National Park Service
U.S. Department of the Interior

Lassen Volcanic National Park

READING FIRE

Burned Area Emergency Response Plan

September 2012

PARK: Lassen Volcanic National Park

DATE: September 6, 2012

PREPARED BY: National Park Service Reading Fire BAER Team

SUBMITTED BY: Darlene M Koontz Date: 9/6/12
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MANAGEMENT SUMMARY

This Burned Area Emergency Response (BAER) plan has been prepared in accordance with Department of the Interior and National Park Service policy, including Departmental Manual 620 Part 3: Burned Area Emergency Stabilization and Rehabilitation and the Interagency Burned Area Emergency Response Guidebook. The primary objective of BAER is to assess the need for and implement cost effective post-fire stabilization measures to protect human life, property, and critical cultural and natural resources in accordance with approved land management plans and policies, and all relevant federal, state, and local laws and regulations.

This plan provides emergency stabilization rehabilitation recommendations for all lands burned within Lassen Volcanic National Park. It was prepared by a BAER team comprised of National Park Service (NPS) staff. Assessments of the burned area were performed by the NPS BAER team and another of United States Forest Service (USFS) personnel under unified command. The USFS BAER team completed a separate plan for treatments and activities proposed on USFS lands.

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In addition to BAER, the NPS BAER team also identified issues best addressed with Burned Area Rehabilitation (BAR) funds. The primary objectives of BAR are to stabilize ecosystems damaged by fire or threatened by post-fire conditions, and repairing or replacing minor infrastructure damaged by fire or post-fire conditions. BAR specifications will be submitted separately in accordance with NPS policy.

Reading Fire Background

A thunderstorm passing over Lassen Volcanic National Park on July 23, 2012 produced numerous lightning strikes, one of which ignited a fire in wilderness one mile northeast of Paradise Meadows. Park personnel decided to manage the fire for resource benefit consistent with the 2012 Lassen Park Fire Management Plan.

Over the next two weeks, the fire gradually grew under park management from ¼ acre to 140 acres, all south of the Lassen Park Highway. On August 6, fire behavior intensified and wind-borne embers started several spot fires north of the highway in the Hat Creek drainage. Dry fuels and winds enabled the fire to expand to 1,011 acres by the end of the day.

Driven by southerly winds, the fire advanced quickly to the north and crossed onto Lassen National Forest at Badger Mountain on August 7. On the evening of August 7th, a Type 2 team took command of the Reading Fire. Initial attack consisted of bulldozers and hand crews building direct and indirect line with the objective of limiting fire spread to the north toward the village of Old Station.

On August 8, continued spot fires on the northern fire perimeter prompted several air tanker retardant drops near Badger Mountain and West Prospect Peak. Slowed on the north, the fire spread primarily east and southeast, reaching 15,491 acres by August 12. A Type 1 team took command of the fire on August 13, and implemented a suppression strategy based on indirect line construction. Burn out operations began along indirect lines through August 16. These were successful in limiting the spread of the fire. Additional air tanker drops on August 17 slowed progression to the northeast and enabled firefighters to hold the lines on Prospect and West Prospect peaks.

By August 18, efforts were shifting to patrol, mop up and repair on the north, south, and west sides of the fire. The east and southeast flanks (in designated Wilderness) were addressed by crews building hand line and attacking spot fires. These efforts were successful, especially as the fire moved into areas cleared by older burns (Bluff, Crater, and Fairfield).

The fire was declared 100% contained on August 22, 2012. The incident was transferred to a Type 3 team on August 23; this team primarily oversaw mop up and repair of suppression damage before returning management of the incident to the park on August 30. Full control of the fire will likely occur during the fall and winter precipitation season.

In total, the Reading Fire directly affected 28,063 acres: 16,925 on NPS, 11,064 on USFS, and 74 on private lands (Figure 1). At the peak of the incident, resources assigned to the incident included more than 1200 personnel, consisting of 31 hand crews, 85 engines, 5 helicopters, and support staff.

READING FIRE SUMMARY	
FIRE NAME	READING
FIRE NUMBER	CA-LNP-003115
FIRE CODE	G3H7
PARK	LAVO
REGION	PACIFIC WEST
STATE	CALIFORNIA
IGNITION DATE	JULY 23, 2012
CONTAINMENT DATE	AUGUST 22, 2012
NPS ACRES	16,925
USFS ACRES	11,064
PRIVATE ACRES	74
TOTAL ACRES	28,063

BAER Assessments, Major Findings and Prescriptions

The BAER teams performed assessments through a combination of field visits, literature reviews and consultations with local technical specialists. The principle goals of the assessments included:

- Identify and inventory values at risk (e.g., property, capital improvements, natural and cultural resources)
- Identify the physical, biological and social mechanisms that pose threats to values at risk (e.g., flooding, erosion, debris flows, rockfall, hazard trees, looting, invasive species)
- Determine the viability of mitigating threats and proposing treatments as warranted.

The following values at risk were assessed for potential hazards on the Reading Fire:

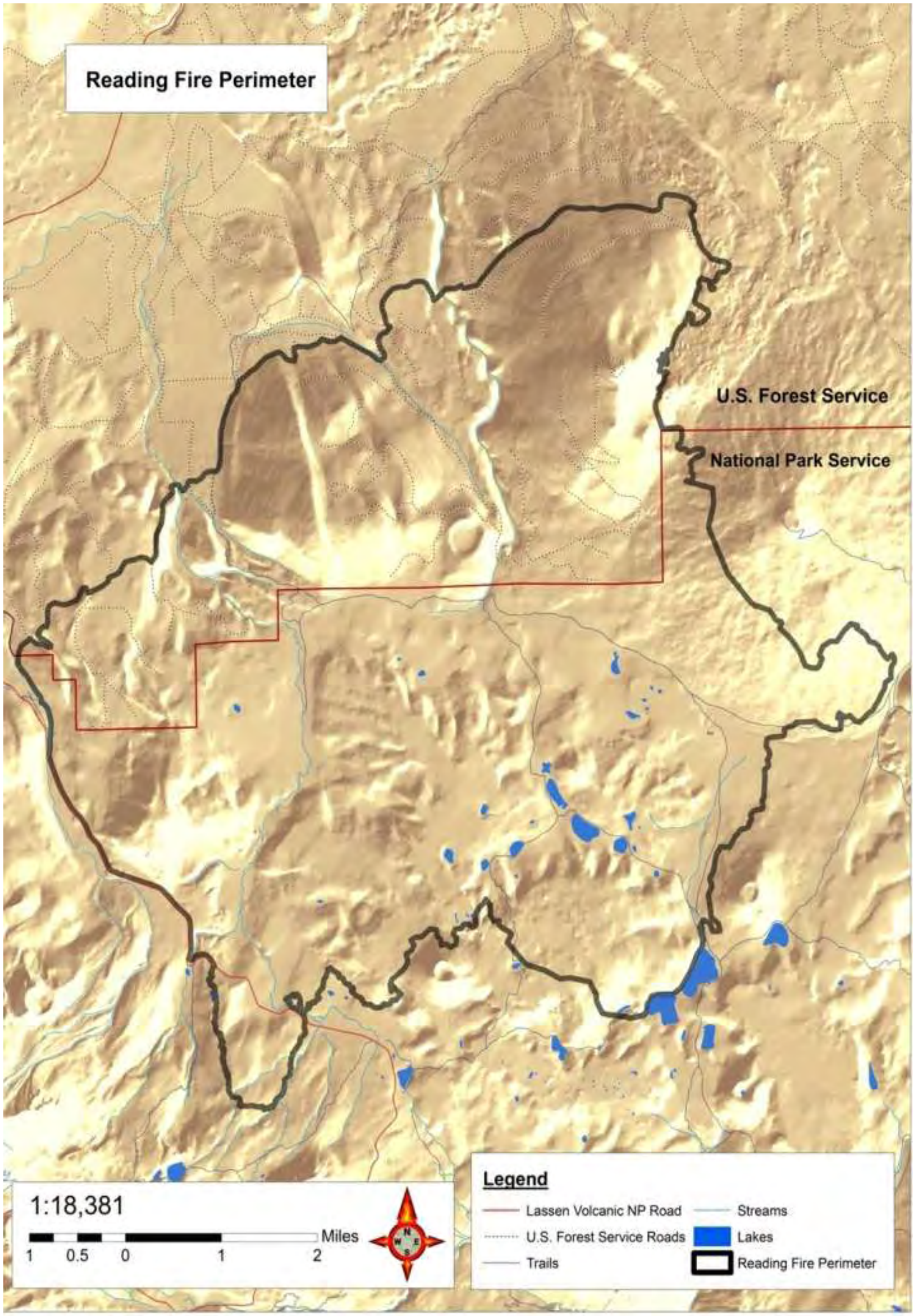


Figure 1. Final Reading Fire perimeter.

- Impacts to Lost Creek and Hat Creek Watershed from post-fire watershed conditions and the effects of sedimentation to downstream fisheries (Wildlife Assessment Section).
- Impacts to culverts (both historic and non-historic) and slope stability along National Register listed Lassen Volcanic National Park Highway (Watershed Assessment Section).
- Hazard tree felling along park road, trails (including Pacific Crest Trail), other heavily used areas of park to protect life and property (Forestry Assessment Section).
- Monitoring and stabilization of cultural resources (Cultural Assessment Section).
- Weed impacts in areas of high burn severity and suppression impacts (Vegetation Assessment Section).
- Replace/rehab safety-related signage that was lost and install warning signs (Infrastructure Assessment Section).
- Monitor/investigate retardant drop zones for water quality issues (Watershed Assessment Section).
- Monitor/investigate retardant drop zones for invasive weed issues (Vegetation Assessment Section).
- (Watershed Assessment Section).
- Effects of sedimentation at the Lost Creek water intake (Watershed Assessment Section).
- Composting toilet in Inholders road area (Watershed Assessment Section).

Major findings and prescriptions include:

- Observed burn severity, hydro-morphology, and the placement of values at risk rule out the threats of damaging flooding and debris flows except in the unlikely occurrence of extreme weather events. Culvert cleaning, floatable debris removal, and road clearing are prescribed for portions of the Lassen Volcanic National Park Highway.
- Imminent hazard trees were removed by the various Incident Management Teams. Additional hazard tree removal along the Lassen Volcanic National Park Highway and Inholder road is proposed.
- Burned safety related signs were noted and others are likely present; these should be replaced. Signs warning of post-fire threats are prescribed in areas of public use.
- Continued assessments are recommended for cultural resources threatened by erosion, hazard trees and looting.
- Noxious non-native invasive plants should be detected and treated using BAR funds.
- There are no significant post-fire threats to special status wildlife species or the fishery in Hat Creek.

The total BAER request for the Reading Fire in FY12 and FY13 is $220,968. The costs are summarized by specification in the table below.

SUMMARY OF BAER TREATMENT AND ACTIVITY COSTS

LINE ITEM NUMBER	SPECIFICATION NUMBER	TITLE	COSTS EMERGENCY STABILIZATION
1	WS-1	Monitor and Remove Rock Fall from Roads	
2	WS-2	Monitor and Remove Debris from Culverts	
3	WS-3	Install Warning Signs on Roads and Trails	
4	WS-4	Remove Floatable Debris Upstream of Culverts	
5	WS-5	Increased Maintenance of the Lost Creek Water Intake	
6	F-1	Hazard Tree Mitigation	
9	CR-1	Conduct Archeological Site Assessments	
10	IL-1	Implementation Leader & Administrator	
11	AP-1	BAER Assessment and Planning Team	
		TOTAL COSTS	

Treatments in Wilderness

A high percentage of the burned lands in Lassen Volcanic National Park are designated Wilderness (Figure 2). As such, a very conservative approach was taken to prescribing treatments in these areas, so long as post-fire conditions posed no threats to safety, property or resources. Philosophical guidance on this topic was provided by a USFS document entitled *BAER Guidance Document—Treatments in Wilderness*, portions of which are presented below.

> Fire in wilderness is typically considered to be a part of the ecological processes that create the natural conditions that have statutory protection in wilderness. BAER stabilization treatments in wilderness are limited to those consistent with law and agency policy. Guidance in FSM 2523.03 provides that any necessary emergency stabilization treatments "are to be consistent with wilderness management objectives". Specific Forest Service Policy regarding BAER activities in wilderness is contained in FSM 2323.43b: "Permit emergency burned area rehabilitation only if necessary to prevent an unnatural loss of the wilderness resource or to protect life, property, and other resource values outside of wilderness. Normally use hand tools and equipment to install selected land and channel treatments" and in 2323.43a : "Use indigenous or appropriate naturalized species to reestablish vegetation where there is no reasonable expectation of natural healing."

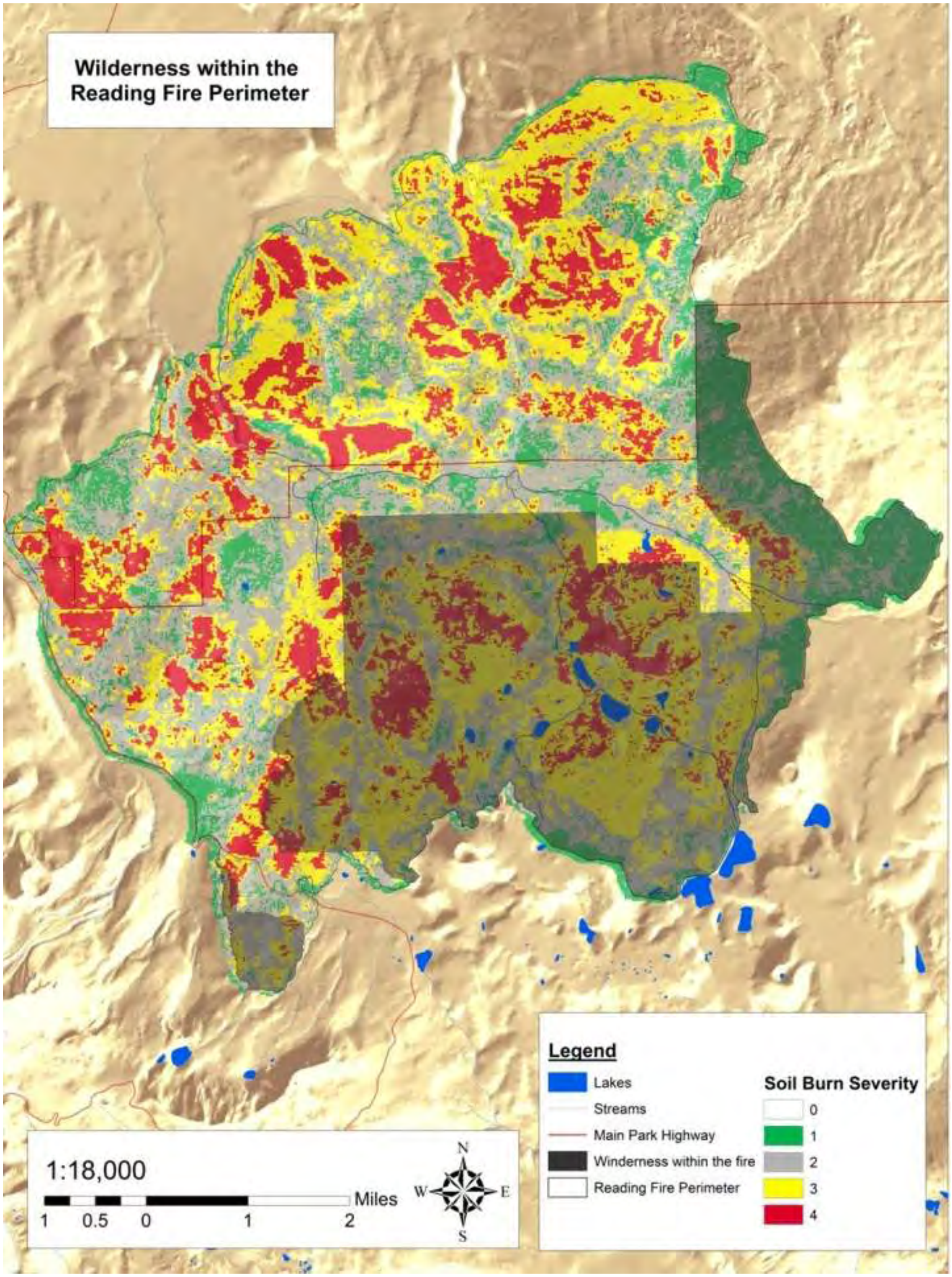


Figure 2. Reading Fire soil burn severity map with Designated Wilderness.

Additional direction regarding use of non-motorized equipment applicable to emergency stabilization needs is contained in FSM 2323.43a: “Use non-motorized equipment to accomplish improvement objectives. Only imminent threat to important values downstream justifies the use of motorized equipment.”

Forest Service decision authority regarding approval for use of motorized equipment, mechanical transport and landing of aircraft for emergency stabilization activities in wilderness is contained in FSM 2326 and supplemented through some Regional directives.

When wilderness is involved in burned area emergency stabilization assessments, “no treatment” is always the preferred action. FS policy provides for two situations where further investigation may be warranted; unnatural loss of the wilderness resource or to protect life, property or other resource values outside of wilderness.

An ‘unnatural loss’ is a degradation of the wilderness resource caused by modern human impacts or manipulations, or interference in biophysical processes. In many cases there is no demonstrable, objective basis for the assertion that the effects of a fire will lead to an unnatural loss of the wilderness resource. Because Forest Service policy does not explicitly discuss all the possibilities regarding the identification of potential unnatural losses of the wilderness resource and techniques to prevent such losses, BAER Team members are encouraged to seek advice from local or Regional wilderness specialists. In most cases it is difficult to justify BAER treatments in wilderness to prevent an unnatural loss of the wilderness resource’.

The vast majority of BAER treatments proposed for wilderness will be due to threats to life and property outside wilderness. Treatments proposed for wilderness must address imminent threats to downstream or down slope human life or property or unacceptable degradation of critical natural or cultural resources. If imminent threats are identified, and treatments exist to prevent or minimize the effects, then a determination must be made regarding the best location for those treatments. Treatments should only be proposed in wilderness when it is the most effective location for providing needed mitigative or preventative effects or when needed to ensure the success of treatments located outside of wilderness.

Once the determination has been made that wilderness areas must be included in the treatment area, determine the least impacting method and minimum tools that will meet the emergency stabilization objectives, while maintaining natural and naturallyappearing conditions. Treatments should not require maintenance and not interfere with long-term social and biophysical wilderness values. Treatments that involve marking sites, access routes, or the use of temporary structures should have a plan for removal when no longer needed.

Where treatments must be used in wilderness, the following options (not an all-inclusive list) may be considered on a case-by-case basis. The scope and intensity of any treatment chosen should be commensurate with the magnitude of the values at risk. Non-structural prevention and stabilization treatments are always preferred over structural treatments in wilderness.

Use with Caution

- Hillslope treatment using existing downed logs or excelsior wattles.
- Hazard warning.
- Trail drainage improvement.
- Protective fences or barriers.
- Seeding of sterile nurse species or native species from local source.
- Weed-free mulch.
- Treatment of invasive species.

Treatments to Avoid

- Hay/straw bales (due to visual effect and potential for weed and non-native seeds).
- Seeding non-natives or non-local natives (to avoid introducing non-native genetics).
- Contour felling (due to visual effects, and loss of natural conditions).
- In-stream structures or riparian planting (due to effects of human actions on habitat).
- Pre-fab erosion control structures (loss of natural conditions).

BURNED AREA ASSESSMENTS

WATERSHED RESOURCE ASSESSMENT

OBJECTIVES

- Assess overall soil and watershed changes caused by the fire, particularly those that pose substantial threats to human life and property, and critical natural and cultural resources. This includes evaluating changes to soil conditions, hydrologic function, and watershed response to precipitation events

- Identify potential flood and erosion source areas and sediment deposition areas

- Identify potential threats to life, property, and critical natural and cultural resources in relation to flooding, debris flows, erosion, sediment deposition, and fire retardant application;

- Develop treatment recommendations, if necessary

- Identify future monitoring needs, if necessary

ISSUES

- Risk to human life and property from floods, mudflows and debris flows within and downstream of the Reading Fire.

- Risks to water quality in due to fire retardant applications.

- Critical natural resources including Hat Creek Rainbow Trout habitat and critical historic and prehistoric cultural resources.

OBSERVATIONS

<u>Background</u>

The purpose of a burned area assessment is to determine if the fire caused emergency watershed conditions and if there are potential values at risk from these conditions. Identification of values at risk occurs through consultation with individuals and state and federal agencies, and through field investigation. Not all values initially identified are determined to be at risk. If emergency watershed conditions are found, and values at risk are identified and confirmed, then the magnitude and scope of the emergency is mapped and described, values at risk and resources to be protected are analyzed, and treatment prescriptions are developed to protect values at risk. The most significant factor leading to emergency watershed conditions is loss of ground cover, which leads to erosion and changes in hillslope hydrologic function in the form of decreased infiltration and increased runoff. Such conditions lead to increased flooding, sedimentation and deterioration of soil condition. Values at risk are human life, property, and critical natural and cultural resources located within or downstream of the fire that may be subject to damage from flooding, ash, mud and debris deposition, and hillslope erosion.

Physiography/Geology/Climate

The Reading fire began as a managed wildfire in the northern portion of Lassen National Park but ultimately burned 16,993 acres in the Park, 11,071 acres to the north on Lassen National Forest, and 75 acres on private lands for a total of more than 28,000 acres. The fire burned primarily in the Hat Creek watershed, a tributary to the Pit River. The area is located in mountainous terrain at the intersection of three biogeographic regions in northeastern California: the southern Cascade Mountain Range, the northern Sierra Nevada Mountains, and the Basin and Range Province. Elevation within the fire perimeter ranges from 5,118 feet above sea level on the northern flank of Badger Mountain to 8169 feet above sea level on the upper slopes of West Prospect Peak. Slopes are relatively flat but the landscape is punctuated by volcanic peaks (e.g., Lassen, Reading, Hat, Fairfield, Prospect, West Prospect, Raker, and Badger) with slopes exceeding 100 percent.

The Reading fire occurred in a geologically unique region well known for volcanic activity. Prior to the Mount St. Helens eruption in May of 1980, the most recent volcanic eruption in the continental United States occurred on Lassen Peak in 1915. Geologic diversity is well represented in the area with plug dome volcanoes, shield volcanoes, composite volcanoes, and cinder cones. Other volcanic evidence includes lava flows devoid of vegetation, as well as a number of geothermal resources including fumaroles, mud-pots, and boiling springs (Lassen Volcanic National Park Fire Management Plan). Geologic diversity is also driven by the geological influence of the southern Cascades, the northern Sierra Nevada, and the Basin and Range province. Some areas within the fire consist of cinder with little organic development and sparse vegetation, however, most burned areas were well forested with moderate to heavy surface and ladder fuels.

The area experiences a Mediterranean-type climate with cool, dry summers and occasional thunderstorms. Winters are cold and wet with deep snowpack formation, averaging 15.7 feet at 8,200 feet above sea level (Taylor 1995). Annual precipitation on the east side of the park is approximately 40 in, mostly occurring as snow (McCullough et al. 2011), while annual precipitation in Mineral on the southwest side of the park is approximately 52 in (Lassen National Park Fire Management Plan). Mean annual high temperatures range from 21 degrees F in winter to 81 degrees F during the summer months.

Fire season in the park typically occurs from July 10 to October 15 of each year, based on historical fire weather data collected from the Manzanita Lake and Chester RAWS and fire incident reports dating back to 1961. This time period also includes the highest incidence of lightning, along with the highest mean daytime temperatures and lowest mean daytime relative humidity's. Outside of these dates, fuel moistures and persistent snowpack reduce the burning indices to near zero (Lassen Volcanic National Park Fire Management Plan).

<u>Soil Burn Severity</u>

Soil burn severity mapping is intended to reflect the degree of effects caused by the fire to soil characteristics that affect soil health and hydrologic function, and hence erosion rate, and runoff potential. It is not a map of vegetation consumption. In mapping soil burn severity, the team evaluated field-observable parameters such as the amount and condition of surface litter and duff remaining, soil aggregate stability, amount and condition of fine and very fine roots remaining, and surface infiltration rate (water repellency). Water repellency was evaluated by observing the length of time a water drop remained beaded on the soil. If water repellency was present, the depth and thickness of this water repellant layer was also measured. Ash and soil color may also indicate how intense the heat was and how long it remained at a given place (residence time). These parameters are compared to similar soils under unburned conditions to estimate the degree of change caused by the fire.

While soil burn severity is not based primarily on fire effects to vegetation, the team used post-fire vegetative condition as one of the visual indicators in assessing soil burn severity. In some cases there may be complete consumption of vegetation by fire, with little effect on soil properties, such as in a shrub ecosystem. Dense vegetation, with a deeper litter and duff layer, results in longer heat residence time, hence more severe effects on soil properties. For example, deep ash after a fire usually indicates a deeper litter and duff layer prior to the fire, which generally supports longer residence times. This promotes loss of soil organic cover and organic matter which are important for erosion resistance, and the formation or exacerbation of water repellent layers at or near the soil surface. The results are increased potential for runoff and soil particle detachment and transport by water, wind, and gravity. This would be mapped as high soil burn severity.

Conversely, sparse or light pre-fire vegetation such as grasses or sparse shrubs usually have negligible litter layer and surface fuels and experience extremely rapid consumption and spread rates, with very little heat residence time at the soil surface. The result is very little alteration of soil organic matter and little or no change in soil structural stability. Water repellency, usually present under shrubs before the fire, may or may not be exacerbated by the fire. Areas between shrubs or grass crowns usually had very little fuel to burn, thus only experienced brief radiant heat as the flashy grasses and sparse shrubs burned. In these cases, soil burn severity would be low.

In between these extremes, the moderate class of soil burn severity is far more diverse in observed soil conditions and can include various vegetation types, ranging from forests to shrub communities. In the case of a forest, the litter layer may be largely consumed, but scorched needles and leaves remain in the canopy and will rapidly become mulch. This is important in re-establishing protective ground cover and soil organic matter. This factor can result in the classification of the area as moderate, rather than high. Generally, however, there will also be less destruction of soil organic matter, roots, and structure in an area mapped as moderate. In a shrub ecosystem, even where pre-fire canopy density was high, litter layer is generally thin, and while the shrub canopy may have been completely consumed by the fire, the soil structure, roots, and litter layer may remain intact beneath a thin ash layer. Above ground indicators such as size of unconsumed twigs remaining to help the team determine how long the heat may have persisted on the site. If only root stubs' and large diameter twigs remain, it was likely a more intense fire with longer heat residence time, and combined with other observations of soil conditions may result in a call of high soil burn severity. More common in chaparral is a condition of remaining small diameter twigs, indicating a flashy fire with short residence time. Combined with other observations of soil conditions this usually resulted in a classification of moderate soil burn severity even though the canopy was partially consumed.

<u>Soil Erosion/Debris Flow</u>

Soil erosion potential following a fire is generally increased over pre-fire potential. This is largely due to loss of soil cover (forbs, grass, leaf, and needle litter), surface horizon soil organic matter responsible for structural stability, and in some cases, increased water repellency at or near the soil surface. The amount of increase over pre-fire condition is related to the degree of soil changes. The degree of soil alteration influences the potential of post-fire soil erosion and debris flow process.

The factors most affected by fire are: 1) the amount of effective soil cover, 2) the inherent susceptibility to soil particle detachment by wind, water, or gravity (a function of soil texture and structural stability), and 3) the surface infiltration rate. Areas of high soil burn severity can be expected to show a larger increase in sediment production than an area of low soil burn severity due the concomitant decrease in soil cover, increase in susceptibility of soil particle detachment, and decrease in the infiltration capacity of the soil. It is important to understand pre-fire erosion behavior when assessing post-fire erosion, since some areas have water repellant surfaces and inherently high erosion potential even before the fire.

<u>Watershed Response</u>

Overland flow occurs as a result of rainfall that exceeds soil infiltration capacity and the storage capacity of depressions. On the unburned forest floor, overland flow is often absent, though when it does occur flow is forced to follow a myriad of interlinking paths that constantly change as organic material (litter and duff layers) and inorganic material (rock) are encountered. Consumption of the forest floor by fire alters the path of overland flow by reducing the overall length of the flow path, resulting in the concentration of flow into a shorter flow path. This concentration of overland flow increases the hydraulic energy of the flow and can result in rill erosion. At the watershed scale, the reduction of hillslope flow path lengths and the formation of rills that have a high water conveyance capacity reduce the times of concentration or the amount of time for overland flow to reach a defined point within the watershed.

Overland flow is also increased if there is an increase in water repellency (hydrophobicity) of the soils because of the fire. This can reduce infiltration and increase overland flow (runoff). Infiltration curves for water repellent soils reflect increasing wettability over time once the soil is placed in contact with water. Water repellency decreases (hence infiltration increases) with time as the substances responsible for hydrophobicity begin to break down, thereby increasing wettability. In general, fire-induced hydrophobicity is broken up or is sufficiently washed away within one to two years after a fire. The thicker and deeper the water repellant layer, the longer it will take to dissipate. However, once soil cover and vegetative canopy begin to recover, this persistent water repellency becomes less significant to the runoff response since the litter and canopy quickly restore protection of soil and obstruction of overland flow, thus enhancing infiltration and reducing energy for runoff and erosion.

Raindrops striking exposed mineral soil with sufficient force can dislodge soil particles. This is known as splash erosion. These dislodged particles can fill in and seal pores in the soil thereby reducing infiltration. Further, once soil particles are detached by splash erosion they are more easily transported in overland flow. Surface erosion is defined as the movement of individual soil particles by a force (wind, water, or gravity), and is initiated by the planar removal of material from the soil surface (sheet erosion) or by concentrated removal of material in a downslope direction (rill erosion). Surface erosion is a function of four factors: 1) susceptibility of the soil to detachment, 2) magnitude of external forces (raindrop impact or overland flow), 3) the amount of protection available by material that reduces the magnitude of the external force (soil cover), and 4) management practices that can reduce erosion.

On-the-ground field observations within and downstream of the burned area were conducted to determine potential watershed response. Channel morphology related to transport and deposition processes were noted, along with channel crossings and stream outlets. Observations included condition of riparian vegetation and the volume of sediment and wood stored in channels and on slopes that could be mobilized.

FINDINGS

In order to assess the degree of threat to values at risk from post-fire watershed conditions, several environmental aspects need to be evaluated including: soil burn severity, erosion and debris flow potential, and watershed response.

Soil Burn Severity

A soil burn severity map is derived from the BARC map through field calibration (ground truthing) of soil burn severity. Calibration of the BARC to a soil burn severity map comprised 58 ground truthing points across the entire fire. Within the Reading Fire on NPS land 16,925 acres were burned. Of those acres, 2,491 have high soil burn severity (15%), 5,898 have moderate soil burn severity (35%), 6,240 have low soil burn severity (37%), and 2,298 (14%) are unburned or very low soil burn severity (Figure 3).

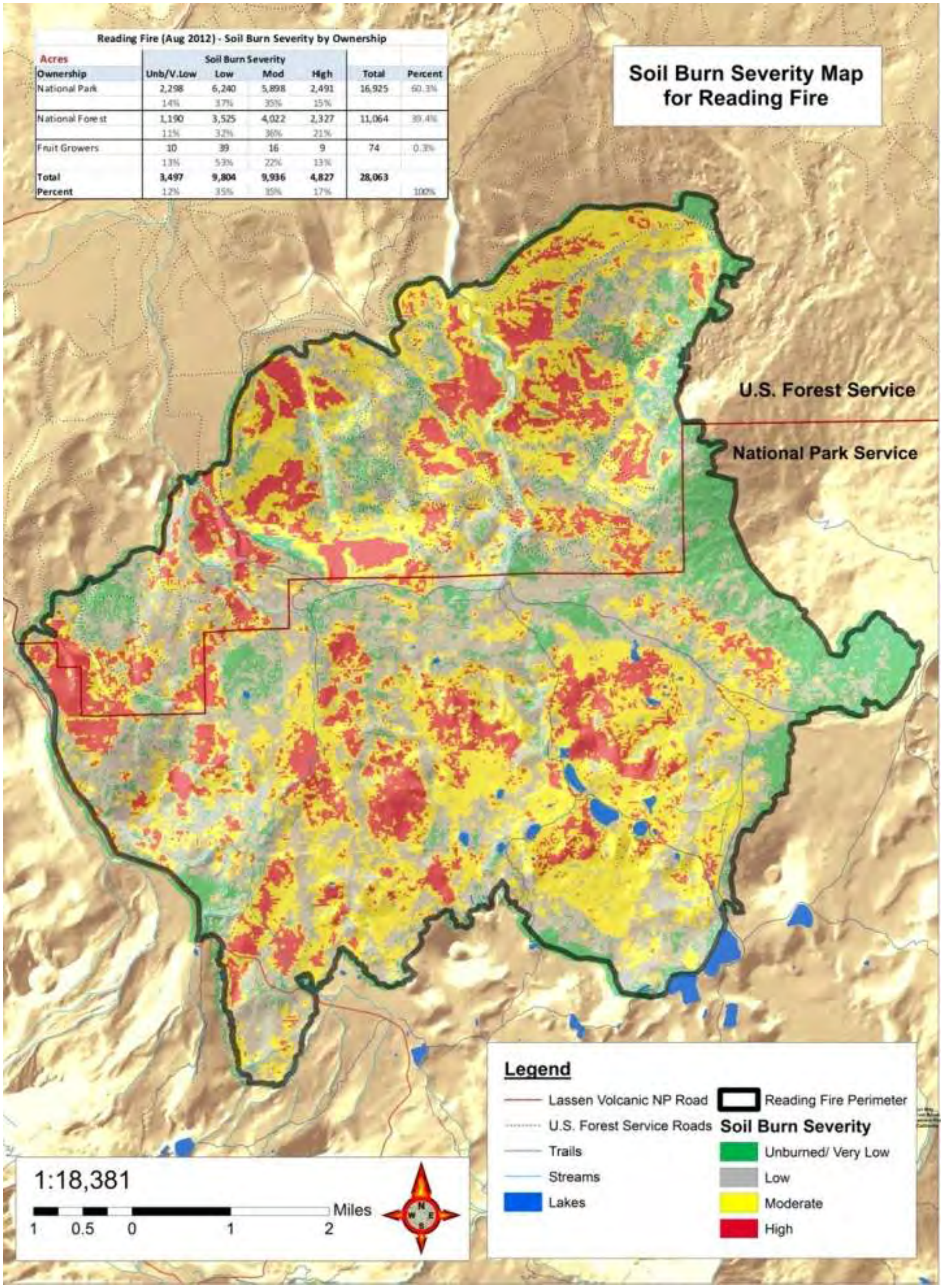
Erosion Potential/Debris Flow Potential

The potential for erosion has increased in the burned areas of the Reading Fire. Typically, the most significant increases occur in areas of high soil burn severity and slopes greater than 35 degrees. However, within the burn perimeter slopes greater than 35 degrees comprise small percent of the area and many of these locations are exposed bedrock. Moreover, most areas experienced low to moderate soil burn severity. Finally, rainfall intensities can be expected to be of relatively low intensity during fall storms. Together these factors tend to suggest a moderate increase in erosion potential over pre-fire conditions.

Field evidence of debris flows in the Hat Creek and Lost Creek watersheds is lacking. This is consistent with the low proportion of slopes greater than 35 degrees and relatively high percentage of exposed bedrock. Therefore, the potential of debris flows arising as a result of post-fire watershed conditions within burned perimeter of the Reading is greater than pre-fire conditions, yet probability still remains low.

Watershed Response

The effect of wildfires on storm runoff is well documented. Wildfires typically cause an increase in watershed responsiveness to precipitation events. Burned watersheds can quickly yield runoff due to the removal of protective tree and shrub canopies and litter and duff layers, thus producing flash floods. Burned areas often respond to the local storm events in a much flashier way. The amount of water yield increase is variable and it is often orders of magnitude larger than pre-fire events. These negative impacts are predominantly true in watersheds that experienced significant consumption of the shrub community and moderate to high soil burn severity effects. Fires may increase the number of runoff events as well since it generally takes a smaller storm to trigger runoff until vegetation begins to recover. Peak flow increases from the fire may also be augmented by floatable and transportable material within the active channels such as Hat Creek and its tributaries and Lost Creek and its tributaries.



Acres	Soil Burn Severity					
Ownership	Unb/V.Low	Low	Mod	High	Total	Percent
National Park	2,298	6,240	5,898	2,491	16,925	60.3%
	14%	37%	35%	15%		
National Forest	1,190	3,525	4,022	2,327	11,064	39.4%
	11%	32%	36%	21%		
Fruit Growers	10	39	16	9	74	0.3%
	13%	53%	22%	13%		
Total	**3,497**	**9,804**	**9,936**	**4,827**	**28,063**	
Percent	12%	35%	35%	17%		100%

Figure 3. Soil burn severity map of the Reading Fire.

Pre- and post-fire conditions were modeled using a 2-year 6-hour storm, which has a design storm magnitude of 1.54 inches. Estimated reduction in infiltration was based on the percentage of hydrophobic soil in the burn area. Pre-fire design flow was estimated at 2.37 cubic feet per second per square mile and post-fire design flow was estimated at 3.19 cubic feet per second per square mile, a modest increase in post-fire runoff (Stewart, 2012).

The primary watershed response of the Reading Fire is largely dependent on the amount of area classified as moderate to high burn severity. Because 50% of the burned area on NPS lands is high to moderate soil burn severity, but with only 15% high, watershed response is expected to be greater when compared to pre-fire conditions. However, watershed response is a function of rain intensity and duration. An initial flush of ash and organic debris and localized erosion and deposition is to be expected during the first fall storms, which are generally of low intensity. However, if the first storms are of high intensity and/or long duration or rain-on-snow events, watershed response could be high, causing localized and downstream flooding.

Throughout the fire area, vegetation recovery is largely dependent on climatic cycles. If wet winters occur, vegetation recovery could be rapid, with forbs and grasses providing ground cover similar to that observed in unburned areas throughout the fires. By the second winter season, forbs, grasses, and re-established shrubs should provide sufficient cover to reduce any increase in watershed response to near pre-fire levels. Once sprouting vegetation begins to produce brushy crowns and a duff/litter layer, watershed response will be reduced further. However, if winters are dry, vegetation recovery will be slow, and thus the establishment of ground cover and shrub communities will be slow, and watershed response will remain slightly elevated over pre-fire conditions.

A consequence of significant runoff, erosion, sediment and debris delivery is a short-term degradation of water quality as ash, sediment, and burned organic debris are delivered to streams and reservoirs within and downstream of burned areas. The impacts of this effect depend largely on the vegetative recovery times in combination with storm characteristics in the same time period.

<u>Values at Risk</u>

All areas within and downstream of the burned area were evaluated by the BAER team and NPS staff for values at risk threatened by post-fire watershed conditions. The values identified include:

- Impacts to culverts (historic and non-historic) and slope stability along Lassen Volcanic National Park Highway.
- Impacts of retardant drops on water quality.
- Impacts to critical property values (e.g., Park Highway, bridges, structures, campgrounds).
- Post-fire watershed condition effect to critical cultural resources.

- Effects of flooding and sedimentation on the Lost Creek water intake.
- Threats to the composting toilet in the In-holders road area.

In regard to flooding from post-fire watershed conditions, Standard Operating Procedures (SOP) for BAER evaluations and treatments are only considered up to 25-year storm events. The ability for BAER to prescribe temporary treatments that withstand storm events greater than a 25-year magnitude becomes problematic. The nature of BAER activities allows for rapid assessment and rapid implementation of treatments to protect human lives, property, and critical natural and cultural resources. Design of treatments and implementation of treatments beyond 25-year storm events usually requires complex engineering and implementation that exceeds the rapid implementation of such treatment.

Culverts

The culverts along the Lassen Volcanic National Park Highway that drain the burned area—particularly below areas of moderate to high burn severity—are at risk of plugging due to increased flow and floatable debris. An assessment of each culvert will be needed to identify culvert cleaning requirements and monitoring will be needed after larger storm events to assess further cleaning needs. Many of the culverts are considered historic and may require monitoring by a cultural resource specialist to avert potential damage from cleaning activities. Additionally, floatable material, mostly woody debris should be removed upstream of culverts within the burned area. This will help prevent plugging of the culverts from transport of this material. Ditches that lead to cross-drain culverts within the burned areas should also be cleaned of floatable material to help prevent plugging.

Water Quality

Five retardant drops were identified within Lassen Volcanic NP. Four of the five occurred in Wilderness and three of five were made by VLATs (Very Large Air Tankers). A single VLAT, such as a DC-10, can apply as much as 12,000 gallons of retardant per drop. The three VLAT drops occurred on the west to southwest flank of Prospect Peak, and the two smaller drops were made on the northwest side of Cinder Cone and east side of Raker Peak. No retardant was applied directly to lakes or watercourses, although the drop east of Raker Peak is with ¼ mile of Hat Creek. Other retardant drops occurred on Forest Service Land, but will not affect Lassen Volcanic National NP given their downstream hydrologic position.

Most of the retardant drops were reported to be Phos-Chek (D-75F, D-75R, and/or 259F) with fugitive coloring (which breaks down in sunlight). The primary ingredients of Phos-Chek D-75F, D-75R, and 259F include diammonium phosphate, monoammonium phosphate, and diammonium sulfate. Trade secret additives comprise 5-10% of the compounds by weight. The ammonium compounds have the potential to be converted to nitrates via nitrification in watershed soils. Nitrate and nitrite are designated criteria pollutants by the EPA and the California Department of Public Health with a combined (nitrate + nitrite) maximum contaminant level (MCL) of 10 mg/l (EPA 2009, CDPH 2009).

An environmental effects and persistence study found that leachate from Phos-Chek D-75R retardant that was aged for 45 days was toxic to fathead minnows after 96 hours of exposure (Little and Calfee, 2005). It was unclear as to whether the toxicity was related to the ammonia leached from the retardant or other ingredients. It is also unclear how quickly ammonia and ammonium are nitrified to the environment. Hence it is appears that the some toxicity may occur within aquatic environments.

During the Big Meadow Fire of 2009 in Yosemite, over 450,000 pounds of Phos-Chek retardant (approximately 1.2 pounds per gallon slurry) was dropped into the Crane Creek and Little Crane Creek watersheds. These watercourses drain into the Merced River, the domestic water supply for the town of El Portal and a Wild and Scenic River. Concerns for public health and Merced River fisheries prompted a BAER Specification for water quality monitoring to detect retardant chemicals. Monitoring revealed no increase over background levels on Crane and Little Crane Creeks and the Merced River.

Given the small amount of retardant applied on the Reading Fire compared to Big Meadow Fire, very porous volcanic bedrock (which discourages long distance overland flow), and the distance of most drops from tributaries, no measureable effects on human health or the environment are expected. In some cases, fire retardants have been shown to encourage the growth of noxious weeds. Monitoring retardant drops for weeds will be part of a weed detection and eradication treatment requested through BAR.

Critical Infrastructures

Critical infrastructures are considered roads, bridges, campgrounds, and other facilities that may be damaged or destroyed, potentially causing loss of life or injury, from flooding, mud flows, and debris flows.

Only two critical infrastructures were identified by the Park to be at risk to flooding, mud flows, and debris flows: a water intake on Lost Creek that supplies water to the Lost Creek and Crags Campground, and a composting toilet in the In-holding road area.

The Lost Creek water intake resides within the stream channel of Lost Creek downstream of burned areas. Upstream and upslope are several areas of high and moderate soil burn severity, which place the intake and water processing facilities at risk from mud flows and flooding. This could require more frequent cleaning of the intake and replacing filters due to higher turbidity, thereby raising maintenance costs.

The composting toilet in the In-holders area was examined by specialists and determined to be not at risk to flooding, mud flows, and debris flows. It lies well away from the active channel of Hat Creek and the steeper slopes of east Raker Peak. Areas of high soil burn severity are located upstream, however these area occur on very gentle alluvial plains which drain to Hat Creek.

Other facilities in or below the burned area—Lost Creek and Crags Campground, and structures at Summit Lake, Twin Lakes, Butte Lake, and Manzanita Lake—were not considered at risk because of distance from streams, localized low soil burned severity, and low angle slopes. Other minor infrastructure such as foot bridges and trails were not considered due to the very remote chance of injury or loss of life from flooding. However, signs warning the public and employees of post-fire flooding, rock fall and hazard trees should be placed at strategic points within and along the perimeter of the burned area.

Critical Cultural Resources

As of completion of this report, two critical cultural resources—historical archeological sites dating to the mid-1930s—have been assessed for potential post-fire watershed threats. Neither is judged to be at risk to post-fire watershed conditions because the slopes above have very little high or moderate soil burn severity. Additionally, because both resources date to the 1930s, each has previously experienced—and seem to have survived—major storm and flood events in 1954, 1964, and 1997. Assessments of watershed threats to cultural resources will continue into the fall of 2012 (see Cultural Resource Assessment).

RECOMMENDATIONS

Emergency Stabilization

Monitor and Remove Rock Fall from Roads (Specification WS-1)
Due to the potential for rock fall on roads within and below burned slopes of the Reading Fire and attendant threats to public and employee safety, it is recommended that the park patrol and remove rock fall and other debris caused by post-fire watershed conditions between ¼ mile west of “Hot Rock” pullout and Dersch Meadows along the Lassen Volcanic National Park Highway. Provided in this specification is time for an Equipment Operator and a Motor Vehicle Operator to use park equipment to patrol and remove rock from the highway.

Monitor and Remove Debris from Culverts (Specification WS-2)
Culverts and drainage structures are at risk to plugging and over-topping from post-fire watershed conditions of the Reading Fire and potentially threaten roads in the park. Culverts and drainage structures on roads should be initially inspected and cleaned before fall storms. For the first year after the fire the culverts and drainage structures should be inspected and cleaned if necessary after significant precipitation events. Funding is provided to clean the culverts six times (up to 3 days per cleaning) to achieve this goal. This specification covers culverts located between ¼ mile west of “Hot Rock” pullout and Dersch Meadows along the Lassen Volcanic National Park Highway. Provided are funds for two equipment operators to run a vacuum truck (if

needed), water truck, and back-hoe, two Motor Vehicle Operators to provide traffic control, and three laborers to assist in the cleaning. It is very important for the Park to clean all culverts before the fall rains commence.

Install Warning Signs on Roads and Trails (Specification WS-3)
Warning signs should be developed and installed on roads and trails within the Park warning visitors and employees of safety hazards related to post-fire watershed threats (flooding, rock fall) and hazard trees. Temporary signs will be constructed and installed—along the Park highway, trailheads, parking areas and campgrounds—in FY12. Long-term signs will be designed, constructed and installed in FY13. The request covers NPS employee time for design and installation and manufacturing costs.

Remove Floatable Debris Upstream of Culverts (WS-4)
Floatable material, mostly woody debris, located upstream of culverts and in roadside ditches within the burned area should be removed from the stream channel to prevent plugging of culverts located ¼ mile west of "Hot Rock" pullout and Dersch Meadows. The size of the culvert will dictate the size of floatable material to be removed. For example, if the culvert is a 24 inches, material greater than 23 inches maximum diameter should be removed to the extent reasonably possible (and without causing damage to the environment). Material should be moved 10 feet away (on the horizontal) from the high water mark of the channel, and stabilized to prevent re-entry. Hand crews can perform this work, although larger material near the road should be removed with heavy equipment. At least two episodes of removal should occur, one as soon as possible in September 2012 (and prior to the onset of fall rains) and the second following in the spring of 2013. The request will cover employee time and associated expenses.

Increased Maintenance of the Lost Creek Water Intake (WS-5)
Post-fire watershed conditions threaten the operation of the Lost Creek water intake and treatment facilities. Recommended is increased cleaning of the intake system located in Lost Creek by removing transported sediment and woody debris, particularly after storm events and spring melt. Also recommended is funding for increased operations at the water treatment plant to remove sediment from drinking water as a result of post-fire watershed conditions. The funding request includes employee time and treatment plant supplies.

<u>Treatments Considered But Not Recommended</u>

Hillslope treatments were considered for the Reading Fire, including hydromulching, straw mulching, seeding, log erosion barriers, and fiber rolls. The low likelihood of a very high post-fire watershed response, even without treatments, and the potential for collateral environmental impacts, such as the introduction of weeds into Wilderness, dictated against prescriptions.

REFERENCES

California Department of Public Health 2009. California Regulations Related to Drinking Water. 255 pp.

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Little, E.E. and R.D. Calfee, 2005. Environmental Persistence and Toxicity of Fire-Retardant Chemicals, Fire-Trol GTS-R and Phos-Chek D75-R to Fathead Minnows. CERC Ecology Branch Fire Chemical Report: ECO-05, 52 pp.

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Watershed Assessment Written by
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INFRASTRUCTURE ASSESSMENT

OBJECTIVES

- Assess, stabilize, and restore damaged roadways, signs, and utilities

ISSUES

- Direct and indirect fire damage, including suppression effects to NPS structure and facilities

- Impacts to roadways, signs, and utilities which facilitate public safety and orderly use of the park

OBSERVATIONS

No NPS or other structures or utilities were burned by the Reading Fire (not including LAVO-2004-A-03, a small wooden “blast” shack - see Cultural Resource Assesment).

There were a total of at least 30 NPS signs on and within the perimeter of the Reading fire (Figure 4). No road signs along the Lassen National Park Highway were burned by the fire, though a single road sign was repaired after sustaining damage from suppression activities. Seven trail signs were located within the interior of the fire in areas that burned with low to moderate soil burn severity. All interior signs had metal posts, including two signs on one post on the Pacific Crest Trail (PCT) north of Lower Twin Lake, one sign on the Nobles Emigrant trail where it crosses Hat Creek, one sign on the PCT at the intersection with Nobles Emigrant Trail, two signs on one post on PCT at north boundary with park; one sign on PCT at north boundary of park. Though metal posts should remain intact following fire, the condition of signs themselves remains to be evaluated.

No sections of road surface sustained damaged resulting from the fire, hazard tree removal, or other suppression activities.

Fire-damaged trees will fall on trails within the fire perimeter (e.g., Nobles Emigrant trail, Pacific Crest Trail, Twin and Cluster Lakes trails) and require periodic removal. Likewise, trail treads will likely suffer erosion and other damage as a result of amplified watershed response.

RECOMMENDATIONS

The Park is in the process of developing BAR treatment specifications to repair or replace signs damaged by the fire or post-fire conditions and perform trail maintenance in 2013, 2014 and 2015. The Pacific Crest Trail is of high priority for opening in 2013 and efforts should focus on ensuring this work is completed.

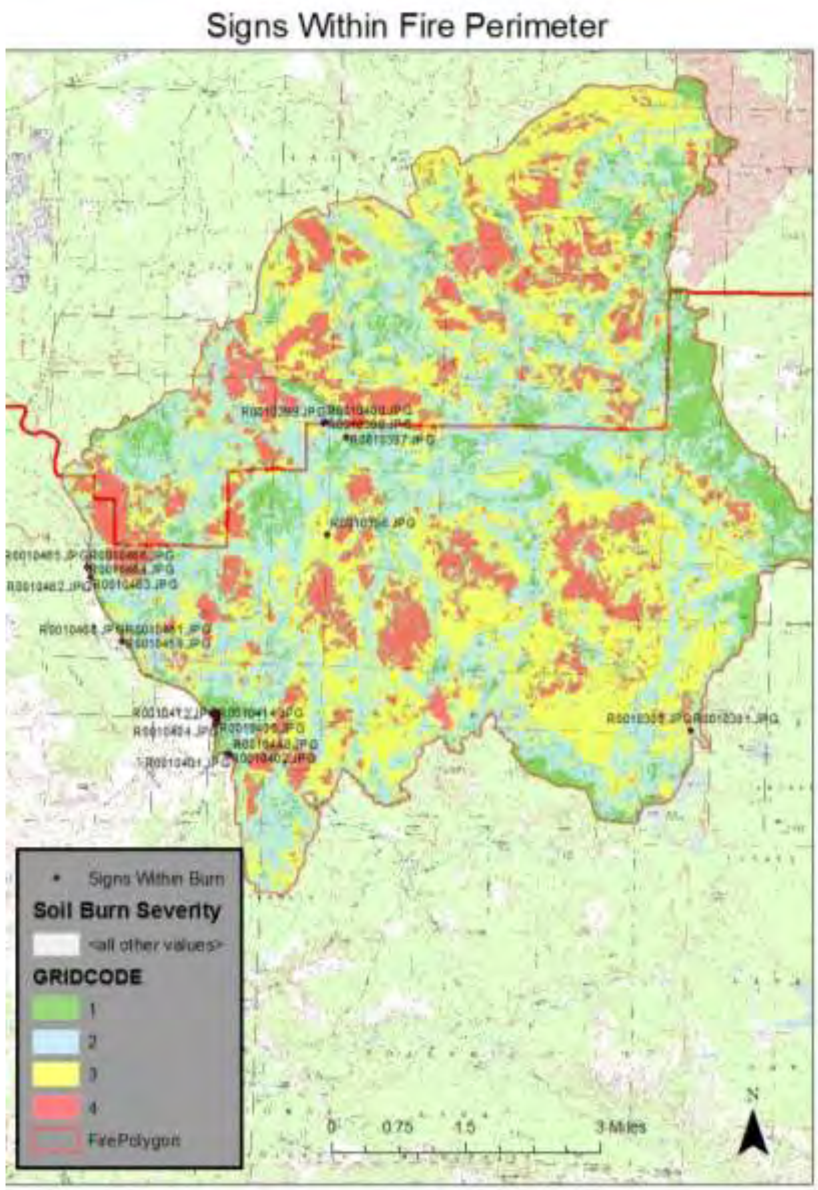

Figure 4. Road and trail signs within the Reading Fire. Soil burn severity gridcode 1 = unburned; 2 = low severity; 3 = moderate severity; 4 = high severity.

FOREST RESOURCES ASSESSMENT

OBJECTIVES

- Identify and evaluate fire-related impacts to forest vegetation and related safety hazards
- Determine rehabilitation needs supported by specifications
- Provide management recommendations regarding forestry issues

ISSUES

- Tree hazards along roadways
- Tree hazards along trails
- Tree debris cleanup

OBSERVATIONS

Background

Hazard trees are those standing, leaning, or leveraged tree boles and crowns that exhibit a *structural target* toward a concentrated public use area, and the *presence* of that individual or group poses an immediate *threat* to life or property. This definition also recognizes that this is a *health and safety* issue, not a land stewardship issue.

The Lassen Volcanic National Park has pertinent reference management documents including the General Management Plan (GMP) dated 2003, and a Fire Management Plan for 2012 (updated annually).This Forest specialist BAER analysis and plan has been prepared in accordance with Department of the Interior and National Park Service policy, including Departmental Manual 620 Part 3: Burned Area Emergency Stabilization and Rehabilitation and the Interagency Burned Area Emergency Response Guidebook.

About five miles of paved roadsides and 4.7 miles (In-holder Road) burned in the Reading Fire on NPS lands. That includes five miles of the Lassen Volcanic National Park Highway, mostly burned on both sides, over four miles of the Hat Creek Inholder Road, all burned on both sides, with minor inclusions of unburned, and less than one mile of peripheral roads in the Hat Creek Inholder road network, some burned on both sides. Of all of these roads, the Lassen Volcanic National Park Highway carries the most traffic and is open seasonally each year. Along the portion of the Lassen Volcanic National Park Highway that had been mechanically thinned and prescribed burned over the last decade, it appeared that reduced fire behavior was experienced.

Areas of obviously dead scorched trees remain along roadsides, and more trees are expected to exhibit mortality indicators by or shortly after bud break next spring.

Mortality in some of the largest pines and firs will continue to occur for up to five years.

Burn Severity

While soil burn severity is not based primarily on fire effects to vegetation, the team used post-fire vegetative condition as one of the visual indicators in assessing soil burn severity. In some cases there may be complete consumption of vegetation by fire, with little effect on soil properties, such as in a shrub ecosystem. Dense vegetation, with a deeper litter and duff layer, results in longer heat residence time, hence more severe effects on soil properties. For example, deep ash after a fire usually indicates a deeper litter and duff layer prior to the fire, which generally supports longer residence times. This promotes loss of soil organic cover and organic matter which are important for erosion resistance, and the formation or exacerbation of water repellent layers at or near the soil surface. (YOSE Big Meadow BAER plan 2009).

Affected Landscape

Reconnaissance and the Burned Area Reflectance Classification (BARC) map showed most forested areas experienced low to moderate burn severity. Overall, 15% of the burn was high severity, and the aerial reconnaissance showed a well distributed mosaic of burn severity across the landscape. Overlay with the pending National Park vegetation map (and a ribbon of surrounding USFS lands) showed a complex matrix of mapped forest types and the BARC map severity classes. That complexity precluded any conclusive figures for severity of burn by forest, non-forest, woodland, or sparse vegetation types. Isolated group torching of over-story trees was observed, and crown fire runs were observed with complete mortality and ground fuel consumption in all divisions on both NPS and USFS lands. Needle fall is underway and many of the serotinous lodgepole pines are dispersing seed now.

FINDINGS

Damaged trees were aggressively removed from Lassen Volcanic National Park Highway above the In-holder road junction for several hundred yards above Dersch Meadows in Section 32. As needed, distributed single and grouped hazard trees were felled in all Divisions. The 32N38 and contributing Forest Roads were prepared and held as fire line in Divisions B and Y and few tree hazards were observed there. Trees were felled across the roadway and pushed to the side for later removal. Logs and slash line portions of the roadway clearance and several groups are in or above culvert inlets. Those felled hazard tree groups on the Lassen Volcanic National Park Highway may qualify for BAER funding status for protection from or mitigation of floatable woody debris.

The park staff has evaluated the removal options for the felled material, and has programmatic solutions under development for contract action to salvage and treat the fuel loadings created from these hazard tree mitigation efforts. Forest system roads will have hazard tree reduction support included in the safety design of any fire rehabilitation efforts to fisheries, T&E, watershed, infrastructure, roads, or trails.

RECOMMENDATIONS

Emergency Stabilization

Hazard Tree Mitigation (F-1)
Remove initial load of tree hazards under contracts. Provide additional sawyers, traffic control, GSA vehicle time, and replacement equipment to Lassen Forestry or seasonal / Maintenance crew for increased tree hazard workload. Provide overtime in anticipation of increased tree failures. Clean up logs along roads from suppression falling and lop or chip slash as appropriate. Coordinate contract utilization standards with park fire staff for burn pile size material standards. Provide additional sign assessments, construction or purchase, and installation along trail segments affected by high burn severity zones with hazard trees yielding elevated visitor safety concerns.

Non-funded management recommendations

Unfunded recommendations include continuing annual aerial survey to monitor forest insect activity in cooperation with USDA Forest Service. The park may also gain additional insight by investigating efficacy of roadside thinning and mastication influencing fire behavior or severity. Technical recommendations include summary of hazard tree frequency to Park Natural Resources and Ranger Division Chiefs for consideration of park trail closures through winter 2012-2013 for natural removal and weakening / failure of increased fire related tree mortality. Above average snow and wind will accelerate the reduction of this hazard; a below average snowfall or wind events will decrease the hazard reduction. Monitoring of this hazard by backcountry patrols will aid in the timing and extent of closure orders.

CONSULTATIONS

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Forest Resource Assessment written by
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VEGETATION ASSESSMENT

OBJECTIVES

- Evaluate and assess fire- and suppression-related impacts to vegetation resources, including native plant communities, sensitive plant species, and aspen
- Determine early detection, treatment and monitoring needs supported by specifications
- Provide non-specification management recommendations to assist in habitat rehabilitation

ISSUES

- Short and long-term wildfire and suppression impacts to native plant communities and sensitive plants
- Potential establishment and spread of invasive species into previously resistant areas within the burn perimeter, particularly those areas with high levels of burn severity, suppression impacts and retardant drops
- Management recommendations to assist in rehabilitation of relict aspen communities

OBSERVATIONS

This report identifies and addresses known and anticipated impacts to vegetation resources resulting from the Reading Fire within Lassen Volcanic National Park (LAVO). Vegetation resources, for this assessment, will be defined as plant communities and state-listed rare plants.

Findings and recommendations in this assessment are based upon information derived from LAVO data, Burned Area Emergency Response (BAER) team specialists, literature reviews, field reconnaissance of the fire areas, aerial surveys, satellite imagery, and spatial data obtained or created during the preparation of this plan.

This assessment describes the issues and concerns expressed by LAVO staff for management of lands affected directly by the fire and indirectly by suppression activities. It details known damage to vegetation resources and outlines anticipated post-fire response and recovery of plant communities and sensitive species. It also describes rehabilitation needs in the form of early detection and eradication of invasive species and recommendations for non-BAER activities to assist the restoration of aspen stands in the Hat Creek drainage.

BACKGROUND

Resource concerns expressed by LAVO related to vegetation include:

- Direct fire impacts on native plant communities and sensitive plant populations
- Indirect impacts of noxious weed invasions on native plant communities and sensitive plant habitats
- Response of aspen stands to varying degrees of burn severity
- Threats to aspen recovery because of heavy deer browsing and competition from lodgepole pine seedlings

Management direction was obtained from the General Management Plan (2003), Lassen Volcanic National Park Weed Management Plan (2008) and the LAVO Fire Management Plan (amended 2012):

- The General Management Plan defines desired resource conditions within each of eight management zones, three of which were affected by the Reading Fire: Wilderness Zone, Scenic Drive Zone, and Inholder Zone:
  - Wilderness Zone: Natural resource conditions are regulated entirely by natural processes and influenced by humans only as needed to restore natural conditions, e.g., removal of non-native species or revegetation of disturbed areas. Fire is recognized as a normal process necessary for maintaining natural vegetative communities.
  - Scenic Drive Zone: Although there is concentrated visitor use in this zone, natural systems are not significantly affected. Management is designed to minimize impacts on natural and cultural resources.
  - Inholder Zone: Signs of human use predominate; roads are maintained to minimize damage to natural and cultural resources.

- The Weed Management Plan tiers off the LAVO Resource Management Plan (1999). Management goals of both plans include protecting the integrity of native plant communities and rare plant populations by preventing the introduction or spread of exotic plant species and eliminating known exotic species within the park. Early Detection and Rapid Response techniques are emphasized in the WMP.

- The Fire Management Plan reiterates the GMP's goal of using fire to restore and maintain natural resource conditions within the park. Natural ignitions are analyzed and whenever possible are allowed to burn if they can be managed for resource benefit. Best management practices are employed whenever possible to limit the introduction and spread of noxious weeds.

The Reading Fire directly affected 28,063 acres, 16,925 of which are within Lassen Volcanic National Park. Most of the burned area supported fir-dominated forests interspersed with smaller stands of lodgepole pine woodland, aspen forest, montane chaparral, meadows, and riparian vegetation. Dry conditions, heavy fuel loadings, and dense conifer forest resulted in most of the burned area experiencing moderate to high soil burn severity.

Findings

Field reconnaissance of areas affected by fire and fire suppression occurred from August 25-30, 2012. Survey methods included roadside and walking surveys of fire lines, drop points, drafting sites, spike camps, and other disturbed areas. Interior areas of the fire were sparingly surveyed due to residual hazards. Surveyors searched for existing noxious weed occurrences and measured the dimensions of disturbed lands.

The LAVO Resource Management Division is primarily responsible for noxious weed work in the park. Data from past inventories and treatments allowed comparison of known occurrences to disturbed lands and potential routes of weed spread introduced during suppression activities. We analyzed spatial data layers documenting burn severity, suppression activities, pre-fire vegetation, sensitive plant and weed locations to determine the potential for invasive species or impacts to vegetation resources.

Vegetation

The Reading Fire area burned in an area of native forests, shrublands, meadows, and riparian vegetation typical of the southern Cascade mountains (Table 1). Most of the burned area supported fir-and pine-dominated forests (Figure 5). Smaller stands of montane chaparral, dry grasslands, and wet meadows were scattered within the forest in specialized habitats. Riparian zones and aspen stands also occupied small areas but are considered by the park to be critical contributors to ecosystem health and diversity. These vegetation types are all adapted to various fire regimes but within the park have been altered as a result of decades of fire suppression.

Table 1. Reading Fire vegetation as classified and mapped by CalVeg (USDA-Forest Service 2012). This classification describes existing vegetation.

Vegetation Type	Major Species (pre-burn)	NPS Acres Affected by Fire	Average Stand Size (acres)
Forests and Woodlands			
Mixed Conifer – Fir	*Abies concolor, Pinus jeffreyi, Arctostaphylos patula*	7504.2	319.3
Mixed Conifer – Pine	*Pinus ponderosa, Calocedrus decurrens, Abies concolor, Pinus lambertiana*	137.9	56.5
Quaking Aspen	*Populus tremuloides, Abies concolor, Pinus contorta*	6.7	3.5
Red Fir	*Abies magnifica, Abies concolor, Pinus monticola*	7487.4	172.6
Lodgepole Pine	*Pinus contorta var. murrayana, Elymus elymoides*	591.8	54.3
White Fir	*Abies concolor, Arctostaphylos patula*	789.4	22.5
Shrublands			
Montane Mixed Chaparral	*Arctostaphylos patula, Chrysolepis sempervirens, Ceanothus velutinus, Prunus emarginata, Ceanothus cordulatus*	347.7	12.4

Herbaceous Vegetation			
Annual Grassland	*Elymus elymoides, Stipa occidentalis*	19.0	5.2
Wet Meadow	*Elymus glaucus, Carex spp., Calamagrostis canadensis, Juncus spp.*	35.2	5.7
Unvegetated			
Barren rock, cliff, talus, lava		24.8	10.4
Water		100.3	10.1

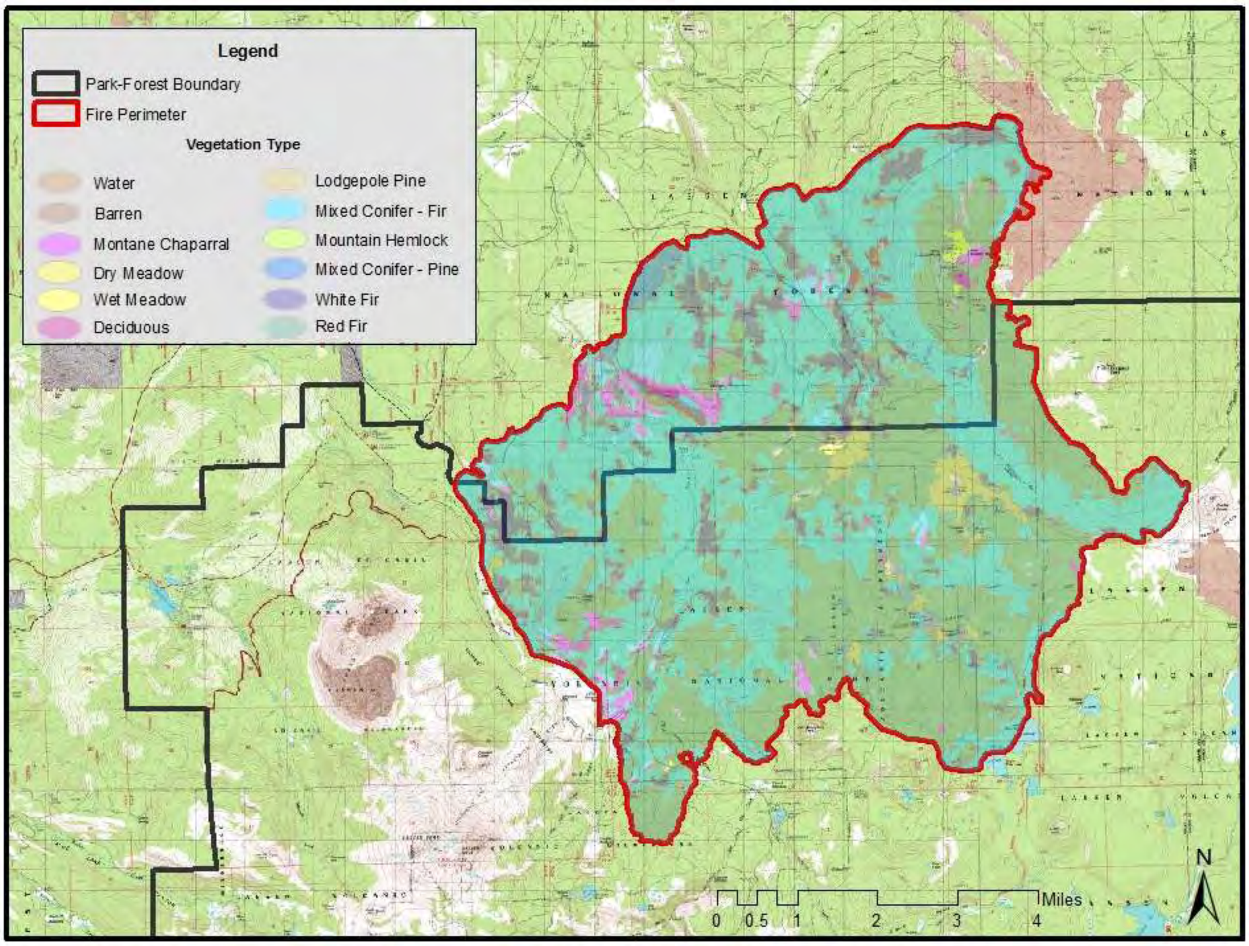

Figure 5. Map of existing vegetation within the Reading Fire boundary. Extent of each vegetation type is listed in Table 1.

Vegetation Type Descriptions

Riparian

Riparian vegetation occurs in narrow bands along seeps, streams and rivers throughout the burn area. Riparian vegetation is typically dominated by willows *(Salix sp.),* alder *(Alnus tenuifolia)* and cottonwood *(Populus sp.)* with an understory of sedges, grasses and forbs. Even in areas of high burn severity, some riparian vegetation survived and was resprouting within 10 days of the fire.

Grassland and Meadow

Meadows and grasslands comprise less than 0.5% of the park and occupy gentle slopes with fine-textured soils. Grasslands dry out early in the growing season while meadows tend to remain wet throughout the season. These communities are dominated by herbaceous vegetation, typically sedges and grasses, are generally less than 100 acres in size and normally surrounded by mixed conifer forest. Fire suppression has caused some of these communities to be invaded by conifers, primarily lodgepole pine.

Grasslands and meadows observed during BAER surveys experienced low burn severity. At LAVO, these habitats tend to be easily invaded by bull thistle (*Cirsium vulgare*) and are vulnerable to a number of other noxious weeds occurring just outside the burn, including cheatgrass (*Bromus tectorum*), reed canary grass (*Phalaris arundinacea*), Klamathweed (*Hypericum perforatum*) and oxeye daisy (*Leucanthemum vulgare*).

Chaparral

Montane mixed chaparral is a minor vegetation type within the burn and tends to indicate rocky, dry sites or sites that burned repeatedly or very hot. The dominant shrub is greenleaf manzanita (*Arctostaphylos patula.)*, with lesser amounts of whitethorn (*Ceanothus cordulatus)*, tobaccobrush *(Ceanothus velutinus)*, and bitter cherry (*Prunus emarginata*). This type can be expected to increase as a result of the Reading Fire. It is susceptible to invasion by aggressive annual species such as cheatgrass and yellow starthistle (*Centaurea solstitialis*).

Lodgepole Pine *(Pinus contorta* var. *murrayana)*

Lodgepole pine is a minor type within the burn but is significant because of its relationship to fire. It is a tree that needs fire to open its cones and mineral soil for seedlings to become established. At LAVO, it occurs on nutrient poor soils, both those that are subsaturated and those that are excessively well drained. On the former soil type, lodgepole pine has largely replaced stands of aspen (*Populus tremuloides*).

Aspen

Aspen stands occupy a nominally small area within the burn, but historically were of much greater extent. Fire suppression has caused most stands to be invaded by conifers, especially lodgepole pine and white fir. The park has mapped many of these relict stands, although most consist of scattered decadent stems and heavily browsed sprouts. Recent studies have suggested that the park's aspen clones may have been starved by shading conifers and drained by deer-caused sprout mortality to the point where they might not survive a high severity burn. LAVO considers aspen to be a critical resource because at least a dozen wildlife species depend on aspen at some point in their life cycles for forage, shelter, or nesting.

Mixed Conifer – Fir, Mixed Conifer – Pine, and White fir
Mixed-conifer forest is the dominant vegetation type within the burn, forming an almost continuous area of dense forest. White fir (*Abies concolor*) is the dominant canopy tree, but close observation reveals that in the absence of fire, shade-tolerant fir have filled in an open woodland co-dominated by fire-tolerant ponderosa (*Pinus ponderosa*), Jeffrey (*P. jeffreyi*), sugar (*P. lambertiana*), and western white (*P. monticola*) pines, red fir (*Abies magnifica*), and incense cedar (*Calocedrus decurrens*). The pines persist as mature to decadent emergent trees, but there are few of them in the reproductive layers. Some stands contain the skeletons of manzanita and Scouler willow (*Salix scouleriana*) because high canopy cover precludes development of a shrub or herbaceous understory. These stands tend to burn with high severity.

Red Fir
Red fir forest is a minor forest type at the higher elevations of the burn area. It is associated with the areas of greatest snow accumulation in the park. In drier sites and at lower elevations, it intergrades with Jeffrey pine, white fir and montane chaparral. The understory consists of sparse herbaceous vegetation with occasional low growing shrubs. These stands usually burn poorly.

Special Status Species

No Federally listed threatened or endangered plants occur within the Reading fire area. Occurrences of four state-rare plant species are known to occur within the burn (Figure 6). All are considered sensitive species by the park and are given special management consideration.

- Northern spleenwort (*Asplenium septentrionale*). Status: S2.3 / G4G5 (globally secure; rare in California but few threats). This small fern grows exclusively in rock crevices and talus. Within the burn area, it is restricted to cliffs and rockfalls on the western face of Raker Peak. Even if burned, its protected root systems probably survived. The main threat to this occurrence is the fire retardant dropped on Raker Peak during suppression.
- Pyrola-leaved buckwheat (*Eriogonum pyrolifolium* var. *pyrolifolium*). Status: S2.3 / G4T4 (Globally secure; rare in California but few threats). This species is restricted to pumice soils and was historically documented in the vicinity of Hat Creek below Hat Lake. This is an area of mixed burn severity and it is unknown whether this occurrence still exists.
- Ash beardtongue (*Penstemon cinicola*). Status: S3.3 / G4 (Globally secure; state status unclear but few threats). This plant is known to occur in wet meadows north of Cluster Lakes. It very likely did not burn, but is vulnerable to infestations of bull thistle that are known to occur nearby.
- Shasta beardtongue (*Penstemon heterodoxus* var. *shastensis*). Status: S4.3 / G5T3. Globally vulnerable; on state watch list but few threats. This species occurs in Badger Flat, which burned with mixed severity. This plant likely survived the fire because it is a deep-rooted perennial, but its habitat is vulnerable to invasion from nearby occurrences of Klamathweed, bull thistle, and

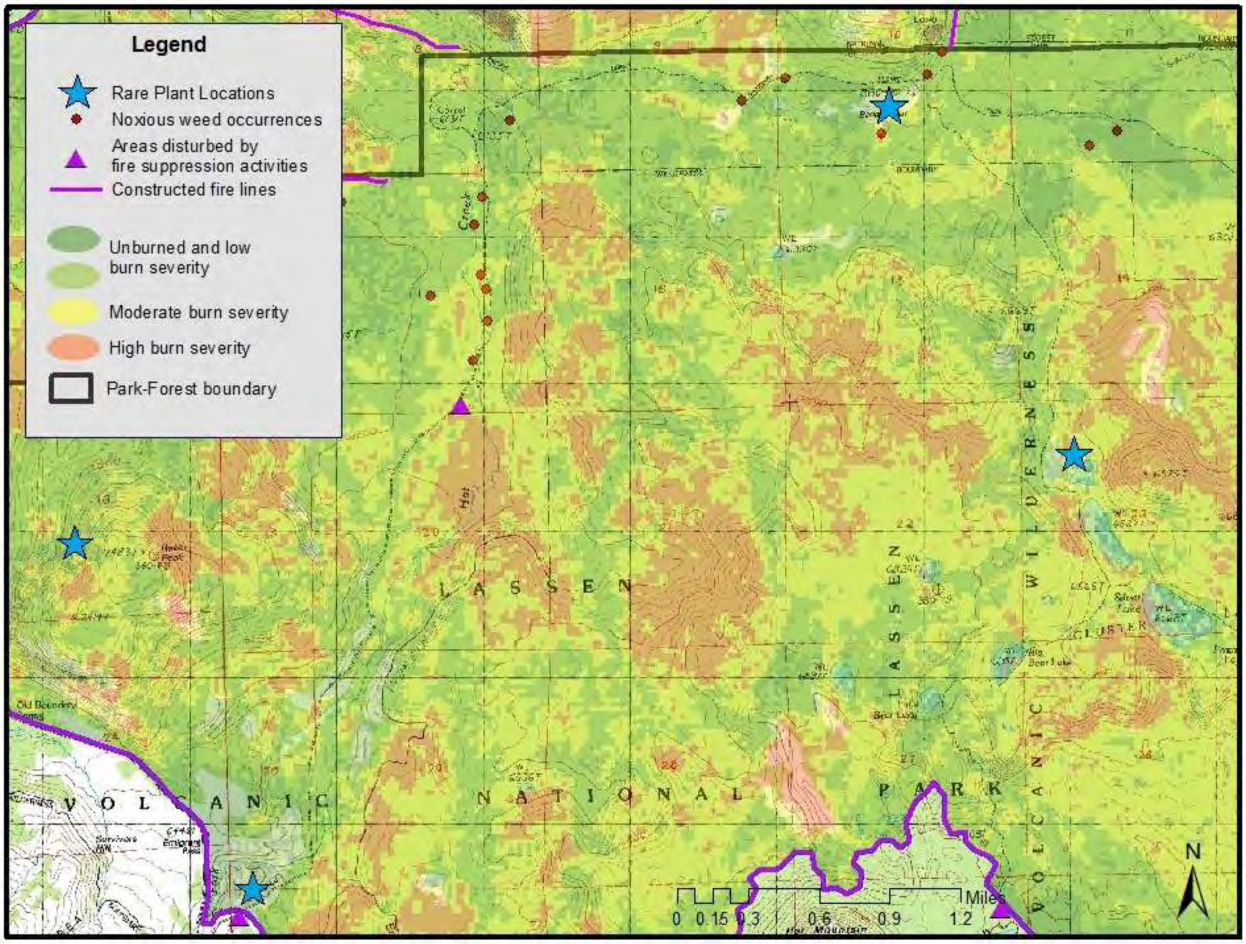

Figure 6. General location of rare plant occurrences within the Reading Fire burn boundary, showing their relationship to existing weed infestations and areas disturbed by the fire and fire suppression activities.

woolly mullein (*Verbascum thapsus*).

Non-native Invasive Plants

The fire area is relatively well surveyed for weeds and has relatively few weed infestations. However, the known infestations are situated (e.g., road sides, stream banks, upwind or upslope) such that they may act as sources for burned areas and those affected by suppression activities (Figure 7). If new infestations become established, the negative consequences to native plant communities and wildlife habitat could be significant and long-term.

During our on-site assessments and review of the LAVO weed database, we identified priority species that have the potential to adversely affect native plant communities in the area affected by fire and fire management (Table 2). These are species that are either documented from within the burn boundary or occur close by and have been identified as being noxious or ecologically harmful by the California Department of Agriculture or the California Invasive Plant Council.

Table 2. Noxious weed ratings for the species known to occur in or near the Reading Fire (Cal-IPC 2012).

Scientific Name	Common Name	Ecological Impact	Invasiveness	Spatial Relation to Reading Fire	Overall Concern Rating
Bromus tectorum	Cheatgrass	High	Moderate	Adjacent	High
Centaurea maculosa	Spotted knapweed	High	Moderate	Adjacent	High
Centaurea solstitialis	Yellow starthistle	High	Moderate	Adjacent	High
Centaurea squarrosa	Squarrose knapweed	Moderate	Moderate	Adjacent	Moderate
Cirsium arvense	Canada thistle	Moderate	Moderate	Adjacent	Moderate
Cirsium vulgare	Bull thistle	Moderate	Moderate	Present	Moderate
Hypericum perforatum	Klamathweed	Moderate	Moderate	Present	Moderate
Lepidium latifolium	Perennial pepperweed	High	High	Adjacent	High
Leucanthemum vulgare	Oxeye daisy	Moderate	Moderate	Present	Moderate
Phalaris arundinacea	Reed canary grass	Moderate	Moderate	Present	Moderate
Taeniatherum caput-medusae	Medusa-head rye	High	High	Adjacent	High
Verbascum thapsus	Woolly mullein	Limited	Moderate	Present	Moderate

Source: California Department of Food and Agriculture 2012, Cal-IPC 2012.
Key:
High = Severe ecological impacts, disruptive to native ecosystems, widely distributed and highly invasive.
Moderate = Substantial and apparent ecological impacts and moderate disruption of native ecosystems; may be limited or widely distributed
Limited= invasive but ecological impacts are relatively minor, although may create problems on a local scale.

Many disturbed sites were created within and adjacent to the burned area boundary. These either contain known noxious weed populations or are vulnerable to noxious weed invasion. New disturbance areas were created by fire suppression activities:

- Construction of hand line (estimated 27 miles, approximately 36 acres)
- Construction and/or use of miscellaneous sites (helispots, drop points, spike camps, water sources (estimated 9 acres)
- Dozer lines near the park boundary (estimated 6 acres)

Personnel, equipment, and material can serve as both source and vector for new noxious weed infestations. Although an equipment washing station was established early in the incident, it was not in operation for three days during the transition from a Type 1 to a Type 3 incident management team. In addition, straw bales and rice straw wattles were used in rehabilitating a large drop point adjacent to the NPS boundary; these materials were not certified free of the seeds of noxious weeds. Personnel assigned to the fire line can serve as vectors for propagules carried on clothing, personal gear and other equipment. We expect approximately five acres of new noxious weed infestations because of these activities, based on field surveys of equipment staging areas and rehabilitated sites, the mileage of fire line constructed and the number and location of spike camps.

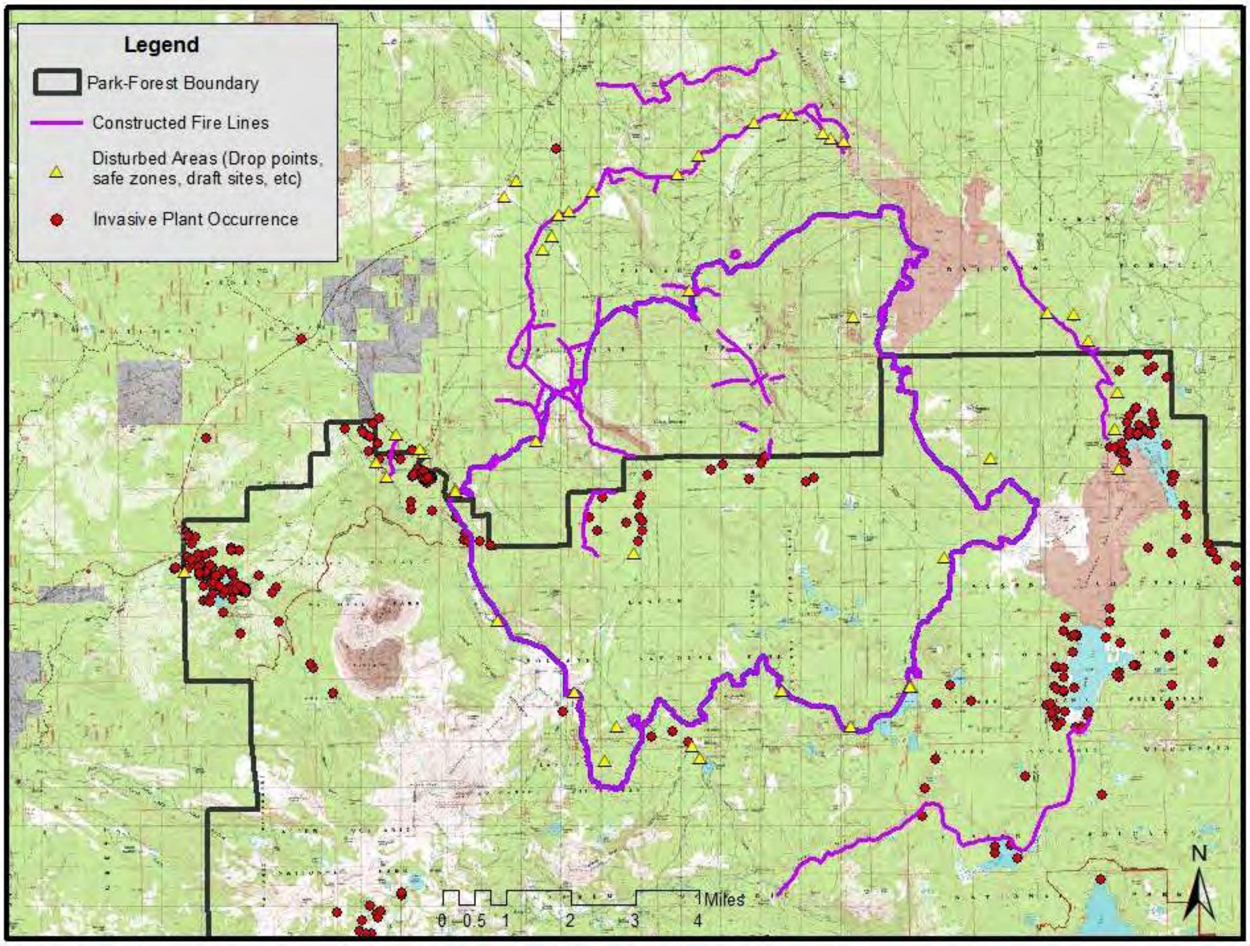

Figure 7. Map of known weed occurrences in relation to the fire boundary and other disturbances related to fire suppression, such as fire lines and staging areas.

Fornwalt et al. (2010) determined that exotic species frequency and cover increase in areas experiencing high and moderate severity burns. Fire-induced changes in soil chemistry, water holding capacity, and seed bank all favor the establishment of noxious weeds over native species. Although most areas of moderate and high severity burning are remote from control activities and known weed occurrences, some are not and therefore are vulnerable to new infestations. We estimate that approximately 78 additional acres have the potential to become infested with noxious weeds because of burn severity (0.5% of the total area of moderate and high burn severity).

Increased runoff and sediment movement will affect some sections of roads, trails, and drainages in the fire area. Each impacted site is likely to provide conditions needed for noxious weed establishment. We can expect an increase of approximately 15 acres of weeds in these areas, based on estimates of erosion hazard and soil burn severity combined with slope and landscape position.

New noxious weed occurrences or expansions of existing occurrences are most likely to appear in disturbed sites or from introduced materials. New disturbed areas are likely to be created during BAER implementation, including:

- Bringing in machinery to chip and shred felled trees
- Construction or use of helispots
- Road base material used for road rehabilitation
- Drop sites and sites where equipment is stored or staged

Noxious weed seed can be unintentionally introduced into the burn area as a result of BAER implementation, especially in the use of contaminated material used to re-grade eroded roads, or by using contaminated vehicles or equipment.

The number of affected acres will be determined after implementation is complete. New noxious weed invasions resulting from BAER implementation will not be detected until the first growing season after measures are implemented. Funding for treating these areas should be submitted in an interim BAER request.

RECOMMENDATIONS

<u>Specifications – Noxious Weed Detection and Treatment</u>

Request to detect and treat noxious weeds on the Reading Fire will be submitted for funding consideration under BAR in FY13.

Early detection and monitoring of invasive plant species

We recommend Early Detection and Rapid Response (EDRR) assessments in 2013 of areas with a high potential for noxious weed establishment or expansion. Because the area with high invasion potential is large, assessments should be prioritized as follows:

1. Burned areas or lands with ground disturbance from fire suppression or BAER activities that contain existing noxious weed occurrences. This category also includes all areas where gravel or straw was applied or stored, areas where retardant was dropped, known sensitive plant locations, and all riparian areas and wetland margins regardless of burn severity.

2. High and Moderate burn severity sites and disturbed lands without existing noxious weed occurrences.

3. Low burn severity sites.

Through early detection and monitoring, recommendations for type and timing of treatment will be improved.

Treatment of invasive plant infestations

Each noxious weed occurrence detected or relocated should be treated immediately. Manual or chemical treatments should be applied as appropriate for each location, occurrence size, phenological stage, and weed species. All herbicide treatments will be ground based, using spot treatments. All treatments will comply with the LAVO General Management Plan (2002) the LAVO Weed Management Plan (2008), and wilderness policy.

In 2014 and 2015, site revisits will determine whether maintenance of treatments is necessary. Treatments should be adapted if the initial treatment is determined to be ineffective.

All herbicide label requirements will be followed and applicators will be trained and certified pesticide applicators. Mechanical treatments may be applied by hand or machinery (such as tilling) as appropriate for the site, the weed(s) being treated, and the size of the infestation.

Management (non-specification)

Monitor for Special Status Species

Because the fire burned through potential habitat for special status species, assessments for these plants are recommended. If rare plants are detected, data needs include map and photo-document each occurrence in addition to assessing the habitat for noxious weed invasion or the potential for invasion.

Ecological Restoration of Aspen

Approximately 150 acres of aspen woodland occur on or adjacent to Hat Creek in LAVO and within the perimeter of the Reading Fire (Figure 8). This area burned at a variety of intensities, resulting in heterogeneous fire severity within the aspen communities. The Reading Fire presents a rare opportunity to examine fire effects (mortality and recruitment) for a keystone species across a broad soil burn severity gradient. The BAER team has two recommendations for aspen management following the Reading fire:

1. Develop a monitoring plan for aspen communities following the Reading fire. The plan should address the following questions:
    a. How does aspen mortality differ across low, moderate, and high burn severity?
    b. How is aspen recruitment affected by soil burn severity?
    c. What are the primary drivers of aspen mortality across the soil burn severity gradient (e.g., size, bole char, level of conifer encroachment).

2. Aspen stands within high severity areas that were heavily encroached by conifers pre-fire may sustain high levels of mortality, with little to no regeneration post-fire. Further, conifer regeneration (e.g., lodgepole pine) may capture the site if no management actions are taken to promote aspen. In this scenario (compromised aspen vigor due to competition from conifers, little aspen regeneration, and

prolific conifer regeneration), Lassen National Park should consider treatments that promote aspen recovery. These could include:

a. Planting of aspen (from local stock)
b. Removal of conifer regeneration (hand pulling or mechanical)
c. Enclosing the regenerating stand with temporary fencing to prevent deer from browsing the new aspen sprouts.

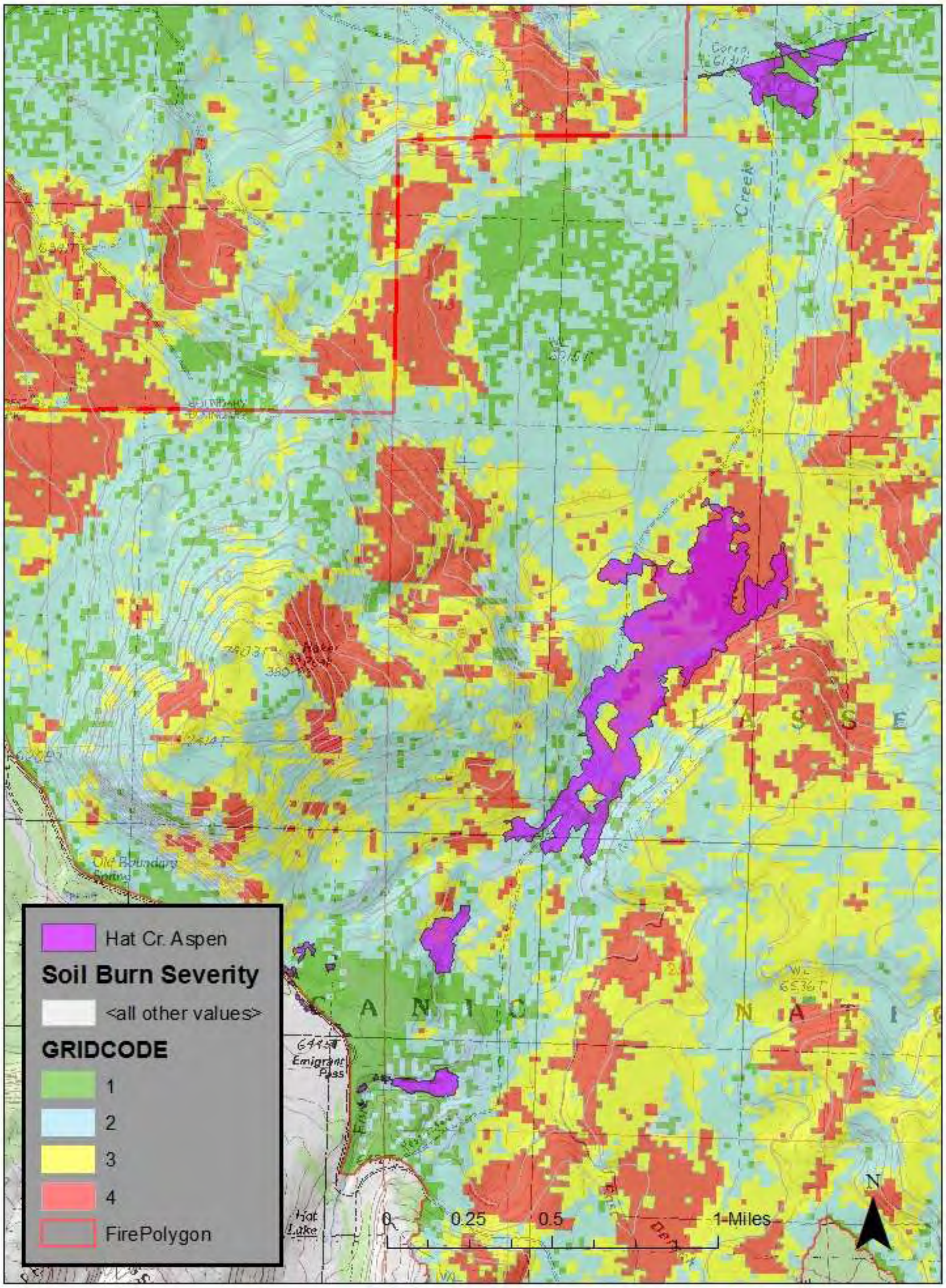

Figure 8. Location of relict aspen stands in the Hat Creek drainage in relation to burn severity. All stands were overtopped by lodgepole pine and/or white fir before the Reading Fire.

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Vegetation Assessment Written By
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WILDLIFE BURNED AREA ASSESSMENT

OBJECTIVES

- Assess effects of the fire and suppression tactics to Federally listed Threatened and Endangered species and their habitats
- Assess effects of the fire and suppression actions to park “special status” species and their habitats
- Conduct Section 7 Emergency consultation with the U.S. Fish and Wildlife Service, if appropriate
- Prescribe emergency stabilization measures and/or monitoring and management recommendations if necessary
- Assess effects of proposed stabilization actions to listed species and habitats, if applicable

ISSUES

- There are no known occurrences of Federally Designated Threatened, Endangered or Proposed Candidate Wildlife or Aquatic species within the Reading Fire area or within sufficient proximity to sustain negative impacts from the fire.

- The Reading Fire burned in an area that does support habitat for many sensitive species, including: the California Spotted Owl; the Northern Goshawk; the American Marten, and native trout. Some of the habitat for these species within the fire area burned at a high severity due to dense forest and fuel structure pre-fire.

- Lakes, ponds, wetlands and creeks within the fire area provide habitat for many amphibian species such as long-toed salamanders, rough-skinned newts, western toads, Pacific chorus frogs and cascades frogs. These habitats and species may experience temporary impacts from post-fire sediment discharge.

- For aquatic species, post-fire impacts may include compromised water quality and changes in water chemistry due to ash delivery, changes in water temperature from loss of canopy shading, scouring of riparian/aquatic vegetation, changes in pool habitat due to geomorphic bed movement, sediment delivery and flushing of species during flood events downstream.

OBSERVATIONS

Information for this assessment was based on a review of relevant research publications and literature including sightings and habitat records from the LNF, LVNP, California Department of Fish and Game (CDFG), United States Fish and Wildlife Service (USFWS) and personal communication with local experts from some of these agencies. The aquatic analysis is based on site-specific and aerial review during the period August 25th thru 31st, 2012. Due to time constraints, every effort was made to visit high priority fisheries and aquatic wildlife sites in the field. Areas with high to moderate burn severity were the focused area for this assessment both on National Forest and National Park Service Lands to effectively evaluate impacts within the fire perimeter.

<u>Background</u>

Figure 9. Hat Creek with intact riparian vegetation providing post fire bank stability. Photo taken August 25th 2012.

Fire may result in a large array of direct and indirect effects to wildlife and fisheries (resident trout populations) in the Hat Creek and Lost Creek watersheds within the Reading fire (Table 3). Direct effects to these populations will generally occur when high severity burns occur in riparian areas. In the Reading Fire, riparian areas generally burned at low or moderate severity, but some isolated areas within the headwaters of Hat Creek and Lost Creek, where it burned more severely, were completely denuded of vegetation.

Since some of the drainages burned very hot, fish may have died as a result of water heating, gas exchange or ash-loading to streams. It is often difficult to locate fish that have died from a fire since they rot quickly or get eaten by scavengers. One brook trout fish kill was observed during field investigations on Hat Creek just downstream of the

National Park Service boundary. The cause of this mortality was not determined in the field. The probability of significant loss of trout as a result of the Reading Fire is unlikely.

Table 3. Acres by burn severity in the Reading Fire.

Burn Severity	Acres	%
High	4,827	17%
Moderate	9,936	36%
Low	9,803	35%
Unburned	3,497	12%
Total	28,063	100%

FINDINGS

There are some risks associated with water quality from ash and sediment delivery post-fire. This is due to the high amount of high soil burn severity (17%), hydrophobic soils (80%), and large amounts of ash. This ash and sediment pose some risk to downstream water systems and fisheries. High soil burn severity and areas with excessive ash are mostly located in the southern half of the burn area and on gentler slopes; this will limit the amount of ash and sediment delivery to streams.

The above threats will be the most acute during the first post-fire rain season from December 2012 through March 2013 and next summer thunder storms in July/August 2013, until burn areas experience new vegetative growth and stream banks stabilize. If significant rain on snow events occur this winter, spawning gravels could be filled with sediment in interstitial spaces, causing oxygen deprivation to eggs and young of the year. Post-fire watershed threat should be reduced measurably after two to three years with favorable precipitation. Based on monitoring following the 2002 McNally Fire, aquatic habitat conditions stabilized after five years. It is not expected for the effects of the Reading Fire to continue beyond fire years.

Hat Creek was visited on August 25th, 28th, 29th and 30th 2012. The riparian corridor has remained intact overall, with small sections of burned stream banks along the mainstem. The areas that did burn into riparian habitat along Hat Creek are expected to quickly recover (Figure 1), lowering the concern for trout impacts. All age classes of trout were observed during initial reconnaissance and adult fish were observed actively feeding. On Upper Hat Creek (6th Level HUC), modeling shows a minor increase in discharge from pre and post fire discharges (see USFS Hydrology report). Although there are some areas of high burn severity, there are more areas that are unburned (or burned at low severity) to dilute an increase in discharge.

The data suggests that the probability of irreversible damage to fish populations within the mainstem of Hat Creek is low. Historical Forest Service surveys indicate the presence of rainbow trout (*Oncorhynchus mykiss*), introduced brook trout (*Salvelinus fontinalis*) and limited numbers of introduced brown trout (*Salmo trutta*). Personal communication with Susan Chappel indicated the possibility of speckled dace

(*Rhinichthys osculus*), Pit sculpin (*Cottus pitensis*) and riffle sculpin (*Cottus gulosus*).

Lost Creek was visited on August 25th and 28th, 2012. In Lost Creek, sedges and perennial grasses remain intact and appear to be providing bank stability and filtration to potential input from post-fire ash and sedimentation. The Reading Fire did not crown into the trees along Lost Creek so needle cast will provide some ground cover later in the year. There is low concern for trout in this drainage given the amount of moderate and high severity in the headwaters (See USFS Soils and Hydrology reports). Throughout the reach, the majority of streambanks were well vegetated and outside the fire perimeter with the exception of a few outcurves. On Upper Lost Creek (6th Level HUC), modeling shows a minor increase in discharge from pre and post fire discharges (see USFS Hydrology report). These data suggests that the probability of irreversible damage to fish populations within the main-stem of Lost Creek is low.

Cascades Frogs were identified as a special sensitive species that warrant further assessment to consider fire impacts to their population and potential habitat within the LVNP. The Cascades frog is known (historically and currently) to utilize habitat above approximately 4,500 feet in elevation. Sediment, soil and ash could fill portions of breeding habitats or could cover egg masses. Sediment is expected to be a temporary impact as spring flows in future years should occasionally flush the system, moving sediments further downstream to settle out in slow waters and reservoirs.

RECOMMENDATIONS

Given there are no federally listed Threatened or Endangered species within the burn unit, no specifications are permitted under BAER.

The post-fire environment that now exists **does not** present an emergency situation for wildlife and aquatic species within the area. Further, other resource treatments will mitigate impacts to wildlife and fisheries (e.g., road and culvert treatments/maintenance will lessen the risk of sediment entering sensitive habitat).

Non-funded management recommendations

It is recommended that the following work/monitoring be pursued using non-BAER funding:

1. Trout populations should be monitored in the headwaters of Hat Creek and Lost Creek to evaluate post-fire effects. Monitoring using electroshocking over time, preferably over several years, will help determine the status of these resident trout populations. If there are future impacts, the effects to the population will be more accurately determined.

2. Collaboration among USFS, CDFG and NPS on research and monitoring of post-fire effects to trout within the Reading Fire perimeter. For the first three years

after the fire, annual meetings should be conducted to evaluate lessons learned from post fire impacts (what could have been done differently, compile existing data, evaluating new data needs and establish photo points).

3. Additional water quality samples should be taken to help to better understand changes in habitat conditions for aquatic biota following the Reading Fire.

4. Storm Patrol should be considered to monitor the effectiveness of road treatments.

5. Land agencies should consider reassessing the resources periodically and implementing appropriate management, e.g.:
    i. Riparian hardwood areas should be assessed for conifer removal if too many remain or too many saplings become established.
    ii. Riparian areas should be periodically monitored for future invasions of weeds. Prompt removal of invasive plants will help maintain ecosystem function.
    iii. Stream temperature should be monitored to ensure that fish habitat is maintained.
    iv. Collaboration between the National Park, the National Forest and Fish & Game should be established and continue in order to maintain information sharing and provide for joint opportunities for landscape scale ecosystem projects.

REFERENCES

Information and material for the Wildlife Burned Area Assessment were taken from the following Reading Fire BAER reports by USFS employees Dan Teater and Danny Burton:

Dan Teater and Melvin Daniel Burton II. August 2012. Fisheries Specialist Report Reading Fire BAER Assessment for Lassen National Forest & Lassen National Park

Melvin Daniel Burton II. September 1, 2012. Wildlife Biology Resource Assessment for Lassen National Forest and Lassen Volcanic National Park

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Wildlife Resource Assessment compiled by Eamon Engber, Vegetation Specialist, Reading NPS BAER Team

CULTURAL RESOURCES ASSESSMENT

OBJECTIVES

- Determine if known or incidentally encountered cultural resources within, adjacent to or downstream of the Reading Fire were impacted by the fire and/or are threatened by post-fire conditions. If applicable, propose emergency stabilization treatments or activities to minimize or avoid those impacts.
- Determine if any proposed emergency stabilization treatments on the Reading Fire might adversely impact cultural resources and take measures to prevent those impacts.
- Meet all Federal cultural resources legal mandates, including consultation with appropriate American Indian tribes.

ISSUES

- Twenty-seven cultural resources are known to occur within or immediately adjacent to the Reading Fire. These resources are comprised of materials subject to direct fire effects or vulnerable to post fire threats such as looting, vandalism, hazard trees, or destabilization (due to vegetation loss).
- Five additional cultural resources are found down slope from the burned area and may be subject to damage resulting from erosion.
- Emergency stabilization treatments are proposed within or around the Reading Fire that involve ground disturbance or other actions that could potentially impact known cultural resources.
- Contemporary members of the Atsugewi Tribe affiliated with the Lassen Volcanic National Park have expressed interest in the protection of cultural resources within the park including fire management projects and incidents.

Introduction

- The NPS recognizes five non-exclusive categories of cultural resources including archeological resources, structures, cultural landscapes, ethnographic resources and museum objects.

Archeological resources are the physical evidence of past human activity, including evidence of the effects of these activities on the environment, and are frequently conceptualized and managed as spatially discrete archeological sites.

Structures are constructed works built to serve some human activity and are usually immobile and can be of either prehistoric or historic age. Examples include buildings and monuments, trails, roads, dams, canals, fences and structural ruins. The National Park Service manages structures through the List of Classified Structures (LCS), an inventory of all prehistoric and historic structures with historical, architectural, or engineering significance.

Broadly defined, *cultural landscapes* are a reflection of human adaptation and use of natural resources and often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions.

Ethnographic resources are basic expressions of human culture and the basis for continuity of cultural systems. These encompass both the tangible and the intangible, and include traditional arts and native languages, beliefs and subsistence activities. Finally, *museum objects* include specimens, objects and manuscript and archival collections. These are frequently kept in a museum or designated curation facility.

Cultural Context

Cultural resources in Lassen Volcanic National Park, including the thirty-two known historic and/or prehistoric sites within the Reading Fire burned area, represent thousands of years of prehistory and history. They reflect a wide array of economic, social and ideological activities crosscutting diverse ethnic groups.

The ethnic groups include Native Americans, whose ancestors were the sole human occupants of the area until Euro-American contact early in the 19th century. Many Native Americans maintain traditional use of NPS lands, including sacred areas, places of cultural significance, and sites where traditional gathering or ceremonies occur. Descendants of Euro-American pioneers and emigrants also identify with many historic locations.

Prehistory: The prehistoric chronology of the region encompassing the Reading Fire needs further study. Patterns of use of the area would be expected to be complex since the burned area is roughly at the intersection of several geographic, ecological, and cultural zones, and archaeological influences from the Sierra Nevada, Great Basin, Southern Cascade, and Central Valley may all be represented. Cleland (1995, as cited in Waechter et al. 2003) has proposed that the earliest uses of the general area occurred prior to 7500 years ago; until about 3000 years ago. He postulates area peoples were highly mobile and emphasized high-elevation resources. They later became more sedentary, emphasizing river resources and finally placing more emphasis on seeds and acorns.

Prehistoric sites in the burned area represent Native American stone tool manufacture, hunting, and probably plant processing. Survey crews have noted that the area has edible resources, including deer, balsam root, gooseberries, grass seeds, and chinquapin that could have been exploited prehistorically. Time-diagnostic artifacts dating use of the burned area are rare, but consistent with use beginning by 5000-3000 BC.

Two recorded archeological sites within or immediately adjacent to the Reading Fire contain a prehistoric archeological component. These sites are indicative of food processing activities, suggesting that these high elevation areas were mostly utilized on seasonal basis.

Ethnography: Lassen Peak, a prominent local landmark a little to the south of the burned area, has been viewed as a boundary point between two groups: the Atsugewi and the Maidu. Current information indicates that the burned area falls within the traditional territory of the Maidu and the Atsugewi (now included within the Federally recognized Pit River Tribe, which is composed of 11 autonomous bands). Specifically, it is associated with one of the two Atsugewi subgroups, the Atsuge. Groups of the Atsugewi, Achumawi, Yana, and Maidu sometimes congregated to take advantage of salmon runs on the lower Pit River, or acorns or roots in other areas (Garth 1978:238; Johnson 1978:361; Waechter et al. 2003). These groups sometimes intermarried, and the Atsugewi traded items such as bows, furs, and shell beads with various peoples including the Achomawi, Northern Paiute, Yana, Klamath, Northeastern Maidu, and Northern Wintun (Davis 1974.)

The Atsugewi occupied an area described as “high, relatively dry, shrubby, and snarled with juniper woodlands” (Moratto 2004:437). Various environmental zones were, however, available to supply a variety of resources, some of which were abundant during particular seasons.

Along the Pit River and its major tributaries, Atsugewi peoples obtained salmon (from the lower Pit River, where they fished at the invitation of the Achumawi), trout, freshwater mussels, and bottom-feeding fish such as suckers. Fishing technologies included nets and basketry traps. For the Atsugewi the river line and fishing was very important for their cultural identity. According to Voeglin river ownership rights were important, but hunting land ownerships rights were not (1942). Tracts of sage and juniper offered game animals—deer, pronghorn, bighorn sheep, and small mammals. In the mountains, deer were an important game animal, while rabbits were important in open areas. Swamps along the Pit River offered waterfowl. For both the Atsugewi and the Yana, important plant foods included the *Epos* (a root found in areas of rocky tablelands), pine nuts, grass seeds, camas bulbs, and berries. Acorns were important in the western portion of the Atsugewi area (Moratto 2004:437-438; Waechter et al. 2003:6).

The Atsugewi, like the Yana and Maidu, followed a yearly round of seasonal transhumance, settling in protected valleys in lower elevation during the winter and making spring, summer, and fall movements to take advantage of seasonally available resources, sometimes in higher elevations (Garth 1953; Kniffen 1928; Kroeber 1925; Waechter et al 2003). Winter villages consisted of earth-lodge or bark structures in sheltered valleys, while summer habitations were more temporary. The topography of the burned area and the deep snows present in winter suggest that it would have been occupied only during warmer seasons.

The Lost Creek area, including a small portion of the burned area, was a traditional gathering location for tiger lily bulbs. (The reference is to *lilium columbianum*, a species native to the area; note that the name is shared with other lily species).

History: Fur trappers were among the first Euro-Americans to venture into the vicinity of the burned area. The first written record discussing the Pit River may be that of Peter Skene Ogden, leader of a Hudson's Bay Company expedition that, in 1827, entered an area having an unidentified river fitting the description of the Pit River. Ogden describes a visit from local Native Americans (Wheeler-Voegelin 1974:6-7).

By the mid-1840s, pioneers were crossing northeastern California to settlement locations in California's interior and in Oregon. Starting in 1848, with the discovery of gold at Sutter's Mill, travelers soon included Americans, Europeans, Latin Americans, Australians, and Asians, all on their way to the gold fields.

Settlers and gold seekers followed three major historic trails into and across northeastern California. These were the Applegate (the southern route of the Oregon Trail, established in 1846), the Lassen (leading south to the California gold fields, blazed in 1848), and the Nobles (briefly known as the Fort Kearney, South Pass, and Honey Lake Wagon Road, also leading to the gold fields) Trails. Portions of the Nobles Trail lie within the burned area.

The namesake for the Nobles Emigrant Trail was emigrant/gold prospector William Nobles, who accidentally blazed a new route between the Honey Lake Valley in California and the Applegate Trail in Nevada. This new route proved much shorter than the Applegate-Lassen route, and Nobles was successfully promoting his trail by 1852. The Nobles Trail was in continuous use until at least 1869; its use declined only when the Central Pacific Railroad provided an alternate form of transportation. Modern roads follow or flank portions of the trail, and other segments serve as modern hiking trails.

By the late 1840s, Sacramento Valley settlers began to seek mountain camps with pasture for their sheep and cattle. Some of the earliest pastures, potentially including some near Lassen Peak roughly south of the burned area, may have been destroyed in Lassen Peak's1910s eruptions.

Starting in the mid 1800's Lassen became a prime spot for both cattle and sheep ranching. According to one source, "In the immediate vicinity of Lassen Park… agricultural wealth was largely limited to graze: the winters proved too long, summers too short, and the snow too deep for successful crop cultivation" (Emmons and Catton 2003). At first ranchers put their cattle on open range on public domain; however, the Forest Service took over the management of Lassen in 1905, and they gave out Forest Service grazing leases. These grazing leases generally were anywhere that water was abundant, had few trees, and room to grown native hay. By 1912, an estimated 1,500 -

2,000 head of cattle grazed under Forest Service lease on land within what would soon become Lassen Volcanic National Park. With the 1916 designation of the park, all USFS grazing leases were phased out and NPS rangers initiated a concerted effort to prevent cattle trespass on parklands (Emmons and Catton 2003). There are remnants of a Historic fence in the burned area that could be associated with historic grazing activities from this period.

In the late 1800's westward expansion increased the need for both land and natural resources. The heart of the creed of these westward expansionists was the insistence that private property was the means to creating a prosperous society. In 1862 the federal government passed the Homestead Act, which allowed people to buy surveyed public land if they lived on the property for a certain amount of time. There was homesteading in Lassen until 1902 when the federal government withdrew public land in the Lassen Peak region from public entry under the various homesteading laws. However, homesteaders who bought land before 1902 kept their lands. Within the burned area there are historically documented homesteads, with associated sites and artifacts (cabins, fences, etc). During the Great Depression of the 1930, when land owners Stewart, Herbert, Long, and others – proved willing to sell the Park Service found itself perennially short of funds authorized for land purchase. In present day about 75 acres of Lassen Volcanic National Park and Lassen National Forest are owned by private landowners.

Also during the 1840s, when the Euro-American population of California increased dramatically during the Gold Rush, demand for timber increased. Logging began with small companies or individuals harvesting timber on private lands. The first loggers used horses and skids to transport logs to local mill sites. From the mills, lumber traveled to market by wagon. Larger operations developed as steam engines and narrow-gauge railroads were used to haul the lumber. By the 1930s, tractor skidding and truck logging had already begun (Syda and Maniery 1998; Waechter et al 2003:5). Cut stumps and at least one former road segment suggest historic logging in the burned area. Hydroelectric power was in demand in California by the early twentieth century, with the Shasta Power Company operating in the area by 1902. There are segments of the Sunflower Flume within the burned area reflect this activity.

The close of the Gold Rush era saw Lassen become federal land in 1905, when Lassen Peak Forest preserve was established. Two years later in 1907, Lassen Peak and Cinder Cone both became National Monuments after a declaration by President Theodore Roosevelt. It wasn't until after the massive eruption of Lassen Peak in 1915 that Lassen became a national park. Lassen Volcanic National Park was dedicated on August 1916.

The park began their first phase of park infrastructure construction in the form of a small administrative center at Mineral, the Lassen Park Road and a ranger's station at Summit Lake. By the late 1920s, the Park Service had begun to take responsibility for fire prevention and control within park lands, constructing a telephone line between the new Warner Valley Ranger Station and Summit Lake, repairing the "old Forest Service lines" between Badger Flat and Butte Lake and between Summit Lake and the Prospect Peak Lookout (Emmons and Catton 2003). Telephone line remnants found in the burn area probably reflect, potentially among other things, Forest Service and Park Service administration of the burned area.

On June 16, 1933 the Public Works Administration created the Civilian Conservation Corps (CCC), who was responsible for a many of the construction and maintenance projects that occurred in Lassen from 1933-1935. According one study, "Administrative facilities [Mineral headquarters] constructed during the 1930s included a new ranger station at Butte Lake and Horseshoe Lake and expanded stations at Warner Valley, and Summit Lake. ECW and CCC crews also constructed…patrol cabins at Lake Helen and Lower Twin Lakes…" (Emmons and Catton 2003). The CCC had two camps in the park, one at Sulfur Works and the other at Boundary Springs/Devastated Area. The CCC camps were designed to be impermanent; most buildings and structures associated with the camps were purchased by private parties and removed from the park boundaries, dismantled, or moved by federal agencies to alternative administrative sites and reused. There were two sites associated with the CCC that were within and near the fire boundary. There was an old CCC road on the edge of the burned area. The remnants of the Boundary Springs/Devastated area campsite are located below the burned area across the Lassen Volcanic Park Road.

Other historic activities within the burned area almost certainly included recreational activities. These activities probably left limited traces on the land (unless cabins within the burned area represent recreational use), but probably included hiking, camping, hunting, and fishing.

Background Information

Impacts to cultural resources as a result of fire, fire management actions and post-fire conditions can be conveniently divided into three categories: direct, operational and indirect. *Direct impacts* are those caused by the wildland fire itself or its byproducts (e.g., smoke); *operational impacts* are caused by fire management actions made in response to wildland fires (e.g., fireline construction, retardant drops); and *indirect impacts* occur as a result of fire-induced changes to the context in which cultural resources are found (e.g., looting and erosion due to loss of vegetation cover).

Operational impacts to cultural resources are identified, assessed and mitigated as part of fire suppression activity damage repair and funded from the emergency suppression account. Suppression-related impacts to cultural resources during the Reading Fire that were noted during the BAER field assessments will be addressed through a separate documentation process (Resource advisor reports and recommendations).

Emergency stabilization funds are used to assess and, if necessary, mitigate the direct effect of fire and related indirect impacts such as erosion, as well as identify and mitigate resources that could be affected by emergency stabilization treatments (e.g., ground-disturbing activities). With regard to direct effects to material cultural resources, the level of threat is a function of the fuels and associated fire behavior and the nature of cultural materials present. Fire effects vary with fire intensity and duration of heating that is dependent upon fuel type, fuel loading, and burning conditions. The results can be interpreted post-burn by examining the soil burn severity if the pre-fire vegetation types is known. Within the Reading Fire area mixed conifer is the predominate fuel type present that burned at varying intensity with the fire perimeter. With the runs exhibited by the fire crown fires with temperatures reaching 1000^{o}C most likely occurred. Also with the quantities of duff present in mixed conifer longer duration smoldering appears to have consumed all surface fuels in some areas. Generally speaking, these burning conditions are known to produce adverse effects to most types of cultural resources known to occur within the general fire vicinity.

Indirect impacts of the greatest concern within the Reading Fire include erosion, fire killed hazard trees, and looting or vandalism resulting from the post-fire exposure of artifacts. This includes incremental sediment loss and deposition, as well as catastrophic events such as debris flows. Onsite and upslope post-fire vegetation condition will influence the potential for the effects of erosion. Falling trees can impact cultural resources through ground impact and root throw. Loss of vegetation can expose collectable cultural resources to looters and facilitate mobility through burned areas.

Applicable emergency stabilization policy and guidance (620 DM Part 3, *Interagency Burned Area Emergency Response Guidebook*) dictates that only those cultural resources known prior to the BAER assessment process, and others discovered incidentally during that process are eligible for emergency stabilization funding. Systematic inventories of burned areas are not allowed, unless those areas will be subjected to potentially detrimental emergency stabilization treatments.

<u>Reconnaissance Methods</u>

Assessments of previously recorded cultural resources within and adjacent to the Reading Fire were performed where safety was not a concern following fire containment. Although the BAER Team assembled over the weekend of August 25th & 26th, no significant fieldwork was undertaken until August 28 through August 31, 2012 due to concerns over hazard trees in burned areas and active fire in some areas resulting from strong wind events. Once field assessments were initiated these were limited to cultural resources in close proximity to the paved road in the park and major dirt roads in the forest. This effort was led by NPS Fire Program Archeologist Joseph Svinarich and USFS District Archeologist Bob Foxworth.

The joint NPS and USFS BAER Team convened on Saturday, August 25th and initiated consultations with the Pit River Tribe, NPS staff from Lassen Volcanic National Park, and USFS staff from the Lassen National Forest, Hat Creek Ranger District. The team consulted within each respective agency, but completed a joint consultation with Shawn Normington, representative of the Pit River Tribe, regarding the BAER process. The Reading Fire and other fires in the vicinity were discussed in general terms. No specific concerns or issues were identified regarding the Reading Fire and Shawn Normington indicated that he was happy that the BAER Team was assigned to the fire. The USFS consulted on an as needed basis within the agency while the NPS conducted one scoping meeting with park staff on August 29th.

Cultural resource assessments for the fire included examination of fire and cultural resource data to identify resources most likely to be threatened by the fire, and completion of field assessments for sites that were easily accessible and in non-hazardous areas of the fire. Record search of historical information was completed, and examination of known cultural resources in relation to soil burn severity and slope data was completed to determine if sites were likely to have burned over and estimate potential threat of erosion due to moderate or high burn severity on steep slopes above given cultural resources. Field assessments consisted of documenting fire related impacts, post-burn threats, and treatment recommendations on a post-fire inspection form developed by the National Interagency DOI BAER Team and shown below.

Emergency Post-Fire Site Inspection Record
DOI BAER Team

Site No. Site Name	Temporary or Other No.
Date of Inspection:	Inspector:
UTM Zone: Easting Northing	
Elevation	
Site Description/Condition	
Prehistoric / Multi-component	
Historic / Other	
Features Present:	
Were Wood Elements Present, describe: Were they burned? Yes ▪ No ▪	
Has the site been vandalized Yes ▪ No ▪ If yes, describe:	
Site Burn Severity ___ Low (duff partially consumed, none to little ladder fuels burned, no canopy burned) ___ Moderate (duff consumed, ladder fuel burned, isolated crown burn or torching) ___ Severe (duff, ladder and crown completely consumed) Note: Map, photograph and describe affected areas of site	
FIRE EFFECTS AT SITE Cracking/spalling ▪ Smoke/soot damage ▪ Stump/root holes ▪ Loss of architectural wood/features ▪ Tree(s) on walls or rubble ▪ Other:	**SUPPRESSION IMPACTS TO SITE** Handline ▪ Drop point/safety zone ▪ Dozer line ▪ Retardant drop impact/staining ▪ Mop-up ▪ Tree falling ▪ Spike Camp ▪ Safety Zone ▪ Vegetation removal ▪ Vehicle ruts ▪ Other:

Emergency Post-Fire Site Inspection Record
DOI BAER Team

EROSIONAL THREATS TO SITE

On site slope %, Aspect °

Site Watershed (to 20 m. out) Slope %, Aspect °

Erosion threat:
Active gully/riling/scouring (depth and extent) ▪
Stump hole/burned log erosion ▪
Pedestaling ▪
Duff absent ▪
Hydrophobic Soils on site ▪
Desiccated (powdery) soils on site ▪

Other:

RECOMMENDED PRESERVATION TREATMENT

▪ No Treatment Recommended
▪ Monitor
▪ Treatment Recommended (describe (e.g. Directional falling, Straw bale, straw scatter, Excelsior matting, sandbag, etc.)

Additional comments:

FINDINGS

Resources located within the fire area or in areas potentially subject to erosional impacts originating within the fire area were examined using GIS to assess for probable adverse effects resulting from fire. Data used in the analysis were obtained from the Type I incident management team assigned to the fire for suppression, from NPS park and USFS district base data, and BAER Team soil scientists.

Burn Severity

Examination of NPS park cultural resources GIS layers and historic data for the fire area have identified twenty-eight known archeological sites and historical features in the fire vicinity. In addition four new archeological sites or historical features were discovered by fire crews during the fire suppression and repair who provided GPS locations for the new discoveries. The following chart summarizes mapped soil burn severity for these resources by agency jurisdiction.

Number of Sites by Soil Burn Severity Class

High Severity	8
Moderate	13
Low	5
Unburned	6

Results of the GIS analysis indicate that 28 of 32 sites are located within burned areas with the majority (21 sites) in areas that appear to have burned at higher intensities. Eight field site assessments were completed during for BAER that included seven sites located within the fire area. Of these sites two that are located within moderate severity burn were determined to be unburned in the field while two sites located within low burn severity were found to have burned at moderate to high severity. Overall the soil burn severity map derived for this incident was found to be accurate only 50 percent of the time for site specific impacts. However, of the six sites located in “unburned” areas, five sites are cleared located outside the fire perimeter and are included in this analysis for potential post-fire erosional impacts.

Slope and Erosion Potential

Cultural resources located on or below steep slopes that burned at moderate to high severity may be subject to increased precipitation run off that can erode archeological sites or historic features. Fire soil burn severity data was examined in conjunction with slope data derived from a ten-meter DEM for the general vicinity of sites located within or near the fire perimeter. Most of the cultural resources assessed are located in areas with low slope values although site level terrain variability can be significant and is not decipherable from the GIS data (in other words field assessments are necessary to determine actual on-site erosion threats).

However, up slope values can be used to derive potential flows resulting winter storms or spring snow melt when examined in conjunction with the soil burn severity and soil type. Results of the hydrologic assessment of watershed indicate debris flows is not a concern for cultural resources, but does not address increased water flow and deposition of increased sediments from the burned areas. For this analysis slopes greater than 40 percent were considered to represent potential risk to sites resulting from erosion. Sites identified as potentially at risk were reviewed with the NPS BAER Team hydrologist and no erosion threat beyond what would have occurred under a natural precipitation regime is anticipated, although a significant event this winter (e.g. 100 year storm) may result in increased impacts. However, for the purposes of BAER treatments only the analysis for 25-year storm impacts is taken into consideration.

Fire-Killed Trees

Archeological sites with fire-killed trees located on or near site features such as standing structures, stone foundations, log cabin remnants, or within recorded artifact concentration areas will need to be assessed. These trees will eventually fall, further disrupting site features and may pull up root balls that will impact subsurface archeological deposits. Completed field site assessments have demonstrated that many areas are full of fire-killed trees and the hazard level can vary significantly within the fire perimeter where fire intensities were moderate to high. The soil burn severity data can be used to identify cultural resources located within moderate to high soil burn severity areas to be assessed for hazard fire-killed trees with the potential to damage archeological sites or historical features. Twenty-three sites are located within these areas, of which five were assessed during the BAER process.

Ground-Disturbing Emergency Stabilization Treatments

Proposed treatments for emergency stabilization were discussed with the BAER Team during team daily meetings. For known resources only one treatment was identified that had the potential to impact a cultural resource. The NPS proposes to monitor culverts along the Lassen Volcanic National Park Highway and remove accumulated woody debris from culverts following major precipitation events and spring snow melt over the next year. The highway and culverts are considered to be a historic structure that is eligible for listing on the National Register of Historic Places.

RECOMMENDATIONS

Treatment recommendations include both an emergency stabilization specification that is eligible for funding under BAER and non-specification management recommendations intended to meet general agency cultural resource management standards.

Emergency Stabilization Specifications

CR-1: Conduct Site Assessments:
BAER cultural resource assessments are performed to identify (1) direct impacts and (2) threatening post-fire conditions that require allowable BAER treatments to mitigate. Thirty-two cultural resources were initially identified as resources at risk, with BAER field assessments completed at eight sites. Four additional archeological sites or historic features are located outside the fire perimeter and determined to not be at risk from indirect impacts. Twenty sites remain within the fire perimeter at risk from direct fire impacts and potentially indirect effects such as erosion and looting. Completion of

BAER cultural resource assessments is recommended prior to the onset of winter to allow for implementation of any identified emergency stabilization treatments identified.

Management Recommendations (Non-Specification Related)

Post-fire field conditions and data collected during fire suppression and BAER often lead to the need for management actions that were not addressed during the incident and are not eligible for emergency stabilization funding. The following recommendations are intended to assist the park meet general NPS management goals.

- Record new cultural resource discoveries to professional standards. Four new archeological sites or historical features were reported during fire suppression and suppression repair activities that require further documentation to meet state standards. Current documentation consists of GPS locations, digital photographs, and some general field notes.
- Update site records for previously recorded sites visited during READ and BAER assessments. Eight sites were visited during the BAER assessments including a couple that were field checked by READs during suppression. Additional documentation was collected that can be used to update current site records.
- Complete Archeological Sites Management Information System (ASMIS) assessments from BAER and READ data. NPS policy requires scheduled monitoring of site condition to be entered into the service-wide archeological sites database (ASMIS). This information can be gleaned from READ and BAER field site assessments.
- Post-fire field conditions are often conducive to conducting field survey in archeologically sensitive areas due to the exposure of artifacts when vegetative cover is lost to fire. An archeological survey design can be derived based on historical literature and mapped fire severity to determine where field visibility is good due to reduced vegetative in archaeologically sensitive areas.

CONSULTATIONS

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Bob Foxworth, USFS District Archeologist, Hat Creek Ranger District.
Shaun Nottingham, Representative, Pit River Tribe

Cultural Resources Assessment Written By Joe Svinarich, Cultural Specialist, Reading Fire BAER Team

MODIFIED COST/RISK ANALYSIS

This cost/risk analysis is designed to allow the comparison of a "no action" to the proposed actions and alternatives using a qualitatively evaluation. Instead of assigning a dollar value to the values at risk, a rating (None, Low, Mid, and High) for the potential for unacceptable impacts for each action is selected. These ratings are made by the interdisciplinary team (IDT) based upon literature review, field observations, experience, and knowledge.

Risk of Resource Value Loss or Damage:

No Action-Treatment Not Implemented (check one)

Resource Value	None	Low	Mid	High
Residential & Commercial Structures		X		
Transportation Infrastructure				X
Lives		X		
Erosion			X	
Timber Resources				X
View Shed				X
Property Value			X	
Soil Productivity			X	
Wildlife Habitat		X		
Economic Development		X		
Aquatic Habitat			X	
Invasive Species				X
Cultural Resources				X
Recreation			X	

Proposed Action Treatments Successfully Implemented (check one)

Resource Value	None	Low	Mid	High
Residential & Commercial Structures		X		
Transportation Infrastructure		X		
Lives		X		
Erosion			X	
Timber Resources				X
View Shed				X
Property Value			X	
Soil Productivity			X	
Wildlife Habitat		X		
Economic Development		X		
Aquatic Habitat			X	
Invasive Species			X	
Cultural Resources				X
Recreation			X	

Probability of Public Safety Treatments Successfully Meeting Objectives:

TITLE	PROBABILITY OF SUCCESS %
ROAD DEBRIS REMOVAL	90
CULVERT CLEANING	85
SIGNS	90
REMOVE FLOATABLE DEBRIS	85
IMPLEMENTATION LEADER	90
ASSESSMENT AND PLANNING	95
AVERAGE	**89**

Summary for Watershed Public Safety Treatments to Remove Road Debris, Maintain Culverts, Remove Floatable Debris, Erect Signs, and Hazard Tree Removal.

1. Are the risks to natural resources and private property acceptable as a result of the fire if the proposed actions are taken?

Proposed Action Yes [X] No [ ]
Rational for answer: The probability of success is determined to be high for immediate remediation of road debris clearing, culvert cleaning, floatable debris, erect sighs, and remove hazard trees.

No Action Yes [ ] No [X]
Rational for answer: Public hazards of rock fall, loss of culverts on roadways, warning signs, and hazard tree removal would endanger life and property.

Alternative(s) Yes [ ] No [X]
Rational for answer: None

2. Is the probability of success of the proposed action, alternatives, or no action acceptable given their costs?

Proposed Action Yes [X] No [ ]
Rational for answer: Yes, costs are determined to be reasonable and everything feasible should be done to protect lives. As a result of the proposed action, lives, property, and safety will be protected as best as possible.

No Action Yes [ ] No [X]
Rational for answer: Not an option due to risks to life and property.

Alternative(s) Yes [ ] No [ ]
Rational for answer: None

3. Which approach will most cost-effectively and successfully attain the objectives and therefore is recommended for implementation from a Cost/Risk Analysis standpoint?

Proposed Action Yes [X] No [ ] Rational for answer:
Rational for answer: The proposed action reasonably meets objectives for protection for life, property, public safety, and critical natural and cultural resources.

No Action Yes [ ] No [X] Rational for answer
Rational for answer: No action would provide insufficient protection for life, property, public safety, and critical natural and cultural resources.