Introduction

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On October 3, 1995 a wildfire ignited on Mount Vision and became what is now known as the Vision Fire. The Vision Fire was the most devastating wildfire at Point Reyes in sixty years, with more than 12,000 acres of state, federal and private lands burned. The origin of the fire was an illegal campfire on State Park lands that was improperly extinguished. The smoldering embers were later propelled by hot, dry 50-mph winds, and the fire spread rapidly through several decadent vegetation communities extending from Bishop pine/Douglas fir stands along the Inverness Ridge to beach grass assemblages in the sand dunes along the Pacific Ocean. At its peak, the fire spread at a rate of 3,100 acres per hour.

By the third day, the fire had consumed over 12,000 acres from mountain ridges to the sea, including 45 privately owned structures in the wildland urban interface along the Inverness Ridge. Although news agencies reported that 20% of the fire was contained on the second day, a discerning eye could easily distinguish from a map of the fire that the only containment was the Pacific Ocean. The fire continued to flare up over the next 10 days, re-threatening homes along the park boundary. Not until October 17, 14 days after ignition, was the fire officially declared controlled. Over 95% of the fire burned within the Point Reyes National Seashore. Within the Seashore, the Vision Fire burned a total of 11,410 acres, consuming 25% of the park's designated wilderness. Other areas burned included 370 acres of Tomales Bay State Park and 386 acres of private lands.

At the height of the fire suppression campaign, 2,164 personnel including 74 hand crews, 27 bulldozers, 7 air tankers, 7 helicopters and 196 fire engines were involved. Over 429,00 gallons of fire retardant and 1 million gallons of water were dropped over the land to control the fire. Park Headquarters were converted into a self-contained city overnight with personnel from several agencies National Park Service (NPS), California Department of Forestry (CDF), U.S. Forest Service, California Department of Corrections, California State Parks, U.S. Weather Service, Bureau of Indian Affairs, and fire departments extending from northern and central California and organizations (Salvation Army, American Red Cross, etc.) forming an encampment on park lands (BAER 1995).

The fire and fire suppression actions together had the potential for long-lasting effects to the natural resources of the Seashore. Fire suppression actions associated with containing and controlling the Vision Fire relied heavily upon direct and indirect mechanized bulldozer fireline construction. Much of the bulldozer line construction occurred in the upper reaches of watersheds with extremely steep and unstable slopes and with cascading effects to existing trails. Bulldozer lines in some areas traversed locations of known invasive nonnative plants, increasing the potential for their spread. Down slope of the line construction were numerous riparian areas, wetlands and estuaries that could be affected by siltation and runoff.

In the midst of the fire fighting, several eager researchers sought to methodically study the effects of the fire on the environment. Many of the researchers had pre-exiting sample sites that they wanted to examine while the fire was still smoldering. Others came with new ideas and proposals for study to record the effects of the fire over the short and long-term. The purpose of this document is to tell the story of the research that grew out of this fire just as quickly as the plants that sprouted amidst the

Cattle on Home Ranch during the Vision Fire.

Fog along flank of Inverness Ridge

Setting

Point Reyes National Seashore is located in Mann County, California, approximately 40 miles northwest of San Francisco. Established by Congress on September 13, 1962, the enabling legislation stated that park designation was

"to save and preserve, for the purpose of public recreation, benefit, and inspiration, a portion of the diminishing seashore of the United States that remains undeveloped" (PL 87-657).

The Wilderness Act of 1976 (P.L. 95-544) established 33,373 acres of wilderness in the Point Reyes National Seashore, thereby adding special protection. Today, nearly half of the Seashore is included in the National Wilderness Preservation System. Encompassing 71,046 acres of coastal dunes, coastal prairies, marine terraces, coastal scrub and forests, this geologically unique peninsula has rightly been called an "Island in Time".

Point Reyes National Seashore shares boundaries with many entities. Marine boundaries are shared with the Gulf of the Farallones National Marine Sanctuary; terrestrial boundaries are shared with Golden Gate National Recreation Area (GGNRA, another National Park), Tomales Bay State Park, The Nature Conservancy, and many private landowners. In 1988, UNESCO's Man in the Biosphere program designated the Golden Gate Biosphere Reserve (GGBR) under the International Biosphere Program; GGBR includes the Seashore, Golden Gate National Recreation Area and other public lands in the region. Much of the eastern border of the park is shared with private landowners. Within the park boundaries, there are several dairy and cattle ranches, which have continued operation after park acquisition, U.S. Coast Guard facilities, and some private in-holdings.

The Mediterranean climate produces heavy summer fog and moderate winter rains (average of 30 inches/year). Fall tends to be hot and dry and is the period of highest fire danger when vegetation is desiccated, and humidity is low. The year-round ambient temperatures are moderate, around 65°F; the difference in the monthly temperatures is only around 6.5°F. Coastal areas have a more moderate climate than the interior and can receive significant moisture from fog in summer. The inland areas receive about half the rainfall as the coastal range. With this variability, many microclimates occur. For example, Point Reyes Headland can be 55°F with fog and wind in the summer, contrasted with Olema Valley, just 15 miles distance, with temperatures above 80°F with no wind.

Point Reyes is part of the Mediterranean division of eco-regions of California and is distinguished by alternate wet and dry seasons (Bailey 1995). The area is notable as a transition zone between the dry west coastal desert and the wet west coast. Mediterranean-type ecosystems host a disproportionate share in the number of plant species worldwide in both the number of species and the number of rare or locally endemic species.

The Coast Ranges are gently to steeply sloping low mountains or marine terraces underlain by shale, sandstone, and igneous and volcanic rocks. Overlain on this topography, the major biomes of the park include forests, grasslands, savannahs, and several types of aquatic environments. Hard leaved evergreen trees and shrubs called sclerophyll forests, which can withstand severe drought and evaporation in the summer, typically dominate the vegetation. The pattern of plant community distribution consistently has forest on north facing slopes and on wetter sites, chaparral/scrub on south facing slopes and drier sites, and riparian corridors between ridges and along valleys. Additionally, the plant communities vary with distance from the marine influence, temperature, and elevation.

Fire History

Many of the plants of Point Reyes have evolved with fire, either requiring fire for regeneration such as Bishop pine, or resprouting rapidly after fire such as coyote bush. The ignition of fires, though, is rarely from lightening strikes at Point Reyes, accounting for only 2% of fires recorded over the past 50 years. he earliest human inhabitants of Point Reyes, the Coast Miwok, used fire to manage the landscape for food and fiber. They concentrated burning in coastal grasslands and oak woodlands to support grazing ungulates such as deer and to force oak trees to produce higher yields of acorns. Mexican ranchers, on the other hand, burned mostly brushlands, saving the grasslands for introduced livestock forage.

Researchers who have studied the fire history of the Point Reyes Peninsula determined from the scarring of old trees and from core samples that there were an average of 2-12 fires per year over the past 300 years (Brown et al. 1999). This fire frequency likely reflects the regular burning efforts of the Coast Miwok and Mexican

A staging area at Sky Camp.

ranchers. Over the past century, though, several fires occurred in Bishop pine stands on Inverness Ridge. The Santa Barbara Weekly Independent reported a forest fire raging near Point Reyes in October 1887. Another fire that started on the west slope of Mount Vision burned through the Bishop pine forest to within two miles of Inverness in October 1927. Dr. Millard Ottinger who purchased a large portion of land on the northern end of Inverness Ridge set numerous fires between 1930 and 1960 in order to clear brush and improve forage production for livestock and deer.

Only one major wildfire, though, has occurred at Point Reyes since the Seashore was established in 1962. The Kelham Beach fire in June of 1976 was started by campers in brush on coastal bluffs in the southern area of the wilderness. The fire burned 325 acres in brush and Douglas fir before it was finally brought under control. All other fires over the past forty years were small and did not alter the landscape.

Fires have occurred at all times of the year at Point Reyes, but the vegetation is more prone to burn beginning in early June, after rains cease in April and May. Typically, a persistent coastal fog forms by early July, following the stabilization of the Pacific high over central California. From July through early September, the fog moves inland and back out to sea in a 3-4 day cycle in response to heating and cooling in California's Central Valley. In September and October, the fog pattern changes as temperatures drop in the Central Valley. Strong foehn winds, also called Santa Ana winds in southern California and Mono winds in central California, may develop if there is a low-pressure trough off the coast. These winds bring warm, dry air to Point Reyes and cause rapid drying of fuels, live and dead. These episodes usually last 1-2 days causing extreme fire danger. The combination of prolonged drought, low relative humidity and a peak in dry vegetation often causes fire danger to be high through October. In addition, almost one-fifth of the area's annual lightning storms occur at this time. The period from September through October is considered the most critical time of fire danger for the Seashore.

Vision Fire Evaluation and Restoration

The Vision Fire met the criteria for generating a major wildfire in Point Reyes: it began in early October when vegetation was desiccated after summer months of drought; and foehn winds blew intensely at 40 to 50 mph along the Inverness Ridge. Ignited by an unattended campfire at around 1300 hr on Mt. Vision, within the Tomales Bay State Park, winds accelerated the spread of the fire through steep terrain and in volatile Bishop pine forests.

Shortly after the fire began, and before it was contained, a Department of Interior multidisciplinary team, the Burn Area Emergency Rehabilitation (BAER) team, was assembled to assess the fire effects. The BAER team was made up of resource specialists with expertise in plants, animals, soils, water resources, cultural resources, structures, roads and trails. Agencies represented on the team included the U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, and Bureau of Indian Affairs. The primary task of the BAER team was to produce a report documenting the fire effects on the resources of the park and adjacent lands, analyzing the fire suppression effects on park resources, and presenting recommendations for mitigation actions, including actions to restore the integrity of the wilderness area portion of the Point Reyes National Seashore in accordance with the Wilderness Act, National Park Service Management Policies.

The BAER team identified several areas of additional research necessary to guide mitigation recommendation. Simultaneously, a number of scientists who were conducting independent research within the park were presented with an opportunity to evaluate the effects of the wildfire upon their studies. Other scientists were eager to initiate research to understand the effects and implications of the wildfire on a myriad of the environmental subjects.

Burn intensity was one of several factors that the BAER team and the researchers analyzed to understand the behavior and results of the fire. Burn intensity on the landscape was identified based on several measures such as soil friability, soil moisture content, cover left, and quality of ash. Approximately 11% of the fire area was burned by high intensity fire, 19% by moderate intensity and 70% by low intensity. Burn intensity varied significantly across the landscape because of slope, aspect and plant species. Plant communities were affected in various ways as burn intensities fluctuated across the landscape, and in turn, burn intensities influenced the recovery of ecosystems.

Plant communities that burned included marshland, coastal prairie, coastal grasslands, riparian, coastal dune, northern coastal scrub, mixed hardwood conifer, Bishop pine forest, and Douglas fir forest. Each of these com-

munities has associated species that are unique to California, and in some cases, to the world. Within the burn perimeter, many species of plants (23), mammals (8), birds (24), insects (8), amphibians (4), reptiles (2) and fish (4) were identified as sensitive or endemic to the park. Several species had special recognition under the U.S. Endangered Species Act and the California Endangered Species Act. Of particular note were the federally listed species such as the steelhead trout (*Oncorhvnchus mykiss*) and northern spotted owl (Strix occidentalis), but also species unique to Point Reyes such as the Point Reyes mountain beaver (*Aplodontia rufa yhaea*) and the Point Reyes jumping mouse (*Zapus trinotatus orarius*; see BAER report 1995).

Eighteen watersheds within the perimeter of the Vision Fire also were affected at various stages based upon fire intensity, slope and soils. Soils on slopes >11% are considered highly erosible and over 80% of the area burned had slopes with this grade. Soil associations within the burn were not only highly prone to erosion but were also hydrophobic (repel water) following exposure to moderate to intense fire intensities. The waxy surface on the leaves of many plant species such as coast live oak was deposited on the soils when the plants were burned, contributing to the hydrophobic soil condition. Consequently, erosion potential was very high within portions of the burn area due to this combination of factors and to the potentially high annual winter rainfall. Of these watersheds, eight were known to contain populations of the threatened steelhead trout and potentially contained populations of the Coho salmon. The Seashore was concerned that impacts from increased sedimentation, ash and carbon input, and alterations of water chemistry could have adversely affect these species.

The BAER team ultimately recommended numerous restoration projects to mitigate the effects of the fire and fire suppression actions on the resources of the park. The projects included 1) restore 23 miles of bulldozer line, 2) restore 6.4 miles of fire fighter hand lines, 3) rebuild 5 miles offence line, 4) remove 13 helicopter landing spots, 5) mitigate 1,100 hazardous trees, 6) restore 10 safety zones, 7) assess 31 historic sites, 8) monitor the spread of non-native weeds, and 9) monitor 10 threatened, endangered or sensitive species.

Research Emphasis

The rapid momentum of events propelled the Seashore to begin restoration actions of natural resources with limited information, and consequently, the Seashore decided to initiate and integrate several studies. The purpose of the research was to evaluate fire and fire suppression effects on the integrity of abiotic resources and plant and animal communities. The projects would encompass analyses of physical, chemical and biological changes to the ecosystems in different areas of bum intensity. The studies were designed to monitor treatments and affected resources to determine the effectiveness of measures taken to mitigate suppression and rehabilitation actions. Feedback from the

Rehabilitation of a burned area for erosion control.

studies could then be utilized to improve future treatments.

The studies also were designed to evaluate the short and long-term post-fire effects on the natural resources of the Seashore. Changes in ash and soil would occur with each rain and resprouting of plants would begin immediately, and so there was an urgency to begin some of the studies while the fire was still burning. Changes in the landscape and populations of some species, though, might continue for several years.

On the first year anniversary of the Vision Fire, the Seashore hosted a symposium giving the researchers an opportunity to tell their stories to the community. This report is a record of some of those fire stories.

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Mount Vision in the distance at the mouth of Drakes Estero and Drakes Head.