YELLOWSTONE NATIONAL PARK
FIRE MANAGEMENT COMMITTEE REPORT

The Yellowstone National Park Fire Management Committee on
____________________19___, at______hours, to evaluate the
______________________ Fire, burning at UTM __________N X ________E
in the __________________ District.

The cause of the fire is:

_____ Lightning
_____ Human-caused
_____ Unknown

The fire is burning within the:

_____ Full Suppression Zone
_____ Conditional Fire Mgt Zone
_____ Prescribed Natural Fire Zone

The purpose of this meeting was to:

_____ Evaluate the fire for initial prescribed natural fire designation

_____ Recommend appropriate suppression response for a designated wildfire

_____ Reevaluate a prescribed natural fire

_____ Other:(specify)______________________________
____
____

The Committe recommendation to the Superintendent is:

____
____
____

Fire Management Committee Members present:

____________________ ____________________
____________________ ____________________
____________________ ____________________
____________________ ____________________

Submitted by:

______________________________________ ______________
Chief Ranger, Committee Chairman Date

Approved by:

______________________________________ ______________
Superintendent, Yellowstone Nat'l Park Date

1991

TRAINEE LIST

EAST ZONE OVERHEAD TEAM

TRAINEES ARE PRIORITIZED BY 1) POSITION AND 2) INDIVIDUALS

NAME	UNIT	WORK PHONE	HOME PHONE
FINANCE SECTION CHIEF (POSITION PRIORITY = 5)			
1- Becky Smith	BLM, Glasgow	228-4316	228-2180
2- Mary Figarelle	BLM, Lewistown	538-7461	538-7461
3- Lori Ankrum	FS, Custer	657-6361	
INCIDENT COMMANDER (POSITION PRIORITY = 6)			
1- Garry Williams	DSL, CLO	FTS 585-5475	443-2725
2- Larry Smith	FS, Custer	657-6361	248-5861
INCIDENT INFORMATION OFFICER (POSITION PRIORITY = 7)			
1- Kay Bugger	FS, Gallatin	FTS 585-4920	585-9721

Perimeter in Chains	1	2	3	4	5	6
	AREA IN ACRES					
1	.01	.01	.01	.01	.01	.01
2	.03	.02	.02	.02	.01	.01
3	.06	.05	.04	.04	.03	.02
4	.11	.10	.08	.06	.05	.03
5	.17	.15	.12	.10	.07	.05
6	.25	.22	.18	.14	.11	.07
7	.34	.29	.24	.20	.15	.10
8	.45	.38	.32	.26	.19	.13
9	.57	.49	.40	.32	.24	.16
10	.7	.6	.5	.4	.3	.2
12	1.0	.8	.7	.6	.4	.3
14	1.4	1.2	1.0	.8	.6	.4
16	1.8	1.5	1.3	1.0	.8	.5
18	2.3	1.9	1.6	1.3	1.0	.6
20	2.8	2.4	2.0	1.6	1.2	.8
22	3.4	2.9	2.4	1.9	1.4	1.0
24	4.0	3.5	2.9	2.3	1.7	1.2
26	4.7	4.1	3.4	2.7	2.0	1.3
28	5.5	4.7	3.9	3.1	2.3	1.6
30	6.3	5.4	4.5	3.6	2.7	1.8
32	7.2	6.1	5.1	4.1	3.1	2.1
34	8.1	6.9	5.8	4.6	3.5	2.3
36	9.1	7.8	6.5	5.2	3.9	2.6
38	10.1	8.7	7.2	5.8	4.3	2.9
40	11.2	8.6	8.0	6.4	4.8	3.2
42	12.	11.	9.	7.	5.	3.5
44	14.	12.	10.	8.	6.	4.
46	15.	13.	11.	8.5	6.	4.
48	16.	14.	11.5	9.	7.	4.5
50	17.	15.	12.	10.	7.	5.
60	25.	21.	18.	14.	11.	7.
70	34.	30.	25.	20.	15.	10.
80	45.	38.	32.	26.	19.	13.
90	57.	49.	40.	32.	24.	16.
100	70.	60.	50.	40.	30.	20.

TABLE OF FIRE AREAS

This table is to help you estimate the area of a fire. To use it, pace the distance around the fire in chains (1 chain = 66 feet), and determine the general shape of the fire. Then select the one column (1-6) which best fits the fire's shape. Read under the column, the acreage listed opposite the number of chains that you paced.

Explanation of columns representing shapes of fires:

1. Fire in the general shape of a circle.
2. Fire in the shape of either a square or rectangle which is not more than twice as long as it is wide with a moderately irregular perimeter.
3. Fire in the shape of a rectangle, about three times longer than it is wide. This column also gives the area of a triangle with a moderately irregular perimeter.
4. Fire in the shape of a rectangle about four times longer than it is wide and having a fairly irregular perimeter.
5. Fire which is long and narrow with an irregular perimeter.
6. Fire with two or three long fingers or a very irregular perimeter.

PRESENT FOREST OVERSTORY OF YELLOWSTONE NATIONAL PARK

These cover types were delimited on 1:15840 scale airphotos with numerous ground transects for control. The lodgepole pine series is a successional or age series with two possible outcomes: 1) LP4 is a stage just under the spruce-fir climax stage. 2) LP3 is a climax or near climax stage where poor, dry soils prevent or severely limit the growth of either Engelmann spruce or subalpine fir. Whitebarked pine often is codominant in older stands of this type.

ASP - Aspen (Populus tremuloides) stands.

DF - Stands dominated by Douglas-fir (Pseudotsuga menziesii), often in scattered islands in a nonforest matrix.

DF1 - Even-aged Douglas-fir (Pseudotsuga menziesii) stands where trees are younger and shorter than those of neighboring stands.

KH - Krumholtz stands consisting of dwarfed wind-shaped Engelmann spruce (Picea engelmannii), subalpine fir (Abies lasiocarpa), and whitebarked pine (Pinus albicaulis) stands, usually islands interspersed in nonforest at upper tree line.

LP0 - Recently burned where reforestation has not yet produced a closed canopy. Approximately 0-40 years post fire.

LP1 - Closed canopy of usually dense lodgepole pine (Pinus contorta) where trees are younger and shorter than those of neighboring stands. On outwash at West Yellowstone, it is islands of short trees next to islands of larger trees. Approximately 40-100 years post fire.

LP2 - Closed canopy dominated by lodgepole pine (Pinus contorta). Overstory still largely intact. Understory usually small to medium Engelmann spruce (Picea engelmannii) and subalpine fir (Abies lasiocarpa) seedlings and saplings. Approximately 100-300 years post fire.

LP3 - Canopy dominated by lodgepole pine (Pinus contorta) beginning to break up. Understory of lodgepole pine and whitebarked pine (Pinus albicaulis). Stands usually on rhyolite and multi-aged. When not on rhyolite, then canopy ragged, dominated by lodgepole pine with an Engelmann spruce - subalpine fir (Picea engelmannii - Abies lasiocarpa) understory. May be the result of past bark beetle attack. Three hundred plus years post fire.

LP4 - Canopy quite ragged, predominately of lodgepole pine (Pinus contorta) but containing some Engelmann spruce (Picea engelmannii), subalpine fir (Abies lasiocarpa), and whitebarked pine (Pinus albicaulis). Understory of small to large spruce and fir seedlings and saplings. Three hundred plus years post fire.

LPP - Lodgepole pine (Pinus contorta) pigmy forests found mostly on Madison Plateau. Multi-aged dwarfed lodgepole pine with a grass understory (height up to ten feet).

NF - All nonforested areas.

SF - Stands dominated by Engelmann spruce (Picea engelmannii) and subalpine fir (Abies lasiocarpa) in both overstory and understory. Lodgepole pine (Pinus contorta) may still be a significant component. Whitebarked pine (Pinus albicaulis) may be a significant component at high elevations.

WB - Stands dominated by mature whitebarked pine (Pinus albicaulis). May also contain considerable Engelmann spruce (Picea engelmannii), subalpine fir (Abies lasiocarpa), or lodgepole pine (Pinus contorta).

FIRE BEHAVIOR OF YELLOWSTONE'S FOREST TYPES

Several year's experience has shown that behavior of natural fires in Yellowstone is highly dependent on the amount of understory fuel available under the tree canopy. If the understory fuel is abundant and dense, extreme fire behavior is possible (i.e. crown fire); if the fuel is sparse, fire progress is slow to nonexistent. Fire brands falling into stands with abundant fuels have a greater opportunity to contact fuel and often result in torching and crowning. Fire brands falling into such stands burn small patches in the needles on the forest floor, occasionally torching a small tree or infrequent fir or spruce in the overstory.

Our forests are singularly lacking in shrubs; therefore fuels in the understory are provided by young trees. This makes the whole process highly dependent on time since last burn and local growing conditions.

The different growth characteristics of the tree species play a significant role in fire behavior. The pines, both whitebarked and lodgepole, are self-pruning trees. Small branches below the productive region of the crown (the upper 8-10 feet) die and fall off the tree. The needles are longer and more sparsely distributed. As the tree grows the crown becomes higher off the ground and does not accumulate much fuel in the easily burnable size classes. The sparse foliage and branching habit of the young lodgepoles in the understory do not provide much burnable fuel.

Spruce and fir on the other hand are not self-pruning. The lower branches simply grow longer forming a conical crown often continuous with fuels on the ground. The branches are generally smaller than those of pines. Fuels in the easily burnable size classes accumulate throughout the life of the tree. When the tree dies a large brush pile results. These concentrations are important as ladder fuels and for providing support from below for crown fires.

Following is a description of each type followed by a discussion of the fire behavior to be expected. The LP series (LP0 - LP4) which accounts for about 80 percent of the forests is generally a successional series with LP3 and LP4 forming endpoints of two branches caused by different growing conditions. The LP3 types are on poor sites where lodgepole pine is either climax or a long persisting successional stage almost lacking an understory. LP4 is the subclimax stage on good sites that are becoming spruce-fir forests.

LP0: Recently burned forests where reforestation has not yet produced a closed canopy. These stands are approximately 0-40 years old.

Fuels in this type consist mostly of forbs and grasses and rotten logs. Sound logs begin to rot and seeds germinate immediately after a fire. As time goes on the number of rotten logs, tree seedlings, and saplings increases. Under normal moisture conditions only the rotten logs burn, predrying and burning some of the herbaceous growth next to them. Occasional small trees or clumps of small trees burn if fuel conditions at their base are just right. If the fire brand rain is heavy enough, most of the rotten logs will burn. Under very dry conditions (drought) the herbaceous growth may dry enough to carry a flaming front. With the right wind and moisture conditions, fire spread through this type is possible though rare. Fire starts are moderately common in this type because of the rotten wood.

LP1: Doghair lodgpole pine stands usually of shorter stature than those neighboring it. Understory nonexistant and forest floor vegetation very sparse. Rotten logs from previous forest may still be present on the forest floor. Stands are usually 50 to 150 years old.

Fuels here are nearly all in the crowns of the doghair lodgepole. The compact needle litter is difficult to burn. Under normal fire season moisture this type is nearly unburnable. Fire brands may find an occasional rotten log and burn out a small spot. Under very dry conditions with high winds fire will spread through the canopy if a crowning fire reaches the stand. Fire spread however will stop when the wind ceases. There are no fuels to get the fire back into the canopy * even if the wind should return. Fire starts in this type are very rare to nonexistent.

LP2: Closed canopy dominated by lodgepole pine. Overstory still largely intact. Understory usually consists of Engelmann spruce and subalpine fir seedlings and saplings up to eight feet tall. Stands are usually 150 to 300 years old.

This type can be considered a transitional type between the almost unburnable LP1 and the highly burnable LP4. At either extreme the stands mapped as LP2 may behave somewhat like the other types. However modal stands (stands halfway between the endpoints) will have their own behavior characteristics. Fuels in this type are largely herbaceous or low shrubs like grouse whortleberry. Under normal conditions this type is very difficult to burn. The understory vegetation stays moist enough to retard fire spread. Very few rotten logs are available. Under very dry conditions the herbaceous growth may carry the fire. Fire spread however is very slow because the canopy keeps wind from reaching the flames. If a good understory of globe huckleberry develops and trees killed by barkbeetles begin to fall and contribute to understory fuels, crowning is possible. In the older stands sufficient young trees may be on hand to allow crowning. Barkbeetle kill is common in this type;however experience has shown that it affects fire behavior very little. The red crowns are much drier than the green crowns but

Crowning is still dependent on the ladder fuels or understory fuels. Fire starts are rare in this type.

LP4: Canopy quite ragged, predominately of lodgepole pine but containing some Engelmann spruce, subalpine fir, and whitebarked pine. Understory of small to large spruce and fir seedlings and saplings. Stands are usually more than 300 years old.

Fuels in this type are right for burning. Young trees contribute to understory fuels and fuels continuous with the overstory. Spruce and fir trees are scattered among the overstory and may contribute to the dead and down fuels in the understory. On the better growing sites, globe huckleberry may also contribute significantly to the fuels. Lichen accumulations in older trees contribute to the fuel load and flashibility of the trees. Lightning strikes and other fire brands find an easily burnable substrate in these crowns. The bulk of the extreme fire behavior takes place in this type. Under normal moisture conditions this type burns. If winds are present, crowning and spotting are nearly inevitable. Without winds, torching occurs. Under dry conditions local crowning and smoke column development is possible even without wind. Spotting is very common and is the largest contributor to fire spread. Under wet conditions these stands allow fires to smoulder and persist although spread is minimal. Deep litter and duff accumulations and rotten logs protected from precipitation by overstory trees provide sites where fires can persist even for several weeks. Most fires start in this type.

LP3: Multi-aged overmature stands that are beginning to break up. Overstory is dominated by lodgepole pine with some whitebarked pine present. Understory of lodgepole pine and whitebarked pine. Stands usually on rhyolite or other dry soils. Stands are more than 300 years old.

Fuels in this type are sparse. Growing conditions are poor. Lodgepole pine forms the overstory and most of the understory. Herbs and small shrubs are widely scattered. Under normal conditions this type burns very poorly. Under dry, windy conditions local areas may burn and spots may develop into local crowning where a fire brand finds the odd concentration of understory fuels producing a very spotty burn. Spread through this type is rare. Fire starts are also rare.

SF: Stands dominated by Engelmann spruce and subalpine fir in both overstory and understory. Lodgepole pine may still be a significant component. Whitebarked pine may be a significant component at high elevations. This type is not common. The successional stage just prior to this type is so burnable that few stands survive to this stage. Most SF stands mapped occur in moist areas with supplemental ground water.

Fuels are often abundant in this type. Grass, herbs, and shrubs are common as well as all age classes of spruce and fir trees. However they are usually wet. Late in the season, dead vegetation may dry out sufficiently to carry a fire. In the late fall, physiological processes of the trees preparing them for winter may bring fuel moisture down to a burnable state. Under normal moisture conditions this type is wet enough to retard fire spread. Under very dry conditions the supplemental water may dry up and leave a high fuel load in a dry condition which would be able to burn quite well.

WBO: Recently burned whitebarked pine (Pinus albicaulis) stands, usually near upper timberline.

Fuels of this type are like those of LPO therefore fire behavior is similar.

WB1: Even-aged whitebarked pine (Pinus albicaulis) stands where trees are younger and shorter than those of neighboring stands.

Fuels of this type are similar to LP1 stands, therefore fire behavior is also quite similar. These are all high elevation stands and only rarely do they dry out enough to burn. On the rare dry year, fire spread is retarded by this type. Fire starts are not known.

WB: Stands dominated by mature whitebarked pine (Pinus albicaulis). May also contain considerable Engelmann spruce (Picea engelmannii), subalpine fir (Abies lasiocarpa), or lodgepole pine (Pinus contorta).

Fuels of this type are similar to either LP2 or LP4; therefore fires behave similarly to those types. These are high elevation types and only dry out on very dry years. Extreme fire behavior is possible on those years with crowning and spotting especially in those stands where spruce and fir trees form a significant understory.

DF1: Even-aged Douglas-fir (Pseudotsuga menziesii) stands where trees are younger and shorter than those of neighboring stands.

The fuels of this type are similar to LP1 and fire behavior can be assumed to be similar. More unpruned dead branches on the tree trunks and higher lichen accumulations may contribute some to dead, dry fuels. Rotten logs may also be more common. This type however is not common in the park and therefore not a significant contributor to fire behavior.

DF: Stands dominated by Douglas-fir (Pseudotsuga menziesii), often in scattered islands in a nonforest matrix.

The understory fuels of this type consist mostly of pine grass with a variety of other herbs. Snowberry or ninebark may contribute significantly in the shrub layer. The bark and needles of the trees do not burn as readily as those of the other species; therefore fire spread in those fuels is slower. Under normal to dry conditions underburning may occur. Where a dense understory of young trees has developed, crowning is possible.

United States
Department of
Agriculture

Forest Service

**Intermountain
Forest and Range
Experiment Station**

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Photo Guides for Appraising Downed Woody Fuels in Montana Forests:

How They Were Made

William C. Fischer

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Photo Guides for Appraising Downed Woody Fuels in Montana Forests:
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ABSTRACT

Eight series of color photographs have been published as three separate photo guides for appraising downed woody fuels in Montana forests. This note tells how these photo guides were constructed. The techniques used to determine the weight and size class distribution of downed woody fuels are given. The procedure used to rate potential fire behavior of the fuel shown in each photo is explained.

KEYWORDS: forest fuels, fuel appraisal

Fuel appraisal (Anderson 1974) is an important fire management task. It is a basic consideration when dispatching initial attack forces for fire suppression and an essential element for planning fuel management activities. Fuel appraisal also provides a basis for developing and evaluating fire management alternatives as part of land management planning.

Forest fuels can be appraised using techniques varying in precision of results and cost of application. Some techniques are suited to application over large areas while others are best applied to small areas. The photo guides described herein are proposed for application at the forest stand level. Precision is unknown but is expected to be intermediate when compared to other fuel appraisal techniques. Precision is probably higher for estimates of fire potential than it is for estimating fuel loads. Cost of application can vary from low to intermediate. This note describes the procedure used to construct the photo guides for appraising downed woody fuels in Montana forests (Fischer 1981a, 1981b, 1981c).

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[1]Research Forester, located at Intermountain Station's Northern Forest Fire Laboratory, Missoula, Montana.

PHOTO GUIDE CONSTRUCTION

The general procedure as well as many of the techniques used to construct the photo guides are similar to those proposed by the USDA Forest Service (1973) and used by Koski and Fischer (1979) and Maxwell and Ward (1976a, 1976b). There are, however, important differences. The above-cited photo series deal with recently created slash fuels while the photo guides described here deal primarily with fuels resulting from natural processes such as wind, snow, insects, disease, and competition for light and moisture; old logging and thinning slash is also included since it is now a part of the natural fuel complex. Another difference is the method used to predict potential fire behavior. Maxwell and Ward (1976a, 1976b) used the old Rate of Spread-Resistance to Control fuel type rating. Koski and Fischer (1979) used Rothermel's (1972) mathematical model. For the guides described here, experienced judgment of fuel and fire behavior experts is used to evaluate fire behavior potential.

Location of Camera Points

Camera points were located in recently undisturbed forest stands. Large blocks of such stands were sought out and camera points established to reflect the different fuel conditions found in each forest cover type present in the drainage.

Layout of Photo Plots

The area within the field of view of a camera installed at the camera point essentially defined the photo plot. For fuel inventory purposes, three transects were established in the photo plot. These transects had a common beginning at the photo point (fig. 1). The location and length of the transects were determined with the aid of the camera used to photograph the plot. The procedure followed to lay out the plot and its transects was:

1. Set up tripod over the camera point.

2. Mount camera on tripod.

3. Composed desired photo on the camera focusing screen or through the camera viewfinder. Lock camera in this position.

4. Install plot marker (fig. 2) 20 ft (6.10 m) in front of the center of the field of view.

5. Extend a straight line from the camera point, through the plot marker, to farthest point where surface fuels can still be discerned on the camera focusing screen or through the camera viewfinder (fig. 1). Mark this point with a stake.

6. Establish right and left transects by running lines from the camera point to the right and to the left edge of the camera's field of view (fig. 1). Transect length was the same as determined for the center transect. Mark both points with stakes.

While the transect length within a plot was the same, it did vary between plots. Transect length depended on the camera's ability to discern surface fuels. Consequently, transect length will vary with amount of undergrowth and other factors affecting the visibility of the forest floor. Transect length varied between 50 and 100 ft (15.2 and 30.5 m), but more often than not it was about 70 ft (21.3 m).

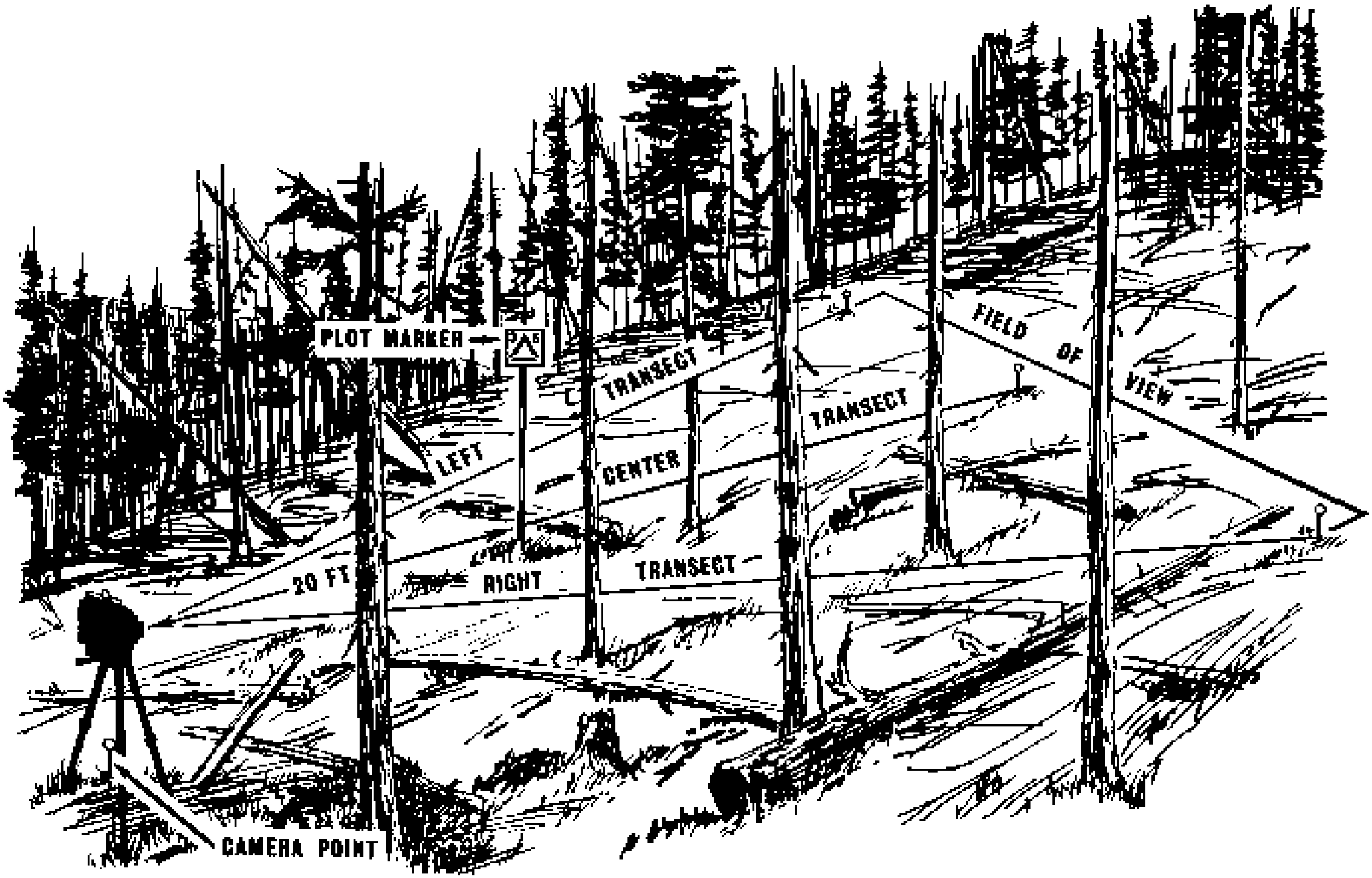

Figure 1.--Location of transects on photo plot.

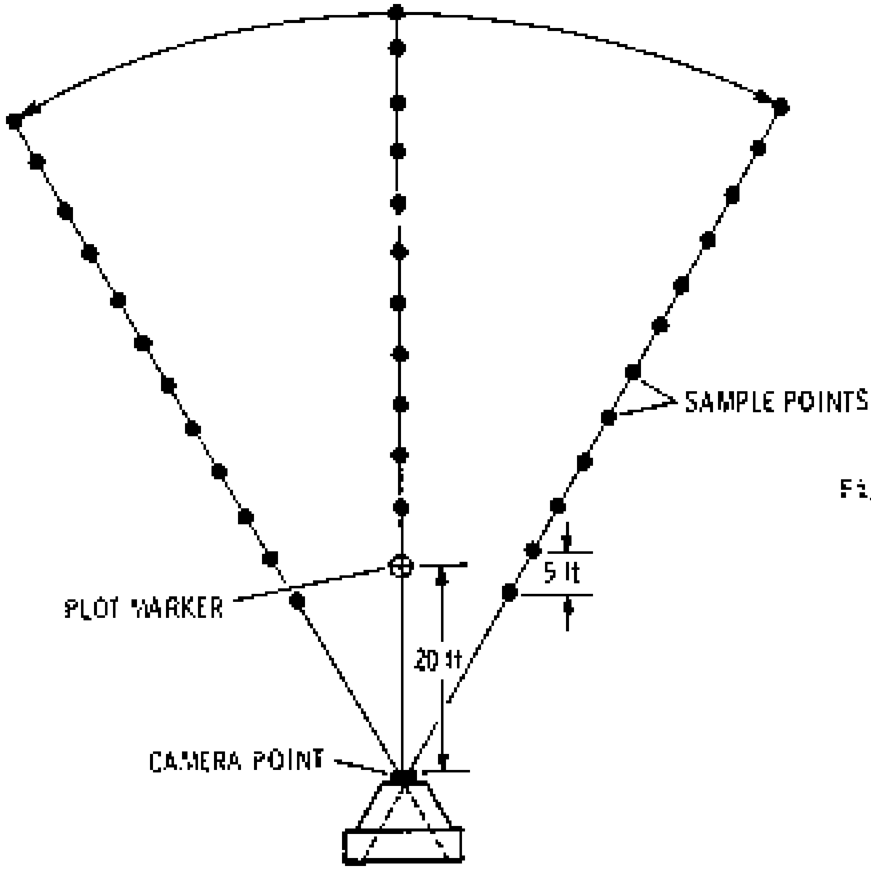

Figure 2.--Location of sampling points on photo plot.

Photographing the Plot

All photography of the plot was done with the camera mounted on a tripod installed over the camera point. Identical photos were taken of each plot using color print film, black and white print film, and color slide film. A Pentax[2] 35 mm camera with a wide-angle (35 mm) lens was used for color slides. Kodak Ektachrome-X film (ASA 64) and High Speed Ektachrome (ASA 160) was used most often for color slides. A Mamiya 6X7 cm shutter-type SLR camera with a 50 mm lens produced the prints. The Mamiya allowed interchanging film holders, which facilitated getting both color and black and white photos with the same camera. About 25 of the plots were photographed using Rolliflex cameras, one loaded with color film and one with black and white film. Both produced satisfactory prints. Color slides also produced satisfactory color prints. Kodak Vericolor II Professional Type S 120 roll film (ASA 100) was used for color prints, and Kodak Tri-X Pan 120 roll film (ASA 400) for black and white prints.

The sequence for photographing the plots was:

1. Set up tripod over the camera point and mount roll film camera on it. (The roll film camera was always used first so the photo could be composed on its focusing screen rather than through the viewfinder of the 35 mm camera.)

2. Compose photograph and lock camera in position.

3. Install plot marker with correct plot number.

4. Lay out plot as indicated in previous section.

5. Take photos using color print film and then black and white print film.

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[2]The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an offical endorsement or approval by the U.S. Department of Agriculture of any product or service to the exclusion of others which may be suitable.

6. Remove camera from tripod and install 35 mm camera in its place.

7. Center camera using plot marker as a guide.

8. Take photo using color slide film.

9. Remove plot marker and take the camera and tripod down.

Plot layout and photography was usually done separately from plot inventory. That is, one crew did the photography and layout while another crew followed behind doing the data collection. Consequently, plot location was recorded on a map and the camera point and transect end point (stakes) were well marked with a flagging tape. The route from the road to the camera point was also well marked with flagging tape.

PLOT INVENTORY

The following information was collected at each plot by the inventory crew:

1. Forest cover type as defined by the Society of American Foresters (1954).

2. Montana forest habitat type as defined by Pfister and others (1977). Pfister's field form was used for this purpose.

3. Age of overstory dominants using an increment borer.

4. Elevation using a barometer.

5. Aspect using a compass.

6. Fuel loading by size class, duff depth, average diameter of fuels 3 inches (7.62 cm) or greater in diameter, percent rotten for 3-inch (7.62-cm) or greater diameter fuels, and volume of sound material 3 inches (7.62 cm) or greater in diameter.

The fuel inventory field procedure developed by Brown (1974) was used to obtain all of the above-mentioned fuel information. Fuel inventory points were installed along each of the three transects established during plot layout (fig. 1). The first point along each transect was installed 20 ft (6.10 m) from the camera point. Additional points were located at 5 ft (1.52 m) intervals along each transect (fig. 2). This design resulted in from 20 to 40 sample points per photo plot. Sampling plane lengths used at each point were as follows:[3]

Fuel size class	Sampling plane length
0-0.25 inch (0-0.64 cm)	4 ft (1.22 m)
0.25-1.00 inch (0.64-2.54 cm)	4 ft (1.22 m)
1.00-3.00 inches (2.54-7.62 cm)	8 ft (2.44 m)
3.00 inches or greater (7.62 cm or greater)	20 ft (6.10 m)

Sampling plane direction was random but kept within the photo plot. That is, sampling plane direction at points along the right and left transects was always kept to the left and right of these lines respectively. This, and locating the first point on each transect 20 ft (6.10 m) from the camera point, insured that the fuel inventory reflected only what was seen by the camera.

[3]Personal communication, James K. Brown, Northern Forest Fire Laboratory, Missoula, Mont.

The downed fuel inventory field sheet developed by Brown (1974) was used to record fuel data collected on each plot (fig. 3).

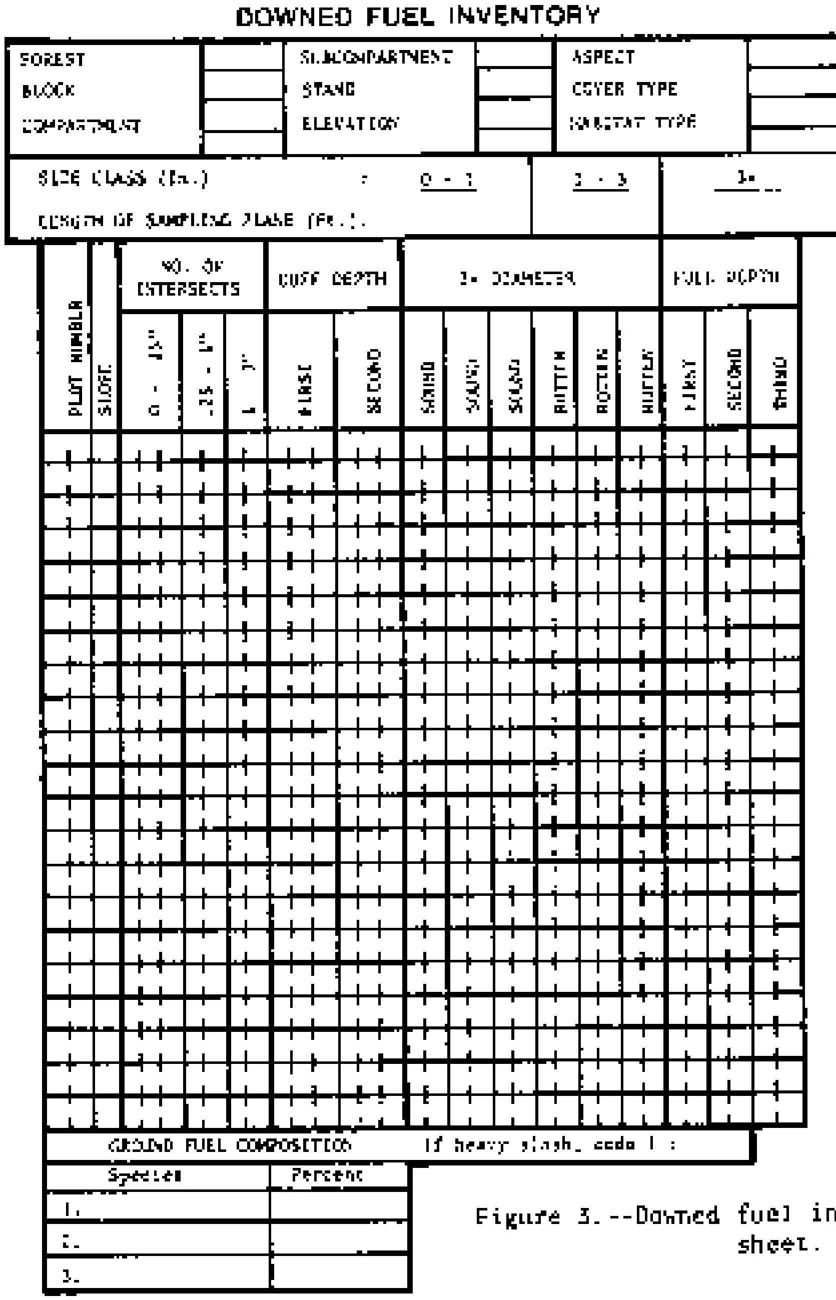

Figure 3.--Downed fuel inventory field sheet.

Fire Potential Rating

Each plot was rated in terms of its potential fire behavior for an "average bad" fire weather situation. The assumed fire weather situation was: temperature - 85° to 90° F (29° to 32° C), relative humidity - 15 to 20 percent, windspeed - 10 to 15 mi/h (17 to 26 km/h), and last measurable rain - 4 weeks ago.

Five elements of fire behavior were rated: rate of spread, intensity, torching, crowning, and resistance to control. In addition, an overall fire potential rating was assigned to each plot. The rating was subjective. Managers and researcher with experience in prescribed fire and fire control assigned adjective ratings according to the following definitions:

Rate of Spread

Nil--fire cannot sustain itself.

Low--spread will be slow and discontinuous.

Medium--uniform spread possible but can be stopped by aggressive ground attack with hand tools.

High--spread will be rapid; indirect attack on fire front may be required for control.

Extreme--spread will be explosive; little chance of control until weather changes.

Intensity

Nil--fire cannot sustain itself.

Low--cool fire; very little hot spotting required for control.

Medium--fire will burn hot in places; aggressive hot spotting with hand tools likely to be successful.

High--too hot for sustained direct attack with hand tools; aerial tankers or large ground tanker required to cool fire front.

Extreme--direct ground attack not possible; air or ground tanker attack likely to be ineffective.

Torching

Nil--no chance of torching.

Low--occasional tree may torch-out.

Medium--pole-sized understory trees likely to torch-out.

High--most of understory and occasional overstory trees likely to torch-out.

Extreme--entire stand likely to torch-out.

Crowning

Nil--sustained spread in crowns will not occur.

Low--sustained spread in crowns unlikely.

Medium--some crowning likely but will not be continuous.

High--sustained crowning likely.

Extreme--sustained crowning will occur.

Resistance to Control Action

Nil--no physical impediments to line building and holding.

Low--occasional tough spots but not enough to cause serious line building and holding problems.

Medium--hand line construction will be difficult and slow but dozers can operate without serious problems.

High--slow work for dozers, very difficult for hand crews; hand line holding will be difficult.

Extreme--neither dozers nor hand crews can effectively build and hold line.

Overall Fire Potential

Nil--fire will not sustain itself.

Low--fire can be easily controlled by several smokechasers with hand tools.

Medium--aggressive crew-sized (6-10) persons initial attack required for successful control.

High--aggressive crew-sized (25 persons) initial attack with substantial reinforcement required for successful control; 10 percent chance that control action will fail.

Extreme--90 percent chance that control action will fail.

Mathematical models designed to predict fire spread and intensity were not used to evaluate fire potential. Existing mathematical models assume uniform and continuous fuels. Such conditions are the exception rather than the rule in recently undisturbed forest stands in Montana.

All fire potential ratings were done in the field at the photo plot. Most plots were rated by three to five people. A few plots were rated by only two people and some by as many as six. A total of 27 different raters participated. Ratings were, however, done individually without consultation among the raters. The field sheet used by the raters is shown in figure 4.

The fire potential rating method used in developing the photo guides is not without precedent in the Northern Rocky Mountains. It is in many ways a refinement of the time-tested concept of fuel rating introduced more than 40 years ago by L. G. Hornby (1936).

Data Analysis and Summary

Fuel inventory data were analyzed and summarized using the computer program DFINV.[4] Fire potential ratings assigned to each plot by the different raters were averaged to obtain a single set of ratings for the plot. This was done by assigning the following values to each objective rating:

Nil - 1

Low - 2

Medium - 3

High - 4

Extreme - 5

If the average value was halfway between two ratings, it was rounded up or down depending on remarks entered by raters on the field sheet (fig. 4).

---

[4]Johnston, Cameron M., July 1975. Downed woody material inventory computer program write-up. On file at Northern Forest Fire Laboratory, Missoula, Mont. Program is located at the USDA Computer Center, Fort Collins, Colo., and is available to all who have access to this facility.

FIRE POTENTIAL EVALUATION STUDY RATING SHEET

STAND NO. ______________

DATE ______________

RATER ______________

INSTRUCTIONS: Circle Appropriate Rating and Give Your Reason(s)

1. RATE OF SPREAD: Nil Low Medium High Extreme
   WHY? ____

2. INTENSITY: Nil Low Medium High Extreme
   WHY? ____

3. TORCHING: Nil Low Medium High Extreme
   WHY? ____

4. CROWNING: Nil Low Medium High Extreme
   WHY? ____

5. RESISTANCE TO CONTROL ACTION (Physical - Not Intensity):
   Nil Low Medium High Extreme
   WHY? ____

6. OVERALL HAZARD: Nil Low Medium High Extreme
   COMMENTS: ____

Figure 4.--Field sheet for rating fire potential.

National fire danger rating system fuel models were assigned by evaluating the photograph in terms of the fuel model descriptions provided by Deeming and others (1977). Similarly, stylized fuel models were assigned according to the fuel model descriptions provided by Albini (1976). Fire ecology group assignment was based on the grouping of Montana habitat types (Pfister and others 1977) developed by Davis and others (1980).

Plot data and information were summarized on a data sheet (fig. 5) that accompanies each photo in the guides. Fuel loadings are recorded to the nearest 0.1 ton/acre for all size classes. Actually, reasonable significant figures for loading are:

-- the nearest 0.1 ton/acre for loading less than 10 tons/acre,

-- the nearest 1.0 ton/acre for loadings between 10 and 50 tons/acre, and

-- the nearest 5.0 tons/acre for loadings greater than 50 tons/acre.

DATA SHEET

Stand No. 352

FOREST COVER TYPE. SAF NO. 218, Lodgepole pine

MONTANA HABITAT TYPE: NO. 720, Subalpine fir/blue huckleberry (ABLA/VAGL)

DOWN & DEAD WOODY FUEL LOADINGS

Size Class (inches)	Weight T/ac	Weight kg/m²
0-0.25	0.3	0.07
0.25-1	1.2	0.27
1-3	5.1	[illegible]
Subtotal 0-3	6.6	1.48
3-6	4.3	0.96
6-10	[illegible]	0.25
10-20	0	0
20+	0	0
Subtotal 3+	5.4	1.21
Total	12.0	2.69

NFDRS FUEL MODEL	STYLIZED FUEL MOD. Albini (1976)
H/G	8/10

OTHER FUEL DATA

Average duff depth: 2.4 in
6.10 cm
Average diameter, 3+ fuels
3.9 in
9.65 cm
Percent rotten, 3+ fuels: 15 %
Volume of sound 3+ fuels:
360 ft³/ac
25.[illegible] m³/ha

STAND AND SITE DATA

AGE of overstory dominants:
PICO 123 yrs.

Average slope: [illegible] %
Aspect: Northwest
Elevation: [illegible] ft [illegible] m
Fire Ecology Group Seven
Remarks:

ESTIMATED FIRE POTENTIAL

Based on an average bad day:
85-90° temp., 15-20% R.H., 10-15 m/h wind, 4 week since rain

Rate of spread	Medium
Intensity	Low
Torching	Low
Crowning	Low
Resistance to control	Low
Over all Fire Potential	Low

STAND LOCATION

National Forest: Lewis and Clark
Ranger District: White Sulphur Springs
Drainage. Fourmile Creek

Photo taken: 8/10/75
By: W. C. Fischer

Figure 5.--Plot photo and accompanying data sheet.

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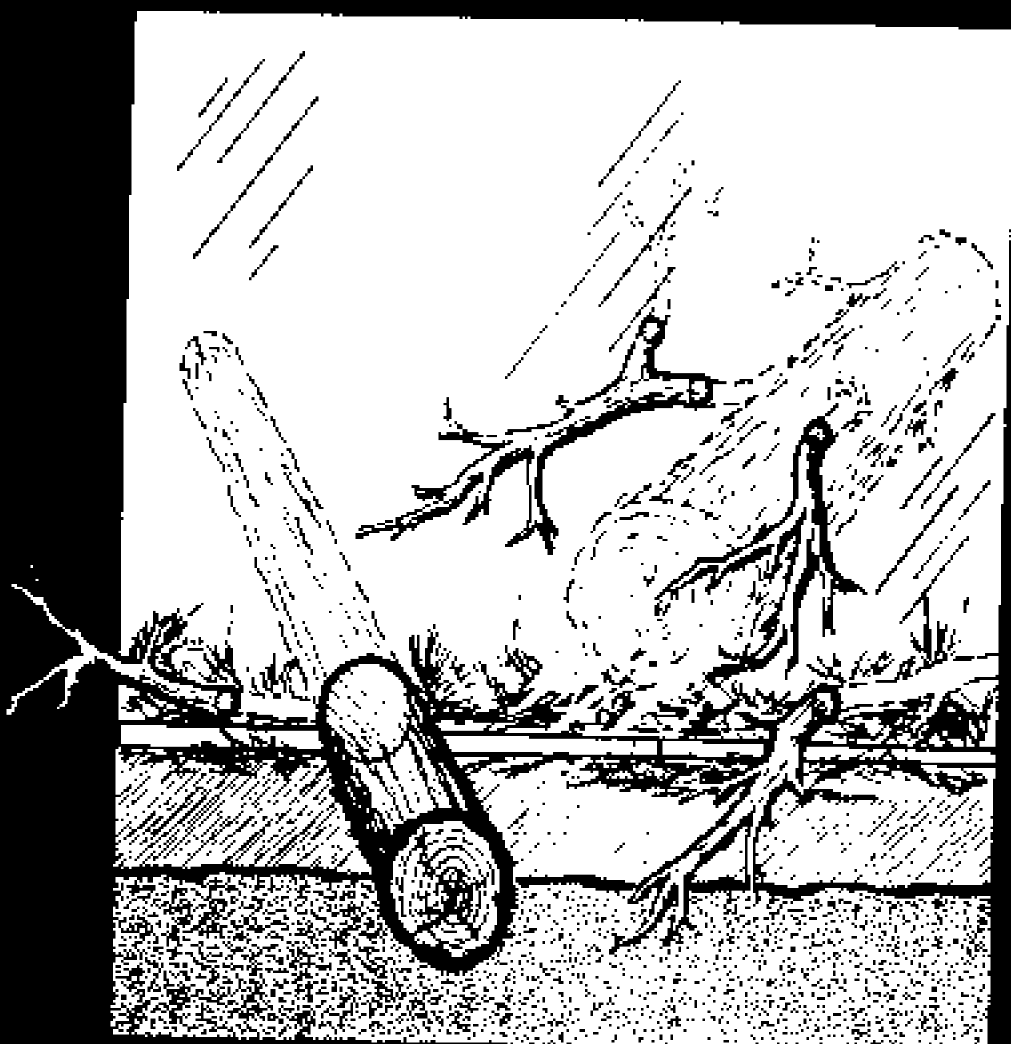
HANDBOOK FOR INVENTORYING DOWNED WOODY MATERIAL

James K. Brown



USDA Forest Service General Technical Report INT-16, 1974
INTERMOUNTAIN FOREST & RANGE
EXPERIMENT STATION
Ogden, Utah 84401

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September 1974

HANDBOOK FOR INVENTORYING DOWNED WOODY MATERIAL

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Forest Service
U.S. Department of Agriculture
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JAMES K. BROWN received his bachelor's degree from the University of Minnesota in 1960, his master's from Yale University in 1961, and his Ph.D. from the University of Michigan in 1968, all in forestry. From 1961 to 1965 he did research on field measurement of fuel properties and fire-danger rating systems while with the Lake States Forest Experiment Station. In 1965 he transferred to the Northern Forest Fire Laboratory, Missoula, Montana, where he is responsible for research on the physical properties and inventory of fuel.

CONTENTS

ABSTRACT

To facilitate debris management, procedures for inventorying downed woody material are presented. Instructions show how to estimate weights and volumes of downed woody material, fuel depth, and duff depth. Using the planar intersect technique, downed material is inventoried by 0- to 0.25-inch, 0.25- to 1-inch, and 1- to 3-inch diameter classes; and by 1-inch classes for sound and rotten pieces over 3 inches. The method is rapid and easy to use and can be applied to naturally fallen debris and to slash. The method involves counting downed woody pieces that intersect vertical sampling planes and measuring the diameters of pieces larger than 3 inches in diameter. The piece counts and diameters permit calculation of tons per acre.

OXFORD: 431

KEYWORDS: fire causes (forest), fuel inventory, forest fuels, debris, planar intersect method, sampling methods.

INTRODUCTION

This Handbook tells how to inventory weights, volumes, and depths of downed woody material. Downed woody material is the dead twigs, branches, stems, and boles of trees and brush that have fallen and lie on or above the ground. This material is usually called slash or logging debris if man creates it by cutting; it is called fuel, natural debris, or detritus if it accumulates without cutting.

Inventorying downed woody material can help land managers practice fuel management, plan for prescribed fire, and estimate utilization potential. For example, undesirable fuel hazards can be identified and plans made for hazard reduction. Fire behavior in wilderness areas can be predicted to aid in implementing let-burn fire policies. The volume of downed fiber can be estimated to plan for sales, removal, and utilization. Managers can communicate in exact terms about their debris problems.

The inventory can be done to provide all or any part of the following information:

1. Weights and volumes per acre of downed woody material for
   a. Diameter size classes of 0 to 0.25, 0.25 to 1, and 1 to 3 inches; and
   b. Diameters of 3 inches and larger for sound and rotten conditions.
2. Average diameter of debris larger than 3 inches.
3. Depth of fuel and forest floor duff.

This Handbook applies most accurately in the western United States because it contains average particle diameters for western conifers; however, the procedures are appropriate for forests everywhere. The inventory procedures are rapid and easy to use. For average amounts of downed debris, about 5 to 6 minutes per sample point are required for the measurements. More time is usually spent in traveling and locating sample points than in making the measurements. If only downed woody material is inventoried, a two-man crew can complete 20 to 40 plots a day, depending on how much debris is present.

The inventory of volumes and weights is based on the planar intersect technique (Brown 1971; Brown and Roussopoulos 1974), which has the same theoretical basis as the line intersect technique (Van Wagner 1968). The planar intersect technique involves counting intersections of woody pieces with vertical sampling planes that resemble guillotines dropped through the downed debris. Volume is estimated; then weight is calculated from volume by applying estimates of specific gravity of woody material. The planar intersect technique is nondestructive and avoids the time-consuming, costly, and often impractical task of collecting and weighing large quantities of forest debris.

Woody pieces less than 3 inches in diameter are tallied by size classes. Pieces 3 inches and larger are recorded by their diameters. Size classes of 0 to 0.25, 0.25 to 1, and 1 to 3 inches were chosen for tallying intersections because:

1. The class intervals provide the most resolution for fine fuels and are small enough to permit precise estimates of volume.

2. They correspond, in increasing size, to 1-, 10-, and 100-hour average moisture timelag classes for many woody materials (Fosberg 1970). [These are standard moisture timelags used in the National Fire-Danger Rating System (Deeming and others 1972).]

Inventory chosen areas as follows:

1. Decide on length of sampling planes and number of sample points.

2. Complete the fieldwork.

3. Calculate weight or volume, size, and depth of debris.

NUMBER AND SIZE OF SAMPLING PLANES

Choose sampling plane lengths from the following tabulation:

Downed material	*Diameter of debris*		
	0-1 in	*1-3 in*	*>3 in*
	Sampling plane (ft)		
Nonslash (naturally fallen material)	6	10-12	35-50
Discontinuous light slash	6	10-12	35-50
Continuous heavy slash	3	6	-15-25

For any area where estimates are desired, 15 to 20 sample points should be located using the sampling plane lengths shown in the tabulation. This sampling intensity will often yield estimates having standard errors within 20 percent of the mean estimates. Areas larger than approximately 50 acres that contain a high diversity in amount and distribution of downed material should be sampled with more than 20 points. If material larger than 3 inches in diameter is scanty or unevenly distributed, the longer sampling planes in the tabulation should be used.

The amount and distribution of downed woody material vary greatly among and within stands. Thus, these sampling recommendations should be considered approximate because a greater or fewer number of plots may be required to furnish adequate precision for any given area. Sampling intensities are discussed further in Appendix I.

FIELD PROCEDURES

Locating Sample Points

Locate plots systematically; two methods are:

1. Locate plots at a fixed interval along transects that lace regularly across a sample area (uniform sampling grid). For example, on a sample area, mark off parallel transects that are 5 to 10 chains apart. Then along the transects locate plots at 2- to 5-chain intervals.

2. Locate plots at a fixed interval along a transect that runs diagonally through the sample area. To minimize bias, have the transect cross obvious changes in fuels. Before entering the sample area, determine a transect azimuth and distance between plots.

Sample Point Procedures

Step 1: *Mark the sampling point* with a chaining pin (No. 9 wire or similar item). Avoid disturbing material around the point. Accurate estimates require measurements of undisturbed material. If standing tree measurements (d.b.h. and height) are a part of the inventory, measure downed material first.

Step 2: *Determine direction of sampling plane* by tossing a die to indicate one of six 30° angles between 0° and 150° (fig. 1). The 0° heading is the transect direction. Turn a fixed direction, such as clockwise, to position the sampling plane. As an alternative for indicating direction of the sampling plane, use the position of the second hand on a watch at a given instant. To avoid bias in placement of the sampling plane, do not look at the fuel or ground while turning the interval.

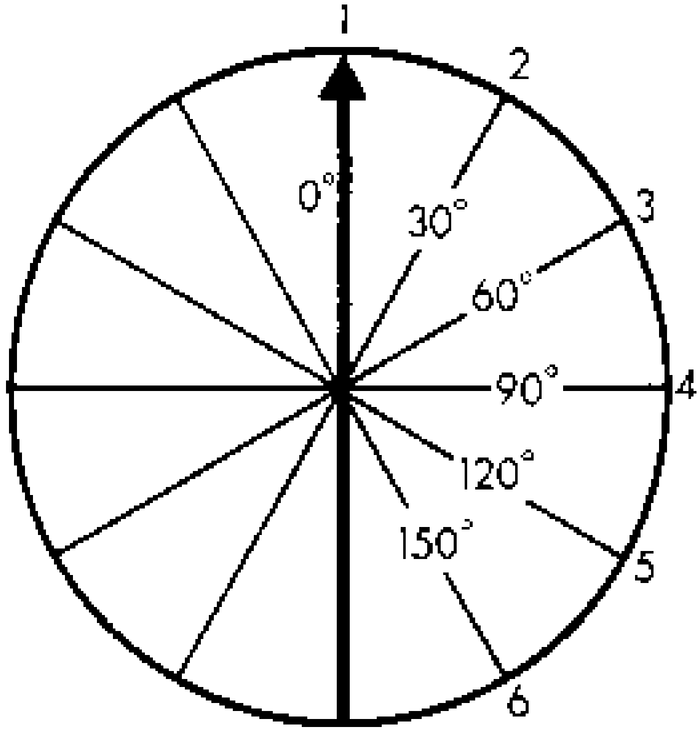


Figure 1.--Locating sampling plane by using die to pick one of six directions.

Step 3: *Denote position of the sampling plane* by running a tape or string out from the sampling point *parallel to the ground* in the direction determined in Step 2 (fig. 2). Extend the tape to the length of the longest sampling plane. A fiberglass rod or 1/2-inch aluminum tube placed along the string beginning at the sampling point facilitates counting pieces less than 1 inch in diameter. The rod should be 6 feet long, the length of sampling plane for small particles. The tape and rod fix the position of vertical sampling planes.

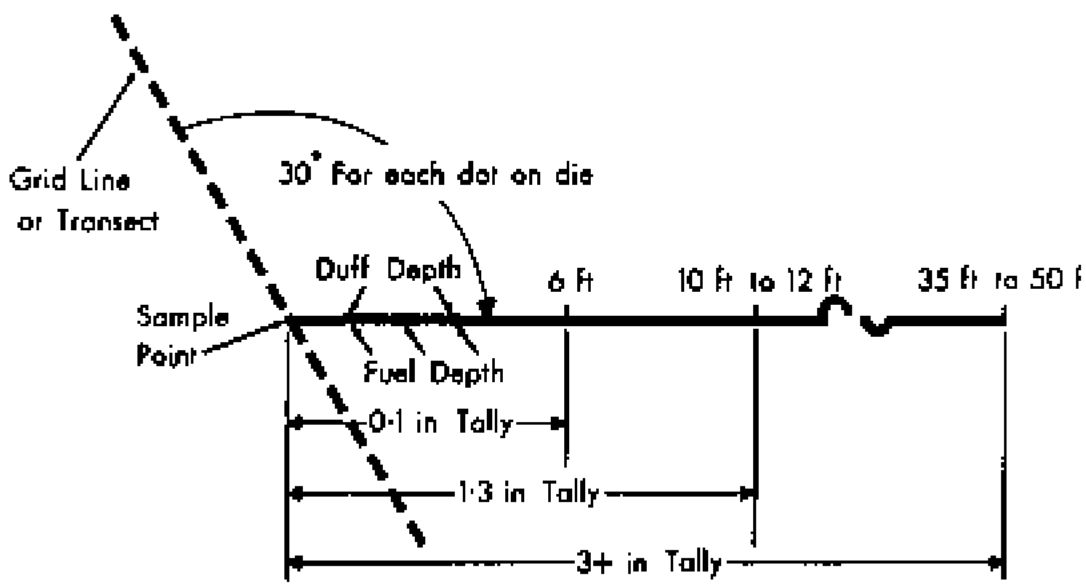


Figure 2.--Top view of sampling plane and location of fuel depth measurements.

Step 4: *Measure or estimate slope* by sighting along the sampling plane from the sample point using an Abney level or similar device. Ample precision is the nearest 10 percent, which can be coded using one digit (10 percent = 1, 90 percent = 9, etc.).

Step 5: *Tally the number of particles* that intersect the sampling plane by the following size classes:

0 to 0.24 inch (0 to 0.6 cm)

0.25 to 0.99 inch (0.6 to 2.5 cm)

1.0 to 2.99 inches (2.5 to 7.6 cm)

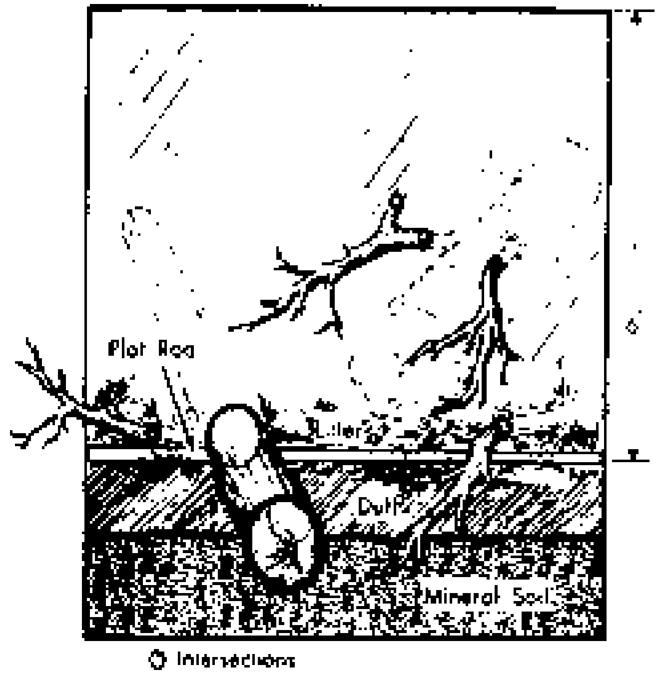
The intersections can be counted one size class at a time or "dot tallied," which takes slightly longer than counting (see sample data form, page 14).

The actual diameter of the particle at the point of intersection determines its size class. A go-no-go gage with openings 0.25 inch, 1 inch, and 3 inches works well for separating borderline particles into size classes and for training the eye to recognize size classes (fig. 3).

The vertical plane is a plot. Consequently, in counting particle intersections, it is very important to visualize the plane passing through one edge of the plot rod and terminating along an imaginary fixed line on the ground. *Once visualized on the ground, the position of the line should not be changed while counting particles* (fig. 4). See tally rules for qualifying particles.

Figure 3.--Diameter of the intersected twig is checked with a go-no-go gage. The plot rod marks the sampling plane.

Figure 4.--The sampling plane is exactly defined by one edge of the plot rod.



Step 6: *Take three measurements of dead fuel depth.* Record depth as the vertical distance from the bottom of the litter layer to the highest intersected dead particle for each of three adjacent 1-foot-wide vertical partitions of the sampling plane (fig. 5). Litter is the surface layer of the forest floor and consists of freshly fallen leaves, needles, twigs, bark, and fruits. Begin the vertical partitions at the sample point. Record to the nearest whole inch.

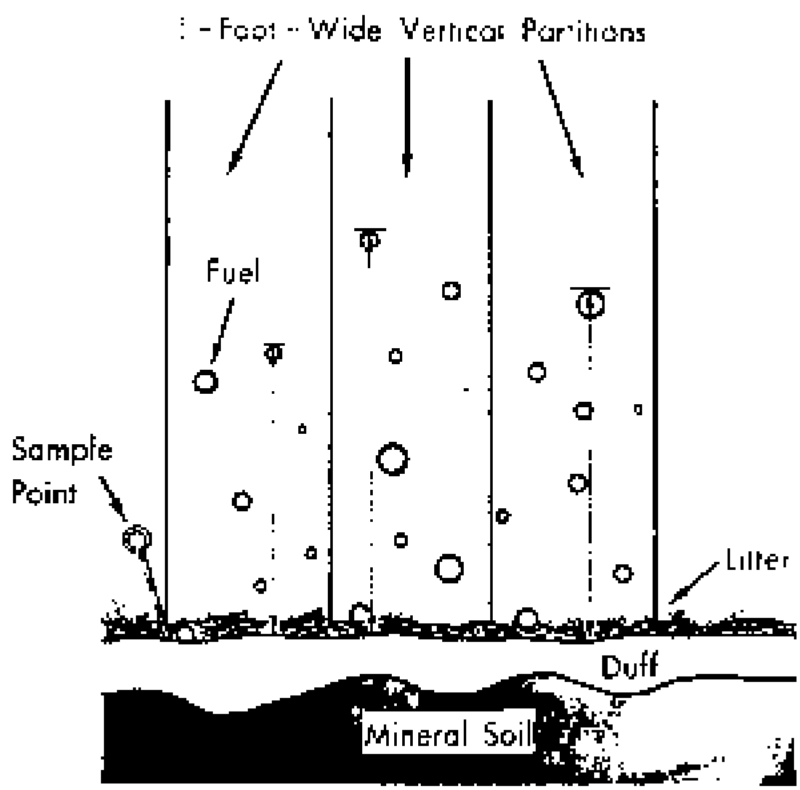


Figure 5.--Cross section of a fuel bed. Depth is measured along the arrows in each 1-foot-wide partition.

Depth should be measured from only those particles included in the inventory for loading. For example, particles acceptable for measurement by the planar intersect technique are also acceptable for determining depth. If other techniques are used to estimate weight per acre of grass and forbs, this vegetation would also qualify for determining depth.

Step 7: *Measure vertical depth of duff* to the nearest 0.1 inch using a ruler along the sampling plane at two points: (1) 1 foot from the plot center; and (2) a fixed distance of 3 to 5 feet from the first measurement.

Duff is the fermentation and humus layers of the forest floor. It does not include the freshly cast material in the litter layer. The top of the duff is where needles, leaves, and other castoff vegetative material have noticeably begun to decompose. Individual particles usually will be bound by fungal mycelium. When moss is present, the top of the duff is just below the green portion of the moss. The bottom of the duff is mineral soil.

Carefully expose a profile of the forest floor for the measurement. A knife or hatchet helps but is not essential. Avoid compacting or loosening the duff where the depth is measured.

When stumps, logs, and trees occur at the point of measurement, offset 1 foot perpendicular to the right side of the sampling plane. Measure through rotten logs whose central axis is in the duff layer (fig. 6).

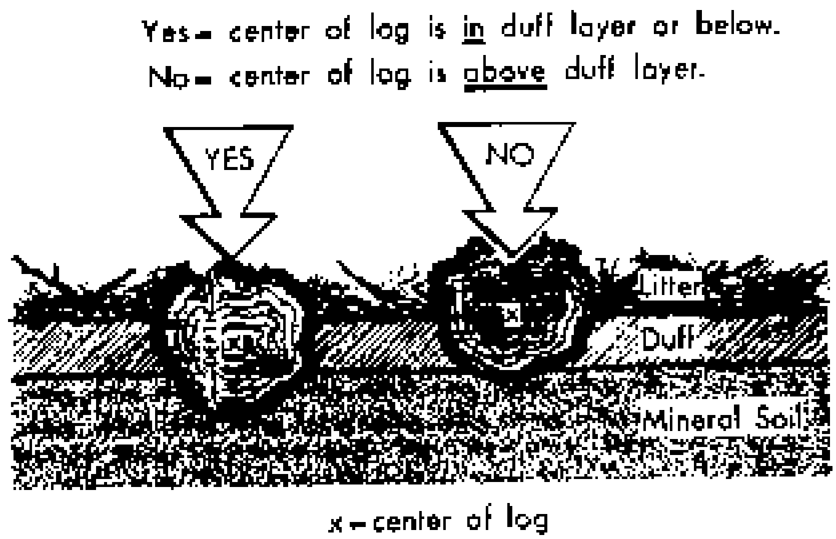


Figure 6.--Duff depth is measured through a rotten log when its central axis lies in or below the duff.

Step 8: *Measure or estimate the diameters* of all pieces 3 inches in diameter and larger that intersect the sampling plane. Measure the diameters at the point of intersection to the nearest whole inch.

Record diameters separately for rotten and nonrotten pieces. Consider pieces rotten when the piece at the intersection is obviously punky or can be easily kicked apart.

A ruler laid perpendicularly across a large piece of fuel works satisfactorily for measuring diameter. Be sure to avoid parallax in reading the ruler. Calipers also work well for measuring diameter. A diameter tape, however, is unsatisfactory for pieces in contact with the ground.

Use as many consecutive lines on the data form (see page 14) as necessary to record diameters.

Step 5: *For the entire sample area, record the predominant species of the 0- to 1-inch-diameter branchwood.* An average diameter for the 0- to 0.25-inch, and 0.25- to 1-inch size classes will be selected from this information. If several species comprise the downed debris, estimate the proportion of the two or three most common species. Base this estimate on a general impression of what exists on the sample area and record as percentages of total 0- to 1-inch branchwood. Or, for a slight reduction in accuracy, omit this step and in the calculations use an average diameter for a composite of species (page 16).

TALLY RULES

The following rules apply to downed woody pieces of all diameters:

1. Particles qualifying for tally include *downed, dead* woody material (twigs, stems, branches, and bolewood) from trees and shrubs. Dead branches attached to boles of standing trees are omitted because they are not *downed* vegetation. Consider a particle downed when it has fallen to the *ground* or is severed from its original source of growth. Cones, bark flakes, needles, leaves, grass, and forbs are not counted. *Dead woody stems and branches still attached to standing brush and trees are not counted.*

2. Twigs or branches lying in the litter layer and above are counted. However, they are not counted when the intersection between the central axis of the particle and the sampling plane lies in the duff (forest floor below the litter) (fig. 7).

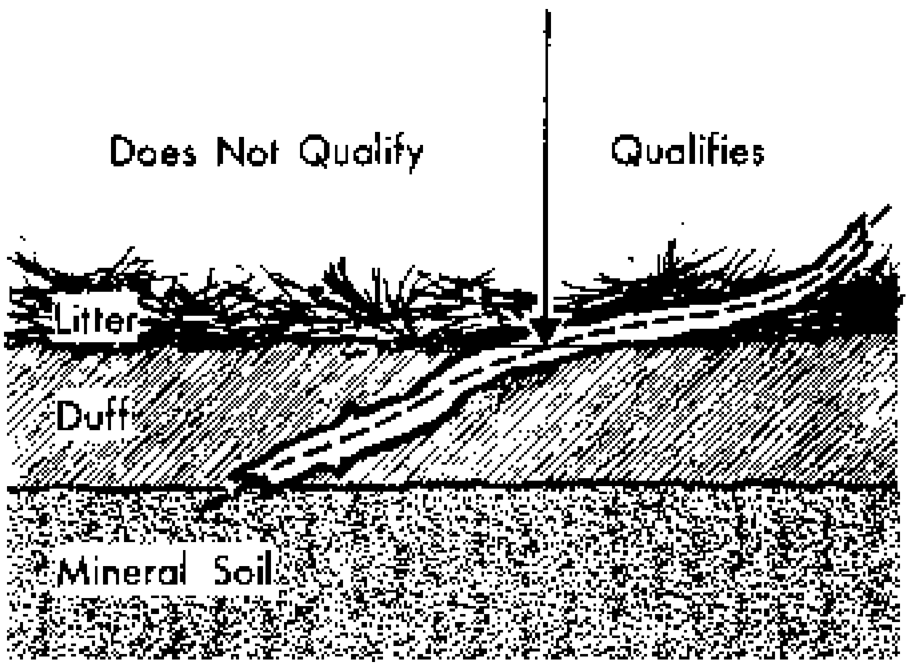


Figure 7.--Regardless of size, pieces are tallied only when intersection lies in and above the litter (right of arrow).

3. If the sampling plane intersects the end of a piece, tally only if the central axis is crossed (fig. 8). If the plane exactly intersects the central axis, tally every other such piece.

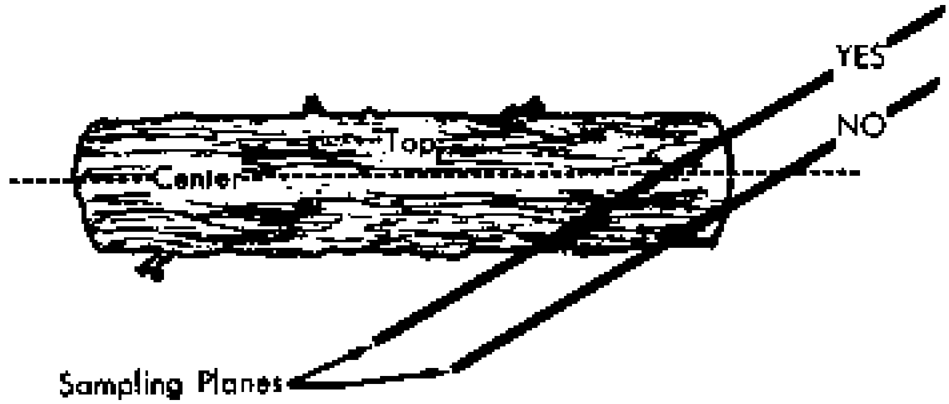


Figure 8.--An intersection at the end of a branch or log must include the central axis to be tallied.

4. Don't tally any particle having a central axis that coincides perfectly with the sampling plane. (This should rarely happen.)

5. If the sampling plane intersects a curved piece more than once, tally each intersection (fig. 9).

Figure 9.--Count both intersections for a curved piece.

6. Tally wood slivers and chunks left after logging. Visually mold these pieces into cylinders for determining size class or recording diameters.

7. Tally uprooted stumps and roots not encased in dirt. For tallying, consider uprooted stumps as tree boles or individual roots, depending on where the sampling planes intersect the stumps. Do not tally undisturbed stumps.

8. For rotten logs that have fallen apart, visually construct a cylinder containing the rotten material and estimate its diameter. The cylinder will probably be smaller in diameter than the original log.

9. Be sure to look up from the ground when sampling because downed material can be tallied up to any height. A practical upper cutoff is about 6 feet. However, in deep slash it may be necessary to tally above 6 feet.

When standing trees are inventoried along with downed material, it is necessary to fix a limit above the ground for sampling downed material. An upper limit helps define a downed tree so that inventory of standing and downed materials will not overlap.[1]

HEAVY SLASH OPTIONS

1. A yardstick attached to a Jacob's staff is useful for marking the sampling plane and speeds the counting of small particles (fig. 10). Erect the Jacob's staff at the sample point. Aline the yardstick with the direction of the sample plane and level it using an attached bubble level.

Figure 10.--A yardstick or meter stick attached to a Jacob's staff defines the sampling plane in heavy slash.

2. In areas with considerable slash, sampling efficiency is improved by ocularly estimating the number of 0- to 0.25-inch intersections and actually counting the number of intersections at a subsample of points. The ocular estimates are adjusted using the ratio of ocular estimates-to-actual counts. This method, incorporating 3P sampling, is described in detail by Beaufait and others (1974).

[1] In the USDA Forest Service Northern Region, a rule has been established that a stem is "downed" and thus qualifies for tallying when the intersection of the sampling plane and central axis is 6 feet or less from the ground. If the midpoint of the bole is more than 6 feet above ground for trees encountered in fixed and variable radius plots, they are inventoried as "standing."

5. For each sampling plane, estimate the proportion of 0- to 1-inch-diameter branchwood to the nearest 10 percent for the three most common species.

UTILIZATION OPTIONS

For pieces over 3 inches in diameter, the following additional measurements can be useful for describing utilization potential:

1. Species
2. Length of piece
3. Diameter at large end
4. Degree of checking, rot, and other defects that apply to the entire piece.

Field Equipment

Item	*Use*
1. Hand compass	Transect and plot layout.
2. Gaming die	Random orientation of sampling planes.
3. 50-foot tape or string and one chaining pin	Delineate the sampling planes.
4. Plot rod	Delineate sampling planes and if calibrated, measure fuel depth.
5. Go-No-Go gage (fig. 11)	Determine size class of borderline particles.
6. 1-foot ruler or steel pocket tape	Measure duff depth and diameters of pieces over 3 inches. Fuel depth could be measured with steel pocket tape.
7. Hypsometer with percent scale	Slope measurement.
8. Sample forms	Record data.
9. For slash: Jacob's staff with attached yard or meter stick and level	Delineate sampling plane for counting small particles.

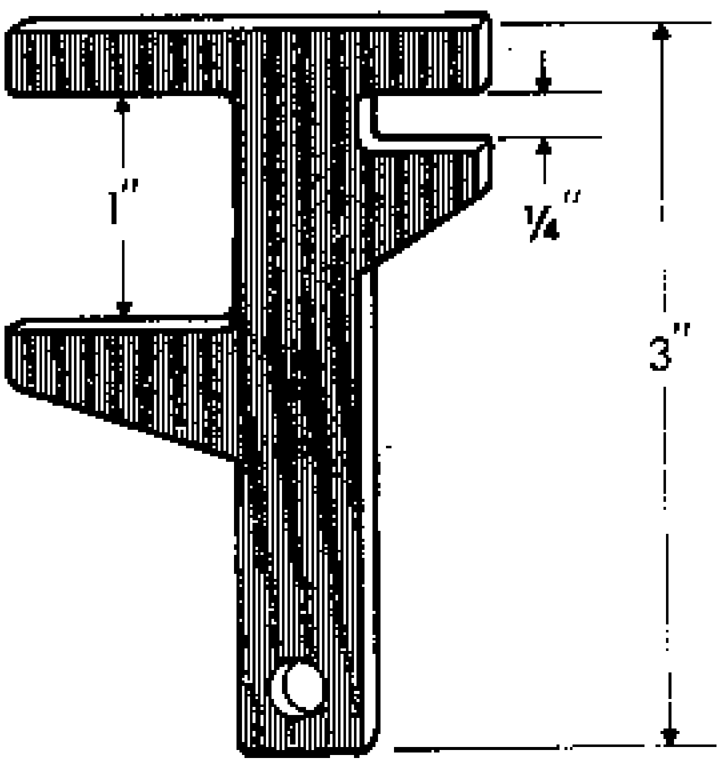


Figure 11.--A Go-No-Go gage can be cut from 1/16 or 1/8-inch sheet aluminum. Cut the notches slightly tight and file smooth to final dimensions.

CALCULATIONS

The calculations can be readily processed by computer[2] and are also easy using a desk calculator. Sample calculations are shown in figures 12 and 13. For a given stand or sample area, fill in the computation summary sheet as follows:

1. Calculate the average slope correction factor (c) using slope correction factors for each sampling plane. Look up the correction factors in table 1 or compute them by:

$$c = \sqrt{1 + \left(\frac{\text{Percent slope}}{100}\right)^2}$$

No slope correction is needed for samples taken using the Jacob's staff.

Table 1.--*Slope correction factors for converting weight/acre on a slope basis to a horizontal basis*

Slope	Correction factor	Slope	Correction factor
Percent	*c*	*Percent*	*c*
0	1.00	60	1.17
10	1.00	70	1.22
20	1.02	80	1.28
30	1.04	90	1.35
40	1.08	100	1.41
50	1.12	110	1.49

[2] Card punching instructions and a FORTRAN program for computing the inventory results are available upon request from the Northern Forest Fire Laboratory, Drawer G, Missoula, Montana 59801.

DOWNED FUEL INVENTORY

[illegible]		[illegible]		ASPECT	
[illegible]		STAND		COVER TYPE	
[illegible]		ELEVATION		HABITAT TYPE	

SIZE CLASS (In.) :	0 - 1	1 - 3	3+
LENGTH OF SAMPLING PLANE (Ft.) :	6	10	35

Plot No.	Slope	No. of intersections			Duff depth		3+ diameter						Fuel depth		
		0 - 1/4	1/4 - 1	1 - 3	First	Second	Sound	Sound	Sound	Rotten	Rotten	Rotten	First	Second	Third
1	3	14	7	3	1.1	1.7	1.0	3	8			2.5	1.0	0	3
1									12						
2	5	8	2	0	.3	7						1.2	1.8	7	2

GROUND FUEL COMPOSITION — If heavy slash, code 1:

Species	Percent
1.	
2.	
3.	

Figure 12.--Sample data form.

DOWNED WOODY MATERIAL COMPUTATION SUMMARY

FOREST: ____________ COMPARTMENT: ____________ STAND: ____________

Formulas to compute tons/acre:

(A) 0- to 3-inch material: $= \frac{11.64 \times n \times d^2 \times s \times a \times c}{Nl}$

(B) 3+-inch material : $= \frac{11.64 \times \Sigma d^2 \times s \times a \times c}{Nl}$

Size class	Constant	n	d^2	s	a	c	Nl	Tons/acre	
0 - .25	11.64	52	.0151	.48	1.15	1.08	12	.275	I
.25 - 1	11.64	11	.289	.48	1.13	1.08	12	1.81	II
1 - 3	11.64	3	2.76	.40	1.13	1.08	20	2.35	III
		Σd^2 for 3+							
3+ Sound	11.64	317		.40	1.0	1.08	70	22.8	IV
3+ Rotten	11.64	769		.30	1.0	1.08	70	41.4	V
				3+ Sound & Rotten = IV + V =				64.2	VI
				Total = I + II + III + VI =				68.6	VII

	Sum of 3+-inch diameters	Number of pieces	Average diameter
Sound :	33	4	8.25 in.
Rotten :	37	2	18.5 in.

Sum of duff depths : 4.5 in.

Number observations : 4

Average duff depths : 1.1 in.

Sum of fuel depths : 40 in.

Number observations : 6

Average fuel depths : 6.7 in.

Figure 12.--Computation summary sheet. The input values are from figure 12.

Σd^2 separately for sound and rotten categories. To obtain weights or volumes for certain diameter ranges (3 to 9 inches, for example), compute Σd^2 for the specified range.

8. Calculate the sum of diameters for all intersected pieces 3 inches and larger (calculate sound and rotten materials separately).

9. Calculate the sum of all measurements for duff depth.

10. Calculate tons/acre, using formulas on the computation sheet (fig. 13).[5] If desired, calculate volumes:

$$\text{Cubic feet per acre} = \frac{32.05 \times \text{tons per acre}}{\text{Specific gravity}}$$

11. Calculate average diameters of intersected pieces 3 inches and larger.

12. Calculate average fuel depth and duff depth as the sum of the depths divided by the number of measurements.

13. Appendix III shows how to calculate needle quantities in slash.

When inventorying large areas that hold many species it is practical to use composite values and approximations for diameters, specific gravities, and nonhorizontal corrections. For example, a timber management and downed-debris inventory in the Northern Region of the USDA Forest Service utilizes composite average diameters, composite average nonhorizontal correction factors, and best approximations for specific gravities.

For the Northern Region inventory, the formulas in figure 13 simplify to:

1. 0- to 0.25-inch size class: $w = 0.09533\ nc/N\ell$

2. 0.25- to 1-inch size class: $w = 1.935\ nc/N\ell$

3. 1- to 3-inch size class : $w = 14.52\ nc/N\ell$

4. 3+-inch sound : $w = 4.656\ \Sigma d^2 c/N\ell$

5. 3+-inch rotten : $w = 3.492\ \Sigma d^2 c/N\ell$

where:

w = weight, tons/acre.

[5]The formulas incorporate an insignificant bias because n, Σd^2, and c are totaled separately. Summing $n \times c$ or $\Sigma d^2 \times c$ over all plots would eliminate the biases; however, this is unnecessarily troublesome.

FURTHER APPLICATIONS

If only debris larger than 3 or 4 inches in diameter is to be inventoried, the line intersect technique described by Howard and Ward (1972) and Bailey (1969) might be more appropriate than the planar intersect method, especially in logging slash. The line intersect method employs a few long sampling planes; the planar intersect method employs many small sampling planes. If debris both greater than and less than 3 or 4 inches in diameter must be inventoried, the planar intersect technique is more efficient. The planar intersect technique can also be coordinated with other measurements of vegetation taken on plots (for example, an inventory of timber volume).

The procedures in this Handbook can be applied to downed debris in areas other than the western United States by assuming or measuring average diameters for the three size classes of particles. Average diameters have been determined for red pine (*Pinus resinosa*), jack pine (*Pinus banksiana*), and oak (*Quercus* spp.) (Brown and Roussopoulos 1974). A convenient method for estimating slash weights of several Lake States tree species has been reported by Roussopoulos and Johnson (1973).

If fire behavior is to be mathematically modeled using models such as Rothermel's (1972), weights of other fine fuels such as needle litter, dead grass, and dead forbs also should be determined by sampling or by extrapolating from existing information. Sampling for quantities of grass, forbs, and litter requires methods other than the planar intersect technique (USDA Forest Service 1959; Brown 1966; Hutchings and Schmautz 1969).

Because practical methods of inventory have been lacking in the past, accumulations of downed fuel and debris have been described in vague terms such as "light," "medium," and "heavy." Using the simple field procedures in this Handbook, weight and volume of downed woody material can be inventoried to provide an objective basis for managing debris.

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APPENDIX I

Sampling Intensities

NUMBER AND SIZE OF SAMPLING PLANES

Sampling precision can be controlled by altering the number of plots and length of sampling planes. As a general rule, the more downed material on an area, the fewer the number and shorter the length of sampling planes required to achieve a given level of precision. Figure 14, based on average sampling variation for number of intersections of 0- to 1-inch and 1- to 3-inch particles, can help in choosing number of plots and length of sampling planes. The data for figure 14 are from many stands of varying composition and downed debris accumulations in northern Idaho and western Montana. Curves for all material under 3 inches in diameter would fall between those for the 0- to 1-inch and 1- to 3-inch classes.

Percent errors of 20 percent or less are probably adequate levels of precision for assessing most fuel problems. Percent error is the standard error of the estimate divided by the mean estimate and expressed as a percentage. More precision, such as percent errors of 10 to 15 percent, may be desirable for evaluating utilization potential of downed woody material.

Precision is maximized using a different length of sampling plane for each size class. However, considering both field effort and precision, it is more efficient to use the same plane length for sampling the 0- to 0.25- and 0.25- to 1-inch classes. The following suggestions will help determine the most efficient number and length of sampling planes for a given area:

1. Record data from about 20 sampling planes in an area and calculate the variation for guiding further sampling.

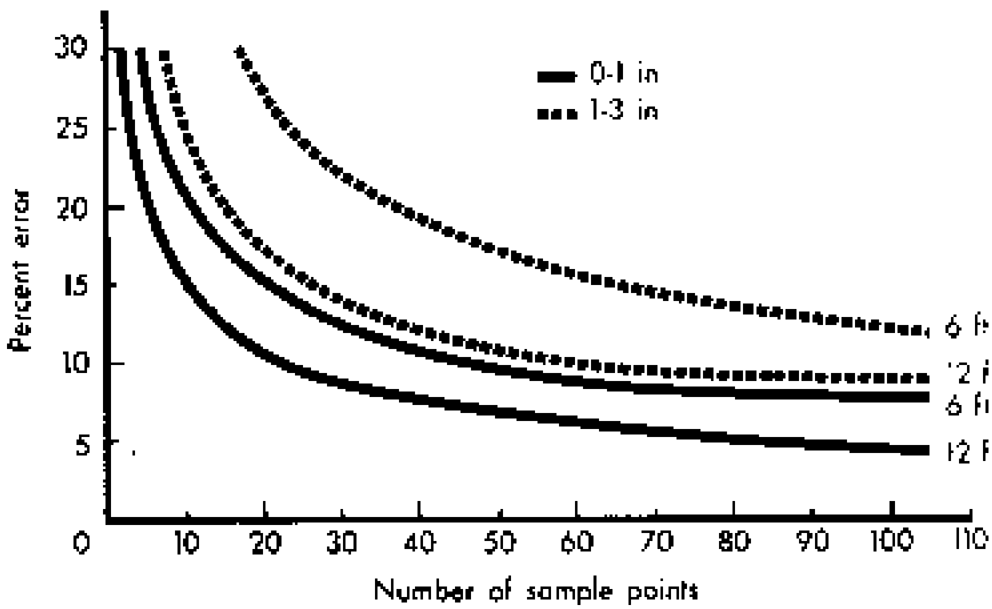

Figure 14.--Percent errors for number of particle intersections along 6- and 12-foot-length sampling planes related to number of sample points for quantities of light slash and nonslash. Percent error is 100X (standard error of the estimate divided by the mean estimate).

2. For material larger than 3 inches in diameter, the sampling plane should be long enough so that on the average at least one intersection occurs with three-fourths or more of the planes. A large sampling variance results when many zeros are recorded for intersections. In areas where very little downed material exists, sampling planes should actually be one to several hundred feet long to provide respectable precision. Where many sampling planes have zero entries, other methods such as measurement of length and diameter of all downed pieces may be the most efficient method of inventory.

3. The number and length of sampling planes should be chosen so that for a piece size of interest, such as material over 3 inches in diameter, at least 35 to 50 intersections occur over an entire sampled area.

SAMPLING PRECISION FOR DEPTH MEASUREMENTS

To achieve percent errors of 15 and 20 percent using two-stage sampling, the most efficient number of secondary sampling units appears to be three for fuel depth and two for duff depth (fig. 15).

The data for figure 15 represent average variation from sampling a wide variety of forest and downed fuel conditions in northern Idaho and western Montana. Several thousand measurements were taken using two secondary sample points for duff depth and three secondary sample points for fuel depth. Vegetation qualifying for fuel depth measurements included all dead downed woody material and dead brush, grass, and forbs. The data were subjected to analysis of variance for two-stage sampling.

The number of sample plots required to attain a given level of precision varies considerably among different areas. For choosing sampling intensities for specific areas the number of primary sample points in figure 15 could be adjusted up or down considerably, depending on homogeneity of the dead vegetation strata.

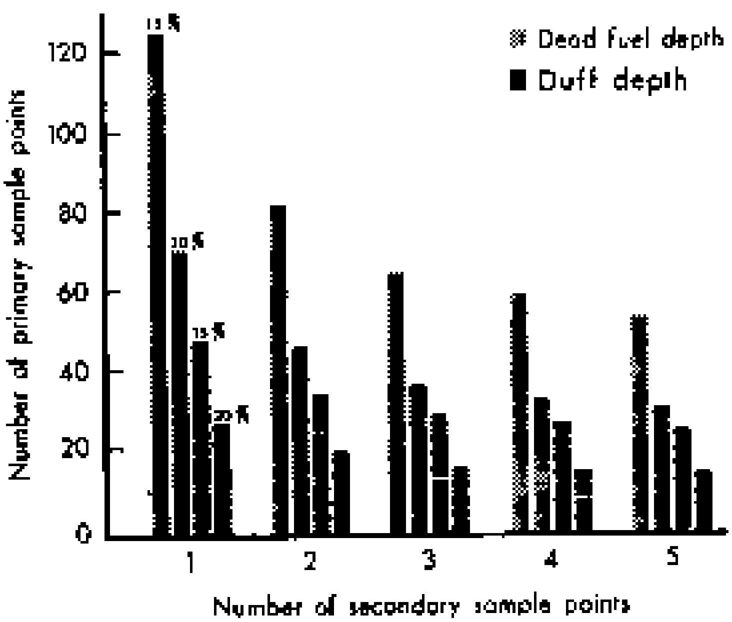

Figure 15.--Number of primary and secondary points needed to achieve percent errors of 15 and 20 percent for fuel depth and duff depth.

APPENDIX II

Specific Gravities of Sound Material

The specific gravities in table 4 are based on ovendry weight and airdry volume and can be used for calculation of loadings.

Table 4.--*Specific gravity of woody twigs and branches with bark attached*

Species	Diameter size class (cm)				
	[1]0 - 1	[1]1 - 10	[2]0 - 1	[2]1 - 3	[2]3 - 5
Ponderosa pine	0.41	0.51	0.57	0.53	0.49
Douglas-fir	.55	.45	.56	.56	.52
Western larch	.46	.55			
Lodgepole pine	.49	.41			
Engelmann spruce	.34	.34			
Subalpine fir	.41	.40	[2].44		
Western redcedar	.48	.33			

[1] William R. Beaufait and Charles E. Hardy. Fire quantification for silvicultural use. USDA For. Serv., Intermt. For. & Range Exp. Stn. (In preparation.)

[2] Brown (1972).

APPENDIX III

Calculating Needle Quantities

Weight of needles can be determined by multiplying ratios of needle-to-branchwood weights (table 5) times estimated branchwood weight. The estimates in table 5 are for branches having all needles attached. The data are based on estimates of needles and branchwood from total living crowns for trees between 2 and 30 inches d.b.h.

Table 5.--*Foliage-to-branchwood ratios based on ovendry weight*

Species	Diameter of branches		No. trees sampled
	0- to 0.25-inch	0- to 1-inch	
Western larch	0.70	0.43	13
Ponderosa pine	14.10	.98	14
Western white pine	3.30	1.02	5
Douglas-fir	2.19	.82	9
Western hemlock	1.90	.80	17
Engelmann spruce	2.38	1.34	4
Western redcedar	5.00	1.45	13
Lodgepole pine[1/]	1.34	.31	3
Grand fir[1/]	2.52	1.00	3

1/ Data by Fahnestock (1960).

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Headquarters for the Intermountain Forest and Range Experiment Station are in Ogden, Utah. Field Research Work Units are maintained in:

- Boise, Idaho
- Bozeman, Montana (in cooperation with Montana State University)
- Logan, Utah (in cooperation with Utah State University)
- Missoula, Montana (in cooperation with University of Montana)
- Moscow, Idaho (in cooperation with the University of Idaho)
- Provo, Utah (in cooperation with Brigham Young University)
- Reno, Nevada (in cooperation with the University of Nevada)

Fuel Load Measurement as a Follow-up to Initial Conditions Report

1. Dead and Down Fuels Inventory

   Select five (5) points at random within fuels typical of those that will burn if the fire becomes large. If there is more than one fuel type (e.g. a spruce-fir stand next to a lodgepole pine stand), five points should be selected in each type.

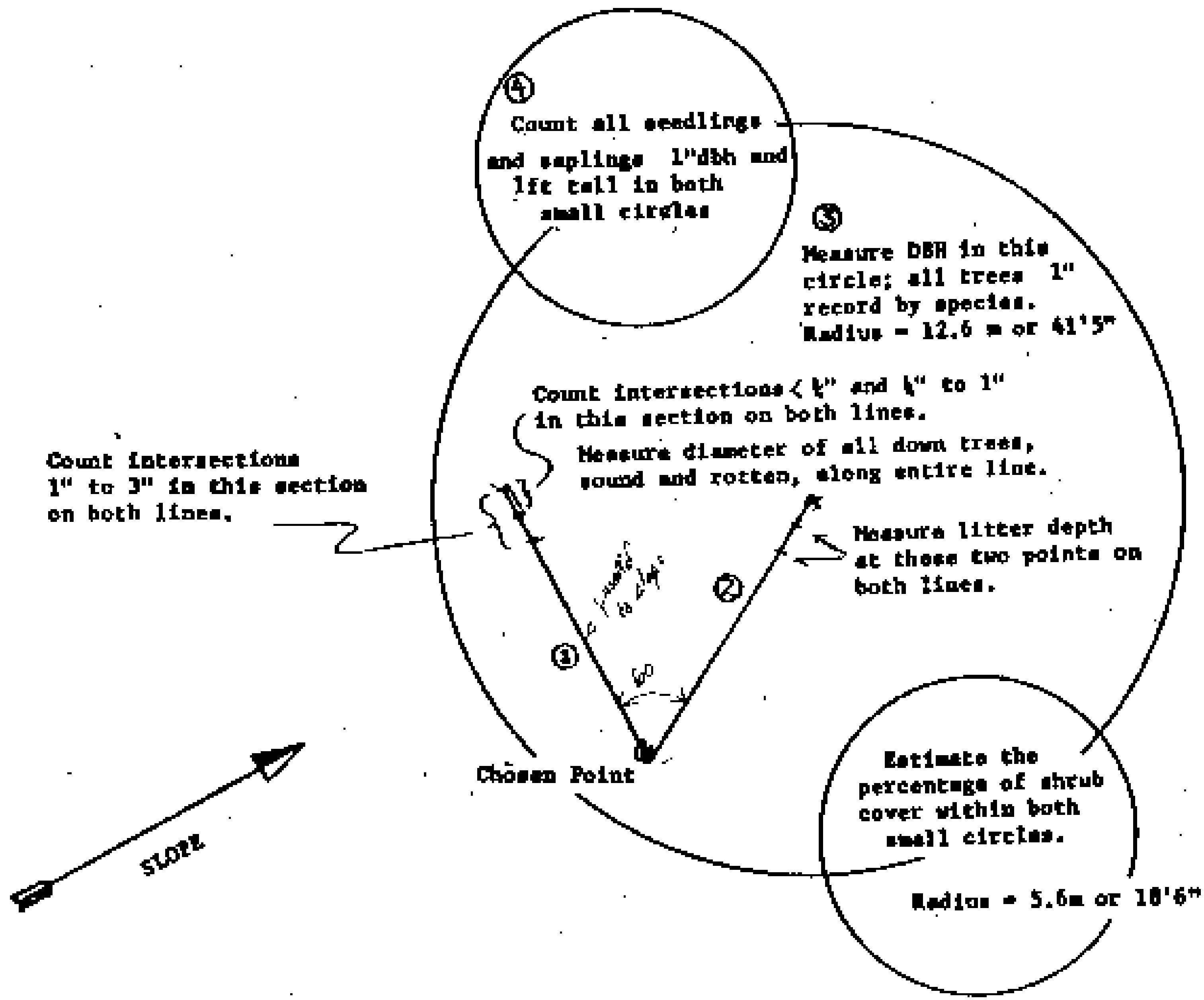
   I. Dead fuel is measured along two lines at an angle of approximately 60° from the five points in each fuel type selected above.
   II. The first line is made from the selected point and runs 10m (33 ft.) across the slope. Following the tally rules, intercepts are tallied: <1/4" and 1/4" to 1" in the 2m furthest from the point. 1" to 3" in the 4m furthest from the point. Litter depth is measured at 2m and 4m from the far end.
   III. The second line is stretched out at a 60° angle to the first and the tally repeated.
   IV. Be sure to record the slope of the second line. (The slope of the first should be zero.)

2. Live Fuels Inventory

   Live fuels are sampled at the first three randomly selected points for the dead and down inventory. Again, it is done for each fuel type.

   I. The far end of the second line becomes the center of a circle with a radius of 12.6m or 41' 5". The diameter of all trees over 1" DBH are recorded by species.
   II. The height of a tree that is representative of the stand dominants is measured and recorded.
   III. Select two points on the circumference of the 12.6m radius circle, across the slope and across the circle from each other. These points become the centers for two circles 5.6m or 18' 6' in radius. All the tree seedlings and saplings less than 1" DBH and greater than 1 ft. tall are counted and recorded by species. The percentage of these smaller circles covered by shrubs is recorded by species. Include grouse whortleberry as a shrub.
   IV. Estimate and record the mean maximum height for both seedlings-saplings and shrubs.

Refer to diagram on back for clarification.


4
Count all seedlings
and saplings 1"dbh and
1ft tall in both
small circles
3
Measure DBH in this
circle; all trees 1"
record by species.
Radius = 12.6 m or 41'5"
Count intersections < ¼" and ¼" to 1"
in this section on both lines.
Measure diameter of all down trees,
sound and rotten, along entire line.
Count intersections
1" to 3" in this section
on both lines.
Measure litter depth
at these two points on
both lines.
1
2
60
Chosen Point
Estimate the
percentage of shrub
cover within both
small circles.
Radius = 5.6m or 18'6"
SLOPE

INSTRUCTIONS FOR FIRE MONITORS

As frontline, on the ground observers, your major responsibility will be to collect field data and make observations. This information will be an aid to the Fire Management Committee in decisions regarding the status of the fire. It is essential that the information be as accurate and representative as you can make it.

FOR INITIAL RECONNAISSANCE:

1. Determine exact location on UTM map and airphoto. Carry a general park map and a 15' quad of the area where the fire is reported to be. Take the appropriate airphoto and grease pencil to mark in the location on the airphoto. If available, take a polaroid camera and photograph the fire location from the air. Include in this picture a part of a meadow, stream, or rock outcrop to make location on an airphoto possible at a later date. If you remain with the fire, return the polaroid picture and airphoto with the helicopter pilot.

2. Determine the cause of the fire. Look for spiral scars on tree tops near the origin, bits of splintered wood, or other indicators of recent lightning strike. Look for fire rings or bits of refuse (candy wrappers, cigarette butts, etc.) that indicate human activity.

3. Take weather reading with the belt weather kit. Record time, wet and dry bulb temperature, wind speed and direction. BE CAREFUL with the sling psycrometer.

4. Gather samples of one hour and ten hour fuels, live needles of the most common trees in the area, and litter and duff. Fill the tin sample cans at least 2/3 full. Keep needles and grass from between the lid and the can.

5. Take a polaroid picture within the forest in the vicinity of the fire start. Include part of the forest floor as well as the tree trunks and tree reproduction. If you remain at the fire, return the photos with the helicopter pilot.

FOR CONTINUED MONITORING OVER A LONGER TIME:

1. Take weather readings on an hourly basis from sunrise to sunset unless otherwise instructed. At a minimum, take readings whenever there is a change in the fire behavior. If the fire is active at night, take readings then as well.

2. Take fuels inventory. Follow the instructions with the recording forms for both down-dead and live fuels.

3. Record in the notebook the time and weather conditions whenever fire behavior changes significantly.

4. Map each day's activity and estimate acerage increases.

5. If the fire becomes active, watch for spot fires out in front of the fire, from a safe distance. If the fire threatens to spread beyond any predetermined boundaries, either by direct spread or by spotting, call 700 Fox immediately.

6. If a recording weather station is set up on the fire, take fire weather readings each day at 1400 Mountain Daylight Time and radio results to 700 Alpha. Use forms provided at the weather station.

While camping in the vicinity of a fire, remember that you are in bear habitat. Keep a clean camp and sleep away from your food. Hang all rations in a tree at least 10 feet off the ground.

INITIAL CONDITION

Fire name ______________ Location ______________

Time of storm ______________

Time of arrival at fire ______________

Photographs: Roll No. ______________ Frame Nos. ______________
Make duplicate record on master photo record.

- -

General Site Description (aspect, slope, position on slope [upper, mid, or lower] etc.)

____

____

____

____

____

- -

If the circumstance of the original ignition is still observable, describe:

____

____

____

General Description of Vegetation: Habitat type ______________

List the tree species of the immediate area in order of abundance: 1. ______________

______________ 2. ______________ 3. ______________

Describe shrubby and herbaceous conditions including species, relative cover, percent dry material, whether the plants are growing actively, or are dormant, etc.

____

____

____

Were samples taken for identification? ______________

MASTER PHOTOGRAPHIC RECORD

Roll No. ________ Page ______ of ________

Frame No. Subject, time and date

1 ____________________

2 ____________________

3 ____________________

4 ____________________

5 ____________________

6 ____________________

7 ____________________

8 ____________________

9 ____________________

10 ____________________

11 ____________________

12 ____________________

13 ____________________

14 ____________________

15 ____________________

16 ____________________

17 ____________________

18 ____________________

19 ____________________

20 ____________________

Hourly weather readings: Time__________ Dry bulb__________ Wet bulb________

w.b. depression_______ R.H._______ Wind speed________ Direction__________

Describe behavior of fire and types of fuels being burned:

____

____

____

____

Photographic record: Roll No.________ Frame Nos.____________
(make duplicate record on master photo record)

Hourly weather readings: Time__________ Dry bulb__________ Wet bulb________

w.b. depression_______ R.H._______ Wind speed________ Direction__________

Describe behavior of fire and types of fuels being burned:

____

____

____

____

Photographic record: Roll No.________ Frame Nos.____________
(make duplicate record on master photo record)

Hourly weather readings: Time__________ Dry bulb__________ Wet bulb________

w.b. depression_______ R.H._______ Wind speed________ Direction__________

Describe behavior of fire and types of fuels being burned:

____

____

____

____

Photographic record: Roll No.________ Frame Nos.____________
(make duplicate record on master photo record)

MOISTURE CONDITIONS

Time__________

Can No.		Wet Wt.	Dry Wt.	Can Wt.	[illegible]

Fuel Moisture stick   Time set out__________

Time	Wt.	Time	Wt.	[illegible]	Wt.	Time	Wt.

NATURAL FIRE INITIAL VISIT FORMS

Instructions

1. Fill out Initial Condition sheet (p. 1). Be sure to take and record photographs.
2. Collect samples of duff, herbaceous plants, and twigs and needles of most abundant trees in sample cans.
3. Take weather readings and record on weather sheet (p. 3).
4. Measure perimeter of fire.
5. Measure rate of spread if the fire is moving and record on included forms.
6. If fire has potential for spread set out fuel moisture stick near base camp in an area as similar as possible to area where fire is burning. Record time on moisture conditions sheet (p. 2).
7. Take weather on hourly basis (p. 3).

Extra copies of each of these forms are kept behind the first set.

The following information for all fires should be phoned or radioed in each morning to reach the Fire Management Office (Operations), Ext [illegible] or [illegible] no later than [illegible].

1. Name of Fire ______________________________ Date ____________

2. Location: T.__________ R.____________ UTM ______________

   Slope ______________ Aspect ______________

3. Cause: Man ______________ Lightning ______________

4. Rate of Spread (chains/hour) ______________
   Forward Spread from Origin (chains) ______________ Direction ________
   Flame Length at Head of Fire ______________

5. Fuel at Fire Origin: Species ______________
   Age Class: Mature ______% Reproduction ______% Pole ______%
   Green ______% Dead ______%
   Other fuels through which fire spread: ______________
   Concentration: Heavy ________ Moderate ________ Light ________

6. Number of Burned Acres ________ Estimated Perimeter ________ chains
   As of ______________ (date & time)

7. Fire Weather when first manned: Temp. ________F. R.H. ______%
   Wind Speed & Direction ______________, Fuel Moisture ______________.

8. Personnel: 1st Attack

Name of Crew	Number on Crew	Time of Arrival
______________	______________	______________

Reinforcement Crews:

______________	______________	______________
______________	______________	______________
______________	______________	______________

Crew Off Fire	Number on Crew	Time of Arrival
______________	______________	______________
______________	______________	______________
______________	______________	______________

Total # of Men (On a given date) ______________ Additional manpower needed ________

9. Resistance to Control ______________ (High, Medium, Low)

10. Estimated Acreage & Perimeter at time of control ______________
11. Fire Out @ ______________ Hrs. Date ______________

12. Remarks: (special features, injuries, property, special difficulties, special requirements, etc.) BE BRIEF!

____

____

____

WB FORM 653-1 (11-63)
[illegible]

FIRE WEATHER SPECIAL FORECAST REQUEST

(See reverse for instructions)

U.S. DEPARTMENT OF COMMERCE
WEATHER BUREAU

I - REQUESTING AGENCY WILL FURNISH:

1. NAME OF FIRE OR OTHER PROJECT*

2. CONTROL AGENCY

3. REQUEST MADE — TIME † — DATE

4. LOCATION *(By 1/4 Sec - Sec - Twp - Range)*

5. DRAINAGE NAME

6. EXPOSURE (*NE, N, SE, etc.*)

7. SIZE OF PROJECT (Acres)

8. ELEVATION* — TOP — BOTTOM

9. FUEL TYPE

10. PROJECT ON — ☐ GROUND — ☐ ORGANIZING

II. WEATHER CONDITIONS AT PROJECT OR FROM NEARBY STATIONS *(See example on reverse)*

PLACE	ELEVATION	OB TIME †	WIND DIR./VEL.	TEMP (DRY)	TEMP (WET)	RH	DP	REMARKS *(Indicate rain, thunderstorms, etc. Also wind condition and 10ths of cloud cover.)*

12. SEND FORECAST TO: — PLACE — VIA — ATTN: *(Name, if applicable)*

II - FIRE WEATHER FORECASTER WILL FURNISH:

13. FORECAST AND OUTLOOK — TIME † AND DATE:

NAME OF FIRE WEATHER FORECASTER — FIRE WEATHER OFFICE

III - REQUESTING AGENCY WILL COMPLETE UPON RECEIPT OF FORECAST

IV. FORECAST RECEIVED: — TIME † — DATE — NAME

Explanation of symbols:

- † Use 24-hour clock to indicate time. Example: 10:15 p.m. = 2215; 10:15 a.m. = 1015.
- * For concentrations (as groups of lightning fires) specify "Concentration"; then give number of fires and size of largest. If concentrations are in more than one drainage, request special forecast for each drainage.
- ‡ No entry necessary. To be computed by the Fire Weather Forecaster.

INSTRUCTIONS

I. Fire Control and other Project Personnel:

1. Complete all items in Section I each time a special forecast is desired.

a. Example of Weather Conditions:

PLACE	ELE-VATION	OB TIME	WIND DIR.-VEL.	TEMP. DRY	TEMP. WET	*(Or Blank) RH	*(Or Blank) DP	REMARKS
Fire camp	2030'	1125	NW 16	85	62			Scattered clouds, 2/10ths Cumulus. Thunderstorm ended 2 hours ago. Wind gusty, direction varies from NW to N.

2. Transmit in numerical sequence to the appropriate Fire Weather Office. (The Fire Weather Forecaster will complete the special forecast as quickly as possible and transmit the forecast and outlook to you by the method requested.)

3. Upon receipt of special forecast, complete Sections II and III.

4. Retain completed copy of form for your records.

5. Should conditions occur that are not correctly forecast, notify the Fire Weather Forecaster by phone or radio.

II. ALL RELAY POINTS should use this form to ensure completeness of data and completeness of the forecast. A supply of the form should be kept by each dispatcher and all others who may be relaying requests for forecast or who may be relaying the forecast.

III. Forms are available from your local Weather Bureau Fire Weather Office. They may also be reproduced by forest or range agencies as needed, entering the phone number and radio identification, if desired.

IV. Fire Weather Forecasters:

1. Copy information received on this form.
2. Complete special forecast as quickly as possible and return forecast and outlook by the method requested.
3. Supply pertinent radar scope information whenever possible, indicating time of radar report.
4. Complete "RH/DP" columns in Item eleven.
5. Retain copy for record purposes.

NATIONAL PARK SERVICE
FIRE SITUATION ANALYSIS
PART I. CURRENT FIRE SITUATION

1. FIRE # & NAME________________ NPS UNIT________ CAUSE________

1a) DATE: _____/_____/_____ 1b) MONITORED air, lookout, at scene? (circle one)

2. FBWS: ______________________________
Lead
FBWS: ______________________________
Trainee

3. 3a) FIRE SIZE __________; 3b) DATE ____ TIME ____;

3c) ELEVATIONAL RANGE __________; 3d) T _____; R ____; Section(s)_____.

4. VEGETATION TYPE ______ ______% 4a) FUEL MODEL ______ ______%
(of area burned) (of area burned)
______ ______% ______ ______%
______ ______% ______ ______%

5. MAP--ATTACH!!! (indicate fire perimeter and fuel models in the area; also indicate points where weather/fire behavior readings were taken and use a large arrow to indicate where the daily fastest rate of spread (recorded in 6c--below) was observed).

6. FIRE ACTIVITY

6a) Relative Intensity: ______________________________
____
____

6b) Daily Rate of Fire Growth: ________ acres/day

6c) Daily Fastest ROS: ______ Direction--H, B, or F (circle one)
Fuel Model____ Compass direction______

7. PROJECTED FIRE ACTIVITY

7a) NFFL Fuel Model(s) in Direction of Spread: ______________________________
____
____
____

7b) Factors that Affect Fire Spread: ____________________

____

____

7c) Forecasted Weather (1-5 days, specify number of days): attach forecast forms. ____________________

____

7d) Predicted Fire Behavior (specify number of days): ____________________

____

8. THREATS/CONSTRAINTS

8a) Life or Property: ____________________

____

____

8b) Natural Resources: ____________________

____

____

8c) Cultural Resources: ____________________

____

____

8d) Management Boundaries: ____________________

____

____

8e) Threats to Exceed Prescription: ____________________

____

____

9. Smoke Movement: ____________________

____

10. FIRE MONITORS' (FIRE BEHAVIOR WEATHER SPECIALIST) RECOMMENDATIONS

10a) Closures/Evacuations: ______________________________

____

10b) Holding Actions: ______________________________

____

10c) Monitoring Frequency: ______________________________

____

11. SPECIAL CONCERNS OR COMMENTS: ______________________________

____

12. NARRATIVE (OPTIONAL) Use back of page

Attach prescribed natural fire data sheet (page 4), photographic log, and weather forecast.

13. PREPARED BY:______________________ Date: __________ Time: __________
Lead FBWS

______________________ Date: __________ Time: __________
Trainee FBWS

NO CHANGE:______________________ Date: __________ Time: __________
Lead FBWS

14. MANAGEMENT ACTIONS: (if applicable) ______________________________

____

REVIEWED BY:______________________ Date: __________ Time: __________
PFM/PBB/FMO

SUPPRESSION RESOURCES ASSESSMENT______________________________

____

15. Nearest Available ICSR/ICMR: Name______________________

Home Phone________ Work Phone________ On Paid Standby? Yes/No (circle)

16.

PRESCRIBED NATURAL FIRE DATA SHEET

FIRE # & NAME ______________________________

	0600	0800	1000	1200	1400	1600	1800	2000	PARK PNF Rx by FUEL MODEL FM	FM	FM
Date											
Time											
Location											
Aspect											
Slope											
WEATHER											
Temp.											
R.H.											
Mid W.S.											
Wind Dir.											
Shading											
FUEL MOISTURE											
1 hr.											
10 hr.											
100 hr.											
Live											
FIRE BEHAVIOR											
Model											
Direction											
Obs. ROS											
Pre. ROS											
Obs. FL											
Pre. FL											
H/A											
FI											

Drought Indices (BI, ERC, KBDI, 1000 hr, etc.) ______________________

PART II

Park ____________________ Fire #/Name ____________________________ Date ______________

17. Fire Situation (including multiple fire problems): ________________________________

____

____

____

18. ALTERNATIVE ACTIONS:

HOLDING ACTIONS

A. (No Action) ____

____

____

____

____

B. ____

____

____

____

____

C. ____

____

____

____

____

FURTHER ALTERNATIVES MAY BE ADDED, if necessary: ______________________________

SUPPRESSION ALTERNATIVE ACTIONS:

Alternative ___.

____

____

____

____

Alternative ___.

____

____

____

____

Alternative ___.

____

____

____

____

Alternative ___.

____

____

____

____

FURTHER ALTERNATIVES MAY BE ADDED, if necessary: ____

____

19. DECISION MATRIX

Impacts On:	Alternative ___ (No Action)	Alternative ___	Alternative ___
Soil			
Air			
Water			
T & E Species			
Vegetation			
Developments			
Recreation			
Wilderness			
Firefighter Safety			
Public Safety			
Cultural			
Adjacent Landowners			
Wildlife			
Other			

20. Management Constraints From Fire Management Plan:

21. Projected Containment/Suppression Needs/Costs:

Alternative____		Alternative ____		Alternative______	
Item	Cost	Item	Cost	Item	Cost

TOTAL COST ________ ________ ________

Alternative:	____	____	____
Est. Completion Time (days)	________	________	________
Est. Fire Size at Project Completion (acres)	________	________	________
Remaining Uncontained Perimeter (%)	________	________	________

22. Preferred Alternative and Rationale: ____

____

____

Attach map of fire for each alternative.

23. Prepared by: ____________________ Date: ____________

Signature: ____________________ Date: ____________

Title: ____________________

Reviewed by: ____________________ Date: ____________

Title: ____________________

Reviewed by: ____________________ Date: ____________

Title: ____________________

Approved by: ____________________ Date ____________
Superintendent

Prescribed Fire Complexity

Management-Ignited Prescribed Fires (Prescribed Burns)

Complexity Element	Rating Value	Weighting Factor	Total Score
1. Potential for escape.		10	
2. Values at risk.		10	
3. Smoke/air quality.		7	
4. Treatment objectives.		7	
5. Fuels/fire behavior.		5	
6. Fire duration.		5	
7. Ignition methods.		3	
8. Management team size.		3	
TOTAL PROJECT COMPLEXITY RATING			

Prescribed Natural Fires

Complexity Element	Rating Value	Weighting Factor	Total Score
1. Potential for escape.		10	
2. Values at risk.		10	
3. Smoke/air quality.		7	
4. Fuels/fire behavior.		5	
5. Fire duration.		5	
TOTAL PROJECT COMPLEXITY RATING			

____________________ ____________
Prepared by (PBB, PFM, FMO) Date

FIRE SITUATION ANALYSIS

The fire situation analysis (FSA) is standardized for National Park Service use and has been broken into Parts I and II. Part I, which is prepared by a FBWS I/II, is designed for use in routine monitoring of prescribed natural fires. It documents the daily fire situation, makes forecasts for upcoming fire activity, and documents that the daily fire situation does not exceed that which has been specifically approved by the Superintendent in the fire management plan. Part II, which will be prepared jointly by the FBWS and/or the PFM/PBB/FMO and other tactical experts as needed, will be prepared along with Part I at the beginning of a PNF and thereafter when a new threat or constraint, referenced in 8a-8e Part I is identified, or when increased holding actions in 10b are indicated; or when the fire management plan and progress of the fire or other situations develop which indicate that a different management strategy is appropriate.

Parts I and II are initially approved by the Superintendent in order to declare that a new fire is to be managed as a PNF. Thereafter, Part I is prepared by an experienced PFM/PBB or FMO specified by NPS policy. This individual then completes and signs block 14 of the FSA, part I, specifying all management actions taken during the last burning period and actions to be taken during the next burning period in order to comply with the park's fire management plan. The recommendation of whether or not to carry the PNF into the next burning period as a PNF or to activate Part II of the FSA is documenlged and approved on the NPS-PNF Decision Record. This record remains on the Superintendent's desk throughout the PNF season and is updated daily by the FMO. Part II is always approved by the Superintendent on the document itself, since Part II legally documents a change in management strategy.

Should additional space be required for any FSA inputs, the back side of each page should be used for continuation.

INSTRUCTIONS FOR PART I (CURRENT FIRE SITUATION)

Part I is a very important management tool. Its usefulness depends on the quality of work by the fire monitor (fire behavior/weather specialist). The information collected and compiled provides the key link between the fire and management actions. It is easy to misinterpret the intent of a simple category title; take the time to read these instructions carefully so that management (at all levels) will receive the complete picture. Turn the page over and write on the back if the space provided for any particular element is inadequate. Do not lump two or three days of information onto one form. If any entry on this FSA does not apply to the fire being analyzed, place an NA in the appropriate blank space; this will ensure that all elements of this document are considered.

1. FIRE # & NAME, NPS Unit, and monitoring method are self-explanatory. Fill in the date of the reconnaissance/report. Cause of ignition; lightning, natural, unknown, human.

2. Write in the name of the Fire Behavior Weather Specialist (FBWS) and the assigned trainee. The lead monitor must be at least a fully qualified FBWS II. The trainee monitor must have successfully completed the training course prerequisites and may use this assignment to fulfill the job experience prerequisites.

3. 3a--FIRE SIZE - Calculate in acres using a dot grid, perimeter tables, etc.
3b--Enter the date and time when the fire size was determined.
3c--Enter the highest and lowest elevations at which the fire has burned.
3d--Give legals: T (township); R (range); and Sections.

4. VEGETATION/FUEL TYPES - Identify for area burned. Use a conventional identification system (i.e., NFFL or NFDRS, etc.).

5. MAP - A map must be included with every submission of the FSA. Outline vegetation or fuel model areas both within and around the burn. Completely label and date every map. Use a large arrow to indicate where the fastest rate of spread was observed. Label location of fire weather/behavior data readings that are recorded on the Fire Data Sheet (page 4) with labels A, B, C, D, etc. on both the map and the data sheet.

6. FIRE ACTIVITY - The intent of this section is to summarize today's "observed" fire activity.

6a--Relative Intensity - Use an adjective rating system; i.e., smoldering, creeping, running, torching, crowning, spotting. Describe for all fuel models present.

6b--Daily Fire Growth - Calculate from fire position/time maps and/or by fire behavior system analysis, using observed weather data. This rate of growth should be expressed as acres/day.

6c--Daily Fastest R.O.S. - Record the fastest rate of spread (linear) observed during the entire day's fire activity (chains/hour). Circle the direction of the fire spread (heading, backing, flanking). Also list the compass direction of spread; i.e., NS, S, NNE. Indicate the fuel model through which the fastest R.O.S. was observed.

7. PROJECTED FIRE ACTIVITY - The intent of this section is to have the fire monitor(s) observe and employ the key variables that influence fire behavior and to predict fire activity.

7a--Fire Behavior System (NFFL) Fuel Models in Direction of Spread - Discuss the predicted fire activity in the various fuel models that are going to be involved as the fire spreads; this will require mapped locations of the fuel models present in all directions of fire spread.

7b--Factors that Affect Fire Spread - Describe barriers and deterrents to fire spread, as well as factors that are likely to increase the spread; i.e., barren sites, fuel changes, local weather patterns, etc.

7c--Forecasted Weather - Obtain long range (1-5 day) forecast, if possible. Specify the type of forecast received. Request spot weather forecasts for time periods of known or expected significant fire danger and for times of any locally observed changes in winds, etc. at the fire site which could increase fire activity. Attach the weather forecast form if received.

7d--Predicted Fire Behavior - Predict fire activity for the next 1 to 5 days (specify the number of days), given current fire position and forecasted weather. Predict the acreage growth expected in the next 24 hours and display the expected growth and fire shape on the map.

8. THREATS/CONSTRAINTS - Address threats and constraints identified in the park's Fire Management Plan. Specify both potential and actual threats.

8a--Life or Property - Briefly describe threats to visitors as well as to fire monitors, firefighters, etc. Threats to consider are reduced visibility, location of roads, trails, ranger station buildings, local land ownership other than NPS, etc.

8b--Natural Resources - Briefly summarize threats to rare, threatened, or endangered species, scenic vistas, water quality, etc.

8c--Cultural Resources - Identify threats to cultural and/or archeological resources. Indicate whether the persons responsible for protection/management have been notified.

8d--Management Boundaries - Describe the proximity of the fire to any management boundaries. Do not simply state that there is a boundary and then describe it; indicate how far the fire is from the boundary(ies) and anticipated arrival time, if any.

8e--Threats to Exceed Prescription - Parks must have specific prescriptions for prescribed natural fires. These are specified in the FMP and must contain fire condition indicies and fire behavior parameters (ie; FL, ROS). Indicate if these are likely to be exceeded.

9. SMOKE MOVEMENT - Describe altitudes containing smoke, direction of smoke movement, relative density, color, presence of inversion and time of lifting (if it occurs). If a highly scenic or popular recreational area is being impacted, described the time and extent of visibility reduction. Also estimate the smoke concentration and probable impacts on nearby towns, cities, or other important targets that are likely to be or are being affected by smoke.

10. FIRE MONITORS' (FIRE BEHAVIOR/WEATHER SPECIALIST) RECOMMENDATIONS

10a--Closures/Evacuations - Advise on closures and/or evacuations; include trails, buildings, roads, recreation or wilderness areas, etc. Also recommend the need for safety signs.

10b--Holding Actions - If fire warrants a holding action to maintain the prescription, provide the justification based on the current situation and predicted fire behavior. Indicate the extent of the proposed action, i.e., natural barriers to be used, length of line to be cut, etc.

10c--Monitoring Frequency - Indicate how often the fire should be monitored on site, given the current and projected conditions. Distinguish between air and ground reconnaissance frequency.

11. SPECIAL CONCERNS OR COMMENTS - Stress the points of concern in the Fire Situation Analysis that only ground monitoring can provide (ie; length of active fire perimeter, number of acres burned, erratic fire behavior, threats to safety, reduced visibility, future monitoring requirements, etc.). Suggested points to address are threats to safety, reduced visibility, future monitoring requirements, or specific local concerns such as land status, etc.

12. NARRATIVE (OPTIONAL) - Use the back of the page (or attach notes) to the FSA to record information that may be of interest and for which space has not been provided.

13. SIGNATURES - Both fire monitors (lead/trainee) contributing to the Part I analysis should sign, date, and time the submission. Refer to the NPS *Prescribed Fire Qualifications System Flow Chart* and job complexity analysis for appropriate staffing levels. A "no change" signature is optional and can be entered by the lead monitor when and if there are no significant changes in items 6-11 of Part I from the previous day's activities; the use of this signature block eliminates the need for duplication associated with the completion of this document.

14. The PFM/PBB/FMO has the responsibility for ensuring that the FSA is properly completed each day and must sign that it has been reviewed and is recommended for approval. The line officer is the Superintendent who has the ultimate responsibility for authorizing the appropriate action(s) based upon Part I submissions, including a daily assessment of available suppression resources. The Superintendent signifies acceptance and approval by signing the Daily Decision Record (NPS Form #___).

15. The FMO is responsible for designating a ICSR or ICMR, whichever is most appropriate, to each PNF for contingency actions. A copy of the FSA Part I (and Part II if changed) should be sent to the incident commander (IC) designate daily and, if necessary, this individual can be placed on paid standby. Ideally the designate IC can and should be the PFM OR PBB if s/he is qualified for the IC job function.

16. A Prescribed Natural Fire Data Sheet (page 4) should be included with all "at scene" reconnaissance reports. The hours listed across the top of the form are only suggested data collection times. The actual frequency is dependent upon the fire and information requirements of the NPS unit. Actual monitoring time for each data collection point is recorded after the date. The * at 1400 hours indicates the recommended time (depending on a unit's time zone and specific needs) at which FSA data should be called into Fire Dispatch or to the park "Fire Contact". It is a critical fire data collection time.

Location identifiers (use letters to identify points) on the data sheet; make sure these data labels correspond with points identified on the map.

The data sheet has space for listing prescription elements. Include park-specific PNF prescription(s) for as many fuel models as applicable; three prescriptions can be listed in the space provided below the fuel model numbers (Fire Behavior System-NFFL).

A photographic log may be required in some situations.

INSTRUCTIONS FOR PART II-- (HOLDING/SUPPRESSION CONSIDERATIONS)

17. FIRE SITUATION - Briefly describe the single or multiple fire problems, smoke problems, fire load or other situations . Discuss the availability of suppression forces, if they are indicated as needed, and their location if known.

18. ALTERNATIVE ACTIONS - Describe the holding and/or fire suppression alternatives which may be used to manage the fire situation. This discussion can include no actions needed, specified holding actions, or a combination of control, confine, contain strategies if suppression is called for. Any of these may involve only a portion of the fire perimeter.

19. DECISION MATRIX - A narrative analysis of the effects of each alternative management action on park values. In essence, you are analyzing the effect of the action and not the effect of the fire. Address only those values which are critical to the selection of a desired alternative. Be brief and to the point!

20. MANAGEMENT CONSTRAINTS - Refer to the park Fire Management Plan for the general management constraints (e.g., public safety protection of features and resources, restoration of natural processes, etc.). These may be listed on a separate sheet or simply referenced to the park Fire Management Plan.

21. PROJECTED HOLDING/SUPPRESSION NEEDS/COSTS - Estimate needs and costs of the holding or suppression action (e.g., contain, confine, control) for each alternative. List by broad category, general considerations such as aircraft costs, personal services, major equipment acquisition, etc.

22. PREFERRED ALTERNATIVE AND RATIONALE - The selection of the preferred alternative will be based upon a relative weighting of management constraints from the fire plan and the impacts of the various alternatives. The objective of this process is to manage the fire problem with the least impact on park natural and cultural resources. This determination requires those responsible for making such decisions to undertake and document a project review similar to that required under NEPA.

23. Signature(s) - of PFM or PBB and others who prepared the FSA.

Reviewed - signature of any designate discussed in fire management plan.

Approval-the Superintendent must sign the FSA Part II each time it is changed to reflect new management strategy.

NPS - PNF DECISION RECORD

FIRE #	FIRE NAME	INITIALS OF RECOMMENDING OFFICIAL (PFM/PBB/FMO)			APPROVED	DISAPPROVED	SUPERINTENDENTS'S SIGNATURE	DATE
		PNF	WF	O				

FORM ______________________ (Instructions on reverse side)

ESCAPED FIRE SITUATION

ANALYSIS

EFSA NUMBER ________

UNIT: ____________________ DATE: ____________________

SUB-UNIT: ____________________ TIME: ____________________

I. FIRE SITUATION:

Fire Name: ____________________ Current Size ____________________

Fuel: ____________________ Fire Behavior ____________________

Narrative (attach description of the existing Local and Regional fire situation;) ____________________

II. FOLLOW UP:

The selected alternative shall be reviewed prior to each shift change to determine if it is still valid. If not, new EFSA will be developed

1. Shift Review:

By: ____________________ Date & Time: ____________________

By: ____________________ Date & Time: ____________________

By: ____________________ Date & Time: ____________________

Decision to make a new EFSA

By: ____________________ Date & Time: ____________________

2. Evaluation of Selected Alternative

IMMEDIATELY AFTER THE FIRE IS CONTROLLED, THE ACTUAL FIRE SHOULD BE EVALUATED AGAINST WHAT WAS PLANNED AND APPROVED.

A. Final Size: ____________ Estimated Suppression Costs $____________

New Resource Value Change $____________

B. Evaluation Criteria Compliance: ____________________

Alternative approved for Implementation:

____________________ ; ____________________ ; ____________________
Signature Line Officer Title Date

____
Time

USDI NATIONAL PARK SERVICE

ESCAPED FIRE SITUATION ANALYSIS

REGION		PARK
DATE	TIME	EFSA NUMBER OF

I. FIRE SITUATION

FIRE NAME	CURRENT SIZE
FUEL	FIRE BEHAVIOR
NARRATIVE (attach description of the existing fire situation)	

ALTERNATIVE APPROVED FOR IMPLEMENTATION:

SIGNATURE	TITLE	DATE	TIME

II. FOLLOW UP

The selected alternative shall be reviewed prior to each operational period to determine if still valid. If not, new EFSA will be developed.

OPERATIONAL PERIOD REVIEW

BY	DATE	TIME
BY	DATE	TIME
BY	DATE	TIME
BY	DATE	TIME
BY	DATE	TIME
BY	DATE	TIME
BY	DATE	TIME
BY	DATE	TIME
BY	DATE	TIME
BY	DATE	TIME

III. EVALUATION CRITERIA

For each category develop the Agency Administrator decisions on specific objectives, expressed as measurable criteria, to be used in the selection of the preferred alternatives.

CRITERIA (Check those criteria which MUST be met)	MUST
ECONOMIC:	
ENVIRONMENTAL:	
SOCIAL:	
OTHER:	

APPROVED BY: (Agency Administrator)	Date & Time

IV. ALTERNATIVES

	A	B	C	D
GENERAL PLAN OF CONTROL (STRATEGIC)				
SPECIFIC PLAN OF OPERATION (TACTICAL)				
PROBABILITY OF SUCCESS				
ESTIMATED CONTROL TIME				
ATTACH MAPS OF ALTERNATIVES				

V. EFFECTS

	A	B	C	D
SIZE Predicted final size (acres)				
MARKET ELEMENTS Improvements Recreation Concessions Fee enhancement Special use permits Water Other (Specify)				
SUM OF RESOURCE DAMAGE	$	$	$	$
NON-MARKET ELEMENTS Smoke Visual Vegetation Threatened & Endangered Species Other (Specify)				
SUM OF RESOURCE DAMAGE	$	$	$	$
SOCIAL ELEMENTS Firefighter Safety Public Concern Public Safety Cultural Archaeology Other (Specify)				
SUM OF SOCIAL DAMAGE	$	$	$	$
SUM OF LOSSES	$	$	$	$
SUPPRESSION COSTS	$	$	$	$
COST PLUS LOSS	$	$	$	$

VII. DECISION TREE

Include Decision Tree Analysis

Preferred Alternative ____________________

VI. EVALUATION

ALTERNATIVES

CRITERIA (From Section III)	A	B	C	E
ECONOMIC				
ENVIRONMENTAL				
SOCIAL				
OTHER				
TOTAL				

KEY. 0 = Does not meet criteria
1 = Partially meets criteria
2 = Fully meets criteria

NATIONAL PARK SERVICE

Prescribed Burn Unit Plan

BURN UNIT NAME: ______________________

Prepared by: ______________________ Date: __________

Reviewed by: ______________________ Date: __________

______________________ Date: __________

______________________ Date: __________

Approved by: ______________________ Date: __________

Superintendent

Copies of approved plan sent to:

II. Burn Unit Description

Location: 1. T______ __ R______ ___ SEC______

2. Latitude N________ ________

Longitude W______ __________

3. UTM Zone ____ Easting_____ ______ Northing____ ___

Size:

Elevation:

Description of Boundaries:

Slope(s):

Aspect(s):

Vegetation Type:	% of Burn Unit Burn Unit	Fuel Model NFFL	Fuel Model NFDRS

Fuel Loading and Dead Fuels:
(assess loadings pre and post burn by dead size classes, biomass, dead to live ratio, age classes, depth etc., as applicable to fuel type.)

III. Vicinity map (attached)
Show relationship of the project to the overall geographic area

IV. Project map (attached)
Utilizing U.S.G.S topographical sheets show the project, its boundaries, line construction, and firing patterns

V. Goals and Objectives

Circle or Underline:

1. Preserve National Processes
2. Hazard Fuel Reduction
3. Other (specify):

Objectives:
(quantify with specific data if possible.)

VI. Complexity

VII. Burn Organization

Personnel:

1. Prescribed Burn Boss: ______________________
2. Ignition Specialist: ______________________
3. Holding Specialist: ______________________
4. Lead Fire Behavior & Weather Specialist: ______________________
5. Safety Officer: ______________________
6. Crew:

Ignition:	Holding:
______________	______________
______________	______________
______________	______________
______________	______________
______________	______________

VIII. Costs

PROJECTED PERSON HOURS:			Projected Costs*
1.	Unit Preparation	______	______
2.	Burning	______	______
3.	Holding	______	______
4.	Monitoring	______	______
5.	Mop-up/Evaluation	______	______

EQUIPMENT:			Projected Costs*
1.	Tools	______	______
2.	Engine	______	______
3.	Fuel	______	______
4.	Mileage	______	______

*Record Required Actual Cost Data on attached paper.

IX. Scheduling

Proposed Ignition Date: ____________________

Projected Burn Duration: ____________________

Actual Ignition Date: ____________________

Date Declared Out: ____________________

Date DI-1202 Submitted: ____________________

Note any dates when the burn may not be conducted during the proposed window:

____________________ ____________________

X. Pre-Burn Considerations

A. Preparation Needs:

On Site:

Off Site:

B. Special Precautions/Regulations: (utility lines, historical sites, safety, etc.)

1. **All burn personnel will wear standard fire fighting leather boots, Nomex pants and shirt, leather gloves and hard hat. They will carry a fire shelter and a fire tool at all times.**

2. **All standard wildland fire fighter safety rules will be strictly enforced (see Fireline Handbook).**

XI. Burning Prescriptions and Observed Conditions

Fuel Model NFFL: ________ NFDRS: ________

	Prescription			Observed*
	Weather	Average	Range	
1.	Temperature:			
2.	Relative Humidity:			
3.	Wind Direction:			
4.	Wind Speed:			
5.	Fuel Moisture:			
	1 Hour:			
	10 Hour:			
	100 Hour:			
	Woody - live:			
	Herbaceous - live:			

* At Time of ignition

Fire Characteristics:

	Prescription			Observed*
	Characteristics	Average	Range	
1.	Rate of Spread:			
2.	Spread Component:			
3.	Heat/Unit Area:			
4.	Energy Release Comp			
5.	Flame Length:			
6.	Burning Index:			

*Standard Observation Time:

Dates of Burn:

XII. Firing Techniques and Holding Methods

A. Firing and ignition

B. Approved holding actions

XIII. Contingency Plan.

XIV. Weather Information

XV. Protection of sensitive features

XVI. Smoke management

XVII. Coordination and public involvement

XVIII. Notification

XIX. Public and personal safety

XX. Monitoring and Evaluation Procedures

XXI. Reports

1. Grand total of all personnel time, equipment and transportations: $______

2. Cost per acre: $______

3. Person days per acre: ______

XXII. Rehabilitation

XXIII. Briefing guide and Go/No Go Checklist (attached)

XXIV. Persons contacted (attached)

PRESCRIBED BURN PERSONNEL COSTS

DATE: ____________ PAGE ____ OF ____

NAME	GRADE/ STEP		REGULAR TIME			OVERTIME			HAZARD OR ENVIRONMENTAL DIFFERENTIAL			
	GS	WG	HRS	RATE	TOTAL	HRS	RATE	TOTAL	HRS	RATE	TOTAL	TOTA
				TOTAL								

Prescribed Fire Complexity

To determine the required management level of a prescribed fire, determine the Burn Complexity using the below rating criteria, then refer to the Prescribed Fire Qualification System flowchart.
Rate each element on a scale of 1 to 10, then multiply by the weighting factor to determine the weighted subvalues to determine the total weighted value, and then the required staffing structure.

PRESCRIBED BURNS

COMPLEXITY ELEMENT/ WEIGHTING FACTOR	RATING VALUE	WEIGHT SUBVALUE	LOW BURN COMPLEXITY	HIGH BURN COMPLEXITY
1. Potential for escape. (10)			Very Low probability	High Probability
2. Values at risk. (10)			Very little risk to people, property, resources.	Great risk to people, property, resources.
3. Fuels/fire behavior. (5)			Mostly uniform & predictable.	Great variability & unpredictability. Prescriptions include very few fuel moisture conditions.
4. Fire Duration. (5)			Fires generally of short duration & require little [illegible].	Fires of long duration & require [illegible] management.
5. Smoke/air quality. (7)			Smoke impacts are low or manageable.	Smoke sensitive areas are frequently affected.
6. [illegible] (5)			Simple and easily [illegible].	Highly complex or extremely [illegible].
7. Management [illegible] (5)			Burn requires a [illegible]	Burn requires large [illegible]
8. Treatment objectives. (7)			Objectives simple & easy to achieve. Prescriptions are broad and consistent with historical conditions.	Objectives are difficult to achieve. Prescriptions are restrictive or burning conditions are rare.
Total Weighted Value				

*STAFFING STRUCTURE:
NORMAL STRUCTURE: 0-300 weighted value points.
COMPLEX STRUCTURE: 301-400 weighted value points.

PRESCRIBED NATURAL FIRE:

COMPLEXITY ELEMENT/ WEIGHTING FACTOR	RATING VALUE	WEIGHT SUBVALUE	LOW BURN COMPLEXITY	HIGH BURN COMPLEXITY
1. Potential for escape. (10)			Very Low probability	High Probability
2. Values at risk. (10)			Very little risk to people, property, resources.	Great risk to people, property, resources.
3. Fuels/fire behavior. (5)			Mostly uniform & predictable.	Great variability & unpredictability. Prescriptions include very few fuel moisture conditions.
4. Fire Duration. (5)			Fires generally of short duration & require little management.	Fires of long duration & require [illegible] management.
5. Smoke/air quality. (7)			Smoke impacts are low or manageable.	Smoke sensitive areas are frequently affected.
Total Weighted Value				

*STAFFING STRUCTURE:
NORMAL STRUCTURE: 0-201 weighted value points.
COMPLEX STRUCTURE: 202-270 weighted value points.

*A Prescribed Fire Manager (PFM) is required when [illegible] administrative [illegible] are involved with 5 or more burns of low complexity, more than 1 burn of high complexity or any combination of the two.

______________________ ______________
Prepared by (PBB/PFM/FMO) Date

DELEGATION OF AUTHORITY

_______________ is assigned as Incident Commander on the _______________ Fire. You have full authority and responsibility for managing the fire suppression activities within the framework of law, Agency policy and direction provided in the Overhead Briefing and Escaped Fire Situation Analysis.

Your primary responsibility is to organize and direct your assigned and ordered resources for efficient and effective suppression of the fire. You are accountable to the _______________ or their designated representative listed below. Financial limitations will be consistent with the best approach to the values at risk.

Specific direction for the _______________ Fire covering management and environment concern is listed;

Constraints;

_______________, will represent me on any occasion that I am not immediately available. This authority is effective _______________

_______________ Date
Time:

_______________ Date
Time:

_______________ Date
Time:

RETURN OF DELEGATED AUTHORITY

The signing of this document returns the authority and responsibility for the management of the ______________________ Fire to the agency line officer having protection responsibility for the land on which the fire is located.

It is mutually agreed the objectives and management direction have been met and the ______________________ Fire Team is hereby released effective

______________________ DATE

______________________ TIME

____
INCIDENT COMMANDER

____
AGENCY LINE OFFICER

____

____

APPENDIX B

LARGE FIRE MANAGEMENT
THE BRIEFING AND DEBRIEFING
OF EAST ZONE FIRE TEAMS

Fire Name ______________________ Agency ______________________

Date ______________________ East Zone Fire Team Assigned ______________________

The following are guidelines for agency and East Zone Teams for the orderly transfer of fire suppression authorities. The guide is for the assumption and release of incoming Overhead Teams plus a checklist of information and data the receiving agency needs to provide. Some information will be in writing and some will be verbal.

I. The Taking Over of a Major Fire by an East Zone Team

A. The assumption of a fire by a team must be as smooth and orderly as possible. It must be remembered that the local agency team is in charge until officially released.

B. Ordering agency should specify expected time of arrival and expected time of takeover by East Zone Team.

C. The East Zone Team Incident Commander should contact the local agency dispatchers in advance and arrange for: (1) expected supported staff, (2) location of line officer briefing, (3) transportation needs.

D. The ordering agency should do the following prior to the arrival of the East Zone Team:

1. Determine incident base and/or camp location.

2. Order fire camp supplies and initial basic support organization for the fire.

3. Order or make ample supply of topography maps, base maps, etc.

4. Determine transportation needs of East Zone Team. (From ordering agency to fire and on fire etc., etc.)

5. Determine line officer briefing time and location.

6. Obtain necessary information for line officer briefing (see below)

7. Order communication cache.

8. Determine Resource Order Flow and how Expanded Dispatch will be facilitated.

9. Order Resource Advisor

10. Consider Mobile Phone

APPENDIX C

E. There should be two briefings of the East Zone Team. First briefing should be by Line Officer at a site away from the fire. Second briefing should be by the agency Fire Team IC at the fire site. Transition period of take over will depend upon complexity, expertise of local fire team and/or other problems.

F. Line Officer Briefing. Should be as soon as possible after arrival of all members on the fire team. It is impossible to list everything a team needs to know. The following are the more important items that should be discussed:

1. General

   a. Name of Fire ______________________

   b. Initial Action Taken ______________________

   c. Approximate size of fire ______________ acres.
   Location of fire (on agency recreation map)

   d. Name of local agency incident commander ______________

   e. General weather condition (start to present) (predicted) ______________________
   ____

   f. Fire behavior ______________________
   ____

   g. Fuel types (know ahead) ______________________

   h. Is it a engine or a tanker show? ______________

   i. Is it a helicopter show? ______________

   j. Incident Base and/or Fire camp location ______________
   ____

   k. Other fires on agency ______________________
   ____

2. Delegation of authority and assignment of responsibility.
   Agency representative ______________________
   (see Appendix A, Delegation of Authority)

3. GHQ organization (if needed or contemplated) ______________
   ____

4. Cause of fire ______________________

   a. Investigation ______________________

b. Name of investigator________________

5. Evaluation team assigned? Names:________________

____

6 Ownership involved and coordination

a. ________________

b. ________________

7. Names of resource advisors assigned to fire________________

____

8. Local fire policy________________

9. Resource values, land values, wilderness, roadless areas, rare and endangered species?________________

10. Priorities for control________________

11. Local unusual fire behavior and fire history in area of fire

____

12. Financial limitations and constraints________________

13. Legal consideration (current investigations in action)____

____

____

14. Pre attack plans ________ yes ________no

15. News media relations________________

____

PIO organization - Report to Incident Commander__________
- Report to agency supervisor__________

16. Known local safety hazards________________

____

Possibility of Evacuation, contact (1) Local Authority, (2) Department of Emergency Services, (3) Sheriff.

17. Local political considerations, attitudes of local residents

____

____

18. Contracting Officer assigned________________

Pay rules peculiar to agency________________

19. Other agencies on fire________________

Agency liaison________________

20. Transportation Routes________________

21. Air Operations

a. Airtankers assigned________________

b. Effectiveness of airtankers to date________________

c. Air Attack Sup. - Name________________
Airport________________
Telephone________________

d. Helicopters assigned________________

22. Personnel on fire (general)________________
____

23. Equipment on fire (general)________________
____
(Exact numbers, names and ETAs provided if available)

24. Supply system to be used (local supply, cache, procedures)
____

25. Land Status________________
____

26. Physical condition of agency overhead team________________
____

27. Agency personnel available (condition)________________
____

28. Rehabilitation policies (anything the team may need to know about________________

29. Estimated time when the East Zone Team will assume command
____

30. Closest medical facilities________________
Closest burn center________________

G. Local Incident Commander Briefing - East Zone Fire Team will be briefed by local Incident Commander upon arrival at fire. East Zone Team should not assume responsibility for the fire until they are thoroughly briefed and comfortable with the situation. Both Incident Commanders will determine exact hour of command change. After briefing, functions will start phasing into their areas of responsibility, but will not assume control until the predetermined time. Agency Team may continue to work on fire in various functions depending upon physical condition and Line Officer's direction.

1. Map of fire (best available)

2. Time of start

3. Spread - fire behavior

4. Fuels at fire

Ahead of fire

5. Anchor points

6. Line held (on map)

7. Natural barriers

8. Weather forecast

9. Incident Base/Camp/Staging Area Sites:

Established

Possible

Spike Camps

10. Airtanker effectiveness to date

11. Hazards (aircraft & people)

12. Access from camp to line

13. Personnel and equipment on line

14. Personnel and equipment ordered (confirm information received at Line Officer briefing).

15. Photos ________ yes ________ no.

16. Helispot and helibase locations (use map)

17. Communication system is use: Radio

Telephone

Mobile phone ____________

18. Water availability ____________

19. Camp fire protection ____________

Crash fire protection at helibase ____________

Medivac arrangements ____________

20. Review of existing plans for control in effect. ____________

21. Smoke conditions ____________

22. Local political issues ____________

23. Any security problems? ____________

24. Overhead on line (Names & location - put on map)

25. Copy machine in camp ________ yes ________ no

II. Release of an East Zone Team

A. Release of an East Zone Team is basically the reverse of the above. Date and time must be approved by Line Officer or their representative. It must be as soon as possible and local fire team members should be assigned and start working with East Zone members at the predetermined time. Local Fire Team should be off 24 hours prior to accepting responsibility of the fire.

B. East Zone Team should start phasing-in Agency Team as soon as demobilization begins.

C. East Zone Team should not be released from the fire until:

1. Fire management activity is at the level and workload a local fire team can reasonably assume.

a. Fire must be controlled.

b. Most all line crew members released that are not needed for patrol and mop up.

c. Base fire camps shut down, reduced or in the process.

d. Planning Section Chief has prepared a rough copy of fire report and narrative.

e. Finance Section Chief should have most all known finance problems resolved. Make contact with Agency budget and financial personnel and orient them 2-3 days before closeout to insure a smooth transition.

f Resource rehab work completed or done to Agency satisfaction

g. Overhead ratings.

2. Finance Section and Service Section Chiefs may have to stay longer or return to local Agency to resolve problems.

D. Fire team should have closed debriefing session prior to meeting with the Agency Line Officer.

E. Line Officer and Interagency Evaluation Team should debrief East Zone Team and prepare evaluation within 10 days after release.

Items to cover:

1. Using Agency should give team written performance evaluation.

2. Were objectives met?

3. Safety.

4. Costs.

5. Outstanding or poor performance of individuals and crews.

III. In the event an East Zone team is assigned to a fire and the above procedures cannot be followed due, the assigned team Incident Commander and their staff will work with members of the using Agency in obtaining the necessary information to make the transition periods effective and organized.

Name_______________ Unit_______________ Date_______________

FIRE TEAM EVALUATION

(This format is used as a guide for a field evaluation on an active incident and does not represent the final evaluation to the Team when the assignment is completed.)

I. COMMAND STAFF — YES NO

a. Which of the following positions are filled?

1) _____ Resource Advisor - How many _____

_____ Fire Information Officer - How many _____

2) Resource Advisor

(a) Are there outside agencies on the fire? _____ _____

(b) How many? _____

(c) Does Resource Advisor attend briefing sessions? _____ _____

(d) Is the Resource Advisor functioning effectively? _____ _____

3) Safety Section

(a) What positions are filled?

_____ Safety Officer

(b) Is the Safety Officer working both on the line and in the camp? _____ _____

4) Fire Information

(a) Was a fire information organization established? _____ _____

If yes, on reverse side, provide the following information

(1) Was the F.I. organization activated soon enough?

(2) Was the F.I. organization staffed adequately?

(3) Were adequate communications established?

(4) Did you observe any problems? If yes, what were they?

(5) Did the F.I.O. work closely with the Incident Commander?

APPENDIX D

2. OPERATIONS SECTION — YES / NO

a. Are there enough support positions so the operation section chief can effectively manage the fire in accordance to the Line Officers objectives. If not, which positions were lacking. ____ ____

b. Are personnel properly classified for the positions being filled? ____ ____

c. Are personnel adequately equipped for their assignments? ____ ____

d. Is air attack coordinated with ground attack? ____ ____

e. Does each strike team/task force leader know who their Division group supervisor is? ____ ____

f. Does each strike team/task force leader know who their Operations Section Chief is? ____ ____

g. Does each Division group supervisor know who the Division group supervisor on each side is? ____ ____

h. Does each Division group supervisor know the physical boundaries of their Division? ____ ____

i. Does each Division group supervisor know the plan for the adjoining Division? ____ ____

j. Is there an adequate number of people in air operations, is the operations section chief aware of what is going on in the section? ____ ____

k. Is the Air Support Group Sup./Air Ops. Branch Director involved in formulation of plans and attending all team meetings? ____ ____

l. Are air restrictions in place? ____ ____

m. Have air restrictions been requested? ____ ____

3. PLANNING SECTION

a. Are there enough support positions to adequately run all phases of the planning organization? ____ ____

b. Is Air Recon available:

1) Fixed wing ____

2) Rotary wing ____

		YES	NO
c.	Are Field Observers being used?	____	____
d.	Do they have adequate transportation?	____	____
e.	Do they have adequate communications?	____	____
f.	Is the Forces Status Board system being used?	____	____
g.	Is an adequate map available for base camp display?	____	____
h.	Is an adequate organization display board posted?	____	____
i.	Is Plans predicting fire spread?	____	____
j	Is the Planning Section preparing fire suppression strategy recommendations?	____	____
k.	Is the Situation Unit Leader used as relief Planning Section Chief?	____	____
l	Are Field Observers reporting on a fixed schedule?	____	____
m.	Is the Planning Section properly equipped?	____	____
n.	Is the Planning Section layout adequate?	____	____
o.	Is a telephone available?	____	____
p.	Is a telecopier available?	____	____
q.	Is the radio communications system adequate?	____	____
r.	Is the fire weather available to the Planning Section?	____	____
s.	Is the fire weather available to the Operation Section?	____	____

ACTION PLAN

a.	Is plan complete?	____	____
b.	Has the fire been properly subdivided?	____	____
c.	Is the proper time sequence a part of the plan?	____	____
d.	Does the plan have proper controls? (Line reports on progress)	____	____
e.	Is the plan realistic, can it logically be accomplished?	____	____
f.	Does the plan allow for flexibility?	____	____

	YES	NO
g. Is there pre set times for plan updating?	____	____
h. Are briefing sessions held at proper time?	____	____
i. Is briefing information provided adequate?	____	____
j. Are maps provided to the Strike Team/Task Force level?	____	____
k. Is briefing information provided to the Strike Team/Task Force level?	____	____

l. Which of the following individuals attended the briefing?

____ Incident Commander ____ Strike Team/Task Force Leaders

____ Planning Section Chief ____ Division Group Supervisor

____ Next Shift Operations Chief ____ Air Tanker Coordinator

____ On Shift Operations Sec. Chief ____ Other:____________

____ Logistics Section Chief ____________________

____ Safety Officer ____________________

____ Finance Section Chief ____________________

m. Are debriefing sessions held with off shift personnel?	____	____
n. Are secondaries a part of the plan?	____	____
o. If a joint fire, does plan agree with other agencies' plans?	____	____

ALTERNATE PLAN

a. Does an alternate plan exist?	____	____
b. Are all concerned personnel aware of it?	____	____
c. Can it be implemented in time to be effective?	____	____
d. If a joint fire, are other agencies aware of alternate?	____	____

4 LOGISTICS SECTION YES NO

a. Is there an adequate number of people in the Logistics Section to adequately run the section? If not, what positions are lacking?

		YES	NO
b.	Is base camp located adequately?	___	___
c.	Is base camp laid out adequately?	___	___
d.	Are the crews being fed in time for shift changes?	___	___
e.	Are the meals being catered?	___	___
f.	If yes, are they complying with contract?	___	___
g.	If not, is the food adequate for crews?	___	___
h.	Is transportation set up and running adequately?	___	___

5. FINANCE SECTION

		YES	NO
a.	Is there an adequate number of people in the Finance Section to adequately run the section? If not, what positions are lacking?	___	___
b.	Is Finance Section Chief serving as a fiscal advisor to the Incident Commander?	___	___
c.	Is Finance Section Chief keeping IC informed on broadly estimated fire costs?	___	___
d.	Is Finance Section Chief attending briefings?	___	___
e.	Is Finance function being coordinated with the Planning and Service Sections?	___	___
f.	Is Finance being coordinated with other agencies on joint fires?	___	___
g.	Is the Finance Section Chief monitoring and counselling others on the use of the Emergency fund?	___	___
h.	Are Finance Officers assigned to time keeping, supply, ground resources management or others to assist with the preparation of financial documents?	___	___

6. CIVIL RIGHTS/EQUAL EMPLOYMENT OPPORTUNITY

		YES	NO
a.	Did the incident have 100 or more personnel involved?	___	___
b.	Was a Civil Rights/EEO position established?	___	___
c.	Was the position used?	___	___
d.	Were any complaints filed with the individual?	___	___

		YES	NO
e.	Were complaints resolved to everyones satisfaction?	____	____
f.	If Not, has the necessary paper work been initiated?	____	____
g.	Was Civil Rights/EEO addressed at all briefings?	____	____

7 DEMOBILIZATION

		YES	NO
a	Was a Demobilization Plan prepared?	____	____
b.	Was demobilization properly coordinated between the Planning Section Chief and Service Section Chief?	____	____
c.	Was a set Demobilization Center established?	____	____
d.	Was demobilization anticipated far enough in advance?	____	____
e.	Were personnel properly rested and fed before release?	____	____
f.	Was private equipment inspected before release?	____	____
g.	Did demobilization proceed orderly and on time?	____	____
h.	Was proper priority given to the release of all people?	____	____

8 FIRE CAUSE/PREVENTION CHECK LIST Date________

(Use reverse side for comments) Unit____________

a. Was fire caused determined? Yes _____ No _____

1) Who determined fire cause?____________________
(Working Title)

b. If not, was investigation in process? Yes _____ No _____

1) Approximately how long after discovery of fire was investigation initiated? _______ Hours.

c. Have any fires of same cause occurred in the same general area this year? Yes _____ No _____ Unknown _____

1) If information available from local personnel, how many fires? ____

d. Were any structures lost or saved? 1) Approximate number lost _______

2) Approximate number saved _____

e. What presuppression factors contributed in the loss or saving of structures?

1) Clearance _____ 3) Access _____ 5) Fuelbreaks _____ 7) Other _____
2) Water Supply _____ 4) Fire breaks _____ 6) Greenbelts _____

f. Was structure spacing instrumental in loss or saving of structures? _____

1) Explain, if applicable ____________________

g. Did structure involvement contribute to fire spread? Yes ____ No ____

1) Indicate type of construction: ____________________

h. If presuppression or fire defense improvements existed, did they contribute to controlling the fire? Yes___ No___ If no, why?__________
None existed ___________.

1) Was lack of maintenance a factor? Yes _____ No _____

Check list completed by: ____________________

Nominations To Interagency Fire Management Overhead Teams

Name Of Candidate:

Home Phone Work Phone

Position To Which Nominated:

Summary of last five (5) years fire experience, including fuel types, size classes, team membership and total number of fires by position

FIRE NAME	FUEL TYPE	SIZE CLASS	POSITION OCCUPIED
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Summary of Individuals Fire Training (Include All S and I Courses)

ATTACH LIFE FLIGHT MAP HERE

APPENDIX G

CLOSEOUT OUTLINE

12/27/[illegible]

INTRODUCE PARTICIPANTS

Host agency personnel, team members, guests, etc.

PURPOSE OF THE CLOSEOUT

To discuss input from host agency and incident management team to identify situations and/or procedures to benefit future incidents. Review functional activities of the incident team and support of the host agency. Review the transition plan turning the incident back to the host agency or another team.

POTENTIAL TOPICS

Command

Opening remarks, agency briefing, EFSA, host agency preparation for the incoming team, political concerns, problems, fire information, sucesses, general support and involvement by the host agency and cooperators.

Operations

Brief history of the fire, perimeter increase by burning period, resources used, fire behavior and weather (can include input from FBA), problems, sucesses, etc.

Air operations, number and types of aircraft used, effectiveness of aircraft, helispots constructed and rehabed, flight hours, etc.

Report on the current status of the fire, mop-up, perimeter, rehab, critical areas to monitor, patrol, etc.

Planning

Presentation of final fire package. Point out special files that need to be dealt with. Status of the demobe effort and demobe yet to be completed. Review the transition plan with resources left to manage the fire. Any special comments from the HRS. Report on the total resources used and any special information of planning interest.

Logistics

Status of supplies and equipment remaining on the fire. Expanded dispatch support and ordering process. Problems/recommendations. Condition of camp being retained or taken down. Return of supplies and equipment to the cache.

Finance

Obligations report, current expenditures and outstanding bills. Timekeeping and ADO needs. Equipment rental agreements. Claims.

Safety

Report on accidents, injuries, evacuations, shelter deployments, etc.

Cooperators

APPENDIX J COMPLEXITY ANALYSIS

A GUIDE FOR ASSESSING FIRE COMPLEXITY

The following questions are presented as a guideline to assist the responsible line office in analyzing the complexity or predicted complexity of a fire situation. Because of the time required to assemble and move an overhead team to a fire, this checklist should be completed when a fire escapes initial attack and be kept as a part of the fire records. As the situation becomes more complex, this checklist should be completed to assure adequate lead time in requesting any necessary assistance.

Use of the Guide:

1. Analyze each element and check the response YES or NO

2. If positive responses exceed, or are equal to negative responses within any primary factor (A through F), the primary factor should be considered as a positive response.

3. If any three of the primary factors (A through F) are positive responses, this indicates the fire situation is or is predicted to be Class I

4. Factor G should be considered after all above steps. If either of these two items are answered YES and three or more of the other primary factors are positive responses, a Class I Team should be considered. If either question in G is answered YES and there are less than three positive responses in the primary factors (A through F), a Class II Team should be considered. If the answers to both questions in G are negative, it maybe advisable to allow the existing overhead to continue action of the fire.

It must be emphasized that this analysis should, where possible, be based on predictions to allow adequate time for assembling and transporting the ordered resources.

GLOSSARY OF TERMS

Potential for blow-up conditions - any combinations of fuels, weather and topography excessively endangering personnel.

Rare or endangered species, - threat to habitat of such species, or in the case of flora, threat to the species itself.

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.

Extended exposure to unusually hazardous line conditions - extended burnout or backfire situations, rock slides, cliffs, extremely steep terrain, abnormal fuel situations such as frost kill foliage, etc.

Disputed suppression responsibility - any fire where responsibility for suppression is not agreed upon due to lack of agreements or difference interpretations, etc.

Controversial fire policy - escaped management fires is one example of this another is differing fire policies between suppression agencies when the fire involves multiple ownership.

A. FIRE BEHAVIOR - OBSERVED OR PREDICTED:

YES	NO	
		1. Burning Index (from onsite weather measurements) predicted to be [illegible] or higher, using the major fuel model in which the fire is burning
		2. Potential for "blowup" conditions (terrain, fuel moistures, winds, [illegible] conditions, etc.).
		3. Crowning, long range spotting, or fire whirls observed, even during "[illegible] periods" (night).
		4. No relief forecast.
		TOTALS

B. PERSONNEL COMMITTED:

YES	NO	
		1. 500 or more line people per shift.
		2. More than three active divisions.
		3. Wide variety of special support personnel or equipment (military, MAFFS, etc.
		4. Are the majority of the local initial attack resources committed to this fi[illegible]
		TOTALS

C. CULTURAL RESOURCES THREATENED:

YES	NO	
		1. Urban interface.
		2. Summer homes.
		3. Other developed areas (industrial, etc.).
		4. Archaeological sites.
		5. Rare endangered species (habitat)
		6. Other special resources.
		TOTALS

D. SAFETY:

YES	NO	
		1. Extended exposure to unusually hazardous line conditions.
		2. Serious accident to fatality.
		3. Is there a substantial air operation that is not properly staffed?
		4. Are there other safety problems?
		TOTALS

E. OWNERSHIP

YES	NO	
		1. Fire burning on more than one land ownership
		2. Potential for claims (damages).
		3. Different or conflicting management objectives.
		4. Disputes suppression responsibility.
		5. Other.
		TOTALS

F. EXTERNAL INFLUENCES:

YES	NO	
		1. Controversial fire policy.
		2. Pre-existing controversies.
		3. Sensitive media relationships.
		4. Smoke Management problems.
		TOTALS

G. EXISTING OVERHEAD:

YES	NO	
		1. Existing overhead worked two shifts without success.
		2. Have overhead overextended themselves (mentally or physically)?
		TOTALS

FIRE COMPLEXITY ANALYSIS

The following questions are presented as a guide to assist the Superintendent and staff in analyzing the complexity or predicted complexity of a fire situation. Because of the time required to assemble to move an Incident Management Team to a fire, this checklist should be completed when a fire escapes initial attack and be kept as part of the fire records. This document is prepared concurrently with the preparation of a new or revised Escaped Fire Situation Analysis.

USE OF THE GUIDE

Analyze each element and determine if it is true for your fire.

1. If there are more positive responses than negative, the fire is predicted to become more complex.

2. If any two of the major headings are totally positive, the fire is predicted to become more complex.

3. If a review of the factors causes you to become uncertain as to the current management of the fire.

If any of the above is true, you should call for assistance.

FIRE COMPLEXITY ANALYSIS GUIDE

FIRE BEHAVIOR: Observed or Predicted — Yes/No

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. ___ ___

TOTAL.................................. ___ ___

RESOURCES COMMITTED

1. 200 or more personnel assigned. ___ ___
2. Increasing number and variety of support personnel and/or equipment. ___ ___
3. Substantial air operation which is not properly staffed. ___ ___
4. Majority of park initial attack resources are committed. ___ ___

TOTAL.................................. ___ ___

PARK RESOURCES THREATENED

1. Urban interface. ___ ___
2. Park developments and facilities. ___ ___
3. Cultural sites. ___ ___
4. Restricted, threatened or endangered species habitat. ___ ___
5. Unique natural resources, special designation zones, wilderness. ___ ___

TOTAL.................................

SAFETY

Yes/No

1. Unusually hazardous fireline conditions.
2. Serious accidents or fatalities. __ __
3. Threat to safety of park visitors from fire and related operations. __ __
4. Park restrictions and/or closures in effect or being considered. __ __
5. No night operations in place for safety reasons. __ __

__ __

TOTAL................................. __ __

JURISDICTION

1. Fire burning or threatening more than one jurisdiction.
2. Potential for claims (damages). __ __
3. Different or conflicting management objectives. __ __
4. Disputes over suppression responsibility. __ __
5. Potential for unified command. __ __

__ __

TOTAL................................. __ __

EXTERNAL INFLUENCES

1. Controversial fire policy.
2. Pre-existing controversies/relationships. __ __
3. Sensitive media relationships. __ __
4. Smoke management problems. __ __
5. Sensitive political interests. __ __

__ __

TOTAL................................. __ __

CHANGE IN STRATEGY		Yes/No
1.	Change in strategy to control from confine or contain.	__ __
2.	Large amounts of unburned fuel within planned perimeter.	__ __
3.	EFSA invalid or requires updating.	__ __
	TOTAL..................................	__ __

EXISTING OVERHEAD		
1.	Worked two operational periods without achieving initial objectives.	__ __
2.	Existing management organization ineffective.	__ __
3.	Overhead over extended themselves mentally and/or physically.	__ __
4.	Incident action plans, briefings, etc. missing or poorly prepared.	__ __
	TOTAL..................................	__ __

GUIDELINE FOR DETERMINING NEED FOR PARK CLOSURES/EVACUATIONS

The following questions are presented as a guideline to assist park fire managers in determining the present or predicted necessity for evacuation of all or part of the park. The final decision for closure/evacuation will be made by the superintendent. Because of the critical time elements involved in closure and evacuation, this checklist should be completed at any time two or more elements in primary factor A are positive and should be kept as part of the park's fire records. This analysis should be based on predictions to allow adequate time for implementing the appropriate action.

For purposes of this guideline, key terms are defined as follows:

1. Partial closure: Park Closure to visitors in specified areas.
2. Full closure: Park closure to visitors at entrances.
3. Evacuation: removal of employees' families and/or visitors from the park.

The following steps are to be taken to make determinations:

1. Analyze each element and check the response "yes" or "no".

2. If positive responses equal or exceed negative responses within primary factors A through D, the Primary factor should be considered a positive response.

3. Primary factor E is considered as a separate determinant.

4. Employ the following criteria to determine action:

   a. If factor E is "no" and one other primary factor is "yes", consider full or partial closure.

   b. If factor E is "no" and two or more primary factors are "yes", consider partial or full closure and evacuation of visitors.

   c. If factor E is "no" and three or more primary factors are "yes", consider evacuation of visitors and employees' families.

   d. If factor E is "yes", evacuate visitors and employes' families regardless of responses to other primary factors.

A. FIRE BEHAVIOR (observed or predicted)

	YES	NO
1. Burning Index, Fuel Model B, 72 or above.		
2. Crowning or spotting observed.		
3. Rate of spread 12 chains per hour or greater.		
4. Fire Size: 3 acres or more.		
5. More than one Class B size fire burning concurrently.		
TOTAL		

B. PERSONNEL COMMITTED PARKWIDE

	YES	NO
1. Usual initial attack forces committed.		
2. Park cooperative agreement crews committed.		
3. Park incidental firefighters committed.		
4. Fires remaining unstaffed after commitment of above park forces.		
5. Relief forces more than two hours away.		
TOTAL		

C. OPERATIONS

	YES	NO
1. Access/egress route likely to be heavily used by suppression traffic.		
2. Extensive air operations in vicinity of developed areas.		
3. Potential incident base location in area which conflicts with routine visitor activities.		
TOTAL		

D. LOCATION AND DIRECTION OF SPREAD

	YES	NO
1. Fire north of developed areas, proceeding south.		
2. Fire south of developed areas, proceeding north.		
TOTAL		

E. EXIT

	YES	NO
• Any vehicular egress route directly threatened for extended period (i.e., to point where no traffic could safely get through).		