents adjacent to the park are notified if any fire poses a possible threat to burn outside park boundaries. News releases are distributed to the media as directed by the Superintendent. Public information outlets of neighboring and cooperating agencies and the Support Office will be provided with all fire situation information.

Crater Lake National Park also has a spill response program in place to contain and remove contaminants, such as fire retardants, foams, and gasoline.

Environmental Consequences

Human health & safety impacts were qualitatively assessed through determination of activities, equipment and conditions that could result in injury, literature review of type and extent of injury caused by equipment and conditions, and in light of mitigation measures and best management practices.

Alternative 1– No Action

Under the No Action Alternative, impacts to human health and safety would be minor. Factors most likely to adversely impact public and fire-fighter health and safety include accidental spills, injuries from the use of fire-fighting equipment, smoke inhalation, and, in severe cases, injuries from wildland or prescribed fires.

Of chemicals used by fire management staff, accidental spills of fire retardants and foams are the most likely to adversely impact human health & safety. Fire retardants used in controlling or extinguishing fires contain about 85% water, 10% fertilizer, and 5% minor ingredients such as corrosion inhibitors and bactericides. Fire suppressant foams are more than 99% water. The remaining 1% contains surfactants, foaming agents, corrosion inhibitors, and dispersants. These qualified and approved wildland fire chemicals have been tested and meet specific requirements with regard to mammalian toxicity as determined by acute oral and dermal toxicity testing as well as skin and eye irritation tests (USDA, 2001). However, they are strong detergents, and can be extremely drying to skin. All currently approved foam concentrates are irritating to the eyes as well. Application of a topical

cream or lotion can alleviate the effects of a retardant, and protective goggles can prevent any injury to the eyes when using foams.

Fuel break development and hazard fuels reduction practices pose safety threats to firefighters. Injuries can occur from the use of equipment as well as from traveling overland to targeted areas for fire-fighting or fire prevention efforts. While each of the crew is trained in the use of fire-fighting equipment, accidental injuries may occur from time to time. Fire management operations apply risk management procedures to minimize and mitigate risks to an acceptable level of residual risk, thus maximizing the safety of wildland firefighters.

Smoke inhalation by firefighting crews can also pose a threat to human health & safety. Smoke from wildland fires is composed of hundreds of chemicals in gaseous, liquid, and solid forms. The chief inhalation hazard appears to be carbon monoxide (CO), aldehydes, respirable particulate matter with a median diameter of 2.5 micrometers (PM2.5), and total suspended particulate (TSP). Adverse health effects of smoke exposure begin with acute, instantaneous eye and respiratory irritation and shortness of breath, but can develop into headaches, dizziness, and nausea lasting up to several hours. Based on a recent study of firefighter smoke exposure, most smoke exposures were not considered hazardous, but a small percentage routinely exceeded recommended exposure limits for carbon monoxide and respiratory irritants (USDA, 2000d).

Use restrictions applied to areas of prescribed fire, wildland fire use, or wildland fires would minimize or eliminate human health & safety concerns resulting from smoke exposure and fire injuries. Restrictions during times of high fire danger would prevent accidental ignitions from general public activities, like campfires, and would indirectly benefit human health & safety.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

The general impacts to human health & safety for Alternative 2 would be similar to those described in the No Action Alternative. In addition, the exclusion of wildland fire use could indirectly impact human health & safety since unnatural fuels accumulation in some areas would be delayed, thus potentially increasing the risk of a catastrophic or stand replacement fires in or near developed areas. Fire management across ecosystem boundaries would indirectly benefit human health & safety by reducing the potential for stand replacement fires crossing administrative boundaries.

The use of mechanical equipment would likely improve human health and safety since only 2 operators would be involved in the treatment of an area versus a typical ground crew ranging from 10-20 persons. Moreover, the operators are seated within a protective cage that deflect any chips or splinters that result from the stripping of the trees.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

The general impacts to human health & safety under the Proposed Action would be similar to those described in the No Action Alternative and Alternative 2. The inclusion of wildland fire use would indirectly benefit human health & safety by expediting the restoration of natural fire regimes to the forest stands in Crater Lake National Park, thus reducing the potential for stand replacement fires that could impact developed areas.

Conclusion

The implementation of any of the alternatives would not impair human health and safety resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

SOCIOECONOMICS

Affected Environment

Crater Lake National Park is located in Klamath County, which has a population of 63,775 (USCB, 2001a). Approximately 44,000 people reside within the city limits and in the surrounding urban growth boundary of Klamath Falls (Klamath, 2001a). Agriculture, timber, and related businesses are major elements of the county's economy, as is transportation. Tourism is probably the fourth most important industry (SCORP, 1999). In addition to the Park, several National Wildlife Refuges, a Volcanic Scenic By-Way, and the Klamath Tribes Casino bring visitors to the county each year. Timber employment is not expected to increase in the near future, and the county looks to increasing economic diversification to aid economic growth. Tourism and recreation are an important part of this mix.

The Park had 426,883 recreational visitors in the year 2000 (DOI, 2001). Each visitor is required to pay an entrance fee. Single, private, non-commercial vehicles are charged $10; pedestrians, single motorcyclists, and bicyclists are charged $5; and commercial buses are charged anywhere from $25 to $200, depending on capacity. In 1996, Crater Lake National Park became one of the first participants in a pilot project established by the United States Congress called the Recreation Fee Demonstration Program. Today, park managers are using the additional fees collected through this program to fund efforts important to the protection of Crater Lake National Park (DOI, 2001).

Approximately 90% of annual park visitation comes during the period June-September. Approximately 28 % of visitors to the Park are from Oregon, 33% are from California, and 8 % from Washington. Of the Oregon visitors, approximate 23 % reside in Jackson County, 11% in Douglas County, and 6% in Klamath County (USDA, 1998b).

Using the MGM2 model developed by researchers at Michigan State University, it is possible to derive a rough estimate of the economic benefits to the local community due to park use (Michigan, 2001). The model uses as inputs the number of annual recreation visits, broken down into local, non-local day use, and overnight visits, including stays at motels and campgrounds, to generate estimates of economic effects on the local community due to the park. The following inputs were used to calculate the economic benefits of the park:

- 56,348 local visits, from the three surrounding counties of Jackson, Douglas, and Klamath Counties (40% of the total visitors from Oregon, based on Pelican Butte Draft EIS data)
- 33,900 visitors who stayed overnight in motels
- 39,112 visitors who stayed overnight in campgrounds, RVs, or backcountry camping
- 299,000 non-local day-users (DOI, 2001k)

The model uses a nationwide average of party size and length of stay in motels and campgrounds for National Park visitors, as well as average spending per party at a rural National Park, to convert the visitation information to estimates of economic benefits. Using the above inputs it is estimated that Crater Lake National Park brings in approximately $2,897,000 in local wages for persons involved in the tourism industry.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to identify and address any disproportionately high adverse human health or environmental effects of its projects on minority or low-income populations.

Minority populations constitute approximately 13% of the total population in this county. Using the Census Bureau's categories, the largest racial group is American Indian and Alaska native (4%), followed by those who said they were of two or more races (3%), and those who said they were some other race (3%). Asian, Black or African American, and Native Hawaiian groups each made up less than 1% of the county's population. In addition, 8% of the population identified themselves as Hispanic or Latino; persons in this category can be of any race.

The median household income for Klamath County was $23,054 in 1989 (USCB, 2001b). At that time, 9,494 of 56,707 individuals, or approximately 17%, were reported to be living in poverty in the county. The county reported an unemployment rate of 8.1%

(Klamath, 2001b) significantly higher than the national average of 4.4% reported by the U.S. Bureau of Labor Statistics for May of 2001.

Environmental Consequences

Socio-economic impacts were quantitatively assessed using U.S. Census Bureau data on personal income, population data, and poverty measures.

Alternative 1– No Action

The most probable socioeconomic impact would be the loss of revenues to the park and concessionaires as a result of use restrictions, road closures, or partial to complete park closures in response to fire and excessive smoke. Use restrictions and road closures would likely to be temporary and infrequent, and of a nature that would not significantly reduce park revenues generated from entrance fees or compromise concessionaire businesses. A catastrophic fire that destroyed developed areas within the park or that resulted in the prolonged closure of part or all of the park would have significant socioeconomic impacts (e.g. damage and loss of property; temporary and prolonged loss of jobs; and loss of revenues to the park and surrounding businesses from a decrease in tourism); however, the likelihood of such a fire is small and the implementation of the Fire Management Plan would further reduce the possibility of an event.

Percentages of minority or socio-economically disadvantaged persons in Klamath County are below the national averages for these categories, and the probability of a disproportionate impact to these populations resulting from the implementation of the Fire Management Plan would be minor. The Klamath Tribes are headquartered in Chiloquin, approximately 20 miles south of the park's boundary, and many of its members reside in Chiloquin and in areas south to Klamath Falls. In light of the distance separating the tribe and the park, it is unlikely that a catastrophic fire originating in the park would directly impact the community.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

General socioeconomic impacts for Alternative 2 would be similar to those described in the No Action Alternative. Increasing the number of acres to be actively managed through prescribed fire, in conjunction with the exclusion of wildland fire as a fire management tool, would require additional ground crew members to meet fire management goals. The use of mechanical equipment would also create several additional jobs. These additional jobs are not expected to significantly affect local and regional economies.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

General socioeconomic impacts for the Proposed Action would be similar to those described in the No Action Alternative and Alternative 2.

Conclusion

The implementation of any of the alternatives would not impair socioeconomic resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their proposals on historic properties, and to provide state historic preservation officers, tribal historic preservation officers, and, as necessary, the Advisory Council on Historic Preservation a reasonable opportunity to review and comment on these actions.

Affected Environment

Cultural resources include archeological, cultural, and historic resources in the park. More than 40 archeological sites have been investigated in the park, including one "archaeologically sensitive area" likely to contain significant material. However, some archaeologists believe that there may be undiscovered artifacts in other areas of the park, which have not been surveyed.

There are 23 National Register historic structures, including the Watchman Lookout, buildings in Rim Village, and buildings in Munson Valley in the Headquarters area. Included in this list is House 19, which is a National Historic Landmark. There are two historic districts, Munson Valley (containing 18 of the National Register historic strucures) and Rim Village. Rim Drive will be a historic district when nominated and listed on the NHRP. The Fort Klamath – Jacksonville Wagon Road is a historic road leading from Highway 62 to the rim area along a path west of the current visitor highway from Highway 62 to the rim. Overall, less than 2% of Crater Lake National Park has been surveyed in accordance with professional standards in archeology (DOI, 1999a).

There are 13 individual landscapes on the Cultural Landscape Inventory (CLI). A new property type, that of a logging railroad grade, was discovered as part of a pre-burn archeological survey in 2001. There is another grade, as yet unsurveyed, in the same vicinity (Mark, 2002).

More than 80 ethnobotanically significant plant species have been identified for the park by the Klamath Tribes. Forty-two of these species belong to the *Carex* genera, commonly known as sedge. Sedges are associated with both riparian and dry meadow habitats of the park. Other common species of importance include conifer trees, willows, huckleberries, and other shrubs, forbs, and hardwood trees that provide berries, nuts, herbal medicines and material for making baskets and containers.

The park is working with the Klamath Tribes to develop a government-to-government agreement regarding proposed revisions to its Fire Management Plan. The agreement would incorporate the necessary and required consultation protocols.

Environmental Consequences

Cultural resource impacts were qualitatively assessed through a presence/absence determination of significant cultural resources and mitigation measures to be employed during wildfire suppression, thinning, and prescribed fire activities.

Alternative 1– No Action

The Fire Management Plan is designed to protect cultural resources, and would generally be successful in doing so by preventing damage to them from stand replacement and/or catastrophic fires. Fire suppression activities, however, can have damaging effects, especially to undiscovered archaeological resources. Ground disturbance by fire crews can displace artifacts from proper placement in the soil, and artifacts can be destroyed by use of hand tools or heavy equipment. In addition, fire retardants can stain or corrode historic structures. If wooden structure protection is necessary, foams could be used. To eliminate potential adverse impacts from the use of fire retardants, their use would be prohibited in the vicinity of any historic structure, unless there is imminent threat from wildfire to the historic structure. Any fire suppression activity in the vicinity of a known historic or archeological site would receive guidance from the Park Historian or a designated representative from the park or the regional office. Similarly, prior to any prescribed fire, the Park Historian or a designated representative would conduct an inspection and develop a plan to protect any existing or newly identified resources in the targeted area. Following prescribed fires and wildland fire use, a similar investigation would be conducted to determine the presence of exposed and, as yet, unknown archaeological sites, as well as the impact of the fire on the resources. Once discovered, appropriate steps would be undertaken to ensure the protection and possible listing of new resources.

The type of archeological remnants likely to be found locally are stone artifacts. Light burning of sites will probably have little effect on lithic artifacts, while heavy burning of sites (such as log corridors) would likely have 40-50% of the lithic artifacts affected, mostly by soot but also by spalling (DOI, 1997).

Fire management activities would likely result in the loss of some ethnobotanicals (individuals). With a majority of the sedge species occurring in both dry and wet meadows, as well as in forest habitats, the loss of individual plants or trees would not threaten the viability of the entire population in the park. In addition, many of the other ethnobotanicals are found in riparian areas and will be unaffected by fire management activities in accordance with mitigation measures outlined in Section 2-4 *Mitigation Measures and Monitoring*.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

General impacts to cultural resources in Alternative 2 would be similar to those described in the No Action Alternative, with the following exceptions. Mechanical fuel treatments could adversely impact known and undiscovered cultural resources, especially archaeological sites, by displacing or destroying them; however, protection measures developed by the Park Historian or a designated representative would eliminate impacts to known resources. Artifacts could also be discovered, and subsequently protected, in these treated areas following the use of prescribed fire to eliminate ground fuels generated from the mechanical fuels treatment.

Exclusion of wildland fire use could result in fewer discoveries of cultural resources since the areas most likely to be subjected to wildland fire use have not been, and would not likely be, surveyed.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

General cultural resource impacts under the Proposed Action would be the same as those described in the No Action Alternative and Alternative 2.

Conclusion

The implementation of any of the alternatives would not impair cultural resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other National Park Service planning documents.

WILDERNESS

Affected Environment

The Wilderness Act of 1964 established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as "wilderness areas". By law, these wilderness areas "shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness" (16 USC 1131).

The Wilderness Act defined and described a wilderness area as area:

- where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain
- of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation
- which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable
- which is protected and managed so as to preserve its natural conditions
- which has outstanding opportunities for solitude or a primitive and unconfined type of recreation
- which has at least five thousand acres of land or is of sufficient size to make practicable its preservation and use in an unimpaired condition
- which may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

These attributes serve both as standards for studying areas and evaluating their suitability for inclusion in the national wilderness preservation system and as objectives to guide National Park Service actions pertaining to the preservation and use of wilderness areas (NPS, 2001; DOI, 1999b).

Under the Wilderness Act, "there shall be no commercial enterprise and no permanent road within any wilderness area designated by this chapter and, except as necessary to meet minimum requirements for the administration of the area for the purpose of this chapter (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area" (16 USC 1133).

The National Park Service wilderness management policies are based on statutory provisions of the 1916 NPS Organic Act (16 USC 1), the 1964 Wilderness Act, and legislation establishing individual units of the national park system (NPS, 2001; DOI, 1999b). In 1902, Congress passed legislation for Crater Lake and its surrounding 180,000 acres to be "dedicated and set apart forever as a public park or pleasure ground for the benefit and enjoyment of the people of the United States." The act (16 USC 121) also required that action be taken for the "preservation of the natural objects...the protection of the

timber…the preservation of all kinds of game and fish," and for use by "scientists, excursionists, and pleasure seekers".

In January 1994, the Park proposed 179,737 acres to be designated as wilderness by Congress, excluding road and utility corridors and developed areas. The U.S. Congress has not yet formally designated these acres as wilderness, however, the park continues to manage the proposed lands as wilderness. This decision is consistent with park policy for management of wilderness, which states "for the purposes of applying NPS wilderness policies, the term 'wilderness' includes the categories of suitable, study, proposed, recommended, and designated wilderness. NPS wilderness policies apply regardless of category" (DOI, 1999b).
Under the NPS Management Policies, each National Park Service unit containing wilderness must develop and maintain a wilderness management plan (or plan for the management of suitable, proposed/recommended wilderness area) to guide the preservation, management, and use of the area. The wilderness management plan will:

- clearly identify the boundaries of wilderness units of the park;
- identify individuals and/or organizations within the park administration responsible for wilderness preservation;
- establish an administrative process to determine "minimum requirement" for actions in wilderness; and
- establish specific management actions to be applied to guide public use and preservation of wilderness resources, including the establishment of desired future conditions.

All management decisions affecting wilderness must be consistent with the "minimum requirement" concept as outlined in the Wilderness Act. The minimum requirement concept is intended to minimize adverse impacts on wilderness character and resources and must guide all management actions in wilderness. This requirement includes decisions concerning administrative practices, historic properties, proposed special uses, research, and equipment use in wilderness (DOI, 1999b).

Planned administrative actions that may result in an exception to a prohibited use (e.g. chainsaws, aircraft use, and mechanical equipment) or have the potential to impact wilderness resources and values must be consistent with an approved wilderness management plan and be documented in accordance with the park's minimum requirements process.

Environmental Consequences

Alternative 1– No Action

The restoration of natural fire regimes to forest stands within the park, particularly those within areas proposed as wilderness, is consistent with the restoration and preservation of wilderness values as described in the Wilderness Act. The application of wildland fire use

would positively impact wilderness character and resources. Wildland fire operations within the proposed Wilderness Area will adhere to the requirements of the Wilderness Act, NPS Management Policies, and the NPS Director's Orders #18 and #41 Wilderness Preservation and Management. All fire management activities within the proposed Wilderness Area will employ minimum actions and tools necessary based upon the Minimum Requirement and Minimum Tool Determination. All fire management activities within the proposed Wilderness Area will follow established MIST implementation guidelines. All fire management activities within the proposed Wilderness Area will follow established Rehabilitation Guidelines for Wilderness Fire Suppression Activities. A Resource Advisor should be available for advice and support with the crew(s) as well as for quality control. When Wilderness campsites or travel routes are closed during fire management activities, visitors will be rerouted to alternative travel routes or campsites.

In light of the above mitigation measures, there would be only minor impacts to wilderness.

Alternative 2 - Ecology-Based Program Excluding Wildland Fire Use

The general impacts to wilderness values under Alternative 2 would be the same as those described under the No Action Alternative. Mechanical thinning will be restricted to areas not proposed for or managed as wilderness. Noise generated from manual and mechanical thinning activities may be heard on several trails in the proposed wilderness. To mitigate the effects, the park would prohibit thinning in Crater Peak, Crater Creek, Red Blanket and PIAL Research during holidays. In addition, the trails that are within or adjacent to these Treatment Units may be closed to visitors during thinning.

Mechanical thinning may result in temporary and minor visual impacts to the wilderness visitor for those trails that allow for a view of the Highway 62 and Grayback/Pinnacles treatment units. To help mitigate this impact, educational/informational materials will be developed and distributed to the wilderness visitor on what to expect during fire management activities including potential noise from chainsaws during line construction, smoke dispersion, safety, helicopter and airplane use, and information on where and when these activities would occur.

Alternative 3 (Proposed Action) - Ecology-Based Program Including Wildland Fire Use

The general impacts to wilderness values under the Proposed Action would be the same as those described under Alternatives 1 and 2.

Conclusion

On condition that equipment used during manual thinning and prescribed fires was codified under a minimum requirement assessment, the implementation of any of the alternatives would not impair wilderness values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3)

identified as a goal in the park's general management plan or other National Park Service planning documents.

CUMULATIVE EFFECTS

The cumulative effects analysis for the Fire Management Plan environmental assessment considers the past, present, and reasonably foreseeable future actions on land uses that could add to (intensify) or offset (compensate for) the effects on the resources and that may be affected by the Fire Management Plan alternatives. Cumulative effects vary by resource and the geographic areas considered here are generally the park and areas adjacent to the park. In some instances, activities may result in both negative and positive impacts when considering the short and long-terms. As a result, some resource categories in Table 3-7 show both positive and negative impacts resulting from a particular activity. The information provided in Table 3-7 is the basis for the cumulative effects described in Table 3-8. A significant cumulative effect for any issue topic would be the "significant" impact as described in Table 2-8 in Section 2.3 – *Impact Definitions*.

Table 3-7 Factors Affecting Cumulative Effects Determinations

	Soils	Water Resources	Vegetation	Ecologically Critical Areas	Wildlife	Air Quality	Noise	Visitor Use & Experience	Human Health & Safety	Socio-economics	Cultural Resources	Wilderness
Past prescribed fires & thinning on the park	+ -	-	+ -	+	+ -	-	-	+ -	+ -		+	+ -
Lightning & human-caused wildfires	+ -	-	+ -	+	+ -	-		+ -	+ -		+ -	+ -
Wildfire suppression past, present, future	-	+ -	-	-	-	+	-	+ -	+	+	+ -	+ -
Timber management on adjacent National Forest lands	+ -	+ -	+ -		+ -		-			+		
Visitation to the park						-	-	+		+		
Hazardous fuels reduction on adjacent National Forest lands	+ -	+ -	+ -		+ -	-	-		+		+ -	+ -
Research and monitoring efforts in the park	+	+	+		+	+		+	+		+	
Proposed designation of wilderness in the park	+	+	+	+	+	+	+	+	-	+	+	+

DIRECT/INDIRECT EFFECTS KEY: (+) Positive/beneficial; (-) Negative/detrimental; (Blank) Neutral/no effect

Table 3-8 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
Soils	Adverse soil impacts (soil erosion or loss) from past roads, park buildings and improvements, willdland fires and suppression efforts; Beneficial soil impacts from past wildland fires (nutrification of soils)	Prescribed fire and thinning activities would have minor adverse effects on soils (soil erosion and compaction), but beneficial effects as well over the short and long-terms (soil development and soil nutrification)	Suppression efforts of large wildfires could adversely impact soils (compaction, erosion from firebreaks, etc.)	Soils inside of the park would improve over time with soil development and nutrification from prescribed fires; Fire Management Plan would not result in significant cumulative impacts; the Proposed Action Alternative would contribute the most to soil cumulative impacts, while Alternatives 1 and 2 would contribute the least
Water Resources	Minor impacts to water resources from past wildfires and suppression efforts	Thinning and prescribed fires would indirectly impact surface water resources (sediment loading and turbidity)	Suppression efforts of large wildfires could adversely impact water resources (sediment loading)	Minor effect on water resources; Fire Management Plan would not result in significant cumulative impacts; All the Alternatives would contribute similarly to water resource cumulative impacts
Vegetation	Natural fuel loading increased in absence of historic low-severity, high frequency fire regime; native plant habitat and diversity declined; increased infestation of noxious weeds	Thinning and prescribed fire would decrease hazardous fuel loadings; native grass and forb species would be favored; forest stand structure in some areas would return to historic conditions; fire regimes would be returned to 12,075 acres	Thinning and prescribed fire efforts in the adjacent National Forests would reduce fuel loadings and help restore historic fire regimes to forest communities adjacent to the park; wilderness designation limits the ability of the park to reduce hazardous fuel loadings in wilderness areas	Habitat and diversity would continue to improve; noxious weeds would continue to decline; fuel loadings would pose a reduced fire danger; Fire Management Plan would not result in significant cumulative impacts; the Proposed Action Alternative would contribute the most to vegetation cumulative impacts, while Alternatives 1 and 2 would contribute the least
Ecologically Critical Areas	Fire regimes for several RNAs were altered with fire suppression efforts; encroachment of conifers into the meadow of Desert Creek in the absence of fire	Prescribed fire and wildland fire use would decrease hazardous fuel loadings in Llao Rock and Desert Creek RNAs, and encroachment by conifers in the meadow at Desert Creek RNA would be reversed	Future monitoring and research would help maintain and preserve the RNAs	Habitat and diversity would continue to improve in the RNAs, encroachment of woody tree species in the Desert Creek meadow would be reversed; Fire Management Plan would not result in significant cumulative impacts; the Proposed Action Alternative would contribute the most to cumulative impacts on ecologically critical areas, while

Table 3-8 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
				Alternatives 1 and 2 would contribute the least
Wildlife	Fire suppression efforts within the park degraded wildlife habitat and diversity; park building and improvements temporarily affect wildlife species	Thinning and prescribed fire would result in minor, short-term disturbance and displacement with minimal species loss; improved habitat and increased wildlife diversity with restoration of historic fire regime	Thinning and prescribed fire efforts in adjacent National Forests would help restore historic fire regime to forest communities adjacent to the park and benefit habitat and species diversity	Wildlife habitat and diversity increases; Fire Management Plan does not result in significant cumulative impacts; the Proposed Action Alternative would contribute the most to wildlife cumulative impacts, while Alternatives 1 and 2 would contribute the least
Air Quality	Industry and agricultural practices emit pollutants and particulate matter; automobiles, past wildland and prescribed fires contribute to some temporary deterioration in air quality and visibility	Prescribed fire emissions would result in minor, short-term air quality and visibility impacts	Future wildland fires programs would contribute to temporary deterioration in air quality and visibility	Class I air quality standards would not be violated; Fire Management Plan would not result in significant cumulative impacts; the Proposed Action Alternative would contribute the most to air quality cumulative impacts, while Alternatives 1 and 2 would contribute the least
Noise	Past development and improvements resulted in short-term noise impacts; traffic associated with visitation of the park continues to produce sustained and long-term source of noise	Thinning and suppression activities would result in minor noise impacts to sensitive receptors	Traffic associated with visitation of the park continues to produce sustained and long-term source of noise	Noise sources and levels in the park would temporarily increase; Fire Management Plan would not result in significant cumulative impacts; the Proposed Action and Alternative 2 would contribute the equally to noise cumulative impacts, while Alternatives 1 would contribute the least
Visitor Use and Experience (including Recreation, Visual	Establishment of the park, improved roads and trails provided access for recreation opportunities; increased population growth results in increased recreational use;	Minor visitor use and experience impacts resulting from thinning and prescribed fire activities	Increased recreation use as population grows	Long-term enhancement of recreation resources and opportunities offsets short-term recreation inconveniences from fuel treatments; Fire Management Plan would not result in significant

Table 3-8 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
Resources, and Park Operations)	proposed designation of wilderness improves recreational experience			cumulative impacts; the Proposed Action Alternative would contribute the most to visitor use and experience cumulative impacts, while Alternatives 1 and 2 would contribute the least
Human Health & Safety	Past suppression efforts protected park staff and visitors	Thinning and prescribed fire activities might result in very minor impacts; long-term improvement in human health & safety with reduction in fuels	Similar effects as described in Past and Present Actions	Human health and safety would improve over time with thinning and prescribed fire activities; Fire Management Plan would not result in significant cumulative impacts; the Proposed Action Alternative would contribute the most to vegetation cumulative impacts, while Alternatives 1 and 2 would contribute the least
Socio-economics	Establishment of the park and visitor use benefits local and regional economies	Very minor effects on local economy	Similar effects as described under Past and Present Actions	Socio-economics would remain relatively unchanged; Fire Management Plan would not result in significant cumulative impacts; the Proposed Action Alternative would contribute the most to socio-economic cumulative impacts, while Alternatives 1 and 2 would contribute the least
Cultural Resources	Establishment of the park helped protect cultural resources; past suppression efforts may have impacted un-recorded sites	Fuel treatments could result in impacts to un-recorded sites	Similar effects as described in Past and Present Actions	Cultural resources continue to be protected; Fire Management Plan would not result in significant cumulative impacts; the Proposed Action Alternative would contribute the most to cultural resources' cumulative impacts, while Alternatives 1 and 2 would contribute the least

Table 3-8 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
Wilderness	Past fire suppression in the park prevented wilderness areas from achieving historic fire regime and allowed for hazardous fuel buildup	Fire management activities would not result in significant impacts to wilderness with the implementation of mitigation measures; fire management activities would help reduce fuel loadings in the wilderness and contribute to improved forest health	Thinning and prescribed fire activities would help reduce fuel loadings in the wilderness and contribute to improved forest health	Wilderness would not be significantly impacted by proposed fire management activities; the Proposed Action Alternative would contribute the most to wilderness cumulative impacts, while Alternatives 1 would contribute the least

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Jerry Weinheimer, U.S. Dept. of Agriculture, Natural Resources Conservation Service
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Michael Ziolko, Meteorology Manager, Oregon Department of Forestry

Persons, Organizations, and Agencies Who Received This Environmental Assessment

TBD

Scoping

Details of the scoping process and the issues that arose from it are described in Chapter 1, Section 15 – *Scoping Issues and Impact Topics*.

National Park Service
U.S. Department of the Interior

Crater Lake National Park
Crater Lake, Oregon 97604

Crater Lake National Park
Fire Management Plan – Environmental Assessment
Finding of No Significant Impact (FONSI)
February 2003

The Burn Boss observes prescribed fire activity in a mixed conifer forest at Crater Lake National Park, November 2002.

Introduction

Crater Lake National Park was established on May 22, 1902 and is the nation's sixth oldest national Park. The Park was created to insure the preservation of Crater Lake and its natural surroundings. The area is characterized by a long history of volcanic and glacial activity, and Crater Lake itself lies within the 6 mile-wide caldera created by the eruption and collapse of Mt. Mazama more than 7,000 years ago.

It is located in the Southern Cascade Mountains and contains 183,224 acres. The Park proposed that 179,737 of these acres be designated as wilderness in its 1994 Wilderness Designation proposal. Pending Congressional approval of that proposal, the Park manages that acreage as wilderness. The Park is bounded on the north by Umpqua National Forest, on the northeast, east, and south by Winema National Forest, on the southwest, west, and northwest by Rogue River National Forest and Sky Lakes Wilderness Area. In addition, the Park adjoins Sun Pass State Forest and an 80-acre block of private land on the southeastern corner. These lands are managed for a variety of uses, including timber, grazing, watershed protection, recreation and wilderness.

Effective fire suppression at Crater Lake National Park for more than a century has increased live and dead woody fuel accumulation on the forest floor and within the forest stands. Fire exclusion has unnaturally altered the landscape in some forest ecosystems. In the absence of fire, many forest communities have advanced successionally. This advancement has lead to greater stand densities, more insect/disease infestations, and greater tree mortality. In some cases, multi-storied conditions have formed continuous vertical fuel ladders. When combined with increased woody fuel, vertical fuel ladders increase the likelihood of extensive, and possibly uncontrollable crown fires.

An environmental assessment (EA) was prepared to better understand the environmental effects associated with employing prescribed fire, wildland fire use and thinning to protect and enhance the cultural and natural resources of the Park, while at the same time protecting employee and visitor safety during these fire management activities. Environmental issues identified during scoping and evaluated in the EA included soils, water resources, vegetation, ecologically critical areas, wildlife (including federally threatened and endangered species), air quality, noise, recreation, visual resources, human health and safety, cultural resources, socio-economics, and wilderness.

Three alternatives for reducing hazardous fuel levels and using fire to manage the forests in the Park were evaluated. The three alternatives included employing the use of prescribed fire and wildland fire use (No Action Alternative), employing prescribed fire and thinning treatments only (Alternative 2), and employing prescribed fire, thinning treatments, and wildland fire use (Proposed Action Alternative).

Proposed Action

Under the proposed action alternative, the current Fire Management Plan (FMP) would be amended to establish four Fire Management Units (FMUs) within the Park: Low Severity, Moderate Severity, High Severity, and Developed. With one exception (Developed FMU), these new fire management units are based upon historical fire regimes and would coincide on the ground with vegetated areas that reflect these regimes. These FMUs provide the context with which to choose the most suitable strategy to achieve resource management goals. The particular mix of strategies implemented within each fire management unit would be based on ecological needs and resource values at risk.

Under the proposed action, the Park has identified 16 treatment units where it would use prescribed fire, manual and/or mechanical methods to reduce fuels over the next several years. Under the Park's 5-year treatment schedule, between 12,715 acres and 20,815 acres would be treated with prescribed fire, wildland fire use, and thinning or a combination/mix of each method. In a scenario with a total of 20,815 acres being treated, the breakdown of acres to be treated by prescribed fire, wildland fire use, and thinning are as follows: prescribed fire (11,165 acres), wildland fire use (up to 8,100 acres), manual thinning (7,700 acres), and mechanical thinning (640 acres).

The proposed action alternative meets the purpose and need by establishing fire management units that are based on historical fire regimes and current resource values at risk. This approach recognizes the ecological role of fire and provides a framework for achieving fire management objectives including reducing hazardous fuel accumulations and providing for firefighter and visitor safety. It provides strategies for the suppression of wildland fires, the use of prescribed fire and some wildland fire, and proposes manual and mechanical fuel treatments as fire surrogates. These strategies are explained below.

Wildfire Suppression

The actions to suppress wildfires are varied and are applied in many different combinations to achieve control of destructive and potentially destructive wildfires.

The actions to suppress wildfires are varied and are applied in many different combinations to achieve control of destructive and potentially destructive wildfires. Tools used to suppress wildfires may include crews digging control lines with hand tools, removing fuels with hand and power tools to limit the spread of fire, setting backfires to reduce the availability of fuel, aircraft dropping fire retardant and water, and (in extreme rare cases) bulldozers blading wide lines to mineral soil.

Prescribed Fire

Prescribed fire is the use of fire to achieve specific goals related to reducing the risk of catastrophic wildfires and returning fire to an ecosystem that thrives best with fire as a natural component. Prescribed fire is aimed at specific resource management objectives and follows required FMP project design standards.

Prescribed fire is applied to small areas of the landscape (< 1000 ac per unit) only when fuel and weather conditions fit a predetermined burn plan. These units are prepared by digging handline to mineral soil around the perimeter, some pruning along the line with chainsaws (after wilderness minimum tool assessment) or using natural barriers such as snow, creeks, rock outcrops, roads and trails to enclose the unit in a controlled line. Personnel then light fuels in the unit using ignition devices such as fusees or drip torches. The fire is then monitored and "held" by a fire crew to ensure the fire is contained and controlled.

Wildland Fire Use

Wildland fire use is the concept of using natural ignitions (i.e. lightning) to achieve goals appropriate for the area where the ignition occurred. The fire is assessed relative to very specific parameters of topography, weather, fuel types and resource risk, and if appropriate the fire is allowed to burn in a low intensity manner to achieve resources objectives while being monitored. The application of this strategy is very dependent on the natural ignition falling within strict fire behavior parameters.

Manual Thinning

Since a significant portion of fire risk is related to the amount and arrangement of organic fuels, risk can be managed by reducing or changing the amount and arrangement of fuels on the landscape. Manual thinning of live and dead brush and small diameter trees is accomplished by crews working with hand tools including chainsaws. Slash from these thinning treatments are lopped and scattered across a unit or burned in small piles.

Mechanical Thinning

Mechanical fuel treatments involve the use of tracked/tired vehicles to remove fuels (live and dead brush, tree limbs, and trees with diameters up to 18" at breast height) along designated existing roads. Treatment areas are limited to within 200 feet of the road centerline. Such a strategy is employed to create fuel breaks to prevent the spread of potentially destructive wildfires across large areas of the park by changing the arrangement and availability of fuels along a road corridor. Such a fuel break alters fire behavior (intensity) and offers more opportunities for containment and control of unwanted fire. Shaded fuel breaks include the retention of widely spaced live trees (≈ 20 feet between crowns) to provide shade and reduce fuel temperatures on the ground.

Public Involvement

The environmental assessment was made available for public review and comment during a 45-day period ending October 15, 2002. A notice announcing its availability was sent out to over 760 interested parties through the park's mailing list, including federal, state and municipal agencies, and individuals. Hard copies of the EA were provided to area libraries in Klamath Falls, Medford, Grants Pass, Roseburg, Ashland, Chiloquin, and Bend, Oregon. Hard copies were also sent to representatives of area tribal nations including the Klamath Tribes, and the Cow Creek Band of Umpqua Tribe of Indians. Hard copies were provided to anyone upon request. The EA was posted on the park's website at: http://www.nps.gov/crla/fireea.htm during the entire comment period.

A total of six responses were received from the public. The only substantive issue raised by respondents was an opposition to the strategy of mechanical fuel treatments within the boundaries of National Parks. These reviewers pointed out that the two mechanical thinning projects (640 acres total) in the Proposed Action were not described in adequate detail to conduct a meaningful impact analysis. They also opposed the use of heavy equipment and were concerned that large trees might be removed as part of a "fee for services" contract, which they felt would in essence open the park to commercial timber harvesting.

In response to these concerns, the inter-disciplinary team (IDT) recommended that the mechanical fuel treatment portion of the Proposed Action (two projects totaling 640 acres) be dropped from implementation. The exclusion of these two projects does not jeopardize the alternative's ability to meet the purpose and need of the action, and otherwise the Proposed Action remains intact as analyzed in the EA. Should the park want to implement these two mechanical thinning projects in the future, they will be considered under an additional environmental compliance process in which more specific project details, and associated impacts, are addressed.

Environmentally Preferred Alternative

The environmentally preferred alternative is the alternative that will promote the national environmental policy as expressed by §101 of the National Environmental Policy Act (NEPA). This includes alternatives that:

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2. assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings

3. attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;

4. preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice

5. achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and

6. enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

In essence, the environmentally preferred alternative is the one that "causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources".

In this case, Alternative 3 (Proposed Action) is the environmentally preferred alternative for Crater Lake National Park since it meets goals 1, 2, 3, and 4 described above. Under the proposed action, fire management activities would reduce hazardous fuel loadings in the Park, and help restore natural ecological processes, including native vegetation function and structure. In addition, the proposed action helps protect Park resources and adjacent lands from the threat of future wildfires. Finally, the proposed action best protects and helps preserve the historic, cultural, and natural resources in the Park for current and future generations.

The Proposed Action and Significance Criteria

As defined at 40 CFR §1508.27, from the regulations of the Council on Environmental Quality that implement the provisions of NEPA, significance is determined by examining the following criteria:

Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

The restoration of the historic fire regime to fire-adapted forest ecosystems, such as ponderosa pine and white fir, would enhance the variety and diversity of native plant species and habitats. Plant communities adapted to high frequency, low-severity fires would be favored with prescribed fire, and hazardous fuels would be reduced (surface and ladder fuels). Prescribed fire and wildland fire use would also release nutrients into the soil and the fertilization effects of ash would provide an important source of nutrition for vegetation in the area. These effects are considered to be minor and not significant impacts because they exemplify natural ecological processes that occur under a natural fire regime for these forest ecosystems in the Cascade Mountains of Oregon.

The EA also discusses the negligible to minor impacts to air quality associated with the proposed action. Over a 5-year period, between 12,075 acres and 20,175 acres would be subjected to prescribed fire and wildland fire use. In any given year, the Park would not likely conduct fire treatments (prescribed fire and wildland fire use) on more than 5,000 acres. There would not be any significant air quality impacts with the use of mitigation measures and adherence to state burning instructions, and in light of the limited number of acres to be burned each year. If weather conditions changed unexpectedly during a prescribed fire or wildland fire use, and there was a potential for violating air quality standards or for adverse smoke impacts on sensitive receptors, the Park would implement a contingency plan, including the option for immediate suppression. Noise impacts to proposed wilderness areas are also considered to be minor since thinning activities would not be conducted adjacent to them during peak recreational use of the areas. In addition, trails in particular wilderness areas may be temporarily closed during thinning treatments.

The degree to which the proposed action affects public health or safety

When conducting fire management activities, human health and safety is the primary concern. Under the proposed action, there would likely be very minor human health and safety impacts (small cuts and bruises) to firefighters resulting from wildland fire suppression and prescribed fire and thinning activities. The proposed action provides the best protection since prescribed fire, wildland fire use, and manual thinning will help reduce hazardous fuels on the Park and minimize the fire danger to the Park staff and nearby private residences and communities. Before conducting any prescribed fire, fire management officials would ensure that adequate weather conditions existed to facilitate smoke dispersion, thus minimizing and/or eliminating potential smoke impacts on sensitive receptors and the general public.

Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

As described in the EA, the intent of the action alternatives was to provide the maximum amount of protection for the important natural and cultural resources of the Park while helping restore natural ecological processes, including native vegetation function and structure. The implementation of the proposed action would result in no significant adverse effects to cultural

resources since these would be marked and avoided during fire management activities. As discussed under the first significance criteria above, the proposed action will have a minor beneficial impact on the fire-adapted forest ecosystems since fire is so important in the perpetuation of those ecosystems. There would be very minor and insignificant impacts to ecologically critical areas in the Park (Research Natural Areas) from fire management activities, primarily from wildland fire suppression activities. There are no prime farmlands or wild and scenic rivers affected.

The degree to which the effects on the quality of the human environment are likely to be highly controversial.

There were no controversial impacts identified during the analysis done for the EA. To address concerns raised during public review of the EA, the proposed action has been modified to exclude two mechanical thinning projects (640 ac) designed to reduce existing fuel loads and the risk of crown fire spread across large areas of the park. Mechanical thinning will not be implemented without additional analysis of the potential environmental impacts and public comment.

Degree to which the possible effects on the quality of the human environment are highly uncertain or involve unique or unknown risks.

There are no identified risks associated with the proposed action that are unique or unknown, and there are no effects associated with the proposed action that are highly uncertain identified during the analysis for the EA or during the public review of the EA.

The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

The proposed action does not establish a precedent for any future actions that may have significant effects, nor does it represent decisions about future considerations. The purpose of this action is to develop a fire management plan and program that utilizes the benefits of fire to achieve desired natural resource conditions while minimizing the fire danger to resources and adjacent lands from hazardous fuel accumulations. Under such a program, prescribed fire, wildland fire use, and manual thinning activities would be conducted over several years to promote fire-adapted plant and wildlife species, and reduce hazardous fuels in the Park (surface and ladder fuels). This program will be evaluated and, if necessary, revised during future revisions to the Park's Fire Management Plan.

Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.

Since the vegetation resources at the Park thrive under a management scheme that includes fire, the application of fire on an annual basis will cumulatively improve the fire-adapted forest ecosystems on the Park. The air quality impacts associated with prescribed fire and wildland fire use would be permitted through the Oregon Department of Forestry and would have a very minor

cumulative effect on the region's air quality. The EA determined that there would be no significant cumulative impacts associated with the proposed action.

The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed on National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

There are 23 National Register historic structures, including the Watchman Lookout, several buildings in Rim Village, and 18 buildings in Munson Valley in the Headquarters area. Included in this list is House 19, which is a National Historic Landmark. There are two historic districts, Munson Valley and Rim Village. Rim Drive will become a historic district when nominated and listed on the NHRP. The Fort Klamath – Jacksonville Wagon Road is a historic road leading from Highway 62 to the rim area along a path west of the current visitor highway from Highway 62 to the rim.

There are 13 individual landscapes on the Cultural Landscape Inventory (CLI). A new property type, that of a logging railroad grade, was discovered as part of a pre-burn archeological survey in 2001. There is another grade, as yet unsurveyed, in the same vicinity.

Overall, less than 2% of Crater Lake National Park has been surveyed in accordance with professional standards in archeology. This amount grows each year as sites are surveyed prior to prescribed fire activity. To date, more than 40 archeological sites have been investigated in the Park.

More than 80 ethnobotanically significant plant species have been identified for the Park by the Klamath Tribes. Forty-two of these species belong to the *Carex* genera, commonly known as sedge. Sedges are associated with both riparian and dry meadow habitats of the Park. Other common species of importance include conifer trees, willows, huckleberries, and other shrubs, forbs, and hardwood trees that are widely distributed throughout the park.

Compliance with section 106 of the National Historic Preservation Act is completed on a project specific basis for prescribed fire activities. Project proposals are sent to the Oregon State Historic Preservation Officer for review and concurrence of the NPS determination of no effect prior to any ground-disturbing activities.

The Oregon State Historic Preservation Office was provided a copy of the EA for review and comment. No comments were received as of December 31, 2002.

The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

The U.S. Fish and Wildlife Service concurred with the determination that the proposed action would "not likely to adversely affect" threatened bald eagles and bull trout and that the project would "likely to adversely affect" the existence of northern spotted owls, but offered measures reasonable and prudent to prevent significant impacts, on August 16, 2002.

Whether the action threatens a violation of Federal, state, or local law or requirements imposed for the protection of the environment.

This action violates no federal, state, or local environmental protection laws.

Impairment

In addition to reviewing the list of significance criteria, the National Park Service has determined that implementation of the proposal will not constitute an impairment to the critical resources and values of the Park. This conclusion is based on a thorough analysis of the environmental impacts described in the Fire Management Plan and its EA, public comment, relevant scientific studies, and the professional judgment of the decision-maker guided by the direction in NPS *Management Policies 2001* (December 27, 2000). The plan under the proposed action will result in only negligible to minor adverse impacts to air quality resources, primarily in the form of smoke impacts to visibility, and to wilderness, primarily in the form of elevated noise levels. Overall, the plan results in benefits to Park resources and values, opportunities for their enjoyment, and it does not result in their impairment.

Mitigation Measures

As part of the proposed action, every fire event within Crater Lake National Park will be monitored, and each mitigation measure listed below will be evaluated to determine 1) if it was implemented as stated, and 2) to evaluate if it was effective at mitigating the impact to the resource it was designed to protect. Monitoring reports will become part of the permanent record of each fire event.

Fire Management Activities:

- Whenever consistent with safe, effective suppression techniques, the use of natural barriers will be used as extensively as possible;
- Fire retardant agents must be on an approved list for use by the Forest Service and Bureau of Land Management;
- Heavy earth-moving equipment such as tractors, graders, bulldozers or other tracked vehicles will generally not be used for fire suppression. The Superintendent can authorize the use of heavy earth-moving equipment in extreme circumstances in the face of loss of human life and/or property;
- When handline construction is required, construction standards will be issued requiring the handlines to be built with minimum impact. No handlines exposing mineral soil will be allowed through cultural sites, and all handlines will be rehabilitated. Erosion control methods will be used on slopes exceeding 10% where handline construction took place;
- All sites where improvements are made or obstructions removed will be rehabilitated to pre-fire conditions, to the extent practicable;

- Educational/informational materials will be developed and distributed to the wilderness visitor on what to expect during fire management activities including potential noise from chainsaws during line construction, smoke dispersion, safety, helicopter and airplane use, and information on where and when these activities would occur;
- A rehabilitation plan as required by NPS-18, with the use of a Burned Area Emergency Rehabilitation (BAER) Team, will be formulated and implemented in advance of demobilization from major fire events.

Visitor Experience and Use

- Fire management activities (excluding fire suppression) will not be conducted near developed areas and trails during holidays;

Soil and Water Resources

- Creek or river crossings will be limited to set and existing locations;
- Except for spot maintenance to remove obstructions, no improvements will be made to intermittent/perennial waterways, springs or seeps, trails, or clearings in forested areas;
- Riparian areas, which have been burned, may be seeded with native seed from native genotypes, as specified in a Burned Area Emergency Rehabilitation (BAER) plan;
- Fire lines will be located outside of highly erosive areas, steep slopes, and other sensitive areas;
- Fire control strategies will be sensitive to wetland values, and firelines will not "tie" into wetland or bog margins except when relying on those areas to naturally retard the fire without constructed line;
- Crews will implement Minimum Impact Suppression Techniques (MIST) fire suppression guidelines to minimize and/or eliminate adverse soil impacts resulting from ground crew activities;
- Crews will implementation MIST fire suppression guidelines to minimize and/or eliminate adverse impacts to surface water resources. These include:

    - Preferred use of water for aerial drops
    - Prohibition of fire retardant use in the Sun Creek Drainage, Lost Creek Drainage, and the caldera
    - Prohibition of Crater Lake, Sun Creek, and Lost Creek as water sources
    - Restriction of camps and toilet facilities from being located within 200 feet of surface water resources;

Wildlife and Plants

- All fires located within 100 acres of a known spotted owl nest or activity center, will be suppressed;
- Repetitive understory burning in spotted owl habitat will be limited to one occurrence per decade;
- No direct overflights of known T&E species nest sites will be allowed below 1500 Above Ground Level (AGL) from March 15 to August 30 each year;
- During the spotted owl breeding season (March 15 to August 30), manual thinning and prescribed fire treatments will not be conducted in those portions of treatment units that are within 0.7 mile of spotted owl nest sites or activity centers;
- Prescribed fire and manual thinning treatments will be very limited in nature within 100 acres of a known spotted owl nest or activity center;
- Within 0.7 miles of any known spotted owl nest site or activity center, 40% of the area will be protected from extensive prescribed fire and manual thinning treatments, while 60% will be subject to such treatments;
- Within 1.2 miles of each known spotted owl nest site or activity center, at least 40% of the area will be protected from fire, and up to 60% will be subject to prescribed fire;
- To protect bull trout habitat, no more than one-half of the upper Sun Creek and Lost Creek watersheds will be allowed to burn in any 20 year period;
- If threatened, endangered, or sensitive plant species are found in a treatment unit, a buffer surrounding the plants will be imposed that prohibits physical damage to the identified population. The assigned Resource Advisor will be consulted when determining the appropriate buffer;
- Prior to prescribed fires in the Panhandle Treatment Unit, park staff will treat the area adjacent to the highway using appropriate hand control methods to reduce chances of spreading known populations of non-native spotted knapweed and St. Johnswort. Park staff will monitor the area after prescribed fires for their occurrence and employ appropriate hand control methods to remove the noxious weeds if they are present;
- Park staff will clean fire management equipment prior to its use to prevent the spread of noxious weeds;
- Park staff will stage fire management operations away from known noxious weed infestations, and will construct fire lines away from known patches;
- Park staff will survey for noxious weeds in treatment units prior to ignition of prescribed fires;
- Any fires occurring in the area of the Sphagnum Bog, Thousand Springs, upper Castle Creek, Copeland Creek, and Trapper Creek would be monitored for post-fire impacts to Mt. Mazama collomia..

Cultural Resources

- No handlines exposing mineral soil will be allowed through cultural sites;

- Prior to all prescribed fire and non-fire fuel treatments, cultural resources in treatments areas will be surveyed, identified and avoided;
- Prior to all wildfire and wildland fire use activities, cultural resources in affected areas will be identified and avoided;
- Fire retardant use will be prohibited in the vicinity of any historic structure, unless there is imminent threat from wildfire to the historic structure;
- The park Historian or a designated representative will conduct an inspection and develop a plan to protect any existing or new cultural resources identified before and after prescribed fires.

Wilderness Resources

- Wildland fire operations within the proposed Wilderness Area will adhere to the requirements of the Wilderness Act, NPS Management Policies, and the NPS Director's Orders 18 and 41 Wilderness Preservation and Management;
- All fire management activities within the proposed Wilderness Area will employ minimum actions and tools necessary based upon the Minimum Requirement and Minimum Tool Determination;
- All fire management activities within the proposed Wilderness Area will follow established MIST implementation guidelines;
- All fire management activities within the proposed Wilderness Area will follow established Rehabilitation Guidelines for Wilderness Fire Suppression Activities;
- A Resource Advisor should be available for advice and support with the crew(s) as well as for quality control;
- When Wilderness campsites or travel routes are closed during fire management activities, visitors will be rerouted to alternative travel routes or campsites;

Research Natural Areas

- Heavy earth-moving equipment is prohibited within all Research Natural Areas;
- Helispots or camps are prohibited within the boundaries of all Research Natural Areas;
- If fire needs to be stopped in the Desert Creek RNA, water and appropriate foams will be recommended over fire line construction at the meadow edge. Phosphorous/clay based retardants will be banned within the RNA boundaries. If fire line construction is necessary, it will be best achieved at the forest-meadow edge rather than through the middle of the meadow;
- Fire suppression activities, including the use of foams and retardants, are prohibited within the Llao Rock RNA;
- Foams and retardants will not be used in the Sphagnum Bog RNA or within 200 feet of the upstream surface waters.

The table below specifies the responsible official and frequency of monitoring for each category of mitigation listed above.

Table 1. List of responsible officials for mitigation measures that are integral to the proposed action alternative.

Mitigation Category	Responsible Official	Monitoring Period
Fire Management Activities	**Incident Commander/ Burn Boss**	**Every fire event**
Visitor Experience and Use	**Incident Commander/ Burn Boss**	**Every fire event**
Soil and Water Resources	**Resource Advisor**	**Each fire event**
Wildlife and Plants	**Resource Advisor**	**Each fire event**
Cultural Resources	**Resource Advisor**	**Each fire event**
Wilderness Resources	**Resource Advisor**	**Each fire event**
Research Natural Areas	**Resource Advisor**	**Each fire event**

Decision

The proposed action does not constitute an action that normally requires preparation of an environmental impact statement (EIS). The proposed action will not have a significant effect on the human environment. Negative environmental impacts that could occur are negligible or minor in intensity. There are no significant impacts on public health, public safety, threatened or endangered species, sites or districts listed in or eligible for listing in the National Register of Historic Places, or other unique characteristics of the region. No highly uncertain or controversial impacts, unique or unknown risks, significant cumulative effects, or elements of precedence were identified. Implementation of the action will not violate any federal, state, or local environmental protection law.

Based on the foregoing, it has been determined that an EIS is not required for this proposed action and thus will not be prepared.

By the following signatory authority, implementation of the proposed action (sans the mechanical treatment strategy) and its associated mitigation measures shall commence on the date set forth below.

Recommended: _____ _____
Superintendent Date

Approved: _____ _____
Director, Pacific West Region Date

South Central Oregon Incident Organizer

Incident Name	
Incident Number	
P # / Fire Code #	
District / Unit	
Incident Dates	

Yes	No	IC's Checklist
		Incident Complexity analysis completed
		Risk Management process completed
		Hazard Mitigations in place
		IRPG Briefing checklist used for all incoming resources and documented
		Work/Rest Guidelines reviewed and tracked
		Personnel are qualified for positions
		Performance evaluations completed for resources assigned from outside the local area
		Type 3 IC accepts no collateral duties except to unfilled command and general staff
		After action review preformed and documented by IC

Incident Commander(s)	Time	Date

Management Check	Yes	No
After incident review (AIR) by Agency Administrator, Fire Program Manager, or Safety Program Manager. Date:_____		

/Signatures/

I.C.:_____ Date: _____

FMO/AFMO: _____ Date: _____

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NORTHWEST INCIDENT ORGANIZER

Initial Attack Size-Up / Risk Analysis (must be completed prior to briefing)

Date:	Time of Dispatch.	Arrival on Scene:
1. Fire Name:	Incident #:	Charge Code:
2. Incident Commander	(t) Incident Commander	

3. Fire Location: (degrees – minutes – seconds)
T: R: Sec:
LAT: Long:

4. Size

5. Fuels Burning: ☐ Grass ☐ Brush ☐ Slash ☐ Re-prod ☐ Timber (light, heavy) ☐ Snag ☐ Logs ☐ Duff
Adjacent Fuels: ☐ Grass ☐ Brush ☐ Slash ☐ Re-prod ☐ Timber (light, heavy) ☐ Snag ☐ Logs ☐ Duff

6. Character of Fire:
☐ Smoldering ☐ Creeping ☐ Running
☐ Spotting ☐ Torching ☐ Crowning

7. Flame Length:
☐ under 2' ☐ 2'-4' ☐ 4'-8' ☐ 8'-11'
☐ 11'>

8. Position On Slope
☐ Bottom 1/3 ☐ Middle 1/3
☐ Top 1/3

9. Present Slope:
☐ 0-30 ☐ 30-45 ☐ 45-60 ☐ 60>

10. Aspect
☐ North ☐ East ☐ South
☐ West ☐ Flat ridge top

11. Wind Speed _____
Direction ☐ N ☐ E ☐ S ☐ W ☐ Upslope
☐ Up canyon ☐ Down slope ☐ Down Canyon

Wind Indicators:
☐ Cumulus ☐ Lenticular ☐ Cold Fronts ☐ Other

12. Spread Potential: ☐ None ☐ Low ☐ Moderate ☐ High
☐ Very High

Elevation:

13. Values at Risk: ☐ Houses ☐ T&E Species ☐ Water Quality ☐ Timber
☐ Improvements ☐ Cultural/Historical ☐ Public Safety ☐ Other *(specify)*
(There is always a value at risk)

14. Hazards (Check all that apply)
☐ Snags ☐ Hazmat ☐ Urban Interface ☐ Power Lines ☐ Septic tanks ☐ Mine Shafts
☐ Evacuation Concerns ☐ Other

15. Cause ☐ Lighting ☐ Human Caused (protect origin/consider Fire Investigator) ☐ Other

16. Additional Resources Needed:

Personnel	**Equipment**	**Supplies**	**Aircraft**

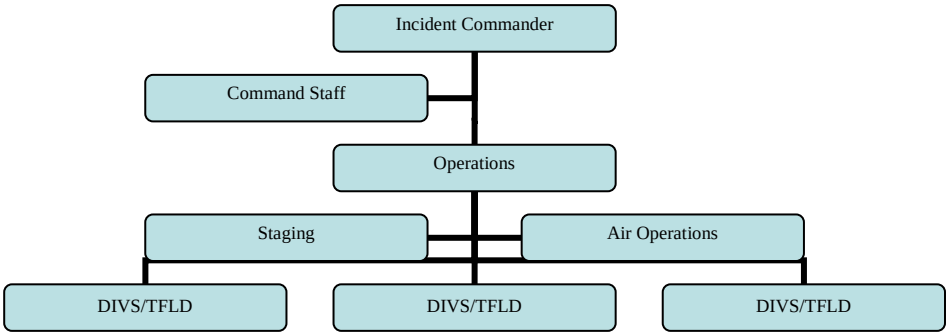
Safety Analysis (must be completed prior to Briefing
(If you answer **NO** to any questions, **take corrective action immediately!)**

Yes	No	Are the Standard Fire orders being Followed and the 18 watch out situations being mitigated?
Yes	No	Do you have a current Forecast? If not obtain through dispatch.
Yes	No	Is observed weather consistent with forecast? (Consider a spot)
Yes	No	Can you control the fire with resources available under current conditions?
Yes	No	Have you developed a plan of attack? (Direct, Indirect, Anchor Points, Priorities)
Yes	No	Have you communicated your plan to everyone on the incident?
Yes	No	Has the command structure been identified to all resources and dispatch?
Yes	No	Are lookouts in place or can you see the entire area?
Yes	No	Can you communicate with everyone on fire and with dispatch?
Yes	No	Are escape routes and safety zones established and identified?
Yes	No	Have you reported the status of the fire to dispatch?
Yes	No	Will the fire be controlled before next operational period?
Yes	No	Do you have a complete list of assigned and ordered resources?
Yes	No	If the fire can't be controlled by next operations period have you notified dispatch?
Yes	No	Are you still comfortable managing this incident? Use complexity analysis.
Yes	No	Do all Fire Line Supervisors have the local pocket card and an IRPG?

INCIDENT OBJECTIVES
1. SAFETY of firefighters and public.
2.
3.
4.
Your goal is to manage the incident and not create another

(Examples: Protect structures, keep fire to east of road, river edge)

INCIDENT ORGANIZATION



SPAN OF CONTROL

What is your span-of-control? How many people do you have answering you? If there are too many to manage properly, make some changes.

1 2 3 4 5 6 7 8 9

Optimum ↑ Too Many

RESOURCE SUMMARY

Resources Ordered	Resource ID	Data/ ETA	At Scene	Briefed Yes/No	Location Assignment	Released	
						Date	Time

INCIDENT COMPLEXITY ANALYSIS (Type 3, 4, 5)		
	YES	NO
Fuels extremely dry and susceptible to long range spotting or you currently experiencing extreme fire behavior.		
Weather Forecast indicating no significant relief or worsening conditions.		
Current or predicted fire behavior dictates indirect control strategy with large amounts of fuel within planned parameter.		
FIREFIGHTER SAFETY		
Performance of firefighting resources affected by cumulative fatigue.		
Overhead overextended mentally and/or physically.		
Communications ineffective with tactical resources or dispatch.		
ORGANIZATION		
Operations are at the limit of span of control.		
Incident action plans, briefings, etc. missing or poorly prepared.		
Variety of specialized operations, support personnel or equipment.		
Unable to properly staff air operations.		
Limited local resources available for initial attack.		
Heavy commitment of local resources to logistical support.		
Existing forces worked 24 hours without success.		
Resources unfamiliar with local conditions and tactics.		
VALUES TO BE PROTECTED		
Urban interface; structures, developments, recreational facilities, or potential for evacuation.		
Fire burning or threatening more then one jurisdiction and potential for unified command with different or conflicting management objectives.		
Unique natural resources, special-designation areas, critical municipal watershed, T&E species habitat, cultural value sites.		
Sensitive political concerns, media involvement, or controversial fire policy.		

If you have checked “Yes” on 3 to 5 of the analysis boxes, consider requesting the next level of incident management support.

Type 5 Characteristics: (a) C&G Staff positions are not activated**. (**b) Resources vary from one to five firefighters. **(c)** Incident is normally contained rapidly during IA. **(d)** A written action plan is not required.

Type 4 Characteristics: (a) C&G Staff positions are not activated**. (b)** Resources vary from single Firefighter to several single resources to a single Task Force or Strike Team. **(c)** The Incident is limited to one operational period in the control phase. Mop-up may extend into multiple periods, **(d)** A written plan is not required.

Type 3 Characteristics: (a) Some of the C&G Staff may be activated, as well as DIVS/GROP Supervisors and Unit leaders. (b) Resources vary from several single resources to several TFL’s/STL’s (c) Incident may be separated into several divisions, but usually does not meet the DIVS/GROP span of control. (d) May involve several burning periods prior to control, which requires a written action plan.

Risk Management		
Maintain your situational awareness (SA). Ensure compliance with the 10 Standard Firefighting Orders and LCES. Continually monitor the 18 Situations and apply appropriate mitigation. As the incident progresses, continually re-evaluate your situation. When hazards are identified mitigate them or change tactics and or strategy.		
Refer to the green pages in the IRPG.		
YES	NO	Decision Points
		Controls in place for identified hazards? If no reassess you situation.
		Are selected tactics based on expected fire behavior? If no reassess your situation.
		Are the current strategy and tactics working? If no reassess your situation.

INCIDENT RISK ANALYSIS (215a)		
Division/Group or Segment	Hazardous Actions or Conditions	Mitigations/ warnings/ Remedies
Operational Period		

SUMMARY OF ACTIONS (ICS 214)	
Date/Time	MAJOR EVENTS (Important decisions, significant events, briefing, Records on conditions, etc…)

DAILY WEATHER AND/OR SPOT RECEIVED

□ YES □ NO → GET IT

□ RED FLAG WARNING □ FIRE WEATHER WATCH

Spot Weather Observation and Forecast Request									
1. Name of Incident or Project			2. Control Agency:			3. Requested By:			
						Date:		Time:	
4. Location: Township, Range, Section or Lat and Long.)					5. Drainage Name:			6. Exposure / Aspect	
7. Size of incident or Project (acres)			8. Elevation		9. Fuel Type		10 Project On:		
			Top	Bottom			Ground Crowning		
11. Weather Conditions at incident or project or from RAWS:									
Place	Elevation	Observation Date/Time	Wind Direction Velocity		Temperature		RH	DP	Sky Condition
			20 ft	Eye-level	Dry Bulb	Wet Buld			
The Weather Forecaster will furnish the information for block 13.							Date/Time:		
13. Discussion and Outlook:									

WORK REST RATIO DOCUMENTATION WORKSHEET				
This worksheet is designated to help the IC document and calculate the amount of rest required to meet the Work/Rest Guidelines • For every 2 hours of work or travel provide 1 hour of sleep or rest. • IC must justify and document work shifts exceeding 16 hours and those that do not meet the 2:1 work/rest guidelines—see below.				
Date	Operational Period Start Time	Operational Period Stop Time	Total Hours Worked	Rest Time (document hours when employee or module rested)
Approval for shift lengths exceeding 16 hrs given By:		Date/Time Approval Given:		
IC Signature:		Date:		

Official Documentation for Extended Work Shift
And/Or
Deviation from 2:1 Work Rest Policy

Date:	Time:	Incident Number	Incident Name	Unit
Incident Type	Operational Period	Incident Commander	IC Type (1-5)	

Justification

Name of Individuals(s) or Crew:

Description of Situation: (Y)

Shifts in excess of 16 hrs on _____ Was due to:

- ◻ Travel Time not administratively controllable.
- ◻ Mobilization and travel of resources to incident location or relocation to incident facilities.
- ◻ Establishing and maintaining administrative, planning, and logistical support for incident.
- ◻ Evacuation, triage, structure protection, or emergency rescue.
- ◻ Establishing initial control lines of the fire.
- ◻ Extended attack efforts to control potentially devastating incident activity.
- ◻ Incident unable to provide personnel with adequate food and lodging.
- ◻ Other/Additional

Extended hour(s)	Date:	Work Hours:	Total Hours:

Rational: (Y)

- ◻ Emergency mobilization of resources to and from incident or facilities.
- ◻ Efforts required setting up, supporting, and undertaking incident control actions.
- ◻ Imperative operational defensive actions to prevent loss of life, resources and property damage.
- ◻ Extenuating circumstances resulted in personnel being left on-location without food and lodging.
- ◻ Other/Additional

Mitigation Measures

Actions taken to reduce Impact on firefighter safety and reduce fatigue: (Y)

- ◻ Rest extended into the following operational period. Hours adjusted _____ on shift by._____
- ◻ Other:

Mitigation hour(s)	Date:	Hours:	Total Hours:

_____

Incident Commander Agency Line Officer or Duty Officer

INCIDENT STATUS SUMMARY (ICS-209)					
1. Date	2.Time	3. Initial	Update	4. Incident #	5. Incident Name
6. Incident Kind	7. Start Date Time	8. Cause	9. IC	10. IMT Type	11.State/Unit
12. County	13. Lat / Long Lat. Long.	14. Short Location Description (in reference to nearest town)			

Current Situation					
15. Size/Area Involved:	16. % Contained or MMA:	17. Expected Contain. Date: Time:	18. Line to Build:	19. Cost to Date.	20. Controlled: Date: Time:

21. Injuries this reporting period	22. Injuries to Date	23. Fatalities:	24. Structure Information			
			Type of Structure	# Threatened	# Damage	# Destroyed
25. Threat to Human Life/Safety Evacuation(s) in Progress- No Evacuation(s) imminent- Potential future threat- No Likely Threat-			Residence			
			Commercial Property			
			Outbuilding /Other			

26. Communities/Critical Infrastructure Threatened (In 12, 24, 48, and 72 hr time frames)

12 hour

24 hour

48 hour

72 hour

27. Critical Resource Needs (kind & amount, in priority order)
1.
2.
3.

28. Major problems and concerns (control problems, social/political/economic concerns or impacts, etc.)
Relate critical resources needs identified above to the Incident Action Plan (ICP)

29. Resources threatened (kind(s) and value/significance)

30. Current Weather Conditions	31. Resource benefits/objectives (for prescribed/wildland fire use only):
Wind Speed_____ MPH Temperature _____ Wind Direction _____ Relative Humidity_____	

32. Fuels/Material Involved: Use the 13 Fire Behavior Models. The incident should select the predominant fuel model with the option to include additional fuels information:

33. Todays observed fire behavior (leave blank for non-fire events)

34. Significant events today (closures, evacuations, significant progress made etc.):

OUTLOOK

35. Est. Control Date and Time:	36. Projected Final Size:	37. Estimated Final Cost:	38. Tomorrow's Forecasted Weather Wind Speed: MPH Temp: Wind Dir: Relative Humidity:

39. Actions planned for next operational period:

40. Projected incident movement/spread during next operational period:

41. For fire incidents, describe resistance to control in terms of:
1. Growth potential
2. Difficulty of Terrain

42. How likely is it that containment/control targets will be met, given the current resources and suppression/control strategy.

43: Projected demobilization start date:

44. Remarks:

45. Committed Resources

Agency	CRW1		CRW2		HEL1	HELI2	HELI3	ENGS		DOZR		WTDR	OVDH	Total
	SR	ST	SR	ST	SR	SR	SR	SR	ST	SR	ST	SR	SR	
Total														

48. Cooperating and Assisting Agencies Not Listed Above:

Approval Information		
47. Prepared by:	48: Approved by:	49: Sent To: By: Date: Time:

Medical Plan	1. Incident Name	2. Date Prepared	3. Time Prepared	4. Operation Period

5. Incident Medical Aid Station

Medical Aid Stations	Location	Paramedics	
		Yes	No

6. Transportation

A. Ambulance Service

Name	Address	Phone	Paramedics	
			Yes	No

B. Incident Ambulances

Medical Aid Stations	Location	Paramedics	
		Yes	No

7. Hospitals

Name	Address	Travel		Phone	Helipad		Burn Center	
		Air	Ground		Yes	No	Yes	No

8. Medical Emergency Procedures

9. Prepared by (Medical Unit Leader)	10. Review by (Safety Officer)

Radio Communications Plan

Radio Channel Utilization

Function	Frequency	Tone	Assignments	Remarks
Command Primary				
Command Secondary				
Tac1				
Tac 2				
Tac 3				
Air to Ground Primary	169.150 RX 169.150 TX Narrowband			
Air to Ground Secondary	151.310 RX 151.310 TX Wideband			
Air Guard	168.625 RX 168.625 TX Narrowband	110.9 110.9		
ICS-205				

Contact List

Name	Location	Work Phone	Name	Location	Work Phone
LIFC Dispatch	Lakeview	947-6315	**ODF Lake**	Lakeview	947-3311
KIFC Dispatch	Klamath	883-6850	**ODF Klamath**	Klamath	883-5555
Bly Ranger Dist	Bly	353-2741	**Fire Cache**	Lakeview	947-6172
Lakeview R.D	Lakeview	947-4479	**Helibase**	Lakeview	947-6191
Paisley R.D	Paisley	943-3114	**Seat Base**	Lakeview	219-1497
Silverlake R.D	Silverlake	576-2107	**Tanker Base**	Klamath	883-6853
Chemult R.D	Chemault	365-7001	**Medford Weather**	Medford	776-4303
Chiloquin R.D	Chiloquin	783-4009			
Klamath R.D	Klamath Falls	885-3400			
Crater Lake	Crater Lake	594-3061			
KFRA BLM	Klamath Falls	883-6916			
LAD BLM	Lakeview	947-2177			
Fort Rock G.S.	Fort Rock	576-2220			
Gerber G.S.	Gerber	545-6746			
Sheldon/Hart	East Desert	947-3315			

MAP SKETCH

↑

Perimeter in Chains ---average chains=acres
17=1 24=2 29=3 34=4 45=7 53=10
65=15

SECTION OF MAP: (1 MILE BY 1 MILE)
TOWNSHIP: RANGE: SECTION:
LAT: LONG:

Staging Location	I.C.P Location				
Notes & Directions: (include roads, creeks, trails etc):					
Prepared By:	Position:	Date:			
		Time:			

FINAL FIRE REPORT (Incident Commander Required to Complete)

STATISTICAL CAUSE (circle the number)	1) Lightning	4) Camp Fire	7) Arson
	2) Equipment Use	5) Debris Burning	8) Children
	3) Smoking	6) Railroad	9) Other
GENERAL CAUSE (circle the number)	1) Timber Harvest	4) Highway	7) Fishing
	2) Harvest Other Prod.	5) Power, Reclamation	8) Other Recreation
	3) For. Man Activ.	6) Hunting	9) Resident
	10) Other		
GRASS TYPE:	Annual	Perennial	

NFDRS (MSCG) FUEL MODEL (circle one):			
A) Annual Grasses	F) Intermountain Brush	K) Light Slash	Q) Alaska Black Spruce
B) Mature Brush	G) West Coast Conifer	L) Perennial Grasses	R) Jardwood Litter sum.
C) Open Pine w/ Grass	H) Short Needle Conifer	N) Saw/Marsh Grasses	S) Tundra
D) Southern Rough	I) Heavy Slash	O) High Pocosin	T) Sage with Grass
E) Hardwood Litter fall	J) Intermediate Slash	P) Southern Long Pine	U) Western Long Pine

RESOURCE TYPES AND NUMBER							
	Engines (Type)		Helitack (via Heli.)		Heli. (Type)		Overhead
	Engines (Type)		Rappell (via Heli.)		Heli. (Type)		Retard Load (gal)
	Engines (Type)		Smokerjumper		Heli-drop (Gal)		Retard Load (gal)
	Engines (Type)		Squad Members		Heli-drop (Gal)		Crews (Type)
	Engines (Type)		Personnel		Heli-drop (Gal)		Crews (Type)
	Tenders (Type)		Heli. (Type)		Aircraft (Type)		Dozers (Type)
	Tenders (Type)		Other		Other		Other

Containment:		
Date:	Time:	Acres:
Control:		
Date:	Time:	Acres:
Out:		
Date:	Time:	Acres:

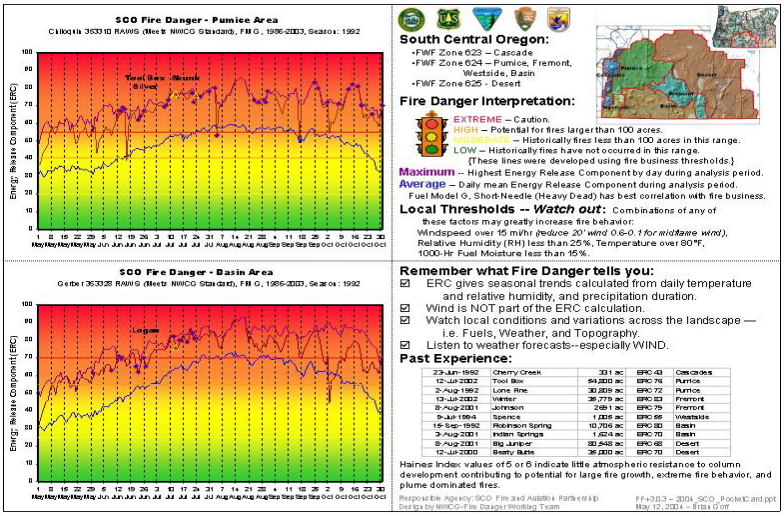
ACRES BURNED BY OWNERSHIP:			
1) BLM	3) NPS	5) USFS	7) STATE
2)BIA	4) FWS	6) PVT	8) OTHER
FMZ:		Net Value Change:	
Signature of Incident Commander:			
			Date:

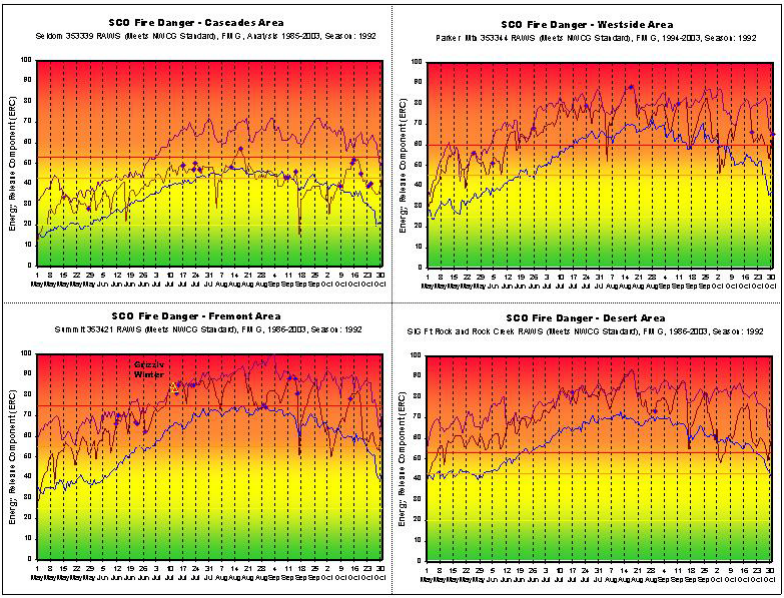
AFTER ACTION REVIEW		
Incident Name		IC:
CRITIQUED BY: (add names)		
The purpose of this After Action Review is to evaluate decisions, actions and how well they worked. Were they within the Standard operation Procedures and the rules? Pay particular attention to how the 10 Standard Firefighting Orders, Mitigation of the 18 Watch Out Situations and LCES were applied. Comment where applicable.		
AAR Leader Signature:		Date:
Reviewed By:		Date:

QUESTIONS AND ANSWERS –AAR CONT. Page 16 IRPG
1. What was planned? Review Primary objectives and expected action plan.
2. What actually happened? Review the day's action.
2-1. Identify and discuss effective and non-effective performance.
2-2. Identify barriers that were encountered and how they were handled.
2-3. Discuss actions that weren't standard operating procedures, ot those that presented safety problems.
3. Why did it happen? Discuss the reason for ineffective or unsafe performance. Concentrate on what not who!
4. What can we do next time? Determine the lessons learned and how to apply them in the future.

South Central Oregon

BLM -Lakeview Resource Area, FS -Fremont-Winema NF, NPS - Crater Lake NP, USFWS - Sheldon /Hart Mtn NWR & Klamath NWR, Oregon Department of Forestry Klamath-Lake District





Appendix 13.E Unit Specific Supplemental Information
(requiring annual revision)

This appendix contains forms that are typically used during the fire year. Forms commonly utilized throughout all fire divisions (e.g. DI-1202s, SF 182s, etc.) are not included in this section. The forms and information contained in this appendix may be revised annually.

Crater Lake National Park
Morning Briefing Checklist

Date: _____

1 Morning Weather: Discussion
   a. Temperature Low_____ High_____
   b. RH's Low_____ High_____
   c. Wind Speed_____ Gust_____ Direction_____
   d. LAL (1 2 3 4 5 6)
   e. Haines Index (2 3 4 5 6)
   f. Outlook / Long Range Forecast_____
   g. Fire Weather Watch / Fire Weather Warning

2. Indicies / Fire Danger Rating Areas

	ERC	BI
Westside	_____	_____
Basin	_____	_____
Cascade	_____	_____
Pumice	_____	_____
Fremont	_____	_____
Desert	_____	_____

3. Industrial Fire Precaution Level (IFPL) Low / Mod / High / Extreme
4. Public Use Restrictions (PUR's and Closures) _____
5. Preparedness Levels National_____Regional_____Local_____
6. Local Shared Resources Available
   a. Air Tankers:_____
   b. IHC:_____
   c. Helicopter(s):_____
   d. Smoke Jumpers:_____
   e. ATGS / Lead Plane:_____

7. Six Minutes For Safety
   Topic:_____

Personnel Attending:

_____ _____ _____
_____ _____ _____
_____ _____ _____
_____ _____ _____

CRATER LAKE FIRE & FUELS TIME LOG

MONTH_____ YEAR_____

NAME_____

In the space provided below, insert a brief description of the day's events. Break down each event with the number of hours in the appropriate boxes at right. Please round to the nearest half hour for every duty performed in a day.	Wildland Fire Use	Prescribed Fire ignition	Prescribed Fire Effects	Prescribed Burn Plan.	Prescribed burn prep	Hazard Fuel Reduction	Travel	Training	Administrative	Physical Training (PT)	Suppression	Project prep/rehab	Annual/admin leave etc
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
MONTHLY TOTAL													

Fire Tracking Table 2010														
Office Ref #	Date	Fire Name	Type	Rebol	Firecode	IQCS Incident #	Tactic	Size Class	Fuel Type	1202	Resources	TRS	Contrl Contn	FF Quals

SEASONAL EMPLOYEE JOB-OFFER CHECKLIST

Supervisor: _____ Date: _____

Employee Name: _____

ARRIVAL & CHECK-IN

_____ **Report to your supervisor at the beginning of your first workday.**
_____ When will you arrive at the park to stay in quarters? Date: _____
(Supervisors must be available to check employees into quarters before occupancy.)
_____ Administrative check-in at Sager Building on first workday (after meeting with supervisor).
_____ Employment paperwork with park personnel office: bring 2 of 3 of following: valid driver's license, social security card, current passport.
_____ Information for Direct Deposit of paycheck.
_____ Receive quarters keys.

HOUSING

_____ Most available seasonal housing requires sharing a bedroom with another employee.
_____ Basic furniture is provided, but occupants must bring bedding, kitchenwares and eating utensils.
_____ Quarters rents include water, sewer, garbage and recycle pickups, power, heat, and basic telephone without long distance calls.
_____ Occupants must use collect, credit card, calling card, third party, or "1-800" numbers to make long distance telephone calls.
_____ Smoking is prohibited in all quarters.
_____ Pets are prohibited in seasonal employee quarters.
_____ There is a small and limited amount of storage space for personal property.
_____ Quarters are located within walking distance of "report-to-work" sites.
_____ Full service communities with large grocery stores, hospitals, shopping centers, and entertainment are located 60-80 miles from quarters.
_____ There are no public transportation services between the park and surrounding communities.

A. Shared Housing

_____ Would you share a house (but not a room) with someone of the opposite sex?
_____ Would you share a house (but not a room) with a married couple?

B. Family Housing or Trailer Hookups

_____ Do you request family housing? (Check with your Division Chief for availability)?
_____ Do you request a trailer pad for a travel trailer? (Check with your Division Chief for availability)?

C. Married Couples

_____ If married and both working for the NPS, would you share a house (but not a room) with single individuals.

D. Roommate Preference

_____ Provide the name of another seasonal employee with whom this employee wishes to share a room.

_____

DUTY HOURS

_____ Enter-on-Duty date and End-of-Season date.
_____ Work Schedule.
_____ Days off.
_____ Annual Leave and Sick Leave benefits and policies.

PAYROLL and MONEY

_____ First paycheck may take up to 4 weeks to be deposited after starting work.
_____ Please bring information from your bank to direct deposit your paycheck.

_____ Oregon State Income Tax is deducted from your paycheck at the rate of about 10%, even if you are not a resident of Oregon.
_____ Quarters rent is automatically deducted from paychecks.
_____ There are no cash machines at the park; closest ones are 50 miles away.
_____ Grade level and pay rate per hour.

MEDICAL INSURANCE

_____ **Workers Compensation (OWCP) for on-the-job injuries or job related illnesses.**
_____ **NO HEALTH BENEFITS for off-the-job illnesses or injuries.**
_____ **No life insurance.**

UNIFORMS

_____ Required to wear uniform. _____ Not required to wear uniform.
_____ Uniform information, allowances, and ordering procedures will be provided when the employee enters on duty.

GOVERNMENT VEHICLES

If employee is required to operate a government vehicle on the job:
_____ Must have a home state driver's license.
_____ Must wear seat belts and shoulder harnesses.
_____ Smoking is prohibited in government vehicles.

PERSONAL VEHICLES

_____ Parking is available near quarters and only on pavement.
_____ Personal vehicles must be registered with the park to avoid paying entrance fees.
_____ **There is no fee for park registration.**
_____ **Registering vehicles with the park requires you to present:**
_____ **Valid state driver's license**
_____ **Current vehicle registration**
_____ **Proof of insurance**

CLIMATE

_____ SNOW during summer season; bring warm clothes!
_____ Elevation of housing is at @6,500 feet above sea level.
_____ Work areas are located between 5,000 and 9,000 feet above sea level.

CONTACTS

_____ Supervisor provides his/her name and office telephone number (fax and e-mail address if desired) to employee for future contact.
_____ Supervisor gets information from employee on how to make contact with employee before employee arrives on duty.
_____ Supervisor should keep this form on file for reference.

All facilities within Crater Lake National Park are "NO SMOKING AREAS"

(1st edition: 03/08/01)

Annual Checklist Fiscal Year 2010

Name	Position & GS	Start Date	End Date	Housing	SSN	Position #	Physical	Red Card	Travel Blanket

Office of Fire Management
Equipment Checkout

NAME: _____ Date: _____

Issued	Item	Issued	Item
	Red Pack		Earplugs
	Fireline Pack (Field Pack)		First Aid Kit
	Radio Harness		MRE / Coyote Camp
	4-6 Water Bottles		Compass
	Fire Shelter		Leather Gloves
	Headlamp		Gripper Gloves
	14 AA Batteries		CRLA Topo Map
	Sleeping Bag & Pad		Incident Size-Up
	Tent		CRLA Radio Frequencies
	Hardhat & Chinstrap		Spot Wx Request Form
	Safety Glasses		Whistle
	Parachute Cord		Chem Sticks
	Flagging		Shoulder Pad
	Mosquito repellant		Carabiner
	Recharg. Battery/ Clamshell		Gatorade

	Nomex Shirts Size:
	Nomex Pants Size:
	CRLA GPS Property Number:
	NPS Radio Property Number:

I have received the gear listed above:

_____ Date: _____
Employee Signature

The gear listed above has been returned to the CRLA Cache:

_____ Date: _____
Supervisor's Signature

Appendix 13.F Wildland Fire Monitoring Plan

10 Introduction

Crater Lake National Park (CRLA) has established a program of fire management to achieve resource management objectives associated with the protection and stewardship of fire-adapted forest ecosystems. The purpose of fire monitoring is to provide effective evaluation of the wildland and prescribed fire management program. The focus of the CRLA fire monitoring program is monitoring vegetation and fuels, and how they are affected by the application of fire. The CRLA fire monitoring program is separate from the Klamath Network Inventory and Monitoring (I&M) Program that tracks ecosystem vital signs at each of six parks.

The CRLA fire monitoring program is designed to determine whether fire and resource management objectives are being met, as well as to document any unexpected consequences of fire management activities. The monitoring program is intended to continuously inform the staff about results of management activities so that the fire management program can adapt to changing conditions using the best available information. To be the most effective, evaluation and integration of fire monitoring data will be a shared responsibility between fire management and natural resource management staffs.

This fire monitoring plan describes the framework that will be used for collecting, managing, and evaluating fire effects information that forms the core of the fire monitoring program at CRLA. The overall sampling design is based on the six major forest communities found within the park. As new information and research results are obtained, relevant changes to the monitoring program will be made. These changes may include new or alternative monitoring techniques, changes in treatment prescriptions, or refinement of management objectives.

History of Fire Management and Monitoring

Crater Lake National Park was established on May 22, 1902 and is the nation's sixth oldest national park. At the time of establishment, fire suppression was the dominant management strategy for the park. It wasn't until the mid-1960's that fire was recognized as an important natural process in western U.S. forests (Leopold et al. 1963) and institutionalized as Departmental policy in 1968 (Kilgore 1973).

In 1976, after more than 70 years of aggressive fire suppression, a prescribed fire program was initiated at the park to restore mixed-conifer forests. The objectives were to favor retention of large ponderosa pine over shade-tolerant species and to create conditions that would enhance ponderosa pine regeneration. Unexpected mortality of large ponderosa pine occurred during the ten-year program of prescribed fires. Through a series of research studies overseen by James K. Agee (University of

Washington), it was determined that some of the prescribed fires had burned too hot and too much duff was removed, thus weakening trees and increasing the probability of attack by bark beetles *(Dendroctonus spp.)*. Recommendations were made for burns to be done earlier in the spring when duff moisture is > 30%. Prescribed burning was discontinued after 1987, however, and the recommendations were never tested.

A formal fire monitoring program was initiated in 1995, in preparation of reviving the prescribed fire program. Due to political and managerial constraints, prescribed fire was not applied again until the fall of 2001. Under the current Fire Management Plan (2004), fire use (prescribed and wildland) along with non-fire treatments (manual thinning) are being used to meet resource management objectives across the park's varied forest types. The current configuration of monitoring plots is summarized in Table 1-1. Some aspects of the monitoring program (such as the total number of plots needed) are currently under development.

Table 1-1. Summary of Fire Monitoring Plots by Forest Series.

Forest Series (i.e. monitoring type)	No. of Monitoring Plots Installed	No. of Monitoring Plots Needed	Monitoring Plot Type	Treatment Type	Project Name(s)
Ponderosa pine	14	20-24	FMH – forest	Rx burn	Timber Crater, TC Southwest, Sharp Desert, Phoenix
White fir	7	20-36	FMH – forest	Rx burn	Panhandle, Sun Creek, Upper Panhandle, West 62, Crater Creek Ridge
Shasta red fir	0	10+	FMH – forest	Fire Use, Rx burn	Crater Peak
Lodgepole pine	0	Unknown	RAP. fuels/ veg	Fire Use, Rx burn	Cornerstone
Mtn. hemlock	12	24-36	RAP. fuels/ veg	Fire Use, Manual thin	Mazama, Munson Valley
Whitebark pine	0	Unknown	RAP. fuels/ veg	Fire Use, Rx Burn	PIAL Research

"FMH –Forest" refers to a plot layout described in the NPS Fire Monitoring Handbook (NPS 2001).
"RAP" refers to Rapid Assessment Plot, a plot layout developed at the park level.

12 Monitoring Framework

The fire effects monitoring framework for CRLA is based on the six major forests types found within the park. These six types or forest series are: 1) ponderosa pine *(Pinus ponderosa)*; 2) white fir *(Abies concolor)*; 3) Shasta red fir *(Abies magnifica var. shastensis)*; 4) mountain hemlock *(Tsuga mertensiana)*; 5) lodgepole pine *(Pinus contorta)*; and 6) whitebark pine *(Pinus albicaulis).*

Each forest series is recognized in the field by the dominant, most shade-tolerant regenerating tree species that is present over a given site (Atzet et.al. 1996). For each forest series, there are few to many tree species associated with the series that may be present depending on the successional status of the site.

Table 1-2 provides a list of species that are associated with each forest series. Note that white fir and lodgepole pine occur within several forest series, representing an adaptation to a broad range of environmental conditions. Figure 1-2 shows the distribution of current forest cover types within the park (e.g. the dominant overstory species, which in most areas of the park is a close approximation of the forest series).

Table 1-2. Common Tree Species of Crater Lake National Park, Oregon.

Forest Series → Tree Species:	Ponderosa pine	White fir	Shasta red fir	Mountain hemlock	Lodgepole pine	Whitebark pine
Ponderosa pine	M	M				
Douglas-fir		M				
Incense cedar		M				
Sugar pine		#				
White fir	#	M	M			
Subalpine fir				#		
Western white pine		#	#	#		
Lodgepole pine	#	#	M	M	M	#
Shasta red fir			M	#		#
Mountain hemlock			#	M		#
Whitebark pine				#		M

"M" = Major species present, "#" = Minor species present

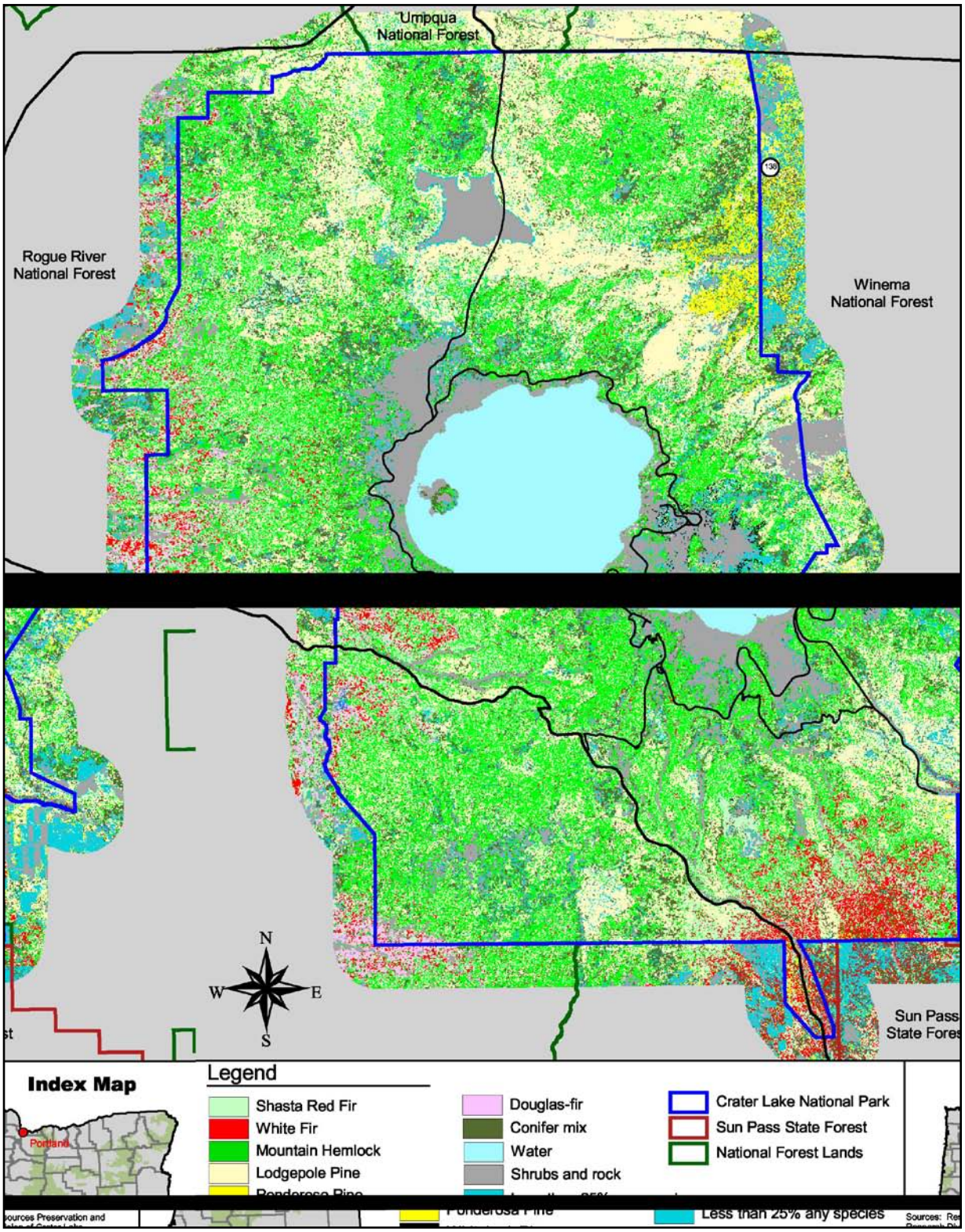


Figure 1-1. Forest Cover Types of Crater Lake National Park, Oregon.

ECOLOGICAL MODEL DESCRIPTION

This section summarizes the current fire ecology literature for the six dominant forest types found at the park. General references include Agee (1993), Agee and Huff (2000), Brown and Smith (2000), the USDA Fire Effects Information System (FEIS) website, and other sources as cited. Taken together, this information forms the basis for constructing an ecological model of the park with its six forest series or component types. Each forest type interacts with fire and other disturbances in a unique and synergistic way through time and across the landscape.

The information in this section guided the development of the resource management objectives and monitoring design found in chapters 3.0 and 4.0. The forest type descriptions are organized along an environmental gradient, beginning with low-elevation ponderosa pine forests and ending with the park's high-elevation whitebark pine forests.

Ponderosa Pine Forests

Environmental Characteristics

Ponderosa pine forests are found in the northeastern corner of the park, to the east of Timber Crater, at elevations up to 5500 ft above mean sea level (MSL). In this forest community, ponderosa pine is the dominant vegetation species and under a regime of frequent fire is normally the only conifer present. White fir is now a common cohort in ponderosa pine stands due to fire exclusion, and lodgepole pine is found in association with ponderosa pine where coarse-textured pumice soils occur, or on topographic basins where cold-air drainage forms frost-pockets. In most pre-settlement ponderosa pine forests, there was a sizable herbaceous component, which together with pine needles created a flashy fuel that encouraged frequent, widespread burning.

The Fire Regime

Historically, fires tended to be of low intensity, rarely scorching the crowns of older, mature trees. Fires tended to be small, frequent, and patchy, in that they consumed too little fuel to scar trees. The historical mean fire return interval is 9 – 15 years. Fire is linked with other disturbance factors in ponderosa pine forests, most notably post-fire insect attack. Scorched trees are more likely to be successfully attacked by western pine beetle *(Dendroctonus brevicomis)*, mountain pine beetle *(D. ponderosae)*, red turpentine beetle *(D. valens)*, or pine engraver beetles *(Ips spp.)*. Reduction in tree vigor during drought is also associated with

insect attack and major losses in mature and old growth ponderosa pine occurred during the drought of the 1920's and 1930's in the Pacific Northwest. Fire may help control dwarf mistletoe infestation by pruning dead branches and consuming tree crowns that have low hanging brooms.

Stand Development Patterns

Soil moisture is more important than light for establishment of ponderosa pine seedlings. Available soil moisture is critical to seedling survival during the spring and early summer. Competition for soil water between trees and other understory plants is greatest in the 0-20 cm soil zone, within which ponderosa pine will be rooting in its first year. Presence of other understory vegetation, such as perennial grasses or mature trees, can reduce height growth of established ponderosa pine compared to open-grown trees, making the small pines more susceptible to thinning by periodic fire. Establishment on bare soil, historically provided by periodic fire, is higher than on micro sites covered by pine needles. The roots more quickly penetrate into the soil, and moisture availability may be enhanced on bare, open patches across the landscape. Shading of the seedlings can be important for protection from heat and frost by reducing incoming short-wave radiation during the day and long-wave radiation loss at night.

The process of stand development in ponderosa pine forests is a result of the shade intolerance of ponderosa pine, periodic good years for seedling establishment associated with years of above-normal precipitation, and frequent fire. Gaps in the forest, created by mortality of an existing small, even-aged group, allow the shade-intolerant pine to become established when a good seed year and appropriate climate coincide. In this opening, the stand of young trees will be protected from fire because of lack of fuel on the forest floor, while the fire will burn under mature stands and eliminate any reproduction there. As the trees in the opening continue to grow, they provide enough fuel to carry the fire and thin the stand. Within a group, relatively uniform spacing is the result of moisture competition and a tendency for closely spaced trees to be selectively killed by fire.

Fire normally maintains the forest as an aggregation of very small, even-aged or even-sized clumps. (West 1969). As one clump ages, it is attacked by western pine beetles and then decomposes by fire, scarifying the site for another clump to regenerate. Because of this interaction between fire and beetles, snags tend to be clustered on the landscape, and coarse woody debris is likely short-lived because of frequent fires. Consumption of coarse woody debris naturally inhibits rhizomatous grasses and shrubs and creates growing space for pine regeneration.

Management Implications

Ponderosa pine forests have experienced significant ecological change since fire suppression began. Fire exclusion has allowed a major increase in white fir density and the chances of stand-replacement fire, characteristic of high-severity fire regimes, are much greater now than historically.

Re-introducing fire within wilderness areas of the park needs careful prescription. Due to their altered fuel and forest structure, it is unlikely that fire excluded forests can absorb the shock of naturally occurring fires during the summer months. Such fires would generally be far too intense, consume too much fuel, and cause the death of many of the older, pre-settlement forest trees (Agee 1993). Prescribed fire is essential to restore such sites and can be done through a series of low intensity fires. Attempts to complete the restoration in a single fire are not realistic. Autumn fires appear to harm low vigor ponderosa pines less than spring fires (Swezy and Agee 1991) in *Abies concolor* forests and it is assumed to be true for ponderosa pine forests as well. Once a series of prescribed fires has reduced surface fuel loads, fuel ladders to the overstory, and total tree density, either continued prescribed fires or natural fires can maintain the role of fire into the future of this forest type.

White Fir Forests

Environmental Characteristics

East of the Cascade Crest, white fir communities are a mix of ponderosa pine and white fir with lesser amounts of Douglas-fir *(Pseudotsuga menziesii)*, incense cedar *(Calocedrus decurrens),* lodgepole pine *(Pinus contorta)*, and sugar pine *(Pinus lambertiana).* Historic fires favored the survival of pines over fir, and most of these stands, concentrated in the south eastern portion of the park, were historically dominated by ponderosa pine.

West of the Cascade Crest, white fir communities are found along the park's west boundary up to 5300 ft above MSL. These communities are a mix of white fir, incense cedar, and Douglas-fir as dominants with lodgepole pine, sugar pine and western white pine as minor cohorts.

The Fire Regime

Specific fire history information is available for the panhandle area of the park. Researchers studied an elevation gradient from the southern end of the panhandle up into the red fir forest types, and found an average fire return interval of 9-42 years along the gradient, with the lower average adjacent to the ponderosa pine type and the upper average adjacent to the red fir type (McNeil and Zobel 1980). Variation

was high, and that probably allowed fire-intolerant white fir (at least while it was young) to survive as a co-dominant in this classic low-severity fire regime type.

Stand Development Patterns

The forest stands in the southern portion of the park are generally one-storied, and composed of small clumps. However, these clumps tend to be comprised of only one of the major species in white fir communities: one clump of ponderosa pine, another of sugar pine, another of white fir, several more of ponderosa pine, etc. Fires are frequent enough to kill most understory trees invading the clumps, so that these forest stands remained relatively open.

Understory shrubs such as gooseberries, currants, and ceanothus would either sprout after burning or reproduce from seeds stimulated to germinate by heating as the fire passed over. As in the ponderosa pine type, frequent fires maintained a low shrub/grass understory. It was probably better developed under pine clumps than under relatively shadier true fir clumps.

Management Implications

White fir forests have been significantly affected by fire exclusion. These open, mixed conifer forests have been choked by white fir regeneration and, to some extent, lodgepole pine. Most of the regeneration ceased about 1950 when growing space in the stands was fully occupied by trees. Fire hazard has significantly increased in white fir communities, and these changed stand conditions have led to increased stand susceptibility to bark beetles. Density management (thinning) and understory burning are recommended to reduce fuel buildup, reduce stand susceptibility to insects and diseases, and reduce the probability of soil damage and erosion resulting from wildfire.

Sugar pine, as a component of mixed-conifer forests, is a species of management concern. With the encroachment of white fir, sugar pine densities have declined. While somewhat shade-tolerant, sugar pine can be damaged by fire when young (Thomas and Agee 1986); while at maturity it is generally very resistant to low- to moderate-severity fires that recur at 15-25 year intervals. Mature trees have a thick, fire-resistant bark and open canopy that retards aerial spread. Sugar pine, along with western white pine and whitebark pine are susceptible to the introduced white pine blister rust and will continue to be at risk throughout their respective ranges. The use of prescribed fire will facilitate the reduction of competing species (e.g. white fir) and create openings for sugar pine regeneration.

Shasta Red Fir Forests

Environmental Characteristics

Shasta red fir forests occupy the mid-flanks of Mt. Mazama at elevations between 5300 and 6600 ft above MSL. These communities are dominated by red fir with varying amounts of lodgepole pine, with lesser amounts of western white pine and white fir. Shasta red fir is a hybrid between noble fir *(Abies procera)* and California red fir *(Abies magnifica).* Their ranges overlap between Mt. Shasta, California and the Calapooya divide, north of Crater Lake, Oregon.

The Fire Regime

Red fir ecosystems have a classic moderate-severity fire regime. Red fir, when mature, is relatively fire tolerant. Average fire frequencies of 40-70 years combined with a range of fire intensities leads to a patchy mosaic of different age structures across landscapes of this type (Chappell and Agee 1996). At Crater Lake, typical large fire sizes in red fir forests have been about 500 acres. Small patches of low, moderate, and high-severity fire typically occur, with high-severity fire often covering less than one-third of the landscape. Old-growth stands of red fir are least likely to burn with high severity.

Stand Development Patterns

Stand development patterns in red fir forests are complex because red fir is not only fire-tolerant but is also shade-tolerant. It does well with or without disturbance. Several stand development patterns are common. If no lodgepole pine is present when a stand replacement fire occurs, shrub dominance will occur (ceanothus and manzanita) with later, slow recolonization by red fir. In moderate-severity patches, some red fir dominants remain and provide seed for colonization by red fir, which does well in these partially shaded conditions, creating a multiple age class stand. In low-severity patches, understory trees are killed but little growing space is opened for regeneration, and red fir reproduces slowly in small gaps where sun flecks occur.

Management Implications

Although there has probably been some increase in older patches, red fir stands have not been affected substantially by fire exclusion over the past 80-100 years. Fire effects from natural fires appear to be within the natural range of variability.

Mountain Hemlock Forests

Environmental Characteristics

Mountain hemlock stands are the highest elevation continuous forests at the park occurring at elevations between 5600 and 7900 ft above MSL. These forests are characterized by the presence of mountain hemlock as the major climax dominant.

Discontinuous stands are transitional to alpine meadows or to a whitebark pine zone at CRLA and occur in a mosaic pattern. Lodgepole pine is a common early seral species in this forest community, indicative of past disturbance by fire. Other occasional ecotonal associates include whitebark pine, Shasta red fir, and subalpine fir. The forests in the subalpine zone have a prolonged winter snowpack and a short growing season that significantly affects both the fire regime and post-fire successional patterns.

The Fire Regime

Mountain hemlock is not well adapted to fire. Its life history strategy towards fire is that of an avoider. Its relatively thick bark provides some protection at maturity, but low-hanging branches, highly flammable foliage and a tendency to grow in dense groups make it very susceptible to fire injury. Mountain hemlock sites are typically moist with annual average precipitation greater than 50 inches, making the probability of fire occurrence low. South-facing slopes are more likely to burn than north-facing slopes.

Fires in these cool wet forests generally occur as infrequent crown fires. When fires do occur, they are often severe stand-replacing events, with the majority of historic fire events resulting in burned patches less than 1200 acres each. Fire return intervals for mountain hemlock forests of the Oregon Cascades are not well documented. One study by Dickman and Cook (1989) suggest intervals greater than 500 years, while Atzet (1996) reports disturbance intervals of 115 years for mountain hemlock forests in the Klamath Mountain Province of southwest Oregon.

Stand Development Patterns

Fire is the primary large-scale disturbance agent in this forest type. Most other disturbances operate at the scale of individual tree gaps or small patches (e.g. insects, disease, and wind). Mountain hemlock is not adapted to grow well in open, recently burned environments. Young seedlings grow best in partial shade and early development is often slow. Mountain hemlock is very shade tolerant and often succeeds lodgepole pine when these species pioneer on drier sites. Where lodgepole pine is present, an even-aged stand of lodgepole pine will emerge from a fire disturbance, but where it is absent, the site may revert to shrubby, non-forest vegetation for more than a century after burning. Where whitebark pine is present, fires are often of moderate-severity, killing some pine but leaving other clumps intact, providing a source of seed for regeneration.

Management Implications

Fire injury makes mountain hemlock very susceptible to insects and disease. Mountain hemlock is particularly susceptible to laminated root rot *(Phellinus weirii).* This fungus spreads from infection centers along tree roots, killing infected

trees in an expanding radial pattern. Active infection centers within mountain hemlock stands have been measured as large as 100 acres. These root rot pockets are characterized by numerous snags in various stages of decay with older-aged snags and downed woody debris at the center of spread.

Fire may play an important role in breaking up *Phellinus* centers, by creating conditions more suitable for the *Phellinus*-resistant lodgepole pine. The pine may then competitively exclude mountain hemlock from the site until the *Phellinus* inoculum is present only in large isolated stumps, remnants of the former stand that have not fully decayed. Dickman and Cook (1989) suggest three possible interactions between fire and fungus that depend on fire-return interval: 1) a fire-return interval of 200 years or less, resulting in dominance by lodgepole pine and disfavoring *Phellinus*; 2) a fire-return interval of 600 years, which may foster mountain hemlock stands infected with *Phellinus*, mixed with other stands dominated by lodgepole pine, much like the present landscape; and 3) absence of fire as a disturbance agent which disfavors lodgepole pine and increases the role of *Phellinus*, creating a forest landscape much different than the one seen today.

Although infrequent and unpredictable, fires have been an important force in shaping mountain hemlock forests especially where they intermingle with subalpine meadows and whitebark pine woodlands. A wildland fire use strategy may offer the most in meeting resource management objectives in this forest type, presuming that an assessment of the expected fire behavior and associated values at risk are conducted for each fire event.

Lodgepole Pine Forests

Environmental Characteristics

The pure lodgepole pine forests that occur at the park coincide with infertile tephra deposits that occupy the broad pumice plateau of south-central Oregon. Topo-edaphic influences have resulted in areas with exceptionally low productivity, aggravated by continual cold air drainage resulting in forests with very open canopies and depauperate understories (Franklin and Dyrness 1988). These forests are identified by the exclusive presence of lodgepole pine in both the overstory and understory, and a paucity of understory shrubs and herbs. Examples of pure lodgepole pine communities in the park include the edge surrounding the Pumice Desert, Pumice Flat, and the Wheeler and Sand Creek drainages.

These lodgepole communities are surrounded by others that also have lodgepole pine, such as the red fir and mountain hemlock communities. The occurrence of lodgepole pine in these communities is a good marker of past high-severity disturbances, which occurs infrequently (more than 100 years between fires) and usually replaces an entire stand with a high intensity fire. These events allow lodgepole pine to dominate

sites otherwise dominated by other species. In the pure lodgepole pine forest, lodgepole pine is the dominant tree species, regardless of disturbance history.

The Fire Regime

Pure lodgepole pine forests are more fuel-limited than other forested communities in the park, due to low wood productivity and leaf area (Gara et. al. 1985). As a result, these forests have a mixed-severity fire regime with the fire behavior more closely linked to coarse fuel dynamics than to fine fuel dynamics. The magnitude of natural fires ranges from slowly burning logs across the forest floor to crown fires. Fires of low to moderate severity encourage secondary disturbance by insects and pathogens. Most lodgepole stands at the park have a patchy history of fire occurrence and spread. The average fire-free interval is 60 - 80 years, with areas bordering higher productivity forest on the low end of the range (Ziegler 1978). Strong winds are likely associated with the rare stand replacement fire in the lodgepole pine type.

Stand Development Patterns

Lodgepole pine trees are usually killed by fire because of their shallow root system and thin bark are not adapted to intense fires. Fire prepares an ideal seedbed and lodgepole pine functions as an early post-fire colonizer. The variety of lodgepole pine in this area has non-serotinous cones *(Pinus contorta var. murrayana)*. Stands reestablish after a disturbance from off-site sources delivered by wind-dispersed seed. Most stands surveyed in the park have multiple age classes resulting from mortality due to either mountain pine beetle (*Dendroctonus ponderosae*) or past fire events. Stems killed by either agent will fall within 5-10 years, and over a 40-50 year period they maintain hard sapwood but decayed heartwood, an ideal vector for fire spread. In the meantime, any clump of trees killed is colonized by a new generation of lodgepole pine, and this process, repeated over time, results in multiple age classes of the pines. Understory vegetation development is never substantial in these forests. Moisture competition restricts tree regeneration to gaps created after a tree falls and few herbs or shrubs tolerate these low productivity sites.

Management Implications

Pure lodgepole forests rarely grow for a century without a major disturbance by fire or insects. Within the park, both log-to-log and crown fire activity has been observed (Agee 1981). The low productivity of these forests has limited the amount of fuel buildup and other changes due to past fire exclusion policies. These stands should be expected under most conditions to have slow-moving fires burning along logs created decades earlier by a past fire or insect disturbance. Fires moving into such stands from adjacent forest types will normally be extinguished on their own as fuels dissipate in the interior of the stand. Under most conditions, these forests will act as

natural fuel breaks. However, the occurrence of past crown fires in this forest type (e.g. Prophecy Fire 1988), suggests that climax lodgepole stands cannot be considered fire barriers under all fire weather conditions.

A policy of wildland fire use may be implemented in this forest type to achieve natural values with the knowledge that human impact on such stands appears to have been minimal over the past 100 years. Under most conditions, these forests will act as natural fuel breaks, where fire suppression, if desired, will be relatively easy. Thinning treatments will enhance the effectiveness of these natural fuel breaks in areas where there are values to be protected.

Whitebark Pine Forests

Environmental Characteristics

Whitebark pine forests occur on several thousand acres in Crater Lake National Park and represent the most expansive and diverse aggregation in southern Oregon. The majority of whitebark pine stands occur around the caldera rim above Crater Lake which is the most heavily visited portion of the park. The distribution of whitebark pine is strongly influenced by the dispersal of seeds by Clark's nutcracker. Whitebark pine occurs on dry, rocky, subalpine slopes and exposed ridges.

Whitebark pine forests east of the Cascades Crest support diverse communities with lodgepole pine, Shasta red fir, and mountain hemlock often separately co-dominating stands. Stands are generally open with an undergrowth of low shrubs, forbs and grasses. Sites where whitebark pine occurs as climax are drier than those where it is seral, such as the flanks of Mt. Scott where pure stands of whitebark pine have been observed (Murray and Rasmussen, 2003).

The Fire Regime

Moderately fire resistant, whitebark pine is favored by both creeping or intense surface and ground fires. Both types of fires kill most shade-tolerant and fire-sensitive species associated with whitebark pine such as mountain hemlock and subalpine fir. Hot surface fires that heat the cambium cause fire injury or death to these thin-barked trees. Fires of low to moderate severity can climb into trees if fuel ladders and downfall are present, thus increasing the potential of torching. The vulnerability of whitebark pine to fire is reduced by the open structure of its stands and the dry, exposed habitats with meager undergrowth in which it grows.

Estimates of mean fire return intervals range from 29 to 144 years for mixed severity fires studied in the northern Rocky Mountain province (Morgan and Murray 2001). Fire history studies for the Cascades Mountain province are lacking. Many fires occurring where whitebark pines grow are ignited by lightning and do not spread very rapidly or cause severe tree injury.

In the park, most fires occurring in whitebark pine forests appear to be small and many burn only one clump (Agee 1993). Fire may stimulate the growth of currants and gooseberries, the alternate hosts for white pine blister rust, and thus the spread of the rust into whitebark pine trees.

A multi-year fire history study is underway at Crater Lake, Mt. Rainier and North Cascades National Parks to determine the fire regimes of whitebark pine in the Cascades Mountain province (Murray, pers. comm.).

Stand Development Patterns

Whitebark pine exhibits high frost resistance and low shade tolerance. Fires create openings conducive to the planting of seeds by Clark's nutcrackers *(Nucifraga Columbiana)* for seedling establishment. On moister sites however, mountain hemlock and subalpine fir may out-compete whitebark pine for light and nutrient resources and limit whitebark pine regeneration.

More information is needed on fire history and the resulting development of Cascadian whitebark pine communities in Oregon and Washington.

Management Implications

Whitebark pine forests in the park, and elsewhere in the Cascades, are dying from the introduced fungus (*Cronartium rubicola*), which causes blister rust. Blister rust has been documented in the park as early as 1935. Current estimates suggest that the disease results in an overall annual decline of 0.4% for mature whitebark pine trees within the park. At that rate of decline, it is anticipated that there would be an additional 20% decline in the current whitebark pine population within 50 years (Murray and Rasmussen, 2003).

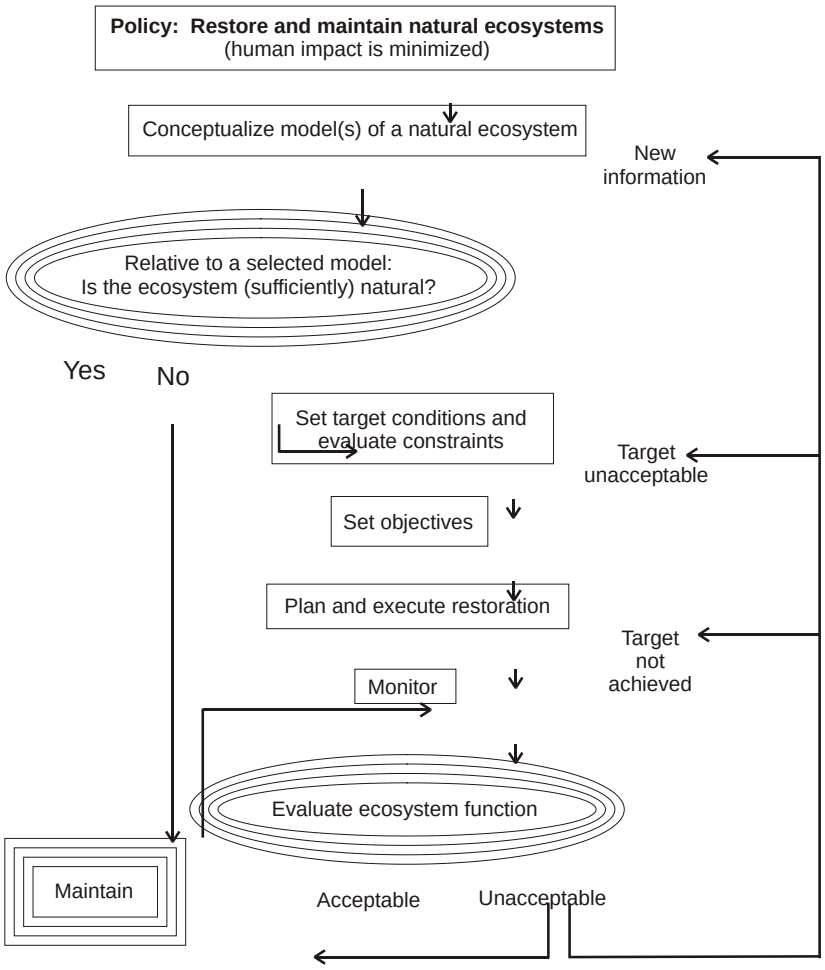
Fire exclusion may have also impacted the health and vitality of the whitebark pine stands in the park. Fire exclusion leads to less opportunity for regeneration coupled with successional advancement of competing trees. Fire exclusion has resulted in a much smaller acreage being exposed to moderate and high severity wildfires, where new opportunities for whitebark pine regeneration could occur. If misapplied, fire could damage existing stands of whitebark pine that provide future sources of seed including blister rust-resistant strains. Additional research is needed on the fire history of Cascadian whitebark pine before park managers consider using prescribed fire as a tool to help restore declining whitebark pine communities.

MANAGEMENT OBJECTIVES AND TARGET CONDITIONS

CRLA park managers use an adaptive feedback process to guide and evaluate the fire and fuels management program as shown in Figure 3-1. This process begins

with policy direction and incorporates the most current information to make knowledge-based management decisions about how best to restore and maintain fire-related natural resource components and processes. These decisions are periodically evaluated against monitoring results, new research and other relevant information. Recommendations and changes are integrated into the planning and execution phases to help guide the management program.

Figure 3-1. Model of adaptive feedback process (Keeley and Stephenson 2000)



Fire management program goals and objectives are described in Chapter 3 of the Fire Management Plan. Cumulatively, these goals and objectives emphasize the desire to understand the effects of fire management actions by monitoring and evaluating the effects of fire and fuels management activities on park natural and cultural resources. To accomplish this task, specific, measurable benchmarks are needed as a point of reference to determine if the resource conditions resulting from fire management actions are meeting park goals for restoring and maintaining natural conditions. To answer the question, "What would the resource look like if we achieve our goals?" target conditions are needed to describe resource goals more

specifically and to serve as a standard by which to measure fire management program success.

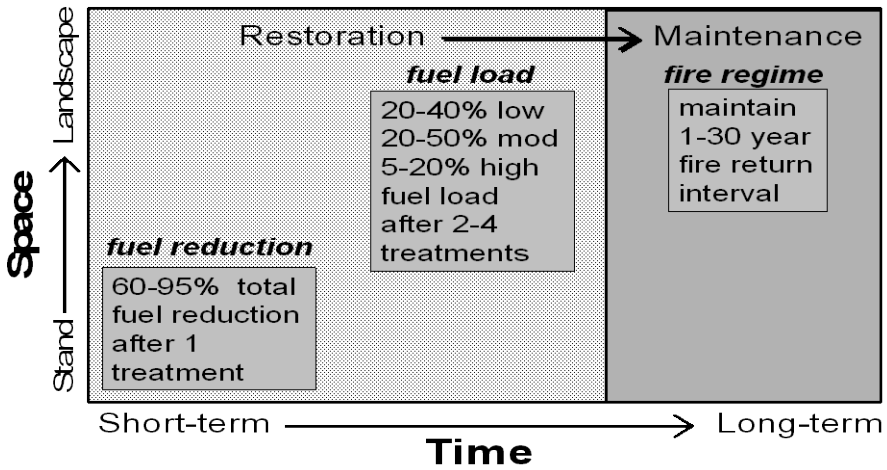
Information used to develop the target conditions includes research data where available, historic photos and written documents, and expert opinion. Target conditions must be periodically evaluated to determine whether they are still realistic and wanted in light of a changing environment. For example, target conditions may be based on our knowledge of past long-term climate conditions; however, future climate changes may preclude achieving these targets. The target conditions will be further refined as new research provides information that increases our knowledge of past, current, and future conditions.

To describe explicitly how to arrive at the target conditions, specific management objectives are developed by adding a method and timeframe to the target conditions. For example, if the target condition is a stand density of 20-250 trees/ha, then the management objective would be to use prescribed fire to reduce stand density to 20-250 trees/ha by 2 years following treatment. Target conditions and specific treatment objectives are described below.

In areas of the parks currently in the restoration phase of the program, structural targets and objectives are used to assess program success. Once these structural conditions are restored, then the area moves into the maintenance phase of the program and process targets are used to evaluate the program goal achievement. Figure 3-2 illustrates the changing nature of targets/objectives over time from the restoration phase to the maintenance phase using an example of fuel load objectives.

Like target conditions, management objectives must be evaluated on a regular basis. As the monitoring results become available, they are used to determine if management objectives are achieved and to determine if management activities need to be adjusted. Also at this time, an assessment of whether the management objectives are still desired is warranted in light of ongoing monitoring results and any new information made available. In this adaptive way, we can be sure that the monitoring program will adequately assess the success of the fire management program. Any changes or additions will be included in future revisions of this fire monitoring plan.

Figure 3-2. How Management Objectives Change Over Time and Space



Resource Management Objectives

The 1999 Resource Management Plan identifies at least three goals that describe in general terms, the desired future conditions for natural resources within Crater Lake National Park. A program of fire management is necessary for achieving certain aspects of these goals:

- *Restore and maintain the natural terrestrial, aquatic and atmospheric ecosystem conditions and processes to the degree that is physically possible and politically practical so they may operate unimpaired from human influences.*

- *Maintain or restore indigenous flora, fauna, and natural communities to the extent possible, to achieve species diversity and community structure equivalent to pre-Columbian times or post-Columbian conditions which would have been created by natural events and processes.*

- *Protect rare species by measures aimed at preserving habitat and preventing extirpation but which minimize adverse influences on other indigenous species.*

These broad goals were recombined into two fire-specific resource management goals that focus on forest ecosystem structure and processes:

- *Across the park's forest-dominated landscapes, maintain a proportion of low and mixed-severity burns that represent historical fire regimes.*

- *Across the park's forest-dominated landscapes, maintain a proportion of forest structure and composition that represents historical landscape mosaics.*

An assessment of historical fire regime characteristics and landscape mosaics was undertaken to develop a set of reference conditions for the park. Information was collected from various sources including: (Agee 1998, Agee 2003, Agee and Huff 1986, Agee and Huff 2000, Atzet 1996, Chappell 1991, Dickman and Cook 1989, Fiedler 1996, McNeil 1975, Morgan and Murray 2001, NPS 2001a, Stuart 1983, Thomas 1982, West 1969, and Ziegler 1978). The results of the assessment are summarized in tables 3-1 and 3-2. From this assessment, desired target conditions (see section 3.2) and their associated treatment objectives (see section 3.3) were developed, consistent with the two fire-specific resource management goals stated above.

Table 3-1 Process-oriented historical fire regime characteristics for CRLA.

Forest Type Name	Fire Regime/ Characteristics BA = basal area of trees	Fire Severity (% of landscape effected)	Mean Fire Return Interval	Fire Intensity BTU/sq ft./sec	Seasonality (% of area burned)
Ponderosa Pine	Low severity Frequent surface fires < 20 % BA removed	Low: 60-95% Mod: 5-35% High: 5-10%	9 - 15 years	Unknown	May- Jun: 0-30% Jul-Sep: 50-70% Oct-Nov: 0-30%
White Fir	Low to Moderate severity Infrequent surface fires < 20% BA removed	Low: 60-90% Mod: 5-35% High: 5-10%	9 - 42 years	20 – 1000 range x = 100	May- Jun: 0-30% Jul-Sep: 50-70% Oct-Nov: 0-30%
Shasta Red Fir	Mixed severity Mix of crown/surface fires 20 – 70% BA removed	Low: 30-60% Mod: 20-40% High: 0-15%	40 - 65 years	1 – 120 range x = 25	May-Jun: 0-20% Jul-Sep: 70-90% Oct-Nov: 0-20%
Mtn. Hemlock	High Stand replacing/crown fires > 70% BA removed	Low: 0-10% Mod: 10-40% High: 60-90%	115+ years	Unknown	May-Jun: 0-5% Jul-Sep: 90-99% Oct-Nov: 0-5%
Lodgepole Pine	Mixed severity Mix of surface/crown fires 20 - 70% BA removed	Low: 0-10% Mod: 10-40% High: 60-90%	60 - 80 years	1 – 40 range x = 10	May-Jun: 0-5% Jul-Sep: 90-99% Oct-Nov: 0-5%
Whitebark Pine	Mixed severity Mix of crown/surface fires 20 – 70% BA removed	Low: 60-90% Mod: 5-20% High: 5-20%	30-300 years	Unknown	May-Jun: 0-5% Jul-Sep: 90-99% Oct-Nov: 0-5%

Table 3-2 Structure-oriented historical landscape mosaics for CRLA.

Forest Type Name	Park Elevation Zones	Disturbance Patch Sizes	Landscape Patch Distribution	Landscape Patch Composition	Stand Basal Area
Ponderosa Pine	1450-2000 m 4800-6600 ft	0.02-0.35 ha (0.49-0.86 ac)	> 75%: 0.1-1 ha 5-24%: 1-10 ha < 1%: 10-100 ha	5-50% pine 0-70% shrub 0-25% grass	40-80 sq. ft/acre
White Fir	1400-1600 m 4600-5300 ft	0.03-0.16 ha (0.07-0.40 ac)	> 75%: 0.1-1 ha 5-24%: 1-10 ha < 1%: 10-100 ha	40-80% fir 15-40% pine 0-20% other	50-200 sq. ft/acre
Shasta Red Fir	1600-2000 m 5300-6600 ft	0.11-31 ha (0.27-77 ac)	70-95%: 0.1-4 ha 5-30%: 5-100 ha < 1%: > 100 ha	30-70% fir 0-20% pine 0-20% other	50-200 sq. ft /acre
Mtn. Hemlock	1700-2400 m 5600-7900 ft	0.1-3,200 ha (0.25-7,900 ac)	80-99%: 0.1-100 ha 1-20%: 100 -2000 ha < 1%: > 2000 ha	50-60%hemlock 0-40% fir 0-10% pine	Unknown

Lodgepole Pine	1200-2000 m 4000-6600 ft	0.1-10,000 ha (0.25-24,000 ac)	80-99%: 0.1-100 ha 1-20%: 100 -2000 ha < 1%: > 2000 ha	95-99% pine 0-5% fir	Unknown
Whitebark Pine	>2000 m >6600 ft	0.1-300 ha (0.25-740 ac)	80-99%: 0.1-100 ha 1-20%: 100 -2000 ha < 1%: > 2000 ha	40-99% pine 0-50% hemlock 0-10% fir	Unknown

Table 3-3 shows the Fire Regime Class that has been assigned to each of the Forest Types within the park, based on their historical fire regime characteristics. This information provides a link to assessing the Fire Regime Condition Class (FRCC).

Table 3-3 Crosswalk between CRLA Forest Types and Fire Regime Classes used by the Interagency FRCC Guidebook.

Forest Type	Mean Fire Return Interval	Fire Regime Characteristics	Fire Regime Class	Fire Frequency & Severity Class
	(consolidated from fire ecology literature)		(from Hann & Bunnell 2001)	
Ponderosa pine	10 - 15 years	Frequent surface fires Low severity	I	0-35 years frequent low severity
White fir	9 - 42 years	Frequent surface fires Low/ Moderate severity	I	0-35 years frequent low severity
Shasta red fir	40 - 65 years	Mix of crown/ surface fires Mixed severity	III	35-100 years less frequent mixed severity
Mountain hemlock	30-115 years	Mix of crown/ surface fires High severity	IV	35-100 years less frequent stand replacement
Lodgepole pine	60 - 80 years	Mix of crown/ surface fires Mixed severity	IV	35-100 years less frequent stand replacement
Whitebark pine	29-144 years	Mix of crown/ surface fires Mixed severity	III	35-100 years less frequent mixed

Target Conditions

Table 3-4 summarizes the set of target conditions that will guide management actions within each forest type. These target conditions are not equivalent to the reference conditions. They have been formulated from a combination of reference condition information and expert opinion. The desired target conditions are not meant to replicate the reference conditions, rather they provide an approximation for management that is within the range of natural variability for the park's ecosystems. The target conditions vary depending on the current condition of a site and/ or state of the ecosystem (restoration versus maintenance phase). Some target conditions are undefined at present. As new information becomes available, it will be incorporated into subsequent updates to this plan.

It should be noted that a particular site may need one to many restoration treatments before the conditions shift and the site is ready for maintenance treatments. The determination that conditions at a particular site have shifted will be based on evaluations of the monitoring data and other relevant information.

Table 3-4. Target Conditions by Forest Type (Restoration and Maintenance phases).

Forest Type Name (Monitoring Type Code) ↓	Target Condition Categories			
	Restoration Phase		Maintenance Phase	
	Fuel Reduction	Stand Density by diameter class and (species composition)	Fuel Load Distribution (% of landscape)	Gap/Patch Size Distribution (% of landscape)
Ponderosa Pine (PIPO)	Reduce 60-90% of existing dead & down fuels	20-50 TPA > 12" dbh < 400 TPA 2-6" dbh (5-50% pine,0-70% shrub, 0-25% grass/sedge)	20-40% 5-30 tons/acre 20-50% 30-60 tons/acre 5-20% >60 tons/acre	75-95%: 0.1-1ha 5-25%: 1-10 ha < 1%: 10-100 ha
White Fir (ABCO)	Reduce 60-90% of existing dead & down fuels	30-80 TPA > 12" dbh < 600 TPA 2-6" dbh (40-80% fir,15-40% pine, 0-20% other)	20-40% 5-30 tons/acre 20-50% 30-60 tons/acre 5-20% >60 tons/acre	75-95%: 0.1-1ha 5-25%: 1-10 ha < 1%: 10-100 ha
Shasta Red Fir (ABMAS)	Reduce 60-90% of existing dead & down fuels	30-80 TPA > 12" dbh < 600 TPA 2-6" dbh (30-70% fir 0-20% pine 0-20% other)	1-25% 5-30 tons/acre 30-70% 30-60 tons/acre 5-20% >60 tons/acre	70-95%: 0.1-4 ha 5-30%: 5-10 ha < 1%: 10 -100 ha
Mtn. Hemlock (TSME)	Reduce 35-55% of existing dead & down fuels	Unknown density (15-60% hemlock, 0-40% fir, 0-10% pine)	Unknown	80-99%: 0.1-100 ha 1-20%: 100-2000 ha < 1%: > 2000 ha
Lodgepole Pine (PICO)	Reduce 35-55% of existing dead & down fuels	Unknown density (80-90% pine, 0-10% fir, 0-10% hemlock)	Unknown	80-99%: 0.1-100 ha 1-20%: 100-2000 ha < 1%: > 2000 ha
Whitebark Pine (PIAL)	Reduce 35-55% of existing dead & down fuels	Unknown density (40-90% pine, 0-50% hemlock, 0-10% fir)	Unknown	80-99%: 1-4 ha 1-20%: 5-300 ha < 1%: > 300 ha

Treatment Objectives

The following SMART (specific, measurable, achievable, relevant, and time-bound) objectives were developed from the park-wide resource management goals and

associated target conditions defined in the previous sections. Treatment objectives have been developed for both restoration and maintenance phases.

Treatment objectives should guide individual treatment projects and be placed into individual treatment plans (e.g. prescribed burns, manual thinning, pile burning) for use in pre- and post-treatment evaluations. Because individual project areas may encompass multiple monitoring types, a given treatment plan may have multiple or varying treatment objectives.

Pre-treatment assessments are to be conducted to determine which phase a particular site falls under. NPS policy endorses the use of the interagency Fire Regime Condition Class (FRCC) methodology to perform an assessment of current conditions. See Hann et. al. (2003).

Ponderosa Pine Forests

Restoration Phase:

- Increase the occurrence of low and mixed-severity burns to a MFRI of 9-15 years.
- Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 60-90%, immediately post-treatment.
- Reduce live tree densities to 20-50 trees/ac > 12 in. dbh (30 cm dbh) within 10 years post-treatment.
- Reduce live tree densities to < 400 trees/ac 2-6 in. dbh (5-15 cm dbh) within 10 years post-treatment.
- Constraint: Limit fire-induced mortality of mature *Pinus* > 18 in. (45 cm dbh) to less than 25% within 2 years post-treatment.

Maintenance Phase:

- Maintain the occurrence of low and mixed-severity burns at a MFRI of 9-15 years.
- Maintain total surface fuel amounts to a range of 30-60 tons/ acre over 20-50% of the treated area, immediately post-treatment.
- Maintain live tree densities at 20-50 trees/ac > 12 in. dbh (30 cm dbh) within 5 years post-treatment.
- Maintain a stand composition of at least 50% *Pinus spp.* and 25% grass/sedge *spp.* within 5 years post-treatment.
- Constraint: Limit fire-induced mortality of mature *Pinus* > 12 in. (30 cm dbh) to less than 20% within 2 years post-treatment.
- Constraint: Limit the total area within the treated area to 20% where surface fuels exceed 60 tons/acre as measured immediately post-treatment.

White Fir Forests

Restoration Phase:

- Increase the occurrence of low and mixed-severity burns to a MFRI of 9-42 years.
- Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 60-90%, immediately post-treatment.
- Reduce live tree densities to 30-80 trees/ ac > 12 in. dbh (30 cm dbh) within 10 years post-treatment.
- Reduce live tree densities to < 600 trees/ ac 2-6 in. dbh (5-15 cm dbh) within 10 years post-treatment.
- Constraint: Limit fire-induced mortality of mature *Pinus* > 18 in. (45 cm dbh) to less than 25% within 2 years post-treatment.

Maintenance Phase:

- Maintain the occurrence of low and mixed-severity burns at a MFRI of 9-42 years.
- Maintain total surface fuel amounts to a range of 30-60 tons/ acre over 20-50% of the treated area, immediately post-treatment.
- Maintain live tree densities at 30-80 trees/ ac > 12 in. dbh (30 cm dbh) within 5 years post-treatment.
- Maintain a stand composition of at least 40% *Pinus spp.* within 5 years post-treatment.
- Constraint: Limit fire-induced mortality of mature *Pinus* > 12 in. (30 cm dbh) to less than 20% within 2 years post-treatment.
- Constraint: Limit the total area within the treated area to 20% where surface fuels exceed 60 tons/ acre as measured immediately post-treatment.

Shasta Red Fir Forests

Restoration Phase:

- Increase the occurrence of low and mixed-severity burns to a MFRI of 40-65 years.
- Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 60-90%, immediately post-treatment.

- Reduce live tree densities to 30-80 trees/ac > 12 in. dbh (30 cm dbh) within 5 years post-treatment.
- Reduce live tree densities to < 600 trees/ac 2-6 in. dbh (5-15 cm dbh) within 5 years post-treatment.

Maintenance Phase:

- Maintain the occurrence of low and mixed-severity burns at a MFRI of 40-65 years.
- Maintain total surface fuel amounts to a range of 30-60 tons/ acre over 30-70% of the treated area, immediately post-treatment.
- Maintain live tree densities at 30-80 trees/ac > 12 in. dbh (30 cm dbh) within 5 years post-treatment.
- Maintain a stand composition of at least 70% *Abies magnifica var. shastensis* within 5 years post-treatment.
- Constraint: Limit the total area within the treated area to 20% where surface fuels exceed 60 tons/acre as measured immediately post-treatment.

Mountain Hemlock Forests

Restoration Phase:

- Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 35-55%, immediately post-treatment.

Maintenance Phase:

- Maintain the occurrence of low and mixed-severity burns at a MFRI of 115+ years.
- Maintain a landscape pattern of disturbance patches that range in size from 0.25-250 acres (0.1-100 ha) over 80-90% of the area.
- Maintain a stand composition of 15-60% *Tsuga mertensiana* within 20 years post-treatment.

Lodgepole Pine Forests

Restoration Phase:

- Increase the occurrence of low and mixed-severity burns to a MFRI of 60-80 years.
- Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 35-55%, immediately post-treatment.

Maintenance Phase:

- Maintain the occurrence of low and mixed-severity burns at a MFRI of 60-80 years.
- Maintain a landscape pattern of disturbance patches that range in size from 0.25-250 acres (0.1-100 ha) over 80-90% of the area.
- Maintain a stand composition of at least 90% of *Pinus contorta* within 5 years post-treatment.

Whitebark Pine Forests

Restoration Phase:

- Increase the occurrence of low and mixed-severity burns to a MFRI of 30-180 years.
- Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 35-55%, immediately post-treatment.
- Constraint: Limit mature (cone-producing) whitebark pine mortality to less than 20% within 2 years post-treatment.

Maintenance Phase:

- Maintain the occurrence of low and mixed-severity burns at a MFRI of 30-180 years.
- Maintain a landscape pattern of disturbance patches that range in size from 0.25-250 acres (0.1-100 ha) over 80-90% of the area.
- Maintain a stand composition of at least 40% of *Pinus contorta* within 5 years post-treatment.
- Constraint: Limit mature (cone-producing) whitebark pine mortality to less than 20% within 2 years post-treatment.

Monitoring Objectives

Monitoring objectives differ from treatment objectives in that treatment objectives describe the target/threshold or change in the condition that is desired, while monitoring objectives describe how to monitor progress toward that target or change. Monitoring objectives contain explicit statements about the certainty of the results.

To determine the minimum sample sizes needed, the following objective variables were selected for each forest type. These objective variables are by definition, a key element of an ecosystem, sensitive to fire-induced change, and linked to the accomplishment of fire program objectives.

Initial minimum sample sizes will be calculated from the first 10 samples of each objective variable per monitoring type. Each forest type will have additional monitoring objectives (one for each treatment objective listed in section 3.3) but they will not be used in calculating minimum sample sizes.

Ponderosa Pine Series (PIPO monitoring type):

Restoration Phase:

Objective variable – total fuel load:

Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 60-90%, immediately post-treatment.

Monitoring objective:

We want to be 80% certain of detecting a 60% reduction in the mean fuel load immediately after treatment. We are willing to accept a 20% chance of saying that a 60% reduction took place when it did not.

Objective variable – mean number of live *Pinus spp.*

Limit fire-induced mortality of mature *Pinus* > 18 in. (45 cm dbh) to less than 25% within 2 years post-treatment.

Monitoring objective:

We want to be 80% certain of detecting a 25% decrease in the number of live overstory ponderosa pine trees (> 45 cm dbh) within 2 years after treatment. We are willing to accept a 20% chance of saying that a 25% decrease took place, when it did not.

Maintenance Phase:

Objective variable - total fuel load:

Maintain total surface fuel amounts to a range of 30-60 tons/ acre over 20-50% of the treated area, immediately after treatment.

Monitoring objective:

We want to be 80% confident that the sample mean of total surface fuel loads is within 25% of a true mean of 30-60 tons/ acre, when assessed immediately after treatment.

Objective variable - live tree density:

Maintain live tree densities at 20-50 trees/ ac > 12 in. dbh within 5 years post-treatment.

Monitoring objective:

We want to be 80% confident that the sample mean of overstory tree density (dbh > 30 cm) is within 25% of a true mean of 50-125 trees/ ha, when assessed 5 years post-treatment.

White Fir Series (ABCO monitoring type):

Restoration Phase:

Objective variable – total fuel load:

Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 60-90%, immediately post-treatment.

Monitoring objective:

We want to be 80% certain of detecting a 60% reduction in the mean fuel load immediately after treatment. We are willing to accept a 20% chance of saying that a 60% reduction took place when it did not.

Objective variable – mean number of live *Pinus spp.*

Limit fire-induced mortality of mature *Pinus* > 18 in. (45 cm dbh) to less than 25% within 2 years post-treatment.

Monitoring objective:

We want to be 80% certain of detecting a 25% decrease in the number of live overstory ponderosa pine trees (> 45 cm dbh) within 2 years after treatment. We are willing to accept a 20% chance of saying that a 25% decrease took place, when it did not.

Maintenance Phase:

Objective variable - total fuel load:

Maintain total surface fuel amounts to a range of 30-60 tons/ acre over 20-50% of the treated area, immediately after treatment.

Monitoring objective:

We want to be 80% confident that the sample mean of total surface fuel loads is within 25% of a true mean of 30-60 tons/ acre, when assessed immediately after treatment.

Objective variable - live tree density:

Maintain live tree densities at 20-50 trees/ ac > 12 in. dbh within 5 years post-treatment.

Monitoring objective:

We want to be 80% confident that the sample mean of overstory tree density (dbh > 30 cm) is within 25% of a true mean of 50-125 trees/ ha, when assessed 5 years post-treatment.

Shasta Red Fir Series (ABMAS monitoring type):

Restoration Phase:

Objective variable – total fuel load:

Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 60-90%, immediately post-treatment.

Monitoring objective:

We want to be 80% certain of detecting a 60% reduction in the mean fuel load immediately after treatment. We are willing to accept a 20% chance of saying that a 60% reduction took place when it did not.

Maintenance Phase:

Objective variable - live tree density:

Maintain live tree densities at 30-80 trees/ac > 12 in. dbh within 5 years post-treatment.

Monitoring objective:

We want to be 80% confident that the sample mean of overstory tree density (dbh > 30 cm) is within 25% of a true mean of 75-198 trees/ha, when assessed 5 years post-treatment.

Mountain Hemlock Series (TSME monitoring type):

Restoration Phase:

Objective variable – total fuel load:

Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 35-55%, immediately post-treatment.

Monitoring objective:

We want to be 80% certain of detecting a 35% reduction in the mean fuel load immediately after treatment. We are willing to accept a 20% chance of saying that a 35% reduction took place when it did not.

Maintenance Phase:

Objective variable – percent species composition:

Maintain a stand composition of 15-60% *Tsuga mertensiana* within 20 years post-treatment.

Monitoring objective:

We want to be 80% confident that the sample mean of percent composition of *Tsuga mertensiana* is within 25% of a true mean of 15-60%, when assessed 20 years post-treatment.

Lodgepole Pine Series (PICO monitoring type):

Restoration Phase:

Objective variable – total fuel load:

Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 35-55%, immediately post-treatment.

Monitoring objective:

We want to be 80% certain of detecting a 35% reduction in the mean fuel load immediately after treatment. We are willing to accept a 20% chance of saying that a 35% reduction took place when it did not.

Maintenance Phase:

Objective variable – percent species composition:

Maintain a stand composition of at least 90% *Pinus contorta* within 5 years post-treatment.

Monitoring objective:

We want to be 80% confident that the sample mean of percent composition of *Pinus contorta* is within 25% of a true mean of 90%, when assessed 5 years post-treatment.

Whitebark Pine Forest Series (PIAL monitoring type):

Restoration Phase:

Objective variable – mean number of live *Pinus spp.*

Limit fire-induced mortality of mature (cone-producing) *Pinus albicaulis* to less than 20% within 2 years post-treatment.

Monitoring objective:

We want to be 90% certain of detecting a 20% decrease in the number of live cone-producing whitebark pine trees within 2 years after treatment. We are willing to accept a 10% chance of saying that a 20% decrease took place, when it did not.

Maintenance Phase:

Objective variable – percent species composition:
Maintain a stand composition of at least 40% *Pinus albicaulis* within 5 years post-treatment.

Monitoring objective:
We want to be 80% confident that the sample mean of percent composition of *Pinus albicaulis* is within 25% of a true mean of 40%, when assessed 5 years post-treatment.

MONITORING DESIGN

The NPS Fire Monitoring Handbook (NPS 2001) identifies four monitoring levels to guide fire effects monitoring efforts:

Table 4-1. NPS Fire Monitoring Handbook - Minimum Recommended Standards

Monitoring Level	Minimum Recommended Monitoring Standards
Level 1 – Reconnaissance	Fire cause, location, size, fuel and vegetation types, relative fire activity, potential for spread, current and forecasted weather, resource or safety threats and constraints, and smoke volume and movement.
Level 2 – Fire Conditions	Fire monitoring period, ambient conditions – topographic and fire weather, fuel model, fire characteristics, and smoke characteristics .
Level 3 – Immediate Post Fire Effects	Fuel reduction, burn severity, vegetative change or other objective dependent variables within 1 to 5 post-burn.

Level 4 – Long-term Change	Continued monitoring of Level 3 variables to measure trends and change over time.

Use of Monitoring Levels 1 and 2

The first two monitoring levels provide information to guide fire management strategies for both wildland and prescribed fires.

Monitoring Goal: *Environmental monitoring and fire observations provide the basic background information needed for decision-making before, during, and after fire events.*

Monitoring Objectives: *Collect information on environmental conditions (current and forecasted weather, and fuel models) and fire conditions (name, location, slope, aspect, spread, intensity, smoke transport and dispersal) for all wildland and prescribed fires. Use the information collected in a timely manner to adapt to changing conditions and successfully manage each fire.*

Use of Monitoring Levels 3 and 4

Monitoring levels 3 and 4 describe short- and long-term monitoring of the effects of fire on fuels and vegetation to guide wildland fire (prescribed and fire use) and can also be applied to non-fire fuel treatment activities such as thinning, shaded fuel-breaks and slash-busting.

Monitoring Goal: *Specific fire-related management objectives guide fire program activities to achieve desired resource target conditions. Vegetation and fuels monitoring provides information needed to determine whether the fuels- and vegetation-related management objectives are being met and to detect any unexpected consequences of prescribed burning or other treatments.*

Monitoring Objectives: *Collect information on fuels and vegetation to determine if specific fire- and fuels-related management objectives have been achieved. Use the information collected to determine if progress is being made towards the desired resource target conditions for each monitoring type as shown in Table 3-4 above.*

The following sections summarize when, where and how monitoring data will be collected as determined by the type of fire management strategy involved. Table 4-2 summarizes the level of monitoring recommended for each Fire Management

Strategy used at CRLA. These recommended levels of monitoring are consistent with the NPS Fire Monitoring Handbook (NPS 2001).

Refer to chapter 3 of the Fire Management Plan for more information about the implementation of these fire management strategies.

Table 4-2. Recommended Monitoring Levels by Fire Management Strategy.

Monitoring Level	Fire Management Strategy		
	Wildland Fire Use	Prescribed Fire	Non-Fire Treatment
Level 1 – Reconnaissance	Yes	Yes	Yes
Level 2 – Fire Conditions	Yes	Yes	No
Level 3 – Post Treatment Effects	Likely	Yes	Yes
Level 4 – Long-term Change	Likely	Yes	Likely

Wildland Fire Monitoring

Field Measurements

The following information will be collected for all wildland fires regardless of management strategy: fire name, location, cause, current size, air temperature, relative humidity, wind speed, wind direction, percent slope, aspect, representative Fire Behavior Prediction System (FBPS) fuel model(s) and description, current fire activity (smoldering, creeping, running, torching), rate of spread, direction of spread, flame length, perimeter and area growth, and smoke transport and dispersal.

All fires managed for resource benefits will have a Wildland Fire Implementation Plan (WFIP) prepared. In addition to the data listed above, the following information will be collected for fires managed for resource benefits at the WFIP stage 2 and 3 when qualified fire effects monitors (FEMOs) are available: canopy cover, tree inventory (seedling/sapling/overstory), shrub inventory, non-native plant frequency, dead and down fuels inventory, and photo record.

Timing of Monitoring

Weather conditions for all wildland fires will be monitored regularly from the time of discovery/ignition and throughout the duration of the fire. The monitoring frequency will be specified in the WFIP.

Fires managed for resource benefits at the WFIP Stage 3 will be monitored with permanent sampling plots placed in a safe location in relation to the approaching flame front for pre-burn data. Post-burn data will be collected within one-year post-burn as a minimum; and there after as needed.

Monitoring Site Locations

On-site environmental, weather and fire conditions for all wildland fires will be monitored as indicated in the WFIP.

Vegetation and fuels data will be sampled at a density determined by the Fire Ecologist at the time of the incident, depending on current and predicted fire activity and vegetation/fuel types.

All plot locations will be located using a handheld GPS. In addition, accurate documentation of plot locations for ease of relocation will be maintained by the Fire Ecology Program office.

Sampling Design

Sampling unit shapes and sizes are described in the Rapid Assessment Protocols (RAP) handbook (See Monitoring Plan Appendix A-2). A combination of variable and fixed plots, and planar transects are specified for vegetation and fuels monitoring.

Intended Data Analysis Approach

The following data summaries will be compiled when fires are managed for resource benefit and the WFIP exceeds stage 2: Tree density - both grouped by species or dbh grouping, or crown code, live vs. dead; tree height and height to live crown will be used to calculate percent crown; percent canopy cover; percent shrub cover by species, percent live versus dead for shrubs as a group and by species, average height by shrub group and species; tons per acre by fuel class; percent frequency by herbaceous species, and by native and exotic, and rare vs. common.

Data Sheet Examples

See the vegetation/fuels RAP handbook in Appendix A-2.

Information Management

Data will be entered, checked for errors, and managed by the Fire Ecology Program staff and supervised by the Fire Ecologist. Original copies of all data will be kept by the Fire Ecology Program office and disseminated as requested. Individual fire monitoring reports will be provided to the park's Fire Management Office within 2-4 weeks of the fire being declared out, depending on the complexity of the event.

Responsible Party

The person in charge of the fire (duty officer, incident commander or fire use manager) is responsible for ensuring that the fire monitoring data is collected, transmitted, acted upon, and filed according to established protocols.

The Fire Ecologist is responsible for collecting, analyzing, and managing vegetation and fuels data collected on fires managed for resource benefits.

Management Implications of Monitoring Results

Monitoring results will be reviewed by the Fire Ecologist each winter. The Fire Ecologist in consultation with Crater Lake Fire Management and Natural Resource Management Staff will determine if the results of previous burns are acceptable. Acceptable results include meeting the monitoring objectives stated above.

If monitoring results show deviations from desired vegetation conditions, or if resource needs change, the group will determine changes necessary for future activities.

Funding

FIREPRO funding will be used for all monitoring activities, and the appropriate project account will be charged according to the latest NPS Wildland Fire Management Budget – Business Rules.

Prescribed Fire Monitoring

Field Measurements

The following information will be collected for all prescribed fires: fire name, location, ignition type (aerial, hand), planned size, air temperature, relative humidity, wind speed, wind direction, percent slope, aspect, National Fire Danger Rating System (NFDRS) fuel model appropriate index (energy release component (ERC) or burning Index (BI)), representative Fire Behavior Prediction System (FBPS)

fuel model, rate of spread, direction of spread, flame length, perimeter and area growth, and smoke transport and dispersal.

In addition to the data listed above, the following information will be collected: live fuel moisture (if applicable), dead fuel moisture (1 hour, 10 hour, 100 hour, 1000 hour, litter, duff) as indicated in the site specific burn plan prescriptions, road or sensitive site visibility, smoke column mixing height, smoke transport and dispersal direction. Smoke particulate data may be collected at smoke sensitive locations as indicated in the site-specific burn plan.

To assess short- and long-term fire effects, the protocols found in the NPS Fire Monitoring Handbook (NPS 2001) will be used. A list of specific protocols will be maintained as part of the monitoring type descriptions (see Monitoring Plan Appendix A-1).

Timing of Monitoring

All prescribed fires will have the environmental conditions monitored at least two weeks in advance of the planned ignition date. On-site weather and fire conditions monitoring will occur throughout all active ignition phases of each fire on a schedule determined by the burn boss with consultation from the lead monitor (FEMO) assigned to the fire.

All prescribed fires will have short-term and long-term fuels and vegetation data collected prior to the ignition date. Timing of data collection will be coordinated through the Fire Ecologist. Generally, data will be collected at the peak of flowering season. Depending on elevation and aspect, this time may vary from early June through mid-August.

Monitoring Site Locations

On-site environmental conditions for all prescribed fires will be monitored at a representative location within the burn area, as determined by the burn boss with consultation from the lead monitor assigned to the burn.

Permanent sampling points for vegetation and fuels data collected as part of the short-term and long-term monitoring effort will be located using stratified random techniques coordinated by the Fire Ecologist.

No monitoring plots will be established on slopes greater than 50%, or on any areas identified by specialists as having significant resource value (e.g., cultural resource isolated finds).

All plot locations will be located using a handheld GPS. In addition, accurate documentation of plot locations for ease of relocation will be maintained by the Fire Ecology Program office.

Sampling Design

Sampling unit shapes and sizes will follow guidelines described in the NPS Fire Monitoring Handbook. Pilot sampling may be used during the establishment of plots in previously un-sampled monitoring types (all monitoring types except ponderosa pine and white fir).

A minimum sample size will be calculated when the initial 10 plots per monitoring type becomes available. Minimum sample size will be calculated for each objective variable in a monitoring type, based on pre-burn or pre-treatment data and then recalculated post-treatment to determine final sample sizes.

Intended Data Analysis Approach

Data will be analyzed by running minimum sample size equations after all plots have reached one-year post-burn and later if objectives so specify (e.g. after second treatment). Tests will be performed to determine if the data fit a normal distribution or if data are skewed. If normal, and if a change objective is involved, we will use a paired t-test to determine if objectives have been met. If the data is skewed we will consult a statistician for assistance.

Data Sheet Examples

See the NPS Fire Monitoring Handbook.

Information Management

Data will be entered, checked for errors, and managed by the Fire Ecology Program staff and supervised by the Fire Ecologist. Program status and results will be recorded in an annual report and issued in January for the previous fiscal year. Original copies of all data will be kept by the Fire Ecology Program office and disseminated as requested.

Responsible Party

The person in charge of the fire (burn boss) is responsible for ensuring that fire monitoring data during the burn is collected, transmitted, acted upon, and filed according to established protocols (e.g. a fire monitor's report is filed within 2 weeks post-burn).

The Fire Ecologist is responsible for collecting, analyzing, and managing all pre- and post-treatment vegetation and fuels data collected on prescribed fires.

The Lead Biological Technician (Fire Effects), in coordination with the Area Fire Ecologist is responsible for hiring and training seasonal fire effects monitoring staff, collecting field data, storing data electronically, performing data quality checks, and assisting with data analysis as needed.

Management Implications of Monitoring Results

Monitoring results will be reviewed by the Fire Ecologist each winter. The Fire Ecologist in consultation with Crater Lake Fire Management and Natural Resource Management Staff will determine if the results of previous burns are acceptable. Acceptable results include meeting the monitoring objectives stated above.

If monitoring results show deviations from desired vegetation conditions, or if resource needs change, the group will determine changes necessary for future activities.

Funding

FIREPRO funding will be used for all monitoring activities, and the appropriate project account will be charged according to the latest NPS Wildland Fire Management Budget – Business Rules.

Non-Fire Treatment Monitoring

Field Measurements

The following information will be collected for all non-fire treatments: project name, location, treatment objectives, project size, treatment prescription, and methods.

Additional data collection may include all or some of the following, based on treatment objectives and resource monitoring needs: canopy cover, tree inventory (seedling/sapling/overstory), shrub inventory, non-native plant frequency, dead and down fuels inventory, and photo record.

Timing of Monitoring

All non-fire treatments (thinning, shaded fuel breaks, etc.) will have short-term and long-term fuels and vegetation data collected prior to treatment. Timing of data collection will be coordinated through the Fire Ecologist. Generally, data will be collected at the peak of flowering season. Depending on elevation and aspect, this time may vary from early June through mid-September or as necessary for effective project completion.

Monitoring Site Locations

Permanent sampling points for vegetation and fuels data collected as part of the short-term and long-term monitoring effort will be located using stratified random techniques coordinated by the Fire Ecologist.

No monitoring plots will be established on slopes greater than 50%, or on any areas identified by specialists as having significant resource value (e.g., cultural resource isolated finds).

All plot locations will be located using a handheld GPS. In addition, accurate documentation of plot locations for ease of relocation will be maintained by the Fire Ecology Program office.

Sampling Design

Sampling unit shapes and sizes are described in the vegetation/ fuels Rapid Assessment Protocols (RAP) handbook (See Monitoring Plan Appendix A-2). A combination of variable and fixed plots, and planar transects are specified.

Intended Data Analysis Approach

The following data summaries will be compiled for data if collected: tree density - both grouped by species or dbh grouping, or crown code, live vs. dead; tree height and height to live crown will be used to calculate percent crown; percent canopy cover; percent shrub cover by species, percent live versus dead for shrubs as a group and by species, average height by shrub group and species; tons per acre by fuel class; percent frequency by herbaceous species, and by native and exotic, and rare vs. common.

Data Sheet Examples

See the vegetation/ fuels RAP handbook in Appendix A-2.

Information Management

Data will be entered, checked for errors, and managed by the Fire Ecology Program staff and supervised by the Fire Ecologist. Original copies of all data will be kept by the Fire Ecology Program office and disseminated as requested.

Responsible Party

The Fire Ecologist is responsible for collecting, analyzing, and managing vegetation and fuels data collected on non-fire treatment projects in coordination with the project manager (FMO, COR).

Management Implications of Monitoring Results

Monitoring results will be reviewed by the Fire Ecologist each winter. The Fire Ecologist in consultation with Crater Lake Fire Management and Natural Resource Management Staff will determine if the results of previous burns are acceptable. Acceptable results include meeting the monitoring objectives stated above.

If monitoring results show deviations from desired vegetation conditions, or if resource needs change, the group will determine changes necessary for future activities.

Funding

FIREPRO funding will be used for all monitoring activities, and the appropriate project account will be charged according to the latest NPS Wildland Fire Management Budget – Business Rules.

LITERATURE CITED

Agee, J.K. 2003. Monitoring post-fire tree mortality in mixed conifer forests of Crater Lake, Oregon, USA. Natural Areas Journal 23:114-120.

Agee, J.K. 1998. The landscape ecology of western forest fire regimes. Northwest Sci. 72:24-34.

Agee, J.K. 1993. Fire Ecology of Pacific Northwest Forests. Island Press, Washington, D.C. pp. 238-350.

Agee, J.K. 1981. Initial effects of prescribed fire in a climax *Pinus contorta* forest: Crater Lake National Park. Nat. Park Serv. Coop. Park Studies Unit Rep. CPSU/UW 81-4. University of Washington, Seattle. 12 pp.

Agee, J.K. and M.H. Huff. 2000. The role of prescribed fire in restoring ecosystem health and diversity in southwest Oregon: part 1 ecological conditions. Rep. to Pacific Northwest Research Station Director's Office, Northwest Forest Plan Issue.

Agee, J.K. and M.H. Huff. 1986. Structure and process goals for vegetation in wilderness areas. In Proceedings: National wilderness research conference: pp. 17-25. USDA For. Serv. Gen. Tech. Rep. INT-212.

Atzet, Thomas, 1996. Fire regimes and restoration needs in Southwest Oregon, In: Hardy, Colin; Arno, Stephen F., eds. The Use of Fire in Forest Restoration. Gen. Tech. Rep. INT-GTR-341. Ogden UT: US Department of Agriculture, Forest service, Intermountain Research Station, 86 p.

Atzet, T., D.E. White, L.A. McCrimmon, and others. 1996. Field guide to the forested plant associations of southwestern Oregon. USDA Forest Service, Pacific Northwest Region, Tech. Rep. R6-NR-ECOL-TP-17-96. Portland, OR.

Brown, J.K. and J.K. Smith. eds. 2000. Wildland fire in ecosystems: effects of fire on flora.

Gen. Tech. Rep. RMRS-GTR-42-vol 2. Ogden UT: US Department of Agriculture, Forest service, Rocky Mountain Research Station, 257 p.

Chappell, C.B. 1991. Fire ecology and seedling establishment in Shasta red fir *(Abies magnifica* var. *shastensis)* forests of Crater Lake National Park, Oregon. M.S. thesis, University of Washington, Seattle. 133 pp.

Chappell, C.B. and J.K. Agee. 1996. Fire severity and tree seedling establishment in *Abies magnifica* forests, southern Cascades, Oregon. Ecological Applications 6(2):628-640.

Dickman A. and S. Cook. 1989. Fire and fungus in a mountain hemlock forest. Canadian Journal of Botany 67:2005-16.

Fiedler, Carl E. 1996. Silvicultural applications: restoring ecological structure and process in ponderosa pine forests, In: Hardy, Colin.; Arno, Stephen F., eds. The Use of Fire in Forest Restoration. Gen. Tech. Rep. INT-GTR-341. Ogden UT: US Department of Agriculture, Forest service, Intermountain Research Station, 86 p.

Franklin J.F., and C.T. Dyrness. 1988. Natural Vegetation of Oregon and Washington. Oregon State University Press, Corvallis, OR. 452 p.

Gara, R.I., W.R. Littke, J.K. Agee, D.R. Geiszler, J.D. Stuart, and C.H. Driver. 1985. Influence of fires, fungi, and mountain pine beetles on development of a lodgepole pine forest in south-central Oregon. In Baumgartner, D.M. et al. (eds.), Lodgepole pine: The species and its management: pp 153-62. Pullman: Washington State University.

Hann, W.J. and D.L. Bunnell. 2001. Fire and management planning and implementation across multiple scales. Int. J. Wildland Fire (27 pgs).

Hann, Wendel, Havlina, Doug, Shlisky, Ayn, et al. 2003. Interagency and The Nature Conservancy fire regime condition class website .USDA Forest Service, US Department of the Interior, The Nature Conservancy, and Systems for Environmental Management *Accessed on February 25, 2004 at www.frcc.gov.*

Keeley, J. E. and N. L. Stephenson. 2000. Restoring natural fire regimes to the Sierra Nevada in an era of global change. Pages 255-265 in Cole, D. N., and S. F. McCool, compilers. Wilderness Science in a Time of Change conference – Volume 5: Wilderness ecosystems, threats, and management; 1999 May 23-27 Missoula MT. Proceedings RMRS-P-15-Vol-5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Kilgore, B.M. 1973. The ecological role of fire in Sierran conifer forests: its application to national park management. Quaternary Research 3:496-513.

Leopold, A.S., S.A. Cain, C.M. Cottam, I.N. Gabrielson, and T.L. Kimball. 1963. Study of wildlife problems in national parks: in national parks and wildlife management in the national parks. Transactions of the North American Wildlife and Natural Resources Conference 28: 28-45.

McNeil, R.C. 1975. Vegetation and fire history of a ponderosa pine-white fir forest in Crater Lake National Park. M.S. thesis, Oregon State University, Corvallis. 171 pp.

McNeil, Robert C. and Donald B. Zobel. 1980. Vegetation and fire history of a ponderosa pine-white fir forest in Crater Lake National Park. Northwest Science, 54 (1): 30-46.

Morgan P., and M. P. Murray. 2001. Implications for conservation of whitebark pine, In: Tomback, D.F.; Arno, S.F.; Keane, R.E., eds. Whitebark Pine Communities. Island Press, Washington, D.C. pp. 290-309.

Murray M. P. and M.C. Rasmussen. 2003. Non-native blister rust disease on whitebark pine at Crater Lake National Park. Northwest Science, 77 (1): 87-91.

National Park Service, U.S. Department of Interior. 2001a. Fire Monitoring Plan for Sequoia and Kings Canyon National Parks. Three rivers, CA. 79 pp.

National Park Service, U.S. Department of Interior. 2001b. Fire Monitoring Handbook. National Interagency Fire Center. Boise, ID. 274 pp.

National Park Service, U.S. Department of Interior. 1998. Crater Lake National Park Resource Management Plan, 270 p.

Stuart, J.D. 1983. Stand structure and development of a climax lodgepole pine forest in south-central Oregon. Ph.D. diss., University of Washington, Seattle.

Swezy, D.M. and J.K. Agee. 1991. Prescribed fire effects on fine root and tree mortality in old growth ponderosa pine. Can. J. For. Res. 21:626-34.

Thomas, T.L. 1982. Forest restoration of Sun Creek, Crater Lake National Park. M.S. thesis, University of Washington, Seattle. 113 pp.

Thomas, T.L. and J.K. Agee. 1986. Prescribed fire effects on mixed conifer forest structure at Crater Lake, Oregon. Can. J. For. Res. 16(5):1082-87.

USDA, Forest Service. Fire Effects Information System (FEIS) Web page. Date accessed: August 8,2002. Accessed at: http://www.fs.fed.us/database/feis/welcome.htm.

West, N.E. 1969. Tree patterns in Central Oregon ponderosa pine forests. The American Midland Naturalist 81(2):584-590.

Zeigler, R.S. 1978. The vegetation dynamics of *Pinus contorta* forest, Crater Lake National Park. M.S. thesis, Oregon State University, Corvallis.

APPENDIX A-1: FMH MONITORING TYPE DESCRIPTIONS

Forest Series	Monitoring Type Name	Monitoring Code	Establishment Date
Ponderosa Pine	PIPO	FPIPO1D09	11/04/2003
White Fir	ABCO	FABCO1D08	10/03/2003
Shasta Re Fir	ABMAS	FABMASID08	11/04/2003
Mountain Hemlock	TSME	FTSMEIT08	Not available yet
Lodgepole Pine	PICO	FPICO1T08	Not available yet
Whitebark Pine	PIAL	FPIAL1T08	Not available yet

FMH-4 Description Sheet	Monitoring Type

Park: Crater Lake NP, Oregon (CRLA)
Monitoring Type Name: Ponderosa Pine
Prepared by: Mary Rasmussen

Fire Treatment Objectives: (*Restoration Phase)*

- Increase the occurrence of low and mixed-severity burns to a MFRI of 9-15 years.
- Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 60-90%, immediately post-treatment.
- Reduce live tree densities to 20-50 trees/ac > 12 in. dbh (30 cm dbh) within 10 years post-treatment.
- Reduce live tree densities to < 400 trees/ac 2-6 in. dbh (5-15 cm dbh) within 10 years post-treatment.
- Constraint: Limit fire-induced mortality of mature *Pinus* > 18 in. (45 cm dbh) to less than 25% within 2 years post-treatment.

Desired Range of Future Conditions:

Forest Type Name (Monitoring Type Code) ↓	Target Condition Categories			
	Restoration Phase		Maintenance Phase	
	Fuel Reduction	Stand Density by diameter class and (species composition)	Fuel Load Distribution (% of landscape)	Gap/Patch Size Distribution (% of landscape)
Ponderosa Pine (PIPO)	Reduce 60-90% of existing dead & down fuels	20-50 TPA > 12" dbh < 400 TPA 2-6" dbh (5-50% pine,0-70% shrub, 0-25% grass/sedge)	20-40% 5-30 tons/acre 20-50% 30-60 tons/acre 5-20% >60 tons/acre	75-95%: 0.1-1ha 5-25%: 1-10 ha <1%: 10-100 ha

Fire Monitoring Objectives:

We want to be 80% certain of detecting a 60% reduction in the mean fuel load immediately after treatment. We are willing to accept a 20% chance of saying that a 60% reduction took place when it did not.

We want to be 80% certain of detecting a 25% decrease in the number of live overstory ponderosa pine trees (> 45 cm dbh) within 2 years after treatment. We are willing to accept a 20% chance of saying that a 25% decrease took place, when it did not.

Fire Monitoring Variables: Total fuel load, overstory ponderosa pine (dbh >45 cm) mortality

Description:

Ponderosa pine forests are found in the northeastern corner of the park, to the east of Timber Crater, at elevations up to 5600 ft above mean sea level (MSL). In this forest community, ponderosa pine (Pinus ponderosa) is the dominant vegetation species (predominantly 40 canopy cover with a range of 11-70%). Other tree species are rare but include Lodgepole pine (Pinus contorta v. murrayana) where coarse-textured pumice soils occur, or on topographic basins where cold-air drainage forms frost-pockets (0-20% canopy cover). There may be an occasional micro-habitat (e.g. north-facing draw) included in this monitoring type where white fir *(Abies grandis)*, Shasta red fir *(Abies magnifica v. shastensis)* or mountain hemlock *(Tsuga mertensiana)* can occur. The shrub layer is dominated by green leaf manzanita (*Arctostaphylos patula*) and snowbrush (*Ceanothus velutinus*), with bitterbrush (*Purshia tridentata*) and rabbitbrush (Chrysothamnus viscidiflorus) present but less common. The herbaceous layer is dominated by *Carex inops*, with western needlegrass *(Acnatherum occidentalis)* present with less abundance. Bottlebrush squirreltail *(Elymus elmoides)* is infrequent.

Rejection Criteria: Areas within 30 meters of firelines, roads, trails, or other areas of human disturbance. Areas with less than 15% canopy cover. Areas where the ratio of overstory ponderosa pine to other overstory species exceeds 2:1 Exclude areas with >50% slope, identified cultural resource sites, and riparian areas.

Notes:

Evaluate trends in 1000-hr fuel loading, large snag density, and bark beetle presence.

Keep an eye out for invading exotic species.

Track 1000 hr fuels based on decay classes.

Pilot sampling will be conducted for the shrub density belt (1m, 2m, & 5m).

Do not take DBH measurements at 1-year post-burn visits.

FMH-4 PLOT PROTOCOLS

GENERAL PROTOCOLS		YES (X)	NO (X)		YES (X)	NO (X)
Preburn	Control Plots/ Opt		X	Herb Height/ Rec	X	
	Herbaceous Density/ Opt		X	Abbreviated Tags	X	
	OP/ Origin Buried		X	Crown Intercept/ Opt		X
	Voucher Specimens/ Rec	X		Herb. Fuel Load/ Opt		X
	Stereo Photography/ Opt		X	Brush Individuals/ Rec		X
	Belt Transect Width: 1/ 2/ 5 meters *			Stakes Installed: 1/7		
	Herbaceous Data Collected at: Q4-Q1 & Q3-Q2					
	* see notes section.					
Burn	Duff Moisture/ Rec	X		Flame Zone Depth/ Rec	X	
Postburn	Herbaceous Data/ Opt: FMH -			Herb. Fuel Load/ Opt		X
	100 Pt. Burn Severity/ Opt		X			

FOREST PLOT PROTOCOLS		YES (X)	NO (X)		YES (X)	NO (X)
Overstory	Area sampled: 50 x 20m	X		Quarters Sampled: Q1-Q4	X	
	Tree Damage/ Rec	X		Crown Position/ Rec	X	
	Dead Tree Damage/ Opt	X		Dead Crown Position/ Opt	X	
Pole-size	Area Sampled:	25 x 20m		Quarters Sampled:	Q1 & Q3	
	Height/ Rec	X*		Poles Tagged/ Rec	X	
	* see notes section					
Seedling	Area Sampled: 25 x 10m	X		Quarters Sampled:	Q1	
	Height/ Rec	X		Seedlings Mapped/ Opt		X
Fuel Load	Sampling Plane Length:	6, 6, 12, 100, 100		Fuel Continuity/ Opt		X
	Aerial Fuel Load/ Opt		X			
Postburn	Char Height/ Rec	X		Mortality/ Rec	X	

Severity collected along: Fuels

OPT = optional/ REC = recommended

FMH-4 Description Sheet	Monitoring Type

Park: Crater Lake NP, Oregon (CRLA)
Monitoring Type Code: FABCO1D08
Date Described: 10/03/03
Monitoring Type Name: White Fir
Prepared by: Mary Rasmussen

Fire Treatment Objectives: (*Restoration Phase)*

- Increase the occurrence of low and mixed-severity burns to a MFRI of 9-42 years.
- Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 60-90%, immediately post-treatment.
- Reduce live tree densities to 30-80 trees/ac > 12 in. dbh (30 cm dbh) within 10 years post-treatment.
- Reduce live tree densities to < 600 trees/ac 2-6 in. dbh (5-15 cm dbh) within 10 years post-treatment.
- Constraint: Limit fire-induced mortality of mature *Pinus* > 18 in. (45 cm dbh) to less than 25% within 2 years post-treatment.

Desired Range of Future Conditions:

Forest Type Name (Monitoring Type Code) ↓	Target Condition Categories			
	Restoration Phase		Maintenance Phase	
	Fuel Reduction	Stand Density by diameter class and (species composition)	Fuel Load Distribution (% of landscape)	Gap/Patch Size Distribution (% of landscape)
White Fir (ABCO)	Reduce 60-90% of existing dead & down fuels	30-80 TPA > 12" dbh < 600 TPA 2-6" dbh (40-80% fir, 15-40% pine, 0-20% other)	20-40% 5-30 tons/acre 20-50% 30-60 tons/acre 5-20% >60 tons/acre	75-95%: 0.1-1 ha 5-25%: 1-10 ha <1%: 10-100 ha

Fire Monitoring Objectives:

We want to be 80% certain of detecting a 60% reduction in the mean fuel load immediately after treatment. We are willing to accept a 20% chance of saying that a 60% reduction took place when it did not.

We want to be 80% certain of detecting a 25% decrease in the number of live overstory ponderosa pine trees (> 45 cm dbh) within 2 years after treatment. We are willing to accept a 20% chance of saying that a 25% decrease took place, when it did not.

Fire Monitoring Variables: Total fuel load, overstory ponderosa pine (dbh >45 cm) mortality

Description: East of the Cascade Crest, white fir communities are a mix of ponderosa pine and white fir (50-70% canopy cover) with lesser amounts of Douglas-fir *(Pseudotsuga menziesii)*, incense cedar *(Calocedrus decurrens),* lodgepole pine *(Pinus contorta*), and sugar pine *(Pinus lambertiana*) at 0-40% canopy cover. Stands are concentrated in the south eastern portion of the park at elevations ranging from 4600-5300 ft above MSL. Occasional Shasta red fir (*Abies magnifica*) and western white pine *(Pinus monticola)* may also be present in small quantities (< 5% canopy cover) in transition to the Shasta red fir monitoring type. The understory may contain snowbrush (*Ceanothus velutinus*), snowberry *(Symphoricarpos albus)*, willow (*Salix scouleri*), and green leaf manzanita (*Arctostaphylos patula*). Forbs are sparse and include prince's pine (*Chimaphila umbellata*). Sedges and grasses (e.g. *Carex inops*, *Elymus elmoides*) are occasional.

West of the Cascade Crest, white fir communities are found along the park's west boundary up to 5300 ft above MSL. These communities are a mix of white fir, incense cedar, and Douglas-fir as dominants with lodgepole pine, sugar pine and western white pine as minor cohorts.

Rejection Criteria: Areas within 30 meters of firelines, roads, trails, ecotones, or other areas of human disturbance. Areas with less than 15% canopy cover. Exclude areas with >50% slope, identified cultural resource sites, and riparian areas.

Notes:
Evaluate trends in 1000-hr fuel loading, large snag density, and bark beetle presence.
Keep an eye out for invading exotic species.
Track 1000 hr fuels based on decay classes.
Pilot sampling will be conducted for the shrub density belt (1m, 2m, & 5m).
Do not take DBH measurements at 1-year post-burn visits.

GENERAL PROTOCOLS		YES (X)	NO (X)		YES (X)	NO (X)
Preburn	Control Plots/ Opt		X	Herb Height/ Rec	X	
	Herbaceous Density/ Opt		X	Abbreviated Tags	X	
	OP/ Origin Buried		X	Crown Intercept/ Opt		X
	Voucher Specimens/ Rec	X		Herb. Fuel Load/ Opt		X
	Stereo Photography/ Opt		X	Brush Individuals/ Rec		X
	Belt Transect Width: 1/ 2/ 5 meters *			Stakes Installed: 1/7		
	Herbaceous Data Collected at: **Q4-Q1 & Q3-Q2**					
	*** see notes section.**					
Burn	Duff Moisture/ Rec	X		Flame Zone Depth/ Rec	X	
Postburn	Herbaceous Data/ Opt: FMH -			Herb. Fuel Load/ Opt		X
	100 Pt. Burn Severity/ Opt		X			

FOREST PLOT PROTOCOLS		YES (X)	NO (X)		YES (X)	NO (X)
Overstory	Area sampled:50 x 20m	X		Quarters Sampled:Q1-Q4	X	
	Tree Damage/ Rec	X		Crown Position/ Rec	X	
	Dead Tree Damage/ Opt	X		Dead Crown Position/ Opt	X	
Pole-size	Area Sampled:	**25 x 20m**		Quarters Sampled:	**Q1 & Q3**	
	Height/ Rec	X		Poles Tagged/ Rec	X	
Seedling	Area Sampled: 25 x 10m	X		Quarters Sampled:	**Q1**	
	Height/ Rec	X		Seedlings Mapped/ Opt		X
Fuel Load	Sampling Plane Length:	**6, 6, 12, 50, 50**		Fuel Continuity/ Opt		X
	Aerial Fuel Load/ Opt		X			
Postburn	Char Height/ Rec	X		Mortality/ Rec	X	
	Severity collected along:	Fuels				

OPT = optional/ REC = recommended

FMH-4 Description Sheet	Monitoring Type

Park: Crater Lake NP, Oregon (CRLA)
Monitoring Type Code: FABMAS1D08
Date Described: 11/04/03
Monitoring Type Name: Shasta red Fir
Prepared by: Mary Rasmussen

Fire Treatment Objectives: (*Restoration Phase)*

- Increase the occurrence of low and mixed-severity burns to a MFRI of 40-65 years.
- Reduce existing surface fuel load amounts (i.e. duff, litter, 1-, 10-, 100-, and 1000-hr. time-lag fuels) by 60-90%, immediately post-treatment.
- Reduce live tree densities to 30-80 trees/ac > 12 in. dbh (30 cm dbh) within 5 years post-treatment.
- Reduce live tree densities to < 600 trees/ac 2-6 in. dbh (5-15 cm dbh) within 5 years post-treatment.

Desired Range of Future Conditions:

Forest Type Name (Monitoring Type Code) ↓	Target Condition Categories			
	Restoration Phase		Maintenance Phase	
	Fuel Reduction	Stand Density by diameter class and (species composition)	Fuel Load Distribution (% of landscape)	Gap/Patch Size Distribution (% of landscape)
Shasta Red Fir (ABMAS)	Reduce 60-90% of existing dead & down fuels	30-80 TPA > 12" dbh < 600 TPA 2-6" dbh (30-70% fir 0-20% pine 0-20% other)	1-25% 5-30 tons/acre 30-70% 30-60 tons/acre 5-20% >60 tons/acre	70-95%: 0.1-4 ha 5-30%: 5-10 ha < 1%: 10 -100 ha

Fire Monitoring Objectives:

We want to be 80% certain of detecting a 60% reduction in the mean fuel load immediately after treatment. We are willing to accept a 20% chance of saying that a 60% reduction took place when it did not.

We want to be 80% confident that the sample mean of overstory tree density (dbh > 30 cm) is within 25% of a true mean of 75-198 trees/ha, when assessed 5 years post-treatment.

Fire Monitoring Variables: Total fuel load, live tree density

Description: Shasta red fir *(Abies magnifica v. shastensis)* forests occupy the mid-flanks of Mt. Mazama at elevations between 5300 and 6600 ft above MSL. These communities are dominated by red fir (10-60% canopy cover) with cohorts of lodgepole pine *(Pinus contorta)*, and lesser amounts of western white pine *(Pinus monticola)* and white fir *(Abies concolor)* and an occasional mountain hemlock *(Tsuga mertensiana)*. Shasta red fir is a hybrid between noble fir *(Abies procera)* and California red fir *(Abies magnifica).* Their ranges overlap between Mt. Shasta, California and the Calapooya divide, north of Crater Lake, Oregon. The shrub layer is varied including *Ribes spp.*, *Arctostaphylos spp.*, *Vaccinium spp.*, and other less common shrubs. The herbaceous layer is also variable depending aspect and elevation. *Pyrola spp.* and *Luzula spp.* are common.

Rejection Criteria: Areas within 30 meters of firelines, roads, trails, ecotones, or other areas of human disturbance. Areas with less than 15% canopy cover. Exclude areas with > 50% slope, identified cultural resource sites, and riparian areas.

Notes:
Keep an eye out for invading exotic species.
Track 1000 hr fuels based on decay classes.
Pilot sampling will be conducted for the shrub density belt (1m, 2m, & 5m).
Do not take DBH measurements at 1-year post-burn visits.

GENERAL PROTOCOLS		YES (X)	NO (X)		YES (X)	NO (X)
Preburn	Control Plots/ Opt		X	Herb Height/ Rec	X	
	Herbaceous Density/ Opt		X	Abbreviated Tags	X	
	OP/ Origin Buried		X	Crown Intercept/ Opt		X
	Voucher Specimens/ Rec	X		Herb. Fuel Load/ Opt		X
	Stereo Photography/ Opt		X	Brush Individuals/ Rec		X
	Belt Transect Width: 1/ 2/ 5 meters *			Stakes Installed: 1/7		
	Herbaceous Data Collected at: **Q4-Q1 & Q3-Q2**					
	*** see notes section.**					
Burn	Duff Moisture/ Rec	X		Flame Zone Depth/ Rec	X	
Postburn	Herbaceous Data/ Opt: FMH -			Herb. Fuel Load/ Opt		X
	100 Pt. Burn Severity/ Opt		X			

FOREST PLOT PROTOCOLS		YES (X)	NO (X)		YES (X)	NO (X)
Overstory	Area sampled:50 x 20m	X		Quarters Sampled:Q1-Q4	X	
	Tree Damage/ Rec	X		Crown Position/ Rec	X	
	Dead Tree Damage/ Opt	X		Dead Crown Position/ Opt	X	
Pole-size	Area Sampled:	**25 x 20m**		Quarters Sampled:	**Q1 & Q3**	
	Height/ Rec	X		Poles Tagged/ Rec	X	
Seedling	Area Sampled: 25 x 10m	X		Quarters Sampled: Q1		
	Height/ Rec	X		Seedlings Mapped/ Opt		X
Fuel Load	Sampling Plane Length:	**6, 6, 12, 50, 50**		Fuel Continuity/ Opt		X
	Aerial Fuel Load/ Opt		X			
Postburn	Char Height/ Rec	X		Mortality/ Rec	X	
	Severity collected along:	Fuels				

OPT = optional/ REC = recommended

APPENDIX A-2: RAPID ASSESSMENT PROTOCOLS (RAP) HANDBOOK

Fuels/Vegetation Monitoring: Rapid Assessment Protocols

Introduction

Certain fire management activities have been identified as needing a type of vegetation and fuels monitoring different from the NPS standardized fire effects monitoring protocols (FMH). These activities include hazardous fuel reduction projects not involving prescribed fire and a subset of wildland fire use for resource benefits.

In response to this emerging monitoring need, a suite of monitoring protocols has been developed to capture short- and long-term effects to vegetation and fuels using a minimum of time and personnel. These protocols have been developed for use in the Southern-Cascades Fire Effects Monitoring Cluster that includes Crater Lake NP in Southern Oregon, and Lassen Volcanic NP and Lava Beds NM in Northern California. Similar protocols have been tested in the mixed conifer forests at Yosemite National Park (K. Paintner, personal comm.).

Collectively referred to as the Rapid Assessment Protocols (RAP), this suite of monitoring protocols consists of permanently marked sampling units (plots and transects) that are installed before treatments are applied and then revisited one-to-many times for post-treatment measurements.

Sampling Design

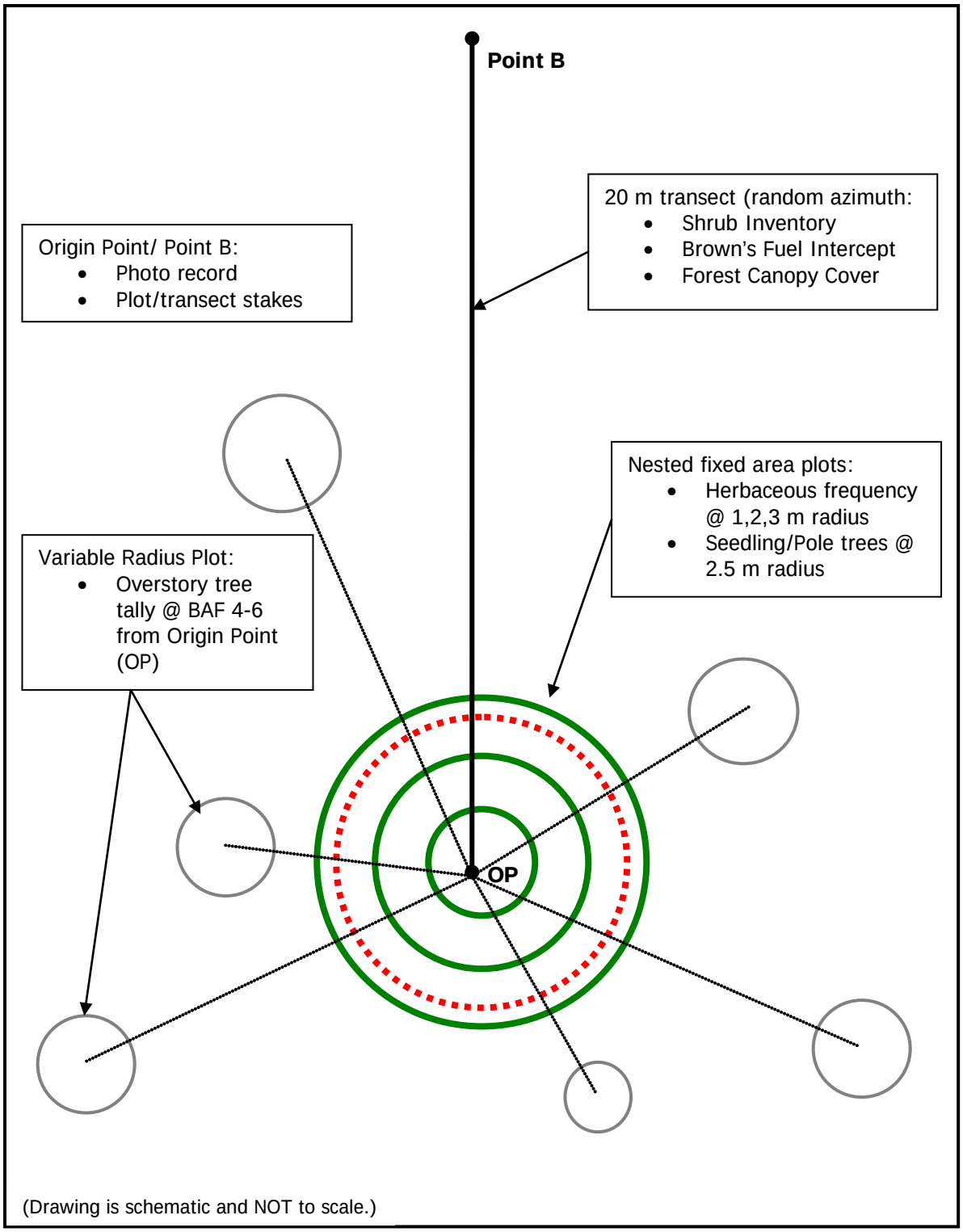
For each sampling unit, a combination of variable and fixed-area plots were selected to capture pre- and post-treatment forest structure including overstory tree layers and herbaceous plant layers. Information on canopy cover, shrub layer, and fuel type, size and loadings are obtained using the planar transect method. A photo record is obtained at each survey location along with site-specific environmental information and geographic coordinates. It is anticipated that a minimum of 20-30 installations will be necessary per project to capture the natural variability of the forest structure, vegetation, and fuels.

Minimum plot calculations for a project survey will be based on a minimum sample size of 10. This suite of protocols is intended for use in mixed-conifer montane forest types – other vegetation types will likely require other sampling protocols to be effective. Additional protocols can/will be developed as needed.

Each sample unit is permanently marked with two pieces of 3/8" rebar located at the Origin Point (OP) and Point B. A metal transect tag label is attached to the OP, identifying the Project Name, Plot Number, Installation Date, and Transect Azimuth.

Figure 1 illustrates how the plots and transects are located in relation to each other.

Figure 1. Sampling Unit Design for the Vegetation/Fuels Rapid Assessment.


Point B
20 m transect (random azimuth:
• Shrub Inventory
• Brown's Fuel Intercept
• Forest Canopy Cover
Origin Point/ Point B:
• Photo record
• Plot/transect stakes
Nested fixed area plots:
• Herbaceous frequency @ 1,2,3 m radius
• Seedling/Pole trees @ 2.5 m radius
Variable Radius Plot:
• Overstory tree tally @ BAF 4-6 from Origin Point (OP)
OP
(Drawing is schematic and NOT to scale.)

Timing of Monitoring

Wildland Fire Use: Fires managed for resource benefits should be monitored with permanent sampling plots placed in a safe location in relation to the approaching flame front for pre-burn data. Post-burn data will be collected within one-year post-burn as a minimum; and there after as needed.

Non-Fire Treatments: Non-fire projects should be monitored with permanent sampling plots pre- and post-treatment, and preferably during the peak flowering season for accurate plant identification.

Monitoring Site Locations

Vegetation and fuels data will be sampled at a density determined by the Fire Ecologist, based on project size, current and predicted fire activity and vegetation/fuel types. Simple random sampling techniques will be used to locate the plots.

All plot locations will be located using a handheld GPS. In addition, accurate documentation of plot locations for ease of relocation will be maintained by the Fire Ecology Program office.

Field Measurements

The RAP field measurements are summarized in the following paragraphs. The best combination of fuels and vegetation information will be gathered based on the recommendation of the Fire Ecologist, commensurate with the treatment objectives. It is anticipated that information on the following parameters will be collected under most circumstances: canopy cover, tree inventory (seedling/sapling/overstory), shrub inventory, non-native plant frequency, dead and down fuels inventory, and photo record.

Plot Location and Photo Record (Form 1):
Data collected includes observer names and plot establishment date, treatment name and type, UTM coordinates, elevation, aspect, slope, data transect direction, route to monitoring location, and photos taken of the transect as viewed from Plot Origin point (OP) to Point B, and Point B to OP.

Herbaceous Plant Frequency (Form 2):
Herbaceous plant species measurements are collected in a series of nested fixed-area circular plots (radii of 1, 2, and 3 m). Data collected includes: species code, species name, exotic or native, and nested location. Data summary will include % frequency by species, and by native and exotic, and rare vs. common occurrence.

Seedling/Pole Tree Inventory (Form 3):
Small tree measurements (≤ 15 cm DBH) are collected within a fixed-area circular plot measuring 20 m² (radius of 2.5 m). Data to be recorded includes species, height code, status (live/dead), and tally. Data summary will be density of seedling and sapling trees by height code and status.

Overstory Tree Inventory (Form 4):
Data collected over a variable-plot radius using a cruiser crutch or prism for trees > 15 cm DBH. Data recorded includes: basal area factor, species, diameter breast height, crown position code, tree status (live/dead), azimuth from plot center to tree, total tree height, height to live crown, and damage codes. Data summary will include tree density (grouped by species, dbh grouping, crown code, or tree status). Tree height and height to live crown will be used to calculate percent crown and crown bulk density.

Forest Canopy Cover Estimates (Form 5):
Data collected along a fixed-length transect of 20 meters. Observations will be collected at 1 m intervals for a total of 20 observations per sample using a densitometer. Data summary will be percent canopy cover by canopy layer.

Shrub Inventory (Form 6):
Data collected along a fixed-length transect of 20 meters. Observations will include shrub species, start and stop points, percent live and average height. Data summary will include percent cover by species, percent live vs. dead for shrubs as a group and by species, and average height by shrub group and species.

Fuels Inventory (Form 7):
Data is recorded along the "b-side" of the 20-m transect line as outlined by Brown (1972). Transect lengths are: 1m (6 ft) for 1- and 10-hr fuels; 2m (12 ft) for 100-hr fuels and 20-m (66 ft) for the 1000-hr fuels. Litter and duff measurements are recorded at 1-m intervals along the 20-m transect. Data summary will include total fuel loading in tons per acre and tons per hectare, and fuel loading by size class.

Intended Data Analysis Approach

The following data summaries will be compiled: Tree density - both grouped by species or dbh grouping, or crown code, live vs. dead; tree height and height to live crown will be used to calculate percent crown; percent canopy cover; percent shrub cover by species, percent live versus dead for shrubs as a group and by species, average height by shrub group and species; tons per acre by fuel class; percent frequency by herbaceous species, and by native and exotic, and rare vs. common.

Data will be analyzed using available statistical packages such as S-Plus or other off-the-shelf software.

Information Management

Data will be entered, checked for errors, and managed by the Fire Ecology Program staff and supervised by the Fire Ecologist. Original copies of all data will be kept by the Fire Ecology Program office and disseminated as requested. A project report will be generated after the 1-year post-treatment data is collected and analyzed. If monitoring results show deviations from desired vegetation conditions, or if resource needs change, an interdisciplinary group consisting of fire and resource management staff will determine changes necessary for future activities.

Funding

FIREPRO funding will be used for all monitoring activities, and the appropriate project account will be charged according to the latest NPS Wildland Fire Management Budget – Business Rules.

Data Sheet Examples

Data will be recorded on the following six forms, field checked for completeness and accuracy, and then entered into an relational database for data exploration and analysis.

VEG/FUELS Rapid Assessment **Plot Location/Establishment Form**
RAP Form 1version 2004

Treatment Unit Name: _____ Plot ID: _____ Survey Date: _____

Park/ Unit Alpha Code: _____ Treatment Type: Burn/ Thin/ Control/ Other _____

Vegetation Type: _____ Fuel Model: _____

Treatment Status (circle one): PRE REPRE POST mo____ YR01 YR02 YR05 OTHER _____

Observer/ Recorder Names: _____

Plot Features:

UTM Zone _____ UTM E _____ UTM N _____ Accuracy _____+/-m

Declination: _____º Elevation: _____ m / ft Slope: _____% Aspect: _____ º

GPS Datum: _____ Topo Quad Name: _____

Directions to Plot (attach map):

_____

_____

_____

_____

_____

Info recorded on Transect Tag Label (attach to Origin Point):

Project Name: _____ Install Date: _____
Plot Number: _____ Transect Azm: _____º

Plot Photographs: Digital ____ Slide ____

Camera Lens _____ mm Film type _____ ASA _____ Roll ID _____

SUBJECT	PHOTO #	DATE	COMMENTS
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____

(Take two photos from OP→ Point B and two photos from Point B→ OP).

VEG/FUELS Rapid Assessment **Herbaceous Plant Frequency Form**

Rap Form 2 version 2004

Treatment Unit Name: _____ Plot ID: _____ Survey Date: _____

Park/ Unit Alpha Code: _____ Treatment Type: Burn/ Thin/ Control/ Other _____

Treatment Status (circle one): PRE REPRE POST mo____ YR01 YR02 YR05 OTHER _____

Observers/ Recorder Names: _____

Directions: Record the names of all species observed in first innermost circle. Then record species observed in circles 2 and 3. Circle 1= radius 1m; Circle 2 = radius 2 m; Circle 3 = radius 3 m. Record the 6-digit NRCS alpha-numeric code that corresponds with the Latin name. Mark each circle that a species is observed in.

NRCS CODE	Latin Name	Native? (Y/ N)	Circle 1	Circle 2	Circle 3

Species Observed, Location, Comments:

VEG/FUELS Rapid Assessment **Seedling/Pole Tree Inventory Form**

RAP Form 3 version 2004

Treatment Unit Name: _____ Plot ID: _____ Survey Date: _____

Park/ Unit Alpha Code: _____ Treatment Type: Burn/ Thin/ Control/ Other _____

Treatment Status (circle one): PRE REPRE POST mo____ YR01 YR02 YR05 OTHER _____

Observers/ Recorder Names: _____

Directions: SEEDLINGS (< 2.5 cm DBH) – Record the number of **live** seedlings by height class and species that are observed within the 2.5 m radius plot.
POLES (2.5 – 15.0 cm DBH) – Record the species, DBH, height class, and status for each pole-sized tree found within the 2.5 m radius plot.

Height class codes: Seedlings: 1= 0.1-30 cm, 2 = 30.1-100 cm, 3 = 100.1+ cm,
Poles: 1= 1-12.0 m, 2 = 2.1-3.0 m, 3 = 3.1-4.0 m, 4 = 4.1-5.0 m, 5 = 5.1+ m.

Seedlings (< 2.5 cm DBH)				Poles (2.5 – 15.0 cm DBH)			
NRCS Species Code	Height Class Code	Tally	Class Total	NRCS Species Code	Diameter	Height Class Code	Live/ Dead

VEG/FUELS Rapid Assessment **Overstory Tree Inventory Form**

RAP Form 4 version 2004

Treatment Unit Name: _____ Plot ID: _____ Survey Date: _____

Park/ Unit Alpha Code: _____ Treatment Type: Burn/ Thin/ Control/ Other _____

Treatment Status (circle one): PRE REPRE POST mo____ YR01 YR02 YR05 OTHER _____

Observers/ Recorder Names: _____ Metric BAF: _____ PRF: _____

Directions: For each tally tree (> 15 cm DBH) – Record the species code, DBH, crown position code, tree status, Azimuth from sample point center, total tree height, height to live crown and damages.

NRCS Species Code	DBH (cm) 000.0	Crown Position Code 00	Live/ Dead L/D	Tree Azimuth 1-360	Tree Ht (m) 000	Ht/ Live Crown (m) 00	Damage Codes (list all applicable)

Crown Position Codes:

Live Trees:	Snags:	Changed Status:	BAF Plot Radius Factor (PRF)
1= Dominant	6 = Recent	11= dead and down	4 0.250
2 = CoDominant	7 = Loose Bark	12 = cut stump	5 0.224
3 = Intermediate	8 = Clean		6 0.204
4 = Subcanopy	9 = Broken above DBH		DBH (cm) X PRF = limiting distance (m)
5 = Open Grown	10 = Broken below DBH		

Damage Codes:

		LIGT = lightning scar
BIRD = bird holes	FIRE = fire scar	MAMM = mammal damage
BROK= broken top	FORK = forked top	MIST = mistletoe
BURL = burl growth	FRST = frost damage	ROTT = pathological rott
CONK = fungal conk	GALL = fungal conk	TWIN = two trunks
CROK = cook or bend	INSE = insect damage	UMAN = human damage
DTOP = dead top	LEAN = leaning	

VEG/FUELS Rapid Assessment — Canopy Cover/ Shrub Inventory Form

RAP Form 5/ 6 version 2004

Treatment Unit Name: _____ Plot ID: _____ Survey Date: _____

Park/ Unit Alpha Code: _____ Treatment Type: Burn/ Thin/ Control/ Other _____

Treatment Status (circle one): PRE REPRE POST mo____ YR01 YR02 YR05 OTHER _____

Observers/ Recorder Names: _____

Forest Canopy Cover

Directions: Observe and record the average canopy height for each tree layer. Record the presence or absence (Y = yes N = No) of tree canopy for understory and overstory layer at 1m intervals along the 20 m transect. OS = Dominant overstory tree canopy layer. US = subordinate tree canopy.

Overstory Tree Layer	Ave. height (m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Understory Tree Layer	Ave. height (m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Shrub Inventory

Directions: Record the 6 digit NRCS alpha-numeric species code and values along the 20 m transect where shrubs start and stop. For each entry, record the proportion of the shrub that is live and an average height.

Shrub CODE	START (0.0 m)	STOP (0.0 m)	% LIVE	Ave. HT (0.0 m)

VEG/FUELS Rapid Assessment **Down Woody Fuels Inventory Form**
RAP Form 7 version 2004

Treatment Unit Name: _____ Plot ID: _____ Survey Date: _____

Park/ Unit Alpha Code: _____ Treatment Type: Burn/ Thin/ Control/ Other _____

Treatment Status (circle one): PRE REPRE POST mo____ YR01 YR02 YR05 OTHER _____
Observers/ Recorder Names: _____

Fuel Loadings:
Transect lengths by diam. size class: 0-0.25": **6 ft** 0.25-1": **6 ft** 1-3": **12 ft** 3+": **66 ft**

0-.25" (1-hr MTL fuel))	0.25-1" (10-hr MTL fuel)	1.0-3.0" (100-hr MTL)	3.0"+ sound (1000-hr MTL)		3.0"+ rotten (1000-hr MTL)	
Record number of intercepts by size class.			Record large end diameter in inches.			
Total Tally	Total Tally	Total Tally	Total Tally		Total Tally	

Litter and Duff Depths:

Transect Point	Litter depth (inches)	Duff depth (inches)	Transect Point	Litter depth (inches)	Duff depth (inches)
1m			11m		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		

Appendix 13. G Pre-Attack Plan and Structure Protection Plan

The pre attack plan addresses the needs that result from fire escape from initial attack, wildland fire use incidents, or large scale prescribed fire operations. The gathering of relatively current information on the location of fixed and transient resources speeds and smoothes the transition from small to larger incident organizations.

The location of all computer files is noted as to location on the Crater Lake National Park computer network. The locations of various other resources are noted as per content and context.

The pre-attack plan is a working, fluctuating document, with few relatively fixed items. As landowners change, interagency agreements are modified, and service providers come and go, this plan will also change. The annual update of this plan should be completed by the FMO by April 15th of each year.

Sample Delegation of Authority

Memorandum

To: Incident Commander

From: Superintendent, Crater Lake National Park

Subject: Limited Delegation of Authority for the Bybee Complex Fires

By this memorandum I am delegating to you limited authority for managing the suppression activities for the Bybee Complex Fires in Crater Lake National Park. As of August 15, 2004 at 06:00 hours you have authority to manage the suppression effort in accordance with the Wildland Fire Situation Analysis (WFSA), the Agency Administrator's Briefing Package and the considerations listed below.

The fire, which originated from a lightning strike on August 13, 2004, is burning within an area managed primarily for resource preservation and wilderness values. My considerations for management of this fire are as follows:

1. Provide for firefighter and public safety.

2. To minimize environmental damage, fire suppression methods used will adhere to the attached guide to Minimum Impact Standards & Techniques, without compromising effective containment, control or personnel safety.

3. Within the park, vehicles used in suppression efforts may be operated only on existing roads.

4. Helicopters may be used if such use is considered essential. Natural openings should be used to the extent possible, with improvements limited to those necessary to safely conduct such operations. The construction of helispots is authorized only in situations where there is a threat to life.

5. Chainsaws, portable pumps and associated hydraulic systems may be used as minimum effective tools for suppression operations.

6. The use of dozers within the Park is not authorized. As the Superintendent, I retain sole authority for any use of dozers in the park.

7. Retardant use and use of foam concentrates is authorized if such use is the minimum effective tool to safely accomplish suppression objectives. Every possible precaution should be taken to prevent retardant drops, or foam deposition, on riparian areas or wetlands. Fugitive-colored retardants area authorized. Should this type of retardant not be available, only water may be used. Non-fugitive-colored retardants are not authorized.

8. As Superintendent, I retain sole authority of implementing and enforcing closures and restrictions within the park.

9. Priorities in protecting natural and cultural resources are:
    - Preservation of Spotted Owl nesting sites
    - Minimizing impact to wilderness values
    - Preventing exotic species introduction
    - Protecting water quality of surface waters
    - Minimizing impacts to Collomia mazama populations
    - Protecting known archaeological and historical features

10. Fire Management Officer Brad Reed and/or Chief Ranger David Brennan will be your contact with the park (Agency Representative).

11. The Park Resource Advisor will be Fire Ecologist Mary Rasmussen, who will provide resource protection standards from the Resource Advisor's Guide.

12. A fire communication system separate from the Park's system will be established and used during your management of the fire.

13. The Park will provide a Fire Information Officer to assist and support your team. To insure that fire information is consistent with the park's management and education strategies, all informational releases will be approved by the Park FIO.

14. I request that you maximize training opportunities for Crater Lake National Park personnel to strengthen our organizational capabilities.

15. Manage the fire cost-effectively for the values at risk.

16. Provide minimum disruption of visitor use of the park consistent with public safety.

17. You will be responsible for assuming management of existing fires within the park, and providing initial attack for new fire starts in the park, and will consults with the Agency Representative and Resource Advisor to ensure appropriate management responses consistent with park management goals.

18. Criteria and standards for returning the management of the fire to the Park will be developed by you and the Park. Before authority for managing the fire is turned back to the park, these criteria and standards must have been achieved.

_____ _____

Craig Ackerman Date
Superintendent

Management Constraints

National Park Service wildland fire management activities are essential to the protection of human life, personal property and irreplaceable natural and cultural resources, and to the accomplishment of the NPS mission. High safety risks and expenses associated with fire management activities require exceptional skill and attention to detail when planning and implementing fire management activities.

CRLA will administer its wildland fire program in a manner that will:

- Achieve maximum overall benefits and minimize damages of wildland fire use within the framework of land use objectives and resource management plans, while giving primary consideration to firefighter and public safety.
- Educate employees and the public about the scope and effect of wildland fire management, including fuels management, resource protection, prevention, hazard/risk assessment, mitigation and rehabilitation, and fire's role in ecosystem management.
- Stabilize and prevent further degradation of natural and cultural resources lost in and/or damaged by impacts of wildland fires and/or fire management activities.
- Maintain the highest standards of professional and technical expertise in planning and safely implementing an effective wildland fire management program.
- Integrate fire management with all other aspects of park management.
- Manage wildland fire incidents in accordance with accepted interagency standards, using appropriate management strategies and tactics and maximize efficiencies realized through interagency coordination and cooperation.
- Scientifically manage wildland fire using best available technology as an essential ecological process to restore, preserve, or maintain ecosystems and use resource information gained through inventory and monitoring to evaluate and improve the program.
- Protect life and property and accomplish resource management objectives, including restoration of the natural role of fire in fire-dependent ecosystems.
- Effectively integrate the preservation of wilderness including the application of "minimum requirement" management techniques into all activities impacting this resource.

All fires occurring in CRLA will be classified as wildland fires. All fires will be effectively managed, considering resource values to be protected and firefighter and public safety, using the full range of strategic and tactical options as described in section 3.3.

A systematic decision-making process will be used to determine the most appropriate management strategies for all unplanned ignitions, and for any prescribed fires that are no longer meeting resource management objectives. The full range of suppression strategies will be considered, but any

methods used to suppress wildland fires should minimize impacts of the suppression action and the fire, commensurate with effective control and resource values to be protected.

Additional points to consider when implementing fire management tactics and strategies are as follows:

- Water drops are preferred to retardant drops. Retardant drops will not occur in the Sun Creek drainage, Lost Creek drainage, or within the caldera. Furthermore, Crater Lake will not be utilized as a water source.
- With due consideration to the impacts on wilderness character, chain saws, helicopters, air tankers, and pumps may be used to meet fire management objectives if determined that they are indeed the minimum required tool.
- If helicopters are used, natural landing sites must be utilized when available. Landings should not occur in Resource Natural Areas or other sensitive sites identified by the Resource Advisor.
- Motor vehicle traffic and heavy equipment use is limited to existing roads unless otherwise approved by the park Superintendent.
- All impacts to visitors should be minimized.
- Firelines will be located to take advantage of natural barriers, rock outcroppings, trails, and streams.
- Firelines will be no wider than necessary to stop the spread of the fire. When firelines approach road corridors, they should be curved as to not present a perpendicular line away from the road.
- Snags and/or burning snags will only be felled when they are determined to be a threat to control lines or to the safety personnel.
- Minimize bucking of windfall during fireline construction efforts. During bucking operations, cuts will be aligned away from trails and other travel corridors.
- Limbing along fireline will only be done when necessary for suppression efforts or personnel safety.
- Avoid creation of bone yards by scattering or burning debris as necessary.
- Facilities (fire camps and helispots) will be located outside of wilderness whenever possible.
- Avoid all sensitive areas as identified by the resource advisor.
- Establish several small camps as opposed to one large one during spike camp operations.
- Camps will be a minimum of 200 feet away from water sources.
- Toilet facilities, if not managed through portable facilities, will be a minimum of 200 feet away from water sources.
- Multiple and varying travel routes will be used to access the fire, water sources, and helispot.
- Nails will not be used in trees
- Garbage will be packed out
- Control lines will be backfilled and scarified
- Water bars and drain dips will be constructed as necessary to minimize erosion.
- All stumps will be flush cut and covered with organic debris
- Position felled/bucked material so as to be least noticeable to visitors. Camouflage cuts wherever possible.
- All flagging, equipment, and litter will be removed during rehab operations
- Camping areas and helispots will be restored to natural state

Interagency Agreements

The National Park Service is signatory to the Northwest Operating Plan (2001) which was prepared as a follow-up to the Master Cooperative Fire Agreement (1998). "This plan supercedes agreements and associated operating plans dated prior to the execution of the Master Cooperative Fire Agreement" (Northwest Operating Plan, 2001).

The Interagency Agreement for Fire Management (FY2003 – FY2008) provides a basis for cooperation among the agencies on all aspects of wildland fire management and as authorized in non-fire emergencies. In addition, it was drafted to facilitate the exchange of personnel, equipment (including aircraft), supplies, services, and funds among the agencies. Under this agreement, the agencies agree to cooperate in the full spectrum of wildland fire management activities, and in non-fire emergencies as authorized, to achieve land management goals. Cooperative efforts shall be provided at the national, geographical, and local levels to facilitate efficient use of personnel, supplies, equipment, training, public education, aviation services and other resources.

In addition to the Northwest Operating Plan and the Interagency Agreement for Fire Management, there are two local operating plans in place outlining local interagency responsibilities during fire season.

The 2003 South Central Oregon Interagency Fire Danger Operating Plan is currently nearing completion. This plan overviews the multiple fire danger rating areas in the South Central Oregon Interagency area. Furthermore, the plan outlines operational guidelines for the area. Agencies involved include: Fremont-Winema National Forest, Oregon Department of Forestry (Klamath-Lake District), Lakeview BLM, US Fish and Wildlife Service (Klamath Basin, Sheldon/ Hart Mountain), Crater Lake National Park.

The 2003 South Central Oregon Multiple Fire Plan provides basic guidelines for incident management and mobilization of resources during multiple ignition events within the South Central Oregon Fire Management area. Agencies involved include: Fremont-Winema National Forest, Oregon Department of Forestry (Klamath-Lake District), Lakeview BLM, US Fish and Wildlife Service (Klamath Basin, Sheldon/ Hart Mountain), Crater Lake National Park.

Evacuation Procedures

Evacuation pre-plans are currently being developed and will be incorporated into CRLA Emergency Operations Plan.

Structural Protection Needs

The following table defines all of the structures and their locations in Crater Lake National Park. These structures would require structural protection in the event a wildland fire was threatening the immediate vicinity of the development.

Table 1 Historical Structures and Locations in Need of Protection

Bldg. #	Locate Code	Square Feet	Current Use	Historical Use	Year Built	Location
#1	61584	Total-6552	Admin Offices	Admin. Bldg.	1934-1936	Munson Valley (HQ)
#2	61603	Total-5245	Interp Offices/ Visitor Center	Ranger Dormitory	1932-1933	Munson Valley (HQ)
#3	61594	Total-5971	Ranger/ Resource Mgmt Offices & Dispatch	Mess Hall	1929	Munson Valley (HQ)
#4	61605	1st-1820 2nd-1729 Total-3549	Maint Storage SAR Cache Wildland Fire Cache	Warehouse	1926	Munson Valley (HQ)
#5	61595	Total-4606	RM Offices & parking	Machine Shop	1932	Munson Valley (HQ)
#9	61592	1st-1075 2nd-1075 Total-2150	Maint Storage	Lumber Shed	1934	Munson Valley (HQ)
#10	61593	1st-1075 2nd-1075 Total-2150	Maint Storage	Lumber Shed	1934	Munson Valley (HQ)
#11		1st-1075 2nd-1075 Total-2150	Maint & VP Storage	Lumber Shed	1934	Munson Valley (HQ)
#13	61602	252	Storage/ Trail Crew Cache	Old Meat House	1929	Munson Valley (HQ)
#14	61589	9734	Maint Shops	Maintenance Building	1955 (1993)	Munson Valley (HQ)
#14-A	61589	11,412	Maint Offices/ Shops/ parking	Maintenance Building	1964 (1993)	Munson Valley (HQ)
#15-A	61616	Total-1639	Quarters	Residence	1963	Munson Valley Steel Circle
#15-B	61616	Total-1639	Quarters	Residence	1963	Munson Valley Steel Circle
#17-A	61618	1299	Quarters	Residence	1956 1957 1958	Munson Valley Steel Circle

#17-B	61618	1095	Quarters	Residence	1956 1957 1958	Munson Valley Steel Circle
#17-C	61618	1095	Quarters	Residence	1956 1957 1958	Munson Valley Steel Circle
#17-D	61618	1299 Total-4788	Quarters	Residence	1956 1957 1958	Munson Valley Steel Circle
#18-A	61626	Total-1639	Quarters	Residence	1963	Munson Valley Steel Circle
#18-B	61626	Total-1639	Quarters	Residence	1963	Munson Valley Steel Circle
#19	61612	1st Fl 1044 2nd Fl 1052 Bsmt 160 Total-2256	Science and Learning Center (future)	Supt's summer residence	1932- 1933	Munson Valley Stone Houses
#20	61628	1st Fl 800 2nd Fl 476 Total-1276	Quarters	Chief Naturalist's summer residence	1933	Munson Valley Stone Houses
#24	61629	1st Fl 504 2nd Fl 375 Total-879	Quarters	Residence	1931	Munson Valley Stone Houses
#24-A		256	Garage	Garage	1958	Munson Valley Stone Houses
#25	61630	1st Fl 525 2nd Fl 308 total-833	Quarters	Residence	1931	Munson Valley Stone Houses
#26-A	61631	1639	Quarters	Residence	1963	Munson Valley Steel Circle
#26-B	61631	1639	Quarters	Residence	1963	Munson Valley Steel Circle
#28	61632	1st Fl 504 2nd Fl 375 Total-879	Quarters	Residence	1933	Munson Valley Stone Houses
#28-A			Garage	Garage	1954	Munson Valley Stone Houses

#30	61633	1st Fl 448 2nd Fl 184 Total-632	Quarters	Residence	1929	Munson Valley Stone Houses
#31	61634	1st Fl 448 2nd Fl 184 Total-632	Quarters	Residence	1928	Munson Valley Stone Houses
#32	61635	1st Fl 448 2nd Fl 184 Total-632	Quarters	Residence	1927	Munson Valley Stone Houses
#33	61588	1st Fl 917	Garage for Qtrs	Garage	1933	Munson Valley
#34ABC	61636	1st Fl 1519 2nd Fl 1240 Bsmt. 728 Total-3487	Quarters	Hospital/ Quarter s	1941– 1948	Munson Valley
#36	62897	518	Storage/ Interp	Transformer & Phone Building	1928	Munson Valley (HQ)
#37	61591	589	Maint/ Sign Shop	Comfort Station	1940	Munson Valley (HQ)
#40	61590	1890	Garage for Qtrs	9 Stall Garage	1998	Munson Valley (HQ)
#58		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	1958 1959	Mazama Campground A Loop
#59		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	1958 1959	Mazama Campground C Loop
#60		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	1957	Mazama CG C Loop
#61		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	1957	Mazama Campground D Loop
#62		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	1961	Mazama Campground E Loop
#63		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	1961	Mazama Campground E Loop

#64		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	1961	Mazama CG G Loop
#66	62937	1st Fl 705 2nd Fl 341	Interp/ Visitor Center	Kiser's Studio	1921 (1926)	Rim Village
#67	62939	1st Fl 1301	Interp/ Visitor Center	Sinnott Memorial	1930	Rim Village
#68	62942	1st Fl 589	Comfort Station	Comfort Station	1937 (2002)	Rim Village
#72	62970	1st Fl 595	Transformer Building/ Storage Leased by Concessionaire	Comfort Station	1928	Rim Village
#82	62933	1st Fl 217	Interp Amphitheater	Amphitheater	1962	Mazama CG D& E Loop
#83A	61637	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#83B	61637	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#84A	61638	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#84B	61638	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#85A	61639	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#85B	61639	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow

#86A	61640	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#86B	61640	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#87A	61641	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#87B	61641	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#88A	62883	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#88B	62883	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#89A	62887	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#89B	62887	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#90A	62890	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#90B	62890	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#116	62971	1st Fl 1300 2nd Fl 275	Interp	Community House	1924 (2001)	Rim Village
#131			Warehouse	Warehouse		Medford
#168	63008	1st Fl 456 2nd Fl 356	Fire Lookout	Fire Lookout/ Museum	1931 1932	Watchman
#170	73568	1st Fl 196 2nd Fl 196	Fire Lookout	Fire Lookout	1952	Mt. Scott
#171		255	Utility	Fuel Transfer	1998	Cleetwood Parking

#172			Lake Level Gauging Station	Lake Level Gauging Station	1959	Cleetwood
#194	62903		Boat Shed	Boat Shed	1941	Wizard Island
#198	73582	1st Fl 146	Rangers - Backcountry Cabin	Ski Cabin	1934	Wine Glass – Rim Drive
#219-A	62893	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#219-B	62893	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#220	73787		Storage	Survey Storage Pole Barn	1987	South Yard
#221-A	62894	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#221-B	62894	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#222	61585	1st 2960 2nd 2960 Total-5920	Community Center	Community School	1964	Munson Valley Steel Circle
#225	62911		Comfort Station	Comfort Station	1983	Cleetwood Cove
#226-A	62895	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#226-B	62895	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#227-A	62896	1st Fl 679 2nd 1019 Total-1698	Quarters	Residence	1958	Munson Valley Steel Circle
#227-B	62896	1st Fl 679 2nd 1019 Total-1698	Quarters	Residence	1958	Munson Valley Steel Circle
#228		48	Maint	Mazama Pump house	1972	Annie Spring
#229		120	Maint	Annie Springs Pump house	1975	Annie Spring
#231	62907		Comfort Station	Wizard Island	1989	Wizard Island
#232	62934	80	Rangers – Fee Booth	Annie Springs Entrance Station	1990	Near Junction of Hwy 62 & Munson Valley

						Road
#233			Maint	Munson Flow Monitor Station	1990	Munson Lagoons South of Steel Circle
#234	62921	80	Rangers – Fee Booth	North Entrance Station	1991	North Entrance Road
#235			Maint	Mazama Flow Monitoring Station	1993	Mazama Lagoons
#236	62914	384	Comfort Station	Comfort Station	1998	Lost Creek CG
#237	73770		Maint Water Treatment	Water Treatment	1994	Near Lost Creek CG
#238	61587	936	Fitness Center	Chevron Dorm	1958	Munson Valley/ Steel Circle
#240	62922		Vault Toilet	Vault Toilet	2000	North Entrance
#241	63010		Vault Toilet	Vault Toilet	2001	Pumice Point Picnic Area
#242	63011		Vault Toilet	Vault Toilet	2001	Whitebark Pine Picnic Area
#243	63012		Vault Toilet	Vault Toilet	2001	Vidae Falls Picnic Area
#244			Vault Toilet	Vault Toilet	future	Lightning Springs Picnic Area
#245	63009		Vault Toilet	Vault Toilet	2001	Corrals
#246	62927		Vault Toilet	Vault Toilet	2002	Old West Boundary
#247	62924		Vault Toilet	Vault Toilet	2001	Ponderosa Picnic Area
#248			Vault Toilet	Vault Toilet	future	reserved
#249			Vault Toilet	Vault Toilet	future	reserved
#250			Vault Toilet	Vault Toilet	future	reserved
#251		27,000	Central Dormitory Leased by Concessionaire	Government Owned	1998	Off Hwy 62 South Near Mazama CG
#252		4300	Garage/ Generator	Government	1998	Off Hwy 62

			Building Leased by Concessionaire	Owned		South Near Mazama CG
#253		9300	Dormitory Leased by Concessionaire	Government Owned	1998	Off Hwy 62 South Near Mazama
#254				reserved		
#255				reserved		
#505			Boathouse	Concession owned		Wizard Island
#551			4 plex cabin	Concession owned	1991?	Mazama Village
#552			4 plex cabin	Concession owned	1991?	Mazama Village
#553			4 plex cabin	Concession owned	1991?	Mazama Village
#554			4 plex cabin	Concession owned	1991?	Mazama Village
#555			4 plex cabin	Concession owned	1991?	Mazama Village
#556			4 plex cabin	Concession owned	1991?	Mazama Village
#557			4 plex cabin	Concession owned	1991?	Mazama Village
#558			4 plex cabin	Concession owned	1991?	Mazama Village
#559			4 plex cabin	Concession owned	1991?	Mazama Village
#560			4 plex cabin	Concession owned	1991?	Mazama Village
#565		1st-12,353 2nd-12,353 3rd-11,222 B-12,353 A-8,093	Hotel – Leased by Concessionaire	Lodge	1912- 1924 1989-1994	Rim Village
#573		364	Comfort Station	Concession owned	1995	Mazama CG – F Loop
#574		?	Camper Service Building	Camper Service Bldg – Concession	?	Mazama Village

				owned		
#575		?	Concession Owned Dormitory	Rim Dorm	1972	Rim near Lodge

Public Fire Use Restriction and Closure Procedures

Introduction

Enforceable fire use restrictions and emergency closures can reduce the possibility of human caused wildfires occurring during periods of seasonal drought, when wildfires can cause serious damage to park resources and threaten the safety of park visitors and employees. It is unlikely that park areas would need to be closed to public entry because of fire danger reasons alone although it could become necessary if there is substantial fire activity in the area and park staff decides that new fire starts must be prevented. Emergency closures for public safety reasons are also made during most fire seasons for certain park areas affected by fire operations.

Objectives

- To restrict the use of fire by the public in defined areas of the parks during periods of high, very high, and extreme fire danger.
- To provide park administrative staff with a procedure for making emergency closures for fire prevention and public safety reasons.
- To ensure that fire use restrictions and emergency closures comply with the requirements set forth in 36 Code of Federal Regulations, Part 1, section 15.

Authority

Fire use restrictions and emergency closures shall be made in compliance with the requirements set forth in 36 Code of Federal Regulations (CFR), sections 15 and 2.13(c). For enforcing fire use restrictions this plan serves as the written determination required in section 15 (c). Decision memoranda will be approved by the Superintendent when fire use restrictions, or emergency closures for fire prevention or public safety reasons, are implemented. Whenever fire use restrictions or area closures are implemented, public notice must be given in compliance with 36 CFR, section 17. Such notice will be widely disseminated, as described in this Appendix.

Procedures for Implementing Fire Use Restrictions or Closures

The Fire Management Officer will identify areas of the parks where fire use restrictions and emergency closures for fire prevention purposes should be implemented. The Fire Management Officer will consider:

- Weather data

- Fuels data
- Visitor use trends
- Fire situation within the park (number of active fires and their potential, probability of new starts, and draw-down of park suppression resources)
- Current fire use restrictions and emergency closures in adjoining national forests (Winema National Forest, Umpqua National Forest, Rogue River National Forest) and other public lands (Sun Pass State Forest).
- Regional and national preparedness plan levels

The Fire Management Officer will consult with the Ranger Operations Supervisor on potential closures and restrictions, and will recommend to the Chief Ranger and Superintendent the appropriate Stage Level that should go in to effect. A decision memorandum will be approved by the Superintendent.

Once restrictions have been approved the Fire Management Officer will coordinate the following in order to place Stage I, Stage II or Stage III restrictions/ closures into effect:

- Work with the Park Public Information Officer and issue a press release announcing the Stage Level.
- Notification of all park visitor center information desk personnel.
- Notification of Ranger Operations Supervisor.
- Coordinate the placing of signs (see Stage I, Stage II, and Stage III signing below).
- Make available to all visitor centers a fire use restriction and emergency closure handout for the public and employees.
- Request that Park Dispatch announce daily the current Stage Level during the morning report broadcast, and put Stage Level information in the written morning report.
- Notification of fire dispatch at Kingsley and Medford Interagency Fire Centers, and Klamath Unit of Oregon Department of Forestry.
- Notification of the park concessionaire.

Procedures for Lifting Fire Use Restrictions or Closures

When fire danger and fire occurrence moderates, the Fire Management Officer will recommend reduction of fire use restrictions and emergency closures for fire prevention purposes. The Fire Management Officer will consider:

- Weather data
- Fuels data
- Visitor use trends
- Fire situation within the park (number of active fires and their potential, probability of new starts, and draw-down of park suppression resources)
- Current fire use restrictions and emergency closures in adjoining national forests (Winema National Forest, Umpqua National Forest, Rogue River National Forest) and other public lands (Sun Pass State Forest).
- Regional and national preparedness plan levels

The Fire Management Officer will consult with the Ranger Operations Supervisor on lifting of fire use restrictions, and will recommend to the Chief Ranger and Superintendent the appropriate level

of restrictions/closures or lifting of restrictions/closures. A decision memorandum will be approved by the Superintendent.

Once the lifting of restrictions/closures has been approved the Fire Management Officer will coordinate the following in order to lift Stage I, Stage II or Stage III restrictions/closures:

- Work with the Park Public Information Officer and issue a press release announcing the Stage Level.
- Notification of all park visitor center information desk personnel.
- Notification of Ranger Operations Supervisor.
- Coordinate the placing of signs (see Stage I, Stage II, and Stage III signing below).
- Request that Park Dispatch announce daily the current Stage Level during the morning report broadcast, and put Stage Level information in the written morning report.
- Notification of fire dispatch at Kingsley and Medford Interagency Fire Centers, and Klamath Unit of Oregon Department of Forestry.
- Notification of the park concessionaire.

Special Signage During 4th of July

Special "NO FIREWORKS" signs will be posted throughout the Parks five days prior to, and five days after the July 4th holiday. The Fire Management Officer will coordinate the posting of the signs with the Ranger Operations Supervisor.

Stage I Fire Use Restrictions

Campfires and Camp Stoves

- Wood fires and charcoal fires are permitted only within established grills or fire rings, or portable self-contained grills, in the following designated areas:
  - Mazama Campground
  - Lost Creek Campground
  - Rim Village Picnic Area ("Picnic Hill")
  - Park residential areas
    - Gasoline and propane camp stoves and gas grills are permitted in campgrounds, picnic areas, backcountry areas and residential areas.

Smoking

- Smoking is permitted only in the following areas:
  - Within buildings where smoking is normally allowed, and directly adjacent to buildings. Ashtrays must be used for both ashes and butts.
  - In vehicles, provided that an ashtray is used for ashes and butts.
  - While stopped in an area at least three (3) feet in diameter that is barren or free of all flammable materials. Ashes and butts must be disposed of safely and may not be discarded on the ground.

Fireworks

- Fireworks are prohibited in the park at all times

Trigger Conditions

- Once the following conditions have been reached, and are anticipated to continue for an extended period of time, Stage 1 fire use restrictions will be implemented. The park will strive to avoid implementing restrictions when trigger conditions are expected to last only very short periods.
  - Similar fire restrictions are in effect for adjoining National Forests are in effect (Winema National Forest, Rogue River National Forest, Umpqua National Forest), and
  - National Fire Danger Rating Staffing Class for any Park fire weather station is three or higher

Signage

- Stage 1 signs will include the following wording:
  - "HIGH FIRE DANGER"
  - "NO WOOD OR CHARCOAL FIRES EXCEPT IN DESIGNATED CAMPGROUNDS AND PICNIC AREAS"
  - "GAS OR PROPANE STOVES PERMITTED"
  - "NO SMOKING EXCEPT WITHIN ENCLOSED VEHICLES, DEVELOPED AREAS, OR DESIGNATED CAMPGROUNDS"

- Signs will be placed at the following locations:
  - Ponderosa Picnic Area bulletin board
  - Old West bulletin board
  - Annie Springs Entrance Station bulletin board
  - North Entrance Station bulletin board
  - Mazama Store bulletin board
  - Mazama Campground kiosk
  - Steel Information Center
  - Rim Visitor Center
  - Crater Lake Lodge
  - Rim Village Cafeteria and Gift Shop
  - Cleetwood Cove ticket shed
  - Trailheads for all maintained trails in park
  - Rim Village Picnic Area

Stage II Fire Use Restrictions

Campfires and Camp Stoves

- Wood fires and charcoal fires are prohibited throughout the park.
  - Gasoline and propane camp stoves and gas grills are permitted in campgrounds, picnic areas, backcountry areas and residential areas.

Smoking

- Smoking is prohibited throughout the park.

Fireworks

- Fireworks are prohibited in the park at all times.

Trigger Conditions

- Once the following conditions have been reached, and are anticipated to continue for an extended period of time, Stage II fire use restrictions will be implemented. The park will strive to avoid implementing restrictions when trigger conditions are expected to last only very short periods.
    - Similar fire restrictions are in effect for adjoining National Forests are in effect (Winema National Forest, Rogue River National Forest, Umpqua National Forest), and
    - National Fire Danger Rating Staffing Class for any Park fire weather station is four or higher

Signage

- Stage 1 signs will include the following wording:
    - "VERY HIGH FIRE DANGER"
    - "NO WOOD OR CHARCOAL FIRES"
    - "GAS OR PROPANE STOVES PERMITTED"
    - "SMOKING PROHIBITED"
- Signs will be placed at the following locations:
    - Ponderosa Picnic Area bulletin board
    - Old West bulletin board
    - Annie Springs Entrance Station bulletin board
    - North Entrance Station bulletin board
    - Mazama Store bulletin board
    - Mazama Campground kiosk
    - Steel Information Center
    - Rim Visitor Center
    - Crater Lake Lodge
    - Rim Village Cafeteria and Gift Shop
    - Cleetwood Cove ticket shed
    - Trailheads for all maintained trails in park
    - Rim Village Picnic Area

Stage III Fire Use Restrictions

Campfires

- Wood fires and charcoal fires are prohibited throughout the park.
- Gasoline and propane camp stoves and gas grills are prohibited throughout the park.

Smoking

- Smoking is prohibited throughout the park.

Fireworks

- Fireworks are prohibited in the park at all times.

Trigger Conditions

- Once the following conditions have been reached, and are anticipated to continue for an extended period of time, Stage III fire use restrictions will be implemented. The park will strive to avoid implementing restrictions when trigger conditions are expected to last only very short periods.
    - Similar fire restrictions are in effect for adjoining National Forests are in effect (Winema National Forest, Rogue River National Forest, Umpqua National Forest), and
    - National Fire Danger Rating Staffing Class for any Park fire weather station is five

Signage

- Stage 1 signs will include the following wording:
    - "EXTREME FIRE DANGER"
    - "NO WOOD OR CHARCOAL FIRES"
    - "GAS AND PROPANE STOVES PROHIBITED"
    - "SMOKING PROHIBITED"
- Signs will be placed at the following locations:
    - Ponderosa Picnic Area bulletin board
    - Old West bulletin board
    - Annie Springs Entrance Station bulletin board
    - North Entrance Station bulletin board
    - Mazama Store bulletin board
    - Mazama Campground kiosk
    - Steel Information Center
    - Rim Visitor Center
    - Crater Lake Lodge
    - Rim Village Cafeteria and Gift Shop
    - Cleetwood Cove ticket shed
    - Trailheads for all maintained trails in park
    - Rim Village Picnic Area

Special Safety Concerns and Regulating Access to Hazardous Areas

Hazardous Conditions

Incident Commanders are responsible for assuring that inspections are conducted for hazardous conditions created by fire activity. These include the following hazards near trails, roads, campsites and developed areas: active fire, falling trees, rolling rocks, or holes from burning stumps/roots. Official warning signs will be posted on trails, roads, around campsites and in developed areas where these hazards exist. Signs should remain in place until the hazards no longer exist or are reduced to a minimal and acceptable level. The areas may require closure to public and employee entry.

Regulating Access to Hazardous Areas

Coordination between Incident Commanders and the Ranger Operations Supervisor and Chief Ranger is essential. Incident Commanders, in collaboration with the Ranger Operations Supervisor, can recommend to the Chief Ranger action that should be considered. It is the Chief Ranger's responsibility to determine actual regulatory measures that will be taken to ensure visitor and

employee safety on trails, roads, campsites and in developed areas. Incident Commanders will coordinate with the Ranger Operations Supervisor regarding who will be responsible for posting signs and physically closing trails or roads. Most fire operations need only limit access to some front country trails for short periods of time and alternative routes are available to the public. In these cases simply regulating trail use with the use of signs and physically blocking trails is adequate and formal Special Order closures are usually not needed. Special Order closures should be used in situations that involve substantial areas, long durations or complex circumstances such as no alternate trail routes available or roads that need to be closed. Warning signs should be posted anytime there are fire caused risks to the public or employees from hazards in a burn area involving trails, roads, campsites and developed areas. Signs must have the following basic information included:

- Warning Signs
    - Warning
    - Nature of the hazard
    - Steps to take to avoid the hazard
- Closed Area Signs
    - Danger
    - The area that is closed
    - The hazard that is causing the closure

Area closure and hazard warning signs require posting outside of the hazard area on routes entering the hazard area. The trail or road should be physically blocked with barricades, on roads, or trail blocks made of rope and flagging tape on trails. Hazardous situations may require posting trail block personnel if it is likely people may ignore the trail closure, such as backpackers hiking through on long trips who may not want to turn back or use alternate routes.

<u>Logistics</u>

ICP and Base Camp Locations

The primary Incident Command Post for will be the dispatch office located in the Canfield Building at park headquarters. This location is central to the communication flow and has all the required amenities, and will serve as ICP until an alternate or other ICP is identified and all resources notified .

The following areas have been identified as possible sites for Incident Command Posts and/ or Base Camps in the event of a Type 1, 2, or 3 incident within Crater Lake National Park.

1. Diamond Lake Incident Command Post, Umpqua NF (see attached ICP plan)
2. Clearwater Incident Base, Umpqua NF (see attached ICP plan)
3. Crater Lake Community Center, Crater Lake NP
4. Annie Creek Incident Base, Winema NF
5. Chiloquin High School — Contact: Principal John Rademacher
   Chiloquin, OR — Office: (541) 783-2321
   T35S, R7E, Sec3 — Home: (541) 783-2687
   Contact: Bill Elrod
   Home: (541) 783-2132

Showers/ laundry/ sleeping areas/ electricity/ phones/ staging.
From Klamath Falls, take Hwy 97N, 28 miles, to Chiloquin and turn right at the Pacific Pride station. School is located on the south end of Chiloquin.

Diamond Lake Incident Base Camp Plan
Diamond Lake Ranger District
Umpqua National Forest

Prepared by:

_____ _____
Von Gruber Date
Asst. Fire Management Officer

Reviewed by:

_____ _____
Robert Cunningham Date
Fire Management Officer

Approved by:

_____ _____
John Ouimet Date
District Ranger

Diamond Lake Incident Base Plan

Introduction

This document is intended to provide guidance in the event of an incident of type III or greater on the Diamond Lake Ranger District. There are two areas of consideration, South Diamond Incident Camp(Snow Park) and Toketee Air Strip. Each of these areas have needs prior to the arrival of and incident management team. These needs are addressed in the form of resource orders that are part of this document. A check list for the area will be completed by the dispatch coordinator or duty officer when either location is activated. The use of this document will aid in the transition from district/forest to and Incident Management Team.

Timelines

The implementation of either Base Camp location requires a 24 hour lead time to effectively mobilize logistical support and place orders for the incident. Special notification such as NOTAM, for the use and activation of the Toketee Air Strip, it is important to give starting date, time, and area for NOTAM/TFR to central dispatch.

South Diamond Incident Camp (Snow Park)

The Incident Base Camp Package is located in the high density storage across from the Toketee dispatch center.

Contact: Robert Cunningham, FMO, Diamond Lake RD, 541-530-7222 / 541- 498-2239
Von Gruber, AFMO, Diamond Lake RD, 541-530-7221/ 541-498-2239
Jill Napper, AFMO, Diamond Lake RD, 541-530-7220 / 541-498-2239

Physical Description

The South Diamond Incident Camp is located at the southeast quarter of the Diamond Lake Ranger District at the South end of Diamond Lake near the 230 entrance to Diamond Lake. This Incident camp can be accessed from Hwy 230 or 138 with preference being 230. The legal description is T. 28 S, R.5 ½ E, Sec. 20 and 21. There are no facilities at this location except a power outlet at the north end near the entrance. This location boarders the Broken Arrow Campground on the south end, and may create a security problem for the incident team. Special contacts for the area will consist of the Resource department at the Diamond Lake RD and Diamond Lake Resort. Other details are addressed in the Incident Base camp Check list in the camp kit or on the map of camp area. The Incident Helibase is located at the 2610 and Hwy 138 at the Lomolo sand shed road, 700 with a Lat/Long of 43 15.3 by 122 10.6. Distances of camp location from major areas are as followed, Klamath Falls 75

miles, Roseburg 66 miles, Redmond 130 miles and Medford is 135 miles. This camp location will accommodate small to large incidents of up to 1500 personnel.

Support Needs

Temporary phone and fax can be set up on site or at the Diamond Lake Visitor Center. Potable water can be attained at Diamond Lake Resort. Power Company will need notified to turn power on, and sanitation services can be obtained from local vendors from Roseburg.

Questions That Need to be Addressed

Estimated number of people to be on Incident?
Type I, II or III incident team?
Estimated duration of Incident?
Has expanded dispatch been set up or is it optional?
What is the priority in the region and are there resources available?

Tasks to be performed

Make five copies of the incident plan for incoming team.
Call supervisors office and inform dispatch of the activation of the camp location.
Inform ODOT of the activation of the helibase at the sand shed.
Request a Temporary Flight Restriction of fire area, camp and helibase through central dispatch.
Notify district and forest staff of the camp activation.
Send central dispatch the predetermined resource orders.
Assign logistics person and two assistants to set up camp area and prepare for incoming team and resources.
Assign a check in recorder to check in incoming resources.
Sign location and direction to camp and helibase from 230m and 138.
Cordon off helibase.
Contact Engineering for possible road improvement and clearing.
Install security fence between South Diamond Incident Camp and the Broken Arrow Campground. The district has two roles in the warehouse or can contact recreation for fencing.

South Diamond Incident Base Camp Check List/ Incident Base Order

Place orders with central dispatch for,

- 28000 or 36000 quiet generators
- Catering unit
- Shower unit
- Phone system either hard line, satellite, or cell all will work out of this location. if using hard line phone system the junction box is located at the junction of 6592 and the entrance to camp location

Portable Toilets equaling 1 toilet for every 10 people.
Security (minimum of two)
Potable water tender (minimum of 1500 gallon).
Medical support team or ambulance with medical personnel till team medical unit leader arrives.
Sanitation for Garbage ie: Dumpsters and pickup.
Misc. Overhead / Type of team needed

NFES orders

1 NFES 2069: Mobile Cache Support Van
1 NFES 0480: Coffee Kit
8 NFES 0549: Shelter Kits octagon
1 NFES 0520: Helicopter support kit
2 NFES 1040: Crash Rescue Kit
2 NFES 0630: evacuation kits litter baskets
1 NFES 0320: Incident Base Maintenance Kits

Clearwater Incident Base (Air Strip)
Umpqua National Forest

Contact: Robert Cunningham, FMO, Diamond Lake RD, 541-530-7222 / 541- 498-2239
Von Gruber, AFMO, Diamond Lake RD, 541-530-7221/ 541-498-2239
Jill Napper, AFMO, Diamond Lake RD, 541-530-7220 / 541-498-2239

Physical Description

This incident base will accommodate large incidents with personnel numbers ranging from 500 to 2500.

Clearwater Air Strip is in the southwest quarter of the Diamond Lake RD, Umpqua NF. The air strip is state controlled and can be accessed from highway 138 to forest road 37 to 3701 to 259. The legal location for this base is T27S, R3E, Sections 11 and 14. the Lat/ Lon location of this base is N43° 13.4' W122° 25.1. This incident base is located approximately 75 miles NW of Klamath Falls, 66 miles E of Roseburg, 130 miles SW of Redmond, and 135 miles N of Medford. The incident helibase is located on site; however, there are no additional facilities at this site.

SPECIAL CONTACTS:

- Oregon State Aeronautics Department
- Medford Central Dispatch (for the purpose of requesting the use of the air strip and issuance of NOTAM)

Support

- Temporary communications such as FAX and telephone may need to be set up at the Toketee Ranger Station.
- Potable water may be acquired at the Toketee Ranger Station.
- There is no power source located on site.
- The telephone jct. box is located at the Toketee Ranger Station (8 miles from base).
- Sanitation services may be obtained from High Lakes Sanitation (coordinate with Diamond Lake RD).
- Recycling services may be obtained from Prospect Sanitation (coordinate with Diamond Lake RD).

Other questions to be addressed

- Estimated number of incident personnel?
- Type I IMT or Type II IMT?
- Estimated duration of incident?
- Has expanded dispatch been established? Is it operational?
- What is the regional priority of the incident? Are resources available?

Tasks to be performed

- Request Incident Base Map from Diamond Lake RD.
- Make copies (5) of Incident Base Plan for incoming team.
- Contact Umpqua SO and inform them that the base will be activated.
- Inform Oregon State of helibase activation.
- Inform Oregon State Aeronautics Department that air strip will be used as an incident base.
- Request Temporary Flight Restriction of 5 miles and 5000 AGL for the incident. Confirm that request has been fulfilled.
- Coordinate with Diamond Lake RD to ensure that all district employees have been informed of the base activation.
- Send KFIFC predetermined resource orders.
- Assign logistics coordinator and two assistants to coordinate layout of incident base. Issue them Incident Base maps.
- Assign check-in recorder to receive incoming resources.
- Sign Incident Base from highway 138.
- Sign from Incident Base to helibase.
- Secure the perimeter of the helibase.
- Contact Diamond Lake RD engineering for possible road improvements and access concerns.

Clearwater Incident Base Order

Power Unit

Order through KFIFC. Needs: 28,000 or 36,000 watt quiet generators. (Local or National contract)

Caterer

Order through KFIFC. Indicate number of personnel assigned to incident and projected growth. (National contract)

Shower Unit

Order through KFIFC. Indicate number of personnel assigned to the incident and projected growth. (National Contract)

Phones

Temporary communications such as FAX or telephone may be set up at the Toketee Ranger Station. In addition, there are four alternatives for phone and data communications.

1. satellite link system (National contract)
2. cell phones (Local vendor)
3. National Guard microwave communications unit (KFIFC / NWCG)
4. hardwire cable to existing jct. box at Toketee Ranger Station (Local contractor)

The decision of which system to utilize should be based on cost, availability, and time needed to render system functional. All systems may be ordered through KFIFC.

Portable Toilets

Portable toilets may be ordered through KFIFC. (Local or National contract) Indicate number of personnel assigned to the incident and expected incident growth. One toilet will accommodate 10 persons.

Need for pumping service should be addressed as pumping should occur once daily.

Security

Security personnel will be ordered through KFIFC. A minimum of two security specialists will be necessary for adequate coverage.

Potable Water Tender

A 1500 gallon potable water tender will be ordered through KFIFC. (Local or National contract) Potable water may be acquired at the Toketee Ranger Station.

Medical Support

Medical support will be ordered through KFIFC. Indicate number of personnel assigned to the incident and projected incident growth. Medical support may either be a fire medical team or a contract ambulance service that utilizes paramedics to staff the ambulance.

Sanitation

Sanitation services include: garbage pickup and the delivery/ retrieval of dumpsters to and from the Incident Base. High Lakes Sanitation is currently on contract with the Diamond Lake RD.

Recycle

Recycling services include: recycling pickup and the delivery/ retrieval of dumpsters to and from the Incident Base. Prospect Sanitation is currently on contract with the Diamond Lake RD.

NFES Orders

NFES 2069: mobile cache support van, 1ea.
NFES 0480: coffee kit, 1ea.
NFES 0549: shelter kit, 20' octagon, 8 ea.
NFES 0520: helicopter support kit, 1ea.
NFES 1040: crash rescue kit, 2 ea.
NFES 0630: evacuation kit, litter basket kit, 2 ea.
NFES 0650: evacuation kit, SKED kit, 2ea.
NFES 0320: incident base maintenance kit, 1ea.

Road and Trail System

Maps of the park road and trail system may be accessed on the K drive at the following address:
K:\ Apps\ GISData\ Data\ Transptn

Utilities

Information on file in park Fire Management Program Assistant's office.

Medical Facilities

Information on file in park Fire Management Program Assistant's office.

Stores, Restaurants, and Service Stations

Information on file in park Fire Management Program Assistant's office.

Transportation Resources / Location

Information on file in park Fire Management Program Assistant's office.

Rental Equipment Sources (by type)

Information on file in park Fire Management Program Assistant's office.

Construction Contractors

Information on file in park Fire Management Program Assistant's office.

Sanitary Facilities

Information on file in park Fire Management Program Assistant's office.

Police and Fire Departments

Information on file in park Fire Management Program Assistant's office.

Communications (radio/ telephone)

Information on file in park Fire Management Program Assistant's office.

Potable Water Sources

Potable water tender may be ordered through Klamath Falls Interagency Dispatch as necessary. Potable water may be acquired at Crater Lake National Park headquarters.

Maintenance Facilities

Information on file in park Fire Management Program Assistant's office.

Operations

Helispot Locations

Table 2 CRLA Helispot Locations

CRLA Helispots

May 2002

All coordinates referenced to North American Datum 1927 (NAD27)

ID	NAME	UTM zone 10 N easting, meters	UTM zone 10 N northing, meters	West longitude, deg min sec	North latitude, deg min sec
1	Discovery Point	568439	4752104	122 09 41	42 55 14
2	Bybee Creek	563668	4754030	122 13 11	42 56 17
3	Crater Peak #1	574851	4745982	122 05 01	42 51 53
4	Crater Peak #2	573423	4746137	122 06 04	42 51 58
5	East Rim Junction	570761	4749359	122 08 00	42 53 44
6	Garfield Peak	571659	4750331	122 07 20	42 54 15
7	Grouse Hill	571011	4759518	122 07 44	42 59 13
8	Little Castle Creek	562174	4751720	122 14 18	42 55 03
9	Mount Scott	580311	4752366	122 00 57	42 55 18
10	National Creek	561406	4764248	122 14 47	43 01 49
11	North Junction	569315	4757113	122 09 00	42 57 56
12	Pinnacles	581219	4744425	122 00 22	42 51 00
13	Pole Bridge Creek	569497	4743698	122 08 58	42 50 41
14	Red Cone #1	563838	4760270	122 13 01	42 59 40
15	Red Cone #2	567079	4760221	122 10 38	42 59

					37
16	Rim Village	569772	4751141	122 08 43	42 54 42
17	Skell Head	577687	4755198	122 02 52	42 56 51
18	Sphagnum Bog	561232	4760689	122 14 56	42 59 54
19	Timber Crater	575977	4767386	122 04 01	43 03 26
20	Union Peak	563955	4742284	122 13 03	42 49 57
21	Williams Crater	563186	4755997	122 13 31	42 57 21
22	Wizard Island	569703	4754203	122 08 45	42 56 21
23	Cloudcap	577732	4753814	122 02 51	42 56 06
24	Annie Creek Sno-Park	577072	4734598	122 03 29	42 45 43
25	Huckleberry Sno-Park	555242	4751187	122 19 24	42 54 48

In addition to these coordinates, a map of all helispots is located in Crater Lake National Park Communications Center.

Flight Routes and Restrictions

Map of flight routes and restrictions may be accessed on the K drive at the following address: K:\ Apps\ GISData\ Data\ NoFlyZones

Water Sources

Within Crater Lake National Park, water sources are primarily limited to fire hydrants and staged water containers such as pumpkins and fold-a-tanks.

Hydrant Locations

There are 28 fire hydrants within the developed areas of Crater Lake National Park. Locations include:

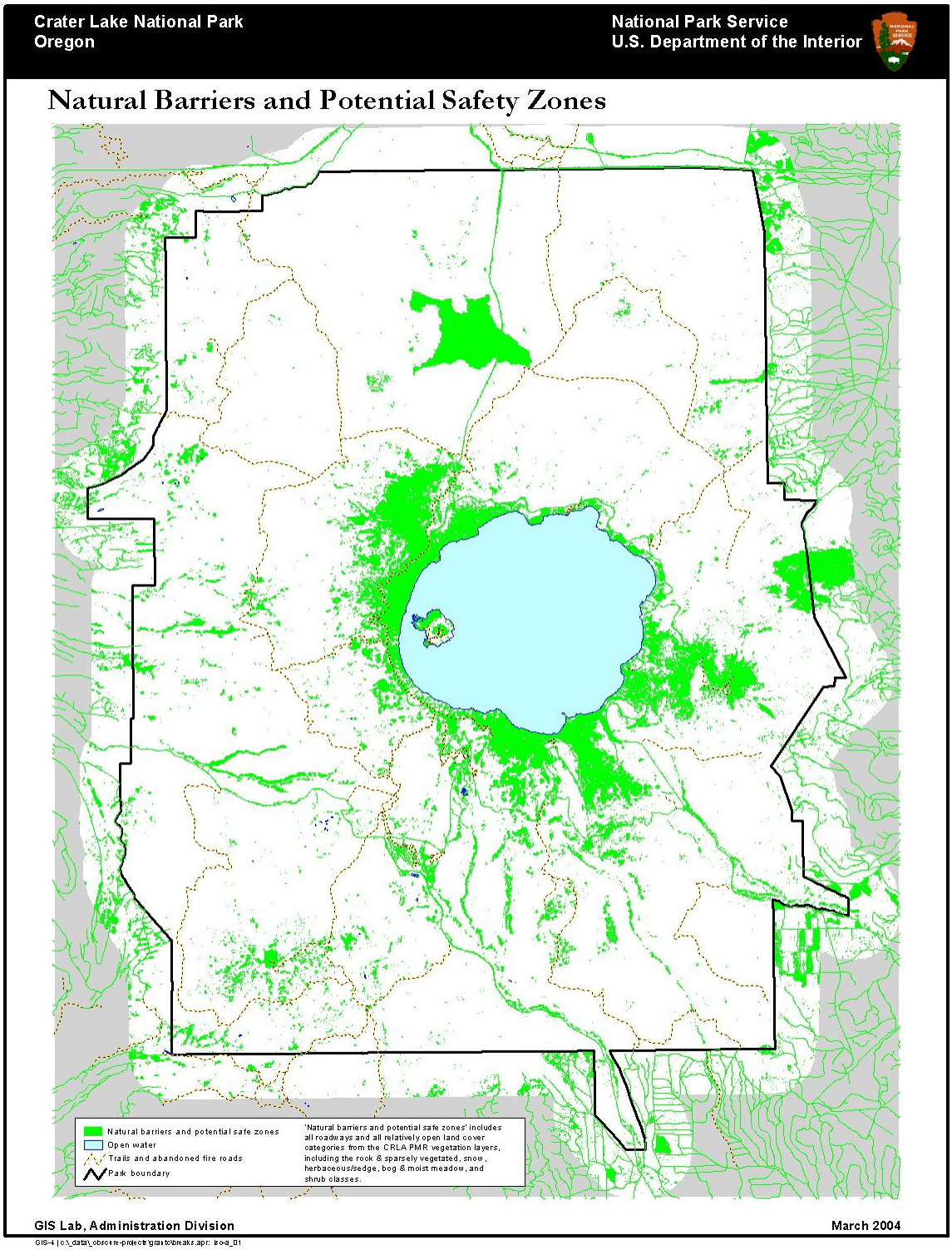
- 6 hydrants at Rim Village
- 7 hydrants at Headquarters / Stone houses
- 3 hydrants at Sleepy Hollow housing area
- 5 hydrants at Steel Circle
- 3 hydrants at Mazama Village camperstore/ cabins
- 4 hydrants at Mazama concessionaire dormitory

Fold-A-Tank Locations

Prior to fire season each year, it is recommended that a 6000 gallon pumpkin be staged and filled at Pole Bridge Creek gravel pit / helispot (N42º 50' 41" W122º 08' 58"). This may be used as a water source to support helicopter bucket operations in the south half of the park. Furthermore, this water source may be supported by water tenders or engines. In addition to the 6000 gallon pumpkin at Pole Bridge Creek, it is recommended that a second 6000 gallon pumpkin or fold-a-tank be staged and filled as needed at North Junction (N42º 57' 56" W122º 09' 00") to support helicopter bucket operations in the north half of the park. This water source may be supported by water tenders or engines.

Natural Barriers and Safety Zones

Figure 1 Natural Barriers and Safety Zones



Fuel breaks and safety zones represented in green on preceding map have not been ground-truthed. For safety reasons, this map will serve as a general guideline for data represented.

Staging Area Locations

In the event of a large fire or episode of multiple ignitions, there may be a need for numerous resources to assist with fire management efforts. When this situation arises, staging areas may be utilized to manage resources until assignments are developed and distributed.

Staging Areas and Locations

1. Maintenance Yard and "Ball Field" – Located at park headquarters. On-site access to fire hydrant, drinking water, and restrooms. Will accommodate multiple resources.
2. Annie Creek Snow Park – N42º 45' 43" W122º 03' 29" - Located south of Crater Lake Panhandle (approximately 1mile south of park boundary) on Hwy 62 S. On-site access to restrooms. Will accommodate multiple resources. Contact Klamath District ODF.
3. North Junction – N42º 57' 56" W122º 09' 00" – Located on West Rim Drive. Will accommodate multiple resources.
4. Cloudcap – N42º 56' 06" W122º 02' 51" – Located on East Rim Drive. Will accommodate multiple resources.
5. Thousand Springs Snow Park – N42 54 48 W122 19 24 – Located on Hwy 62 W outside of park. Will accommodate multiple resources. Contact Rogue River NF.

<u>Planning</u>

Park Base Map

Park Base map may be accessed on the K drive at the following address: K:\ Apps\ GISData\ Data

Topographic Map

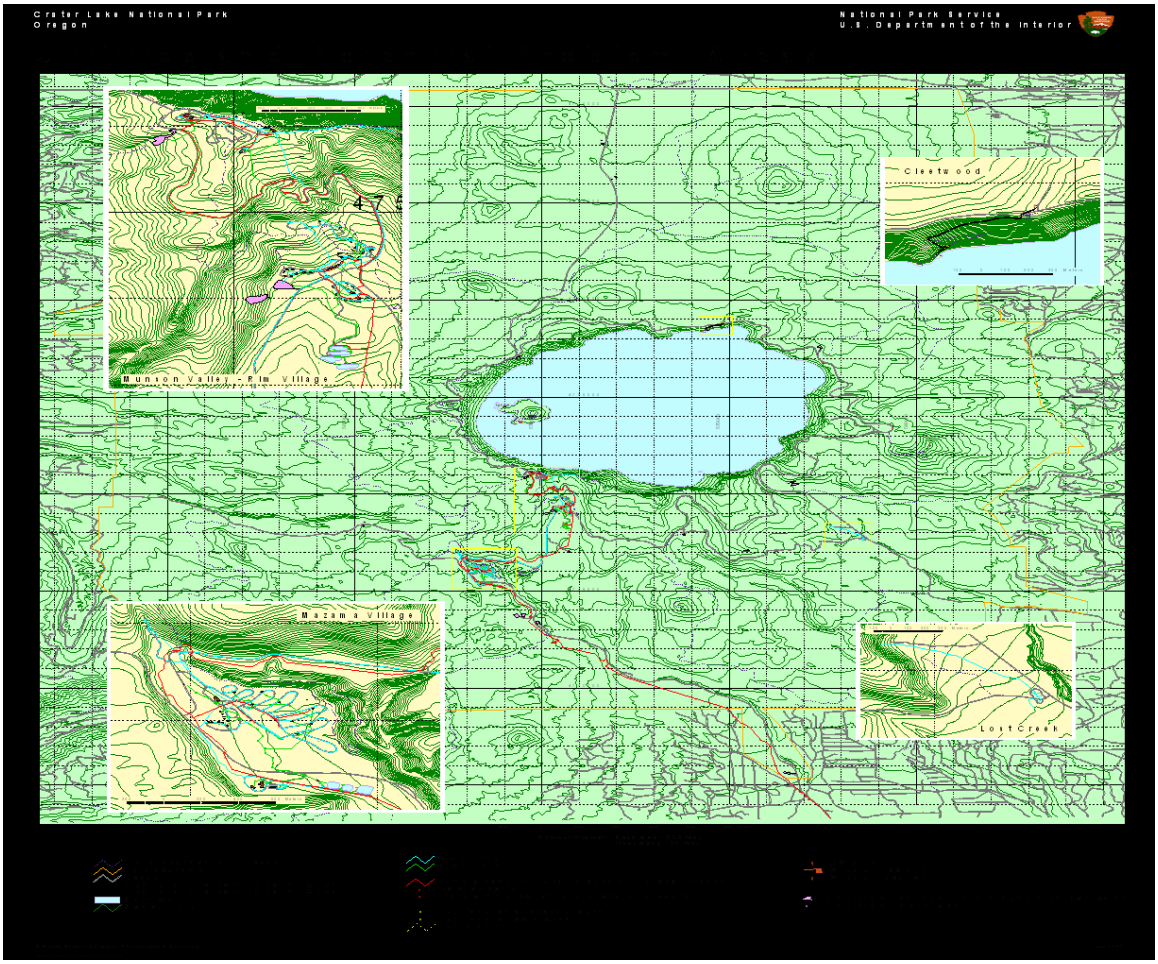
Topographic map may be accessed on the K drive at the following address:
K:\ Apps\ GISData\ Data\ Topogrph

Vegetation/ Fuels Map

Vegetation and fuels map may be accessed on the K drive at the following address:
K:\ Apps\ GISData\ Data\ Vegetatn

Hazard Locations (Ground and Aerial)

Figure 2 Hazard Locations (Ground and Aerial)



Archaeological/ Cultural Base Map

Archaeological/ Cultural Base map may be accessed on the K drive at the following address:
K:\ Apps\ GISData\ Data\ Cultural

Endangered Species and Critical Habitat

Endangered species and critical habitat map may be accessed on the K drive at the following address:
K:\ Apps\ GISData\ Data\ Species

Sensitive Plant Populations

Sensitive plant population map may be accessed on the K drive at the following address:
K:\ Apps\ GISData\ Data\ Species

Land Status

Land status map may be accessed on the K drive at the following address:
K:\ Apps\ GISData\ Data\ Boundry

Preparedness Checklist

Return any and all defective equipment to the Crater Lake National Park Fire Cache. Equipment defects will be inspected to determine necessary repair and/ or replacement.

JANUARY

- Issue Forestry Technician seasonal job announcement through Human Resource Department.
- Determine in-park fire training needs and establish training dates. This includes basic training (S-130, 190, 211, 212, and the 8hr. refresher).
- Continue Crater Lake Fire Cache and vehicle inventory requisition and replacement of equipment and supplies.
- Complete previous years data summary reports for fire monitoring.
- Update fire history and 1202 database in GIS.
- Complete all annual fire reports and required reports.

FEBRUARY

- Receive rated Forestry Technician applications from Human Resources.
- Begin seasonal hiring process (Fire and Fuels).
- Follow up with chainsaw maintenance facilities.
- Schedule wildland fire physicals for employees with primary firefighting responsibilities who require an update.

MARCH

- Begin work capacity testing (pack test).
- Finish inventory Crater Lake Fire Cache.
- Begin engine pumps test.
- Conduct annual winter fire operations meeting.

APRIL

- Continue seasonal hiring process.
- Finish engine pump tests.
- Continue pack testing.
- Coordinate operations meetings with local cooperators.
- Begin clean-up, maintenance, servicing and restocking of all fire vehicles.
- Continue inventory of Crater Lake fire cache and restock if necessary. Prepare for seasonal gear issues.
- Test pumps and chainsaws prior to crew issue.

MAY

- Continue seasonal hiring process.
- Early May – EOD of fire and fuel crew leaders.
- Conduct one 8-hour refresher course for crew leaders, permanent fire staff, and collateral duty personnel.
- Activate the Crater Lake weather stations and begin collecting observation.
- Middle of May – EOD of all crew members.
- Continue clean-up, maintenance, servicing, and restocking of engine and fire vehicles.
- Crater Lake Fire Cache – Begin summer issue of PPE and crew equipment.
- Conduct annual pre-season Supervisory Ranger, Fire and Fuels Crew Leader, and collateral duty operations meeting.
- Begin daily vehicle readiness checks as per FAMOG.
- Begin mechanical hazard fuels reduction projects.
- Prescribed burnings of approved units in prescription.
- Prescribed burn plans completed for Superintendent's signature.
- Rehires submit updated red card information. (experience/ training)
- Begin collecting fire weather observations and calculating fire danger ratings.
- Begin or continue a physical fitness program and continue all year.

JUNE

- New hires submit red card application information (experience/ training).
- Red cards issued.
- Complete all required pre-season wildland fire training (S-130, 190, 211, 212, and the 8-hour refresher) including Basic Aviation Safety.
- Begin daily individual firefighter personal protective equipment checks as per FAMOG.
- Each crew to begin and maintain a daily station log.
- Begin fuel moisture sampling (as required, ongoing).
- Establish additional fuel loading plots (as required, ongoing).
- Complete all non-fire related training (POSH, defensive driving, CRLA orientation, Update training, etc.)
- Complete engine, fire vehicle, and station inventory and restock as necessary.
- Begin season-long proficiency training as per the 2003 readiness review standards.
- Continue mechanical hazard fuel reduction projects.
- Prescribed burn preparation activities.
- Prescribed burning of approved units in prescription.
- Conduct fire hydrant flow tests as per FAMOG.

JULY

- Continue mechanical hazard fuel reduction projects.
- Pressure test fire engine primary hose per FAMOG.
- Prescribed burn preparation activities.
- Prescribed burning of approved units in prescription.
- Continue fire hydrant flow tests.
- Continue fuel moisture and fuel loading sampling.
- Conduct employee fire extinguisher use training.
- Conduct weekly and/ or daily training sessions on safety, engine operations, chainsaws, portable pumps, and helicopter use.

- Complete Readiness Review.

AUGUST
- Continue daily fire readiness check of vehicles, equipment, and PPE.
- Continue daily and weekly informal training.
- Continue proficiency training.
- Continue mechanical hazard fuel reduction projects.
- Prescribed burn preparation activities.
- Continue fuel moisture and fuel loading sampling.
- Prescribed burning of approved units in prescription.

SEPTEMBER
- Continue daily fire readiness check of vehicles, equipment, and PPE.
- Continue daily and weekly informal training.
- Continue proficiency training.
- Continue mechanical hazard fuel reduction projects.
- Prescribed burn preparation activities.
- Continue fuel moisture and fuel loading sampling.
- Prescribed burning of approved units in prescription.

OCTOBER
- Continue daily fire readiness checks of vehicles, equipment, and PPE.
- Continue daily and weekly informal training.
- Continue mechanical hazard fuel reduction projects.
- Prepare end-of-season crew report as per FAMOG.
- Continue fuel moisture and fuel loading sampling.
- Complete fuel loading data entry.
- Re-inventory engines, patrol vehicles, and station facilities. Prepare deficiency list for replacement items.
- Attend annual end of season operations meeting.
- Prescribed burn preparation activities.
- Prescribed burning of approved units in prescription.
- Begin end-of-season vehicle and power equipment winterizing.
- All fire crew leaders-submit updated experience and training (EZ form) to fire dispatch for yourself and your crewmembers.

NOVEMBER
- Prescribed burn preparation activities.
- Prescribed burning of approved units in prescription.
- Continue winterizing all fire vehicles, pumps, chainsaws, and PPE.
- Final closure of station facilities.
- Perform quality checks of fuels data.
- Prepare and submit Fire and Fuel Crews annual reports.

DECEMBER
- Send out chainsaws/ pumps for maintenance.
- All 1202's (Fire Reports) completed and entered in SACS.

- Prepare requisitions for Crater Lake Fire Cache and vehicle inventory restocking. Analyze and summarize fuel loading data collected during the season.

Structure Fire Preplan
Crater Lake National Park

Produced for the
BYBEE COMPLEX
September 14, 2006
September, 2008 Revision

Table of Contents

1) Location and Ownership
2) Park Visitation & Occupancy
3) Objectives and Decision Process
4) Structures: Numbers, Types, and Sizes
5) Water Sources
6) Hazards to Firefighters
7) Types of Protection Methods
8) Staffing Requirements

Appendix A: Equipment List

Appendix B: Site maps

Appendix C: Structure Specific Firefighting Preplans for Park Structures (courtesy of Keno Fire Dept, Klamath County, Oregon)

Appendix D: Structure Specific Firefighting Preplans (NPS)

Appendix E: Excerpt from Crater Lake Fire Management Plan (Chapter 3 Fire Management Units) Description of the vegetative type and historic fire behavior.

Appendix F: Mutual Aid Agreement with Klamath County Fire Defense Board

Appendix G: Crater Lake Evacuation Plan

Appendix H: Crater Lake Helispots

Appendix I: Cultural Resource Considerations

1) Location and Ownership of Community At Risk

The park is located in the southern Cascade Mountains of Oregon and contains 183,224 acres. A 1974 National Park Service (NPS) wilderness proposal recommended wilderness designation for 122,400 acres of lands within the park. This proposal was transmitted to Congress for consideration as legislation, but has not been acted on. In 1994, park management recommended that 179,737 acres be included in an expanded wilderness proposal, but this recommendation has not become a formal wilderness proposal. Although none of the park has been officially designated as wilderness through legislation, the park currently manages these 179,737 acres as wilderness.

The park is bounded on the north by the Umpqua National Forest, on the northeast, east, and south by the Fremont-Winema National Forests, on the southwest, west, and northwest by the Rogue River National Forest and Sky Lakes Wilderness Area. In addition, the park adjoins Sun Pass State Forest and an 80-acre block of private land on the southeastern corner (See Figure 1-1). These lands are managed for a variety of uses, including timber, grazing, watershed protection, recreation and wilderness.

The official concessionaire for Crater Lake National Park is Xanterra Parks and Resorts, White City, Oregon; phone 541-830-0050. Xanterra operates two lodges, two restaurants/gift shops, a camper store, a gas station, and the Mazama Campground. Most visitor services buildings in the Mazama Village Area are owned by Xanterra.

All other Crater Lake National Park structures, including residences and dorms, are owned by the National Park Service.

Within the **Community At Risk** there are three (3) distinct **Developed Areas**:

1) **Rim Village**
2) **Park Headquarters**, and
3) **Mazama Village**

2) Park Visitation and Occupancy

Park Visitation:

The Park had 426,883 recreational visitors in the year 2000 (DOI, 2001i). Approximately 90% of annual park visitation comes during the period June-September. Approximately 28 % of visitors to the Park are from Oregon, 33% are from California, and 8 % from Washington. Of the Oregon visitors, approximate 23 % reside in Jackson County, 11% in Douglas County, and 6% in Klamath County (USDA, 1998b).

Further breakdown of the yearly visitors are as follows:

- 56,348 local visits, from the three surrounding counties of Jackson, Douglas, and Klamath Counties (40% of the total visitors from Oregon, based on Pelican Butte Draft EIS data)
- 33,900 visitors who stayed overnight in motels
- 39,112 visitors who stayed overnight in campgrounds, RVs, or backcountry camping
- 299,000 non-local day-users (DOI, 2001k)

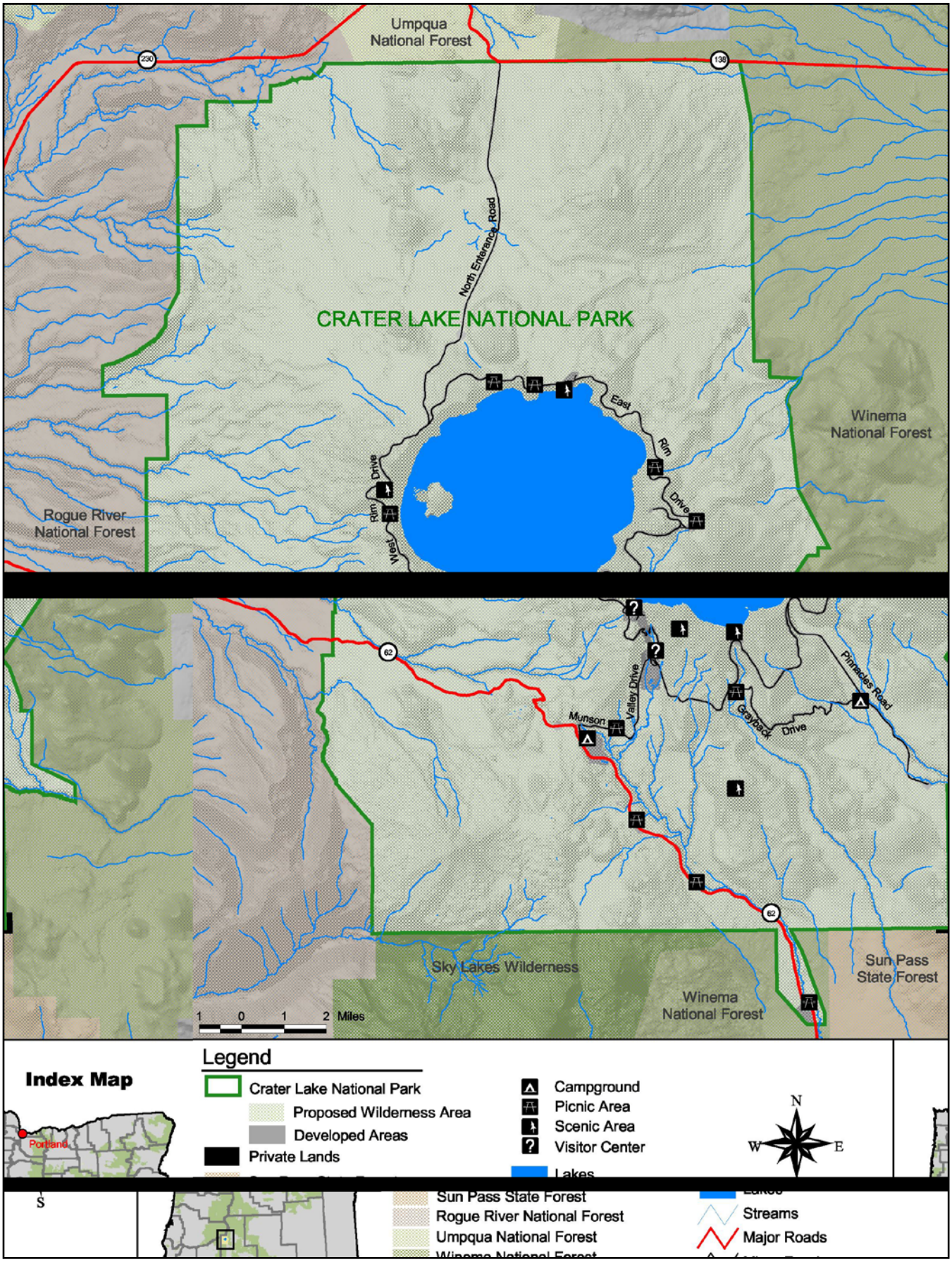


Figure 1-1. Crater Lake National Park and Vicinity

Structure Occupancy & Descriptions

VISITOR CENTERS: There are two visitor centers at Crater Lake National Park. Both are staffed by park rangers who assist with park information, trip planning, weather forecasts, and backcountry permits. Books, maps, posters, and other educational materials are sold at both locations.

The **Steel Information Center**, located at Park Headquarters, is open 9:00 AM – 5:00 PM daily. An 18 minute park orientation film is shown twice hourly. The building also houses the Park's Archives, botanical collections, and library. Building does not have a sprinkler system, but does have a fire alarm system. The structure is wood sided and shingled.

The **Rim Visitor Center**, located between the cafeteria and the lodge in Rim Village, is open June through September. The **Sinnott Memorial Overlook and Museum**, located at the bottom of a steep set of stairs below the Rim Visitor Center, is open during the same hours as the Rim Visitor Center once the snow has melted out. It contains exhibits about Crater Lake and a panoramic view. Both buildings have internal sprinkler systems. The visitor center is wood sided and shingled. The museum is partially underground and resembles a military "pill box".

EMERGENCY SERVICES: The **Canfield Building,** located in the Park Headquarters Area houses the Park's Emergency Medical Services, Law Enforcement, and Fire Management offices. The Park's Communication Center and Aquatic Research Lab are also located in the building. Building has an internal sprinkler system, and is wood frame and shingled.

MAINTENANCE: The **Maintenance Building**, located at Park headquarters contains the Park's Fire & Ambulance Station, pumping station, park-wide phone system, emergency generator (Powers only the Park Headquarters Area), gas station (underground tanks), Flammable Locker Room, mechanics shop, roads vehicle storage/ shop, and utility shop. One bay has an internal sprinkler system. The building has stucco siding and steel roofing.

ADMINISTRATION: The **Sager Building**, located at Park Headquarters contains the Park's Administrative and Natural History Association Offices. Building has an internal sprinkler system, and is wood sided and shingled.

RESOURCE MANAGEMENT: The **Resource Management Building**, located at Park Headquarters and adjacent to maintenance building houses the Wild fire engines, GIS offices, and resource offices. It is wood frame with metal roof.

The **Science & Learning Center Research Complex (Building 19) & dorm (Building 20)** are located above Stone House Residences in the Park Headquarters Developed area. Both buildings have internal sprinkler systems and are wood sided/ shingled.

RESIDENTIAL: The **Sleepy Hollow, Steel Circle, and Stone Houses Residential Areas** located in the Headquarters Area are occupied by seasonal/ permanent National Park Service employees/ families and Xanterra Employees. There are approximately 20 families who stay year round in the Sleepy Hollow and Steel Circle apartments. These apartment complexes are wood sided with metal roofs. There are no residential sprinkler systems in buildings. The Stone House residences are wood sided and shingled. Maximum occupancy of the Headquarters Housing Area is approximately 100.

The **Mazama and Rim Village Dormitories (three buildings)** are occupied by both seasonal and permanent Xanterra employees. The dormitory at Rim Village is operational from late spring to mid fall. One of the dormitories at Mazama is operational all year long but generally has minimal staffing/occupancy in winter months. Both dorms have internal sprinkler systems and the Mazama Dorms have backup emergency generators. Mazama Village Dorms have metal roofing and wood siding. Rim Village Dorm has wood siding. Maximum occupancy of both Mazama Dorms is approximately 75 and Rim Dorm is approximately 100.

There are two Xanterra Employee **RV Parks in Mazama Village.** One is located between Visitor Campground and Highway 62 and the other is located adjacent to Mazama Dormitories. Both are occupied by approximately 25 hard sided RVs in the summer and early fall.

LODGING: There are two facilities for overnight lodging inside the park. **Crater Lake Lodge** has 71 rooms and is located at Rim Village, overlooking the lake. It is open from mid spring to mid fall. The Lodge has an internal sprinkler system and backup emergency generator. **Mazama Motor Inn** has 40 units in 10 cabins and is located seven miles south of the lake in Mazama Village. It is generally open during the summer months only.

CAMPGROUNDS: There are two campgrounds inside Crater Lake National Park. **Mazama Campground** contains 213 sites and is operated by Xanterra Resorts from early June to early October. The campground has restrooms, showers, laundry, and a camper store/gas (underground tanks) and propane fill station (tank is located to the left side and behind store). The camper store also contains a large commercial laundry facility for Xanterra Lodges (does not operate in winter months). There is an alarm system in Camper Store and the building is wood sided.

The **Lost Creek Campground** is operated by the National Park Service in the summer months and has 16 tent camping sites. It is located in the southeast corner of park on the spur road to Pinnacles Overlook. There is a rock sided, fire proof shingled restroom. The water system is gravity fed from a spring located approximately 1 mile west and uphill from campground. A stream runs adjacent to restroom but has a threatened Bull Trout species.

The **Mazama Village Annie Creek and Rim Village Restaurants/Gift shops** are operated by Xanterra. Both buildings are wood/rock sided. They also have internal sprinkler systems.

BRIDGES: Within the Community At Risk are two bridges on Munson Valley Road. The **Annie Creek Bridge** is located just north of the Mazama Village area and has the Park's Water Treatment Plant and pumps under bridge. This water treatment plant provides water for the entire developed area.

The **Goodbye Bridge** is located midway between Mazama Village and Park Headquarters Developed Areas. Both Bridges have a designed load rating of HS15, which is less the "Standard Highway Rating" of HS20. Inventory Rating for both bridges is 27 tons and Operating Rating is 35.9 Tons.

3) Objectives and Decision Process

Objectives:

1. Provide for public and firefighter safety.
2. Protect and preserve historic structures.
3. Protect and preserve trees and vegetation surrounding the structures.

Decision Process:

There are three levels for the structure fire preparedness decision process as defined by the proximity of wildfire to Community At Risk (figure 3-1). The decision process begins when the wildfire has potential to go beyond initial attack. The levels are as follows:

*** Level I Within a five mile (5) radius from approximate geographical center of Community At Risk. Fire is uncontained beyond initial attack.**

*** Level II Within a three (3) mile radius from approximate geographical center of Community At Risk. Fire is uncontained beyond initial attack.**

*** Level III Within one (1) mile of any developed area within Community At Risk (shaded area on map). Fire is uncontained beyond initial attack.**

In the decision process, fire progression could dictate moving rapidly through all or some of the Levels simultaneously (i.e. Fire is already within one mile of a developed area risk and the decision components, as applicable, of Levels II and III will need implementation at same time as Level I's). Also, there are some areas which could be excluded if natural barriers prevent any possible threat to a Developed Area.

Level I

- IC/IMT and FMO need to review the Structure Protection Plan
- Make the following notifications:

1) Chiloquin/Agency Lake Fire District Chief and request the Chief's assessment of situation in the event that County and State Conflagration resources might be requested.
2) Fire Staff on Fremont/Winema National Forest
3) Oregon Department of Transportation Dispatch (possible road closures & evac)
4) Adjacent Law Enforcement Jurisdictions (possible road closures & evac)
5) American Red Cross (for help w/ possible evacuation relocation sites)
6) Park Personnel per Fire Management Plan (resource issues, etc.)

- Set up a dip site w/ 6,000 tank for Type I helo - not inside of Park
- Include structures that lie within Community At Risk in Incident Status Summary (ICS 209)

Level II

- Order the following resources:

1) Representatives from the agencies notified in "Level III"

2) Equipment List (Appendix A)
3) Two (2) Task Force Leaders
4) One (1) Division Supervisor
5) Two (2) Water Tenders
6) Two (2) Staging area managers (one for the relocation of evacs)
7) Five (5) Type IIIs and/or IV Engines

- Develop an evacuation plan based on the fire's behavior (refer to Appendix)
- Incident Status Summary should indicate the # and type of structures that are threatened (residences, commercial, etc.) within the Community At Risk.

Level III

- Order the following resources:

1) Two (2) Structural Task Forces (one water tender & 4 Type I/II engines)
2) One (1) Type II Initial Attack crew
3) Type II helo w/ management
4) Appropriate number of external and/or internal Law Enforcement to help with Evacuation
5) Two (2) ambulances to help with evacuation of disabled residents/visitors
6) Two (2) FALC and a Falling Boss

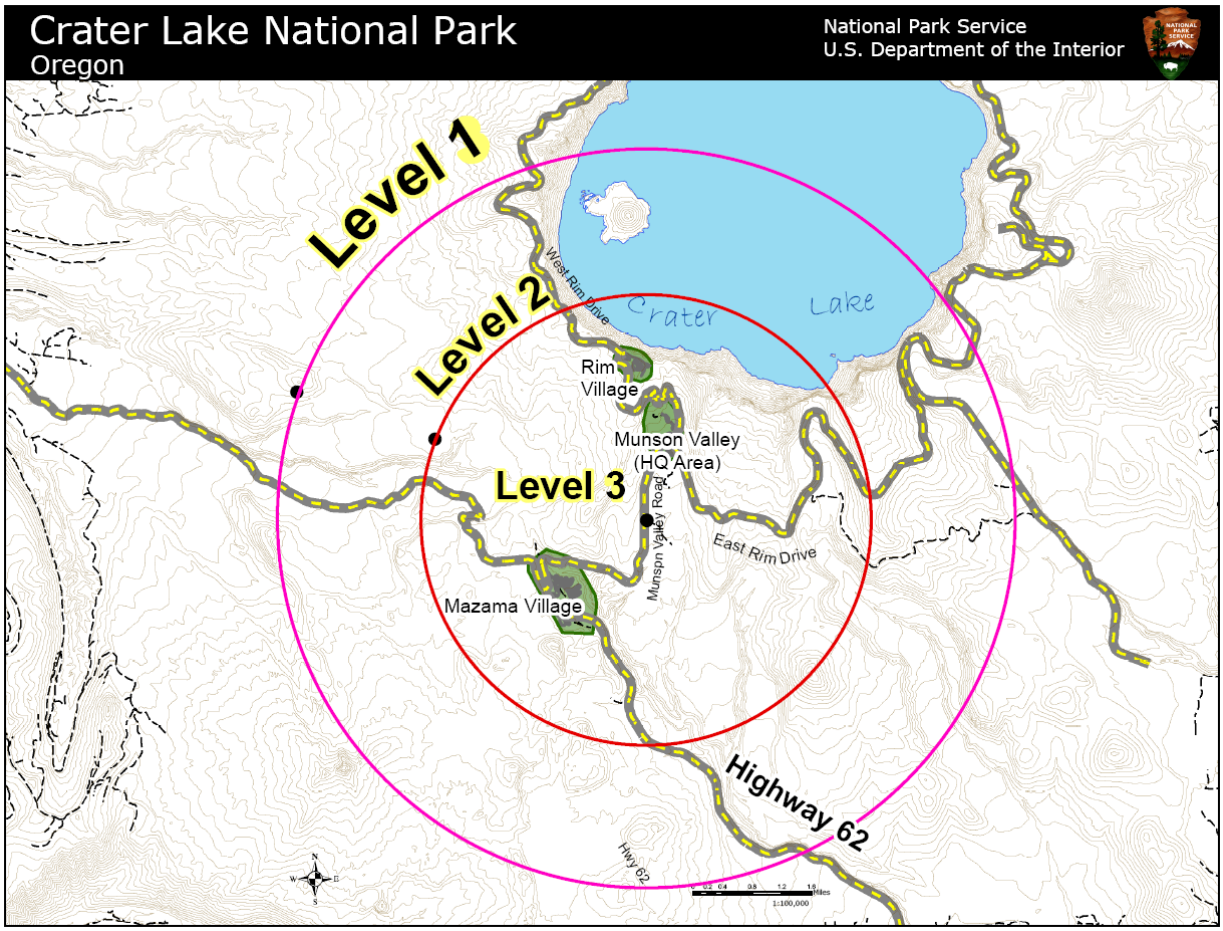


Figure 3-1 Decision Levels

4) Structural Protection Needs

The following table defines all of the structures and their locations in Crater Lake National Park. These structures would require structural protection in the event a wildland fire threatened the Community At Risk.

Table 1 Historical Structures and Locations in Need of Protection

#1	*61584*	*Basement, 1st, 2nd, Attic (6,552)*	*Admin Offices*	*Admin. Bldg.*	*1934-1936 (1986)*	*Munson Valley (HQ)*
#2	*61603*	*1st, 2nd (5,245)*	*Interp Offices/ Visitor Center*	*Ranger Dormitory*	*1932-1933 (1986)*	*Munson Valley (HQ)*
#3	*61594*	*1st,2nd & Attic (5,971)*	*Ranger/Resource Mgmt Offices & Dispatch*	*Mess Hall*	*1929 (1987)*	*Munson Valley (HQ)*
#4	*61605*	*1st:1,820 2nd:1,729 (3,549)*	*Maint Storage SAR Cache Wildland Fire Cache*	*Warehouse*	*1926*	*Munson Valley (HQ)*
#5	*61595*	*1st, 2nd, Attic (4,606)*	*RM Offices & parking*	*Machine Shop*	*1932 (1998)*	*Munson Valley (HQ)*
#9	*61592*	*1st-1075 2nd-1075 (2,150)*	*Maint Storage*	*Lumber Shed*	*1934*	*Munson Valley (HQ)*
#10	*61593*	*1st-1075 2nd-1075 (2,150)*	*Maint Storage*	*Lumber Shed*	*1934*	*Munson Valley (HQ)*
#11		*1st-1075 2nd-1075 (2,150)*	*Maint & VP Storage*	*Lumber Shed*	*1934*	*Munson Valley (HQ)*
#13	*61602*	*252*	*Storage/Trail Crew Cache*	*Old Meat House*	*1929*	*Munson Valley (HQ)*
#14	61589	1st, 2nd, Attic (9,734)	Maint Shops	Maintenance Building	1955 (1993)	Munson Valley (HQ)
#14-A	61589	1st, 2nd, (11,412)	Maint Offices/ Shops/parking	Maintenance Building	1964 (1993)	Munson Valley (HQ)
#15-A	61616	1st, 2nd & attic:Total:1 639	Quarters	Residence	1963	Munson Valley Steel Circle

#15-B	61616	1st, 2nd & attic:Total: 1,639	Quarters	Residence	1963	Munson Valley Steel Circle
#17-A	61618	1299	Quarters	Residence	1956 1957 1958	Munson Valley Steel Circle
#17-B	61618	1095	Quarters	Residence	1956 1957 1958	Munson Valley Steel Circle
#17-C	61618	1095	Quarters	Residence	1956 1957 1958	Munson Valley Steel Circle
#17-D	61618	1299 Total-4788	Quarters	Residence	1956 1957 1958	Munson Valley Steel Circle
#18-A	61626	1st, 2nd & attic:Total: 1,639	Quarters	Residence	1963	Munson Valley Steel Circle
#18-B	61626	1st, 2nd & attic:Total: 1,639	Quarters	Residence	1963	Munson Valley Steel Circle
#19	*61612*	*1st:1,044* *2nd:1,052* *Bsmt160* *Total-2,256*	*Science and Learning Center Offices*	*Supt's summer residence*	*1932-* *1933* *(2005)*	*Munson Valley Stone Houses*
#20	*61628*	*1st: 800* *2nd:476* *Total-1,276*	*Science and Learning Center Quarters*	*Chief Naturalist's summer residence*	*1933* *(2005)*	*Munson Valley Stone Houses*
#24	*61629*	*1st Fl 504* *2nd Fl 375* *Total-879*	*Quarters*	*Residence*	*1931*	*Munson Valley Stone Houses*
#24-A		256	Garage	Garage	1958	Munson Valley Stone Houses
#25	*61630*	*1st Fl 525* *2nd Fl 308* *total-833*	*Quarters*	*Residence*	*1931*	*Munson Valley Stone Houses*
#26-A	61631	1639	Quarters	Residence	1963	Munson Valley Steel Circle
#26-B	61631	1639	Quarters	Residence	1963	Munson Valley Steel Circle

#28	*61632*	*1st Fl 504 2nd Fl 375 Total-879*	*Quarters*	*Residence*	*1933*	*Munson Valley Stone Houses*
#28-A			Garage	Garage	1954	Munson Valley Stone Houses
#30	*61633*	*1st Fl 448 2nd Fl 184 Total-632*	*Quarters*	*Residence*	*1929*	*Munson Valley Stone Houses*
#31	*61634*	*1st Fl 448 2nd Fl 184 Total-632*	*Quarters*	*Residence*	*1928*	*Munson Valley Stone Houses*
#32	*61635*	*1st Fl 448 2nd Fl 184 Total-632*	*Quarters*	*Residence*	*1927*	*Munson Valley Stone Houses*
#33	*61588*	*1st Fl 917*	*Garage for Qtrs*	*Garage*	*1933*	*Munson Valley*
#34ABC	*61636*	*1st Fl1519 2nd Fl1240 Bsmt. 728 Total-**3487***	*Quarters*	*Hospital & Quarters*	*1941 – 1948*	*Munson Valley*
#36	*62897*	*518*	*Storage/Interp*	*Transformer & Phone Building*	*1928*	*Munson Valley (HQ)*
#37	*61591*	*589*	*Maint/Trails Cache*	*Comfort Station*	*1940*	*Munson Valley (HQ)*
#40	61590	1890	Garage for Qtrs	9 Stall Garage	1998	Munson Valley (HQ)
#58		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	2004	Mazama Campground A Loop
#59		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	2005	Mazama Campground C Loop
#60		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	2006	Mazama CG C Loop
#61		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	2007	Mazama Campground D Loop
#62		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	2008	Mazama Campground E Loop
#63		1st Fl 364	Comfort Station Leased by	Comfort Station	1961	Mazama Campground

			Concessionaire			E Loop
#64		1st Fl 364	Comfort Station Leased by Concessionaire	Comfort Station	1961	Mazama CG G Loop
#66	*62937*	*1st Fl 705* *2nd Fl 341*	*Interp/Visitor Center*	*Kiser's Studio*	*1921* *(2002)*	*Rim Village*
#67	*62939*	*1st Fl 1301*	*Interp/Visitor Center*	*Sinnott Memorial*	*1930* *(2002)*	*Rim Village*
#68	*62942*	*1st Fl 589*	*Comfort Station*	*Comfort Station*	*1937* *(2002)*	*Rim Village*
#72	*62970*	*1st Fl 595*	*Comfort Station*	*Comfort Station*	*1928* *(2006)*	*Rim Village*
#82	62933	1st Fl 217	Interp Amphitheater	Amphitheater	1962	Mazama CG D&E Loop
#83A	61637	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#83B	61637	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#84A	61638	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#84B	61638	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#85A	61639	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#85B	61639	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#86A	61640	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#86B	61640	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow

#87A	61641	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#87B	61641	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#88A	62883	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#88B	62883	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#89A	62887	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#89B	62887	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#90A	62890	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#90B	62890	1st-738 2nd-508 (1,238)	Quarters duplex	Residence	1991	Munson Valley (HQ) Sleepy Hollow
#116	*62971*	*1st Fl 1300* *2nd Fl 275*	*Interp*	*Community House*	*1924* *(2001)*	*Rim Village*
#131			Warehouse	Warehouse		Medford
#168	*63008*	*1st Fl 456* *2nd Fl 356*	*Fire Lookout*	*Fire Lookout/* *Museum*	*1931* *1932*	*Watchman*
#170	73568	1st Fl 196 2nd Fl 196	Fire Lookout	Fire Lookout	1952	Mt. Scott
#171		255	Utility	Fuel Transfer	1998	Cleetwood Parking
#172			Lake Level Gauging Station	Lake Level Gauging Station	1959	Cleetwood
#194	*62903*		*Boat Shed*	*Boat Shed*	*1941*	*Wizard Island*
#198	*73582*	*1st Fl 146*	*Rangers - Backcountry Cabin*	*Ski Cabin*	*1934*	*Wine Glass – Rim Drive*
#219-A	62893	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#219-B	62893	Total-1639	Quarters	Residence	1964	Munson Valley

						Steel Circle
#220	73787		Storage	Survey Storage Pole Barn	1987	South Yard
#221-A	62894	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#221-B	62894	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#222	61585	1st 2960 2nd 2960 Total-5920	Community Center	Community School	1964	Munson Valley Steel Circle
#225	62911		Comfort Station	Comfort Station	1983	Cleetwood Cove
#226-A	62895	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#226-B	62895	Total-1639	Quarters	Residence	1964	Munson Valley Steel Circle
#227-A	62896	1st Fl 679 2nd 1019 Total-1698	Quarters	Residence	1958	Munson Valley Steel Circle
#227-B	62896	1st Fl 679 2nd 1019 Total-1698	Quarters	Residence	1958	Munson Valley Steel Circle
#228		48	Maint	Mazama Pump house	1972	Annie Spring
#229		120	Maint	Annie Springs Pump house	1975	Annie Spring
#231	62907		Comfort Station	Wizard Island	1989	Wizard Island
#232	62934	80	Rangers – Fee Booth	Annie Springs Entrance Station	1990	Near Junction of Hwy 62 & Munson Valley Road
#233			Maint	Munson Flow Monitor Station	1990	Munson Lagoons South of Steel Circle
#234	62921	80	Rangers – Fee Booth	North Entrance Station	1991	North Entrance Road
#235			Maint	Mazama Flow Monitoring Station	1993	Mazama Lagoons
#236	62914	384	Comfort Station	Comfort Station	1998	Lost Creek CG
#237	73770		Maint Water Treatment	Water Treatment	1994	Near Lost Creek CG

#238	61587	936	Fitness Center	Chevron Dorm	1958	Munson Valley/Steel Circle
#240	62922		Vault Toilet	Vault Toilet	2000	North Entrance
#241	63010		Vault Toilet	Vault Toilet	2001	Pumice Point Picnic Area
#242	63011		Vault Toilet	Vault Toilet	2001	Whitebark Pine Picnic Area
#243	63012		Vault Toilet	Vault Toilet	2001	Vidae Falls Picnic Area
#244			Vault Toilet	Vault Toilet	future	Lightning Springs Picnic Area
#245	63009		Vault Toilet	Vault Toilet	2001	Corrals
#246	62927		Vault Toilet	Vault Toilet	2002	Old West Boundary
#247	62924		Vault Toilet	Vault Toilet	2001	Ponderosa Picnic Area
#248			Vault Toilet	Vault Toilet	future	reserved
#249			Vault Toilet	Vault Toilet	future	reserved
#250			Vault Toilet	Vault Toilet	future	reserved
#251	85540	27,000	Central Dormitory Leased by Concessionaire	Government Owned	1998	Off Hwy 62 South Near Mazama CG
#252	85542	4300	Garage/Generator Building Leased by Concessionaire	Government Owned	1998	Off Hwy 62 South Near Mazama CG
#253	85541	9300	Dormitory Leased by Concessionaire	Government Owned	1998	Off Hwy 62 South Near Mazama
#254				reserved		
#255				reserved		
#505			Boathouse	Concession owned		Wizard Island
#551			4 plex cabin	Concession owned	1991?	Mazama Village
#552			4 plex cabin	Concession owned	1991?	Mazama Village
#553			4 plex cabin	Concession owned	1991?	Mazama

						Village
#554			4 plex cabin	Concession owned	1991?	Mazama Village
#555			4 plex cabin	Concession owned	1991?	Mazama Village
#556			4 plex cabin	Concession owned	1991?	Mazama Village
#557			4 plex cabin	Concession owned	1991?	Mazama Village
#558			4 plex cabin	Concession owned	1991?	Mazama Village
#559			4 plex cabin	Concession owned	1991?	Mazama Village
#560			4 plex cabin	Concession owned	1991?	Mazama Village
#565		*1st-12,353* *2nd-12,353* *3rd-11,222* *B-12,353* *A-8,093*	*Hotel – Leased by Concessionaire*	*Lodge*	*1912-1924* *1989-1994*	*Rim Village*
#570			Rim Café & Gifts	Government Owned – space shared w/ Concession	(2006)	Rim Village
#573		364	Comfort Station	Concession owned	1995	Mazama CG – F Loop
#574		6,596	Camper Service Building	Camper Service Bldg – Concession owned	1990 (1992)	Mazama Village
#575	85487	?	Concession Owned Dormitory	Rim Dorm	1972	Rim near Lodge

Note: Structures in Italics are listed on the Historic Register

5) Water sources

Water sources are very limited in the park and are generally associated with steep canyon walls. Crater Lake, Sun Creek, and Lost Creek are prohibited from use as water sources due to their resource sensitivity. All other potential water sources must be approved by a resource advisor, or the Fire Management Officer if no resource advisor is available.

Within Crater Lake National Park, water sources are primarily limited to fire hydrants and staged water containers such as pumpkins and fold-a-tanks.

Hydrant Locations

There are 35 fire hydrants within the developed areas of Crater Lake National Park. Locations include:

- 10 hydrants at Rim Village
- 6 hydrants at Headquarters / Stone houses
- 3 hydrants at Sleepy Hollow housing area
- 5 hydrants at Steel Circle
- 7 hydrants at Mazama Village Camper Store, Cabins & Annie Creek Restaurant
- 4 hydrants at Mazama concessionaire dormitory

6) Communications

Radio and wireless telephone communications are limited in several areas of the park due to mountainous terrain creating dead spots. The park maintains two radio repeaters to minimize this limitation. Some of these communications dead spots coincide with blind spots experienced at the parks' two fire lookout towers. These radio repeaters and fire lookouts are located atop The Watchman and Mt. Scott.

7) Hazards to Firefighters:

a) Propane Tanks in Mazama Campground and behind Mazama Camper Store

b) Only one entry/exit road into Mazama Village Campground & Cabins

c) Only entry/exit road into Rim Village.

d) Only one entry/exit road into the Stone House area at Headquarters

e) Only one entry/exit road into the Mazama Dorm Complex

f) Only one entry/exit road into Steel Circle and Sleepy Hollow

g) The hazard posed by direct impingement by wildfire on hillsides above Sleepy Hollow and Mazama Dorm Housing Areas.

h) Flammable vegetation growing next to buildings.

i) Gas pumps at Maintenance Building #14 in Headquarters Area and at Mazama Village Camper Store.

j) (2) 275 Gallon vented Heating Fuel Tanks in each Steel Circle Apartment first floor.

7) Types of Protection Methods:

1. Establish a hose lay with sprinklers and protection lines. Several hours (4-5) in advance of the fire; sprinklers should be operational and additional wetting should be done with protection lines, as necessary.
2. Whenever possible, incorporate natural barriers (i.e. green vegetation, lawn, and shoreline) to establish the defense perimeter.
3. Use light, flashy fuels for burnout operations. Avoid burning in brush or timbered areas.
4. Use fire shelter wrap to cover fuel tanks and any other hazardous materials.
5. Shelter wrap vents and any other unprotected openings to the structures.
6. Sweep the roofs (use a hose stream on the roofs), as necessary, to remove leaf litter build-up.
7. Fuels management activities near the building should be limited to removing standing dead snags and overhanging trees.
8. Permanent sprinklers mounted on the buildings and plumbed into a hose system may be an option for preemptive structure defense. Due to the historic nature of the buildings on the property, this option would need to be approved by cultural resource advisors.

Building # 551 – 560 (Mazama Cabins):

2 Crews and a Faller 2 days to clear snags and small diameter trees around cabins.

18” around foundation perimeter should be bare soil.

Close crawl space vents

Cabin wrap

Therma-Gel or foam shake roofs

2 Type I Engines

Building # 573 – F-Loop Comfort Station:

Wrap gable vents

18” around foundation perimeter should be bare soil.

Safety Zone is parking lot between Camper Store and Annie Creek Restaurant

Buildings 251-253: Mazama Dorm Complex

Remove recycle dumpsters

Buildings 24, 25, 28, 30, 31, 32, 33, 34 (Stone Houses at HQ):

Set up sprinklers

Apply foam to cedar shake roofs

Use Type 3 or 4 Engines due to egress problems

Building 575 (Rim Dorm):

Set up sprinklers attached to hydrants at ends of structure

8) Staffing Requirements:

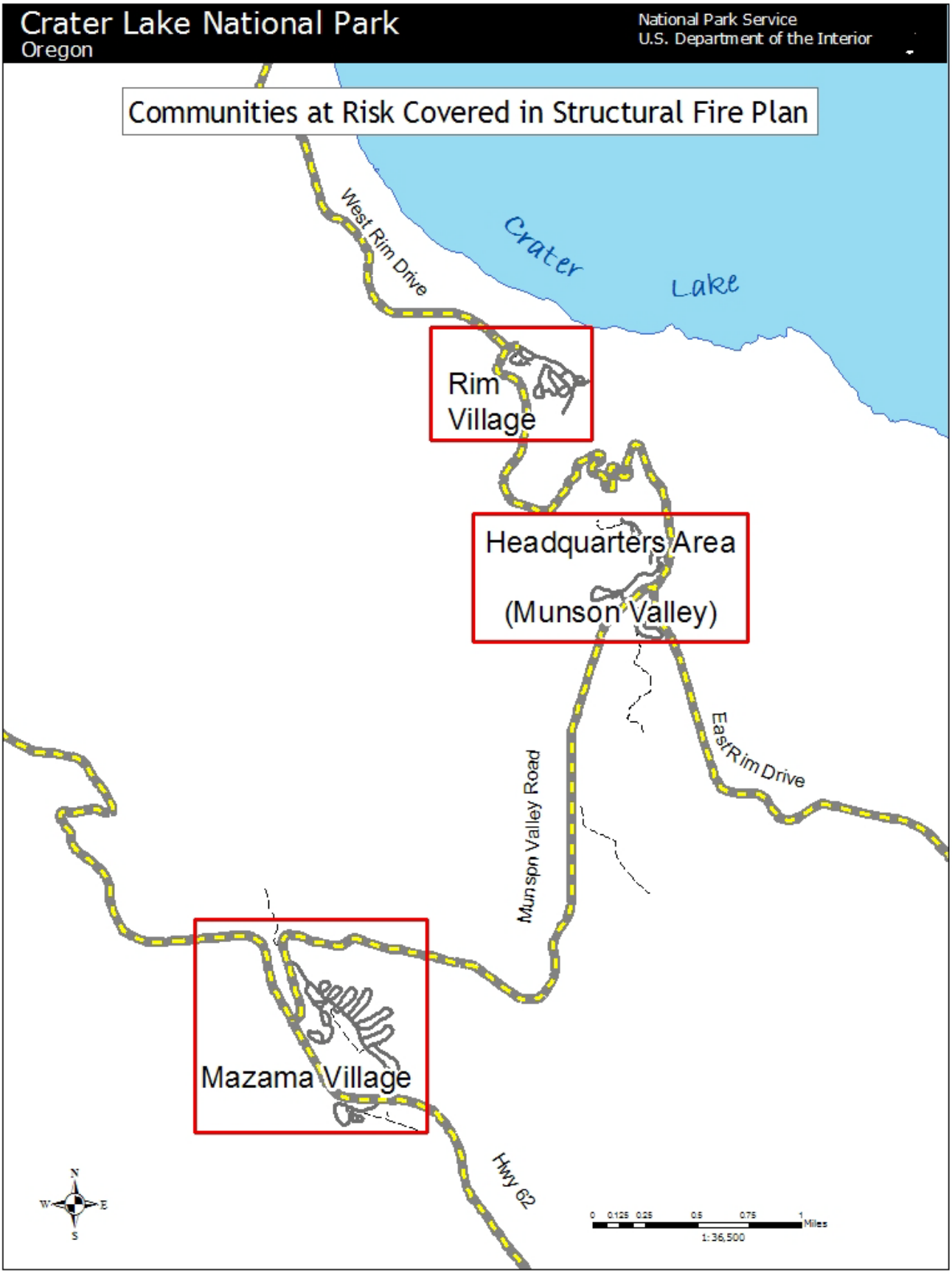
It is recommended that the structure protection efforts be staffed with a minimum of ten firefighters. Initial implementation of the plan will require more resources to expedite set up. A twenty person hand crew or two fire use modules is sufficient to set up the system in one operational period.

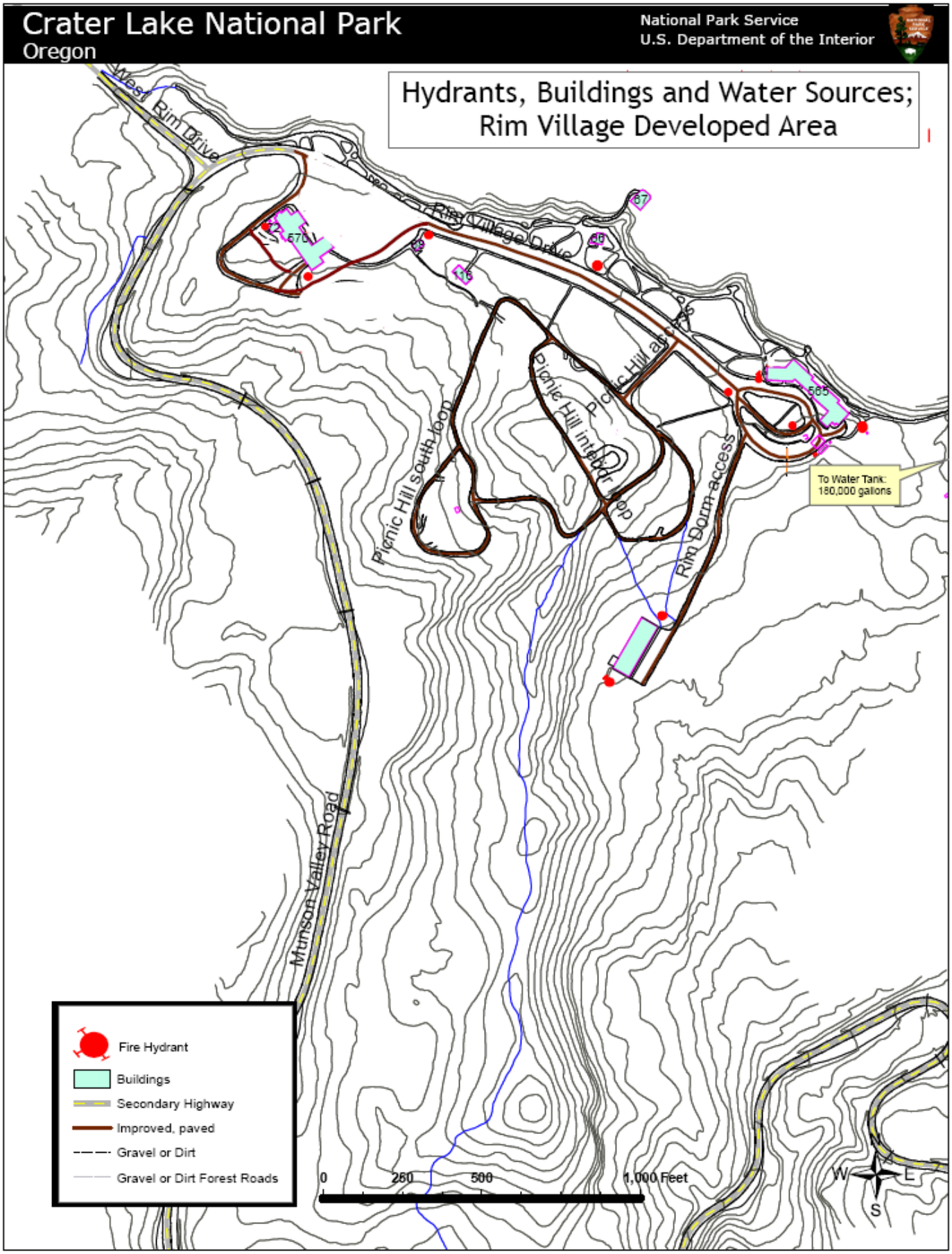
Appendix A: Equipment List

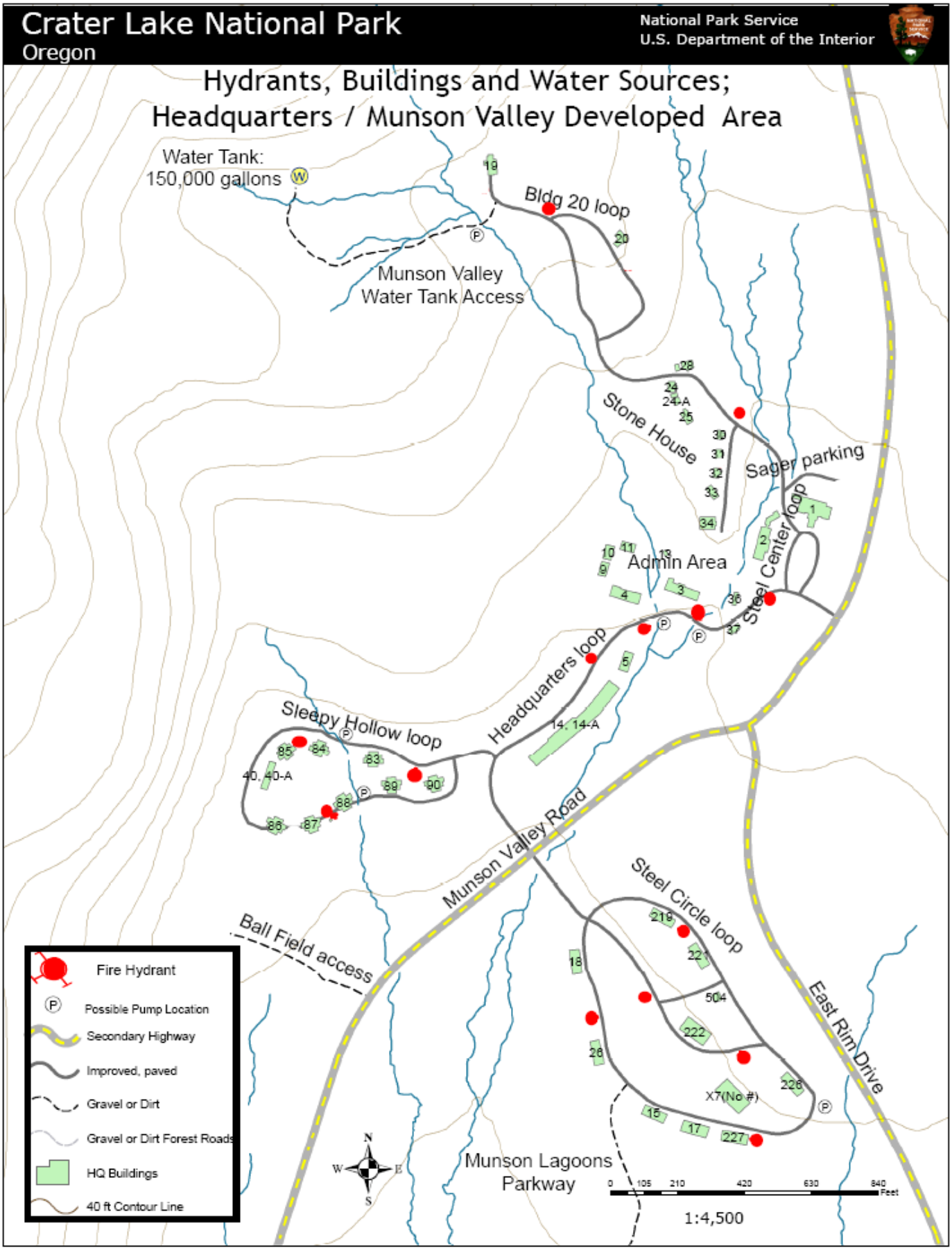
Item	Quantity
Hose 1 ½ inch (50’ sections)	200
Hose 1 inch (100’ sections)	100
Hose ¾” (50’ sections) w/ appliance	40
Wye, Gated 1 1/2" inch	50
Wye, Gated 1”	30
Reducers, 1” – ¾”	50
Reducers, 1 ½” – 1”	100
Sprinkler Kit	5
Visqueen roll, 100’ long & 16’-20’ wide	3
Drip Torches	20
Fusees, (case)	5
Foam, Class A (5 gallon container)	20
Nozzles-Forester, 1”	50
Mark III pump kits	12
Volume Pump, 3”	4
Tee, Inline 1 ½” w/ shutoffs	30
Tanks, Portable (6,000 gallons)	2
Tanks, Portable (1800-2500 gallons)	10
Shelter Wrap (roll)	10
Staple Hammers w/ lots of staples	10
Pump, Backpack	20
Ladder, 20-24’ extension	3
Duct Tape (roll)	5
Zip Ties	400
Nails	
Pipe Strapping Tape	
Traffic Cones	
Barricades	
Ribbon	

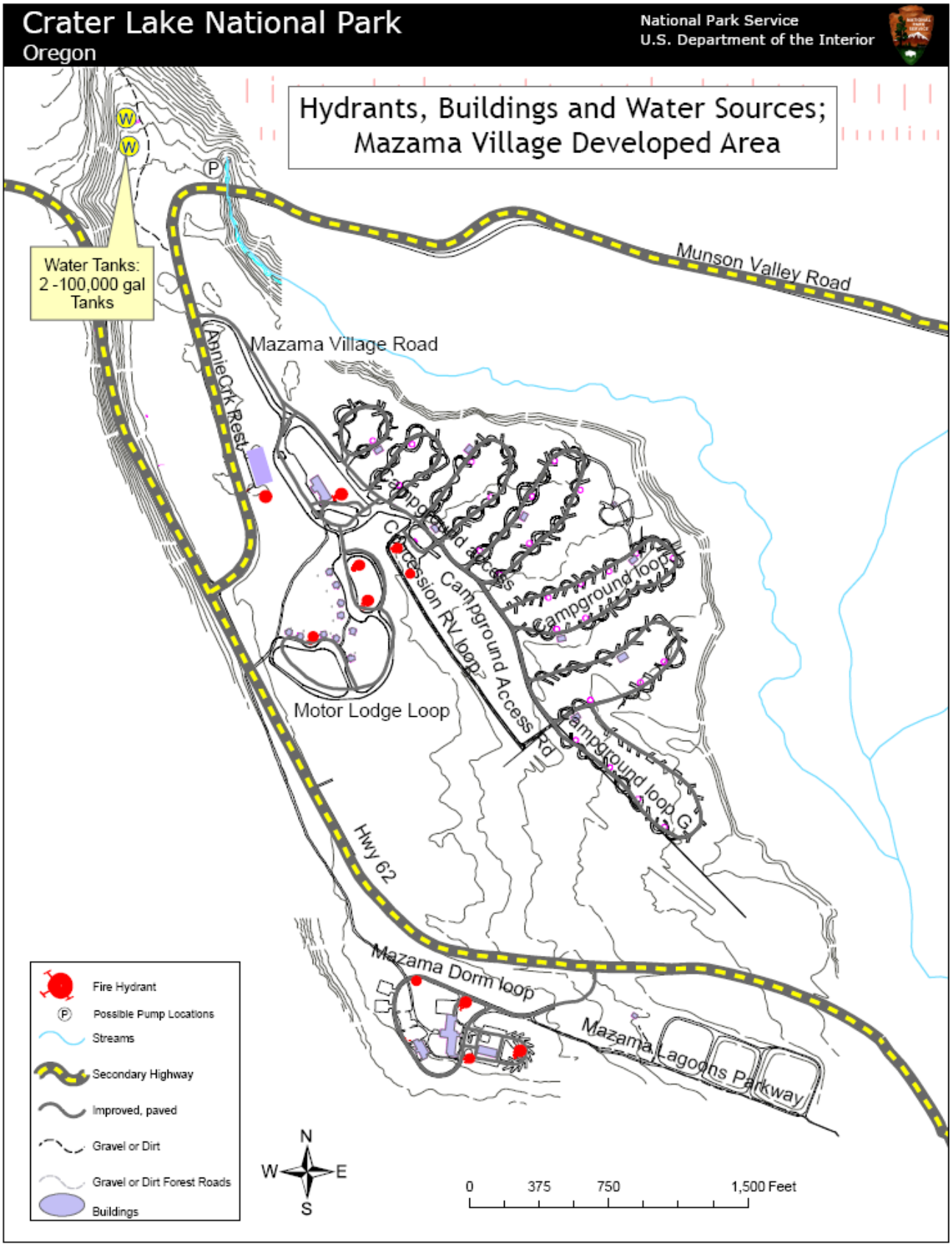
Appendix B Site Maps

Figure B – 1 Crater Lake National Park Community At Risk
Figure B – 2 Rim Village Developed Area
Figure B – 3 Headquarters Developed Area
Figure B – 4 Mazama Village Developed Area


Crater Lake National Park
Oregon
National Park Service
U.S. Department of the Interior
Communities at Risk Covered in Structural Fire Plan
West Rim Drive
Crater
Lake
Rim
Village
Headquarters Area
(Munson Valley)
East Rim Drive
Munson Valley Road
Mazama Village
Hwy 62
N
W
E
S
0 0.125 0.25 0.5 0.75 1 Miles
1:36,500


Crater Lake National Park
Oregon
National Park Service
U.S. Department of the Interior
Hydrants, Buildings and Water Sources;
Rim Village Developed Area
West Rim Drive
Rim Village Drive
Picnic Hill south loop
Picnic Hill interior loop
Rim Dorm access
Munson Valley Road
To Water Tank:
180,000 gallons
Fire Hydrant
Buildings
Secondary Highway
Improved, paved
Gravel or Dirt
Gravel or Dirt Forest Roads
0
250
500
1,000 Feet
N
W
E
S


Crater Lake National Park
Oregon
National Park Service
U.S. Department of the Interior
Hydrants, Buildings and Water Sources;
Headquarters / Munson Valley Developed Area
Water Tank:
150,000 gallons
Bldg 20 loop
Munson Valley
Water Tank Access
Stone House
Sager parking
Steel Center loop
Admin Area
Headquarters loop
Sleepy Hollow loop
Munson Valley Road
Steel Circle loop
East Rim Drive
Ball Field access
Munson Lagoons
Parkway
Fire Hydrant
Possible Pump Location
Secondary Highway
Improved, paved
Gravel or Dirt
Gravel or Dirt Forest Roads
HQ Buildings
40 ft Contour Line
N
W
E
S
0 105 210 420 630 840 Feet
1:4,500


Crater Lake National Park
Oregon
National Park Service
U.S. Department of the Interior
Hydrants, Buildings and Water Sources;
Mazama Village Developed Area
Water Tanks:
2 -100,000 gal
Tanks
Munson Valley Road
Mazama Village Road
Annie Crk Rest
Concession RV loop
Campground Access Rd
Campground loop
Campground loop G
Motor Lodge Loop
Hwy 62
Mazama Dorm loop
Mazama Lagoons Parkway
Fire Hydrant
Possible Pump Locations
Streams
Secondary Highway
Improved, paved
Gravel or Dirt
Gravel or Dirt Forest Roads
Buildings
N
W
E
S
0
375
750
1,500 Feet

STRUCTURE PROTECTION PLAN

TOWN OR AREA—---CRATER LAKE PARK----------

SUBDIVISION(S)-MAZAMA DORMITORY----------

OTHER DESCRIPTION—-N 42 51.561 W 122 09. 787----------

PLAN PREPARED BY---Stearns---------- DATE---9-22-08----------

THIS PROTECTION PLAN IS DESIGNED TO QUICKLY AND SAFELY ASSIGN RESOURCES TO PROTECT STRUCTURES. THE PLAN IS DIVIDED INTO THE FOLLOWING SEGMENTS:

1. GENERAL INFORMATION OF AREA
2. WATER SUPPLY
3. RESOURCES NEEDED
4. TACTICS
5. PROBABILITY OF SUCCESS
6. SAFETY CONSIDERATIONS
7. MAP

Map legend
H= home
T= trailer
C= cabin
OB= outbuilding
B= barn

Flagging color codes
----------= homes on road
----------= water source
----------= haz mat

PROBABILITY OF SUCCESS GOOD
Poor (20%) fair (40%) good (60%) very good (80%) circle one and explain

SAFETY CONSIDERATIONS: SNAGS, MARGINAL SAFETY ZONE, JACKPOT FUELS ADJACENT TO STRUCTURE.

W= water source
FT= fuel tank
HAZ= haz mat
SAFT= safety zone
1= needs little or no attention
2= needs protection but savable
3= to dangerous to protect

WATER SUPPLY FIRE HYDRANTS ON SITE.

RESOURCES NEEDED	ORDERED	RECEIVED
CREW,		
STRUCTURAL FOAM CAPABLE ENGINES		
STRUCTURE WRAP 1 ROLL		
SPRINLER KIT		
PACKING AND DUCT TAPE		

TACTICS

CREW TO SNAG AREA PRIOR TO FIRE ARRIVAL. ENGINES TO PROVIDE PROTECTION DURING INCIDENT. COVER GABLE ATTIC VENTS WITH STRUCTURE WRAP, SPRINKLERS ON FUELS ADJACENT TO STRUCTURES.

MAP
(ATTACH IF
AVAILABLE)

CRATER LAKE NATIONAL PARK

PREFIRE PLAN

Building Number and Name: Steel Information Center (Building #2)

Building Construction Type: Type V Wood Frame. Two story with attic space above 2n^{d} floor and small basement.
Roof Construction: Solid Wood Rafter
Floor Construction (if > 1 level): Solid Wood Joist
Special Construction and Personnel Hazards:

- HVAC in attic above second floor and centered above central stairway. System is mounted on roof joists
- Attic has low clearance and will not allow passage for firefighters w/ SCBAs
- Attic is the full length of building w/ no fire walls.
- Access and egress is limited to two doors in the winter (i.e. at the far ends)
- Snow in winter greatly limits egress for fire fighters if conditions deteriorate.

Occupancy Type: Office and 40 seat auditorium	**Building Size**: Approx 31 x 103’
Location of Water Supply: Winter: 200’ SW in front of Ranger Station; Summer: 70’ south	**Available Flow (gpm)**: Unknown

Estimated Fire Flow For Level of Involvement =(L x W)/3	**25%** = 1642 gpm	**75%** = 4927 gpm
	50% = 3285 gpm	**100%** = 6570 gpm

Sprinkler coverage (full/partial/none)
Level 1: None **Level 2**: None **Attic**: None

Fire Department Connection: NO	**Standpipe**: NO	**Alarm Panel**: Controls on wall behind first floor Info/ lobby desk

Predicted Ventilation Options:

- Windows on floors 1 and 2 (only ventilation option for floors 1 and 2)
- Gable ends for attic

Problems Anticipated:

- A fire will require long interior attack lines, especially on the upper floors
- Heavy fuel load in library and museum storage (books, wood shelves, old signs, etc.)

Basement access

Electrical panel in basement

Primary electrical shutoff in basement

Attic access on floor 2

CRATER LAKE NATIONAL PARK

PREFIRE PLAN

Building Number and Name: Canfield Building (Ranger Station - Bldg 3)

Building Construction Type: Type V Wood Frame. Three story with small attic space above 3rd floor.

Roof Construction: Solid Wood Rafter

Floor Construction (if > 1 level): Solid Wood Joist

Special Construction and Personnel Hazards:

- Two hanging rock chimneys on the roof are supported by unprotected steel posts
- Extensive HVAC systems on third floor
- Extreme clutter on floor 3 from extensive HVAC and storage poses a serious threat to fire personnel if visibility is reduced.
- Access and egress limited to one door in the winter
- Snow in winter greatly limits egress for fire fighters if conditions deteriorate.

Occupancy Type: Office	**Building Size**: Approx 26 x 125’
Location of Water Supply: Canfield hydrant adjacent to side A/D	**Available Flow (gpm)**: Unknown

Estimated Fire Flow For Level of Involvement =(L x W)/3	**25%** = 825 gpm	**75%** = 2450 gpm
	50% = 1650 gpm	**100%** = 3250 gpm

Sprinkler coverage (full/partial/none)

Level 1: Full Coverage **Level 2**: Full Coverage **Level 3:** Full coverage **Attic**: Full Coverage

Fire Department Connection: YES	**Standpipe**: NO	**Alarm Panel**: Controls in Dispatch

Predicted Ventilation Options:

- Windows on floors 1 and 2 (only ventilation option for floors 1 and 2)
- Gable ends for floor 3, and attic (only one set of windows exists on floor 3, side C)

Problems Anticipated:

- A fire will require long interior attack lines, especially on the upper floors
- Automatic closing doors in stairwells will hinder attack line advancement unless chocked open

CRATER LAKE NATIONAL PARK

PREFIRE PLAN

Building Number and Name: Maintenance Building (Building # 14)

Building Construction Type: Type II Limited Combustible. Existing roof is built over a previous roof leaving an extensive hidden floor-2 loft area the full width of the building (bays 1-15). THE ENTIRE FLOOR-2 LOFT AREA IS OPEN WITHOUT ANY FIRESTOPS.
Roof Construction: Exposed steel I-beam and corrugated steel.
Floor Construction (if > 1 level): Light weight steel truss bays 5 - 15. Poured concrete & exposed steel I-beams over bays 1 - 4.
Special Construction and Personnel Hazards:

- Extensive unprotected steel trusses and unprotected steel columns on floor-1 and unprotected steel I-beams on floor-2.
- Large hidden loft area the entire width of building on floor-2 with limited access points.
- Previous built-up tar roof is still in place above ceilings in bays 1-4.
- Collapse hazard from cantilevered overhang if fire present on floor-2.
- Extreme HIGH VOLTAGE hazard in "electrical" room, bay 15 (20,800 Volts!).
- Overhead diesel lines in bays 4 - 15.
- Extremely HEAVY overhead doors in all bays, SECURE DOORS IF ENTER!
- Large flammable storage area.

Occupancy Type: Commercial	**Building Size**: Approx 415 x 65
Location of Water Supply: Canfield, Ratt Hall, & sleepy hollow hydrants. Draft site on Munsun creek next to Canfield building if block culvert.	**Available Flow (gpm)**: Unknown

Estimated Fire Flow For Level of Involvement =(L x W)/3	**25%** = 2500 gpm	**75%** = 7500 gpm
	50% = 5000 gpm	**100%** = 10,000 gpm

Sprinkler coverage (full/partial/none)
Level 1: Carpenter shop only **Level 2**: None **Attic**: None

Fire Department Connection: No	**Standpipe**: No	**Alarm Panel**: Controls in Bay-1, A-B corner

Predicted Ventilation Options:
Horizontal of garage doors and 2nd floor front windows. Hidden 2nd floor area will be extremely difficult to ventilate except by opening steel roof from a ladder truck.

Problems Anticipated:

- Quick collapse of 1st floor ceiling due to extensive steel trusses, unprotected steel supports, and snow load if in winter.
- Fire on ground floor will easily spread vertically into the hidden loft area on 2nd floor. Access to the loft area is very limited: 1)door in lunch room, 2) 3x3' wall hatch on 2nd floor parts storage upstairs bay 3, and 3) side D if take siding off.
- Built-up tar roof above ceilings in bays 1-4 provides large fuel load in hidden loft area which will be extremely difficult to extinguish.
- Fire attack of hidden loft area on floor-2 will require ladder trucks for opening steel roof above cantilevered overhang and wall opening on gable ends.

Suggestions:

- ✓ 2nd alarm immediately and special request 2 ladder trucks.
- ✓ Organize staff to remove snow plows/vehicles if conditions are safe.

Primary electrical shutoff for MOST of the building (NOT the pump, generator or switch room)

Electrical shutoff for pump, generator and switch room ONLY

Access door in lunch room for hidden floor-2 loft area

3X3 access hatch in upstairs storage bay 3 for hidden floor –2 loft area

Built-up tar roof still in place above bays 1 - 4

Phone room on Floor-2, side D

CRATER LAKE NATIONAL PARK

PREFIRE PLAN

Building Number and Name: Mazama Cabins
10 single story buildings (cabins A-J) in two loops, each building has 4 rooms

Building Construction Type:
Type 5 (Wood Frame) – All single story

Roof Construction:
Solid wood rafters with wood shake shingles

Floor Construction (if > 1 level):
N/A (Single Story)

Special Construction and Personnel Hazards:

- Wood interior walls and ceiling
- 5 buildings have a decorative 2nd Floor window that only opens to vestibule
- Exposure buildings with wood shake roofs.
- Main disconnect for all cabins in between Cabins B and C.
- Open attic area with no separation between rooms

Occupancy Type: Motel	**Building Size**: Approx 55' x 35' (but not square) Approx 1500 sq. feet
Location of Water Supply: 3 Hydrants within Cabin loops See attached map that follows	**Available Flow (gpm)**: Unknown

Estimated Fire Flow For Level of Involvement =(L x W)/3	**25%** = 125 gpm	**75%** = 375 gpm
	50% = 250 gpm	**100%** = 500 gpm

Sprinkler coverage (full/partial/none)
Level 1: None **Level 2**: N/A **Attic**: None

Fire Department Connection: None	**Standpipe**: None	**Alarm Panel**: None

Predicted Ventilation Options:

- Gable end vents
- Wood shake roof

Problems Anticipated:

- Exposure buildings with wood siding and shake wood roofs
- Open attic area with no separation between rooms
- Vehicles limiting access and as exposures

CRATER LAKE NATIONAL PARK

PREFIRE PLAN

Building Number and Name: Steel Circle Residence 226B

Building Construction Type: Type III/V Wood Frame. Two story with attic space above 2nd floor.

Roof Construction: Solid Wood/Gluelam Rafters, Unprotected Steel Columns

Floor Construction (if > 1 level): Solid Wood Joist, hardwood on 2nd floor, concrete slab on ground floor

Special Construction and Personnel Hazards:

- Unprotected steel columns
- Attic access hatch has no inside latch
- Two 275 gallon fuel tanks in outside garage

Occupancy Type: Residential	**Building Size**: Approx 50' X 26'
Location of Water Supply: Winter: 340' south to Residence 227 Summer: 100' north toward Community Center	**Available Flow (gpm)**: Unknown

Estimated Fire Flow For Level of Involvement =(L x W)/3	**25%** = 225 gpm	**75%** = 825 gpm
	50% = 550 gpm	**100%** = 1100 gpm

Sprinkler coverage (full/partial/none)
Level 1: None **Level 2**: None **Attic**: None

Fire Department Connection: NO	**Standpipe**: NO	**Alarm Panel**: None

Predicted Ventilation Options:

- First floor: Windows on side A, Doors on sides A & C
- Second floor: Windows on sides A & C, Door on side C
- Attic: ceiling hatch on floor 2 opens to vents on side A (poor option)

Problems Anticipated:

- A winter fire will require a long hose lay, diminishing water pressure
- Duplex design creates extreme exposure issues
- Flashover may result in structural failure
- Winter access to side C is extremely limited

PREFIRE PLAN DATA COLLECTION SHEET

ASSESS BUILDING

Building dimensions and layout

Building construction type

Type I (fire-resistive): structural members are noncombustible (i.e concrete or protected steel, etc.). Such as many high rises and parking garages.

Type II (limited combustible: similar to type I but less fire resistance (i.e. unprotected steel I-beams and trusses). Such as the maintenance building.

Type III (ordinary): exterior walls non or limited combustible (e.g. brick or block) and interior is wood

Type IV (heavy timber): exterior walls non or limited combustible (e.g. brick or block) but structural members are large wood. Such as old factories, mills, warehouses.

Type V (wood frame): walls, floors, supports out of relatively small dimensional wood. Most houses and buildings in the park.

Roof construction (wood truss, metal truss, solid wood beam, metal beam, combination)

Floor construction

Special hazards (trusses, unprotected steel columns, remodel issues, hanging chimneys, haz-mat, dead-ends, HVAC, etc.)

Presence of below grade floors. If so note entry, egress, and ventilation locations on plot plan

Sprinkler coverage (By floor and attic listed as full or partial)

Paths for horizontal and vertical fire travel (poke throughs, hidden openings)

Ventilation options (gable end, roof, other, special problems)

ASSESS INFORMATION FOR PLOT PLAN/FLOOR PLAN

Note nearest hydrant location and flow
Note electrical shut-off location
Note gas shut-off location, if applicable
Verify floor plan provided is accurate
Note attic access location
Note stairwell, entrance, egress locations
Note fire department connection location [FDC] (Sprinkler, Standpipe, or both)
Note fire Protection System Location (sprinkler control, alarm control panel)
Note sprinkler valve locations
Note Firewall location and condition, if applicable

PROCESS INFORMATION AND FINAL PLAN

Calculate estimated fire flow for different levels of involvement [(L x W)/3 per floor]
25% 50% 75% 100%

Fill out side one of Prefire Plan with appropriate information
Final plot plan with appropriate notations and symbols
Make copy for 11 and

Appendix E Excerpt from Crater Lake Fire Management Plan pertaining to vegetative type in developed areas. (Chapter 3)

3. High Severity FMU

Physical and Biotic Characteristics

The boundaries of the High Severity FMU coincide with the **lodgepole pine** and **mountain hemlock** forest communities located in the upper elevations throughout the park. This FMU is shown in red on the accompanying FMU map (See Figure 3-1) and comprises 105,224 acres or 57% of the park's total landbase.

Lodgepole Pine Forests

Environmental Characteristics

Climax lodgepole pine communities occur in the park where topo-edaphic influences result in areas with exceptionally low productivity, aggravated by continual cold air drainage. These forests are identified by the exclusive presence of lodgepole pine in both the overstory and understory, and a paucity of understory shrubs and herbs. Examples of climax lodgepole pine communities in the park include the edge surrounding the Pumice Desert, Pumice Flat, and the Wheeler and Sand Creek drainages.

These climax lodgepole communities are surrounded by others that also have lodgepole pine, such as the red fir and mountain hemlock communities. The occurrence of lodgepole pine in these communities is a good marker of past high-severity disturbances, which occurs infrequently (more than 100 years between fires) and usually replaces an entire stand with a high intensity fire. These events allow lodgepole pine to dominate sites otherwise dominated by other species. In the climax lodgepole pine forest, lodgepole pine is the dominant tree species, regardless of disturbance history.

The Fire Regime

Climax lodgepole pine forests have a moderate-severity fire regime. A combination of low, moderate, and high severity fires occurs through space and time. The magnitude of natural fires ranges from slowly burning logs across the forest floor to crown fires. Fires of low to moderate severity encourage secondary disturbance by insects and pathogens. Most lodgepole stands at the park have a patchy history of fire occurrence and spread. The average fire-free interval is 60 - 80 years, with areas bordering higher productivity forest on the low end of the range. Strong winds are likely associated with the rare stand replacement fire in the lodgepole pine type.

Stand Development Patterns

Lodgepole pine trees are usually killed by fire because of their shallow root system and thin bark. Fire prepares an ideal seedbed and lodgepole pine functions as an early post-fire colonizer. The variety of lodgepole pine in this area has non-serotinous cones *(Pinus contorta var. murrayana)*. Stands reestablish after a disturbance from off-site sources delivered by wind-dispersed seed. Most stands surveyed in the park have multiple age classes resulting from mortality due to either mountain pine beetle (*Dendroctonus ponderosae*) or past fire events. Stems killed by either agent will fall within 5-10 years, and over a 40-50 year period they maintain a hard sapwood but decayed heartwood, an ideal vector for fire spread. In the meantime, any clump of trees killed is colonized by a new generation of lodgepole pine, and this process, repeated over time, results in multiple age classes of the pines. Understory vegetation development is never substantial in these forests. Moisture competition restricts tree regeneration to gaps created after a tree falls and few herbs or shrubs tolerate these low productivity sites.

Management Implications

Climax lodgepole forests rarely grow for a century without a major disturbance by fire or insects. Within the park, both log-to-log and crown fire activity has been observed. The low productivity of these forests has limited the amount of fuel buildup and other changes due to past fire exclusion policies. These stands should be expected under most conditions to have slow-moving fires burning along logs created decades earlier by a past fire or insect disturbance. Fires moving into such stands from adjacent forest types will normally be extinguished on their own as fuels dissipate in the interior of the stand. Under most conditions, these forests will act as natural fuel breaks. However, the occurrence of past crown fires in this forest type (e.g., Prophecy Fire 1988), suggests that climax lodgepole stands cannot be considered fire barriers under all fire weather conditions.

A policy of wildland fire use may be implemented in this forest type to achieve natural values with the knowledge that human impact on such stands appears to have been minimal over the past 100 years. Under most conditions, these forests will act as natural fuel breaks, where fire suppression, if desired, will be relatively easy. Thinning treatments will enhance the effectiveness of these natural fuel breaks in areas where there are resource values at risk.

Mountain Hemlock Forests

Environmental Characteristics

Mountain hemlock stands are the highest elevation continuous forests at the park occurring at elevations between 5600 and 7900 feet. These forests are characterized

by the presence of mountain hemlock as the major climax dominant. Discontinuous stands are transitional to alpine meadows or to a whitebark pine zone in the park and occur in a mosaic pattern. Lodgepole pine is a common early seral species in this forest community, indicative of past disturbance by fire. Other occasional ecotonal associates include whitebark pine, Shasta red fir, and subalpine fir. The forests in the subalpine zone have a prolonged winter snowpack and a short growing season that significantly affects both the fire regime and post fire successional patterns.

The Fire Regime

Mountain hemlock is not well adapted to fire. Its life history strategy towards fire is that of an avoider. Its relatively thick bark provides some protection at maturity, but low-hanging branches, highly flammable foliage and a tendency to grow in dense groups make it very susceptible to fire injury. Mountain hemlock sites are typically moist with annual average precipitation greater than 50 inches, making the probability of fire occurrence low. South-facing slopes are more likely to burn than north-facing slopes.

Fires in these cool wet forests generally occur as infrequent crown fires. When fires do occur, they are often severe stand-replacing events, with the majority of historic fire events resulting in burned patches less than 1200 acres each. Fire return intervals for mountain hemlock forests of the Oregon Cascades are not well documented. One study by Dickman and Cook suggest intervals greater than 500 years, while Atzet reports disturbance intervals of 115 years for mountain hemlock forests in the Klamath Mountain Province of southwest Oregon.

Stand Development Patterns

Fire is the primary large-scale disturbance agent in this forest type. Most other disturbances operate at the scale of individual tree gaps or small patches (insects, disease, wind). Mountain hemlock is not adapted to grow well in open, recently burned environments. Young seedlings grow best in partial shade and early development is often slow. Mountain hemlock is very shade tolerant and often succeeds lodgepole pine when these species pioneer on drier sites. Where lodgepole pine is present, an even-aged stand of lodgepole pine will emerge from a fire disturbance, but where it is absent, the site may revert to shrubby, non-forest vegetation for more than a century after burning. Where whitebark pine is present, fires are often of moderate-severity, killing some pine but leaving other clumps intact, providing a source of seed for regeneration.

Management Implications

Fire injury makes mountain hemlock very susceptible to insects and disease.
Mountain hemlock is particularly susceptible to laminated root rot *(Phellinus weirii).* This fungus spreads from infection centers along tree roots, killing infected

trees in an expanding radial pattern. Active infection centers within mountain hemlock stands have been measured as large as 100 acres. These root rot pockets are characterized by numerous snags in various stages of decay with older-aged snags and downed woody debris at the center of spread.

Fire may play an important role in breaking up *Phellinus* centers, by creating conditions more suitable for the *Phellinus*-resistant lodgepole pine. The pine may then competitively exclude mountain hemlock from the site until the *Phellinus* inoculum is present only in large isolated stumps, remnants of the former stand that have not fully decayed. Dickman and Cook suggest three possible interactions between fire and fungus that depend on fire-return interval: 1) a fire-return interval of 200 years or less, resulting in dominance by lodgepole pine and disfavoring *Phellinus*; 2) a fire-return interval of 600 years, which may foster mountain hemlock stands infected with *Phellinus*, mixed with other stands dominated by lodgepole pine, much like the present landscape; and 3) absence of fire as a disturbance agent which disfavors lodgepole pine and increases the role of *Phellinus*, creating a forest landscape much different than the one seen today.

Although infrequent and unpredictable, fires have been an important force in shaping mountain hemlock forests, especially where they intermingle with subalpine meadows and whitebark pine woodlands. A wildland fire use strategy may offer the most in meeting resource management objectives in this forest type, presuming that an assessment of the expected fire behavior and associated values at risk are conducted for each fire event.

Wildland Fire Management Situation Summary for High Severity FMU

The wildland fire use for resource benefits option is an appropriate management response for natural ignitions originating in this FMU. Fire regimes in this FMU are within an historical range and the risk of losing key ecosystem components is low.

Prescribed fire and Non-fire applications such as manual thinning may be desirable options for protecting specific resource values by reducing fuel buildups and modifying forest structure to reduce fire intensities if ignitions do occur.

4. Developed FMU

Physical and Biotic Characteristics

The boundaries of the Developed FMU coincide with the "Developed Management Zone" identified in the draft 2004 General Management Plan (in prep.). This FMU consists of discrete areas where administrative and visitor facilities are concentrated including South Maintenance Yard, Mazama Dormitory, Mazama Village and Campground, Park Headquarters and Munson Valley Residence area, Lost Creek

Campground, and Rim Village. This FMU is shown in light blue on the accompanying FMU map (See Figure 3-1) and comprises approximately 3,487 acres or 2% of the park's total landbase.

In this FMU, natural and cultural resources have been modified for visitor and park operational needs. Sign of human activity are fairly obvious by the concentration of visitor centers, lodges, campgrounds, administrative offices, maintenance areas, and residences and their associated paved paths, roads, and parking areas. Mountain hemlock and Shasta red fir forests form a visual backdrop for these areas and pose a fire risk from the accumulation of fuels associated with these forest types.

Specific Fire Management Objectives

The desired future condition for this FMU is a series of visually pleasing landscapes that pose little risk of catastrophic crown fire and the resulting threat of fire damage to existing structures. To accomplish this goal, manual thinning treatments will be applied to maintain a minimum tree density of 108 trees per acre (e.g. 20 x 20 foot spacing between tree boles) and to reduce down dead fuel loads by 35 - 55%.

Wildland Fire Management Situation Summary for Developed FMU

The wildland fire suppression option is an appropriate management response for ignitions originating in this FMU because of the imminent threat to visitors and facilities. Wildland fire use is not an appropriate tool for the same reasons.

Prescribed fire and non-fire applications such as manual thinning are desirable options for protecting resource values by reducing fuel buildups and modifying forest structure to meet
target conditions.

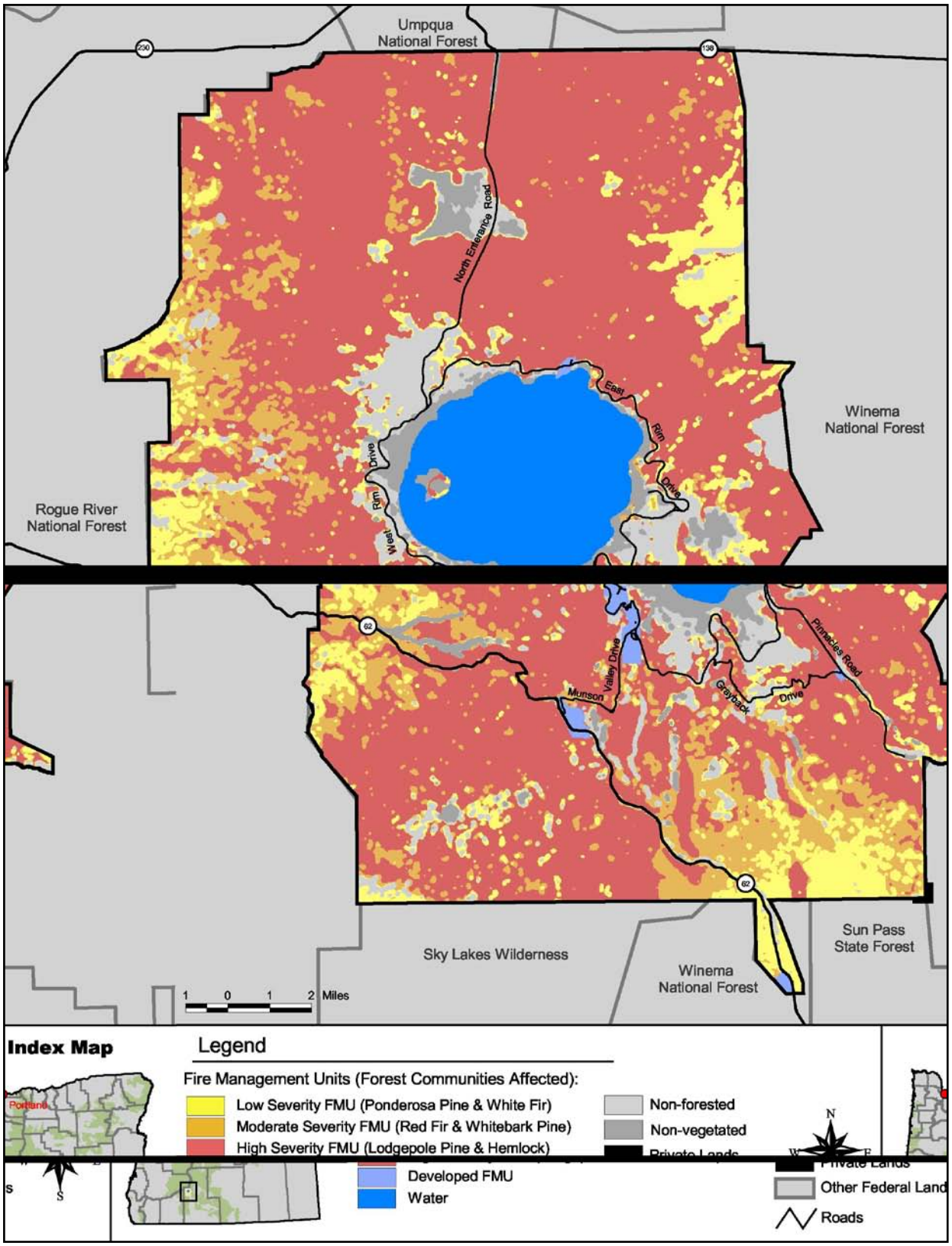


Figure E-1 Crater Lake NP Fire Management Units (FMUs)

Appendix F

KLAMATH COUNTY FIRE DEFENSE BOARD

MUTUAL AID AGREEMENT

1.0 INTRODUCTION:

WHEREAS, certain disasters/emergencies have the potential of outstripping the capacity of any community to effectively protect life and property; and

WHEREAS, the parties desire to combine and coordinate their resources for responses to disasters/emergencies occurring in their jurisdictions.

NOW, THEREFORE, under the authority of ORS Chapter 190, it is agreed between
the parties as per the attached signature page.

BE IT RESOLVED, This Agreement shall become effective on the date signed, and
shall be effective as to each additional party as provided in Section 18 of this Agreement,
and is entered into for the purpose of securing to each party periodic disaster/emergency assistance for response to disasters/emergencies resulting from any cause. This agreement
is approved by the Klamath County Fire Defense Board on this 26th day of June, 2008 and
shall be reviewed for change every five years hereafter.

2.0 AUTHORITY:

This Agreement is entered into under the authority granted to the parties by their respective charters and/or Oregon Revised Statutes (ORS). Further, ORS 190.010 authorizes units of local government to enter into written agreements with any other units of
local government for the purpose of any and all functions and activities that the parties to the
agreement, its officers or agencies, have authority to perform, and ORS
190.010 authorizes units of state and local governments to enter into agreements with each
other to cooperate in the performance of their duties.

3.0 SCOPE OF AGREEMENT:

This Agreement, being in conformance with the Oregon Fire Service Mobilization Plan as adopted by the Oregon State Fire Marshal, shall include the following types and kinds of mutual aid assistance, and operating terms and conditions.

3.1 Type of Equipment and Personnel:

The parties hereto agree to provide to all other parties to this Agreement personnel

and equipment as described in Attachment “A” which is incorporated herein by this reference.
Parties agree when providing equipment and personnel; equipment meets the requirements
of the Oregon State Fire Marshal’s Mobilization Plan and personnel meet the training requirements of the Oregon State Fire Marshal’s Mobilization Plan.

Further, the parties hereto recognize and agree that such personnel and equipment may be periodically unavailable under this Agreement due to normal operating requirements. However, when any significant change occurs to the available equipment and/or personnel which shall last more than thirty (30) days, the party experiencing such change shall notify all other parties to this Agreement.

3.2 Good Faith:

Each of the parties hereto agrees to attempt to furnish to a requesting party such assistance as the requesting party may deem reasonable and necessary to successfully abate an emergency in the requesting party’s jurisdiction. Provided, however, that the party
to whom the request is made shall have sole discretion to refuse such request if sending such assistance may lead to an unreasonable reduction in the level of protection within its
own jurisdiction, and provided further that a state or local agency may refuse a request for
assistance if necessary to comply with any limitations on the use of dedicated funds by that
agency.

3.3 Dispatching:

It is agreed by the parties hereto that mutual aid assistance, when requested, shall be
dispatched promptly and that first response by the jurisdiction requesting assistance shall not
be a prerequisite to a request for assistance under this Agreement. The parties hereto also
agree to cooperate in designing and implementing a move-up or dispatch system to provide
automatically a quick and adequate response of personnel and equipment as a given situation warrants. Further, the parties hereto agree that in highly unusual situations requests
for assistance may take any reasonable form. In all cases when resources are dispatched,
units will keep the local dispatch center informed of their status.

3.4 Supervision:

When personnel and/or equipment are furnished under this Agreement, the agency
having incident command responsibility for the incident shall have overall supervision of mutual aid personnel and equipment during the period such incident is still in progress. Provided, however, when officers from the requesting jurisdiction have not arrived at the scene of the incident, the commanding officer of the jurisdiction arriving first to provide mutual

aid assistance shall be in command of the incident until relieved. Further, “supervision”, as
used in this section, refers to conduct of the mission. Each person participating in the mission
remains an employee of that person’s employing agency and is subject to the personnel policies solely of that employing agency.

3.5 Incident Command System:

Parties hereto agree to operate using the National Incident Management System (NIMS) and meet the requirements of NIMS.

3.6 Communications:

For communication interoperability; parties of this agreement who hold FCC frequency
licenses agree to grant permission to signers of this agreement the use of those frequencies.

4.0 WAIVERS:

4.1 General Waivers:

Except for instances of gross negligence, reckless, or intentional acts on the part of a
party’s volunteers, employee(s), or officers, each party to this Agreement waives all claims
against all other parties to this Agreement for compensation for any loss, damage, personal
injury, or death occurring to personnel and/or equipment as a consequence of the performance of this Agreement.

4.2 Hold Harmless:

Any party responding to a request for assistance under this Agreement shall save and
hold harmless the requesting party from, and indemnify the requesting party against, any and
all third party liability for or on account of any death or injury to person (s), or damage to property arising out of any action by the personnel of the responding party taken pursuant to
the provisions of this Agreement, excepting gross negligence, reckless, or intentional acts on
the part of a party’s volunteers, employee(s), or officers. Each party hereto agrees to obtain
liability insurance, or equivalent coverage, covering its activities assumed under this Agreement, to the minimum dollar amounts required under the Oregon Tort Claims Act, ORS
30.270(1)

4.3 Workers’ Compensation:

Each party to this Agreement agrees to provide workers’ compensation insurance
coverage to each of its employees and volunteers, and responding under this agreement

recognizes that although overall incident command supervision will usually be provided by the jurisdiction in which the incident occurs, supervision of individual employees will be provided by their regular supervisors. The intent of this provision is to prevent the creation of "special employer" relationships under Oregon workers' compensation law.

5.0 REFUSALS TO PERFORM:

This is a mutual aid agreement and it is assumed that all available assistance will generally be provided. Nothing, however, in this Agreement shall be construed to prevent a party to whom a request for assistance is made from refusing to respond when that is appropriate in its sole determination.

In addition, any responding party may refuse to perform any specific task when, in the sole determination of the responding party's commanding officer, response would create an unreasonable risk of danger to the responding party's employees and/or equipment or any third party.

6.0 COMPENSATION:

The signers of this agreement agree that personnel and equipment may be made available for the first 24 hours and are approximately equivalent. Each responding agency is responsible for their individual costs during the first 24 hours unless other arrangements are made.

In those instances a request for specialized equipment and / or personnel is made outside the scope of this agreement the requesting agency may be responsible for incurred cost. Agency to agency negotiation is encouraged.

7.0 COST RECOVERY:

The parties hereto agree that any cost recovery actions brought by responding jurisdictions under this Agreement against third parties shall be coordinated by the jurisdiction in which the incident giving rise to the response occurred. If the requesting party chooses not to bill a third party for costs incurred, the requesting party shall be liable to all responding parties only to the extent as herein agreed.

8.0 TERMINATION:

Any party hereto may terminate this Agreement at any time by giving thirty (30) days' notice of the intention to do so to any and all other parties. Such notice shall be sent to the governing body of the other parties and a copy thereof to the Fire Chief of the department/district of the parties notified. This agreement will remain in effect so long as there are at least two parties remaining.

9.0 EXTRA JURISDICTIONAL OPERATING AUTHORITY:

The parties hereto recognize and agree that ORS Chapters 190, 453, 476 and 478 extend the powers and authorities of the parties herein beyond their regular jurisdictions when operating under this Agreement.

10.0 RETIREMENT SYSTEM STATUS:

The parties hereto recognize and agree that under this Agreement public employee retirement benefits and social security benefits accrue in the manner prescribed by the employee's regular employment and are the responsibility of the regular employer as if the employee were performing the employee's regular duties. No additional benefits arise due to participation in assistance under this Agreement.

11.0 ASSIGNMENTS/SUBCONTRACTS:

Except as expressly provided herein, the parties hereto recognize and agree not to assign, sell, transfer, subcontract or sublet rights, or delegate responsibilities under this Agreement, in whole or in part, without the prior written approval of the other parties hereto.

12.0 SUCCESSORS IN INTEREST:

The provisions of this Agreement shall be binding upon and inure to the benefit of all other parties to the Agreement and the respective successors and assigns.

13.0 COMPLIANCE WITH GOVERNMENT REGULATIONS:

Each party to this Agreement agrees to comply with federal, state and local laws, codes, regulations, and ordinances applicable to the work performed under this Agreement.

14.0 FORCE MAJEURE:

No party to this Agreement shall be held responsible for delay or default caused by fires, riots, acts of God and/or war which is beyond the reasonable control of the parties.

15.0 SEVERABILITY:

If any provision of this Agreement is declared by a court having jurisdiction to be illegal or in conflict with any law, the validity of the remaining terms and provisions shall not be affected; the rights and obligations of the parties shall be construed and enforced as if the Agreement did not contain the particular provision held to be invalid.

16.0 AMENDMENTS:

The terms and conditions of this Agreement shall not be waived, altered, modified, supplemented, or amended in any manner whatsoever without prior written approval of the parties hereto.

17.0 DISPUTE RESOLUTION:

This Agreement shall be governed by and construed in accordance with the laws of the State of Oregon as interpreted by the Oregon courts. However, the parties may attempt to resolve any dispute arising under this Agreement by any appropriate means of dispute resolution, except binding arbitration.

United States Department of the Interior
National Park Service
Crater Lake National Park
Addendum to the Klamath County Fire Defense Board Mutual Aid Agreement

The following sections are agreed to, with changes:

3.2 Good Faith
4.1 General Waivers
4.2 Hold Harmless
9.0 Extra Jurisdictional Operating Authority

The following sections cannot be agreed to for the reasons listed below:

4.3 Workers' Compensation
17.0 Dispute Resolution

3.2 Good Faith:

Each of the parties hereto agrees to attempt to furnish to a requesting party such assistance as the requesting party may deem reasonable and necessary to successfully abate an emergency in the requesting party's jurisdiction. Provided, however, that the party to whom the request is made shall have sole discretion to refuse such request if sending such assistance may lead to an unreasonable reduction in the level of protection within its own jurisdiction, and provided further that a state or local agency may refuse a request for assistance if necessary to comply with any limitations on the use of dedicated funds by that agency *or for other reasons related to funding or availability of personnel or equipment*.

4.1 General Waivers:

Except for instances of gross negligence, reckless, or intentional acts on the part of a party's volunteers, employee(s), or officers, each party to this Agreement waives all claims against all other parties to this Agreement for compensation for any loss, damage, personal injury, or death occurring to personnel and/or equipment as a consequence of the

performance of this Agreement. *The claims of the United States, not the claims of employees of the United States, are waived against other parties.*

4.2 Hold Harmless:

Any party responding to a request for assistance under this Agreement shall save and hold harmless the requesting party from, and indemnify the requesting party against, any and all third party liability for or on account of any death or injury to person (s), or damage to property arising out of any action by the personnel of the responding party taken pursuant to the provisions of this Agreement, excepting gross negligence, reckless, or intentional acts on the part of a party's volunteers, employee(s), or officers. Each party hereto agrees to obtain liability insurance, or equivalent coverage, covering its activities assumed under this Agreement, to the minimum dollar amounts required under the Oregon Tort Claims Act, ORS 30.270(1). *The National Park Service will be liable for the negligent acts of its employees committed in the scope of employment to the extent authorized by Congress in the Federal Tort Claims Act, 28 U.S.C. §2671 et seq..*

4.3 Workers' Compensation:

Each party to this Agreement agrees to provide workers' compensation insurance coverage to each of its employees and volunteers, and responding under this agreement recognizes that although overall incident command supervision will usually be provided by the jurisdiction in which the incident occurs, supervision of individual employees will be provided by their regular supervisors. The intent of this provision is to prevent the creation of "special employer" relationships under Oregon workers' compensation law. *The United States is self-insured. The National Park Service may not enter into an agreement that contains a worker's compensation insurance requirement.*

9.0 EXTRA JURISDICTIONAL OPERATING AUTHORITY:

The parties hereto recognize and agree that ORS Chapters 190, 453, 476 and 478 extend the powers and authorities of the parties herein beyond their regular jurisdictions when operating under this Agreement. *The Congressional authority cited above gives the National Park Service authority to act outside of its normal territorial jurisdiction (the National Park System).*

17.0 DISPUTE RESOLUTION:

This Agreement shall be governed by and construed in accordance with the laws of the State of Oregon as interpreted by the Oregon courts. However, the parties may attempt to resolve any dispute arising under this Agreement by any appropriate means of dispute

resolution, except binding arbitration. *The National Park Service cannot agree to waive the sovereign immunity of the United States and submit to the jurisdiction of the state courts of Oregon. Only Congress can waive the sovereign immunity of the United States.*

18.0 SIGNATURES:

BE IT RESOLVED, The undersigned warrant and represent that they are duly authorized to bind the agency represented by the undersigned as a party to this Agreement,
and that the agency represented by the undersigned as a party to this Agreement, and that
the agency represented by the undersigned is authorized to participate in and carry out the
functions required by this Agreement. All signatures shall be executed in counterparts, using
the form appearing below.

Agency Name: _____

Board President/Other Name: _____
Please Print

Signature: _____

Fire Chief Name: _____
Please Print

Signature: _____

Date Signed: _____

Evacuation for temporary housing

Contact American Red Cross (first notification is at "Level III")

Within the Park's Fire Management Plan, the following areas have been identified as possible sites for Incident Command Posts and/or Base Camps in the event of a Type 1, 2, or 3 incident within Crater Lake National Park. These sites can be considered for Residents who have been evacuated from Park.

6. Diamond Lake Incident Command Post, Umpqua NF (see attached ICP plan)
7. Clearwater Incident Base, Umpqua NF (see attached ICP plan)
8. Crater Lake Community Center, Crater Lake NP
9. Annie Creek Incident Base, Fremont Winema NF
10. Chiloquin High School — Contact: Principal John Rademacher
    Chiloquin, OR — Office: (541) 783-2321
    T35S, R7E, Sec3 — Home: (541) 783-2687
    Contact: Bill Elrod
    Home: (541) 783-2132

    Showers/ laundry/ sleeping areas/ electricity/ phones/ staging.
    From Klamath Falls, take Hwy 97N, 28 miles, to Chiloquin and turn right at the Pacific Pride station. School is located on the south end of Chiloquin.

Appendix H

CRLA Helispots

May 2002

All coordinates referenced to North American Datum 1927 (NAD27)

ID	NAME	UTM zone 10 N easting, meters	UTM zone 10 N northing, meters	West longitude, deg min sec	North latitude, deg min sec
1	Discovery Point	568439	4752104	122 09 41	42 55 14
2	Bybee Creek	563668	4754030	122 13 11	42 56 17
3	Crater Peak #1	574851	4745982	122 05 01	42 51 53
4	Crater Peak #2	573423	4746137	122 06 04	42 51 58
5	East Rim Junction	570761	4749359	122 08 00	42 53 44
6	Garfield Peak	571659	4750331	122 07 20	42 54 15
7	Grouse Hill	571011	4759518	122 07 44	42 59 13
8	Little Castle Creek	562174	4751720	122 14 18	42 55 03
9	Mount Scott	580311	4752366	122 00 57	42 55 18
10	National Creek	561406	4764248	122 14 47	43 01 49
11	North Junction	569315	4757113	122 09 00	42 57 56
12	Pinnacles	581219	4744425	122 00 22	42 51 00
13	Pole Bridge Creek	569497	4743698	122 08 58	42 50 41
14	Red Cone #1	563838	4760270	122 13 01	42 59 40
15	Red Cone #2	567079	4760221	122 10 38	42 59 37
16	Rim Village	569772	4751141	122 08 43	42 54 42
17	Skell Head	577687	4755198	122 02 52	42 56 51
18	Sphagnum Bog	561232	4760689	122 14 56	42 59 54
19	Timber Crater	575977	4767386	122 04 01	43 03 26
20	Union Peak	563955	4742284	122 13 03	42 49 57
21	Williams Crater	563186	4755997	122 13 31	42 57 21
22	Wizard Island	569703	4754203	122 08 45	42 56 21
23	Cloudcap	577732	4753814	122 02 51	42 56 06
24	Annie Creek Sno-Park	577072	4734598	122 03 29	42 45 43
25	Huckleberry Sno-Park	555242	4751187	122 19 24	42 54 48

In addition to these coordinates, a map of all helispots is located in Crater Lake National Park Communications Center.

Appendix I

Cultural Considerations (FMP Appendix 13.D.3)

There are 23 National Register historic structures, including the Watchman Lookout, buildings in Rim Village, and buildings in Munson Valley in the Headquarters area. Included in this list is House 19, which is a National Historic Landmark. There are two historic districts, Munson Valley (containing 18 of the National Register historic strucures) and Rim Village.

The Exclusion FMA includes scattered clusters of human developments in the Park. These include:

- Mazama Village
- Munson Valley
- Rim Village
- Lost Creek Campground
- Governors Bay developed area
- Cleetwood Cove developed area

Most of these regions contain structures of high monetary and cultural value. For these reasons, all wildland fires are suppressed in these areas. Normal suppression considerations, as well as sensitivity to the particular areas that are threatened, will dictate the exact location of control lines and the choice of appropriate techniques during the suppression of a wildland fire.

Treatment of Cultural Areas (FMP Appendix 13.D.3)

Cultural Resources

- No handlines exposing mineral soil will be allowed through cultural sites;
- Prior to all prescribed fire and non-fire fuel treatments, cultural resources in treatments areas will be surveyed, identified and avoided;

- Prior to all wildfire and wildland fire use activities, cultural resources in affected areas will be identified and avoided;
- Fire retardant use will be prohibited in the vicinity of any historic structure, unless there is imminent threat from wildfire to the historic structure;
- The park Historian or a designated representative will conduct an inspection and develop a plan to protect any existing or new cultural resources identified before and after prescribed fires.

Fire suppression activities are designed to prevent fire from damaging these resources, and is generally successful is doing so. However, the fire suppression action itself can have damaging effects. Ground disturbance by fire crews can displace artifacts from proper placement in the soil, and artifacts can be destroyed by use of hand tools (bulldozers will not be used in fire suppression operations) (Switzer 1974). Fire retardants can stain or corrode historic structures and will not be used in the vicinity of these structures. If wooden structure protection is necessary, foams will be used, similar to their use at Yellowstone in 1988. Any fire suppression activity in the vicinity of a known historic or archeological site will receive guidance from the Park Historian at Crater Lake or a designated representative from the Park or the regional office.

Appendix 13.H Long-term Prescribed Fire and Hazard Reduction Plan

Table 2-5 summarizes the total number of acres in each FMU, mean fire return intervals, and the approximate number of acres targeted for treatment in each FMU using prescribed fire, manual and mechanical thinning, and wildland fire use. Table 2-6 illustrates the proposed treatment activity by calendar year and FMU. Within the Fire Management Units, the park has identified 16 treatment units where it would conduct prescribed fire, manual, and/or mechanical fuel treatments. Table 2-7 identifies the treatments units within their respective FMU, depicts the proposed acreages and timing of treatments, and provides descriptions of the various treatment units. Table 2-8 summarizes the components of each alternative for comparison.

Table 2-5 Crater Lake National Park 5-Year Treatment Plan

FMU	Total Acres in FMU	Mean Fire Return Interval	Annual Treatment Targets (acres)[2]	Target Acres to be Treated over 5 Years	Breakdown of 5-year Target Acres to be Treated by			
					Fire Use[3] (per event)	Prescribed Fire	Manual Thinning	Mech. Thinning
Low	19,539	10-15 years	1,350-1,990	6,750-9,950	0-3,200	6,750	4,250[4]	
Moderate	22,957	40-60 years	383-563	1,915-2,815	0-900	1,915	190[4]	
High	105,224	80-100 years	500-1,300	2,500-6,500	0-4000	2,500	2,350[4]	
Developed	3,487	n/a	310	1,550	n/a		910[5]	640[5]
Total	**151,207[1]**		**2,543-4,163**	**12,715-20,815**	**0-8,100**	**11,165**	**7,700**	**640**

[1] The remaining 32,017 acres in the park contain non-forest vegetation, such as meadows, and non-combustible vegetation, e.g. Crater Lake, and are not included in fire management units. The acreages associated with non-forest vegetation and non-combustible vegetation are 21,111 acres and 13,293 acres respectively.
[2] Yearly amounts may vary according to weather and other planning/implementation considerations.
[3] The acres to be treated annually and under the 5-year treatment plan are equal to or greater than those displayed in Alternative 2 since wildland fire use is contemplated.
[4] Manual thinning target acres are captured under those acres to be treated by prescribed fire (e.g. after 4,250 acres of manual treatments are conducted in the Low-Severity FMU, those same acres and up to another 2,500 acres would be treated with prescribed fire, for a total treatment in that FMU of 6,750 acres, at a minimum).
[5] Manual and mechanical thinning treatments would be employed as fire surrogates.

Table 2-6 Treatment Activity by Calendar Year and Fire Management Unit

FMU	2002	2003	2004	2005	2006	2007
Low	1,500	0	1,500	1,500	750	1,500
Moderate	0	0	0	615	600	700
High	0	1,500	1,000	0	0	0
Developed	0	270	640	260	380	0
Total Acres[1]	1,500	1,770	3,140	2,375	1,730	2,200

[1] Total acres include those acres to be treated by prescribed fire and mechanical thinning. Manual thinning is already captured in those acres targeted for prescribed fire treatments since hand thinning will often be followed up with prescribed fire.

Table 2-7 Multi-year Treatment Schedule

Treatment Area	Treatment Acres & Treatment Year(s)	Treatment Methods	Treatment Area Description
Low Severity FMU			
Panhandle	1,000 acres 2002-2003	Manual thin, prescribed fire	Treatment unit is composed of mixed patches of mature ponderosa pine with younger white fir and lodgepole pine and scattered mature sugar pine along Hwy 62. Portions of the area were treated with prescribed fire in the mid '70s and '80's.
Upper Pan	500 acres 2002-2003	Manual thin, prescribed fire	Treatment unit includes mature ponderosa pine and white fir with minor amounts of Shasta red fir and aspen located between highway 62 and the south park boundary above the panhandle.
Sun Creek	1,500 acres 2004	Manual thin, prescribed fire	Treatment unit consists of mixed-conifer stands of ponderosa pine, white fir and sugar pine in the Sun Creek drainage near the park's south boundary.
Sharp Desert	1,000 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary between Desert Creek and Sharps Peak.
TC South	500 acres 2005	Manual thin, prescribed fire	Treatment unit is composed of ponderosa pine forests along the NE park boundary north and west of Desert Creek.
Red Blanket	750 acres 2006	Manual thin, prescribed fire	Treatment unit includes mixed conifer forests with a Douglas fir component on the south facing slopes of upper Red Blanket canyon.
Crater Creek Ridge	1,500 acres 2007	Manual thin, prescribed fire	Treatment unit consists of mixed conifer forests above Crater Creek along the west park boundary.

Moderate Severity FMU			
PIAL Research	200 acres 2007	Prescribed fire	Treatment unit consists of pure stands of whitebark pine (both upright and krummholtz forms) with less than 5% lodgepole pine and mountain hemlock present on the flanks of Mt. Scott.
West 62	1,215 acres 2005-2006	Prescribed fire	Treatment unit contains mixed conifer forest with patches of variable age-classes found between the west park boundary and hwy 62 west.
Crater Peak	500 acres 2007	Prescribed fire	Treatment unit is composed of mostly Shasta red fir with some mountain hemlock and minor amounts of lodgepole pine along the SW, S, and SE flanks of Crater Peak.
High Severity FMU			
Phoenix	1,500 acres 2003	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component.
Cornerstone	1,000 acres 2004	Manual thin, prescribed fire	Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component
Developed Zone FMU			
Mazama	270 acres 2003	Manual thin, pile burn	Treatment unit is composed of mountain hemlock, lodgepole and Shasta red fir forests in the Mazama Village Area including campground, dormitory, and sewage treatment facilities
Munson Valley-Rim Village	640 acres 2004	Manual thin, pile burn	Treatment unit includes mountain hemlock, Shasta red fir and lodgepole pine forests and sedge meadows associated with Park Headquarters, Munson Valley residential area, and visitor facilities at Rim Village.
Hwy 62 Fuel break	260 acres 2006	Mechanical thin	Treatment unit is centered along the highway 62 road corridor from park's west boundary to the intersection with Munson Valley road. Mixed conifer stands near the west boundary grade into pure stands of mountain hemlock and lodgepole pine above 5500 ft elevation.
Grayback-Pinnacles Fuel break	380 acres 2005	Mechanical thin	Treatment unit includes a mixed mosaic of mountain hemlock and lodgepole pine forests with dispersed sedge meadows along Grayback Motor-Nature Road and Pinnacles Valley Road, including Lost Creek Campground and facilities.

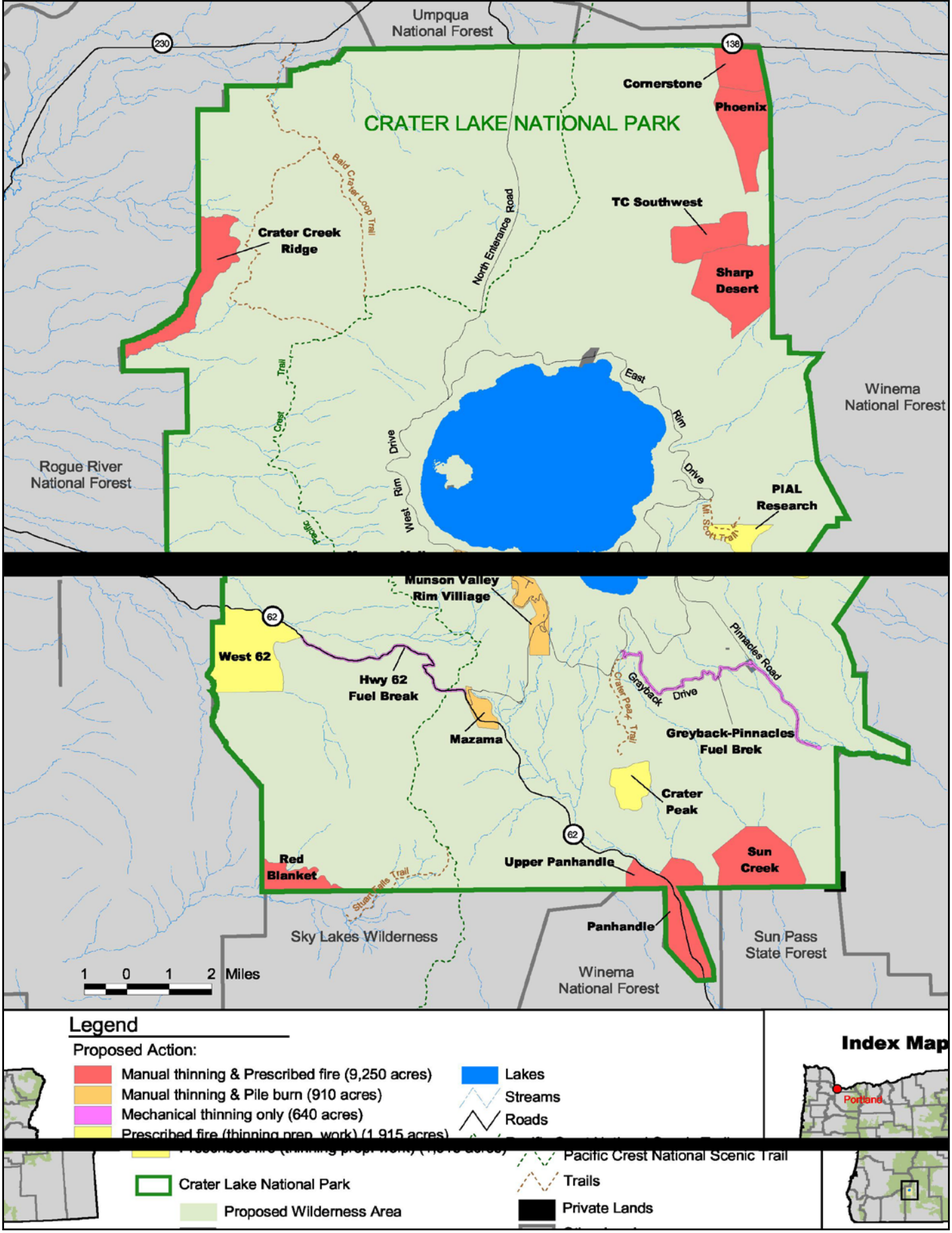


Figure 1: Prescribed Fire and Hazard Reduction Treatment Area

Appendix H – Multi -Year Fuels Treatment Schedule Amended 1/22/10

Purpose of Amendment

On January 22, 2010, Fire Management Officer Greg Funderburk, Fire Ecologist Calvin Farris, and Fuels Management Specialist John Donahue reviewed the Multi Year Fuels Treatment Schedule for Crater Lake National Park. Through this meeting, this amendment was created to reflect changes due to the completion and postponement of projects, new fire effects information, rearrange the order of projects, and extending the plan out for five years.

Amended Multi-Year Fuel Treatment Plan

Crater Lake National Park Fire Management Plan Multi-Year Fuels Treatment Schedule outlines a projected work plan for the Park's fire management program. The numbers of acres treated are shown in table A. Because both managed wildland and prescribed fire are dependent on environmental and social conditions, the acreages listed are what is currently planned and accomplishment of these acreages may or may not be possible.

Table A. Acres Planned for Treatment

Year	Manual Treatments	Prescribed Fire	Total
2010	200	1763	1963
2011	1300	625	1925
2012	2095	1040	3135
2013	2515	900	3415
2014	425	2475	2900
Totals	6535	6803	13338
Annual Averages	1307	1361	2668

Table B lists the tentative fuels treatment projects by year for Crater Lake National Park. These projects and associated acreages are subject to change. Factors that would cause change include, but are not limited to the following:

- Unwanted wildland fires that may burn units or portions of units prior to this schedule.
- Unwanted wildland fires in close proximity to other fuels treatment units that may provide opportunities to treat adjacent units prior to the schedule date.
- Managed wildland fires that may provide treatment of scheduled units.
- Opportunities to accomplish cooperative projects with adjacent landowners and other agencies in a year other than when the unit is scheduled.
- Opportunities to accomplish additional targeted projects in a given calendar year due to favorable conditions.
- Diminished opportunities to accomplish proposed targets due to weather, air quality, or resource availability constraints.
- National or Regional preparedness levels that would preclude the use of prescribed fire or managed wildland fire.
- Socio-political or administrative concerns that would preclude the use of prescribed fire or managed wildland fire.
- Lack of available funding and/or staffing to safely and efficiently accomplish projects.
- Cultural or natural resource impacts that cannot be avoided or mitigated.
- Trends from monitoring effects of treatments indicating a change is needed.
- Changes in federal and/or National Park Service fire management policies.
- Updated research that may help guide the treatment schedule.

Table B. Annual Projected Fuels Treatment Areas

Year 6 and beyond will be developed during annual reviews and updates of the Fire Management Plan.

Calendar Year 2010 Project Target: 1963 Acres				
Project	**Type**	**Acres**	**Season**	**Fiscal Year**
Phoenix Burn	RX	1353	Late Summer/ Fall	2010
Upper Panhandle Jackpot	RX	50	Late Summer/ Fall	2010
Sun Creek Dripline Thin	M	200-1554	Summer	2010
Upper Panhandle Burn	RX	360	Late Summer/ Fall	2010/ 2011

Calendar Year 2011 Project Target: 1925 Acres				
Project	**Type**	**Acres**	**Season**	**Fiscal Year**
Highway 62 Fuel Break	M	260	Summer	2011
Mazama Campground Thin	M	40	Summer	2011
Sharp Desert Dripline Thin	M	1000-1883	Summer	2011
Sun Creek South Burn	RX	625	Late Summer/ Fall	2011/ 2012

Calendar Year 2012 Project Target:3135 Acres				
Project	**Type**	**Acres**	**Season**	**Fiscal Year**
Grayback-Pinnacles Fuel Break	M	380	Summer	2012
West 62 Thin	M	1215-2062	Summer	2012
Crater Creek Ridge Thin	M	500-1486	Summer	2012
Sharp Desert Burn	RX	1000-1883	Late Summer/ Fall	2012
Mazama Campground Pile Burn	RX	40	Late Summer/ Fall	2012/ 2013

Calendar Year 2013 Project Target: 3415 Acres				
Project	**Type**	**Acres**	**Season**	**Fiscal Year**
Highway 138 Boundary Thin	M	750	Summer	2013
Bear Creek Drip line Thin	M	700	Summer	2013
Munsun Valley WUI	M	40-643	Summer	2013
Southwest Boundary Thin & Pile	M	475	Summer	2013
Panhandle Thin & Pile	M	550	Summer	2013
Sun Creek North Burn	RX	900	Late Summer/ Fall	2013/ 2014

Calendar Year 2014 Project Target: 2900 Acres				
Project	**Type**	**Acres**	**Season**	**Fiscal Year**

Bear Butte Thin	M	425	Summer	2014
Panhandle Pile Burn	RX	550	Late Summer/ Fall	2014/ 2015
Highway 138 Boundary	RX	750	Late Summer/ Fall	2014/ 2015
Southwest Boundary Pile RX	RX	475	Late Summer/ Fall	2014/ 2015
Bear Creek Burn	RX	700	Late Summer/ Fall	2014/ 2015

Project Descriptions

Phoenix- Treatment unit borders the NE park boundary, containing mixed-conifer forest stands with a heavy lodgepole component.

Upper Panhandle – Treatment unit includes mature ponderosa pine and white fir with minor amounts of Shasta red fir and aspen located between Annie Creek and the south park boundary above the panhandle.

Sun Creek-Treatment unit consists of mixed-conifer stands of ponderosa pine, white fir and sugar pine in the Sun Creek drainage near the park's south boundary.

Mazama Campground- Remaining area in Treatment unit composed of mountain hemlock, lodgepole and Shasta red fir forests in the Mazama Village Area around campground.

Crater Creek- Treatment unit consists of mixed conifer forests above Crater Creek along the west park boundary.

Sharp Desert- Treatment unit is composed of ponderosa pine forests along the NE park boundary between Desert Creek and Sharp Peak.

Greyback-Pinnacles Fuel Break- Treatment unit includes a mixed mosaic of mountain hemlock and lodgepole pine forests with dispersed sedge meadows along Greyback Motor-Nature Road and Pinnacles Valley Road, including Lost Creek Campground and facilities.

Highway 62 Fuel Break- Treatment unit is centered along the highway 62 road corridor from park's west boundary to the intersection with Munson Valley road. Mixed conifer stands near the west boundary grade into pure stands of mountain hemlock and lodgepole pine above 5500 ft elevation.

West 62-Treatment unit contains mixed conifer forest with patches of variable age-classes found between the west park boundary and hwy 62 west.

Highway 138 Boundary – Mixed conifer stand with a high component of lodgepole pine adjacent Highway 138 on the north boundary east of the north entrance road.

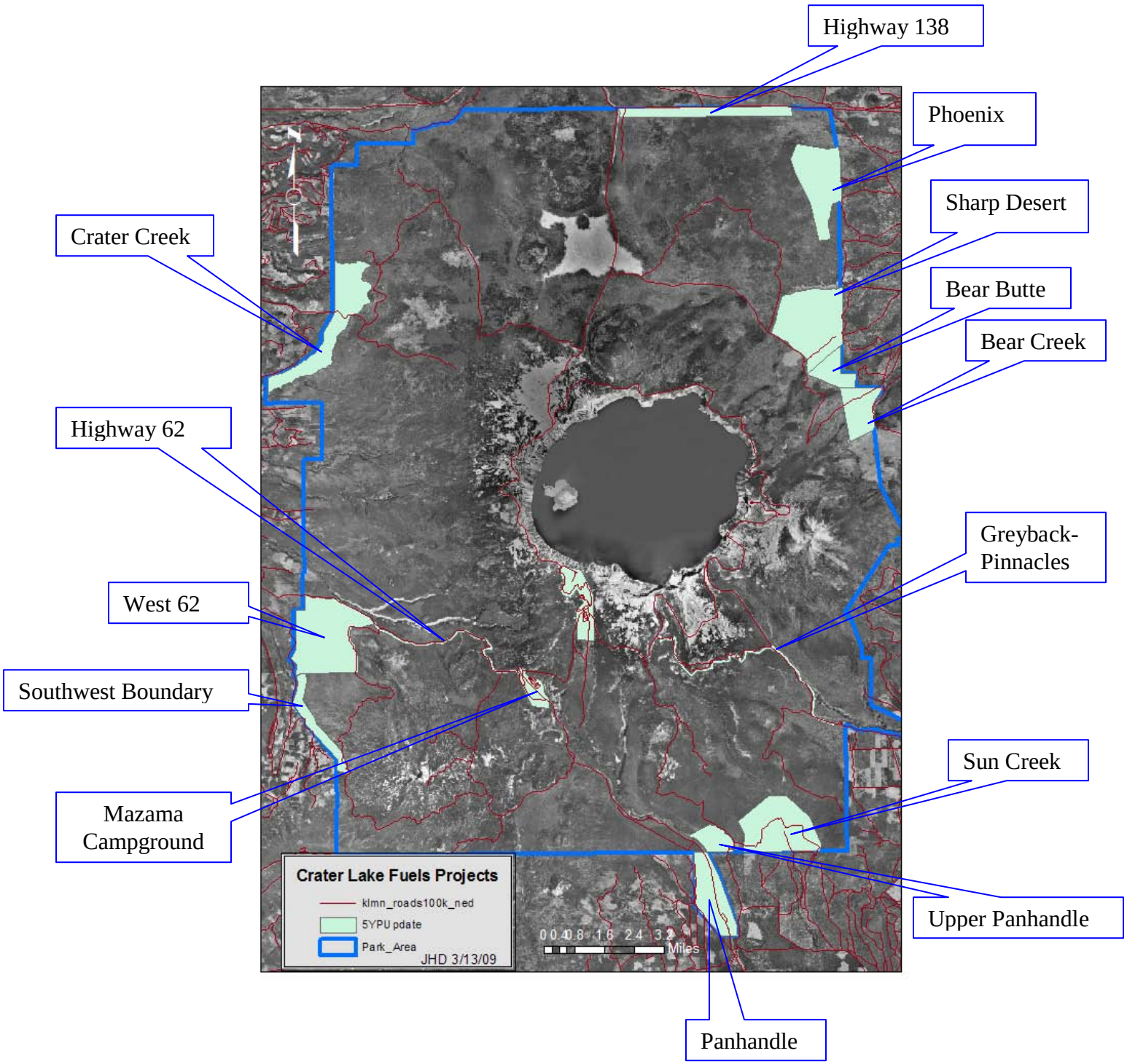
Bear Creek – Mixed conifer unit on the east boundary north of the Prophecy fire.

Munson Valley WUI – Defensible space treatment around structures.

Southwest Boundary – Treatment unit contains mixed conifer forest along west boundary south of the West 62 unit.

Panhandle- Treatment unit is composed of mixed patches of mature ponderosa pine with younger white fir and lodgepole pine and scattered mature sugar pine along Hwy 62. Portions of the area were treated with prescribed fire in the mid '70s and '80's.

Bear Butte – Treatment of mixed conifer on east boundary north of Bear Creek.



Appendix 13.I Fire Prevention Plan

Fire prevention is an important aspect of the parks' preparedness activities. Analysis of human-caused fires at Crater Lake National Park has indicated that, in most cases, human-caused fires have occurred near camping areas. Most have been escaped campfires and have resulted in burned areas of less than 0.1 acre per incident. These fires are often associated with camping outside of designated areas or other illegal activities outside of developed areas.

The park will conduct an active fire prevention program including public messages, inspections, fire use restrictions, and hazard abatement reduction around structures. Additional prevention activities for the park will consist of prevention signing, prevention messages through interpreters and staff, news media releases and prevention patrols during periods of very high or extreme fire danger.

A more detailed description of the park's fire information and education program is found in Chapter 9, Public Information and Education. The park's fire restriction and closure program is described in Appendix 13.G, Pre-Attack Plan.

Public Fire Use Restriction and Closure Procedures

Introduction

Enforceable fire use restrictions and emergency closures can reduce the possibility of human caused wildfires occurring during periods of seasonal drought, when wildfires can cause serious damage to park resources and threaten the safety of park visitors and employees. It is unlikely that park areas would need to be closed to public entry because of fire danger reasons alone although it could become necessary if there is substantial fire activity in the area and park staff decides that new fire starts must be prevented. Emergency closures for public safety reasons are also made during most fire seasons for certain park areas affected by fire operations.

Objectives

- To restrict the use of fire by the public in defined areas of the park during periods of high, very high, and extreme fire danger.
- To provide park administrative staff with a procedure for making emergency closures for fire prevention and public safety reasons.
- To ensure that fire use restrictions and emergency closures comply with the requirements set forth in 36 Code of Federal Regulations, Part 1, section 1.5.

Authority

Fire use restrictions and emergency closures shall be made in compliance with the requirements set forth in 36 Code of Federal Regulations (CFR), sections 1.5 and 2.13(c). For enforcing fire use restrictions this plan serves as the written determination required in section 1.5 (c). Decision memoranda will be approved by the Superintendent when fire use restrictions, or emergency closures for fire prevention or public safety reasons, are implemented. Whenever fire use restrictions or area closures are implemented, public notice must be given in compliance with 36 CFR, section 1.7. Such notice will be widely disseminated, as described in this Appendix.

Procedures for Implementing Fire Use Restrictions or Closures

The Fire Management Officer will identify areas of the parks where fire use restrictions and emergency closures for fire prevention purposes should be implemented. The Fire Management Officer will consider:

- Weather data
- Fuels data
- Visitor use trends
- Fire situation within the park (number of active fires and their potential, probability of new starts, and draw-down of park suppression resources)
- Current fire use restrictions and emergency closures in adjoining national forests (Winema National Forest, Umpqua National Forest, Rogue River National Forest) and other public lands (Sun Pass State Forest).
- Regional and national preparedness plan levels

The Fire Management Officer will consult with the Ranger Operations Supervisor on potential closures and restrictions, and will recommend to the Chief Ranger and Superintendent the appropriate Stage Level that should go in to effect. The Superintendent will approve a decision memorandum.

Once restrictions have been approved the Fire Management Officer will coordinate the following in order to place Stage I, Stage II or Stage III restrictions/closures into effect:

- Work with the Park Public Information Officer and issue a press release announcing the Stage Level.
- Notification of all park visitor center information desk personnel.
- Notification of Ranger Operations Supervisor.

- Coordinate the placing of signs (see Stage I, Stage II, and Stage III signing below).
- Make available to all visitor centers a fire use restriction and emergency closure handout for the public and employees.
- Request that Park Dispatch announce daily the current Stage Level during the morning report broadcast, and put Stage Level information in the written morning report.
- Notification of fire dispatch at Kingsley and Medford Interagency Fire Centers, and Klamath Unit of Oregon Department of Forestry.
- Notification of the park concessionaire.

Procedures for Lifting Fire Use Restrictions or Closures

When fire danger and fire occurrence moderates, the Fire Management Officer will recommend reduction of fire use restrictions and emergency closures for fire prevention purposes. The Fire Management Officer will consider:

- Weather data
- Fuels data
- Visitor use trends
- Fire situation within the park (number of active fires and their potential, probability of new starts, and draw-down of park suppression resources)
- Current fire use restrictions and emergency closures in adjoining national forests (Winema National Forest, Umpqua National Forest, Rogue River National Forest) and other public lands (Sun Pass State Forest).
- Regional and national preparedness plan levels

The Fire Management Officer will consult with the Ranger Operations Supervisor on lifting of fire use restrictions, and will recommend to the Chief Ranger and Superintendent the appropriate level of restrictions/closures or lifting of restrictions/closures. The Superintendent will approve a decision memorandum.

Once the lifting of restrictions/closures has been approved the Fire Management Officer will coordinate the following in order to lift Stage I, Stage II or Stage III restrictions/closures:

- Work with the Park Public Information Officer and issue a press release announcing the Stage Level.
- Notification of all park visitor center information desk personnel.
- Notification of Ranger Operations Supervisor.
- Coordinate the placing of signs (see Stage I, Stage II, and Stage III signing below).

- Request that Park Dispatch announce daily the current Stage Level during the morning report broadcast, and put Stage Level information in the written morning report.
- Notification of fire dispatch at Kingsley and Medford Interagency Fire Centers, and Klamath Unit of Oregon Department of Forestry.
- Notification of the park concessionaire.

Special Signage During 4th of July

Special "NO FIREWORKS" signs will be posted throughout the Parks five days prior to, and five days after the July 4th holiday. The Fire Management Officer will coordinate the posting of the signs with the Ranger Operations Supervisor.

Stage I Fire Use Restrictions

1. **Campfires and Camp Stoves**

- Wood fires and charcoal fires are permitted only within established grills or fire rings, or portable self-contained grills, in the following designated areas:
- Mazama Campground
- Lost Creek Campground
- Rim Village Picnic Area ("Picnic Hill")
- Park residential areas
- Gasoline and propane camp stoves and gas grills are permitted in campgrounds, picnic areas, backcountry areas and residential areas.

2. **Smoking**

- Smoking is permitted only in the following areas:
  - Within buildings where smoking is normally allowed, and directly adjacent to buildings. Ashtrays must be used for both ashes and butts.
  - In vehicles, provided that an ashtray is used for ashes and butts.
  - While stopped in an area at least three (3) feet in diameter that is barren or free of all flammable materials. Ashes and butts must be disposed of safely and may not be discarded on the ground.

3. **Fireworks**

- Fireworks are prohibited in the park at all times

4. **Trigger Conditions**

- Once the following conditions have been reached, and are anticipated to continue for an extended period of time, Stage 1 fire use restrictions will be implemented. The park will strive to avoid implementing

restrictions when trigger conditions are expected to last only very short periods.

- Similar fire restrictions are in effect for adjoining National Forests are in effect (Winema National Forest, Rogue River National Forest, Umpqua National Forest), and
- National Fire Danger Rating Staffing Class for any Park fire weather station is three or higher

5. Signage

- Stage 1 signs will include the following wording:
  - "HIGH FIRE DANGER"
  - "NO WOOD OR CHARCOAL FIRES EXCEPT IN DESIGNATED CAMPGROUNDS AND PICNIC AREAS"
  - "GAS OR PROPANE STOVES PERMITTED"
  - "NO SMOKING EXCEPT WITHIN ENCLOSED VEHICLES, DEVELOPED AREAS, OR DESIGNATED CAMPGROUNDS"
- Signs will be placed at the following locations:
  - Ponderosa Picnic Area bulletin board
  - Old West bulletin board
  - Annie Springs Entrance Station bulletin board
  - North Entrance Station bulletin board
  - Mazama Store bulletin board
  - Mazama Campground kiosk
  - Steel Information Center
  - Rim Visitor Center
  - Crater Lake Lodge
  - Rim Village Cafeteria and Gift Shop
  - Cleetwood Cove ticket shed
  - Trailheads for all maintained trails in park
  - Rim Village Picnic Area

Stage II Fire Use Restrictions

1. Campfires and Camp Stoves

- Wood fires and charcoal fires are prohibited throughout the park.
- Gasoline and propane camp stoves and gas grills are permitted in campgrounds, picnic areas, backcountry areas and residential areas.

2. Smoking

- **Smoking is prohibited throughout the park.**

3. Fireworks

- Fireworks are prohibited in the park at all times.

4. Trigger Conditions

- Once the following conditions have been reached, and are anticipated to continue for an extended period of time, Stage II fire use restrictions will be implemented. The park will strive to avoid implementing restrictions when trigger conditions are expected to last only very short periods.
- Similar fire restrictions are in effect for adjoining National Forests are in effect (Winema National Forest, Rogue River National Forest, Umpqua National Forest), and
- National Fire Danger Rating Staffing Class for any Park fire weather station is four or higher

5. Signage

- Stage 1 signs will include the following wording:
  - "VERY HIGH FIRE DANGER"
  - "NO WOOD OR CHARCOAL FIRES"
  - "GAS OR PROPANE STOVES PERMITTED"
  - "SMOKING PROHIBITED"
- Signs will be placed at the following locations:
  - Ponderosa Picnic Area bulletin board
  - Old West bulletin board
  - Annie Springs Entrance Station bulletin board
  - North Entrance Station bulletin board
  - Mazama Store bulletin board
  - Mazama Campground kiosk
  - Steel Information Center
  - Rim Visitor Center
  - Crater Lake Lodge
  - Rim Village Cafeteria and Gift Shop
  - Cleetwood Cove ticket shed
  - Trailheads for all maintained trails in park
  - Rim Village Picnic Area

Stage III Fire Use Restrictions

1. Campfires

- Wood fires and charcoal fires are prohibited throughout the park.
- Gasoline and propane camp stoves and gas grills are prohibited throughout the park.

2. Smoking

- Smoking is prohibited throughout the park.

3. Fireworks

- Fireworks are prohibited in the park at all times.

4. Trigger Conditions

- Once the following conditions have been reached, and are anticipated to continue for an extended period of time, Stage III fire use restrictions will be implemented. The park will strive to avoid implementing restrictions when trigger conditions are expected to last only very short periods.
- Similar fire restrictions are in effect for adjoining National Forests are in effect (Winema National Forest, Rogue River National Forest, Umpqua National Forest), and
- National Fire Danger Rating Staffing Class for any Park fire weather station is five

5. Signage

- Stage 1 signs will include the following wording:
  - "EXTREME FIRE DANGER"
  - "NO WOOD OR CHARCOAL FIRES"
  - "GAS AND PROPANE STOVES PROHIBITED"
  - "SMOKING PROHIBITED"
- Signs will be placed at the following locations:
- Ponderosa Picnic Area bulletin board
- Old West bulletin board
- Annie Springs Entrance Station bulletin board
- North Entrance Station bulletin board
- Mazama Store bulletin board
- Mazama Campground kiosk
- Steel Information Center
- Rim Visitor Center
- Crater Lake Lodge
- Rim Village Cafeteria and Gift Shop
- Cleetwood Cove ticket shed
- Trailheads for all maintained trails in park
- Rim Village Picnic Area

Additional Emergency Fire Restriction Orders can be put in place using Park Superintendent Orders.

Appendix 13.J Rental Equipment Agreements

Crater Lake currently has an incident purchasing plan in place. The Fire Management Program assistant is responsible for updates to this plan. The plan is located at their workstation.

Regional and national rental equipment agreements will be utilized if local vendors are not available when necessary.

Appendix 13.K Contracts for Suppression and Prescribed Fire Resources

Crater Lake utilizes contract resources from both the Northwest resource pool and the Pacific West Region exclusive use crew contract.

Crater Lake fire management maintains no contracts of its own, and will procure resources through regional or national lists.

Appendix 13.L Burned Area Emergency Stabilization and Rehabilitation Plan

YYYYY Fire
BURNED AREA EMERGENCY STABILIZATION AND REHABILITATION (ESR) PLAN

AGENCY/ UNIT: XXXXX

LOCATION: *City, County, State*

DATE: *Date Prepared*

PREPARED BY: *Individual, formal team, or ad hoc team*

Submitted By: _____ Date: _____
Title (i.e., Burned Area Emergency Stabilization and Rehabilitation Team Leader.)

REVIEW AND APPROVAL
Specify agency, XXXXX

I. Suppression Operations Funding Approval (check one box below):

☐Approved
☐Approved with Revision (see attached)
☐Disapproved

Specify Title and Jurisdiction (Field Unit Agency Administrator), Date

II. Burned Area Rehabilitation Funding Approval (check one box below):

☐ Approved
☐ Approved with Revision (see attached)
☐ Disapproved

Specify Title and Jurisdiction (Region/ State Agency Administrator), Date

Regional Fire Management Coordinator concurrence that the plan fits the technical definition for use of Burned Area Rehabilitation finding. *(U.S. Fish and Wildlife Service Only)*

Regional Fire Management Coordinator, Region *X* Date

III. Agency Operational Base Funding Approval (check one box below):
☐ Approved
☐ Approved with Revision (see attached)
☐ Disapproved

Specify Title and Jurisdiction (Region/ State), Date

III. Burned Area Rehabilitation Funding Approval (check one box below):

☐ Approved
☐ Approved with Revision (see attached)
☐ Disapproved

Specify Title and Jurisdiction (Headquarters), Date

EXECUTIVE SUMMARY

Introduction

This plan has been prepared in accordance with specify agency policy. This plan provides burned area emergency stabilization and rehabilitation (ESR) recommendations for all lands burned within the YYYYY Fire perimeter and downstream impact areas including: public lands administered by the specify agency and other jurisdiction if necessary. The primary objectives of the YYYYY Fire Burned Area Emergency Stabilization and Rehabilitation (ESR) Plan are:

Emergency Stabilization

- To prescribe cost effective post-fire stabilization measures necessary to protect human life, property, and critical cultural and natural resources.
- To promptly stabilize and prevent further degradation to affected resources on lands within the fire perimeter or downstream impact areas and mitigate damages caused by fire suppression operations in accordance with approved land management plans and policies, and all relevant federal, state, and local laws and regulations.

Rehabilitation

- To repair or improve lands unlikely to recover naturally from severe wildland fire damage by emulating historic or pre-fire ecosystem structure, function, diversity, and dynamics according to approved land management plans.
- Restore or establish healthy, stable ecosystems, even if these ecosystems cannot fully emulate historic or pre-fire conditions as specified in approved land management plans.

This plan addresses emergency stabilization and rehabilitation of fire suppression and fire damages. *Summarize who did what. Such as: The burned area emergency stabilization and rehabilitation team (ESR) Team conducted an analysis of fire damages throughout the lands impacted by the fire. The watershed assessment group assessed the overall watershed changes caused by the fire and developed a burn severity map. Archeologists inventoried suppression impacts for potential damage to cultural sites as well as initiating a cultural resource damage assessment. The vegetation specialist evaluated and assessed fire damages and suppression impacts to vegetative resources, including threatened and endangered (T&E) species, and identified values at risk associated with vegetative losses. The wildlife biologist conducted an assessment of T&E species and initiated and closed Section 7 consultations with U.S. Fish & Wildlife Service. The GIS specialists gathered the data layers necessary for the plan, coordinated GPS activities. The operations specialists inventoried fire suppression impacts, developed specifications for their rehabilitation and initiated repair of fence cuts.*

Individual resource Burned Area Assessment Reports produced by these specialists are in Appendix I.. The individual treatments specifications including the effectiveness monitoring identified in the assessments can be found in Part F. A summary of the costs by jurisdictions is in Part E. Appendix II contains the National Environmental Policy Act (NEPA) compliance documentation summary. Appendix III contains the ESR Plan maps. Appendix IV contains photo documentation. Appendix V contains supporting documentation.

Fire Background

Provide a summary of the fire:

- *When and how it started.*
- *A chronological summary of fire and fire management organization growth.*
- *Issues to be addressed in the ESR Plan*

Fire Damages and Threats to Human Safety and Natural and Cultural Resources

Discuss the damages caused by suppression activities and the fire. List the recommended fire suppression activity damage, emergency stabilization, and rehabilitation treatments recommended in the plan. Summarize the individual resource burned area assessments:

XXXXX Management Requirements

Provide basic field unit information and issues that will affect Burned Area Emergency Stabilization and Rehabilitation.

Emergency Stabilization

Identify issues and concerns (hazardous environments, wilderness designation, cultural resource restrictions, water quality requirements, etc.) that will impact agency objective achievement as discussed in approved land management plans that are pertinent to emergency stabilization actions under consideration.

Rehabilitation

The following statements in approved XXXXX management plans justify the proposed burned area rehabilitation treatments funded with Burned Area Rehabilitation funds.

Quote (include page number, approving officials name, and date approved for review and auditing purposes) pertinent passages from approved land management plans (i.e., Forest Plans, Comprehensive Conservation Plan, Master Plan, Habitat Management Plan, Grazing Management Plan, Marsh and Water Management Plan, etc.) that justify the proposed rehabilitation activities. Such as:

- *"Restore riparian areas invaded by salt cedar to historic Southwestern Willow Flycatcher habitat" (Lower Colorado River Refuge Complex Comprehensive Conservation Plan, page 31, Cathy Smith, October 2, 1997).*
- *"Rehabilitate longleaf-wiregrass communities degraded by past forest practices" (St. Marks NWR Habitat Management Plan, page 56, John Doe, February 29, 2001).*
- *"Maintain grazing allotment fences in the Coot Creek Allotment" (Ely District, BLM, Coot Creek Grazing Allotment Management Plan, page 43, Jane Doe, March 24, 1989).*

PART A - FIRE LOCATION AND BACKGROUND INFORMATION

Fire Name	YYYYY
Fire Number	
Agency Unit	
Region	
State	
County(s)	
Ignition Date/ Cause	
Zone	
Date Controlled	
Jurisdiction	Acres
XXXXX	
other jurisdictions	
other jurisdictions	
other jurisdictions	
other jurisdictions	
other jurisdictions	
Total Acres	
Date Contained	

PART B - NATURE OF PLAN

E. Type of Plan (check one box below)

	Emergency Stabilization
	Rehabilitation
	Both Emergency Stabilization and Rehabilitation

II. Type of Action (check one box below)

	Initial Submission
	Updating or Revising the Initial Submission
	Supplying Information of Accomplishment to Date on Work
	Different Phase of Project
	Final Accomplishment Report (To Comply with the Closure of the 9262 Account)

PART C - EMERGENCY STABILIZATION AND REHABILITATION ASSESSMENT

Emergency Stabilization Objectives

- *Locate and stabilize severely burned slopes which pose a direct threat to human life, property or critically important cultural and/ or natural resources.*
- *As practical and necessary, restore natural conditions to areas disturbed by fire suppression actions.*
- *Prevent the establishment of non-native invasive plants.*
- *Prevent degradation of unburned areas within the fire perimeter before spring greenup by wild ungulates and horses.*
- *Etc.*

Rehabilitation Objectives

- *Rehabilitate former salt-cedar areas with willows, cottonwoods, and other native species as specified in the refuge's approved Comprehensive Conservation and Habitat Management Plan.*
- *Rehabilitate burned grazing program infrastructure (i.e., boundary and allotment management fences and water troughs).*
- *Repair or replace burned facilities in the Coot Creek campground.*
- *Etc.*

PART D - TEAM ORGANIZATION, MEMBERS, AND RESOURCE ADVISORS

I. Approval Authorities

Specify Agency (for multi-agency plans duplicate for each agency)

Activities Requiring Local Agency Administrator Approval Fire Suppression Damages (charged to Fire Suppression)	Status	Cost
Subtotal		

Status: C=Completed; O=Ongoing; P=Planned

Activities Requiring Regional/ State/ Headquarters Approval Emergency Stabilization and Rehabilitation (charged to BAR)	Status	Cost
Subtotal		

Status: C=Completed,; O=Ongoing; P=Planned

Total Emergency Stabilization and Rehabilitation Costs	

II. Burned Area Emergency Stabilization and Rehabilitation (ESR) Team Members:
(List of technical specialists used to develop the plan)

Position	Team Member (Agency)
Team Leader	*Cathy Smith (NPS)*
Public Information	
Operations	
NEPA Compliance & Planning	
Hydrologist	
Soil Scientist	
Geologist	
Cultural Resources/ Archeologist	
Vegetation Specialist	
Wildlife Biologist	
GIS Specialist	
Documentation/ Computer Specialist	
Photographer	
Other Technical Specialists	

III. Resource Advisors: (Note: Resource Advisors are individuals who assisted the ESR Team with the preparation of the plan. See Part H for a full list of agencies and individuals who were consulted or otherwise contributed to the development of the plan.

Name	Affiliation
Jane Doe	*XXXXX NWR, Project Leader*

PART E - SUMMARY OF ACTIVITIES AND COSTS

The summary of activities and cost table below identifies emergency stabilization and rehabilitation costs charged or proposed for funding from Suppression Operations, Burned Area Rehabilitation, agency operation, and other funding sources. Expenditures are displayed in the total cost column. They are coded with the appropriate cost authority. The total cost of the rehabilitation effort to date, excluding the costs absorbed by the fire account (fire crews, labor, and associated overhead) is displayed as either Suppression Operations (F), Burned Area Rehabilitation (BAR), Emergency Watershed Protection (EWP), or Agency Operations/Other (O/OP) or other.

Fire Name: YYYYY

As of *date*

Specification Cost Summary

Account	Dollars	Dollars
Fire Suppression Activity Damage Rehabilitation (F)		
Burned Area Rehabilitation (BAR)		
Emergency Stabilization	$	
Rehabilitation	$	
Emergency Watershed Protection (EWP)		
Agency Operations/Other (OP/O)		
Funding Summary - Estimated Total		

PART E - SUMMARY OF EMERGENCY STABILIZATION ACTIVITIES - COST SUMMARY TABLE - YYYYY Fire

Spec #	Title	Unit	Unit Cost	# of Units	Cost by Funding Source				Implementation Method	Specification Total
					F	BAR	EWP	OP/O		
N-3b	*Soil Stabilization*	*Acre*	*$ 264.85*	*200*		*$ 52,9*			*P,C*	*$ 52,970*
TOTAL COST					$ 0	$ 52,97	$ 0	$ 0		$ 52,970

COST: F1=Suppression Operations, BAR=Burned Area Rehabilitation, EWP=Emergency Watershed Protection, OP/O=Agency Operations Funding, Other

METHOD: FC=Crew Assigned to Fire, C=Contract, EFC=Emergency Fire Contract, P=Agency Personnel

PART E - SUMMARY OF REHABILITATION ACTIVITIES - COST SUMMARY TABLE - YYYYY Fire

Spec #	Title	Unit	Unit Cost	# of Units	Cost by Funding Source		Implementation Method	Specification Total
					BAR	OP/O		
N-3b	*Sagebrush Planting*	*Acre*	*$ 264.8*	*200*	*$ 52,970*		*P,C*	*$ 52,970*
TOTAL COST					$ 52,970	$ 0		$ 52,970

COST: BAR=Burned Area Rehabilitation, OP/O=Agency Operations Funding, Other

METHOD: FC=Crew Assigned to Fire, C=Contract, EFC=Emergency Fire Contract, P=Agency Personnel

PART F - INDIVIDUAL TREATMENT SPECIFICATIONS

SPECIFICATION TITLE:		AGENCY:	
PART E LINE ITEM:		FISCAL YEAR(S) (list each year):	

F. **WORK TO BE DONE** (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

A. General Description:

B. Location/(Suitable) Sites:

C. Design/Construction Specifications:

1.

2.

D. Purpose of Treatment Specifications:

E. Treatment Effectiveness Monitoring Proposed:

II. LABOR, MATERIALS AND OTHER COST:

➢ PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST/ITEM
TOTAL PERSONNEL SERVICE COST	
☐ EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST/ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
☐ MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST/ITEM
TOTAL MATERIALS AND SUPPLY COST	
☐ TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST/ITEM
TOTAL TRAVEL COST	
☐ CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST/ITEM
TOTAL CONTRACT COST	

SPECIFICATION COST SUMMARY						
FISCAL YEAR	UNIT	UNITS COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY__						
FY__						
FY__						
FY__						
FY__						
TOTAL						

FUNDING SOURCE
F - Suppression Operations
BAR - Burned Area Rehabilitation
EWP - Emergency Watershed Protection
OP/O - Agency Operations/ Other

METHODS
P - Agency Personnel Services
C - Contract (long-term)
EFC - Emergency Fire Contract (short-term)
FC - Incident Management Crew Assignment

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services, **E** = Equipment **M** = Materials/ Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-Reference Location within ESR Plan Accomplishment Report (for Rehabilitation treatments quote (include page number, approving officials name, and date approved for review and auditing purposes) pertinent passages from approved land management plans:

PART G - POST-REHABILITATION REQUIREMENT[1]

The following are post-rehabilitation, implementation, operation, maintenance, monitoring, and evaluation actions beyond three years to ensure the effectiveness of initial investments. Estimated annual cost and funding source is indicated.

Emergency Stabilization

1. Monitor and maintain road culverts clear of debris ($5,000 - OP/O)
2. Monitor ($1,000) and dredge ($75,000 - OP/O) sediment ponds as need
3. Continue invasive species monitoring and control ($50,000 - OP/O)
4. Etc.
5. Etc.
6. Etc.

Rehabilitation

1. Monitor and maintain drip irrigation system ($25,000 - OP/O)
2. Long-term Monitoring
   A. Monitor riparian vegetation recovery ($10,000 - OP/O)
   B. Complete district cultural resources systematic survey ($75,000 - OP/O)
   C. Southwestern willow flycatcher population monitoring ($25,000 - OP/O)
3. Etc.

PART H - CONSULTATIONS

U.S. Fish and Wildlife Service
   Jane Doe, Regional Archeologist

National Marine Fisheries Service
   John Doe, Anadromous Fish Biologist

Umatilla Tribe
   Jane J. Doe, Tribal Council Member

Etc.

[1] Non-9262 funding

APPENDIX I - ESR BURNED AREA ASSESSMENT REPORTS

- *Soil & Watershed Damage Assessment Report*
- *Vegetation Damage Assessment Report*
- *Forest Damage Assessment Report*
- *Wildlife Damage Assessment Report*
- *Cultural Damage Assessment Report*
- *Faculty Assessment Report*
- *Etc.*

YYYYY FIRE *RESOURCE* DAMAGE ASSESSMENT REPORT

Objectives
Issues
Observations
    Background Information
    Reconnaissance Method
    Findings
Recommendations
    Management (specification related)
    Specification Monitoring (specification related)
    Management (non-specification related)
Consultations
References

APPENDIX II - ENVIRONMENTAL COMPLIANCE

Federal, State, and Private Lands Environmental Compliance Responsibilities

All projects proposed in the YYYYY Fire Burned Area Emergency Stabilization and Rehabilitation (ESR) Plan that are prescribed, funded, or implemented by Federal agencies on Federal, State, or private lands are subject to compliance with the National Environmental Policy Act (NEPA) in accordance with the guidelines provided by the Council on Environmental Quality (CEQ) Regulations (40 CFR 1500-1508); *insert department and agency policy*. This Appendix documents the ESR Team considerations of NEPA compliance requirements for prescribed rehabilitation and monitoring actions described in this plan for all jurisdictions affected by the YYYYY burned area emergency.

Related Plans and Cumulative Impact Analysis

XXXXX *Specify Plan (approval date)*. The XXXXX *Specify Plan* was reviewed and it was determined that actions proposed in the YYYYY Fire ESR Plan within the boundary of the XXXXX are consistent with the management objectives established in the Comprehensive

Conservation Plan. The Comprehensive Conservation Plan NEPA compliance process specifically addresses:

- *List specific issues*

(Duplicate for all plans reviewed)

Cumulative Impact Analysis

Cumulative effects are the environmental impacts resulting from the incremental impacts of a proposed action when added to other past, present, and reasonably foreseeable future actions, both Federal and non-Federal. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. The emergency protection and rehabilitation treatments for areas affected by the YYYYY Fire, as proposed in the YYYYY Fire ESR Plan, do not result in an intensity of impact (i.e. major ground disturbance, etc.) that would cumulatively constitute a significant impact on the quality of the environment. The treatments are consistent with the above jurisdictional management plans and associated environmental compliance documents and categorical exclusions listed below.

Applicable and Relevant Categorical Exclusions

The individual actions proposed in this plan for XXXXX are Categorically Excluded from further environmental analysis as provided for in the *specify relevant departmental and agency Categorical Exclusions*. All applicable and relevant Department and Agency Categorical Exclusions are listed below. Categorical Exclusion decisions were made with consideration given to the results of required emergency consultations completed by the ESR Team and documented below.

Applicable Department *specify* Categorical Exclusions

List

Applicable *specify* agency Categorical Exclusions

List

Statement of Compliance for the YYYYY Fire Burned Area Emergency Stabilization and Rehabilitation Plan.

This section documents consideration given to the requirements of specific environmental laws in the development of the YYYYY Fire ESR Plan. Specific consultations initiated or completed during development and implementation of this plan are also documented. The following executive orders and legislative acts have been reviewed as they apply to the YYYYY Fire ESR Plan:

- National Historic Preservation Art (NHPA).
- Executive Order ll988. Floodplain Management.

- Executive Order 11990. Protection of Wetlands.
- Executive Order 12372. Intergovernmental Review.
- Executive Order 12892. Federal Actions to Address Environmental Justice in Minority and Low-income Populations.
- Endangered Species Act.
- Secretarial Order 3127. Federal Contaminated
- Clean Water Act.
- Clean Air Act.

CONSULTATIONS

- List partners and neighbors consulted

NEPA Checklist: If any of the following exception applies, the ESR Plan cannot be Categorically Excluded and an Environmental Assessment (EA) is required.

(Yes) (No)

( ) ( ) Adversely affect Public Health and Safety

( ) ( ) Adversely affect historic or cultural resources, wilderness, wild and scenic rivers aquifers, prime farmlands, wetlands, floodplains, ecologically critical areas, or Natural Landmarks.

( ) ( ) Have highly controversial environmental effects.

( ) ( ) Have highly uncertain environmental effects or involve unique or unknown environmental risks.

( ) ( ) Establish a precedent resulting in significant environmental effects.

( ) ( ) Relates to other actions with individually insignificant but cumulatively significant environmental effects.

( ) ( ) Adversely effects properties listed or eligible for listing in the National Register of Historic Places

( ) ( ) Adversely affect a species listed or proposed to be listed as Threatened or Endangered.

( ) ( ) Threaten to violate any laws or requirements imposted for the "protection of the environment" such as Executive Order 11988 (Floodplain Management) or Executive Order 11990 (Protection of Wetlands).

National Historic Preservation Act

Ground Disturbance:

( ) None

( ) Ground disturbance did occur and an archeologist survey, required under section 110 of the NHPA will be prepared. A report will be prepared under contract as specified by the ESR Plan.

A NHPA Clearance Form:

( ) Is required because the project may have affected a site that is eligible or on the national register. The clearance form is attached. SHPO has been consulted under Section 106 (see Cultural Resource Assessment, Appendix I).
( ) Is not required because the ESR Plan has no potential to affect cultural resources (initial of cultural resource specialist).

Other Requirements

(Yes) (No)

( ) ( ) Does the ESR Plan have potential to affect any Native American uses? If so, consultation with affiliated tribes is needed.

( ) ( ) Are any toxic chemicals, including pesticides or treated wood, proposed for use? If so, local agency integrated pest management specialists must be consulted.

I have reviewed the proposals in the YYYYY Fire Burned Area Emergency Stabilization and Rehabilitation Plan in accordance with the criteria above and have determined that the proposed actions would not involve any significant environmental effect. Therefore it is categorically excluded from further environmental (NEPA) review and documentation. ESR Team technical specialists have completed necessary coordination and consultation to insure compliance with the National Historic Preservation Act, Endangered Species Act, Clean Water Act and other Federal, State and local environment review requirements.

_____

ESR Team Environmental Protection Specialist Date

_____

Project Leader, XXXXX National Wildlife Refuge Date

APPENDIX III - MAPS

- Fire Perimeter
- Jurisdiction Map
- Suppression Impacts
- Soils
- Burn Severity
- Vegetation Communities
- Vegetation Mortality
- Threatened and Endangered Species Areas
- Invasive Species
- Wind Erosion Risk Map

APPENDIX IV - PHOTO DOCUMENTATION

APPENDIX V - SUPPORT DOCUMENTS

PART F - INDIVIDUAL TREATMENT SPECIFICATIONS

SPECIFICATION TITLE:		AGENCY:	
PART E LINE ITEM:		FISCAL YEAR(S) (list each year):	

I. WORK TO BE DONE
(describe or attach exact specifications of work to be done):

Number and Describe Each Task:

A. General Description:

B. Location/(Suitable) Sites:

C. Design/Construction Specifications:

1.

2.

D. Purpose of Treatment Specifications:

E. Treatment Effectiveness Monitoring Proposed:

II. LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST/ITEM
TOTAL PERSONNEL SERVICE COST	
☐ EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST/ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
☐ MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST/ITEM
TOTAL MATERIALS AND SUPPLY COST	
☐ TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST/ITEM
TOTAL TRAVEL COST	
☐ CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST/ITEM
TOTAL CONTRACT COST	

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNITS COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY__						
FY__						
FY__						
FY__						
FY__						
TOTAL						

FUNDING SOURCE
F - Suppression Operations
BAR - Burned Area Rehabilitation
EWP - Emergency Watershed Protection
OP/O - Agency Operations/ Other

METHODS
P - Agency Personnel Services
C - Contract (long-term)
EFC - Emergency Fire Contract (short-term)
FC - Incident Management Crew Assignment

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services, **E** = Equipment **M** = Materials/ Supplies, **T** = Travel,
C = Contract, **F** = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-Reference Location within ESR Plan Accomplishment Report (for Rehabilitation treatments quote (include page number, approving officials name, and date approved for review and auditing purposes) pertinent passages from approved land management plans:

YYYYY *RESOURCE* DAMAGE ASSESSMENT REPORT

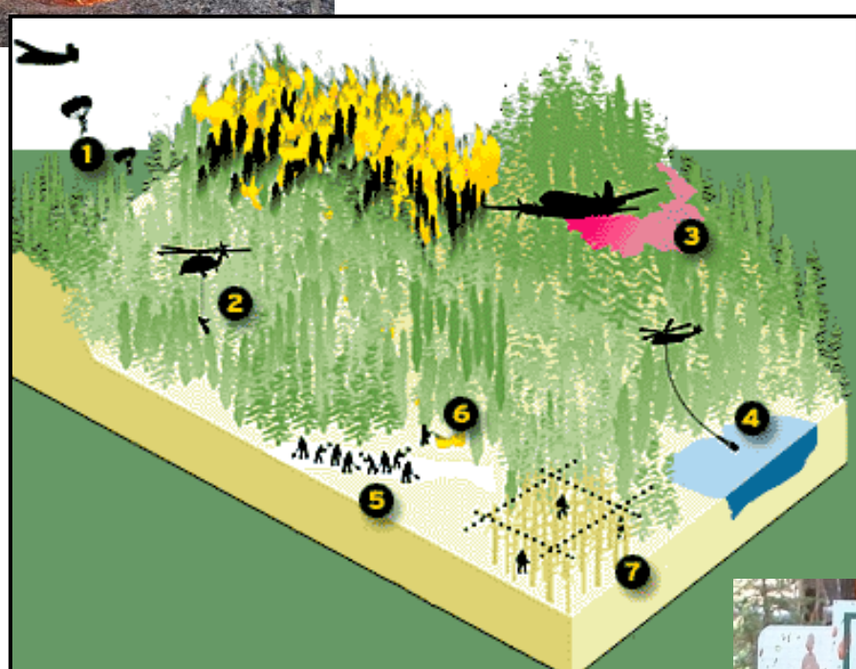
Objectives
Issues
Observations
- Background Information
- Reconnaissance Method
- Findings

Recommendations
- Management (specification related)
- Specification Monitoring (specification related)
- Management (non-specification related)

Consultations
References

Resource Advisor Guide

Crater Lake National Park
National Park Service
U.S. Department of the Interior



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Purpose

This guide is intended to serve as a reference document for a Resource Advisor being consulted on a fire management action at Crater Lake National Park. Appendix 13.D.2 of the Fire Plan is a Biological Opinion issued by the U.S. Fish and Wildlife Service. This Opinion is to be considered an integral part of the Fire Plan and this Resource Advisor's Guide. Resource Advisors are cautioned that the Opinion must be read and followed. It is intended to provide sufficient background, together with the Fire Management Plan and its environmental assessment, to mitigate possible environmental effects of a complex fire management plan that includes fire suppression, prescribed fire, and wildland fire use.

Forest Types and Their Fire Regimes

The first step in evaluating fire effects is defining the forest ecosystem in which the fire management action will occur. From this information, the historical nature of fire in the system, projected fire behavior, and anticipated fire effects can be judged. There are several general ways that the forest ecosystems can be defined. For the purposes of this Guide, six types are defined and can be referenced to the Pacific Meridian Resources map produced for the Park in 1996 (Table 1). The six types are: ponderosa pine, white fir, Douglas-fir, lodgepole pine, red fir, and mountain hemlock. For in-depth discussion of these forest types and fire beyond information needed for short-term decision needs, refer to Agee (1993), *Fire Ecology of Pacific Northwest Forests.*

Ponderosa Pine

The ponderosa pine type at Crater Lake is primarily found in the northeastern corner of the Park. In these forest communities, ponderosa pine is the potential (climax) vegetation and is the only conifer present. Along the margin of ponderosa pine communities, particularly at meadow edges, lodgepole pine may be found in association with ponderosa pine. The ponderosa pine type had a low severity fire regime with relatively frequent fire occurrence. While substantial fire history information exists elsewhere in the type, little immediate fire history work has been done in this type in the Park. Nevertheless, fairly frequent fire at the stand level was characteristic of ponderosa pine forests. Average fire return intervals were about 5-15 years (Agee 1994) for the type elsewhere in Oregon. The structure-of the ponderosa type was open and Park-like (i.e., grassy understory) with a stable overstory of pure ponderosa pine. The forest was an aggregation of very small, even-aged or even-sized clumps, averaging at most about 30 m on a side. As one clump would age, it would be attacked by western pine beetles and then be decomposed by fire, scarifying the site for another clump to regenerate. Because of this interaction between fire and beetles, snags tended to be clustered on the landscape, and coarse-woody debris was likely short-lived because of the frequent fires. Consumption of the coarse woody debris naturally inhibits rhizomatous grasses and sedges and create growing space for pine regeneration.

Table 1. Forest types of Crater Lake National Park (Pacific Meridian Resources 1996).

Forest Type	Associated Tree Species
Ponderosa pine	Nearly pure Ponderosa pine
White fir	White fir, ponderosa pine, conifer mix
Douglas-fir	Douglas-fir, white fir, conifer mix
Red fir	Red fir, lodgepole pine, mountain hemlock, conifer mix
Lodgepole pine	Nearly pure Lodgepole pine
Mountain hemlock	Mountain hemlock, lodgepole pine, whitebark

Note: Not all tree species in the Park are defined as PMR types but will usually be of scattered occurrence in the major types. Water, rock, snow, grass/herb, bogs/moist meadow, and shrub are also included as PMR types but not listed here.

Elsewhere, a stable pattern of one-storied mature forest in clumps with a grassy understory was maintained by the frequent fires. The clumped pattern is still very evident across most of the northeast section of the Park in this type. Each fire would decrease the chance of a subsequent fire becoming intense by consuming needle litter and top-killing shrubs. Weak sprouting species such as bitterbrush were likely not as widespread through the forest as they are today.

Fire exclusion has allowed a major increase in tree density of ponderosa pine. Chances of stand-replacement fire, characteristic of high severity fire regimes, are much greater than historically. This type is a primary candidate for prescribed fire because of the need to restore fuel and stand structure to more natural, low severity fire regime conditions.

White Fir

The white fir type has a major component of ponderosa pine, as well as sugar pine. Historic fires favored the pines over white fir, and most of these stands, concentrated in the southern portion of the Park, were historically dominated by ponderosa pine. Specific fire history information is available for the panhandle area of the Park from work by McNeil and Zobel (1980). They studied an elevation gradient from the southern end of the panhandle up into the red fir forest types, and found an average fire return interval of 9-42 years along the gradient, with the lower average adjacent to the ponderosa pine type and the upper average adjacent to the red fir type. Variation around the mean was high, and that probably allowed fire-intolerant white fir (at least while it is young) to survive as a codominant in this classic low severity fire regime type.

Like the ponderosa pine type, the stands were generally one-storied, and composed of small clumps. However, these clumps tended to be of the major species comprising the type: one clump of ponderosa pine, another of sugar pine, another of white fir, several more of ponderosa pine, etc. (Thomas and Agee 1986). Fires were still frequent enough to kill most understory trees invading under the clumps, so that these forest remained relatively open. Understory shrubs such as gooseberries, currants, and ceanothus would either sprout after burning or reproduce from seeds stimulated to germinate by heating as the fire passed over. As in the ponderosa pine type, a low shrub/grassy understory was maintained by frequent fires. It was probably better developed under the pine clumps than under the relatively shadier true fir clumps. The white fir has been significantly affected by fire exclusion. The open forest has been choked by white fir regeneration (and to some extent, lodgepole pine in the early years). Most of the regeneration ceased about 1950 (McNeil and Zobel 1980) when growing space in the stands was fully occupied by trees. Fire hazard has significantly increased, and this type, along with the ponderosa pine type, has been identified as a focus type for prescribed fire to restore the low severity fire regime.

Douglas-Fir

The Douglas-fir type is among the least-studied forest types in the Park. It is not a common type and occurs in relatively inaccessible areas in the southwestern portion of the Park. In. the southern Cascades of Oregon, Douglas-fir is characterized by a moderate severity fire regime (Morrison and Swanson 1990). In the southwestern portion of the Park, it occurs in a complex mixture with red fir, climax lodgepole, and white fir forests, and probably has a fire regime characteristic of all of these: low to moderate severity. Multiple age classes are visually obvious in this type. Douglas-fir is quite resistant to fire damage when mature, and will be found with mixtures of western white pine, white fir, and lodgepole pine. Longer fire-free periods associated with the fire exclusion period have probably increased the probability of higher severity fire in this type, but it is not widely distributed in the Park and probably should not be a focus of prescribed fire efforts unless it is adjacent to a white fir type being prescription burned in the southern edge of the Park.

Lodgepole Pine

The lodgepole pine ecosystem is defined, like the ponderosa pine type, on the basis of a single species present: lodgepole pine. This type is sometimes called climax lodgepole, and is associated with sites of exceptionally low productivity, and usually cold air pockets (Stuart 1983). It is intermixed with other forests that also have lodgepole pine, such as the red fir and mountain hemlock types. There, lodgepole pine is a good marker of past high-severity disturbance that allowed it to dominate sites otherwise dominated by other species. In the climax lodgepole pine forest, lodgepole pine is the dominant regardless of disturbance history. It is identified by the presence of lodgepole pine only in the overstory, little to no understory, and a dearth of understory shrubs and herbs: bitterbrush, long-stolon sedge *{Carex pensylvanica),* western needlegrass *{Stipa occidentalis),* and pussypaws *(Calyptridium umbellata).* Zeigler (1978) mapped the lodgepole pine forests of Crater Lake National Park.

Climax lodgepole pine forests have a moderate severity fire regime. Most show an origin from a more widespread stand replacement-type fire, such as occurred across the lodgepole pine flats in the 1988

Prophecy fire at Crater Lake, but most have a patchy history of fire occurrence and spread. The average fire-free interval is probably around 60 years, with areas bordering higher productivity forest on the low end of the range.. In 1980, a ponderosa pine prescribed fire spread into climax lodgepole pine forest by means of down and decayed logs, with little spread outside of log corridors. Even so, the trenching effect of fire along log corridors on surficial roots caused substantial but not complete tree mortality in the vicinity. Strong winds are likely associated with the rare stand replacement fire in the lodgepole pine type.

Most stands surveyed have multiple age classes either from mountain pine beetle *{Dendroctonus ponderosae)* or fire events of the past. Stems killed by either agent will fall within 5-10 years, and over a 40-50 year period they have a hard sapwood but decayed heartwood, an ideal vector for fire spread. In the meantime, any clump of trees killed is colonized by a new generation of lodgepole pine, and this process, repeated over time, results in multiple age classes of the pines. Understory development is never substantial in these forests. Moisture competition restricts tree regeneration to gaps created after pulsed tree deaths, and few herbs or shrubs tolerate these low productivity sites.

Under most conditions, these forests will act as fuelbreaks, where fire suppression, if desired, will be relatively easy. Prescribed fire is not justified as a high priority in these stands because of the lack of demonstrated ecological change due to fire exclusion, and the occurrence of these forests in remote areas of the Park away from developed zones.

Red Fir

Red fir ecosystems have a classic moderate severity fire regime. Red fir, when mature, is relatively fire tolerant, and combined with average fire frequencies of 40-70 years, and a range of fire intensities due to typical fires burning for months, has a patchy mosaic of different fire severities. Typical fire sizes at Crater Lake of the larger fires in this type have been about 200 ha (500 ac). Small patches of low, moderate, and high severity fire typically occur (Chappell and Agee 1996), with high severity fire often covering less than one-third of the landscape. Old-growth stands are least likely to burn with high severity.

Stand development patterns in red fir forests are complex because red fir is not only fire tolerant but shade tolerant. It does well with or without disturbance. Several stand development patterns are common. The first two are in patches where stand replacement fire occurs. If a seed source of lodgepole pine is present, it will colonize the patch and often create a nearly pure lodgepole pine stand for many decades. If no lodgepole pine is present when the fire occurs, shrub dominance will occur (ceanothus and manzanita) with later, slow recolonization by red fir. In moderate severity patches, some red fir dominants remain and provide seed for colonization by red fir, which does well in these partially shaded conditions, creating a multiple age class stand. In low severity patches, understory trees are killed but little growing space is opened for regeneration, and red fir reproduces slowly in small gaps where sun flecks occur. Red fir stands have not been affected substantially by fire exclusion, although at the landscape level there has probably been some additional development towards more older patches. Fire effects from wildland fire use appear to be within the natural range of variability.

Mountain Hemlock

Mountain hemlock stands are the highest elevation continuous forests at Crater Lake. Lodgepole pine is a common early seral species in the mountain hemlock zone, indicative of past disturbance by fire. Many of these stands are difficult to differentiate from the climax lodgepole pine forests mentioned earlier, but usually have an understory component of mountain hemlock.

Mountain hemlock and/or lodgepole pine are thin-barked species, so fires, regardless of fireline intensity, are often of stand replacement severity. Where lodgepole pine is present, an even-aged stand of pine will emerge from the fire, but where it is absent, the site may revert to shrubby, nonforest vegetation after burning. In the Parkland zone, this is commonly true where hemlock grows. Almost a century of fire exclusion may have little impact on the behavior of fires today in mountain hemlock forests.

Whitebark Pine

Whitebark pine is common at the highest elevations of the park (6,700' – 9,000'). Nearly half of the whitebark pine trees on the Park's west side are dead or dying from an introduced disease (Murray and Rasmussen 2003). Thus, whitebark pine is considered a sensitive species.

Fire regimes of whitebark pine are complex. A study was conducted in the Park between 2003-2005. Eighty-two percent of stands have charcoal which indicates fire is a natural element of this forest type (Siderius and Murray 2005). Fires appear to be relatively infrequent (every 39– 314 years). About fifty-six percent of fires have been high severity and forty-four percent have been low severity. Thus, as a whole, whitebark pine is considered a mixed severity fire regime.

During approved lightning-ignited events, Resource Advisors should determine whether the fire area has been surveyed for disease-resistent trees. If not, s/he should coordinate a survey to identify 'candidate' trees. These candidate trees are rare and can only be identified by personnel trained in blister rust identification. Any candidates should be protected from fire damage. This is because these rare trees may be the 'lifelink' to the pine's future as a seedsource. This was successfully done during the Bybee Complex (wildland fire use incident) of 2006.

Resource Standards for Fire Strategies

These standards will be employed in all fire management actions within Crater Lake National Park to ensure resource protection. In the protection of sensitive resources, discussed later in this Guide, it is assumed that all of the following standards will apply.

Fire Suppression

The primary objective for fire suppression in the wilderness of Crater Lake National Park is to confine, contain, or control, at minimum total costs, all wildfires. All necessary steps will be taken to meet the policy of protecting life and property. Within those constraints, actions to achieve wilderness protection with minimum adverse effect on the wilderness resource, will include the following "light on the land" (LOTL) techniques:

Tactical Standards

- Avoid cutting live trees, especially quaking aspen and five-needled pines (sugar, western white, and whitebark) unless a threat to safety or fire line success.
- Chain saws, helicopters, air tankers, or pumps can be used when essential to meet suppression objectives, but with due consideration to impacts on wilderness character and subject to minimum tool determination.
- Helicopters are restricted to natural landing sites when available and will not occur in Research Natural Areas or other sensitive sites identified by the Resource Advisor.
- Motor vehicle and heavy equipment use is limited to existing roads.
- Water drops are preferred over fire retardant. Retardants are prohibited in the Sun Creek watershed, in the Lost Creek watershed, or in the caldera. Crater Lake will not be used as a water source.
- Firelines will be located to take advantage of natural barriers, rock outcroppings, trails, streams, etc.
- Firelines will be no wider than necessary to stop the spread of the fire.
- Burning snags will be felled only when they are a definite threat to fall across the fire line or to the safety of firefighters. Otherwise, they will be allowed to burn down naturally.
- Low stump heights will be used on any trees removed in the suppression effort.
- Bucking of windfall in building fire line shall be minimized. Where bucking is done, saw cuts will be aligned away from trails or other travel corridors.
- Limbing along the fire line will be done only as necessary for suppression efforts or firefighter

safety.

- Scattering of unburned fuels, rather than consolidated boneyards is encouraged.
- Protection of five-needled pines from crown fires: Where safe and feasible, non-pine ladder trees directly beneath the pine canopy which are less than 100 years (any fir or mountain hemlock ≤ 15"dbh) should be felled when torching is expected.

Logistic

- Facilities (fire camps and helispots) will be located outside of backcountry whenever possible.
- Use of existing campsites is preferred, rather than creating new ones.
- Avoid all sensitive areas as identified by the Resource Advisor.
- Camps will be a minimum of 200 feet away from water sources.
- Toilet facilities, if not managed through portable options, will be a minimum of 200 feet away from water sources.
- Consult with Resource Advisor on travel routes to be used to the fire, sources of water, and helispots.
- All garbage will be packed out.

Rehabilitation

- Control lines will be backfilled and scarified.
- Water bars will be installed and drain dips constructed to minimize erosion.
- Stumps will be flush cut and covered with soil, moss, etc.
- Position felled/bucked material so as to be least noticeable to visitors and camouflage where possible.
- All flagging, equipment and litter will be removed. New biodegradable flagging will be phased in.
- Camping areas and helispots will be restored using native materials.

Prescribed Fire

Prescribed fire will be used in a variety of forest types for the purposes of restoring these ecosystems to natural conditions and maintaining them in such condition. Prescribed fire will also be used in other forest types for the purposes of decomposing fuels created by the hazard tree management program, while also perpetuating natural conditions. All prescribed fire will be executed under the behavioral and decision chart guidelines in the Fire Management Plan and will be monitored for vegetation effects through the NPS Pacific West Region protocol.

Wildland Fire Use (Lightning – ignited)

Previously termed, "prescribed natural fire," such fires will be encouraged when they meet certain prerequisites. A suite of factors are considered before allowing wildland fire use events. The relevant decisions are defined in the accompanying Crater Lake Fire Management Plan (2003). Fire effects will be monitored for vegetation effects according to the NPS Pacific West Region protocol (e.g. Rapid Assessment

Protocol).

Sensitive Resources and Fire Management Strategies

Note: All maps referred to in this section are available in the Dispatch Office copy of this Guide. Because of the sensitive nature of these resources, specific locations of these resources are not available for general readers of the Guide.

Research Natural Areas

As of 1996, Crater Lake National Park has four Research Natural Areas (RNA): Llao Rock, Desert Creek, Sphagnum Bog, and Pumice Desert (see *Wilderness and Research Natural Area* map). Research Natural Areas have been established to allow natural processes to dominate and thus, facilitate research and monitoring of baseline conditions. Management is to ensure the protection of RNA ecosystems (Federal Committee on Ecological Reserves 1977).

Fire retardants and foam pose a serious threat to native biota. Terrestrial ecosystems are prone to a variety of their impacts which include: 1) inhibition of native legume (nitrogen fixers) recovery; 2) increases in invasives such as Kentucky bluegrass; 3) decreases in species richness and cover, and; 4) injury to plant tissue (Adams and Sommons 1999). If realized, these impacts would seriously compromise the ability of any RNA to serve as a baseline of natural conditions. Therefore, the use of retardant and foam are prohibited from use in RNAs except for safety emergencies.

Natural fires that occur in Research Natural Areas are generally consistent with the establishment intent. The greatest possible impact on RNAs is derived from poorly conceived fire control operations rather than fire effects. Each RNA described below is unique in terms of its potential to burn and mitigating circumstances for fire management strategies (Table 2).

<u>Llao Rock RNA</u>

Llao Rock RNA covers approximately 176 ha near the gently sloped broad top of Llao Rock, and includes some steep terrain on the inner caldera of Crater Lake. Although true alpine elevations are not in the Park, alpine-like conditions dominate most of the RNA, with small stringers of mountain hemlock forest on the north side and scattered whitebark pine in the subalpine zone. The subalpine zone habitat has a unique assemblage of wildflowers that are relatively few in number but are noted for their colorful flowers. Two rare plant species occur in the subalpine zone. One of the largest populations of pumice grapefern *(Botrychium pumicola),* a federal Species of Concern, is found at the site growing in light-colored, loose pumice. The second Species of Concern is the endemic Crater lake rockcress *{Arabis suffrutescens* var. *horizontalis)* that has a small population also growing in pumice substrate. Other flora and fauna are typical of the subalpine zones of the Park and associated high country.

Fire suppression activities, including aerial retardants or foam, are barred from the RNA. The caldera zone of the RNA combined with the Rim Drive, which borders the northwest and north of the RNA, should suffice as control lines in the event that a fire starts in the RNA. Fire lines built in the RNA, particularly if they tie in to "open ground" are likely to impact the rare species that occur there.

Lightning ignitions in the RNA or in adjacent ground, should not be suppressed solely because it is likely to enter the RNA. Fire is as much a natural process there as the infertile soil or alpine climate. However, if fires do occur in the vicinity, fire monitors should seek out the rare plant populations and evaluate before-after effects on these populations. It is very unlikely that the rare plants will burn, because of their preference for open, barren-ground pumice conditions. Trampling effects of monitoring will probably be more important to avoid than fire on the landscape.

<u>Pumice Desert RNA</u>

The Pumice Desert RNA, a broad shallow basin surrounded by forest, is the largest RNA in the Park at 1236 ha. The site is deeply mantled by Mount Mazama pumice and has average plant cover of only 4.5%. Only 14 plant species are recorded for the area. Occasional pine invasion has occurred along the

desert's margin.

The area is not capable of carrying a fire. The desert acts as a firebreak. During the 1981 Desert Cone Prescribed Burn, fire stopped at the desert margin. Therefore, fuel breaks are neither necessary or allowed. Prescribed fire in not applicable to the RNA since sparse fuels will not carry a fire. The largest fire management impact is likely to be fire suppression activities directed towards surrounding forests. Helispots and camps are prohibited within the boundaries, although the paved parking turnoff on the southern margin is acceptable.

Desert Creek RNA

The 757 ha Desert Creek RNA, in the northeastern portion of the Park, is very likely to be affected by fire. It as a central non-forested area with bitterbrush / long-stolon sedge, and is surrounded by three forest types: ponderosa pine / bitterbrush-manzanita / sedge, ponderosa pine / bitterbrush –snowbrush / sedge, and lodgepole pine / bitterbrush /sedge. This RNA has received notable fire management activities. The establishment report notes "the Park Service has conducted some prescribed underburns….which has benefited the ponderosa pine communities… Under natural conditions periodic fires removed understory vegetation which thus acted to fire-proof stands from more catastrophic fires. Lodgepole pine is susceptible to underburning and generally dies where this management technique is used. Underburning should continue…as it is a compatible and necessary management too."

Desert Creek has numerous historic control lines from past prescribed fires. If fireline construction becomes necessary, it is best to re-establish this control lines rather than create new scarring of the soil. If the spatial pattern of these historic lines are inadequate for control tactics, new lines can be made at forest-meadow edge (rather than through a meadow). During the late season when the meadow vegetation is cured, it provides a more defensible line than the forest. Early season burns probably do not need control lines at the meadow edge because fuel moistures are high. Late season prescribed fires should employ backlining with water or foam at the edge of the meadow if the meadow edge is the control line. As the meadow likely burned in historic fires, it may well be totally within the burn unit and after burning should increase its forb/grass cover relative to bitterbrush cover. Wildland fire use events in the "blue boundary zone" of the Fire Management Plan can be allowed to burn with the same precautions mentioned above for fire suppression and prescribed fire.

Sphagnum Bog RNA

The 73 ha Sphagnum Bog RNA lies along the west-central boundary of the Park. It encompasses a broad basin at the head of Crater Creek where two large springs emerge. The springs flow through a shallow gradient stream reach between expanses of mire and open forest. The site consists of a series of interconnected openings containing bog communities ranging from *Carex rostrata* sedge wetlands to *Vaccinium occidentale* bog huckleberry thickets to *Salix barclayi* willow carrs. The sensitive resources here include both the unique plant communities and the hydrologic processes (water quantity and quality) that maintain the bog.

Fire suppression activities can use the bog complex as a good firebreak, as the complex rarely burns. However, fire control strategies should not try to construct line in forested communities between bogs. The rare plant *Collomia mazama* occurs in open areas here. It is designated as a federal Species of Concern. Fire retardants should not be used in the RNA or in nearby upstream areas ("upstream" is difficult to define where surface water is so limited, but caution is needed when planning retardant drops). Prescribed fire is not planned for this area of the Park. Wildland fire use will burn in the vicinity of the bog. As it has for centuries, moderate severity fire has burned in the vicinity of the bog in 1986 (the Sphagnum Bog fire). It had no discernible effect on the bog. By killing vegetation, site evapotranspiration is reduced and may result in significantly more water present in bog ponds.

Table 2. Prohibited* or appropriate suppression tactics for Research Natural Areas at Crater Lake.

Research Natural Area	Aerial Drops	Camps	Control Line	Helispots
Desert Creek	Water Only	Prohibited	Conservative Use	Prohibited
Llao Rock	Water Only	Prohibited	Prohibited	Prohibited
Sphagnum Bog	Water Only	Prohibited	Prohibited	Prohibited
Pumice Desert	Water Only	Prohibited	Prohibited	Prohibited

* Any tactic is permissible for safety emergencies

Threatened/Endangered/Sensitive Animal Species

Plant and animal species evolved through a series of "coarse filters" of environment and habitat. Fire was one of the coarse filters that "managed" habitat through time before the Park was established. Unlike plant species, none of the threatened/endangered/sensitive animal species are endemic to Crater Lake National Park (Appendix RA-1). Nonetheless, it is incumbent on fire management activities at Crater Lake to cooperate in ecosystem management activities so as not to further threaten these species, and hopefully to aid in their recovery. Each of the species below has some unique habitat characters that could be influenced by fire management activities. Appropriate mitigation is discussed for each species. At any time that a potential effect on known listed species is defined by fire presence, discussed for each species below, emergency consultation will be initiated with the Fish and Wildlife Service unless prior clearance associated with the review of the Fire Management Plan and/or Resource Advisor Guide has been granted.

Upon locating a dead, injured, or sick endangered or threatened species specimen, initial notification must be made to the nearest Fish and Wildlife Service Law Enforcement Office. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered species or preservation of biological materials from a dead animal or fish, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. In Oregon, contact the Service's Law Enforcement Office at 541/883-6900, the Southwest Oregon Field Office at 541/957-3474, or the Klamath Basin Fish and Wildlife Office at 541/885-8481.

A "Biological Opinion and Concurrence Memorandum for Proposed Fire Management Plan, is included with the Fire Management Plan (Appendix 13.D.2). All Resource Advisors and Incident Commanders are required to be familiar with and comply with the terms of the opinion.

Northern Spotted Owl

The federally Threatened northern spotted owl *(Strix occidentalis caurina)* is an old-growth dependent species that prefers complex forest structure. It is at the eastern end and upper-elevational limits of its range at Crater Lake National Park. Both potential habitat and owl sightings and nests have occurred within the Park (see *Spotted Owl Activity and Potential Habitat* map). Potential habitat is found in patches throughout the Park (colored green), with higher density of patches and larger patch sizes southwest of a diagonal line connecting the northwest to the southeast corner of the Park. All nest locations have been located within areas identified as potential habitat, but occasional sightings have been documented outside of these patches.

Fire, even if operating within its bounds as a natural process, has the potential to degrade habitat for northern spotted owls, particularly if high severity fire occurs at a wide scale. Little is known about owls and fire, although monitoring of owls on the Yakima Indian Nation in eastern Washington showed that radio telemetered owls continued to forage in light to moderate-severity patches created by wildfire, but only unburned nest sites continued to be used. At Crater Lake, there were two known nest sites in 1994, with high probability of additional but un-located nest sites.

Recommendations: The LOTL fire suppression tactical standards mentioned earlier in this Guide should be implemented to protect known nest sites of northern spotted owls.

Around documented northern spotted owl nest sites, as well as activity centers for nesting pairs and single owls, fire managers will delineate a spotted owl core area within which all fire will be suppressed . The delineated spotted owl core area shall: 1) include the actual nest tree or activity center, and; 2) encompass and comprise the best, closest, and most contiguous 100 acres of suitable northern spotted owl nesting, roosting, foraging habitat surrounding each nest site or activity center.

Within a 1.2 mile radius of each nest site and documented activity center, prescribed fires will be allowed in up to 60% of the area if the remaining 40% is currently suitable nesting, roosting, foraging habitat. The objective is to avoid reducing the amount of suitable nesting, roosting, foraging habitat with a 1.2 mile radius below 40% (1,158 acres) of the total acreage (2,895). However, areas within a 0.7 mile radius of nest sites or activity centers are considered of higher value to owls. Therefore, of the 40% acreage protected from fire within a 1.2 mile radius of these sites, the majority of protected acreage will be identified within the 0.7 mile buffer.

No Prescribed Natural Fire or Management Ignited Prescribed Fire will be permitted during breeding season in any spotted owl habitat. If natural fire occurs in suitable habitat for spotted owls, prior to it being surveyed according to protocol, it should be assumed that the habitat contains a spotted owl or owls and appropriate safeguards taken to reduce the likelihood of incidental take from the fire event or suppression actions.

Prescribed fire is not being considered in any known nest site vicinities. Wildland fire use should be allowed to occur in spotted owl foraging habitat with appropriate post-fire monitoring. Over most of the habitat where fire and owls may co-occur, the fire regime is one of moderate severity, so that a complex mixture of low, moderate, and high severity burned patches, along with unburned "islands", are likely to occur. Owl nest and foraging behavior should be a focus of this post-fire monitoring. In this way, the currently unknown relation between owls and the fire regimes at Crater Lake can be better understood and will help to guide future resources management at the Park.

No direct overflights of known nest sites will be allowed below 2,000 feet Above Ground Level (AGL) from March 15 to August 30 each year.

If a fire occurs in suitable spotted owl habitat, especially if near a known owl activity center. Park staff should conduct an investigation to determine what effect the fire event had on the habitat and/or the spotted owls that may have occupied the area.

Peregrine Falcon

The peregrine falcon *(Falco peregrinus anatum)* is a State-listed threatened species that has been reintroduced to Crater Lake National Park. It is a cliff-nesting bird whose nest sites in the caldera are in un-burnable terrain. Its foraging areas over the lake and over wide-ranging forested terrain are unlikely to be affected by this Fire Management Plan. In 2007, there are no known nests in the Park.

The greatest likelihood of effect is from overflights of aircraft during the breeding season. Low aerial overflights will be banned from nest vicinities (I mile radius) during the breeding season. Any fire suppression or wildland fire use within 2 miles of nest sites will be identified as possible overflight fires and falcon presence and breeding status will be reviewed prior to overflight constraints being reduced.

- Human disturbance in known nest sites will be avoided from January through July.
- Aircraft flights in the caldera area must remain above the 2,000 foot AGL level.

Small Carnivores (California wolverine, Pacific fisher, pine marten)

The most recent state-of-the-art assessment of small carnivore populations (Ruggiero *et. al.* 1994) suggests that we know little about the habitat requirements of small carnivores. However, old forest structure, including large woody debris for denning (both logs and snags), is an important structural characteristic of habitat for these animals. As they are found across a wide variety of forest types, specific forest types or dominant species are much less important than landscape structure.

Fire suppression activities within the bounds of this plan are unlikely to adversely affect small carnivore populations. Any post fire restoration plans would evaluate leaving large woody debris and some log piles as potential den sites in their potential habitats.

Prescribed fire operations in the white fir and ponderosa pine forest types will remove multi-layered canopies and consume coarse woody debris in those types. The large tree structure will be maintained, but snag and coarse woody debris levels could be less in those forest types. The effect on the currently unknown population of small carnivores in those forest types is unknown. Monitoring of these rare species is very expensive and often fruitless, so that restoration of natural forest conditions in the white fir and ponderosa pine forest types will have uncertain effects on small carnivores. However, since xeric forest types are avoided by marten (Buskirk and Ruggiero 1994), fisher (Powell and Zielinski 1994), and wolverine is a higher montane-subalpine species in this region (Banci 1994), effects of prescribed fires should be minimal on small carnivores.

Wildland fire use events at Crater Lake tend to be patchy in terms of fire severity. This patchiness

historically was associated with habitat improvement for small carnivores, and will likely be associated with habitat maintenance for them in the future. High-severity patches will create prey concentration areas, moderate severity patches will create coarse woody debris, and unburned patches mixed with low severity fire patches will provide complex forest structure for these animals.

If fishers or wolverines are identified as being associated with wildland fire use areas, Dr. Keith Aubry, Forest Service scientist at the Olympia Forestry Sciences Laboratory (360-753-7685) should be contacted. He conducted radio telemetry studies on fishers on the Prospect Ranger District, Rogue River . National Forest, in 1995-96, and may have advice or interest in following these animals.

Bull Trout

The bull trout *(Salvelinus conffuentus),* a federally listed Threatened species, is a native Pacific Northwest trout that has a radically smaller distribution and abundance than it had even 40 years ago. Bull trout probably reached maximum distribution and abundance after the last glaciation when clear cold water streams were abundant. Habitat fragmentation, together with habitat degradation (particularly warming waters) and interspecific competition from the exotic brook trout, have led to major declines of the species. Ideal temperatures average 4-9C, with maximum temperatures for juveniles at 15C and adults 18C. Catastrophic events can extirpate the species from given watersheds (Knowles and Gurntow 1996).

The bull trout is found in only two streams at Crater Lake: Sun Creek and Lost Creek (see *Sensitive Species* map). The "catastrophic event" most likely to affect these streams is a high severity forest fire. The Sun Creek watershed near the caldera is the mountain hemlock type, but it grades quickly into the red fir type, characteristic of a moderate severity fire regime. One 125 ha patch of lodgepole pine forest on the west side of the creek is apparently the result of a stand replacement fire or fires in the 1800-1820 era (Zeigler 1980), but past fire activity appears to be moderate severity for the most part.

Management of bull trout in Sun Creek and Lost Creek over the long run will depend on avoiding catastrophic disturbance. Catastrophic disturbance is more likely to occur the longer a fire exclusion policy is implemented in these watersheds. Currently, wildland fire use is projected to create patchy effects (see Chappell and Agee 1996) and should prevent large scale stand replacement fire in Sun Creek.

Sun Creek Recommendations: Fire suppression actions should totally avoid the use of fire retardant/foam in the upper Sun Creek watershed. The chemical toxicity of retardant (Johnson and Sanders 1977) and foam are lethal to aquatic invertebrates, algae, and fish populations (Hamilton *et. al*. 1998).

Fire line construction by hand outside of the riparian corridor should not have any effect on the population. Camps in this area should be avoided.

Prescribed fire could possibly be used to reduce fuel loads, but it is very difficult to apply in red fir / lodgepole pine stands because they are non-flammable during much of the average dry season.

Wildland fire use should be allowed in the Sun Creek area, but it is recommended that the amount of terrain affected by high severity burning from such fires be constrained. Usually in the red fir zone, high severity burns affect less than one-third of the burned area (Chappell and Agee 1996). If no more than one-half of the upper watershed is burned in any 20 year period (this includes low, moderate, and high severity patches), this would keep "opened" areas of high severity fire to 20 percent or less of the potentially forested area of the upper watershed during any time period. Confine and contain strategies will be employed when projected wildland fire use spread for any single fire reaches this target size within the hydrologic limits of the existing bull trout habitat (see *Sensitive Species* map). Wildland fire use events will be allowed to burn in this area over time until they are projected to exceed these limits. In this way fire can play close to a natural role while not placing the bull trout population at risk, until more is known about the species and its relationship to local conditions.

Moderate severity fire should maintain a source of snags and coarse woody debris for the stream channel. It may reduce shading effects on the stream channel from current levels, but upper Sun Creek is an incised channel in glowing avalanche deposits oriented in a north-south direction, so that upland burning with less than 20% high severity fire will have a minimal effect on shading effects on stream temperature.

Lost Creek Recommendations: Lost Creek is a very small watershed and is part of the Sand Creek drainage. It appears to have a lodgepole pine stand largely regenerated after an 1869 fire (Zeigler 1978). The *P. contorta / Carex-Lupinus* vegetation type has a moderate severity fire regime, and the same limitations on high fire severity as made for Sun Creek apply here. No retardant drops are permitted.

Northern Goshawk

The Northern Goshawk *(Accipifer gentilis)*, a federal Species of Concern, is rare in Crater Lake National Park. Little is known of habitat requirements for goshawks, but the SAT Team (1993) defined-the following forest management activities as helpful in conserving habitat for northern goshawks: (1) retain the upper canopy trees at known or suspected nest sites; (2) retain down wood and logs for prey, particularly squirrel species; and (3) manage stands for understory removal and canopy retention.

Fire suppression under the LOTL guidelines above should have no effect on northern goshawk. Prescribed fires, by removing understory, should increase foraging access for this large hawk. Removal of coarse woody debris by prescribed fire will not be so complete as to eliminate squirrel habitat, but will reduce it from current levels. Wildland fire use will have similar offsetting effects. The low and moderate severity portions of those fires will retain and preserve overstory canopy while removing understory trees. The moderate and high severity patches of those fires should create coarse woody debris and aid squirrel habitat. The overall effect should be an increase in northern goshawk.

Monitoring of northern goshawk nesting and foraging behavior should be implemented after identification of goshawk nest activity near either a prescribed fire unit or a wildland fire use. This monitoring will help to identify relationships between fire at the Park and northern goshawk populations.

Other Rare Animal Species

No specific mitigation strategies are identified for other rare species that may be found regionally but have not been documented in Crater Lake National Park. These species are unlikely to be affected by the fire management plan at Crater Lake. They include the pygmy rabbit *(Brachylagus idahoensis),* lynx *(Lynx canadensis),* gray wolf *(Cams lupis),* western sage grouse *{Centrocercus urophasianus phaios),* and Columbian white-tailed deer *(Odocoileus hernionus virginianus).* If other species are found in implementing any resource action or monitoring, they will be added to the more specific list of species for which specific mitigation may be warranted.

Threatened/Endangered/Sensitive Plant Species

Fire plays a role in the management of many threatened and endangered plant species. Fire helps maintain open habitat, encourages sexual and vegetative reproduction, and affects competing or associated plant species. Although fire may injure or kill plants, long-term effects on species may be beneficial (Hessi and Spackman 1995).

The Park supports eight State-listed species including one federal Species of Concern (Appendix RA-1). Most of the species listed, however, are found in environments that are unlikely to burn, so that fire suppression activities rather than fire presence is the greater hazard to these plants. Specific location maps for these species are on the *Sensitive Species* map. *Arnica viscosa* is a talus species. Other arnicas, such as *Arnica cordifolia,* generally increase in cover after fire. *Arnica viscosa* is unlikely to burn as a talus species. *Arabis suffrutescens* var. *horizontalis* is found in dry, rocky pumice and intermixed with sparse, open, mountain hemlock forest. *Botrychium pumicola* is a pumice-related species that grows where no humus exists, so it is not threatened at all by fire. *Collomia mazama* occurs in subalpine wet meadow habitats. It may burn if fires in adjacent forests move into adjacent non-forested areas, and effects are not known. *Carex crawfordii* is a wetland species and will not be subject to fire. *Poa bolanderi* occurs in the vicinity of the Crater Peak (Goodbye) fire of 1978; other bluegrasses benefit from fire by opening growing space. Chappell (1991) found it growing on this fire roughly 10 years later.

Wildfires and wildland fire use events are likely to affect some threatened/endangered/ sensitive plant species. Based on species affinities, and known locations, simple post-fire monitoring of known populations can be employed. *Collomia mazama* is the highest priority species as the others are very unlikely to burn or

their relation to fire is expected to be neutral to positive.

Any fires occurring in the area of Sphagnum Bog, Thousand Springs (wet meadow southeast of creek), upper Castle Creek, Copeland Creek, and Trapper Creek should be monitored for *Collomia.* Fire monitors assigned to wildland fire use burns in these vicinities can obtain both pre- and post-fire information, such as. Did the microhabitat burn? Were tops killed, base heated? What was early post-fire response?

As described earlier in the Fire Management Plan, sensitive tree species in the Park are identified as quaking aspen, whitebark pine, western white pine, and sugar pine. These trees are extremely valuable to wildlife for food sources and cover. Protective measures are outlined in the Tactical Standards section and within the Fire Management Plan.

Alien Species

Alien or exotic species are a major threat to biodiversity in the management of natural ecosystems. Many alien species are encouraged by disturbance, so that development, logging, and fire can all result in temporary or permanent invasion of non-native species into a national Park. Fortunately, few alien tree dominants are adapted to grow in the climate of Crater Lake National Park. Most aliens that can grow are intolerant of shade so as forest grows back they are shaded out and are only temporary invaders. For example, aliens such as *Senecio jacobea* (tansy ragwort) and *Circium vulgare* (thistle) are present in the red fir zone on fires that burned in 1978 and 1981 (Chappell 1991) but they are uncommon to rare. Roads and riparian zones, both of which are frequently disturbed corridors, often act as vectors for alien plants, which can then spread into nearby disturbed environments.

To date, fire management at Crater Lake National Park has not to date documented as being an agent of spread for alien plants. Although fires do top-kill much vegetation, post fire recovery of native vegetation usually outcompetes alien plants. Recommendations: For fire suppression actions, fire lines, camps, or helispots are highest priority spots for monitoring alien plant invasions. Surveys should be implemented in the first post-fire year. Pulling to prevent flowering and seed set is the preferred control technique. Potentially forested terrain is less likely to be a problem than places on the landscape where shrub/herb vegetation is the potential vegetation.

For prescribed fire units and wildland fire use, post-fire surveys should be implemented focusing on open areas. Hand pulling should be the preferred control strategy.

Aliens of highest priority should be the knapweeds *(Centaurea* spp.), scotch broom *(Cytisus scoparius)* if it is present, and St. John's wort *(Hypericum perforatum).*

Air Quality

Crater Lake National Park is a Class I airshed designated by the 1977 Clean Air Act amendments. The Fire Management Plan must be in conformance with the Clean Air Act, Oregon State Smoke Management Plan, and the Oregon Visibility Protection Plan. The geography of the Park lends itself to good mixing during most of the year: the Park is at high elevation and has enough wind to provide good mixing.

Fires designated as wildfires and on which suppression strategies are employed are exempt from air quality regulations. It is anticipated that suppression strategies will be successful in limiting air quality problems by confine, contain, and control strategies. Management fires, however, including both prescribed fires and wildland fire use, have detailed regulatory mechanisms that will be in place during the times that fires are active. In addition to coordination with State smoke management personnel, the decision tree of the Fire Management Plan will operate to guide decisions about effects of current fires and whether new ignitions should continue as management fires or be classified as wildfires.

Prescribed fires in the Park will undergo the same screening as prescribed fires elsewhere in the State. Short-term impacts of prescribed fires are projected from a combination of air quality and weather monitoring to calculate emissions, smoke transport, and mixing heights. Approval from the State Department of Forestry for air quality clearance will be a standard operating procedure for prescribed fires.

Wildland fire use events generally occur over longer periods of time during the summer and are characterized by periods of lesser or greater smoke emissions depending on fuel consumption and rate of

spread. These fires are also coordinated with the Oregon Department of Forestry, but it is most likely that local issues at the Park level will guide management controls. Typical wildland fire use s tend to attract visitor interest rather than affect visitor safety or health, because they occur away from roads and have been relatively small size in comparison to the Park. These fires (< 1000 acres over the season) will not cause significant degradation to air quality or visibility except for short periods. If the impact of smoke does become significant (as evaluated through the daily decision tree), several actions may be taken: additional fires may be classified as wildfires and suppressed; the current fire(s) may be suppressed; or the current fire(s) may be allowed to continue with smoke warnings posted for visitors and daily re-evaluations made through the decision tree.

Air quality effects over the past life of the wildland fire use program have indicated that air quality issues, including visibility, have not been significant issues. The visibility monitoring network of the National Park Service has not identified wildland fire use s to be a significant contributor to visibility degradation in the Park. However, these data are available on an annual basis and in years with significant wildland fire use s activity, can be compared to years without such activity. Regional fire activity will also contribute to air quality at Crater Lake and need to be included in the analysis.

Cultural Resources

Cultural resources include archeological, cultural, and historic resources in the Park. A number of these have been identified and are mapped, and the map is available in the Dispatch Office copy of this Guide. Close to 40 named or isolated archeological sites are mapped, including one "archeologically sensitive area" likely to contain significant material. There are 26 contributing structures currently on the National Register; the Watchman Tower, buildings in Rim Village, and buildings in Munson Valley in the Headquarters area. The Wineglass Cabin is, not as yet, on the List of Classified Structures (buildings older than 50 years). There is also an historic road leading from Highway 62 to the rim area along a path west of the current visitor highway from Highway 62 to the rim. Contributing features include blazed trees, road bed, camps and various artifacts. It is currently being surveyed. The old rim road awaits both survey and a determination of eligibility. It is the intent of the Fire Management Plan to protect these resources.

Fire suppression activities are designed to prevent fire from damaging these resources, and is generally successful is doing so. However, the fire suppression action itself can have damaging effects. Ground disturbance by fire crews can displace artifacts from proper placement in the soil, and artifacts can be destroyed by use of hand tools (bulldozers will not be used in fire suppression operations) (Switzer 1974). Fire retardants can stain or corrode historic structures and will not be used in the vicinity of these structures. If wooden structure protection is necessary, foams will be used, similar to their use at Yellowstone in 1988. Any fire suppression activity in the vicinity of a known historic or archeological site will receive guidance from the Park Historian at Crater Lake or a designated representative from the Park or the regional office.

Prescribed fires will have cultural resources surveys completed before and after the fire. Post-fire surveys are important because burns often uncover undocumented sites (Agee 1993). The type of archeological remnants likely to be found locally are stone artifacts. Lightly burned sites have little effect on lithic artifacts, while heavily burned sites (such as log corridors) will have 40-50 percent of the lithic artifacts affected, mostly by soot but also spalling (Lentz *et. al.* 1996). Prescribed fires will not be planned or, executed in areas of historic buildings without careful consideration of objectives to be reached and the best techniques to achieve those objectives. Historic structure historic district and historic landscape values must be evaluated and preserved. A range of techniques that might be utilized could include manual fuel removal, wet lines, foam applications, etc.

There are two significant historic roads - Rim Drive that circles the caldera rim and the Fort Klamath – Jacksonville Wagon Road. The wagon road crosses through the park in an east-west fashion, with a section that heads west and north from Highway 62 up to the caldera rim.

There are thirteen individual designed landscapes on the Cultural Landscapes Inventory (CLI). A new property type, that of a logging railroad grade, was discovered as part of a pre-burn archeological survey in 2001. There is another grade, as yet un-surveyed, in the vicinity of Bear Butte.

Overall, less than 2% of Crater Lake National Park has been surveyed in accordance with professional standards in archeology. The amount of surveyed acreage grows each year as sites are

recorded prior to prescribed fire or other management activities. To date, more than 40 archeological sites and/or isolated finds have been investigated in the park.

More than 80 plant species have been identified by the Klamath Tribes as culturally important. Other common species of importance include conifer trees, willows, huckleberries, and other shrubs, forbs, and hardwood trees that are widely distributed throughout the park.

Wilderness Values

Wilderness values are paramount in any Park that is predominately designated or proposed wilderness, as is Crater Lake (see *Wilderness and Research Natural Area* map). Fire suppression activities are guided by LOTL suppression tactics, as described earlier, that are employed to minimize the direct effects of fire suppression activities on wilderness landscapes. Prescribed fire is employed primarily to restore wilderness character to Park landscape previously affected by human activity (fire exclusion) and is compatible with wilderness management principles. Wildland fire use is used to restore a natural process, fire, to the wilderness landscape, to the extent consistent with protection of life and property. The Fire Management Plan is itself an attempt to restore wilderness values to the greatest degree possible, and should not compromise those values except for the safety and property constraints noted above.

Scenic Resources

The major scenic attraction at Crater Lake National Park, as the name implies, is the lake itself. However, the vegetation is clearly an important backdrop to the lake and forms the major landscape texture element on the many vistas looking outward from the lake. The Fire Management Plan will have minimal effects on scenic resources. Fire suppression activities through LOTL will not be noticeable to Park visitors once operations and rehabilitation are complete. Prescribed fires will have short-term negative impacts on foreground scenic quality by killing small understory trees and creating dead fuel from them. Over time, as the areas green up, and larger residual trees are more visible, scenic impressions will improve above the pre-fire levels (Brown and Daniel 1984). Wildland fire use s will have effects primarily on background, long-distance vistas. After the first year, when most of the killed trees have browned and shed their foliage, these fires, mostly moderate severity ones, will simply add minor texture to an already heavily textured landscape created by effects of topography and soil, and different forest species composition and age classes of forests. For example, the Castle Point burn of 1986 is now indistinguishable as a fire from Rim Drive, although it burned >200 ha and is visible from the Rim. If wildland fire use s occur in the vicinity of the Rim Road, mountain hemlock are likely to die as a result, and foreground snag patches are likely to occur. For the first year or two, as the trees shed their leaves and bark, they will be unattractive, but will soon become attractive "ghost trees" and add to the forest diversity of the landscape along the highway. Mitigation measures for scenic resources from the Fire Management Plan are not necessary.

Water, Soil, and Wetlands

The Fire Management Plan will not have any significant detrimental effects on water, soil, or wetland values. The LOTL fire suppression guidelines will minimize those effects by implementing state-of-the-art mitigation while protecting life and property. Fire suppression activities can use wetlands as good firebreaks, as these areas rarely burn. Refer to the map *Wetlands of Crater Lake National Park* in the Dispatch Office copy of this report. However, fire control strategies must be sensitive to wetland values, and fire lines should not "tie" into wetland or bog margins except when relying on those areas to naturally retard the fire without constructed line. Fire retardants or foams will not be used in the vicinity of wetlands.

Wetland values should be enhanced by the use of prescribed and/or wildland fire use. The low fire line intensities should not increase runoff or erosion hazard; most of these areas are low gradient and all contain very coarse- textured soils. Fire should have a positive effect, if any, on the hydrologic complex feeding wetlands, by reducing evapotranspirational area by killing some vegetation, and increasing annual water flow through the wetland (see also Research Natural Areas, Sphagnum Bog RNA).

Maps of Interest

Maps with the following senstive resources are available in the Dispatch (Communications Center) Office provide site-specific guidance.

- *Research Natural Areas*
- *Sensitive Species Locations*
- *Spotted Owl Activity and Potential Habitat*
- *Archeological and Historical Locations*
- *Wetlands of Crater Lake National Park*

References

Adams, R., and D. Simmons. 1999. Ecological effects of fire fighting foams and retardants. Proceedings – Australian bushfire conference. Albury. Charles Sturt University, School of Environmental & Information Sciences.

Agee, James K. 1993. Fire Ecology of Pacific Northwest Forests. Island Press. Washington, D.C., 193 pp.

Agee, James K. 1994. Fire and Weather Disturbances in Terrestrial Ecosystems of the Eastern Cascades. U.S. Department of Agriculture, Forest Service. Pacific Northwest Research Station. General Technical Report PNW-GTR-320.

Banci, V. 1994. Wolverine, pp. 99-127 In: Ruggiero, L, K.B. Aubry, S.W.Buskirk, L.J. Lyon, and W.J. Zielinski. (tech eds). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine.

USDA Forest Service General Technical Report RM-254.Botti, S.J., G. Thomas Zimmerman, H.T. Nichols, and J.W. van Wagtendonk.1994. Fire management and ecosystem health in the National Park System. National Park Service, Branch of Fire and Aviation Management.

Brown, T.C., and T.C. Daniel 1984. Modeling forest scenic beauty: concepts and application to ponderosa pine. USDA Forest Service Research Paper RM-256.

Buskirk, S.W., and L. Ruggiero. 1994. American marten, pp. 7-37 In: Ruggiero, L., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech eds).The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine. USDA Forest Service General Technical Report RM-254.

Chappell, Christopher. 1991 . Fire Ecology and Seedling Establishment in Shasta Red Fir *(Abies magnifica* var. *shastensis*) forests of Crater Lake National Park, Oregon, M.S. thesis. University of Washington, Seattle.

Chappell, C.B., and J.K. Agee. 1996. Fire severity and tree seedling establishment in *Abies magnifica* forests, southern Cascades, Oregon. Ecological Applications 6(2): 628-640.

Federal Committee on Ecological Reserves. 1977. A directory of Research Natural Areas on Federal lands of the United States of America. USDA Forest Service. Washington, D.C.

Hamilton, S., D. Larson, S. Finger, B. Poulton, N. Vyas, and E. Hill. 1998. Ecological effects of fire retardant chemicals and fire suppressant foams. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/othrdata/fireweb/fireweb.htm

Hessi, A., and S. Spackman. 1995. Effects of fire on threatened and endangered plants: An annotated bibliography. USDA National Biological Service Information and Technology Report 2. Washington, D.C

Johnson W.W., and H.O. Sanders. 1977. Chemical forest fire retardants: Acute toxicity to five freshwater fishes and a scud. USD! Fish and Wildlife Service Technical Paper 91. Washington, D.C.

Knowles, C.J., and R.G. Gurntow. 1996. Saving the Bull Trout: An analysis of a candidate species. The

Thoreau Institute. Oak Grove, OR.

Lentz, S.C., J.K. Gaunt, and A.J. Willmer. 1996. Fire effects on archeological resources. Phase I: The Henry fire. Holiday Mesa, Jernez Mountains, New Mexico. USDA Forest Service General Technical Report RM-GTR-273.

McNeil, R.C., and D.B. Zobel. 1980. Vegetation and fire history of a ponderosa pine-white fir forest in Crater Lake National Park. Northwest Sci.54:30-46.

Morrison, P., and F.J. Swanson. 1990. Fire history and pattern in a Cascade Range landscape. USDA Forest Service General Technical Report PNW-GTR-254.

Murray, M.P., and M.C. Rasmussen. 2003. Non-native blister rust disease on whitebark pine at Crater Lake National Park. Northwest Science 77:87-91.

Pacific Meridian Resources. 1996. Vegetation maps for Crater Lake National Park. Portland, OR.

Powell, R.A., and W.J. Zielinski. 1994. Fisher, pp. 38-73 In: Ruggiero, L., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech eds). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine. USDA Forest Service General Technical Report RM-254.

Pyne, S.J., P.L. Andrews, and R.D. Laven 1996. Introduction to wildland fire. John Wiley. New York.

Ruggiero, L., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech eds).1994. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine. USDA Forest Service General Technical Report RM-254.

Scientific Assessment Team (SAT). 1993. Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific Northwest. USDA Forest Service Pacific Northwest Region/Pacific Northwest Research Station. Portland, OR.

Siderius, J.; Murray, M.P. 2005. Fire knowledge for managing Cascadian whitebark pine ecosystems. Final report to the Interagency Joint Fire Sciences Program, (#01B-3-3-26). 44 p.

Stuart, J.D. 1983. Stand structure and development of a climax lodgepole pine stand in south-central Oregon. Ph.D. dissertation. University of Washington, Seattle, WA.

Switzer, R. 1974. The effects of forest fire on archeological sites in Mesa Verde National Park, Colorado. Artifact 12: 1-8.

Thomas, Terri L. and J. K. Agee. 1986. Prescribed fire effects on mixed conifer forest structure at Crater Lake, Oregon. Can. J. For. Res. 16:1082-1087.

USDA Forest Service 1994. Scientific framework for ecosystem management in the interior Columbia River basin. USDA Forest Service Eastside Ecosystem Management Project. Walla Walla, WA.

Zeigler, R.S. 1978. The vegetation dynamics of *Pinus contorta* forest. Crater Lake National Park. M.S. thesis, Oregon.

Appendix RA-1

Rare Species of Crater Lake NP

April 2007

Common Name	Scientific Name	USFWS	Fed. Species of Concern	State Rank*
Animals				
Northern spotted owl	*Strix occidentalis caurina*	Threatened		1
Bull trout	*Salvelinus confluentus*	Threatened		1
Crater Lake Newt	*Taricha granulosa ssp.mazamae*			1
Oregon Spotted Frog	*Rana pretiosa*	Candidate		1
Pacific fisher	*Martes pennanti pacifica*	Candidate	Y	2
California wolverine	*Gulo gulo luteus*		Y	2
Lewis' Woodpecker	*Melanerpes lewis*		Y	2
White-headed Woodpecker	*Picoides albolarvatus*		Y	2
Peregrine falcon	*Falco peregrinus anatcm*			2
Barrow's Goldeneye	*Bucephala islandica*			2
Merlin	*Falco columbarius*			2-extinct
Tailed frog	*Ascaphcs truei*		Y	4
Cascade frog	*Rana cascadae*		Y	4
Northern goshawk	*Accipiter gartilis*		Y	4
Yuma Myotis	*Myotis yumanensis*		Y	4
Long-eared Myotis	*Myotis evotis*		Y	4
Silver-haired Bat	*Lasionycteris noctivagans*		Y	4
Olive-sided Flycatcher	*Contopus cooperi*		Y	4
Willow Flycatcher	*Empidonax traillii*		Y	4
Northern Sagebrush Lizard	*Sceloporus graciosus*		Y	4
Mountain Quail	*Oreortyx pictus*		Y	4
Long-legged Myotis	*Myotis volans*		Y	4
Hoary Bat	*Lasiurus cinereus*			4
California Myotis	*Myotis californicus*			4
Western Gray Squirrel	*Sciurus griseus*			4
Brazilian Free-tailed Bat	*Tadarida brasiliensis*			4
American Marten	*Martes americana*			4
Bufflehead	*Bucephala albeola*			4
Black-backed Woodpecker	*Picoides arcticus*			4
Three-toed Woodpecker	*Picoides tridactylus*			4
Flammulated Owl	*Otus flammeolus*			4
Great Gray Owl	*Strix nebulosa*			4
Common Nighthawk	*Chordeiles minor*			4
Ringtail	*Bassariscus astutus*			4
Vascular Plants				
Crater Lake Rockcress	*Arabis suffrutescens horizontalis*		Y	1
Pumice Grapefern	*Botrychium pumicola*			1
Mt. Mazama Collomia	*Collomia mazama*			1
Shasta Arnica	*Arnica viscosa*			2
Abrupt-Beaked Sedge	*Carex abrupta*			2
Crawford's Sedge	*Carex crawfordii*			2
Lesser Bladderwort	*Utricularia minor*			2
Shaggy Hawkweed	*Hieracium horridum*			2
Pine Woods Cryptantha	*Cryptantha simulans*			3
Swamp Willow-Herb	*Epilobium palustre*			3
Greene's Hawkweed	*Hieracium greenei*			3
Anderson's Lupine	*Lupinus andersonii*			3
Few-Flowered Mannagrass	*Torreyochloa erecta*			3
Bolander's Bluegrass	*Poa bolanderi*			3
Oarleaf Buckwheat	*Eriogonum pyrolifolium var. pyrolifolium*			3
California Mountain Ash	*Sorbus californica*			3
Lance-Leaved or Triangle Moonwort	*Botrychium lanceolatum*			4
Jepson's Monkeyflower	*Mimulus jepsonii*			4

*1= threatened with extinction or presumed to be extinct worldwide, 2=Threatened, Endangered or Extirpated from Oregon, 3=In Review, 4=Watch List

Appendix 13.N Prescribed Fire Notification List

PARK STAFF						
Name / Office	**Phone Number**	**Date contacted**	**E-Mail Address**	**Date sent**	**FAX NUMBER**	**Date faxed**
Superintendent	541-594-3001		Craig_Ackerman@nps.gov		541-594-3004	
Chief Ranger	541-594-3051		Pete_Reinhardt@nps.gov		541-594-3050	
Chief, Research & Resource Preservation	541-594-3071		Mac_Brock@nps.gov		541-594-3070	
Chief, Interpretation & Cultural Resources	541-594-3091		Marsha_McCabe@nps.gov		541-594-3010	
Chief, Maintenance	541-594-3031		Don_Tyree@nps.gov		541-594-3010	
Chief, Administration	541-594-3011		Stephen_H_Clark@nps.gov		541-594-3010	
Management Assistant	541-594-3008		Charlene_V_Miller@nps.gov		541-594-3004	
OTHER AGENCIES						
Klamath Falls Interagency Fire Center	541-883-6850		orkfc@dms.nwcg.gov		541-883-6830	
Winema National Forest (WNF) Supervisor	1-541-947-6201				541-883-6709	
WNF Fire Staff Officer	541-883-6792				541-883-6709	
WNF Chiloquin FMO	541-783-4066		JHampton@fs.fed.us		541-783-4009	
WNF Chemult FMO	541-885-3410		gliebercajt@fs.fed.us		541-885-3452	
Umpqua National Forest (UNF) Dispatch	1-541-957-3325				541-957-3298	
UNF Diamond Lake R.D. Dispatch	1-541-498-2239				541-498-2253	
UNF Forest Supervisor	1-541-672-6601				541-957-3495	
UNF Fire Staff Officer	1-541-496-3532				541-496-3534	

UNF Diamond Lake R.D. FMO	1-541-498-2239				541-498-2253	
Medford Interagency Fire Center	1-541-858-2340				541-858-2346	
Rogue River National Forest (RRF) Supervisor	1-541-858-2210				541-858-2255/2205	
RRF Fire Staff Officer	1-541-858-2215				541-858-2255/2205	
RRF Cascade Fire Zone FMO	1-541-865-2773				541-865-2795	
Oregon Department of Forestry (ODF) Klamath Unit Protection Forester	541-883-5680				541-883-5555	
Klamath County Commissioners	541-883-5100		Bocc@co.klamath.or.us		541-883-5163	
Klamath Tribes Chairperson	1-800-524-9787 or 541-783-2218/2219		Execcomm@cdfnet.net		541-783-3706	
USFWS Klamath Falls	541-885-8481		No Email.		541-885-7837	
PRIVATE						
Crown Pacific	1-541-433-2222		Dougt@crown-pacific-timber.com		541-433-9581	
Wilson's Cabins	541-381-2209		No e-mail		No fax	
Fort Klamath General Store	541-381-2263					
Xanterra Parks and Resorts	541-594-2255, ext. 3600		cwillis@xanterra.com			
Chiloquin Resource Advisory Committee	541-783-2470		Chilfire@cvc.net		541-783-3697	
Diamond Lake Resort	1-541-793-3333		Diresort@rosenet.net		541-793-3309	

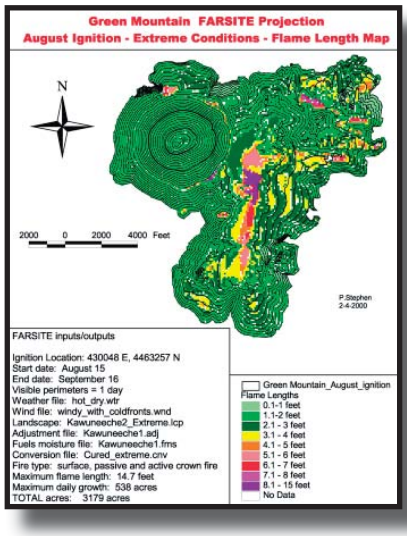
Diamond Lake Junction Café & Store	1-541-365-4478 541-365-4422		No e-mail		No fax	
Crater Lake Resort	541-381-2207 or 541-381-2349		No e-mail		No fax	
Union Creek Resort	1-541-560-3565		No e-mail		541-560-3339	
Friends of Crater Lake Chairperson	541-783-3136		crlaranger@alwaysonnetworks.com		No fax	

Appendix 13.O Media Contacts for Wildland Fire

Name	Fax Number
AP Portland	503-228-5514
Bend Bulletin	541-385-5802
Bend Radio City	541-389-7885
Glide Weekly	541-496-0869
Grants Pass Courier	541-474-3814
Klamath Falls Herald & News	541-885-4456
KAGO Klamath Falls	541-883-6141
KBOY Medford	541-772-6282
KDKF Klamath Falls	541-883-8931
KDOV Medford	541-776-0618
KDRV Medford	541-779-9261
KEZI Eugene	541-343-9664
KFLS, KKRB	541-884-2845
KGW TV	503-226-5059
KLAD	541-882-8836
KMED, KRWQ, KZZ	541-858-5416
KOBI	541-779-5564
KOMO-TV Seattle	206-443-3422
KOTI	541-883-7664
KPIC TV	541-672-4482
KPTV	503-230-1065
KRSB	541-673-7598
KTMT, KMFR	541-776-2360
KTVL	541-779-0451
Los Angeles Times	213-237-7355
Medford Mail Tribune	541-776-4376
NPS PWR- Public Information Office	510-817-1485
Portland Oregonian	503-227-5306
Roseburg News	541-957-4270

Wildland Fire Use

Implementation Procedures Reference Guide



May 2005

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Forward

"Wildland Fire Use, Implementation Procedures Reference Guide" (2005 Guide) provides standardized procedures, specifically associated with the planning and implementation of wildland fire use. These procedures meet all policy requirements described in the 2003 "Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy." In addition, the 2005 Guide tiers directly to policy as defined in agency manuals.

Prior to implementing wildland fire use under the standards in the 2005 Guide, local units must have ensured compliance with National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA) and Endangered Species Act (ESA) requirements. In addition, an approved fire management plan must be in place which identifies how the local unit plans to implement wildland fire use. All actions implemented under this guide must also be consistent with local unit land and resource management plans.

This "Implementation Procedures Reference Guide" (2005 Guide) meets the requirements of the National Fire and Aviation Executive Board (NFAEB) to develop common language and unified direction or guidance for agency/bureau manuals, directive handbooks, and guidelines to complete final implementation of this policy.

05APR05

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4-5-05

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Executive Summary

This document, the "Wildland Fire Use Implementation Procedures Reference Guide" (2005 Guide) provides direction, guidance, and assistance in implementing the Federal Wildland Fire Management Policy, specifically associated with the planning and implementation of wildland fire use, for the National Park Service, USDA Forest Service, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, and Bureau of Land Management.

Originally, this document was published as the "Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide" (USDI/USDA1998) (1998 Guide). The 1998 Guide established consistent agreement among agencies regarding specific, detailed implementation of Federal fire policy direction. The 2005 Guide represents the first revision to the original and expands and clarifies the process for wildland fire use planning and implementation consistent with the "Federal Wildland Management Policy Review and Update" (USDI/USDA/DOE/DOD/USEPA/FEMA/NASF 2001) and the "Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy" (USDA/USDI 2003). The 2005 Guide tiers directly to agency policy and guidance as specifically cited in agency manuals.

The 2005 Guide describes basic policy framework and clarifies what is and is not applicable within policy. The new implementation guide incorporates changes and revisions based on 7 years of experience in using the original process.

The purpose of the 2005 Guide is to provide standardized interagency operational level interpretation and implementation of the appropriate management response to all wildland fires, but has the greatest value for potentially long-duration wildland fires. Planning, implementation procedures, management requirements, and formats, including the wildland fire implementation plan (WFIP), are provided. The WFIP is a progressively developed strategic plan consisting of three stages. Progression through the stages is based on changing levels of fire complexity and management needs.

Effective and efficient implementation of wildland fire is the goal of the Federal Fire Policy. Managing wildland fires to accomplish resource objectives, maintain public and firefighter safety, and manage cost expenditures requires significant information archival to document the management decision process for wildland fire use and other wildland fires. This evolving documentation process has been the cornerstone of successful applications of wildland fire use over the past 30 years.

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Introduction

The Departments of Interior and Agriculture, together with tribal governments, states, and other jurisdictions, have responsibility for protection and management of natural and cultural resources on public and Indian Trust lands in the United States. Managing wildland fires for resource benefit (wildland fire use (WFU)) is an option available to Federal agencies who have an approved land use plan and fire management plan that allow for wildland fire use. Opportunities and risks associated with management of wildland fire use and other long duration fire incidents are increasing in both complexity and geographic extent. Escalating values to be protected associated with intricate land use objectives are compounding wildland fire use management program implementation concerns. Uniform Federal policies and procedures are essential to facilitate greater efficiency and responsiveness in the management of fire to meet resource objectives.

Wildland fire use, based on Federal Fire Policy direction, is a direct component of wildland fire management. It is a management action equal to wildfire suppression and thus, constitutes an emergency action. It receives consideration, management attention, and management policies equal to wildfire suppression, except for specific differences related to ignition source and management action success (see operational clarification statements below).

This guide provides procedures and requirements to implement the full range of wildland fire use management actions within an appropriate management response framework consistent with the "Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy" (USDI/USDA 2003). Policy statements from the Federal Wildland Fire Policy directly relevant to wildland fire use include:

> **Safety:** Firefighter and public safety is the first priority. All fire management plans and activities must reflect this commitment.

Fire Management and Ecosystem Sustainability: The full range of fire management activities will be used to achieve ecosystem sustainability including its interrelated ecological, economic, and social components.

Response to Wildland Fire: Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale and across agency boundaries. Response to wildland fires is based on ecological, social and legal consequences of the fire.

Use of Wildland Fire: Wildland fire will be used to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in its natural ecological role. Use of fire will be based on approved fire management plans and will follow specific prescriptions contained in operational plans.

Science: Fire management plans and programs will be based on a foundation of sound science. Research will support ongoing efforts to increase our scientific knowledge of biological, physical, and sociological factors. Information needed to support fire management

will be developed through an integrated interagency fire science program.

Interagency Cooperation: Fire management planning, preparedness, prevention, suppression, use of wildland fire, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners.

Communication and Education: Agencies will enhance knowledge and understanding of wildland fire management policies and practices through internal and external communication and education programs.

Operational clarification statements from the Federal Fire Policy directly relevant to wildland fire use include:

"Only one management objective will be applied to a wildland fire. Wildland fires will either be managed for resource benefits or suppressed. A wildland fire cannot be managed for both objectives concurrently. If two wildland fires converge, they will be managed as a single wildland fire."

"Human-caused wildland fires will be suppressed in every instance and will not be managed for resource benefits."

"Once a wildland fire has been managed for suppression objectives, it may never be managed for resource benefit objectives."

"Wildland fire use is the result of a natural event. The Land and Resource Management Plan, or the Fire Management Plan, will identify areas where the strategy of wildland fire use is suitable. The wildland fire implementation plan (WFIP) is the tool that examines the available response strategies to determine if a fire is being considered for wildland fire use."

"When a prescribed fire or a fire designated for wildland fire use is no longer achieving the intended resource management objectives and contingency or mitigation actions have failed, the fire will be declared a wildfire. Once a wildfire, it cannot be returned to a prescribed fire or wildland fire use status."

Clarifying terms and definitions from the Federal Fire Policy having importance to wildland fire use include:

Wildland Fire: Any nonstructure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire, wildland fire use and prescribed fire.

Wildfire: An unplanned, unwanted wildland fire, including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

Wildland Fire Use: The application of the appropriate management response to naturally-ignited wildland fires to accomplish specific resource management objectives in predefined designated areas outlined in fire management plans.

Prescribed Fire: Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements (where applicable) must be met prior to ignition.

Other policy clarifying briefing papers include:

> **Three Kinds of Wildland Fire:** Wildfire, wildland fire use, and prescribed fire. (National Fire and Aviation Executive Board 2005a).
>
> **Use of Wildland Fire:** Describes the two types of wildland fire applications—wildland fire use or prescribed fire—that provide for resource benefits. The term is synonymous with "Fire Use." (National Fire and Aviation Executive Board 2005b).

While unique agency missions may cause wildland fire use management operational differences, it is expected that these differences will be minor and not limit cross-jurisdictional planning and implementation. The interagency wildland fire use planning and implementation procedures described in this guide will enhance effective and efficient operations across administrative boundaries, facilitate short- to long-duration management, reduce problems or suspensions of operations during personnel transfer of commands, improve agency ability to meet other challenges and opportunities when managing wildland fires for resource benefit, and fulfill the standardization of procedures and policies direction from the Federal Fire Policy.

This reference guide is structured to provide a management summary for each section (in shaded red boxes), then more detailed descriptions of processes, and contains reproducible forms in Appendix A.

Wildland Fire
Use Planning and Assessment

Wildland Fire Implementation Plan

Specific planning and documentation requirements exist for management of wildland fires where resource benefits are a primary objective. The full planning process used for wildland fire use events is uniquely different from the processes used for management of unwanted wildfires. Figure 1 illustrates the basic wildland fire use planning process.

A standard wildland fire implementation plan (WFIP) has been developed. The complete WFIP consists of three stages and is prepared progressively. Each individual stage constitutes a stand alone implementation plan and specific forms and formats are available for each stage. Progression from one stage to the next is dependent upon fire activity, potential duration, and relative risk as it relates to the incident. As each progressive stage is prepared, it is attached to the previous stage and becomes the guiding document until management of the fire accomplishes resource objectives or progression to a higher stage occurs.

Since each stage can be completed individually and used as a stand-alone plan, it is possible that an individual fire will be managed under only Stage I for its duration. Some fires will progress to Stage II and some will progress to Stage III. Thus, the overall objectives for managing individual fires can be accomplished through successful implementation of any or all of the stages, as illustrated by the left portion of Figure 1.

WFIP Stage I documents the fire situation, agency administrator decision, management actions, and sets the

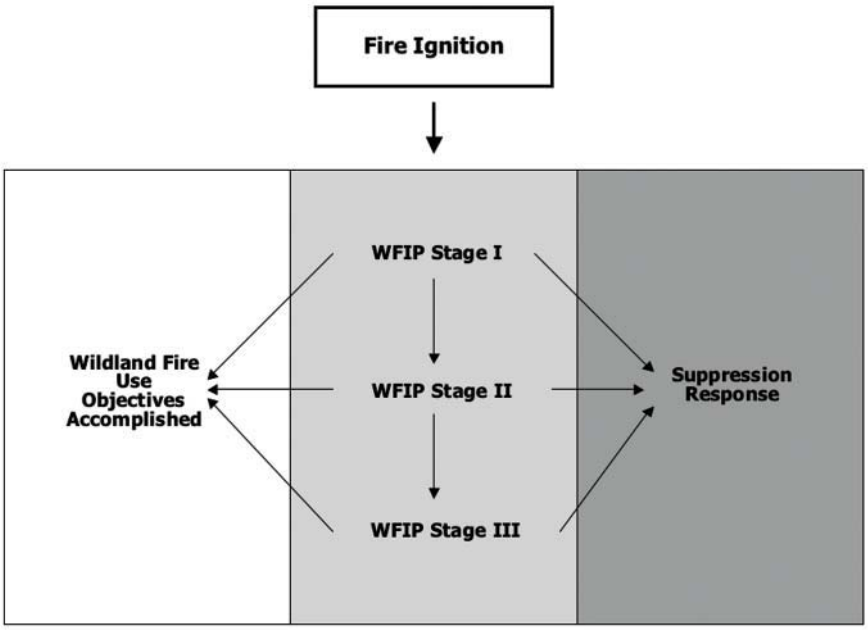


Figure 1. Generalized flow of wildland fire implementation plan showing progression of stages and points of movement to a suppression response.

initial periodic assessment schedule. This stage is the initial stage of the planning process. Given suitable circumstances, it can be used to manage a fire with low potential for spread and negative impacts. Components of WFIP Stage I include:

- **Strategic Fire Size-Up** (documents fire situation, including fire location and cause). A Strategic Fire Size-Up is completed for all wildland fires and provides information necessary to decide whether to implement a wildland fire use or a suppression response. All wildland fires naturally caused and in a fire management unit approved for wildland fire use become wildland fire use (WFU) candidates. For fires not meeting these criteria, WFIP planning stops at this point and a suppression action is initiated. For wildland fires meeting these criteria (WFU candidate), planning continues into the Decision Criteria Checklist.

- **Decision Criteria Checklist** (documents the decision to manage the fire for resource benefits or initiate a suppression action).

- **Management Actions** (identifies management actions).

- **Periodic Fire Assessment** (sets assessment frequency, confirms decision to continue with WFU, identifies planning stage needs and implementation qualification levels). A Periodic Fire Assessment is completed as part of each stage on a schedule determined by managers. Completing this step in Stage I provides direction to move to Stage II, remain with Stage I, or initiate a suppression response.

The Strategic Fire Size-Up, Decision Criteria Checklist, and Periodic Fire Assessment are points in WFIP Stage I where a suppression response could be indicated (Figure 1), although the agency administrator can decide to suppress a fire at any time.

WFIP Stage II defines management actions required in response to a changing fire situation as indicated by monitoring information and the Periodic Fire Assessment completed as part of Stage I. Stage II is used to manage larger, more active fires with greater potential for geographic extent than in Stage I. Under suitable circumstances and fire situations, this stage could represent the end point in WFIP planning and be used to manage a fire through its duration. Components of WFIP Stage II include:

- Objectives

- Fire Situation

  —Current and predicted fire behavior
  —Current and predicted weather
  —Threats
  —Safety considerations
  —Environmental concerns
  —External concerns

- Management Actions (include description of action and expected duration)

- Estimated Costs

- Periodic Fire Assessment. Completing this step in Stage II provides direction to move to Stage III, remain with Stage II, or initiate a suppression response.

WFIP Stage III defines management actions required in response to an escalating fire situation, potential long duration, and increased need for management activity, as indicated by the Periodic Fire Assessment completed as part of Stage II. It addresses management objectives and constraints in detail, describes the maximum area that the fire may be managed within (Maximum Manageable Area or MMA), identifies foreseeable threats and concerns, provides a quantitative long-term risk assessment, identifies management actions to mitigate or eliminate threats,

provides cost estimates, and documents a periodic assessment of the situation. This stage constitutes a substantial planning effort but some of the information used in this stage can be preplanned or completed prior to fire ignition if the administrative unit desires to do so. Such preplanning is strongly encouraged. Additional information on preplanning is provided in Appendix B.

Components of WFIP Stage III include:

- Objectives and Risk Assessment Considerations
  - —Natural and Cultural Resource Objectives
  - —Management Constraints
- Maximum Manageable Area (MMA) Definition and Maps
- Weather Conditions and Drought Prognosis
- Long-term Risk Assessment (describe techniques and outputs, include maps as appropriate)
- Threats
  - —MMA
  - —Public Use and Firefighter Safety
  - —Smoke Dispersion and Effects
  - —Other
- Monitoring Actions (actions, frequency, and duration)
- Mitigation Actions (describe management actions, management action points that initiate these actions, and key to map if necessary)
- Resources Needed to Manage the Fire
- Contingency Actions (describe actions necessary when mitigation actions are unsuccessful)
- Information Plan
- Estimated Costs
- Post-burn Evaluation
- Signatures and Date
- Periodic Fire Assessment

Table 1. WFIP completion timeframes

WFIP Stage	Maximum Completion Timeframe
WFIP Stage I	8 hours after confirmed fire detection and Strategic Fire Size-Up
WFIP Stage II	48 hours after need indicated by Planning Needs Assessment
WFIP Stage III	7 days after need indicated by Planning Needs Assessment
Periodic Fire Assessment	As part of all stages and on assigned frequency thereafter

Wildland Fire Implementation Plan Completion Timeframes

Specific completion timeframes have been established for each stage of the WFIP. Table 1 shows maximum completion timeframes for WFU planning tasks. Units may accelerate planning timeframes to facilitate implementation of management actions.

Detailed Description - Wildland Fire Implementation Plan Procedures

Wildland Fire Implementation Plan - Stage I

WFIP Stage I establishes the information base for managing the fire. It documents the current and predicted situation, all appropriate administrative information, and aids managers by providing them with information to make an initial decision to continue management of the fire for resource benefits or to take suppression action. It also allows the manager to select and document a recommended response action. Stage I consists of four specific components: Strategic Fire Size-Up, Decision Criteria Checklist, Management Actions, and Periodic Fire Assessment (an element of all stages). The information shown in the box below illustrates all WFIP Stage I elements. The four Stage I components are described in detail in the following sections. Advancement in the planning process above Stage I is determined by the Periodic Fire Assessment indicating a higher stage is needed or the agency administrator directing a higher stage be initiated. A sample plan is included in Appendix A and an electronic software package for WFIP preparation is available.

Purpose: Documents the fire situation and agency administrator decision, describes management actions, and sets the initial periodic assessment schedule as the preliminary stage of the planning process.

Information Sources: Fire size-up information, current fire weather and fuel moisture conditions, local information, agency administrator input, and site-specific information from the fire management plan (FMP).

Completion Time: The Strategic Fire Size-Up is completed as soon as aerial or on-the-ground resources provide a confirmation of the fire's existence and the required fire size-up information.

All remaining Stage I components are completed within 8 hours of completion of Strategic Fire Size-Up.

WFIP Stage I Content

- ❑ Strategic Fire Size-Up
  - Fire name
  - Fire number
  - Administrative unit(s)
  - Start date/time
  - Discovery date/time
  - Current size
  - Fuel model(s)
  - Current weather
  - Observed fire behavior
  - Location
  - Fire management unit
  - Cause
- ❑ Decision Criteria Checklist
- ❑ Management Actions
  - Forecasted weather
  - Forecasted fire behavior
  - Hazards and safety concerns
  - Management actions
  - Availability of resources
- ❑ Periodic Fire Assessment

Strategic Fire Size-Up

All reported wildland fires receive a size-up. The Strategic Fire Size-Up consists of a standard information set (refer to Incident Response Pocket Guide or Interagency Standards for Fire and Fire Aviation Operations or locally developed operating guidelines and forms) needed for the duty officer to determine if the fire meets the requirements for WFU management. The duty officer is responsible within his/her delegated authority for determining if the fire meets minimum WFU requirements and keeping the agency administrator informed of the situation. Two key pieces of information collected for the Strategic Fire Size-Up will help the duty officer make this determination. These are fire location in regard to the fire management plan's fire management unit (FMU) and the cause of the fire. Location of the fire in an FMU not approved for wildland fire use or being human-caused is reason to initiate a suppression response. If the fire is located in an FMU approved for wildland fire use and naturally ignited, it becomes a WFU candidate and the planning process continues into the Decision Criteria Checklist. This determination is noted at the bottom of the Strategic Fire Size-Up form (Figure 2 shows that portion of the Strategic Fire Size-Up). The entire form is available in Appendix A. The appropriate information is circled and the person preparing this form initials and dates after completion.

Decision Criteria Checklist

The Decision Criteria Checklist consists of three sections: decision elements, approved response action, and justification for suppression response (Figure 3). The decision elements are five questions the agency administrator must answer. This process allows the agency administrator to gain better situational awareness and helps evaluate if the current wildland fire should be managed under a WFU response. These questions assess threats from the fire, potential effects of the fire, risk from the fire, effects of other fire activity on management capability, and allows the agency administrator to consider external or other unanticipated issues.

To complete the checklist, the agency administrator answers the decision elements, based on input from his/her staff, and determines if the fire should receive a WFU management response or a suppression response. **A "Yes" response to any of the five elements indicates that management should take a suppression response. All "No" answers to the decision elements indicate that the fire is a viable candidate to be managed as a WFU.**

FMU (circle appropriate FMU situation)	WFU Approved	WFU Not Approved		
Cause (circle fire cause)	Natural Ignition	Human-caused Ignition		
Suitability for Wildland Fire Use (circle situation, initials of person preparing, date/time)	**Wildland Fire Use Candidate** – Continue with Decision Criteria Checklist	**Suppression**	**Initials**	**Date/Time**

Figure 2. Location, cause, and WFU suitability portions of Strategic Fire Size-Up.

Detailed Explanations of Decision Elements

- ❑ The first decision element involves the relative threats to life and property. If known threats cannot be adequately mitigated (i.e., "yes" answer), managing the fire as a WFU has potential concerns due to fire location, serious threats to firefighter and public safety, and potentially significant consequences.

- ❑ The second decision element involves objectives and resource conditions for wildland fire management as stated in the FMP. Potential outcomes and desired effects are closely correlated with burning conditions and fire behavior. Objectives and constraints include air quality and effects on natural and cultural resources, as applicable. References for objectives and constraints include the unit FMP, unit land management plan, and agency administrator input.

- ❑ The third decision element involves a relative assessment of the risk for the fire. Since the decision to suppress or manage the fire is time constrained (8-hour decision space), it may not be possible to complete a long-term risk assessment. In lieu of the quantitative long-term risk assessment, a qualitative assessment process has been developed to provide the agency administrator with a quick but comprehensive assessment of the relative risk of the fire. Input information for this decision element is acquired by completing the Wildland Fire Relative Risk Assessment (Figure 4). This assessment must be completed to support the Decision Criteria Checklist in Stage I, and is reevaluated during each Periodic Fire Assessment. Neither a high nor low relative risk rating necessarily predisposes a "yes" or "no" answer on the Decision Criteria Checklist. The agency administrator must still decide what level of risk is acceptable. A description of the

Decision Criteria Checklist

Decision Element	Yes	No
Is there a threat to life, property, or public and firefighter safety that cannot be mitigated?		
Are potential effects on cultural and natural resources outside the range of acceptable effects?		
Are relative risk indicators and/or risk assessment results unacceptable to the appropriate agency administrator?		
Is there other proximate fire activity that limits or precludes successful management of this fire?		
Are there other agency administrator issues that preclude wildland fire use?		

The Decision Criteria Checklist is a process to assess whether or not the situation warrants continued wildland fire use implementation. A "Yes" response to any element on the checklist indicates that the appropriate management response should be suppression-oriented.

Approved Response Action (check one)		Signature/Position	Date
Suppression Response			
Wildland Fire Use Response			

Justification for Suppression Response:

_____

_____

_____

_____

_____

Figure 3. Decision Criteria Checklist (a standard size reproducible copy of the checklist is included in Appendix A).

Wildland Fire Relative Risk Assessment is provided in the following section (Wildland Fire Relative Risk Assessment).

- The fourth decision element pertains to other local and regional fire activity, commitments of unit and cooperator resources, specific unit FMP limitations on fire numbers, and availability to fill special skill positions from local resources for this fire. If current fire activity precludes the ability to manage the fire with adequate resources and skill mixes, then the response to this element will be "Yes" and a suppression response is indicated.

- The final decision element allows agency administrator discretion in the event there are other issues which were unknown to the fire staff and must be considered as part of the decision to manage the fire for resource benefits. Agency administrators will document other issues that precluded management of the fire for resource benefits.

Once the Decision Criteria Checklist is complete, the agency administrator decides whether to initiate actions to manage the fire as a WFU or manage it under a suppression response. At the bottom of the Decision Criteria Checklist is a check box for the approved response action followed by the agency administrator's (or other delegated individual's) signature and date. If a suppression response is selected, the agency administrator must include a justification for this selection at the bottom of the page.

Wildland Fire Relative Risk Assessment

The Federal Fire Policy requires that sound risk management be a foundation for all fire management activities. Recent reviews and audits have also stressed the need for risk management. In fact, risk management is rapidly becoming a cornerstone phrase associated with fire management. A report by the National Academy of Public Administration (NAPA) (2001), "stresses the role of risk reduction in wildlands as a critical mitigation approach to improve community protection." The Government Accountability Office (USGAO 2004) completed a report on risk assessment associated with the fuels treatment program. This report also stresses the importance of risk assessment in fire and fuels management.

Using fire to meet resource objectives contains an inherent level of risk given that we are dealing with a number of unknowns and uncertainty in what the future will bring. The relative risk rating is intended to characterize the general magnitude of risks associated with implementing a wildland fire use incident as a snapshot in time. It is an attempt to qualify the level of uncertainty regarding the eventual outcomes of the fire in relation to management objectives and other mandates. The relative risk rating is a direct input into the Decision Criteria Checklist, Wildland Fire Use Management Assessment, and Periodic Fire Assessment.

The Wildland Fire Relative Risk Assessment provides the agency administrator with a quick but comprehensive assessment of the relative risk of the fire. This is a qualitative process that can be completed in less time than a quantitative, long-term risk assessment. The relative risk rating produced from this assessment is a decision support aid for the agency administrator in answering Decision Criteria Checklist elements and during the Periodic Fire Assessment.

The relative risk assessment chart uses three risk components: values, hazard, and probability. Each of these components is assessed in an independent step. Then, the three outputs are evaluated in a final step that provides the relative risk for the fire. Each risk component is defined by three variables. One variable is located on the right and one on the left side of the box and the third variable is defined by three interior lines extending from top to bottom (Figure 4).

Values: Values are those ecologic, social, and economic resources that could be lost or damaged

because of a fire. Ecologic values consist of vegetation, wildlife species and their habitat, air and water quality, soil productivity, and other ecologic functions. Social effects can include life, cultural and historical resources, natural resources, artifacts, and sacred sites. Economic values make up things like property and infrastructure, economically valuable natural and cultural resources, recreation, and tourism opportunities.

Hazard: The hazard in wildland fire is made up of the conditions under which it occurs and exists, its ability to spread and circulate, the intensity and severity it may present, and its spatial extent.

Probability: Probability refers to the likelihood of a fire becoming an active event with potential to adversely affect values.

The Wildland Fire Relative Risk Assessment Chart is shown in Figure 4. Four steps are necessary to complete the risk assessment. Step-by-step instructions for completing the Wildland Fire Relative Risk Assessment are included in Appendix A. Each step is available individually in a larger format figure in Appendix A.

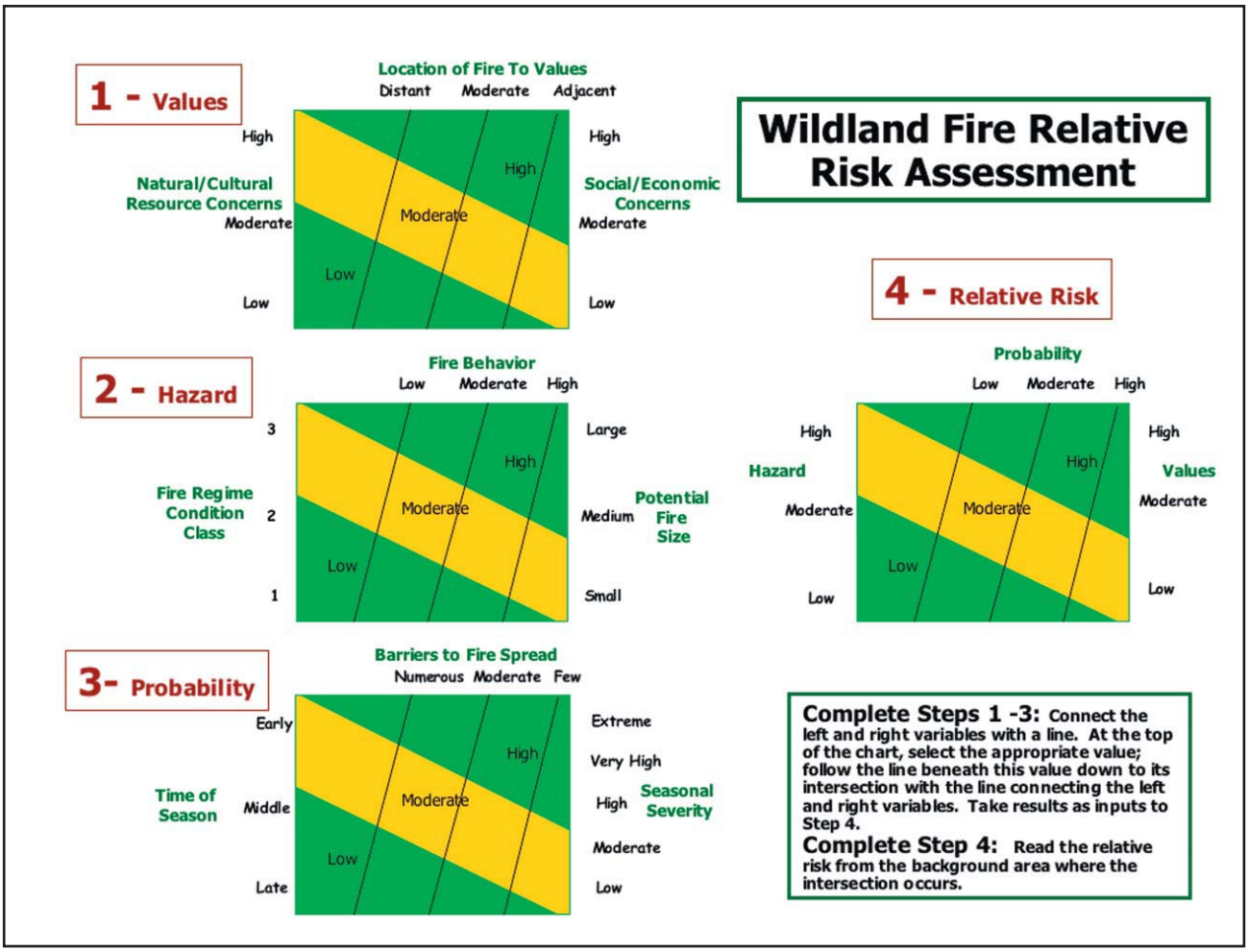


Figure 4. Wildland Fire Relative Risk Assessment.

Initial information to consider in developing the rating for the individual element is provided in the following section and after each individual chart in Appendix A. This descriptive list is not all inclusive and items on the list can vary by place and time. Users are expected to exercise their judgment in determining the ratings; information is intended to provide both guidance in completion and flexibility in determining exactly what the descriptions mean. Local information can and should be amended to the lists to better reflect site-specific situations. Local, site-specific information concerning air quality and smoke management must be amended into the Wildland Fire Relative Risk Assessment at the local level to reflect variances in situations and local values and regulatory concerns. Air quality criteria should be reflected in the values assessment portion, smoke production can be incorporated into the hazard descriptive list, and descriptive information related to the probability of adverse smoke events, if available, can be addressed as part of the probability assessment.

Part 1: Value Assessment: Values are those ecologic, social, and economic effects that could be lost or damaged because of a fire. Ecologic values consist of vegetation, wildlife species and their habitat, air and water quality, soil productivity, and other ecologic functions. Social effects can include life, cultural and historical resources, natural resources, artifacts, and sacred sites. Economic values make up things like property and infrastructure, economically valuable natural and cultural resources, recreation, and tourism opportunities. This assessment area allows opportunity for the local agency administrator to identify particular local concerns. These concerns may be identified in the fire management plan or other planning documents.

Natural/Cultural Resource Concerns - key resources potentially affected by the fire. Examples include, but are not limited to, habitat or populations of threatened, endangered, or sensitive species, water quality, erosion concerns, and invasive species.

Low	Moderate	High
Resource concerns are few and generally do not conflict with management of the fire. Mitigation measures are effective.	Significant resource concerns exist, but there is little conflict with management of the fire. Mitigation measures are generally effective.	Multiple resource concerns exist, some of which may conflict with management of the fire. The effectiveness of needed mitigation measures is not well established.

Social/Economic Concerns - the risk of the fire, or effects of the fire, impacting the social or economic concerns of an individual, business, community or other stakeholder involved with or affected by the fire. Social concerns may include degree of support for the wildland fire use program or resulting fire effects, potential consequences to other fire management jurisdictions, impacts to tribal subsistence or gathering of natural resources, air quality regulatory requirements and public tolerance of smoke. Economic concerns may include potential financial impacts to property, business, or infrastructure. Infrastructure impacts may be costs to repair or replace sediment catchments, wildlife guzzlers, corrals, roads, culverts, power lines, domestic water supply intakes, and similar items.

Low	Moderate	High
Local support for wildland fire use is high. The fire should have little or no impact on subsistence or tribal activities involving treaty rights. The fire is expected to remain within a single jurisdiction or agreements are in place to allow the fire to move across several jurisdictions. Media coverage is favorable. Few structures or business ventures are potentially affected by the fire. There are few impacts to recreation and tourism.	Local support of wildland fire use is clearly divided between supporters and opponents. The fire will have some impacts on subsistence or tribal activities involving treaty rights. The fire is expected to involve more than one jurisdiction, cooperator, or special interest group and agreements need to be developed. Media coverage tends to be a mix of favorable and unfavorable views. Some structures may be threatened by the fire or some business ventures may be affected by the fire.	Local support for wildland fire use is low. The fire will have significant impacts on subsistence or tribal activities involving treaty rights. Smoke impacts may become a concern for higher level air quality regulatory agencies. The fire is expected to involve several jurisdictions, cooperators, and special interest groups and agreements requiring significant negotiation need to be developed. Media coverage tends to be unfavorable. Many structures or private properties could be threatened.

Location of Fire to Values

Distant	Moderate	Adjacent
Fire location is not proximate to values to be protected or fire is located where it is highly unlikely that it would reach the values.	Fire location is moderately proximate to values. Location is such that, based on historical data, fire could potentially reach the values but will take multiple burning periods and sustained fire activity to reach the values.	Fire location is in close proximity to values. Without mitigation actions, fire will be expected to reach the values.

Part 2: Hazard Assessment: The hazard in wildland fire is made up of the conditions under which it occurs and exists, its ability to spread and circulate, the intensity and severity it may present, and its spatial extent.

Current Fire Behavior – the current fire behavior or that most recently observed. Changing fire behavior is addressed through repeated completion of the Periodic Fire Assessment.

Low	Moderate	High
Short duration flaming front with occasional torching. Fuels are uniform and fire behavior can be easily predicted and tactics implemented.	Short range spotting occurring. Moderate rates of spread are expected with mainly surface fire and torching. Fuels and terrain are varied but don't pose significant problems in holding actions.	Long range spotting greater than one-quarter mile. Extreme rates of spread, and crown fire activity are possible. Fuels, elevation, and topography vary throughout the fire area creating high resistance to control.

Fire Regime Condition Class — a measure of ecological functions at risk based on changes in vegetation.

1	2	3
Vegetative composition and structure are resilient and key components are at low risk of loss. Few, if any, fire return intervals have been missed and fuel complexes are similar to historic levels.	Both the composition and structure of vegetation has shifted toward conditions that are less resilient and more at risk of loss. Some fire return intervals have been missed, stand structure and composition, and fuel complexes have been altered and present potential for fires of severity and intensity levels in excess of historic levels.	The highly altered composition and structure of the vegetation predisposes the landscape to fire effects well outside the range of historic variability, potentially producing changed fire environments never before measured.

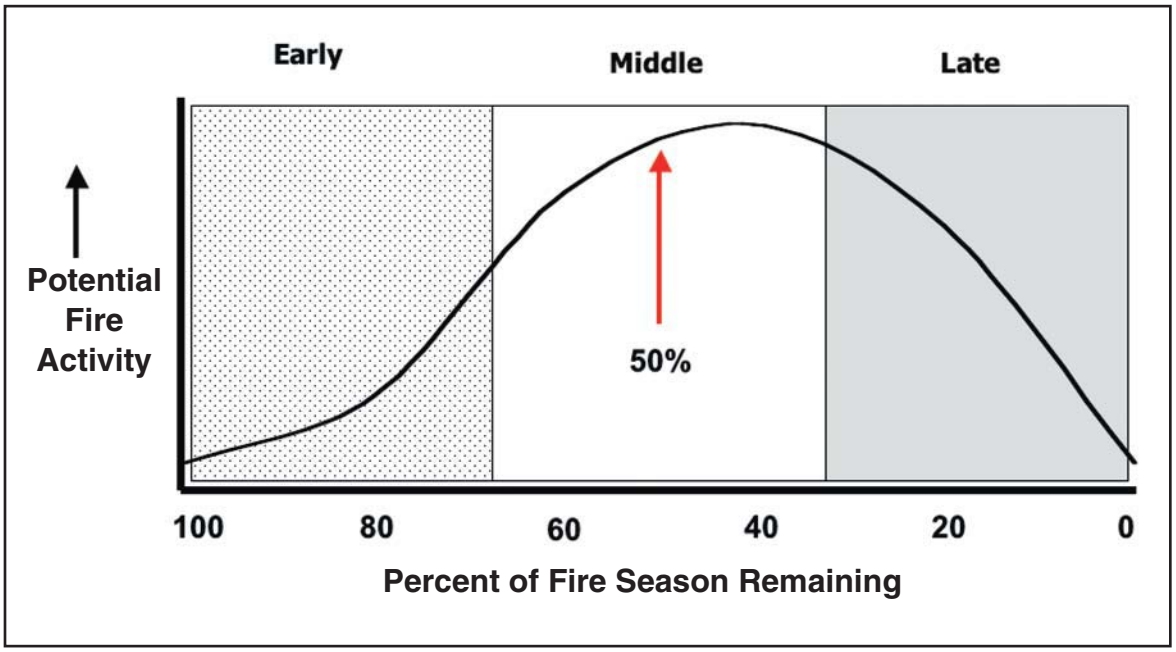
Potential Fire Size — the potential fire size by the end of the season in comparison to historical fire occurrence.

Small	Medium	Large
Fire size is expected to be small for the dominant fuel type involved.	Fire size is expected to be in the mid-range for the dominant fuel type involved.	Fire size is expected to be large for the dominant fuel type involved.

Part 3: Probability Assessment: Probability refers to the likelihood of a fire becoming an active event having potential to adversely affect values.

Time of Season — the current time in relation to the historical fire season. The chart below the guidelines reinforces the importance of time of season. During the early part of the fire season, the peak of burning activity is still to come, thus the fire could present substantial variation in behavior and activity. In the middle of the season, the peak of burning activity may or may not have occurred while in the late part of the season, the peak of fire activity generally has occurred and managers can reasonably expect diminishing fire activity and behavior as time progresses. As the amount of fire season remaining decreases or as the time of season progresses from early to late, management concerns and issues associated with potential fire activity decrease.

Early	Middle	Late
The current date is in the early portion of the historic fire season, at least two-thirds of the established fire season remains and the peak of burning activity is still to come.	The current date is in the middle of the historic fire season, at least one-third of that period has passed and no less than one-third remains. The peak burning activity period either has occurred, is occurring now, or will occur very soon.	The current date is in the latter part of the historic fire season. At least two-thirds of the historic period has passed, the peak burning activity period has occurred, and the probability of a season-ending or fire-ending event is increasing quickly.



Seasonal Severity — a measure of the potential burning conditions as expressed by factors such as energy release component (ERC), drought status, live fuel moistures, dead fuels moistures, soil moisture, stream discharge, and similar types of measures.

Low	High	Extreme
Measures of fire danger are below to somewhat above seasonal averages. Drought status is within seasonal norms with no long-term drought present.	Measures of fire danger are well above seasonal averages but not setting new records. The area is in short-term drought (1-2 years of drought) but not considered to be in long-term drought.	Measures of fire danger are setting new records. The area is considered to be in long-term drought (3 or more years of drought).

Barriers to Fire Spread – a measure of the natural defensibility of the fire location and an indication of degree of potential mitigation actions needed.

Numerous	Moderate	Few
The location of the fire and presence of natural barriers and firebreaks limit the horizontal fuel continuity, minimal mitigation actions on the ground will be needed.	The location of the fire and presence of some natural barriers and firebreaks limit the horizontal fuel continuity on some, but not all, fire flanks, some mitigation actions on the ground will be needed to protect threats to boundaries and sensitive areas.	The location of the fire and presence of only limited natural barriers and firebreaks will permit fire spread across continuous fuels. Mitigation actions on the ground will be needed but are expected to be effective.

Alternative Risk Assessment Methods

If preplanning or ongoing planning efforts lead to the development of additional mechanisms for assessing risk, these outputs can be utilized during the relative risk assessment process. Some planning analyses provide indications of values, hazards, and probability that may be used in lieu of completing Steps 1, 2, and 3 of the Relative Risk Assessment. Step 4, determination of the risk, must be completed, regardless of how the values, hazard, and probability are determined. Figures 5 and 6 show some examples of preplanning products that could be used for Steps 1, 2, and 3.

Mapping products like those illustrated in Figure 5 provide locations of communities, wildland-urban interface, infrastructure, natural resource concerns, etc. These maps can be used in conjunction with fire management units to assess risk from fire to these values and can be directly used in the relative risk chart as levels of values for Step 1 or Step 4.

In Figure 6, fire hazard can be used to evaluate the hazard portion of the relative risk, and fire risk could be an indicator of probability. These data can be used in conjunction with fire management unit information to assess the hazard and probability and can be directly used in the relative risk chart as levels of hazard and probability in Steps 2, 3, and/or 4.

There are numerous other methods that can be used to help evaluate the relative risk. If an alternative method is used to derive the value, hazard, and probability, that method must be documented on the relative risk rating charts.

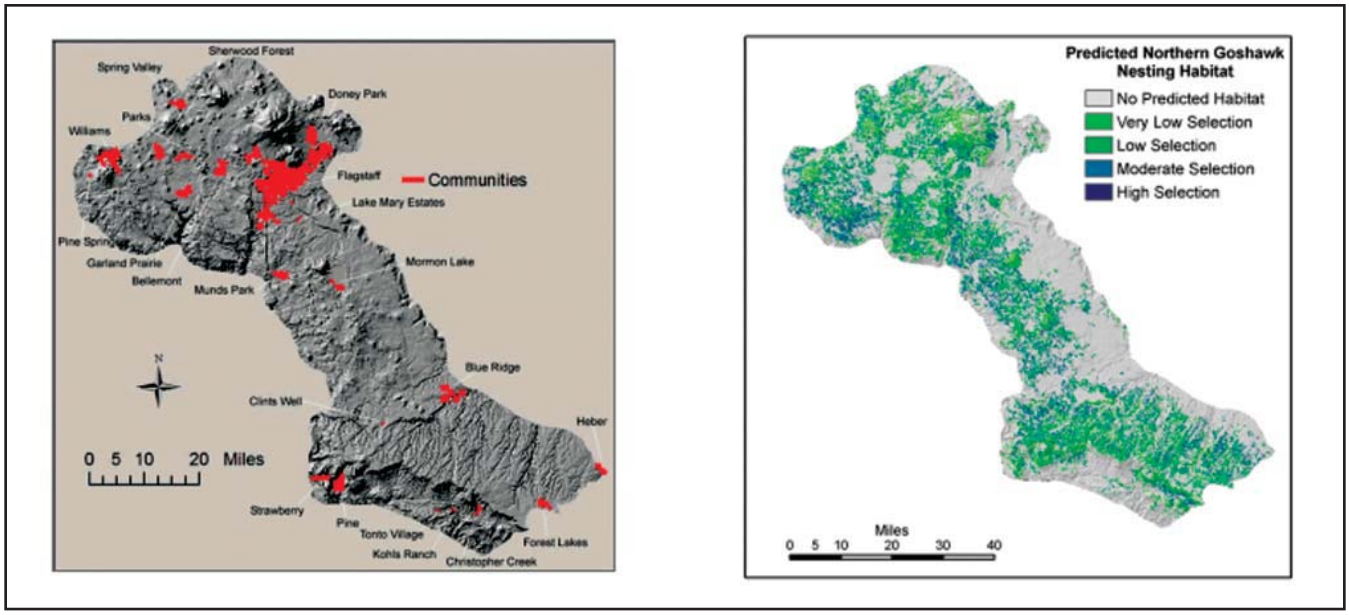


Figure 5. Geographic information system (GIS) mapping outputs showing community locations and wildlife species concern areas (courtesy of ForestERA, Northern Arizona University, Flagstaff, AZ).

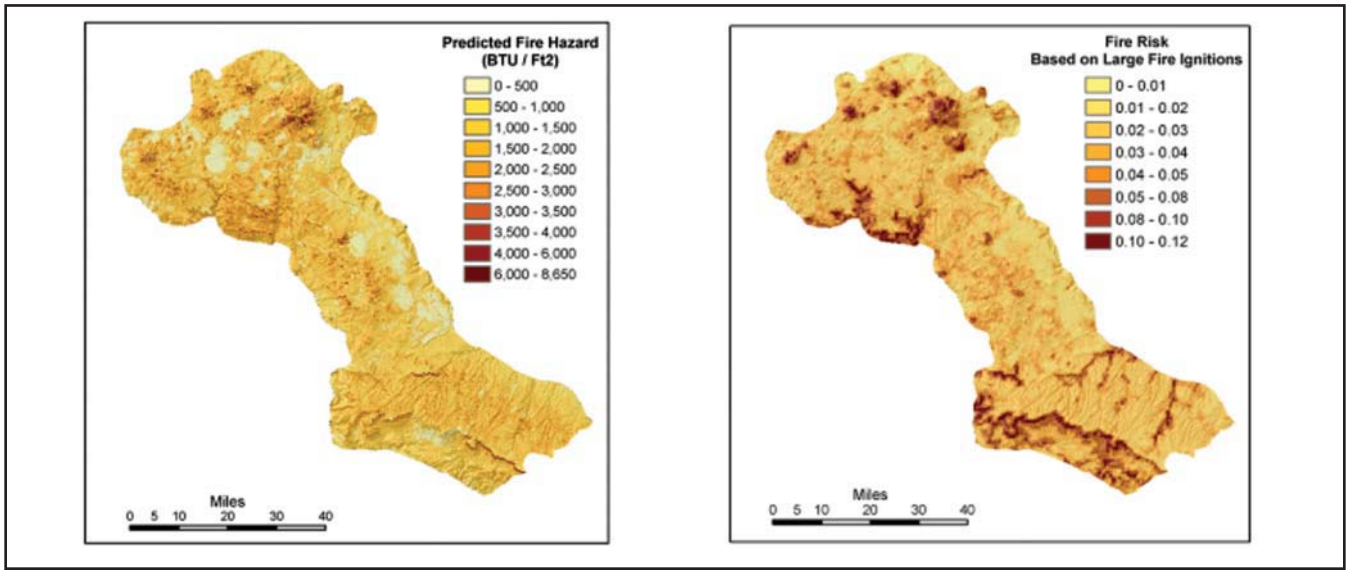


Figure 6. Geographic information system mapping outputs showing predicted fire hazard and fire risk (courtesy of ForestERA, Northern Arizona University, Flagstaff, AZ).

Management Actions

Management actions describe activities necessary to manage the fire until the Periodic Fire Assessment indicates a change in WFIP planning stage and activity is required or until objectives are achieved. Management actions will include monitoring and other actions as appropriate. Monitoring actions are important components of Stage I management actions. Monitoring actions are necessary to track fire movement, fire activity, fire effects, and to provide information vital to completing the Wildland Fire Use Management Assessment (see Periodic Fire Assessment section). Management actions should be designed to safely achieve the wildland fire use objectives as detailed in the fire management plan, and be based upon the fire situation and forecasted weather and fire behavior. Within the forecasted weather section, include an initial discussion of assessment of air quality forecasts/allowable burn days, as applicable for the local area.

Periodic Fire Assessment

For each wildland fire use action, the agency administrator (or delegated individual) is required to initially affirm and periodically reaffirm the capability to manage the fire as a WFU event. This process is intended to document and ensure management accountability throughout the duration of the wildland fire use. The Periodic Fire Assessment process:

- affirms continued management of the fire to meet resource objectives or provides rationale for conversion to a suppression response.
- confirms and documents the decision to establish, remain at, or move up to the next stage of planning.
- validates the minimum planning and implementation qualifications.

The Periodic Fire Assessment accomplishes the above-stated purposes by:

- completing a Decision Criteria Checklist (either by reaffirming the Decision Criteria Checklist completed in the previous stage or through completion of a new one),
- assessing the level of risk the fire presents using the Wildland Fire Relative Risk Assessment process (either by reaffirming the Wildland Fire Risk Assessment completed in the previous stage or through completion of a new one),
- assessing the planning needs of the unit,
- assessing the minimum planning and implementation qualifications for each stage of the WFIP, and
- completing a signature table that affirms the agency administrator's concurrence to manage the fire for resource benefits at a particular stage.

The initial Periodic Fire Assessment is completed as part of WFIP Stage I. It is then redone on the recurring timeframe set by the assessment frequency.

Purpose: To evaluate and document:

- the capability to manage the fire to meet resource benefits;
- relative risk,
- management organization, operational, and personnel qualification needs; and
- the WFIP planning level required to meet identified needs.

The Periodic Fire Assessment is completed on a set schedule in conjunction with all three WFIP stages.

Information Sources: Fire monitoring information, risk assessments results, current fire activity, fire location, fire size, fire danger indicators, time period of fire season, fire behavior and weather forecasts, and agency administrator and staff input.

Estimated Completion Time: ≤ .5 hour.

Periodic Fire Assessment

- ❑ Decision Criteria Checklist
- ❑ Wildland Fire Relative Risk Assessment
- ❑ Wildland Fire Use Management Assessment
  - —Part 1: Planning Needs Assessment
  - —Part 2: Fire Use Manager Decision Chart
- ❑ Signature Page

Decision Criteria Checklist

The Decision Criteria Checklist completed in Stage I or during the most recent Periodic Fire Assessment is reviewed for continued validity. The validity of the checklist is noted on the Periodic Fire Assessment signature page. If the Decision Criteria Checklist is no longer valid, management of the fire for resource benefits can no longer continue. See WFIP Stage I Decision Criteria Checklist procedures for a description of the Decision Criteria Checklist and an example form.

Wildland Fire Relative Risk Assessment

The Wildland Fire Relative Risk Assessment, completed during Stage I or during the most recent Periodic Fire Assessment, is reviewed and updated to remain current and ensure validity. **It is important that this assessment be reviewed and updated as conditions change over time (this review and update is required in the Periodic Fire Assessment).** See WFIP Stage I Wildland Fire Relative Risk Assessment procedures for a description of the Wildland Fire Relative Risk Assessment and example forms.

Wildland Fire Use Management Assessment

The Wildland Fire Use Management Assessment consists of two parts:

- Part 1: Planning Needs Assessment Chart
- Part 2: Fire Use Manager Decision Chart

This section is completed to determine the level of planning and management capability and qualifications commensurate with the fire activity and management capability.

Part 1: Planning Needs Assessment Chart

The Planning Needs Assessment Chart is used as part of the Periodic Fire Assessment to determine or affirm the level of planning commensurate with the relative risk, potential fire duration, and fire activity. The Planning Needs Assessment Chart indicates the need to establish, remain at, or to move up to the next stage of planning and is the principle guide for transition throughout the WFIP process. This chart aids managers in assessing the need to complete detailed, long-term assessment and implementation plans for a particular fire. The chart also guides agency administrators in setting priorities for planning needs for multiple fires and ensuring that those fires having the greatest need have the necessary planning done within the framework of management capabilities and time constraints. It must be noted that agency administrators and staff have the prerogative to move up and complete the next or all WFIP Stage(s) for any or all wildland fires at any time. **When the Planning Needs Assessment Chart indicates progression to a higher level and that stage of the WFIP is completed, the fire will be managed under that WFIP stage either for its duration or until the chart indicates a need to progress to the next higher level.** This chart does not provide guidance to move down or backward through planning stages. Once WFIP Stage III is indicated and completed, the fire will not return to management under Stage I. The Planning Needs Assessment Chart is shown in Figure 7.

To complete the chart in Figure 7, connect the left and right variables with a single line (potential fire duration and relative risk, respectively). Select the appropriate level of fire activity at the top of the chart and follow the line beneath that value down to its intersection with the line connecting the left and right variables. Read the planning need from the background area where the intersection occurs. The relative risk values are those obtained from the Wildland Fire Relative Risk Assessment process described above.

Table 2 shows the minimum interagency qualification requirements for wildland fire use planning at each stage of the WFIP process. This information should be used with the Planning Needs Assessment Chart to determine appropriate levels of planning qualifications. Higher qualified personnel can always be used to complete the various planning levels if desired. Duty officer qualifications are defined in local unit fire management plans.

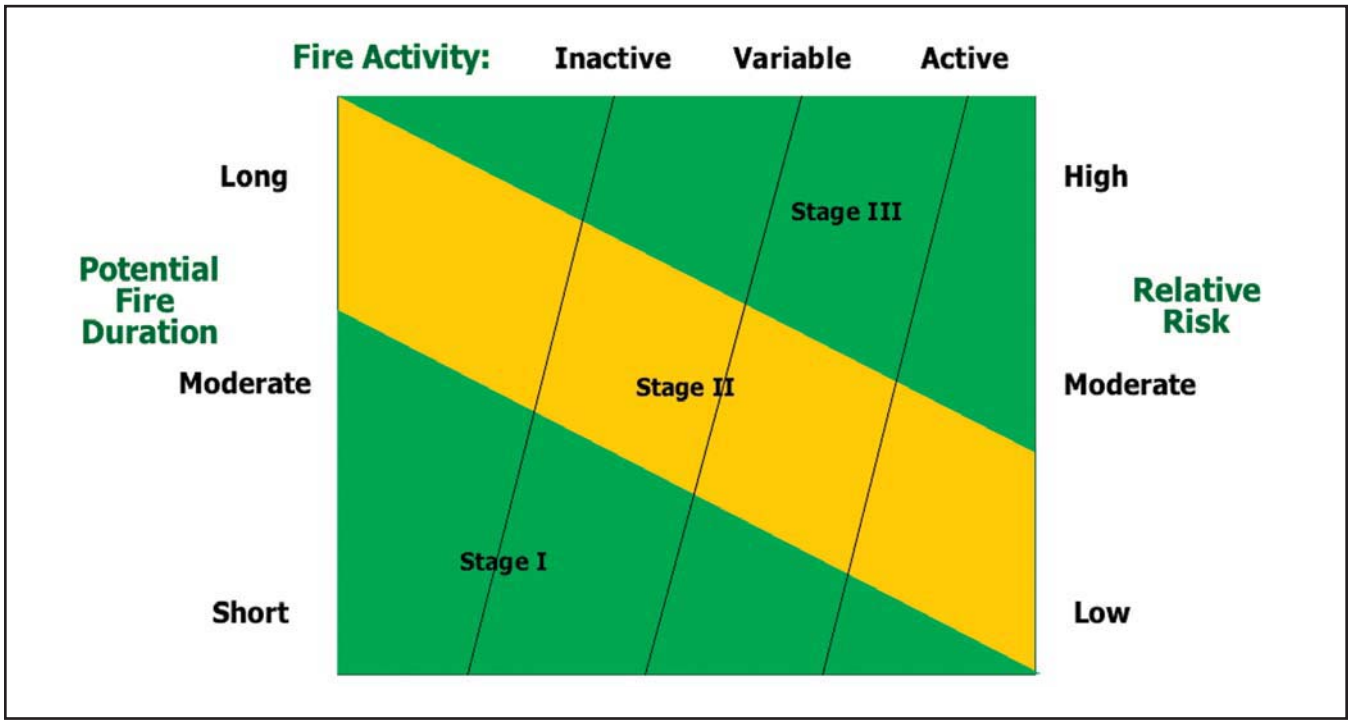


Figure 7. Planning Needs Assessment Chart.

Table 2. WFIP planning minimum qualifications

WFIP Stage	Minimum Planning Qualifications
WFIP Stage I	Unit Duty Officer
WFIP Stage II	Fire Use Manager Type 2 (FUM2)
WFIP Stage III	Fire Use Manager Type 2 (FUM2)

Part 2: Fire Use Manager Decision Chart

The Fire Use Manager Decision Chart is used during each stage as part of the Periodic Fire Assessment. This chart guides the agency administrator in determining the appropriate qualification levels for implementation of management actions. The Fire Use Manager Decision Chart indicates the need to establish, remain at, move up, or move down to a specific level of implementation qualifications and is the principle guide for transition of implementation qualifications throughout the WFIP process (the key difference between this chart and the Planning Needs Assessment Chart is that this chart is used throughout the duration of the fire and provides an indication of remaining at a level, moving up, **or moving down** in implementation qualification requirements). The Fire Use Manager Decision Chart is shown in Figure 8.

To complete the chart in Figure 8, connect the left and right variables with a single line (potential fire duration and relative risk, respectively). Select the appropriate level of fire activity at the top of the chart and follow the line beneath that value down to its intersection with the line connecting the left and right variables. Read the level of fire use manager needed directly from the background area where the intersection occurs. The relative risk values are those obtained from the Wildland Fire Relative Risk Assessment process.

Table 3 shows the **minimum** level of implementation qualifications. During implementation, as fire activity and management needs escalate, implementation qualification needs ascend to a higher level. But as conditions moderate and management needs drop, implementation qualifications can descend to lower levels. Table 3 and Figure 8 are used jointly as fire situations and conditions escalate; when conditions are moderating or lessening, Table 3 and Figure 8 provide the necessary qualification levels for implementation. However, once either Stage II or Stage III is completed, a Fire Use Manager (FUM2 or FUM1) must be assigned for implementation. Qualifications do not descend back to an ICT4 after either Stage II or Stage III has been completed.

Initial information to consider in selecting the value for each variable in Figures 7 and 8 is provided in the following section and after each individual chart in Appendix A. This list is not all inclusive and items on the list can be expected to vary by place and time. Users are expected to exercise their judgment in selecting the values; information is intended to provide both guidance in completion and flexibility in determining exactly what the descriptions mean. Local information can and should be amended to the lists to better reflect site-specific situations.

Table 3. WFIP implementation minimum qualifications

WFIP Stage	**Minimum Implementation Qualifications** (Use Fire Use Manager Decision Chart to determine recommended position)
WFIP Stage I	Incident Commander Type 4 (ICT4) **(Must have local knowledge or prior experience in implementing WFIPs and managing wildland fire use events.)**
WFIP Stage II	Fire Use Manager Type 2 (FUM2)
WFIP Stage III	Fire Use Manager Type 2 (FUM2)

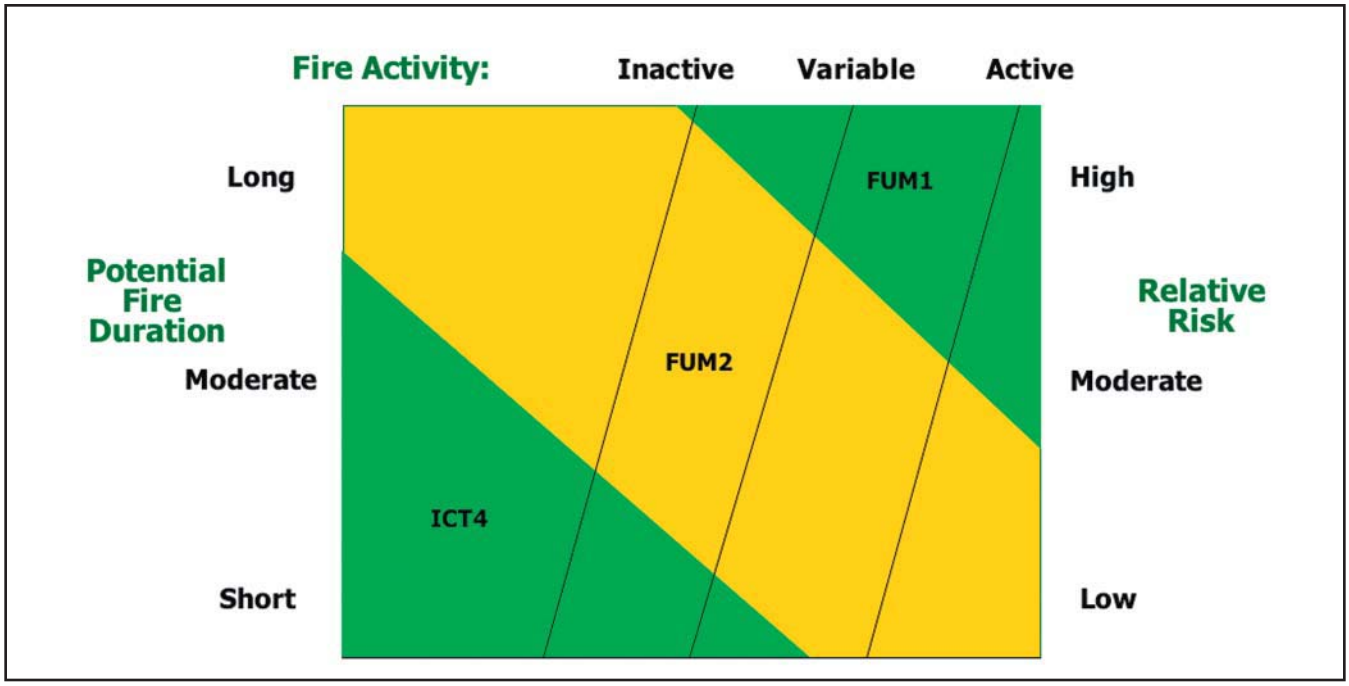


Figure 8. Fire Use Manager Decision Chart.

Guidelines for Planning Needs Assessment Chart and Fire Use Manager Decision Chart (while the charts are different and used for different purposes, the input values are the same and the following information applies to both charts).

Potential Fire Duration – the estimated length of time that the fire may continue to burn in comparison to historical fire durations and amount of fire season available for a given area.

Short	Moderate	Long
Fire is expected to persist for only the shortest time in comparison to historical fire durations. This may be as short as only a few days. Fuels may be limiting, weather may be limiting, or time of fire season may be limiting. Generally, this could be referenced as less than the historical average fire length for a given area.	Fire is expected to last for a time period similar to the historical average length of fires.	Fire is expected to last for a time period longer than the historical average length of fires.

Relative Risk – a measure of the relative risk, determined directly from the Wildland Fire Relative Risk Assessment, so no range of values is listed here.

Fire Activity - the relative activity of the fire in terms of intensity and spread over time.

Inactive	Variable	Active
Fire is burning with very low intensity and little or no spread and little or no increase in burned area. Fire is confined to surface litter and duff layers.	Fire is burning predominantly in surface litter and duff layers, with low intensity and little or no spread but has occasional periods of increased intensity and spread. Growth of burned area is not constant but occurs in response to increased activity. Area increase may be static for moderately long periods and then increase for short periods. Fire size usually increases by less than 50 percent during active periods.	Fire is burning in all fuel strata (litter, surface, and crown) with periods of sustained flaming fronts, perimeter growth, and area increases that can exceed 100 percent at times. Infrequent periods of low activity occur but spread is generally constant.

Signature Table

Local fire staff review and complete the assessments and checklist. Once these forms are completed they are taken to the agency administrator (or his/her designee) and **must be reviewed and confirmed on the specified assessment frequency.**

On the Signature Table, the following must be completed:

- Assessment Frequency,
- Valid Date(s),
- Signatures,
- Date,
- Confirmation of Decision Criteria Checklist,
- Validation of WFIP Planning Stage, and
- Confirmation of Fire Use Manager level.

Assessment Frequency and Valid Dates

The assessment frequency is how often the assessment will be reviewed. This frequency can be daily, but each unit can determine the appropriate assessment frequency. It can be less frequent than a daily requirement.

The frequency for completing the Periodic Fire Assessment is established based on the current and expected fire and weather situation. When units set a monitoring and assessment frequency, they should consider developing a "step-up" frequency based on levels of fire activity, external attention and influences, or other critical concerns. Then, as situational concerns escalate, the monitoring and assessment frequency can correspondingly increase. Conversely, as situational demands lessen, monitoring and assessment can "step down" and become less frequent. **Units must identify standards and rationale for establishing assessment frequency, especially "step-up" and "step-down" actions.**

The valid dates reflect the length of time that the identified assessment frequency will be used. If the assessment frequency is changed, the valid dates must be changed accordingly.

Signatures/Delegation

The agency administrator or designated individual must sign the Periodic Fire Assessment Signature Page in conformance with the specified assessment frequency. The Periodic Fire Assessment signature authority can be redelegated to specific positions as allowed by agency policy.

When redelegation occurs, agency administrators must document, in writing, the revalidation authority to the designated individuals. This permits the delegated individual to validate that management capability is adequate to continue management of the fire for resource benefits. If or when fire conditions or complexity levels escalate, Periodic Fire Assessment signature authority will automatically and immediately revert to the agency administrator who made the initial delegation of authority.

Periodic Fire Assessment

Signature Table

Assessment Frequency _____

Valid Date(s) _____

Name/Title	Date	Decision Criteria Checklist Valid	WFIP Planning Stage Required	Fire Use Manager Level
		Yes/No	I, II, III	I, II, Other

Wildland Fire Implementation Plan - Stage II

WFIP Stage II represents the continuation of management for resource benefits. During this stage, objectives are clearly defined, the fire situation is described, management actions commensurate with the fire situation are established, cost estimates are prepared, and the Periodic Fire Assessment is continued to evaluate the need to remain at Stage II or move to WFIP Stage III.

Components of WFIP Stage II and output products are shown in the box below.

Advancement in the planning process above Stage II is determined by the Periodic Fire Assessment indicating Stage III is needed or the agency administrator directing Stage III to be completed.

WFIP Stage II

- ❏ Objectives
- ❏ Fire Situation
  - —Current and predicted weather
  - —Current and predicted fire behavior
  - —Threats
  - —Safety considerations
  - —Environmental concerns
  - —External concerns
- ❏ Management Actions (include description of action and expected duration)
- ❏ Estimated Costs
- ❏ Periodic Fire Assessment

Purpose: **Documents specific management objectives, describes the fire situation and associated management concerns, identifies management actions, estimated costs, and documents the Periodic Fire Assessment.**

Information Sources: Objectives = developed from staff input and fire management plan.

Fire Situation = information available from monitoring the fire, weather observations and weather forecasts.

Risk Assessment = the minimum risk assessment required is the output from the wildland fire relative risk assessment completed in the Periodic Fire Assessment.

Management Actions = developed from staff input commensurate with predicted fire behavior, risk assessment, fuel types, fuel continuity, overall objectives, and defined management concerns.

Estimated Costs = developed from staff input, based on identified management actions and resources needed.

Completion Time: All elements of WFIP Stage II must be completed within 48 hours of need as indicated from the Periodic Fire Assessment.

Objectives

Land management is the process of making land use decisions for the future, setting objectives, implementing actions to accomplish the objectives, achieving outputs, and performing evaluations which compare results to objectives. In land management programs, objectives are used to establish desired outcomes for management actions. Objectives represent the single most influential factor in land management program implementation. They are fundamental to successful management to achieve desired land use decision conditions.

In wildland fire use, goals and objectives are important. Goals are primary basic products of the long-range management plans commonly referred to as land use decisions. They deal with large areas and long time periods. Land use decisions establish resource condition objectives; allowable, limited, or excluded uses for an area and the term and conditions for such use; and recommend management actions to achieve desired conditions. Objectives, a necessary component of the planning process, provide a bridge between goals and implementation actions. They identify changes resulting from management actions that move from the current situation to a desired situation. Site-specific treatment objectives must be developed to guide project-level operations in wildland fire use. These are very well-defined statements that describe what one or more wildland fires must accomplish to meet resource management objectives, as stated in land and resource management plans.

Objectives defined in WFIP Stage II represent specific statements of accomplishments for wildland fire use and provide a link back to fire management plans and land and resource management plans. These objectives must be specific, measurable, achievable, relevant, and trackable. At the Stage II planning level, more detailed tactical implementation of strategic objectives for wildland fire use activities takes place. At this level, the WFIP Stage II is a site-specific plan to guide implementation of fire management activities on the ground. Objectives are formulated from local unit input, agency administrator direction, fire management plans, and land and resource management plans.

Fire Situation

The fire situation section describes current conditions surrounding the fire and includes the following:

- Current and predicted weather
- Current and predicted fire behavior (predictions are vital to initial implementation actions because they provide):
  - —Estimates of fire size and shape at a given time,
  - —Models of management alternatives,
  - —Determinations of resource needs, production rates, and requirements,
  - —Placement of resources,
  - —Estimates of behavior under different weather patterns,
  - —Estimates of ignition patterns, including spotting,
  - —Modeling for contingency action planning,
  - —Developing prescriptions through historical weather records,
  - —Verifying prediction outputs.
- Threats
- Safety considerations
- Environmental concerns
- External concerns

The sum total of these efforts will be information on those factors affecting the fire and how it will burn and what it may affect. This information will support decisions on management actions, resource needs, and overall strategy and tactics concerning the appropriate management response.

Risk assessment during this stage can be quickly assessed through the Wildland Fire Relative Risk Assessment Chart during the Periodic Fire Assessment. However, if the unit has the capability to complete full long-term risk assessments through the use of the Rare Event Risk Assessment Process (RERAP), Fire Area Simulator (FARSITE), or other quantitative methods, they are encouraged to do so. This will provide the best information available. In the event such quantitative methods cannot be completed in a timely

manner, the Wildland Fire Relative Risk Assessment can be used to obtain a subjective assessment of the risk. The Stage II fire situation can be updated as current and forecasted weather and other situational factors change.

Management Actions

The Stage II planning level represents an escalation of both planning and operational actions over those needed for WFIP Stage I implementation. Management actions in this stage can vary significantly, depending upon specific circumstances of the particular fire. In cases where the fire may be fuel limited—surrounded by sparse fuels or natural barriers with limited spread potential in relation to values at risk—monitoring may be specified as the predominant implementation action. Monitoring is necessary to track fire movement, fire activity, fire effects, and to provide information vital to completing the Wildland Fire Use Management Assessment. In other cases, monitoring plus some form of mitigation actions may be necessary. In still other cases, fuel types in which the fire is burning may require immediate actions to delay, direct, or check the spread of fire on one or more flanks. WFIP Stage II management actions should be designed to safely achieve the wildland fire use objectives as detailed in the fire management plan and be based upon the fire situation and forecasted weather and fire behavior. These actions represent operational activities and resources needed to accomplish those activities until monitoring information or the Periodic Fire Assessment indicates a change in management planning and actions is required.

Estimated Costs

Cost estimates developed in this stage represent projections of expenditures using the resources identified to accomplish the management actions and assume no escalation to Stage III. If the planning needs transition to Stage III, new cost estimates that reflect a new set of management actions and a firefighting resource mix will be prepared.

Periodic Fire Assessment

Once Stage II is completed, the Periodic Fire Assessment must be completed. The process can be continued from Stage I but the signature page must clearly reflect the change in "WFIP Planning Stage Required" from Stage I to Stage II. The agency administrator (or delegated individual) is required to periodically verify the capability to continue management of the fire as a WFU event. This process documents and ensures management accountability throughout the duration of the wildland fire use event.

The Periodic Fire Assessment consists of the same elements as described for WFIP Stage I (See WFIP Stage I Periodic Fire Assessment description for more information). These include:

- Decision Criteria Checklist
- Wildland Fire Relative Risk Assessment
- Wildland Fire Use Management Assessment
  - —Part 1: Planning Needs Assessment
  - —Part 2: Fire Use Manager Decision Chart
- Signature Page

Wildland Fire Implementation Plan - Stage III

This stage represents completion of planning necessary to direct long-term implementation and successfully accomplish the desired objectives. The WFIP has been progressively developed throughout all stages; this represents the final stage. It presents detailed strategic and tactical implementation information and will be attached to information developed in previous stages.

Stage III consists of the information shown in the box on the following page.

This stage details operational activities and documents the planning completed to ensure adequate mitigation actions have been developed to reduce or eliminate threats to values. These actions should reduce the probability that fire behavior or fire effects will exceed acceptable limits.

Objectives

Objectives defined in WFIP Stage III represent site-specific statements of accomplishments for wildland fire use and provide a link back to fire management plans and land use plans. These are very well-defined statements that describe what one or more wildland fires must accomplish to meet resource management objectives. They should be specific, measurable, achievable, related/relevant, and trackable. At the Stage III level, the most detailed tactical implementation of strategic objectives for wildland fire use activities takes place. At this level, WFIP Stage III is a very detailed operational plan to guide implementation of fire management activities on the ground over potentially longer durations than in Stage I or II. Objectives will be formulated from local unit input, agency administrator direction, fire management plans, and land and resource management plans.

Purpose: Document a risk assessment and provide implementation actions necessary for management of a wildland fire to accomplish identified objectives over a potentially long duration.

This stage provides a definition of the acceptable management limits of individual or multiple fires, or fire complexes represented by the maximum manageable area (MMA). It considers long-term fire behavior predictions and risk assessments and supports decisionmaking. It identifies threats from the fire and addresses operational actions to mitigate or eliminate those threats.

Information Sources: Local expertise, experience, knowledge, maps, monitoring data, fire behavior predictions, risk assessment, and operational evaluation and identification of tactics and resources. MMA = staff negotiated and developed from objectives, maps, on-the-ground evaluation, aerial observation, monitoring, or as set by the FMP.

Completion Time: Stage III of the Wildland Fire Implementation Plan must be completed within 7 days from when the Periodic Fire Assessment indicates the need. The agency administrator can direct it to be completed before the Periodic Fire Assessment does.

Maximum Manageable Area (MMA) Determination

All wildland fires being managed under appropriate management response strategies identified in a WFIP Stage III will have a defined MMA. The MMA delineates the geographic limits of the fire area as defined by the capability of management actions to meet resource objectives and mitigate risk for a given wildland fire managed for resource benefits. It represents an important tool in the planning

process and serves as a planning reference and not as a rigid prescription element. It is based primarily on natural defensibility and facilitates identification of threats to a management boundary and threats to values within and adjacent to that boundary. It provides a planning basis for risk assessment analyses. It provides for closely directed fire management application in a specific area defined by resource objectives, fire and weather prescription elements, social concerns, political considerations, and management capability.

WFIP Stage III

- ❑ Objectives and Risk Assessment Considerations
  - —Natural and cultural resource objectives
  - —Constraints
- ❑ Maximum Manageable Area Definition and Maps
- ❑ Weather Conditions and Drought Prognosis
- ❑ Long-term Risk Assessment (describe techniques and outputs, include maps as appropriate)
- ❑ Threats
  - —MMA
  - —Public Use and Firefighter Safety
  - —Smoke Dispersion and Effects
  - —Other Resources
- ❑ Monitoring Actions (actions, frequency, and duration)
- ❑ Mitigation Actions (describe all management actions, management action points that initiate these actions, and key to map if necessary)
- ❑ Resources Needed to Manage the Fire
- ❑ Contingency Actions (describe actions necessary when mitigation actions are unsuccessful)
- ❑ Information Plan
- ❑ Estimated Costs of Long-term Implementation Actions
- ❑ Post-burn Evaluation
- ❑ Signatures and Date
- ❑ Periodic Fire Assessment

Maximum manageable areas have the following attributes:

- MMAs are developed from either predetermined areas identified in the fire management plan or during preparation of Stage III of the Wildland Fire Implementation Plan.

- MMAs define the geographic limits of management capability to meet resource objectives and accommodate the social, political, and resource impacts for all wildland fires managed to meet resource objectives.

- MMAs serve as planning references for developing risk assessment and risk management information and not as a rigid prescription element.

- A fire exceeding the MMA does not require an automatic change to a different strategy. There will be cases where a change in strategy from wildland fire use to wildfire suppression and the formal implementation of the Wildland Fire Situation Analysis (WFSA) process because a wildland fire use event exceeded an established MMA is not prudent or logical. In these situations, experience may indicate that the MMA will be exceeded by the specific wildland fire use on a very small or nonthreatening scale. Management options in this situation include:

  —Constraining the fire spread to the small or nonthreatening overrun of the original acceptable area using whatever resources are available to deal with the situation. Containment must be

accomplished within 48 hours from the end of that burning period, or the fire must be converted to a wildfire accompanied by a WFSA. If containment is successful, management as a WFU fire may continue. If the fire is converted to a wildfire, no further acreage gain may be attributed to wildland fire use.

- In some situations, there may be reasonable justification to change MMA locations. Any proposed change to the MMA must be thoroughly documented and justified by the unit managing the fire. Approval to change the MMA will be provided by the next higher level in the organization. Changes in the MMA are not warranted simply due to the spread of the fire near the boundary. The approving level will review the initial MMA establishment criteria, changes to the situation affecting the need to change the boundary, and local and regional situations before determining if the proposed change is warranted.

- Where adjacent units/agencies have established adjacent MMAs for separate fires, it will be acceptable, given the units'/agencies' agreement, to manage fire spread from one MMA into another without formal change of either MMA boundary.

Weather Conditions and Drought Prognosis

A discussion of current weather conditions and trends in comparison to historical records provides insight into the relative severity of the current situation, reinforces fire danger indicators, and supports decisionmaking. A review of the drought situation provides additional support to fire danger indicators and supports current and future decisions. This information is available from historical weather records, climatological reviews, research information, wildland fire assessment tools, and National Weather Service archives. Information presented here is valuable in further defining the hazard posed by the specific fire(s) being managed. Kinds of information useful for this discussion include, but are not limited to:

- Historical weather trends and patterns,
- General wind patterns,
- Historical wind direction analyses,
- Climatological probabilities,
- Historical length of fire season,
- Severity of the current season and comparison with other significant fire years,
- Seasonal drought outlook, and/or
- Precipitation probability over defined time periods.

Long-term Risk Assessment

Decisionmaking associated with managing wildland fire for resource benefits can have critical impacts. Risks and uncertainties relating to wildland fire use must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity. It is important to make high quality and informed decisions. Decisionmaking is facilitated by factual information and prediction of outcomes or consequences of the decision. Of particular importance is the ability to assess the degree of risk presented by the particular wildland fire.

The importance of risk assessment is reinforced through the "Guiding Principles from the Federal Fire Policy" and affirmed by the 2003 Implementation Strategy that states, "Sound risk management is a foundation for all fire management activities," and "Fire management plans are based on the best available science."

During the most detailed planning stage of the WFIP (Stage III), an assessment of the long-term risk that a particular fire may present is required. This is critical input information to ongoing management activities, development of mitigation

strategies and actions, continuing support for decisions about the fire, and future implementation activities. Technological advances in fire behavior prediction, meteorological analysis, fire spread estimation, fire effects prediction, smoke production and dispersal, rare event assessment, and fire area simulation make it possible to obtain better information, reduce uncertainty, assess potential fire outcomes, evaluate consequences of failure, and determine probabilities of success more effectively than ever before. Using these techniques to gain the type of information necessary for consideration in decisionmaking promotes better management choices and ultimately, more desirable outcomes. As new technology becomes operationally available for application in management situations, it will be utilized to improve operational actions to the greatest degree possible. The Long-term Risk Assessment is also based on the principles of assessing values, hazard, and probability. These three elements are not directly assessed in the risk assessment, but pervade the entire Stage III planning process. The sum total of this information is used by the agency administrator to reduce uncertainty and support management decisions and actions.

Specific assessment outputs useful in evaluating long-term risk include:

- Indications of how the fire may burn; predictions of intensity and severity.
- Fuel conditions, moisture conditions, departures from average conditions.
- Fire dynamics — indicators of potential rapid escalation in fire behavior.
- Analysis and comparison of current fire danger indicators with historical data and trends.
- Fire history reviews, records of past fires in terms of area burned and type of fires (i.e., low to moderate intensity, surface fire, stand replacement, etc.).
- Probability of the fire reaching the planning area boundary (MMA).
- Probability of a season-ending weather event.
- Probability of a fire-slowing weather event.
- Probability of a large spread weather event.
- Indications of where the fire may spread or total area that may be burned by the fire.
- How fast the fire will travel.
- How soon the fire may reach critical sites or the planning area boundary.
- Predictions of the range of potential fire effects on natural and cultural resources.
- Probability of adverse smoke events and dispersal.
- Review of past precipitation history.

An array of decisionmaking support aids is available to support wildland fire assessments. The choice of technique will depend on the information needed and the state of knowledge regarding that subject area. Techniques may range from a subjective, descriptive comparison to a very objective indepth analysis using sophisticated mathematical models and quantitative data as available on the local unit. The Stage III Long-term Risk Assessment provides quantitative information derived from specific analyses which utilize historic weather data, long-term climatological data, fuel moisture data, fuel conditions, fire danger, seasonal severity, satellite imagery, and simulation modeling. Use of technological tools is appropriate when a specific method can give the decision maker information that reduces uncertainty associated with possible outcomes and facilitates the best decision possible.

No mandatory requirements exist for risk assessment. **However, in WFIP Stage III, an assessment must be completed that yields some of the information listed in the output list above.** Units are encouraged to acquire input information and data and to utilize available long-term risk assessment techniques such as the Rare Event Risk Assessment Process (RERAP), Fire Area Simulator

(FARSITE), fire effects indicators such as those gained from the Fire Order Fire Effects Model (FOFEM), and smoke emissions models. Risk assessments will both utilize and affect information contained in the Weather Conditions and Drought Prognosis, Threats to the MMA, Threats to Public Use and Firefighter Safety, Threats to Smoke Dispersion and Effects sections of WFIP Stage III. Assessment outputs will have a direct bearing on information developed and included in the Monitoring Actions, Mitigation Actions, Resources Needed to Manage the Fire, and Contingency Actions sections of WFIP Stage III. As the quality of risk assessment increases, the quality of subsequent decisions and probability of desirable outcomes will increase. Units should strive for the highest quality decisions possible.

Table 4 illustrates some common models useful in assessing wildland fire.

Table 4. Computer applications for assessing wildland fire

Model	Description
BehavePlus	BehavePlus can be used to predict a number of different factors given different fuel loadings, arrangements, and weather that describe fire behavior, in terms of rate of spread, flame length, size of fire, and spotting distances. The BehavePlus fire modeling system is a PC-based program that is a collection of models that describe fire and the fire environment. It is a flexible system that produces tables and graphs and can be used for a multitude of fire management applications. BehavePlus is the successor to the BEHAVE fire behavior prediction and fuel modeling system.
Canadian Forest Fire Danger Rating System (CFFDRS)	The CFFDRS is comprised of two primary subsystems: The FWI, or Fire Weather Index System and the FBP, or Fire Behavior Prediction System. The FWI System depends solely on daily weather measurements, is a good indicator of several aspects of fire activity, and is best used as a measure of general fire danger for administrative purposes.
	The FBP System allows the user to predict the rate of spread (meters per minute), fuel consumption (kilograms per square meter), and intensity (kilowatts per meter) at the head, back, or flanks of fires that are still accelerating after ignition or have reached a steady-state condition with their environment. A general description of the type of fire is also given (for instance, surface fire or intermittent crowning). A simple elliptical fire growth model is employed in estimating the size and shape of a fire originating from a single ignition source as opposed to an established line of fire.
CONSUME	Consume 2.1 is a personal computer (PC) based interactive fuel consumption model that predicts total and smoldering fuel/biomass consumption during prescribed fires and wildland fires. Predictions are based on weather data, the amount and fuel moisture of fuels, and a number of other factors.
FARSITE (Fire Area Simulator)	A fire growth simulation model that computes fire behavior and spread over a range of time under conditions of heterogeneous terrain, fuels, and weather. This model projects where and how fast a fire may spread and how hot or intense it may burn. It is a fire growth simulation model that uses spatial information on topography and fuels along with weather and wind files. It incorporates the existing models for surface fire, crown fire, spotting, post-frontal combustion, and fire acceleration into a two-dimensional fire growth model.

FFE-FVS (Fire and Fuels Extension – Forest Vegetation Simulator)	A model developed to simulate forest growth and yield but has been adapted to provide information for fuels reduction. It provides expected fire behavior and effects if a wildland fire burns through an area over the simulation period.
FireFamilyPlus	The fire climatology and occurrence program that combines and replaces the PCFIRDAT, PCSEASON, FIRES, and CLIMATOLOGY programs into a single package with a graphical user interface for the PC.
FIREMON	FIREMON is an inventory and fire effects monitoring package that provides fire managers with sampling methods, data storage, and a data analysis package.
FlamMap	A software program that creates geographic information system maps of potential fire behavior characteristics and environmental conditions. It is not a replacement for FARSITE or a fire growth simulation model. There is no temporal component in FlamMap. It uses spatial information on topography and fuels to calculate fire behavior characteristics at one instant.
FEIS (Fire Effects Information System)	The Fire Effects Information System provides up-to-date information on fire effects on plants, animals, and ecosystems.
FOFEM (First Order Fire Effects Model)	A computer program for predicting tree mortality, fuel consumption, smoke production, and soil heating caused by prescribed fire or wildfire. First order fire effects are those that concern the direct, indirect or immediate consequences of fire. First order fire effects form an important basis for prediction of secondary effects such as tree regeneration, plant succession, and changes in site productivity, but these long-term effects generally involve interaction with many variables (for example, weather, animal use, insects, and disease) and are not predicted by this program. Currently, FOFEM provides quantitative fire effects information for tree mortality, fuel consumption, mineral soil exposure, smoke and soil heating.
LANDFIRE	LANDFIRE is a wildland fire, ecosystem, and fuel assessment mapping project designed to generate consistent, comprehensive, landscape-scale maps of vegetation, fire, and fuel characteristics for the United States. LANDFIRE includes a Rapid Assessment, which will map and model Fire Regime Condition Class (FRCC) at a broad-scale resolution for the entire United States by the summer of 2005. The Rapid Assessment is designed to fill data needs before the entire suite of LANDFIRE products is available and to help refine reference vegetation dynamics models for the LANDFIRE project.
NFDRS (National Fire Danger Rating System)	This system combines weather, climate, and fuels information to predict the relative fire danger and potential for wildland fires to occur on a daily basis.
NEXUS	A crown fire hazard analysis software that links separate models of surface and crown fire behavior to compute indices of relative crown fire potential. NEXUS can be used to compare crown fire potential for different stands, and to compare the effects of alternative fuel treatments on crown fire potential. NEXUS includes several visual tools useful in understanding how surface and crown fire models interact.

RERAP (Rare Event Risk Assessment Process)	RERAP determines probabilities that a wildland fire will reach or exceed an MMA or reach an area of concern due to a rare weather event. It also can provide probabilities of a season-ending event and smoke events.
VCIS	The Ventilation Climate Information System (VCIS) allows users to assess risks to values of air quality and visibility from historical patterns of ventilation conditions.
VDDT (Vegetation Dynamics Development Tool)	This model uses state in transition models or box and arrow diagrams to show how vegetation can change over time.
WFAS (Wildland Fire Assessment System)	The Wildland Fire Assessment System is an internet-based information system. The current implementation provides a national view of weather and fire potential, including national fire danger and weather maps and satellite-derived "Greenness" maps.

Threats

Identification of all known and anticipated threats is critical in evaluating values, hazard, and probability for the fire(s). The nature of long-term strategic planning involves anticipating and prediciting where the fire may move, what it may impact, and designing a strategy to minimize or eliminate those impacts. Threats must be defined for the MMA boundary, all sensitive natural and cultural resources inside and immediately outside that boundary, firefighters and the public, air quality, and other concerns as appropriate. Once a threat is defined in this section of Stage III, it must be linked through subsequent sections and appropriate actions (monitoring and mitigation) must be tied to that identified threat.

Monitoring Actions

A monitoring plan of action is necessary to ensure successful accomplishment of the objectives and to continually acquire information relevant to the fire situation. Monitoring is useful for documenting observed fire weather, observed fire behavior, fire movement toward management action points (MAP), fire effects, smoke dispersal and volume, and to aid in validating fire behavior and weather forecasts. Monitoring variables that are important can include, but are not limited to: smoke dispersal, live and dead fuel moistures, daily weather observations, fire perimeter and progression mapping, and observed fire behavior. Monitoring frequency will be based on fire activity and location. All monitoring information will be analyzed, applied as needed, and archived as part of the final documentation package.

Mitigation Actions

Science-based risk assessments, as discussed in the previous section, provide a solid foundation for developing a successful risk management/mitigation strategy. But, it must be clearly understood that risk assessment and risk management are not synonymous. Based on the risk assessment, decision makers decide what to do about managing the risk. Part of WFIP Stage III is a detailed plan that identifies mitigation actions, the activities for mitigating or eliminating risk. Risk can be mitigated or eliminated in three central ways: reduce the hazard, reduce the probability

of the hazardous event occurring, and reduce the value of potential losses that could occur from the risk.

In wildland fire use, the first two risk mitigation types are the most frequently utilized, identified as mitigation actions in the implementation plan, and implemented as needed. Mitigation actions are on-the-ground activities that serve to increase the defensibility of a particular point, area, or line, like a planning area boundary (to reduce the probability of the hazardous event occurring); to check, direct, or delay the spread of fire (reduce the hazard); and to minimize threats to life, property, and resources (reduce value of potential losses or impacts). Mitigation actions serve to mitigate or eliminate identified threats and may include non-fire tasks (such as closures, evacuations, management actions to reduce impacts from smoke, etc.) and specific fire applications.

Management action points are tactical decision points, either geographical points on the ground both inside and outside the MMA or specific points in time where an escalation or alteration of management actions is warranted in response to fire activity, proximity to identified threats, time of season, weather changes, or management decisions. The points are placed on maps that accompany the WFIP. They can be started in Stage II and added to in Stage III for long-range needs. These points must be tied to identified threats in the plan. Each management action point will have one or more corresponding mitigation actions described which will need implementation when the fire reaches it or after a specified time period. This documentation stays with the fire through its management and is amended periodically as new management action points and mitigation actions are developed. As management personnel change over the life of a WFU fire, this documentation provides continuity in direction needed when a fire approaches the management action point.

Resources Needed to Manage the Fire

Based on monitoring and mitigation actions, the information plan, and management oversight and qualifications needed to accomplish the objectives, resources needed to implement the plan and accomplish the objectives must be identified in this section. Resources identified here include those needed for the projected duration of operations as described in Stage III.

Contingency Actions

Contingency actions are actions necessary when mitigation actions are unsuccessful (impacts to values could occur). They are identified for implementation to control the spread of fire into unwanted areas or to prevent it from adversely impacting a sensitive value (reduce hazard and/or probability). For example, if the fire crosses the MMA at any point along the perimeter and mitigation was unsuccessful, onsite firefighting resources will be utilized to achieve control. If control cannot be accomplished, the fire will be converted to a wildfire. All fires that are converted to wildfires will have a Wildland Fire Situation Analysis (WFSA) prepared to select the proper strategic alternative and identify necessary resources. Contingency actions may also include preplanned coordinated actions with air regulatory agencies in the event that forecast or smoke management plans are not accurate.

Information Plan

Among agency staff, cooperators, and affected publics, fire use objectives, risks, and tradeoffs are not always well understood or well accepted. Communication and education of all agency personnel involved with the planning and implementation of wildland fire use is crucial to successful program implementation. An understanding of the guiding principles and objectives by the public and media is essential for full social and political acceptance and endorsement of this program. As a result, it is becoming increasingly

important to establish and maintain an aggressive and efficient communication and education effort for wildland fire use programs and for each wildland fire that is managed. In addition, wildland fire use operational actions are often viewed negatively.

This element of WFIP Stage III provides documentation of the role of information during the wildland fire use event, the messages to be communicated, and operational procedures and processes to ensure that the information reaches all applicable audiences and supports local unit needs.

Estimated Costs

Cost estimates developed in this stage are projections of expenditures expected to be incurred during implementation over the predicted duration of the fire. These estimates will include both costs expended to date and projections from the signed date into the future.

Post-burn Evaluation

Post-burn evaluations will be conducted as dictated by agency policy to evaluate the degree of accomplishment of stated objectives and desired fire effects. Secondly, an evaluation of the total operation is vital to improvement of programmatic efficiency. Specific areas that may be evaluated include, but are not limited to:

- Management and mitigation of safety.
- Use of best available science, including weather and fire behavior forecasts, long-term risk assessments, fire growth simulations if applicable.
- Short-term fire effects.
- Public information and education, notification of individuals, groups, and areas potentially impacted by fires.
- Consistency with land and resource management plans and fire management plans.
- Attention to resource management issues and concerns.

Signatures and Date

WFIP Stage III must be approved by the agency administrator or delegated individual upon completion. This approval is documented by signature and date at the end of Stage III. This approval does not constitute the Periodic Fire Assessment which must be continued on the set frequency after completion of Stage III.

Periodic Fire Assessment

Once Stage III is completed, the Periodic Fire Assessment is completed. The process can be continued from Stage I or II but the signature page must clearly reflect the change in “WFIP Planning Stage Required” to Stage III. The agency administrator (or delegated individual) is required to periodically affirm the capability to continue management of the fire as a WFU event. This process will document and ensure management accountability throughout the duration of the wildland fire use event.

The Periodic Fire Assessment consists of the same elements as described for WFIP Stage I (See WFIP Stage I Periodic Fire Assessment description for more information). These include:

- Decision Criteria Checklist
- Wildland Fire Relative Risk Assessment
- Wildland Fire Use Management Assessment
  —Part 1: Planning Needs Assessment
  —Part 2: Fire Use Manager Decision Chart
- Signature Page

Wildland Fire Use Management Organizations

Organizational Needs

Managing wildland fire for a wide range of objectives across diverse land uses and vegetative complexes subject to a mixture of fire regimes is one of the highest risk and complex programs facing natural resource managers. Organizational needs to complete this management vary significantly with site-specific circumstances. All wildland fires managed for resource benefits (wildland fire use) will have a position commensurate with the fire situation and needs (see "Wildland Fire Use Management Assessment") assigned. Additional personnel necessary to accomplish the objectives and implement the WFIP will be determined for the specific situation locally.

No interagency standards exist for the configuration of teams responsible for preparation of wildland fire implementation plans, the duration of time that they must be in place, and what products they must create. Use of an incident action plan is appropriate for all fires that exceed the first few days when actions must be performed by on-the-ground personnel. This is a safety concern and is necessary to provide clear and concise direction, to document assigned resources and mitigation actions and other safety issues like frequency assignments and emergency medivac procedures. Long-term management of wildland fires includes periods of fire behavior that range from extremely active to inactive. Fire activity will cycle with weather, fuel moisture and availability, and successful implementation of mitigating actions. Having someone with expert fire behavior knowledge in the management organization is advised.

As conditions escalate, management needs will increase; additional personnel can be added to support and assist the Fire Use Manager, and, if conditions extend to the highest difficulty levels, a formal management team can be ordered. These formalized teams may make the most significant contribution in support of local units and management of the fire. These teams may be developed locally from unit and cooperator personnel or be a formal, established fire use management team (FUMT) obtained through the established resource ordering process. A FUMT has a minimum standard of Type II qualified personnel, with the Incident Commander having attended S-580 Advanced Fire Use Applications. The FUMT includes an Incident Commander, Planning Section Chief, Operations Section Chief, Logistics Section Chief, Safety Officer, Information Officer and Long-term Fire Behavior Analyst (LTAN). Normally at least three additional positions are filled which may be different on each assignment and are determined by the Incident Commander and the agency administrator. If a FUMT is assigned, the Fire Use Manager's responsibilities may or may not be fulfilled by the Incident Commander; if these responsibilities are not filled by the Incident Commander, a Fire Use Manager will also be assigned.

The capability to predict fire behavior and assess long-term management considerations is critical and, in most situations, is done by the LTAN who is trained in using fire behavior and risk assessment models and is familiar with information technology. The LTAN is critical in predicting the potential area and extent of burning, assessing long-term risk, and validating the maximum manageable area (MMA). He/she also predicts the potential of a fire to reach certain values that may be threatened over the long term and the potential timing of a fire-ending event. A Fire Behavior Analyst (FBAN) provides tactical fire behavior predictions, obtains weather observations and forecasts, and assesses short-term risk.

Amending the WFIP is important. In Stage I and Stage II levels, the WFIP will require amending as often as the current and forecasted weather expires, which is an element of those stages. This can be expected to happen every 5 to 7 days at a minimum. Stage III may be more encompassing in regard to long-term assessment and mitigation planning but will also require periodic amendments. Normally as the fire season progresses, new mitigation actions are developed and new fires may be authorized in the original MMA. Mapping, weather predictions and seasonal severity assessments will change over the life of the fire which need to be included as updated information becomes available. Agency administrators are required to approve any amendments to the plan as they occur.

References

National Academy of Public Administration. 2001. Managing wildland fire: enhancing capacity to implement the Federal Interagency Policy. Washington, D.C.

National Fire and Aviation Executive Board. 2005a. Three kinds of wildland fire. Briefing Paper #03. National Interagency Fire Center, Boise, ID.

National Fire and Aviation Executive Board. 2005b. Use of wildland fire. Briefing Paper #02. National Interagency Fire Center, Boise, ID.

U.S. General Accounting Office. 2004. Wildland Fires: Forest Service and BLM need better information and a systematic approach for assessing the risks of environmental effects. Washington, D.C. (name changed to U.S. Government Accounting Office).

USDI/USDA/DOE/DOD/DOC/USEPA/FEMA/NASF. 2001. Review and update of the 1995 Federal Wildland Fire Management Policy. Washington, D.C.

USDI/USDA. 1998. Wildland and prescribed fire: implementation procedures reference guide. Boise, ID.

USDA/USDI. 2003. Interagency strategy for the implementation of Federal Wildland Fire Management Policy. Washington, D.C. 62 p.

Appendix A: Wildland Fire Implementation Plan

Standardized, reproducible forms for the WFIP process are included in this appendix. While a standardized format is provided for the WFIP (in Word format) that can be used to prepare the document, an electronic version similar to the WFSA electronic program will be available. Users can choose to prepare a WFIP by using the forms presented in this appendix or by using the electronic version when available.

Specific forms included for the complete WFIP are:

WFIP Stage I

- Strategic Fire Size-Up
- Decision Criteria Checklist
- Relative Risk Rating
  —Wildland Fire Relative Risk Assessment: Step 1: Determining Values
  —Wildland Fire Relative Risk Assessment: Step 2: Determining Hazard
  —Wildland Fire Relative Risk Assessment: Step 3: Determining Probability
  —Wildland Fire Relative Risk Assessment: Step 4: Determining Wildland Fire Relative Risk
- Planning Needs Assessment Chart
- Fire Use Manager Decision Chart

WFIP Stage II

WFIP Stage III

Wildland Fire Implementation Plan

Table of Contents

Fire Name	
Fire Number	
Administrative Unit(s)	

Documentation Product	**Needed**	**Completed**
WFIP Stage I:		
Strategic Fire Size-Up		
Decision Criteria Checklist		
Management Actions		
Periodic Fire Assessment		
WFIP Stage II:		
Objectives		
Fire Situation		
Management Actions		
Estimated Costs		
Periodic Fire Assessment		
WFIP Stage III		
Objectives		
MMA Definition		
Weather Conditions and Drought Prognosis		
Long-term Risk Assessment		
Threats		
Monitoring Actions		
Mitigation Actions		
Resources Needed		
Contingency Plan		
Information Plan		
Estimated Costs		
Post-burn Evaluation		
Signatures and Date		
Periodic Fire Assessment		
Appendix		

WFIP Stage I:

Strategic Fire Size-Up

Fire Name		
Fire Number		
Administrative Unit(s)		
Start Date/Time		
Discovery Date/Time		
Current Date/Time		
Current Size		
Fuel Model		
Current Weather		
Observed Fire Behavior		
Location: Legal Description(s)		
Latitude/Longitude		
Local Description		
FMU (circle appropriate FMU situation)	WFU Approved	WFU Not Approved
Cause (circle fire cause)	Natural Ignition	Human-caused Ignition

Suitability for Wildland Fire Use (circle situation, initials of person preparing, date/time)	**Wildland Fire Use Candidate —** Continue with Decision Criteria Checklist	**Suppression**	**Initials**	**Date/Time**

Decision Criteria Checklist

Decision Element	Yes	No
Is there a threat to life, property, or public and firefighter safety that cannot be mitigated?		
Are potential effects on cultural and natural resources outside the range of acceptable effects?		
Are relative risk indicators and/or risk assessment results unacceptable to the appropriate agency administrator?		
Is there other proximate fire activity that limits or precludes successful management of this fire?		
Are there other agency administrator issues that preclude wildland fire use?		

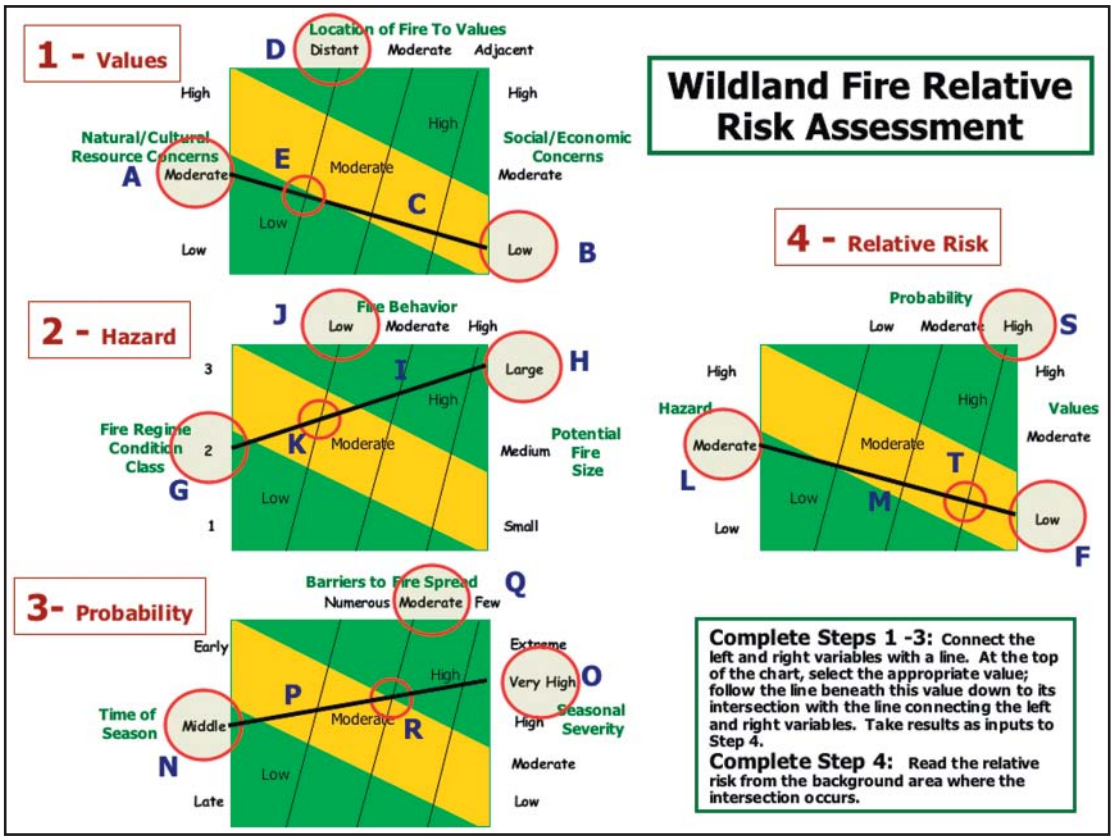
The Decision Criteria Checklist is a process to assess whether or not the situation warrants continued wildland fire use implementation. A "Yes" response to any element on the checklist indicates that the appropriate management response should be suppression-oriented.

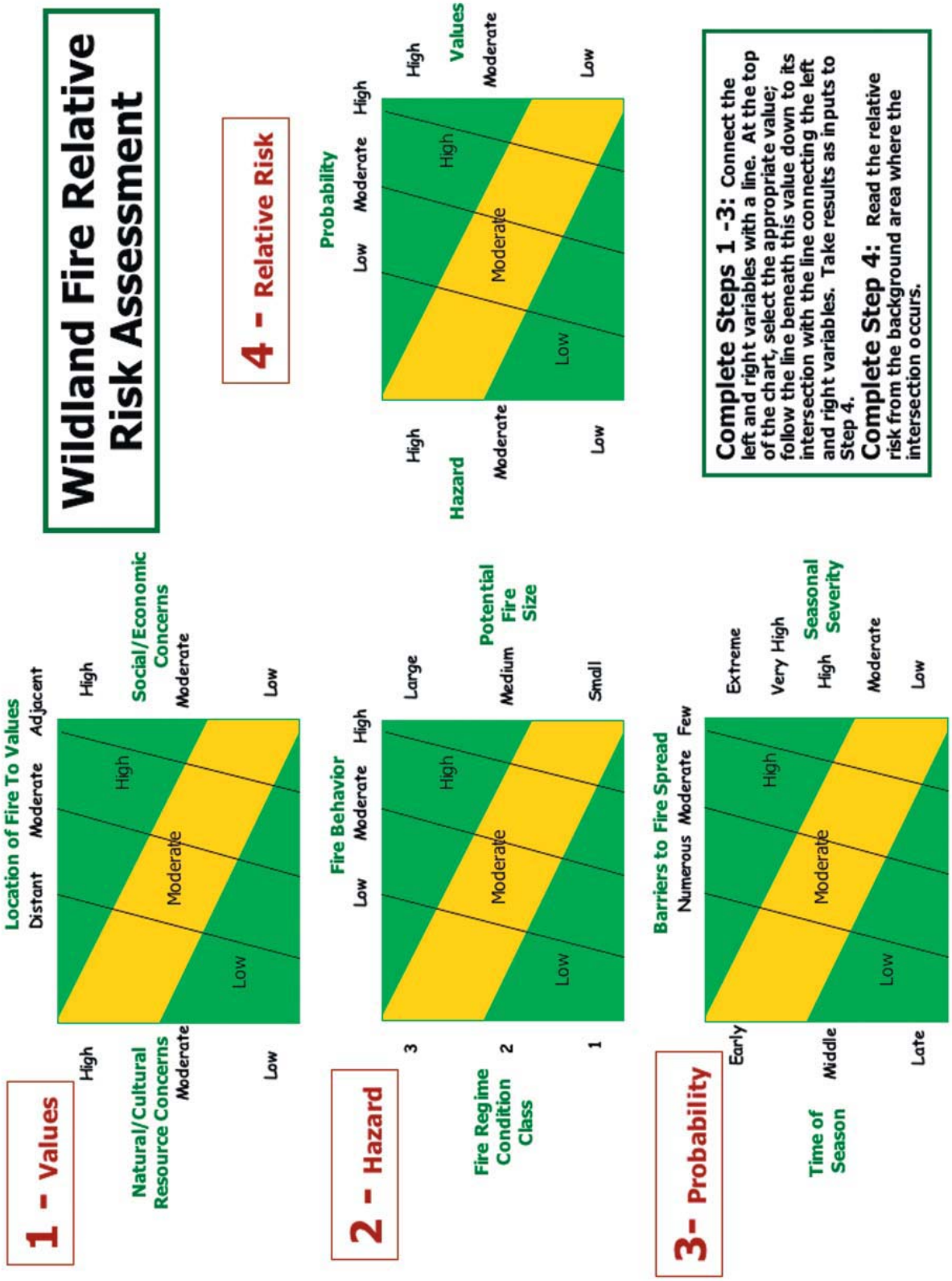
Approved Response Action (check one)		Signature/Position	Date
Suppression Response			
Wildland Fire Use Response			

Justification for Suppression Response:

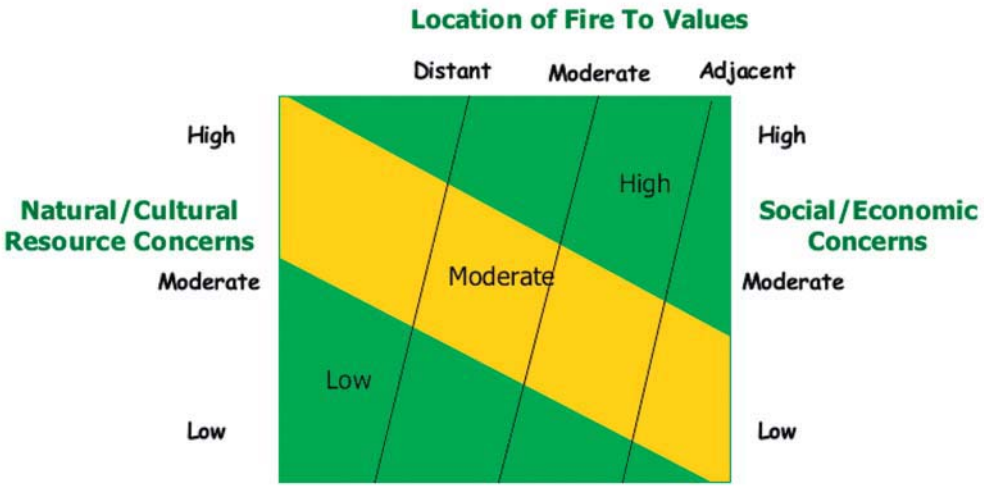
Step-by-Step Instructions for Completing the Wildland Fire Relative Risk Assessment

A	Step 1	Locate Natural/Cultural Resource Concern level
B	Step 1	Locate Social/Economic Concern level
C	Step 1	Draw line connecting left and right variables
D	Step 1	Locate Location of Fire to Values level
E	Step 1	Follow interior line down to intersection with line connecting left and right variables, locate Value Assessment output (Low, Moderate, High)
F	Step 4	Take Step 1 - Value Assessment output to Step 4 as Value input
G	Step 2	Locate Fire Regime Condition Class level
H	Step 2	Locate Potential Fire Size level
I	Step 2	Draw line connecting left and right variables
J	Step 2	Locate Fire Behavior level
K	Step 2	Follow interior line down to intersection with line connecting left and right variables, locate Hazard Assessment output (Low, Moderate, High)
L	Step 4	Take Step 2 - Hazard assessment output to Step 4 as Hazard input
M	Step 4	Draw line connecting Value and Hazard levels
N	Step 3	Locate Time of Season level
O	Step 3	Locate Seasonal Severity level
P	Step 3	Draw line connecting left and right variables
Q	Step 3	Locate Barriers to Fire Spread level
R	Step 3	Follow interior line down to intersection with line connecting left and right variables, locate Probability Assessment output (Low, Moderate, High)
S	Step 4	Take Step 3 – Probability assessment output to Step 4 as Probability input
T	Step 4	Follow interior line down to intersection with line connecting left and right variables, locate Relative Risk Assessment (Low, Moderate, High)




Wildland Fire Relative Risk Assessment
1 - Values
Natural/Cultural Resource Concerns
High
Moderate
Low
Location of Fire To Values
Distant
Moderate
Adjacent
High
Moderate
Low
Social/Economic Concerns
High
Moderate
Low
2 - Hazard
Fire Regime Condition Class
3
2
1
Fire Behavior
Low
Moderate
High
High
Moderate
Low
Potential Fire Size
Large
Medium
Small
3- Probability
Time of Season
Early
Middle
Late
Barriers to Fire Spread
Numerous
Moderate
Few
High
Moderate
Low
Seasonal Severity
Extreme
Very High
High
Moderate
Low
4 - Relative Risk
Hazard
High
Moderate
Low
Probability
Low
Moderate
High
High
Moderate
Low
Values
High
Moderate
Low
Complete Steps 1 -3: Connect the left and right variables with a line. At the top of the chart, select the appropriate value; follow the line beneath this value down to its intersection with the line connecting the left and right variables. Take results as inputs to Step 4.
Complete Step 4: Read the relative risk from the background area where the intersection occurs.

Wildland Fire Relative Risk Assessment:
Step 1: Determining Values



Connect the left and right values with a line. At the top of the chart, select the appropriate value; follow the line beneath this value down to its intersection with the line connecting the left and right variables. Read the Value Assessment from the background area where the intersection occurs.

Notes:

Part 1: Value Assessment: Values are those ecologic, social, and economic effects that could be lost or damaged because of a fire. Ecologic values consist of vegetation, wildlife species and their habitat, air and water quality, soil productivity, and other ecologic functions. Social effects can include life, cultural and historical resources, natural resources, artifacts, and sacred sites. Economic values make up things like property and infrastructure, economically valuable natural and cultural resources, recreation, and tourism opportunities. This assessment area allows opportunity for the local agency administrator to identify particular local concerns. These concerns may be identified in the fire management plan or other planning documents.

Natural/Cultural Resource Concerns — key resources potentially affected by the fire. Examples include, but are not limited to, habitat or populations of threatened, endangered, or sensitive species, water quality, erosion concerns, and invasive species.

Low	Moderate	High
Resource concerns are few and generally do not conflict with management of the fire. Mitigation measures are effective.	Significant resource concerns exist, but there is little conflict with management of the fire. Mitigation measures are generally effective.	Multiple resource concerns exist, some of which may conflict with management of the fire. The effectiveness of needed mitigation measures is not well established.

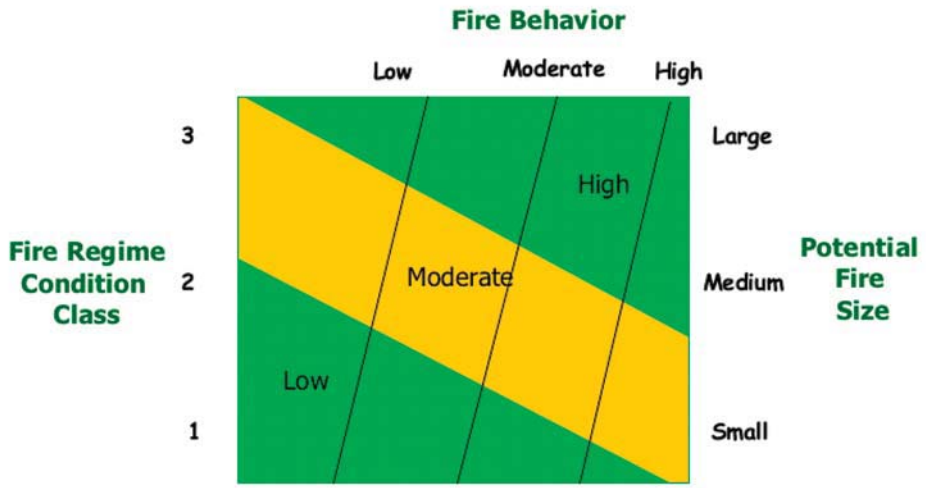
Social/Economic Concerns — the risk of the fire, or effects of the fire, impacting the social or economic concerns of an individual, business, community or other stakeholder involved with or affected by the fire. Social concerns may include degree of support for the wildland fire use program or resulting fire effects, potential consequences to other fire management jurisdictions, impacts to tribal subsistence or gathering of natural resources, air quality regulatory requirements and public tolerance of smoke. Economic concerns may include potential financial impacts to property, business, or infrastructure. Infrastructure impacts may be costs to repair or replace sediment catchments, wildlife guzzlers, corrals, roads, culverts, power lines, domestic water supply intakes, and similar items.

Low	Moderate	High
Local support for wildland fire use is high. The fire should have little or no impact on subsistence or tribal activities involving treaty rights. The fire is expected to remain within a single jurisdiction, or agreements are in place to allow the fire to move across several jurisdictions. Media coverage is favorable. Few structures or business ventures are potentially affected by the fire. There are few impacts to recreation and tourism.	Local support of wildland fire use is clearly divided between supporters and opponents. The fire will have some impacts on subsistence or tribal activities involving treaty rights. The fire is expected to involve more than one jurisdiction, cooperator, or special interest group and agreements need to be developed. Media coverage tends to be a mix of favorable and unfavorable views. Some structures may be threatened by the fire or some business ventures have been affected by the fire.	Local support for wildland fire use is low. The fire will have significant impacts on subsistence activities or tribal activities involving treaty rights. Smoke impacts may become a concern for higher level air quality regulatory agencies. The fire is expected to involve several jurisdictions, cooperators, and special interest groups, and agreements requiring significant negotiation need to be developed. Media coverage tends to be unfavorable. Many structures or private properties could be threatened.

Location of Fire to Values

Distant	Moderate	Adjacent
Fire location is not proximate to values to be protected or fire is located where it is highly unlikely that it would reach the values.	Fire location is moderately proximate to values. Location is such that, based on historical data, fire could potentially reach the values but will take multiple burning periods and sustained fire activity to reach the values.	Fire location is in close proximity to values. Without mitigation actions, fire will be expected to reach the values.

Wildland Fire Relative Risk Assessment: Step 2: Determining Hazard



Connect the left and right values with a line. At the top of the chart, select the appropriate value; follow the line beneath this value down to its intersection with the line connecting the left and right variables. Read the Hazard Assessment from the background area where the intersection occurs.

Notes:

Part 2: Hazard Assessment: The hazard in wildland fire is made up of the conditions under which it occurs and exists, its ability to spread and circulate, the intensity and severity it may present, and its spatial extent.

Current Fire Behavior – the current fire behavior or that most recently observed. Changing fire behavior is addressed through repeated completion of the Periodic Fire Assessment.

Low	Moderate	High
Short duration flaming front with occasional torching. Fuels are uniform and fire behavior can be easily predicted and tactics implemented.	Short range spotting occurring. Moderate rates of spread are expected with mainly surface fire and torching. Fuels and terrain are varied but don't pose significant problems in holding actions.	Long range spotting greater than one-quarter mile. Extreme rates of spread, and crown fire activity are possible. Fuels, elevation, and topography vary throughout the fire area creating high resistance to control.

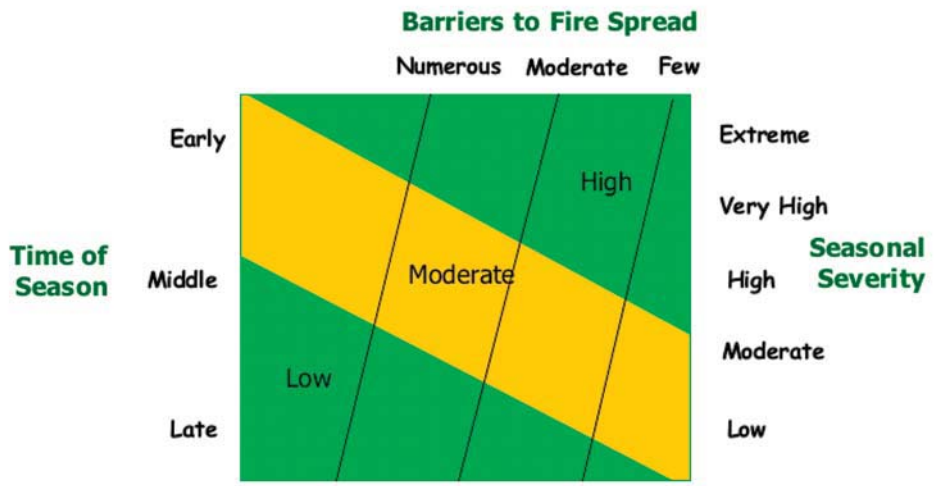
Fire Regime Condition Class – a measure of ecological functions at risk based on changes in vegetation.

1	2	3
Vegetative composition and structure are resilient and key components are at low risk of loss. Few, if any, fire return intervals have been missed and fuel complexes are similar to historic levels.	Both the composition and structure of vegetation has shifted toward conditions that are less resilient and more at risk of loss. Some fire return intervals have been missed, stand structure and composition, and fuel complexes have been altered and present potential for fires of severity and intensity levels in excess of historic levels.	The highly altered composition and structure of the vegetation predisposes the landscape to fire effects well outside the range of historic variability, potentially producing changed fire environments never before measured.

Potential Fire Size – the potential fire size by the end of the season in comparison to historical fire occurrence.

Small	Medium	Large
Fire size is expected to be small for the dominant fuel type involved.	Fire size is expected to be in the mid-range for the dominant fuel type involved.	Fire size is expected to be large for the dominant fuel type involved.

Wildland Fire Relative Risk Assessment: Step 3: Determining Probability



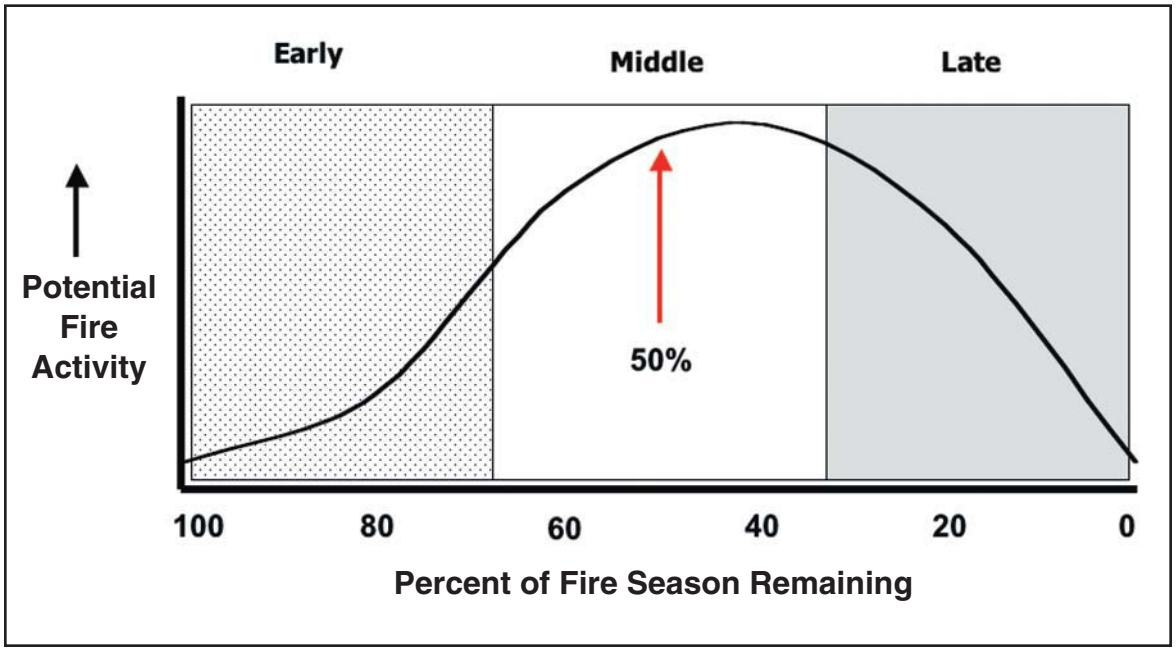
Connect the left and right values with a line. At the top of the chart, select the appropriate value; follow the line beneath this value down to its intersection with the line connecting the left and right variables. Read the Probability Assessment from the background area where the intersection occurs.

Notes:

Part 3: Probability Assessment: Probability refers to the likelihood of a fire becoming an active event having potential to adversely affect values.

Time of Season — the current time in relation to the historical fire season. The chart below the guidelines reinforces the importance of the time of season. During the early part of the fire season, the peak of burning activity is still to come, thus the fire could present substantial variation in behavior and activity. In the middle of the season, the peak of burning activity may or may not have occurred, while in the late part of the season, the peak of fire activity generally has occurred and managers can reasonably expect diminishing fire activity and behavior as time progresses. As the amount of fire season remaining decreases or as the time of season progresses from early to late, management concerns and issues associated with potential fire activity decrease.

Early	Middle	Late
The current date is in the early portion of the historic fire season, at least two-thirds of the established fire season remains and the peak of burning activity is still to come.	The current date is in the middle of the historic fire season, at least one-third of that period has passed and no less than one-third remains. The peak burning activity period either has occurred, is occurring now, or will occur very soon.	The current date is in the latter part of the historic fire season. At least two-thirds of the historic period has passed, the peak burning activity period has occurred, and the probability of a season-ending or fire-ending event is increasing quickly.



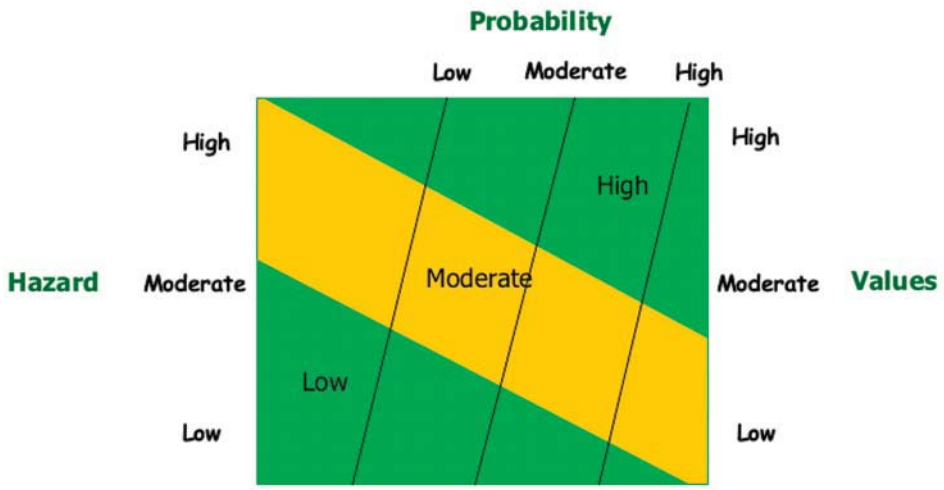
Seasonal Severity — a measure of potential burning conditions as expressed by factors such as energy release component (ERC), drought status, live fuel moistures, dead fuels moistures, soil moisture, stream discharge, and similar types of measures.

Low	High	Extreme
Measures of fire danger are below to somewhat above seasonal averages. Drought status is within seasonal norms with no long-term drought present.	Measures of fire danger are well above seasonal averages but not setting new records. The area is in short-term drought (1 to 2 years of drought) but not considered to be in long-term drought.	Measures of fire danger are setting new records. The area is considered to be in long-term drought (3 or more years of drought).

Barriers to Fire Spread — a measure of the natural defensibility of the fire location and an indication of degree of potential mitigation actions needed.

Numerous	Moderate	Few
The location of the fire and presence of natural barriers and firebreaks limit the horizontal fuel continuity, minimal mitigation actions on the ground will be needed.	The location of the fire and presence of some natural barriers and firebreaks limit the horizontal fuel continuity on some, but not all fire flanks, some mitigation actions on the ground will be needed to protect threats to boundaries and sensitive areas.	The location of the fire and presence of only limited natural barriers and firebreaks will permit fire spread across continuous fuels. Mitigation actions on the ground will be needed but are expected to be effective.

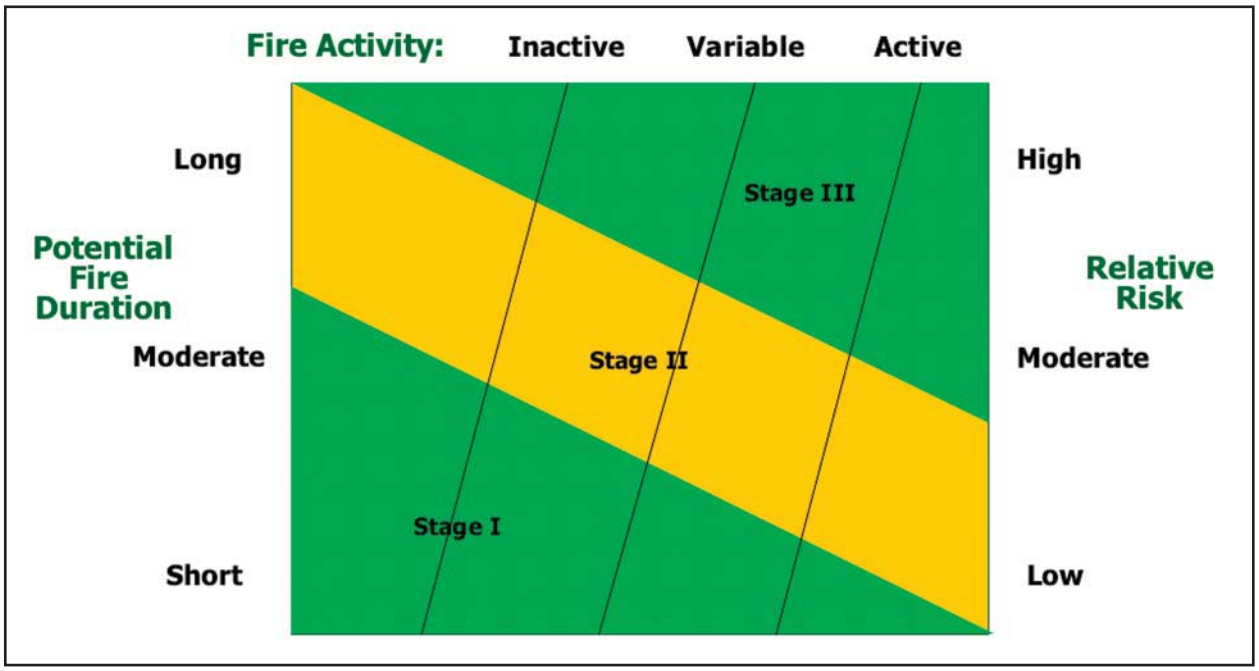
Wildland Fire Relative Risk Assessment:
Step 4: Determining Wildland Fire Relative Risk



Connect the left and right values with a line. At the top of the chart, select the appropriate value; follow the line beneath this value down to its intersection with the line connecting the left and right variables. Read the Relative Risk from the background area where the intersection occurs.

Notes:

Planning Needs Assessment Chart



To complete the chart, connect the left and right variables with a single line (potential fire duration and relative risk, respectively). Select the appropriate level of fire activity at the top of the chart and follow the line beneath that value down to its intersection with the line connecting the left and right variables. Read the planning need from the background area where the intersection occurs. The relative risk values are those obtained from the Wildland Fire Relative Risk Assessment process.

Minimum interagency qualification requirements for wildland fire use planning at each stage of the WFIP process. This information should be used with the Planning Needs Assessment Chart to determine appropriate levels of planning qualifications. Higher qualified personnel can always be used to complete the various planning levels if desired. Duty officer qualifications are defined in local unit fire management plans.

Table 5. WFIP minimum planning qualifications

WFIP Stage	Minimum Planning Qualifications
WFIP Stage I	Unit Duty Officer
WFIP Stage II	Fire Use Manager Type 2 (FUM2)
WFIP Stage III	Fire Use Manager Type 2 (FUM2)

Guidelines for Planning Needs Assessment Chart

Potential Fire Duration – the estimated length of time that the fire may continue to burn in comparison to historical fire durations and amount of fire season available for a given area.

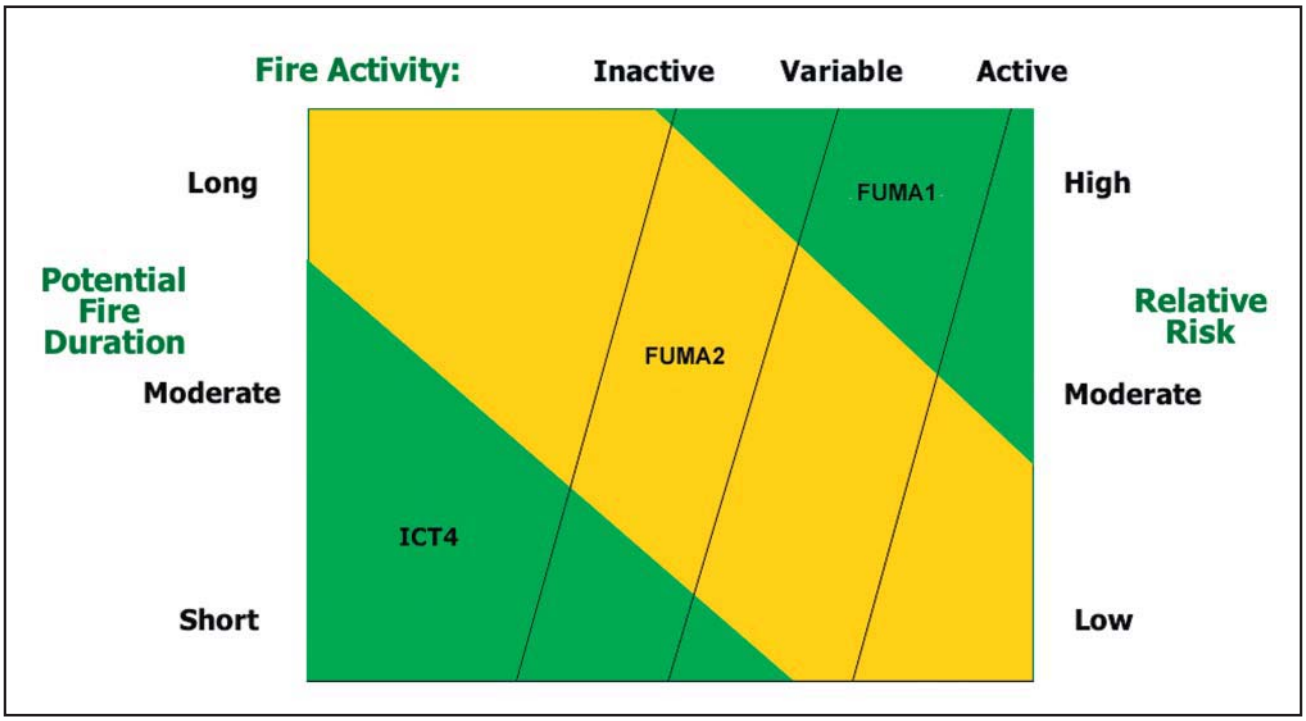
Short	Moderate	Long
Fire is expected to persist for only the shortest time in comparison to historical fire durations. This may be as short as only a few days. Fuels may be limiting, weather may be limiting, or time of fire season may be limiting. Generally, this could be referenced as less than the historical average fire length for a given area.	Fire is expected to last for a time period similar to the historical average length of fires.	Fire is expected to last for a time period longer than the historical average length of fires.

Relative Risk – a measure of the relative risk, determined directly from the Wildland Fire Relative Risk Assessment, so no range of values is listed here.

Fire Activity – the relative activity of the fire in terms of intensity and spread over time.

Inactive	Variable	Active
Fire is burning with very low intensity, little or no spread, and little or no increase in burned area. Fire is confined to surface litter and duff layers.	Fire is burning predominantly in surface litter and duff layers, with low intensity and little or no spread but has occasional periods of increased intensity and spread. Growth of burned area is not constant but occurs in response to increased activity. Area increase may be static for moderately long periods and then increase for short periods. Fire size usually increases by less than 50 percent during active periods.	Fire is burning in all fuel strata (litter, surface, and crown) with periods of sustained flaming fronts, perimeter growth, and area increases that can exceed 100 percent at times. Infrequent periods of low activity occur but spread is generally constant.

Fire Use Manager Decision Chart



To complete the chart, connect the left and right variables with a single line (potential fire duration and relative risk, respectively). Select the appropriate level of fire activity at the top of the chart and follow the line beneath that value down to its intersection with the line connecting the left and right variables. Read the level of fire use manager needed directly from the background area where the intersection occurs. The relative risk values are those obtained from the Wildland Fire Relative Risk Assessment process.

Minimum level of implementation qualifications. During implementation, as fire activity and management needs escalate, implementation qualification needs ascend to a higher level. But as conditions moderate and management needs drop, implementation qualifications can descend to lower levels. Table 3 and Figure 8 are used jointly as fire situations and conditions escalate; when conditions are moderating or lessening, Figure 8 provides the necessary qualification levels for implementation.

Table 6. WFIP minimum implementation qualifications

WFIP Stage	Minimum Planning Qualifications (Use Fire Use Manager Decision Chart to determine recommended position)
WFIP Stage I	Incident Commander Type 4 (ICT4) **(Must have local knowledge or prior experience in implementing WFIPs and managing wildland fire use events)**
WFIP Stage II	Fire Use Manager Type 2 (FUM2)
WFIP Stage III	Fire Use Manager Type 2 (FUM2)

Guidelines for Fire Use Manager Decision Chart

Potential Fire Duration – the estimated length of time that the fire may continue to burn in comparison to historical fire durations and amount of fire season available for a given area.

Short	Moderate	Long
Fire is expected to persist for only the shortest time in comparison to historical fire durations. This may be as short as only a few days. Fuels may be limiting, weather may be limiting, or time of fire season may be limiting. Generally, this could be referenced as less than the historical average fire length for a given area.	Fire is expected to last for a time period similar to the historical average length of fires.	Fire is expected to last for a time period longer than the historical average length of fires.

Relative Risk – a measure of the relative risk, determined directly from the Wildland Fire Relative Risk Assessment, so no range of values is listed here.

Fire Activity – the relative activity of the fire in terms of intensity and spread over time.

Inactive	Variable	Active
Fire is burning with very low intensity, little or no spread, and little or no increase in burned area. Fire is confined to surface litter and duff layers.	Fire is burning predominantly in surface litter and duff layers, with low intensity and little or no spread but has occasional periods of increased intensity and spread. Growth of burned area is not constant but occurs in response to increased activity. Area increase may be static for moderately long periods and then increase for short periods. Fire size usually increases by less than 50 percent during active periods.	Fire is burning in all fuel strata (litter, surface, and crown) with periods of sustained flaming fronts, perimeter growth, and area increases that can exceed 100 percent at times. Infrequent periods of low activity occur but spread is generally constant.

Management Actions

Forecasted Weather (Include an initial assessment of air quality forecasts/allowable burn days as applicable)	
Forecasted Fire Behavior	
Hazards and Safety Concerns	
Management Actions	
Availability of Resources	

Periodic Fire Assessment

Insert the following sections, either by completing new versions or by using those already completed as part of WFIP Stage I:

- Decision Criteria Checklist
- Wildland Fire Risk Assessment
  —Part 1: Planning Needs Assessment
  —Part 2: Fire Use Manager Decision Chart
- Signature Page

Periodic Fire Assessment

Signature Table

Assessment Frequency _____

Valid Date(s) _____

Name/Title	Date	Decision Criteria Checklist Valid	WFIP Planning Stage Required	Fire Use Manager Level
		Yes/No	I, II, III	I, II, Other

WFIP Stage II

Attach Stage I information.

Objectives

Objectives	

Fire Situation

Current and Predicted Weather	
Current and Predicted Fire Behavior	
Threats	
Safety Considerations	
Environmental Concerns	
External Concerns	

Management Actions

Management Actions	

Estimated Costs

Estimated Costs	

Periodic Fire Assessment

Insert the following sections, either by completing new versions or by using those already completed as part of WFIP Stage I:

- Decision Criteria Checklist
- Wildland Fire Risk Assessment
  —Part 1: Planning Needs Assessment
  —Part 2: Fire Use Manager Decision Chart
- Signature Page

Periodic Fire Assessment

Signature Table

Assessment Frequency _____

Valid Date(s) _____

Name/Title	Date	Decision Criteria Checklist Valid	WFIP Planning Stage Required	Fire Use Manager Level
		Yes/No	I, II, III	I, II, Other

WFIP Stage III

Attach Stage I and Stage II information. Update and/or revise Stage I and II as necessary.

Objectives

Natural and Cultural Resource Objectives	
Constraints	

Maximum Manageable Area (MMA) — Definition and Maps

Acres in MMA	
Definition of MMA	
Attach Map of MMA	

Weather Conditions and Drought Prognosis

Weather Conditions/ Drought: Discussion and Prognosis	

Long-term Risk Assessment and Map (if applicable)

Risk Assessment (Describe techniques utilized and outputs, include maps as appropriate)	

Threats

Threats to MMA	
Threats to Public Use and Firefighter Safety	

Smoke Dispersion and Effects	

Other Threats	

Monitoring Actions

Describe monitoring actions, frequency, duration	

Mitigation Actions

Describe holding actions and other mitigation actions, and management action points that initiate these actions, and key to map, if necessary.	

Resources Needed to Manage the Fire Under Expected Weather Conditions

Describe resources necessary to accomplish ignition, holding, other mitigation actions, and monitoring actions.	

Contingency Actions

Describe contingency actions, management action points that initiate them, resources needed, etc.	

Information Plan

Describe information plan, contacts, responsibilities, etc.	

Estimated Costs of Managing the Fire

Describe costs in terms of resources needed, projected duration, etc.	

Post-burn Evaluation

Describe post-burn evaluation procedures, resource requirements, costs, duration, etc.	

Signatures

Incude signatures/titles/ dates for preparing, approving, and any concurring individuals.	

Periodic Fire Assessment

Insert the following sections, either by completing new versions or by using those already completed as part of WFIP Stage II:

- Decision Criteria Checklist
- Wildland Fire Risk Assessment
  - —Part 1: Planning Needs Assessment
  - —Part 2: Fire Use Manager Decision Chart
- Signature Page

Periodic Fire Assessment

Signature Table

Assessment Frequency _____

Valid Date(s) _____

Name/Title	Date	Decision Criteria Checklist Valid	WFIP Planning Stage Required	Fire Use Manager Level
		Yes/No	I, II, III	I, II, Other

Appendix B: Preplanning Wildland Fire Implementation Plan Elements

Parts of the WFIP can be planned well in advance of fire season. Preplanning is especially critical in those fuel types where fires develop rapidly and a "long duration" fire is only a few days. In many cases, these elements can be part of the fire management unit information in the fire management plan. The following items from the WFIP can be preplanned:

- **Objectives** – all or most of these should be known in advance and based on the resource objectives in the land use plan and fire management unit objectives.

- **Constraints** – standards and guidelines within the land use plan and fire management unit are the basis for any operational constraints. These constraints typically affect which types of activities may occur where or when.

- **Safety Considerations** – document those safety considerations associated with various aspects of the environment, such as cliffs or mineshafts; with well-known and generally regular weather events, such as foehn winds; and with particular times of the year, such as hunting seasons.

- **Values at Risk** – document those values threatened by either the simple presence of fire, and certain fire intensity, or any appropriate management response actions that may be taken. These values may consist of different types of natural and cultural resources or physical features such as campgrounds or private property.

- **External Concerns** – these consist of concerns known to exist for cooperators, adjacent owners or land managers, communities, regulatory agencies, and other stakeholders (i.e. the critical concerns discussed as part of the relative risk rating). Not all concerns can be known in advance since some are situational and not tied to a particular fire management unit. The objectives and constraints should adequately cover internal concerns.

- **Implementation Actions** – some preliminary implementation actions, or appropriate management responses, can be developed in advance, particularly for Stage I and Stage II. Most often, these will consist of different levels of monitoring to some holding or checking actions. Units that expect to develop Stage III without the aid of a FUMT may develop more detailed descriptions of the allowable responses or a list of response options.

- **Maximum Manageable Area** – preliminary MMAs can be designated based on roads, jurisdictional or land allocation boundaries, watershed boundaries, or similar features. These MMAs are not finalized until a wildland fire use event occurs and management is elevated to Stage III. Preliminary MMAs can include information on which segments are naturally defensible and which are not, as well as what types of actions may be needed to increase the defensibility of those segments. Preplanned MMAs may be the only option for some fire management units.

- **Management Action Points** – preliminary management action points may be identified to address certain types of values at risk or preliminary MMA boundaries. Full development may not happen until the fire occurs since the appropriate management response often depends on fire behavior.

- **Monitoring Plan** – do not confuse the monitoring plan with monitoring as an appropriate management response. The monitoring plan is intended to determine if the fire is meeting or has met management objectives. Since nearly all the management objectives should be known in advance, this plan can also be prepared in advance.

- **Information Plan** – use experience from past fires, both suppression and wildland fire use, to develop many elements of the information plan. Some elements may be more situational or new contacts or contact methods may occur between the development of this preliminary plan and an actual fire.

- **Agreements** – although not technically part of the WFIP, fully implementing a WFIP may require that cross-jurisdiction agreements be in place to allow the fire to move from one jurisdiction to another. These jurisdictions may be other land management agencies; state or local fire protection agencies or districts; or private landowners.

In addition to WFIP elements, several types of data are recommended for advanced development or for addition to the fire management plan as data are developed from different fires. As appropriate, update data each year. The following list is not exhaustive but intended as a tickler:

- Weather Data

  —NFDRS station catalogs and weather files

  —Definitions for:

    . . . Season or fire-ending event

    . . . Fire-slowing events (event plus number of days the event is effective)

    . . . Large fire growth events or key weather events that result in large fire growth

- Term files for use in RERAP

- Preliminary RERAP assessments for individual FMUs with assumptions (risk of fire movement over set distances by time of year and general direction)

- FARSITE layers, including changes resulting from the previous year's fires and vegetation management actions

- Structure protection plans

- Potential evacuation needs, routes and responsibilities, which should be shared with the appropriate authority in advance of an ignition.

- Mitigation measures for threatened and endangered species (TES) (i.e. plants, animals, and fish) that have been successful in the past

- Data layers (actual data or location of data)

  —Fuels

  —Roads and trails

  —Streams

  —Values to be protected (some of this data may be protected)

  —Land status

  —Fire history

  —Fuels treatment history

  —Vegetation type or dominant species

  —Vegetation structure

  —Potential vegetation

  —Fire regime or fire regime condition class

  —Smoke sensitive areas

Appendix 13.Q Post-Project Evaluation Form

This form is to be completed and submitted for review within 30 days of declaring the project complete.

Instructions

Block 1: Self-explanatory.

Block 2: Copy of the Project Objectives as listed in the Project Plan.

Block 3: Give quantitative results of how well objectives were met (percent of 1-hour and 10-hour fuels removed, percent of burn area with fuels reduced, percent of area with acceptable/ unacceptable scorch, etc.).

Block 4: Give a short narrative of problems encountered and suggestions for improving or refining operations and prescriptions i.e. firing pattern, equipment limitations, drought index, effectiveness of barriers.

Block 5: Self-explanatory - for providing feedback to the prescribed fire program.

Block 1

Individual Leading Evaluation:
Project Name:
Fire Management Unit:
Fire Number:
Number Acres Treated:
Fire Number:
Total Cost:
Cost per Acre:

Block 2

Objectives:

Block 3

Results:

Block 4

Problems Encountered, Methods to Improve Next Operation:

Block 5
Burn Boss comments:

_____ _____
Burn Boss Signature Date

Fire Management Officer comments:

_____ _____
Fire Management Officer Signature Date

Wildland Fire Decision Support System
Text System - Decision Analysis Report (Instructional "HELP")

Form needs to be locked (can be done on the Forms Toolbar)
Click HERE and click F1 to view form HELP

Unit Name
Enter the name of the agency unit responsible for incident decisions.

Date
Enter the date of the decision.

Response Level 1
Select the Response Level.

National Significance No
Only upgraded by Region/National representative when incident has national interest.

INFORMATION

	RL1	RL2	RL3	NOTE: Information listed under RL columns refers to: NA - Not Applicable; O - Optional; M - Mandatory; R - Recommended
Incident Name	M			Enter unique incident name.
Latitude	M			Enter Latitude in Decimal Degrees or Deg, Min, Sec
Longitude	M			Enter Longitude in Decimal Degrees or Deg, Min, Sec
Geographic Area	M			SELECT GEOGRAPHIC AREA Select geographic area from pick list (Alaska, Eastern, Eastern Great Basin, Northern Rockies, North Ops, Northwest, Rocky Mountain, South West, Southern, Western Great Basin)
Owner Name	M			Enter the incident author's name.
Affected Jurisdiction(s)	R			Enter the names of agencies/cooperators affected by the incident.
Fire Number	M			Enter the unique incident number made up of 2-letter state abbreviation, 3-letter unit identifier and the sequential incident number such as NM-CIF-000333.

Fire Code	R	Enter financial code for the incident.
Incident Start Date/Time	M	Enter the incident start date and time.
Containment Date/Time		Enter the incident containment date and time.
Controlled Date/Time		Enter the incident controlled date and time.
Out Date/Time		Enter the incident out date and time.
Incident Size	M	Enter incident size at time decision is being documented.
Incident Cause	R	SELECT CAUSE OF IGNITION Select the cause of ignition from pick list (Natural, Human, Unknown)
Landscape Data Source	R	Enter the source for landscape fuels, elevation, slope, aspect, canopy characteristics, etc.

SITUATION

	RL1	RL2	RL3	
Map	M	M	M	*See Attached Map(s)* Attach maps of incident area that include incident location, topographical information and other information pertinent to decision.
Fire Weather Forecast	M	M	M	*See Attached Forecast(s)* Attach pertinent fire weather information such as fire weather forecast, spot forecast or long lead outlook.
Current/Forecasted Fire Danger	M	M	M	Enter current/forecast fire danger as text or graphical information.
Fuels	M	M	M	Enter text descriptions of fuels conditions. Maps or graphical information can be attached.
Hazards and Safety Concerns (check applicable items)	M	–	–	☐ Human Factors ☐ Operations ☐ Travel

				☐ Environmental Factors ☐ Aviation Operations ☐ Other (list) Enter information regarding other safety concerns.
Hazards and Safety Concerns (list all concerns)	–	M	M	List and discuss hazards and safety concerns.
Short-Term Fire Behavior	M	M	M	Discuss expected short-term fire behavior as analyzed with FlamMap or BEHAVE. Outputs can be attached.
Resource Availability	M	M	M	Discuss local resource availability and expected resource availability in geographic area.
External Influences	O	M	M	☐ Pre-existing controversies/relationships ☐ Potential sensitive media relationships ☐ Potential smoke management problems ☐ Potential sensitive political interests ☐ Other Enter discussion of potential external influences.
Additional Risk Analysis	NA	M	M	Additional Risk Analysis Required as Response Levels progress - Users Define specific analysis tools
Medium-Term Fire Behavior	O	R	R	Discuss medium-term fire behavior as analyzed with applications like FARSITE. Outputs can be attached.
Value Inventory	O	R	R	Include a summary list of values in incident vicinity. Map of values inventory can be attached.
Fire Spread Probability	O	O	R	*See WFDSS - web system* FSPro model run available in WFDSS
RAVAR	O	O	R	*See WFDSS - web system* Rapid Assessment Values at Risk produced from values data combined with FSPro analysis within WFDSS
SCI	O	O	R	*See WFDSS - web system* Stratified Cost Index calculated within WFDSS

OBJECTIVES

	RL1	RL2	RL3	
Strategic Objectives	M	M	M	Enter strategic objectives for incident as discussed in land, resource, and fire management plans. Objectives are often broad and general.
Management Requirements	O	M	M	Enter management requirement applicable to the planning area, such as “No dozers in the wilderness”. Include Post-Fire requirements for “Fire Management Activity Damage Repair”, “Burned Area Emergency Restoration” and “Burned Area Restoration”.
Relative Risk Assessment	M	O	NA	*See Relative Risk Assessment Chart* See Appendix and complete the chart by drawing the lines.
Incident Objectives	M	M	M	Enter specific incident objectives. Incident objectives are more detailed than the strategic objectives found in land, resource and fire management plans.
Incident Requirements	O	M	M	Enter incident requirements that are detailed and specific to the incident, such as “no retardant North of Hwy 76” or “No retardant in Oak Canyon”.

COURSE OF ACTION

	RL1	RL2	RL3	
Initial Response	M	NA	NA	Enter the pre-planned dispatch response as outlined in fire management and dispatch plans.
Planning Area	NA	O	R	*See Attached Map* Area within which the incident is expected to be managed.
Implementation Actions	NA	R	R	*General Course of Action and Management Resources* Describe the general course of action to be taken.
MAP 1			O	*Management Action Points (MAP) Designator and Description* Enter unique identifier for management action plan and description such as “MAP 1, North Oak Creek”.

				Recommended Actions Describe the actions to be taken for the MAP. *Recommended Resources* Describe the resources needed to carry out the recommended actions. *Estimated Time to Complete* Enter the expected time needed to complete the recommended actions. *Estimated Costs* Enter the estimated cost of the recommended actions. *(Repeat for multiple MAPs-Click here and F1 for HELP)*
MAP 2...			O	*Management Action Points (MAP) Designator and Description* *Recommended Actions* *Recommended Resources* *Estimated Time to Complete* *Estimated Costs* *(Repeat for multiple MAPs-Click here and F1 for HELP)*
Complexity Analysis	NA	O	R	*Complete Complexity Analysis Below, Reference Guidelines are included in Appendix. Click Here and hit F1 for Help*

FIRE BEHAVIOR: Observed or Predicted

1. Burning Index (from on-site measurement of weather conditions) predicted to be above the 90% level using the major fuel model in which the fire is burning. ☐
2. Potential exists for “blowup” conditions (fuel moisture, winds, etc). ☐
3. Crowning, profuse or long-range spotting. ☐
4. Weather forecast indicating no significant relief or worsening conditions. ☐

FIREFIGHTING RESOURCES COMMITTED:

1. Responders may range from 200-500 or more. ☐
2. Numerous kinds and types of resources may be required including many that will trigger a formal demobilization process ☐
3. Complex aviation operations involving multiple aircraft may be involved. ☐
4. Incident requires an Incident base and numerous other ICS facilities to provide support. ☐
5. Majority of initial attack resources committed. ☐

VALUES THREATENED:

1. Critical infrastructure or Key Resources may be adversely affected or possibly destroyed and actions to mitigate affects may extend into multiple Operational Periods and require considerable coordination. ☐
2. Restricted, threatened or endangered species habitat. ☐
3. Cultural/Heritage sites. ☐
4. Unique natural resources, special designation zones or wilderness. ☐
5. Other special resources. ☐

SAFETY:

1. Hazardous fire line conditions. ☐
2. Serious accidents or fatalities. ☐

3. Threat to safety of visitors from fire and related operations. ☐
4. Restrictions and/or closures in effect or being considered. ☐
5. No night operations in place for safety reasons. ☐

E. **OWNERSHIP:**

1. Fire burning or threatening more than one jurisdiction. ☐
2. Potential for claims (damages). ☐
3. Different or conflicting management objectives. ☐
4. Dispute over fire management responsibility and jurisdiction. ☐
5. Potential for Unified Command. ☐

F. **EXTERNAL INFLUENCES:**

1. Elected and appointed governing officials, stakeholder groups, and political organizations require a high level of interaction. ☐
2. Pre-existing controversies/relationships. ☐
3. Sensitive media relationships. ☐
4. Population surrounding general incident area is affected (smoke, evacuation, etc.) ☐

G. **CHANGE IN STRATEGY**

1. Change in strategy (from lower to higher intensity management). ☐
2. Large amounts of unburned fuel within planned perimeter. ☐
3. WFDSS DAR invalid or requires updating. ☐

H. **EXISTING OVERHEAD:**

1. Resources may need to remain at scene for extended operational periods, require complete logistical support, and numerous personnel replacements. ☐
2. Existing management organization ineffective. ☐
3. Overhead/IMT overextended mentally and/or physically. ☐
4. Formal Incident Action Plan (IAP) needed for each operational period. ☐

RECOMMENDED MANAGEMENT ORGANIZATION

Other

Reference Fire Costs	NA	O	R	*See WFDSS - web system, or attach other Estimated Cost Information*
Contingency Actions	NA	O	R	Describe the actions to be taken, in detail, should the incident move beyond the planning area. Attach maps if necessary to inform the decision.

VALIDATION

RL1 RL2 RL3

Is the pre-planned initial attack being successful?	M	NA	NA	☐ Yes -- Continue ☐ No -- Move to RL2
Review Situation, Objectives, and Course of Action - Determine if Objectives can be met.	NA	M	M	☐ Yes -- Continue ☐ No -- Revise Course of Action

DECISION SUMMARY

	RL1	RL2	RL3	
Response Decision	M	M	M	Enter text to describe the decision.
Response Decision Rationale	M	M	M	Enter text describing the response rationale behind the decision.
Signature	M	M	M	Signature of line officer responsible for incident decision.
Periodic Assessment Frequency	M	M	M	Enter the time frame, conditions, and course of action for which the decision will be reviewed, such as daily, every 7 days, or fire crosses Spring Creek.

PERIODIC ASSESSMENT

	RL1	RL2	RL3	
Relative Risk Assessment	NA	M	O	*See Relative Risk Assessment Chart* See Appendix and complete the chart by drawing the lines.
Response Level Progression Chart	M	M	NA	*See Response Level Progression Chart* See Appendix and complete the chart by drawing the lines.
Normal Validation Process	NA	NA	M	*Refer to Validation Subsection*

Appendix

Enter Appendix Section Identifier and Title

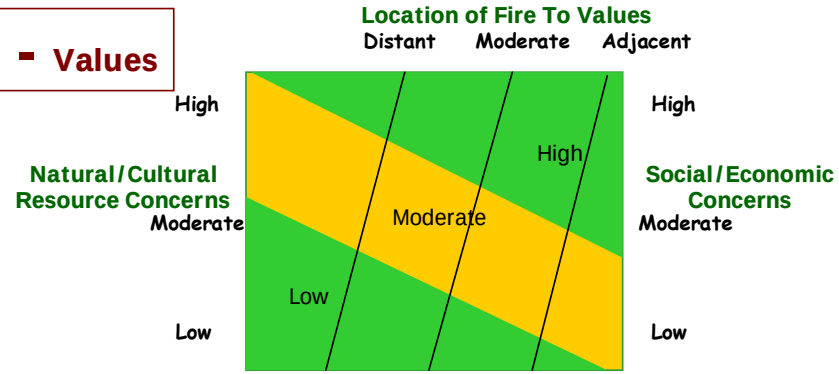
CHART INSTRUCTIONS:

Use drawing tools to draw lines across the charts. Drawing tool can be accessed from VIEW – TOOLBARS – DRAWING or INSERT-ILLUSTRATIONS-SHAPES.

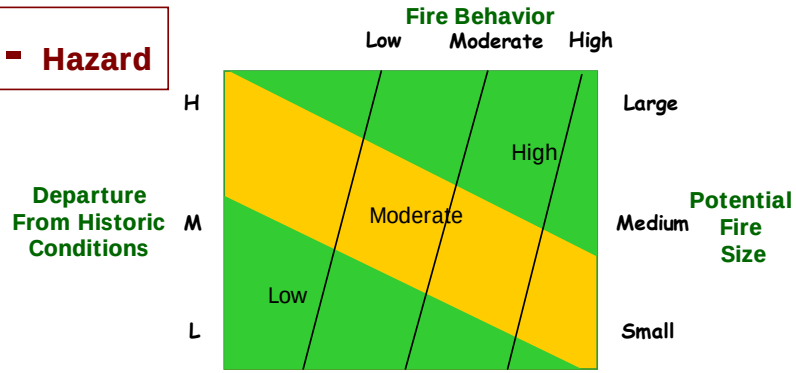
See the Appendix for step-by-step instructions for the use of the relative risk assessment chart.

Wildland Fire Relative Risk Assessment

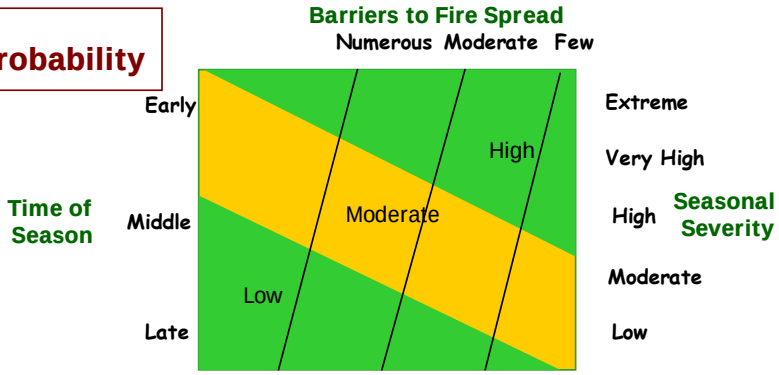
1 - Values



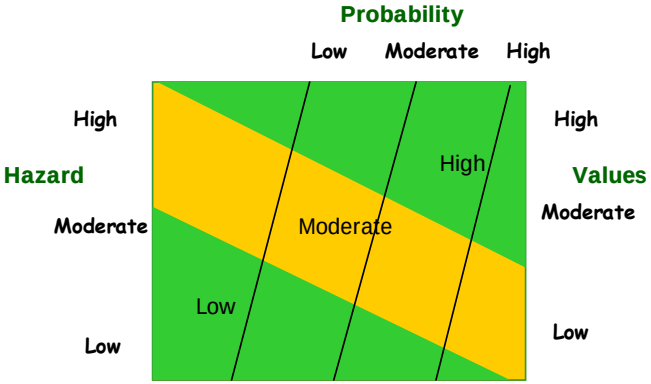
2 - Hazard



3- Probability



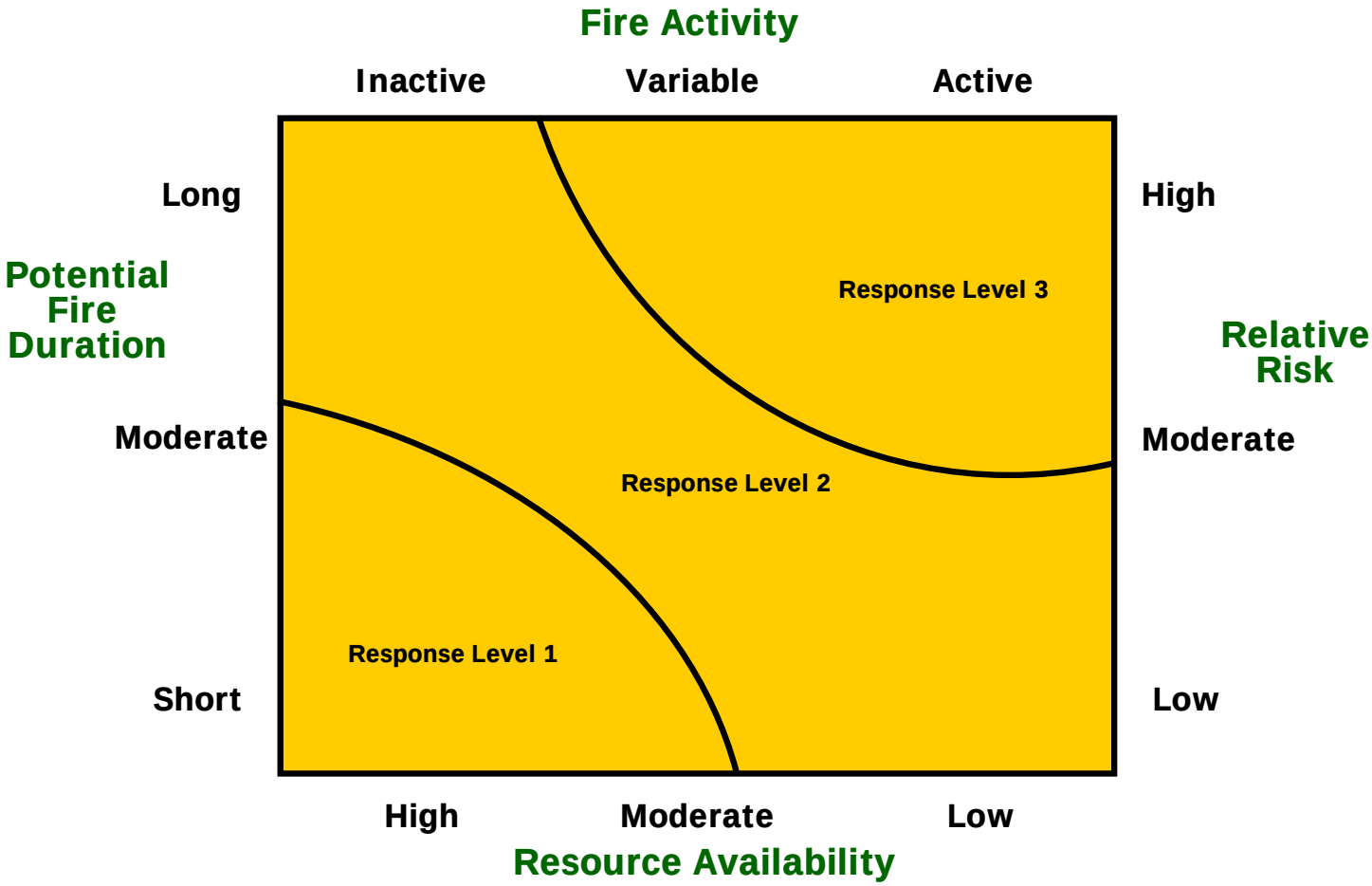
4 - Relative Risk



Complete Steps 1 -3: Connect the left and right variables with a line. At the top of the chart, select the appropriate value; follow the line beneath this value down to its intersection with the line connecting the left and right variables. Take results as inputs to Step 4.

Complete Step 4: Read the relative risk from the background area where the intersection occurs.

Response Level Progression Chart



Guidelines for Assessing Complexity

The following list of complexity elements are presented as to provide a review guide for Agency Administrators and staff to review and consider in analyzing the complexity or predicted complexity of a fire situation.

USE OF THE GUIDELINES:

1. Analyze each element and check if that element is a factor of concern for this incident.

2. Fire Complexity and ultimately Incident Management Team determination is based on the current and predicted fire situation. Discussion between the Incident Commander, Fire support Staff and the Agency Administrator is critical in determining the Type of Team configuration that will be needed for the Incident. Careful consideration should be given to the specific question(s) that are checked.

3. The question content and not a total number of checked items should be used as discussion points between the Agency Administrator, Host Unit Staff, Incident Commander, and his/her Incident Management Team for determining whether the Incident is moving upward or downward in Complexity. Upward trending fire complexity is indicated by increasing numbers of checked elements while declining fire complexity is indicated by decreasing numbers of checked elements. Managers should give careful consideration to the specific complexity elements that are checked and use this in determining the appropriate management organization for the specific incident.

GLOSSARY OF TERMS

Potential for blow-up conditions - **Any combination of fuels, weather and topography excessively endangering personnel.**

Smoke Management - **Any situation which creates a significant public response, such as smoke in a metropolitan area or visual pollution in high-use scenic areas.**

Wildland Fire Relative Risk Assessment

The Federal Fire Policy requires that sound risk management be a foundation for all fire management activities. Recent reviews and audits have also stressed the need for risk management. In fact, risk management is rapidly becoming a cornerstone phrase associated with fire management. A report by the National Academy of Public Administration (NAPA) (2001)*,"*stresses the role of risk reduction in wildlands as a critical mitigation approach to improve community protection." The Government Accountability Office (USGAO 2004) completed a report on risk assessment associated with the fuels treatment program. This report also stresses the importance of risk assessment in fire and fuels management.

All wildland fires present an inherent level of risk given that we are dealing with a number of unknowns and uncertainty in what the future will bring. The relative risk rating is intended to characterize the general magnitude of risks associated with implementing wildland fire management activities as a snapshot in time. It is an attempt to qualify the level of uncertainty regarding the eventual outcomes of the fire in relation to the management objectives and other mandates. The relative risk rating is a direct input into the periodic fire assessment and response level progression chart.

The Wildland Fire Relative Risk Assessment provides the Agency Administrator with a quick but comprehensive assessment of the relative risk of the fire. This is a qualitative process that can be completed in less time than a quantitave long-term risk assessment.

Appendix 13. R Wildland Fire Decision Support System (WFDSS)

The relative risk assessment chart uses three risk components: values, hazard, and probability. Each of these components is assessed in an independent step. Then, the three outputs are evaluated in a final step that provides the relative risk for the fire. Each risk component is defined by three variables. One variable is located on the right and one on the left side of the box and the third variable is defined by three interior lines extending from top to bottom.

Values: Values are those ecologic, social, and economic resources that could be lost or damaged because of a fire. Ecologic values consist of vegetation, wildlife species and their habitat, air and water quality, soil productivity, and other ecologic functions. Social effects can include life, cultural and historical resources, natural resources, artifacts, and sacred sites. Economic values make up things like property and infrastructure, economically valuable natural and cultural resources, recreation, and tourism opportunities.

Hazard: The hazard in wildland fire is made up of the conditions under which it occurs and exists, its ability to spread and circulate, the intensity and severity it may present, and its spatial extent.

Probability: Probability refers to the likelihood of a fire becoming an active event with potential to adversely affect values.

Initial information to consider in developing the rating for the individual element is provided in the following section. This descriptive list is not all inclusive and items on the list can vary by place and time. Users are expected to exercise their judgment in determining the ratings; information is intended to provide both guidance in completion and flexibility in determining exactly what the descriptions mean. Local information can and should be amended to the lists to better reflect site-specific situations. Local, site-specific information concerning air quality and smoke management must be amended into the Wildland Fire Relative Risk Assessment at the local level to reflect variances in situations and local values and regulatory concerns. Air quality criteria should be reflected in the values assessment portion, smoke production can be incorporated into the hazard descriptive list, and descriptive information related to the probability of adverse smoke events, if available, can be addressed as part of the probability assessment.

PART 1: VALUE ASSESSMENT:

Values are those ecologic, social, and economic effects that could be lost or damaged because of a fire. Ecologic values consist of vegetation, wildlife species and their habitat, air and water quality, soil productivity, and other ecologic functions. Social effects can include life, cultural and historical resources, natural resources, artifacts, and sacred sites. Economic values make up things like property and infrastructure, economically valuable natural and cultural resources, recreation, and tourism opportunities. This assessment area allows opportunity for the local Agency Administrator to identify particular local concerns. These concerns may be identified in the fire management plan or other planning documents.

Natural/Cultural Resource Concerns - key resources potentially affected by the fire. Examples include, but are not limited to habitat or populations of threatened, endangered, or sensitive species, water quality, erosion concerns, and invasive species.

Low	Moderate	High
Resource concerns are few and generally do not conflict with management of the fire. Mitigation measures are effective.	Significant resource concerns exist, but there is little conflict with management of the fire. Mitigation measures are generally effective.	Multiple resource concerns exist, some of which may conflict with management of the fire. The effectiveness of needed mitigation measures is not well established.

Social/Economic Concerns - the risk of the fire, or effects of the fire, impacting the social or economic concerns of an individual, business, community or other stakeholder involved with or affected by the fire. Social concerns may include degree of support for the wildland fire use program or resulting fire effects, potential consequences to other fire management jurisdictions, impacts to tribal subsistence or gathering of natural resources, air quality regulatory requirements and public tolerance of smoke. Economic concerns may include potential financial impacts to property,

business, or infrastructure. Infrastructure impacts may be costs to repair or replace sediment catchments, wildlife guzzlers, corrals, roads, culverts, power lines, domestic water supply intakes, and similar items.

Low	Moderate	High
Local support for wildland fire use is high. The fire should have little or no impact on subsistence or Tribal activities involving treaty rights. The fire is expected to remain within a single jurisdiction or agreements are in place to allow the fire to move across several jurisdictions. Media coverage is favorable. Few structures or business ventures are potentially affected by the fire. There are few impacts to recreation and tourism.	Local support of wildland fire use is clearly divided between supporters and opponents. The fire will have some impacts on subsistence or Tribal activities involving treaty rights. The fire is expected to involve more than one jurisdiction, cooperator, or special interest group and agreements need to be developed. Media coverage tends to be a mix of favorable and unfavorable views. Some structures may be threatened by the fire or some business ventures may be affected by the fire.	Local support for wildland fire use is low. The fire will have significant impacts on subsistence activities or Tribal activities involving treaty rights. Smoke impacts may become a concern for higher level air quality regulatory agencies. The fire is expected to involve several jurisdictions, cooperators, and special interest groups and agreements requiring significant negotiation need to be developed. Media coverage tends to be unfavorable. Many structures or private properties could be threatened.

Location of Fire to Values

Distant	Moderate	Adjacent
Fire location is not proximate to values to be protected or fire is located where it is highly unlikely that it would reach the values.	Fire location is moderately proximate to values. Location is such that, based on historical data, fire could potentially reach the values but will take multiple burning periods and sustained fire activity to reach the values.	Fire location is in close proximity to values. Without mitigation actions, fire will be expected to reach the values.

PART 2: HAZARD ASSESSMENT: The hazard in wildland fire is made up of the conditions under which it occurs and exists, its ability to spread and circulate, the intensity and severity it may present, and its spatial extent.

Current Fire Behavior – the current fire behavior or that most recently observed. Changing fire behavior is addressed through repeated completion of the Periodic Fire Assessment.

Low	Moderate	High
Short duration flaming front with occasional torching. Fuels are uniform and fire behavior can be easily predicted and tactics implemented.	Short range spotting occurring. Moderate rates of spread are expected with mainly surface fire and torching. Fuels and terrain are varied but don't pose significant problems in holding actions.	Long range spotting > ¼ mile. Extreme rates of spread, and crown fire activity are possible. Fuels, elevation, and topography vary throughout the fire area creating high resistance to control.

Departure from Historic Conditions – a measure of ecological functions at risk based on changes in vegetation.

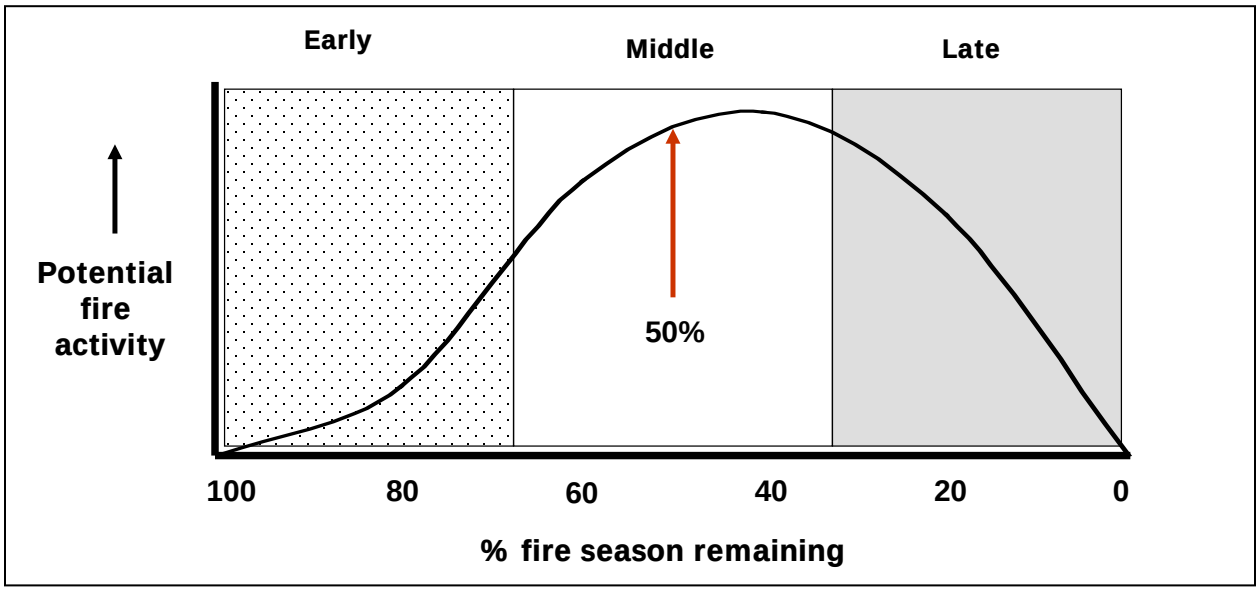
1	2	3
Vegetative composition and structure are resilient, similar to historic conditions, and key components are at low risk of loss.	Both the composition and structure of vegetation has shifted from historic conditions towards conditions that are less resilient and more at risk of loss.	Vegetation composition and structure are highly altered and predisposes the landscape to fire effects well outside the range of historic variability, potentially producing changed fire environments never before measured.

Potential fire size - the potential fire size by the end of the season in comparison to historical fire occurrence.

Small	Medium	Large
Fire size is expected to be small for the dominant fuel type involved.	Fire size is expected to be in the mid-range for the dominant fuel type involved.	Fire size is expected to be large for the dominant fuel type involved.

PART 3: PROBABILITY ASSESSMENT: Probability refers to the likelihood of a fire becoming an active event having potential to adversely affect values.

Time of Season - the current time in relation to the historical fire season. The chart below the guidelines reinforces the importance of time of season. During the early part of the fire season, the peak of burning activity is still to come, thus the fire could present substantial variation in behavior and activity. In the middle of the season, the peak of burning activity may or may not have occurred while in the late part of the season, the peak of fire activity generally has occurred and managers can reasonably expect diminishing fire activity and behavior as time progresses. As the amount of fire season remaining decreases or as the time of season progresses from early to late, management concerns and issues associated with potential fire activity decrease.



Early	Middle	Late
The current date is in the early portion of the historic fire season, at least 2/3 of the established fire season remains and the peak of burning activity is still to come.	The current date is in the middle of the historic fire season, at least 1/3 of that period has passed and no less than 1/3 remains. The peak burning activity period either has occurred, is occurring now, or will occur very soon.	The current date is in the latter part of the historic fire season. At least 2/3 of the historic period has passed, the peak burning activity period has occurred, and the probability of a season-ending or fire-ending event is increasing quickly.

Seasonal Severity - a measure of the potential burning conditions as expressed by factors such as energy release component (ERC), drought status, live fuel moistures, dead fuels moistures, soil moisture, stream discharge, and similar types of measures.

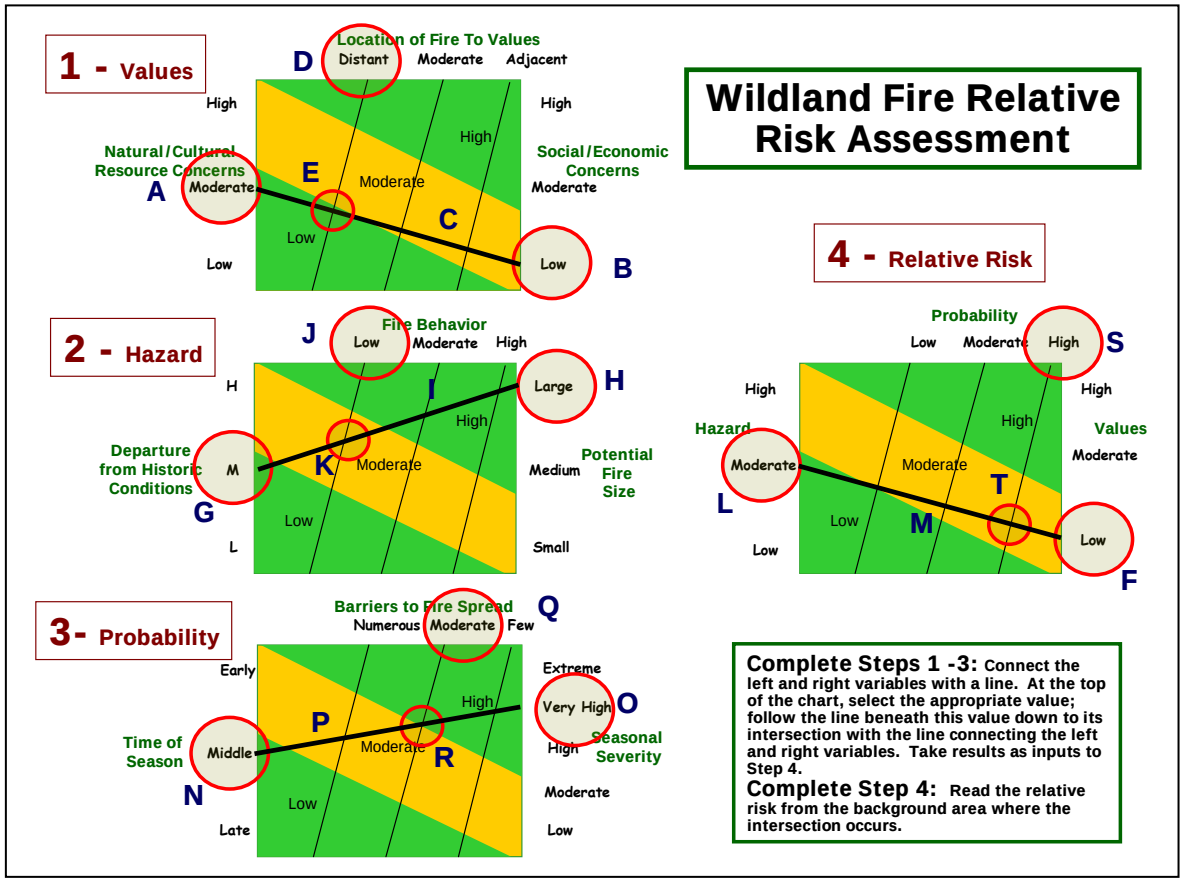
Low	High	Extreme
Measures of fire danger are below to somewhat above seasonal averages. Drought status is within seasonal norms with no long-term drought present	Measures of fire danger are well above seasonal averages but not setting new records. The area is in short-term drought (1-2 years of drought) but not considered to be in long-term drought.	Measures of fire danger are setting new records. The area is considered to be in long-term drought (3 or more years of drought).

Barriers to Fire Spread – a measure of the natural defensibility of the fire location and an indication of degree of potential mitigation actions needed.

Numerous	Moderate	Few
The location of the fire and presence of natural barriers and fuel breaks limit the horizontal fuel continuity, minimal mitigation actions on-the-ground will be needed.	The location of the fire and presence of some natural barriers and fuel breaks limit the horizontal fuel continuity on some, but not all fire flanks, some mitigation actions on-the-ground will be needed to protect threats to boundaries and sensitive areas.	The location of the fire and presence of only limited natural barriers and fuel breaks will permit fire spread across continuous fuels. Mitigation actions on-the-ground will be needed but are expected to be effective.

A	Step 1	Locate Natural/Cultural Resource Concern level
B	Step 1	Locate Social/Economic Concern level
C	Step 1	Draw line connecting left and right variables
D	Step 1	Locate Location of Fire to Values level
E	Step 1	Follow interior line down to intersection with line connecting left and right variables, locate Value Assessment output (Low, Moderate, High)
F	Step 4	Take Step 1 - Value Assessment output to Step 4 as Value input
G	Step 2	Locate Fire regime condition class level
H	Step 2	Locate Potential Fire Size level
I	Step 2	Draw line connecting left and right variables
J	Step 2	Locate Fire Behavior level
K	Step 2	Follow interior line down to intersection with line connecting left and right variables, locate Hazard Assessment output (Low, Moderate, High)
L	Step 4	Take Step 2 - Hazard assessment output to Step 4 as Hazard input
M	Step 4	Draw line connecting Value and Hazard levels
N	Step 3	Locate Time of Season level
O	Step 3	Locate Seasonal Severity level
P	Step 3	Draw line connecting left and right variables
Q	Step 3	Locate Barriers to Fire Spread level
R	Step 3	Follow interior line down to intersection with line connecting left and right variables, locate Probability Assessment output (Low, Moderate, High)
S	Step 4	Take Step 3 – Probability assessment output to Step 4 as Probability input
T	Step 4	Follow interior line down to intersection with line connecting left and right variables, locate Relative Risk Assessment (Low, Moderate, High)

Step-By-Step Instructions for Completing the Wildland Fire Relative Risk Assessment



Guidance for Implementation of Federal Wildland Fire Management Policy

February 13, 2009

Foreword

The *Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001)* is the primary interagency wildland fire policy document. The *Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (June 20, 2003)* was developed and approved under the authority of the Wildland Fire Leadership Council (WFLC) to set forth direction for consistent implementation of the federal fire policy. It has been used since that time.

On May 2, 2008, the WFLC issued a memorandum entitled *Modification of Federal Wildland Fire Policy Guidance*. This memorandum directed federal agencies to test and implement new guidelines for wildland fire management. The modifications were tested in a number of field units in the 2008 fire season.

In 2009 the National Wildfire Coordinating Group (NWCG) issued a memorandum to the NWCG executive board (NWCG#001-2009, January 7, 2009) that 1) affirms the soundness of the *Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001)*, 2) reiterates the policy changes stated in the May 2, 2008 WFLC memorandum entitled *Modification of Federal Wildland Fire Policy Guidance*, 3) states that the Wildland Fire Decision Support System (WFDSS) will replace existing analysis and decision processes, and 4) confirms that the *Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (June 20, 2003)* will be replaced in 2009.

This document, *Guidance for Implementation of Federal Wildland Fire Management Policy (February, 2009)*, is that replacement.

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Fire Executive Council

February 13, 2009

Memorandum

To: Chief, USDA Forest Service
Director, Bureau of Indian Affairs
Director, Bureau of Land Management
Director, Fish and Wildlife Service
Director, National Park Service

From: Chair, Fire Executive Council

Subject: Guidance for Implementation of Federal Wildland Fire Policy

On February 13, 2009, the Fire Executive Council (FEC) approved Guidance for the Implementation of Federal Wildland Fire Management Policy. This Guidance provides for consistent implementation of the 1995/2001 Federal Fire Policy, as directed by the Wildland Fire Leadership Council.

Successful implementation of the Guidance requires that each of the federal wildland fire agencies work together through development of unified direction and guidance for agency/bureau manuals, directives, handbooks, guidebooks, plans agreements and other pertinent documents to complete final implementation of this guidance.

In approving the Guidance the FEC:

- directs the National Wildfire Coordinating Group to adopt the guidance and review and revise, as appropriate, all interagency training courses, operational guides, standards, terminology, reporting requirements, skill/competency/qualification/certification requirements and other pertinent documents.
- directs the federal fire directors to work collaboratively with state, local and tribal fire managers and public and nongovernment organizations to communicate direction stated in the guidance with internal and external audiences to foster understanding and support for the complexity of wildland fire management.
- directs the federal fire directors to revise or develop accountability standards, performance measures and tracking systems to assess if resource and protection objectives are met during the course of management on all wildland fires.

We thank the interagency team that produced this implementation guidance and extend special appreciation to the National Association of State Forest, International Association of Fire Chiefs, National Association of Counties, The Wilderness Society, and The Nature Conservancy for the support and commitment in completing the document.

APPROVAL

The *Guidance for Implementation of the Federal Wildland Fire Policy (February, 2009)* is hereby approved by the Fire Executive Council. Implementation actions are to begin immediately.

22 FEB 09

U.S. Department of Agriculture — Date
Forest Service, Fire & Aviation Management
Tom Harbour, Director

2/18/09

Department of the Interior — Date
Office of Wildland Fire Coordination
Kirk Rowdabaugh, Director

FEB. 13, 2009

Bureau of Land Management — Date
Fire and Aviation Management Directorate
Jim Douglas, Assistant Director

2/19/09

National Park Service — Date
Visitor and Resource Protection
Karen Taylor-Goodrich, Associate Director

2/20/09

Fish and Wildlife Service — Date
National Wildlife Refuge System
Division Natural Resource and Conservation Planning
Andy Loranger, Chief

2/20/09

Bureau of Indian Affairs — Date
Trust Services
Vicki Forrest, Deputy Director

2-17-09

Department of the Interior — Date
National Business Center –
Aviation Management Directorate
Mark Bathrick, Associate Director

2/20/09

National Wildfire Coordinating Group — Date
Ex officio
Brian McManus, Chair

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Introduction

The *Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001)* remains sound and presents a single cohesive federal fire policy for the Departments of the Interior and Agriculture. However, some issues associated with implementation of this policy need closer attention and clarification to fully achieve the intent of the policy.

One such policy area is the Wildland Urban Interface (WUI). WUI is more complex and extensive than previously considered in the 1995 and 2001 Federal Fire Policy reviews. Fire management activities affecting WUI areas require closer coordination and more engagement between with federal, state, local and tribal land and fire managers to ensure firefighter and public safety and mitigate property loss from wildland fire.

A key finding of the 2001 review of the 1995 policy was that "multiple terms for various management options to respond to wildland fire have confused agency managers and employees, operators, partners, and the public, and have perpetuated multiple fire management program elements". This important communications issue will be resolved only through federal, state, local and tribal engagement in building a foundation for common terms (see Appendix A) with understanding and support by all.

The current policy clearly states that wildland fire analysis will carefully consider the long-term benefits in relation to risks both in the short and long term:

> "Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries. Response to wildland fire is based on ecological, social, and legal consequences of fire. The circumstances under which a fire occurs, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected dictate the appropriate management response to fire."
>
> *1995/2001 Federal Wildland Fire Management Policy*

The intent of this framework is to solidify that the full range of strategic and tactical options are available and considered in the response to every wildland fire. These options are to be used to achieve objectives as described in Land and Resource Management Plans and/or Fire Management Plans, subject to clear processes defined to manage fire that crosses jurisdictional boundaries. Mutually developed objectives with adjoining jurisdictions for managing fires that crosses jurisdictional boundaries will also be recognized.

This guidance also calls for increased dialogue and collaboration between federal agencies and tribal, local, and state agencies as plans are updated and implemented to manage wildfires in order to accomplish resource and protection objectives.

This document, *Guidance for Implementation of Federal Wildland Fire Management Policy (February 2009)*, replaces the *Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (June 20, 2003).* This updated guidance consolidates and clarifies

changes that have occurred since the 2003 strategy document was issued, and provides revised direction for consistent implementation of the *Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001)*

Guidance for Implementation

The following guidelines should be used to provide consistent implementation of federal wildland fire policy. Further guidance is provided in the Federal Wildland Fire Management Policy section Table 1.

1. Wildland fire management agencies will use common standards for all aspects of their fire management programs to facilitate effective collaboration among cooperating agencies.
2. Agencies and bureaus will review, update, and develop agreements that clarify the jurisdictional inter-relationships and define the roles and responsibilities among local, state, tribal and federal fire protection entities.
3. Responses to wildland fire will be coordinated across levels of government regardless of the jurisdiction at the ignition source.
4. Fire management planning will be intergovernmental in scope and developed on a landscape scale.
5. Wildland fire is a general term describing any non-structure fire that occurs in the wildland. Wildland fires are categorized into two distinct types:
    a. Wildfires – Unplanned ignitions or prescribed fires that are declared wildfires
    b. Prescribed Fires - Planned ignitions.
6. A wildland fire may be concurrently managed for one or more objectives and objectives can change as the fire spreads across the landscape. Objectives are affected by changes in fuels, weather, topography; varying social understanding and tolerance; and involvement of other governmental jurisdictions having different missions and objectives.
7. Management response to a wildland fire on federal land is based on objectives established in the applicable Land/ Resource Management Plan and/or the Fire Management Plan.
8. Initial action on human-caused wildfire will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety.
9. Managers will use a decision support process to guide and document wildfire management decisions. The process will provide situational assessment, analyze hazards and risk, define implementation actions, and document decisions and rationale for those decisions.

Implementation

Each of the departments or agencies participating in the review will adopt the *Guidance for Implementation of Federal Wildland Fire Management Policy (February 2009)* and review and revise, as appropriate, all manuals, handbooks, guidebooks, plans, agreements and other pertinent documents.

The National Wildfire Coordinating Group (NWCG) will adopt the *Guidance for Implementation of Federal Wildland Fire Management Policy (February 2009)* and review and revise, as appropriate, all interagency training courses, operational guides, standards, terminology, reporting requirements, skill/competency/qualification/certification requirements and other pertinent documents.

The federal fire directors, in collaboration with state, local and tribal fire managers and public and nongovernment organizations, will communicate direction stated in the *Guidance for Implementation of Federal Wildland Fire Management Policy (February 2009)* with internal and external audiences to foster understanding and support for the complexity of wildland fire management.

The federal fire directors will revise or develop accountability standards, performance measures and tracking systems to assess if resource and protection objectives are met during the course of management on all wildland fires.

Federal Wildland Fire Policy - Guiding Principles and Policy Statements

The following guiding principles and policy statements are excerpted from the *Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001).* These remain the foundational principles for Federal Wildland Fire Management Policy.

Guiding Principles

1. Firefighter and public safety is the first priority in every fire management activity.

2. The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process. Federal agency land and resource management plans set the objectives for the use and desired future condition of the various public lands.

3. Fire Management Plans, programs, and activities support land and resource management plans and their implementation.

4. Sound risk management is a foundation for all fire management activities. Risks and uncertainties relating to fire management activities must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity. Net gains to the public benefit will be an important component of decisions.

5. Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives. Federal agency administrators are adjusting and reorganizing programs to reduce costs and increase efficiencies. As part of this process, investments in fire management activities must be evaluated against other agency programs in order to effectively accomplish the overall mission, set short- and long-term priorities, and clarify management accountability.

6. Fire Management Plans and activities are based upon the best available science. Knowledge and experience are developed among all federal wildland fire management agencies. An active fire research program combined with interagency collaboration provides the means to make these tools available to all fire managers.

7. Fire Management Plans and activities incorporate public health and environmental quality considerations.

8. Federal, State, tribal, local, interagency, and international coordination and cooperation are essential. Increasing costs and smaller work forces require that public agencies pool their human resources to successfully deal with the ever-increasing and more complex fire management tasks. Full collaboration among federal wildland fire management agencies and between the federal wildland fire management agencies and international, State, tribal, and local governments and private entities result in a mobile fire management work force available for the full range of public needs.

9. Standardization of policies and procedures among federal wildland fire management agencies is an ongoing objective. Consistency of plans and operations provides the fundamental platform upon which federal wildland fire management agencies can cooperate, integrate fire activities across agency boundaries, and provide leadership for cooperation with State, tribal, and local fire management organizations.

Federal Wildland Fire Management Policy

Each of the seventeen policy areas are assessed in depth in the following table (Table 1). The policy area's guiding principle is restated first. The left column provides statements to help clarify the Management Intent of the policy statement. The right column specifies actions needed to implement the policy statement.

Table 1 – Policy Clarification of Management Intent and Implementation Actions

Policy Statement	
Management Intent	**Implementation Actions**
1. Safety Firefighter and public safety is the first priority. All Fire Management Plans and activities must reflect this commitment.	
No natural or cultural resource, home, or item of property is worth a human life. All strategies and tactics should seek to mitigate the risk to firefighters and the public.	Agency administrators will develop and establish process, procedures and objectives that ensure firefighter and public safety. Incident Commanders will develop and establish incident objectives, strategies and operational tactics that ensure firefighter and public safety.
2. Fire Management and Ecosystem Sustainability The full range of fire management activities will be used to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social components.	
"Full range of fire management activities" may include any vegetative management treatment tool. Ecosystem sustainability provides a supply of goods, services, social values, and natural processes in perpetuity. Economic intent is to provide for sustainable supplies of goods, services, and social values through implementation of appropriate fire management activities.	Land/Resource Management Plan's (L/RMP) will be developed consistent with both ecological conditions, and fire regime dynamics, and consider the short and long term effects of both action and no action alternatives for planned vegetation management activities as well as responses to wildfire. Agencies will exploit the full range of fire management options to sustain healthy ecosystems within acceptable risk levels as identified in the L/RMP, or Fire Management Plan (FMP). Fire management activities will be based on planning and decision analysis processes that address current and anticipated situational conditions.
3. Response to Wildland Fire Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries. Response to wildland fires is based on ecological, social and legal consequences of the fire. The circumstances under which a fire occurs, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and, values to be protected, dictate the appropriate response to the fire.	
The L/RMP will define and identify fire's role in the ecosystem. The response to an ignition is guided by the strategies and objectives outlined in the L/RMP and/or the Fire Management Plan. Values to be protected from and/or enhanced by wildland fire are defined in the L/RMP and/or the Fire Management Plan. L/RMP and fire management planning is coordinated across jurisdictional boundaries.	FMP's assist in developing the management response to meet L/RMP objectives in designated Fire Management Units (FMU). Fire management strategies will consider current landscape conditions and spatial and temporal components of the fire regime. Responses to wildland fires will be coordinated across jurisdictional boundaries.

Policy Statement	
Management Intent	**Implementation Actions**
4. Use of Wildland Fire Wildland fire will be used to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in its natural ecological role. Use of fire will be based on L/RMP and associated Fire Management Plans and will follow specific prescriptions contained in operational plans.	
Use planned and unplanned ignitions to achieve land and resource management goals. Fire management is one tool in the restoration process and should be integrated with other land management activities. Preference will be given for natural ignitions to be managed in meeting the role of fire as an ecological process. Decision support process encourages strategies to manage fire to restore and maintain the natural fire regime where safe and possible.	Incident objectives will identify resource objectives for wildfires managed to achieve resource objectives. Beneficial accomplishments will be measured through specific quantified objectives.
5. Rehabilitation and Restoration Rehabilitation and restoration efforts will be undertaken to protect and sustain ecosystems, public health and safety, and to help communities protect infrastructure.	
Conduct emergency stabilization of burned areas such that no further harm is done. Probability of success will be evaluated for rehabilitation and restoration efforts.	Burned areas will be assessed to determine suitable and effective emergency stabilization and rehabilitation needs to meet current and anticipated environmental conditions. Rehabilitation and restoration activities will be evaluated to assess effectiveness of treatments.
6. Protection Priorities The protection of human life is the single, overriding priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be done based on the values to be protected, human health and safety, and the costs of protection. Once people have been committed to an incident, these human resources become the highest value to be protected.	
Resources are allocated nationally, geographically, and locally based on protection priorities. Protection of human life overrides all other priorities should response capability limits be reached. Local protection priorities are established in the L/RMP and/or FMP.	NMAC establishes national protection priorities considering maintenance of initial attack capability; protection of communities, infrastructure, property, cultural and natural resources; costs; local agency objectives; and national response framework and tasking. Geographic and local area coordination groups will establish a process to set protection priorities. The Agency Administrator will convey protection priorities, based on the L/RMP and FMP, to the geographic and national groups through an incident status report and ensure that protection priorities are known and carried out by the incident commander(s).

Policy Statement	
Management Intent	**Implementation Actions**
7. Wildland Urban Interface The operational roles of federal agencies as partners in the Wildland Urban Interface are wildland firefighting, hazard fuels reduction, cooperative prevention and education, and technical assistance. Structural fire suppression is the responsibility of tribal, state, or local governments. Federal agencies may assist with exterior structural protection activities under formal Fire Protection Agreements that specify the mutual responsibilities of the partners, including funding. (Some federal agencies have structural protection authority for their facilities on lands they administer and may also enter into formal agreements to assist state and local governments with structural protection).	
Prevent the movement of wildfires from the wildlands into the WUI area, out of the WUI area into the wildlands, and improve efficiency of wildfire suppression in WUI situations. The primary responsibility for protecting private property and rural communities lies with individual property owners and local governments. Recognize that many states have wildland fire responsibility while rural fire districts have structural responsibility.	Agreements will be developed to clarify jurisdictional inter-relationships and define roles and responsibilities among local, state, tribal, and federal fire protection entities, based on each organization's enabling protection authorities and assistance/mutual aid responsibilities. Agencies will support the development and implementation of Community Wildfire Protection Plans (CWPP). The Federal wildland agencies will collaborate with tribal, state and local fire management organizations to identify and reconcile gaps in protection responsibility.
8. Planning Every area with burnable vegetation must have an approved Fire Management Plan. Fire Management Plans are strategic plans that define a program to manage wildland fires based on the area's approved land management plan. Fire Management Plans must provide for firefighter and public safety; include fire management strategies, tactics, and alternatives; address values to be protected and public health issues; and be consistent with resource management objectives, activities of the area, and environmental laws and regulations.	
Promote interagency and inter-governmental planning. Encourage landscape scale planning across jurisdictional boundaries.	The FMP should be interagency or intergovernmental in scope and developed on a landscape scale, where practical to take advantage of efficiency, reduce conflict and provide understanding and cooperation. L/RMP and/or FMPs will address the location and conditions under which resource benefits and protection objectives can be met.

Policy Statement	
Management Intent	**Implementation Actions**
9. Science Fire Management Plans and programs will be based on a foundation of sound science. Research will support ongoing efforts to increase our scientific knowledge of biological, physical, and sociological factors. Information needed to support fire management will be developed through an integrated interagency fire science program. Scientific results must be made available to managers in a timely manner and must be used in the development of land management plans, Fire Management Plans, and implementation plans.	
Increase the body of scientific knowledge and understanding about fire management programs through the development of management tools and transfer of knowledge to practitioners and decision makers. Social sciences are a part of the research need.	Agencies will integrate science in planning and monitoring processes. Agencies will coordinate fire-related research to improve fire management program capability. Agencies will emphasize applied science including fire and fuels, physics, social science, and operations research areas. Agencies will seek to improve decision support tools through updated data sets and advances in technology.
10. Preparedness Agencies will ensure their capability to provide safe, cost-effective fire management programs in support of land and resource management plans through appropriate planning, staffing, training, equipment, and management oversight.	
Recognize that particular budget processes and external influences will affect capability and capacity. Size the organization to meet realistic and sustainable management objectives by effective preparedness planning on an interagency basis. Realize efficiencies by incorporating other federal, tribal, state, and local agencies and nongovernmental organizations to meet peak demands for resources. Preseason agreements are an integral part of preparedness.	Agencies will identify and realign organizational staffing and equipment mixes to implement a safe and cost effective fire management program that meets the fire management guidance identified in the L/RMP. Agencies will develop a common process for determining budget needs and cost sharing for all aspects of fire management operations. Implement training program to meet staffing levels (qualification requirements) with the emphasis on managing fires for both protection and resource management objectives. Agencies will develop agreements to efficiently utilize other federal, state, local, and non governmental resources.

Policy Statement	
Management Intent	**Implementation Actions**
11. Suppression Wildland fires are suppressed at minimum cost, considering firefighter and public safety, benefits, and values to be protected, consistent with resource objectives.	
Suppression considerations will be addressed in L/RMP and FMP's. Notwithstanding protection of life, the cost of suppression, emergency stabilization and rehabilitation must be commensurate with values to be protected.	Use a decision support process to assess conditions, analyze risk and document decisions. Predictive services products will be used to support pre-positioning resources. Agencies will coordinate staffing levels through common trend analysis of environmental indicators
12. Prevention Agencies will work together and with their partners and other affected groups and individuals to prevent unauthorized ignition of wildfires.	
Prevention focuses on the activities needed to reduce human-caused ignitions. Prevention includes mitigating risks and loss to ecosystems and communities.	Agencies will work with all partners to develop and implement risk assessment, prevention, and mitigation plans to reduce the frequency of wildfires due to human–caused ignitions..
13. Standardization Agencies will use compatible planning processes, funding mechanisms, training and qualification requirements, operational procedures, values-to-be- protected methodologies, and public education programs for all fire management activities.	
All processes are compatible and transparent so that individuals from cooperating agencies (federal, tribal, state, and local) can more effectively work together. Enhance public and cooperator understanding of wildland fire management processes.	To the extent possible, agencies will use common standards in all aspects of fire management programs so that planning and budgeting methodologies applied in one situation will provide the same results in similar circumstances. Agencies will develop and implement common operational field guidance and operational procedures to deal with all aspects of fire management operations. Agencies will streamline interagency transfer of funds to reduce fiscal inconsistencies.
14. Interagency Cooperation and Coordination Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners.	
Involve all participating agencies, federal, tribal, state, local, and non-governmental organizations in fire management activities. Get everyone working in concert, rather than in opposition to each other.	Ensure that fire management program actions are implemented in collaboration with cooperators and affected partners with due consideration of all management objectives. Agencies will engage cooperators and affected partners at the strategic, and program planning levels, as well as the tactical, program implementation level.

Policy Statement	
Management Intent	**Implementation Actions**
15. Communication and Education Agencies will enhance knowledge and understanding of wildland fire management policies and practices through internal and external communication and education programs. These programs will be continuously improved through the timely and effective exchange of information among all affected agencies and organizations.	
Knowledge and understanding reach all personnel in the field, across agencies. Develop and provide consistent communication, education and outreach with shared messages for the public and internal staff. Have a public that understands the risk, benefits and complexity of wildland fire management.	Develop a consistent and uniform message using common terminology on importance and role of wildland fire in natural resource management. Develop understanding with the public on what we're trying accomplish with fire management. Build understanding with the public on their role when living and recreating in fire prone ecosystems.
16. Agency Administrator and Employee Roles Agency administrators will ensure that their employees are trained, certified, and made available to participate in the wildland fire program locally, regionally, and nationally as the situation demands. Employees with operational, administrative, or other skills will support the wildland fire program as necessary. Agency administrators are responsible and will be held accountable for making employees available.	
Employees participate in wildland fire operations to obtain understanding, expand capabilities, and increase organizational capacity. Assure that we maximize use of the local workforce for efficiencies of knowledge, cost and involvement. Maintain a competent and capable workforce to implement the wildland fire management program to include fuels, aviation, suppression, planning, monitoring, research, communication, finance, etc.	Agency administrators will train, qualify, and certify available personnel for local fire needs and interagency fire management priorities. Agencies will consider adjustment of annual performance expectations based on employee and program contribution to the fire effort.
17. Evaluation Agencies will develop and implement a systematic method of evaluation to determine effectiveness of projects through implementation of the 2001 Federal Fire Policy. The evaluation will assure accountability, facilitate resolution of areas of conflict, and identify resource shortages and agency priorities.	
Use adaptive management process to evaluate and improve the fire management program at all levels. Provide a formal review process to monitor and evaluate performance, suggest revisions, and make necessary adaptations to the implementation guidance at all organizational levels on a regular basis.	Conduct interagency, internal and periodic reviews of the fire management program (all agencies) to determine: 1) consistency of policy implementation; 2) effectiveness of interagency coordination; 3) progress towards ecosystem sustainability; 4) cost management; 5) safety.

Appendices

Appendix A: Glossary

The hierarchy of terminology will be those defined in law, those defined in policy, those defined in this guidance and then all other agency and interagency documentation. The NWCG Glossary of Wildland Fire Terminology will be maintained as the source of record.

Controlled burn – synonymous with Prescribed Fire.

Escaped Prescribed Fire – a prescribed fire that has exceeded or is expected to exceed prescription parameters or otherwise meets the criteria for conversion to wildfire. Criteria is specified in "Interagency Prescribed Fire – Planning and Implementation Procedures Reference Guide".

Fire Management Plan (**FMP**) **–** a plan that identifies and integrates all wildland fire management and related activities within the context of approved land/resource management plans. It defines a program to manage wildland fires (wildfire and prescribed fire). The plan is supplemented by operational plans, including but not limited to preparedness plans, preplanned dispatch plans, prescribed fire burn plans and prevention plans. Fire Management Plan's assure that wildland fire management goals and components are coordinated.

Initial Action – the actions taken by the first resources to arrive at a wildfire.

Land/Resource Management Plan (L/RMP) – a document prepared with public participation and approved by an agency administrator that provides general guidance and direction for land and resource management activities for an administrative area. The L/RMP identifies the need for fire's role in a particular area and for a specific benefit. The objectives in the L/RMP provide the basis for the development of fire management objectives and the fire management program in the designated area.

Planned Ignition –the intentional initiation of a wildland fire by hand-held, mechanical or aerial device where the distance and timing between ignition lines or points and the sequence of igniting them is determined by environmental conditions (weather, fuel, topography), firing technique, and other factors which influence fire behavior and fire effects (see prescribed fire).

Prescribed Fire—is a wildland fire originating from a planned ignition to meet specific objectives identified in a written, approved, prescribed fire plan for which NEPA requirements (where applicable) have been met prior to ignition (see planned ignition).

Protection - the actions taken to limit the adverse environmental, social, political, and economical effects of fire (FEC Briefing Paper, 3/14/2008).

Response to wildland fire - the mobilization of the necessary services and responders to a fire based on ecological, social, and legal consequences, the circumstances under which a fire occurs,

and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected.

Suppression - all the work of extinguishing a fire or confining fire spread.

Unplanned Ignition – the initiation of a wildland fire by lightning, volcanoes, unauthorized and accidental human-caused fires (see wildfire).

Use of Wildland Fire - management of either wildfire or prescribed fire to meet resource objectives specified in Land/Resource Management Plans.

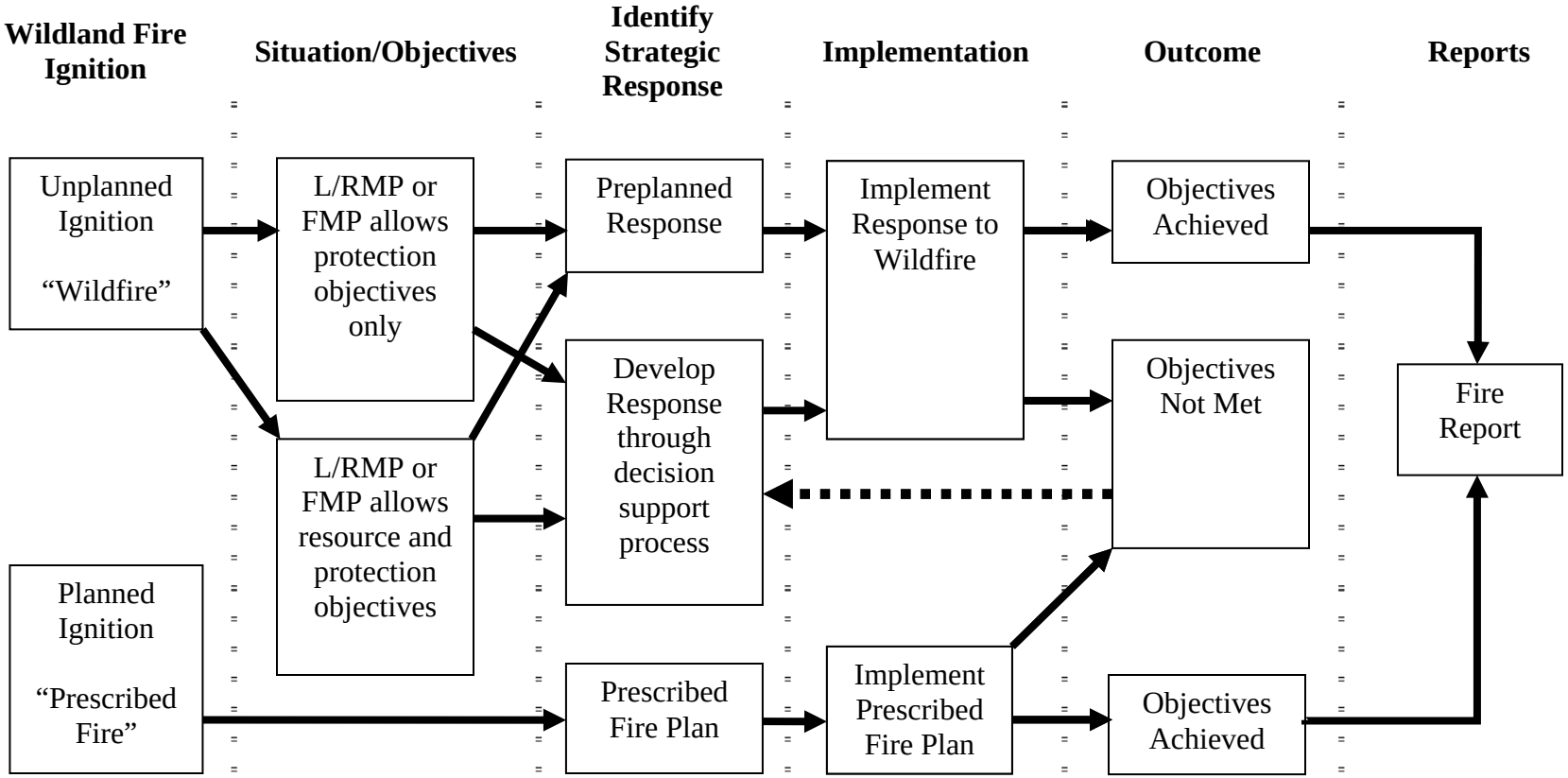
Wildfire – unplanned ignition of a wildland fire (such as a fire caused by lightning, volcanoes, unauthorized and accidental human-caused fires) and escaped prescribed fires.
(See unplanned ignition and escaped prescribed fire).

Wildland Fire – a general term describing any non-structure fire that occurs in the wildland.

Wildland Urban Interface (WUI) – The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetation fuels.

Appendix B: Wildland Fire Flowchart

This chart depicts, in general, the process to be taken given an ignition, regardless of source. Management actions depend on the provisions in the approved Land, Resource and Fire Management Plan and/or Fire Management Plan for an area. This chart is generally applicable to most agencies' fire management programs. However, specific exceptions may exist.



Appendix C: What Changed 2004 to 2009

The following provide some of the significant modifications that were made to the guidance in the "Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (2004)" in drafting the "Guidance for Implementation of Federal Wildland Fire Management Policy (2009)." To simplify the discussion the "Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (2004)" will be referred to as "Strategy" and the "Guidance for Implementation of Federal Wildland Fire Management Policy (2009)" will be referred to as "Guidance".

Strategy: Provided seven operational clarification statements

> Guidance: Provides nine statements of guidance for implementation.

Strategy: Operational Clarification statement 1) "Only one management objective will be applied to a wildland fire. Wildland fires will either be managed for resource benefits or suppressed. A wildland fire cannot be managed for both objectives concurrently. If two wildland fires converge, they will be managed as a single wildland fire."

> Guidance: "A wildland fire may be concurrently managed for one or more objectives and objectives can change as the fire spreads across the landscape. Objectives are affected by changes in fuels, weather, topography; varying social understanding and tolerance; and involvement of other governmental jurisdictions having different missions and objectives."

Strategy: Operational Clarification statement 2) "Human caused wildland fires will be suppressed in every instance and will not be managed for resource benefits.

> Guidance: "Initial action on human-caused wildfire will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety."

Strategy: Operational Clarification statement 3) "Once a wildland fire has been managed for suppression objectives, it may never be managed for resource benefit objectives."

> Guidance: "A wildland fire may be concurrently managed for one or more objectives and objectives can change as the fire spreads across the landscape. Objectives are affected by changes in fuels, weather, topography; varying social understanding and tolerance; and involvement of other governmental jurisdictions having different missions and objectives."

Strategy: Operational Clarification statement 4) "The Appropriate Management Response (AMR) is any specific action suitable to meet Fire Management Unit (FMU) objectives. Typically, the AMR ranges across a spectrum of tactical options (from monitoring to intensive management actions). The AMR is developed by using FMU strategies and objectives identified in the Fire Management Plan."

Guidance: The term Appropriate Management Response is removed from implementation guidance with "Response to Wildland Fire" as the policy area defining the actions for managing a wildland fire.

Strategy: Operational Clarification statement 5) "The Wildland Fire Situation Analysis process is used to determine and document the suppression strategy from the full range of responses available for suppression operations. Suppression strategies are designed to meet the policy objectives of suppression."

Guidance: "Managers will use a decision support process to guide and document wildfire management decisions. The process will provide situational assessment, analyze hazards and risk, define implementation actions, and document decisions and rationale for those decisions.

Strategy: Operational Clarification statement 6) "Wildland fire use is the result of a natural event. The Land/Resource Management Plan, or the Fire Management Plan, will identify areas where the strategy of wildland fire use is suitable. The Wildland Fire Implementation Plan (WFIP) is the tool that examines the available response strategies to determine if a fire is being considered for wildland fire use."

Guidance: "Managers will use a decision support process to guide and document wildfire management decisions. The process will provide situational assessment, analyze hazards and risk, define implementation actions, and document decisions and rationale for those decisions."

Strategy: Operational Clarification statement 7) "When a prescribed fire or a fire designated for wildland fire use is no longer achieving the intended resource management objectives and contingency or mitigation actions have failed, the fire will be declared a wildfire. Once a wildfire, it cannot be returned to a prescribed fire or wildland fire use status."

Guidance: "Managers will use a decision support process to guide and document wildfire management decisions. The process will provide situational assessment, analyze hazards and risk, define implementation actions, and document decisions and rationale for those decisions."

Strategy: Policy Implementation Flowchart

Guidance: Updated Appendix F: Wildland Fire Flowchart from Review and Update of the 1995 Federal Wildland Fire Management Policy (2001) to reflect implementation terminology of planned and unplanned ignitions. (See Appendix B)