Bagley Fire 2012

BAER Report

Forest Vegetation
Hazard Trees/Salvage

Shasta-Trinity National Forest

Shasta Lake NRA and Mt Shasta/McCloud Management Units

Submitted by: _____
Keli McElroy
Westside Silviculturist
Shasta-Trinity National Forest
Sept. 20, 2012

Objectives

The objectives of this forest resources assessment on following the Bagley Fire includes:

1) evaluate the extent of the changed condition of vegetation as it relates to safety and habitat;
2) evaluate the potential for future mortality as a result of the Bagley fire; and
3) recommend possible mitigations to the changed condition including reforestation, hazard tree reduction and salvage on federal lands.

Management Direction

Shasta-Trinity National Forest Land Resource Management Plan (Forest Plan), NW Forest Plan and the STNF Late Successional Reserve Assessment (LSR) (1999) provide the following direction:

National Forest Management Act (1976):

(d)(1) It is the policy of the Congress that all forested lands in the National Forest System shall be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans.

LSR Management

1. The NW Forest Plan Appendix A page B-6 **"**Depending on stand conditions, treatments could include, but should not be limited to: … (4) reforestation" .

2. Shasta-Trinity National Forest, Forest Wide LSR Assessment: Chapter 2 (Potential Wildfire Effects) discusses the need to conduct reforestation activities. Chapter 3 (Young Plantations) discusses recommended stocking levels. Chapter 4 (Potential Treatments; Table 4.2) displays potential treatments to allow for continued development of late- successional habitat following a stand replacing event including reforestation. Activity Design Criteria lists the specifics pertaining to reforestation activities.

Inventoried Roadless Areas

Under the Forest Plan (pages 4-45 through 4-47):

1. No new roads will be constructed for Forest Service activities
2. Retain late seral stage forest stands
2. Use of mechanized equipment will be permitted for… management of insects disease and other pests interfering with the attainment of ecosystem health, recreation and non-recreation values; fuels management.
3. Proposals for removal of dead, dying or high risk trees due to catastrophic events are subject to additional site-specific environmental analysis at the ecosystem planning level.
4. Maintain snags, dead/down material and hardwoods at naturally occurring levels.

<u>Roadless Rule (2001)</u>
Timber may not be cut, sold, or removed in inventoried roadless areas of the National Forest System <u>unless</u>:

the Responsible Official determines that one of the following circumstances exists (the cutting, sale, or removal of timber in these areas is expected to be infrequent):

1. The cutting, sale, or removal of generally small diameter timber is needed for one of the following purposes and will maintain or improve one or more of the roadless area characteristics as defined in § 294.11.

(i) To improve threatened, endangered, proposed, or sensitive species habitat; or

(ii) To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects, within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period;

Forest Vegetation Characteristics

The dominant vegetation type within the Bagley fire perimeter is mixed conifer and Douglas-fir forest. Species composition tends to follow elevation and temperature gradients ranging from Douglas-fir/white fir at the highest areas in the northern portion of the burn area to ponderosa pine/gray pine/chaparral in the lowest, warmest areas at the southern end of the burn area.

South-facing slopes are often dominated by large areas of hardwood and chaparral vegetation. These areas tend to have low productivity due to topographic position and geologic parent material. The remainder of the fire perimeter is highly productive due to soil quality and high rainfall. Historically, these areas have demonstrated a high capacity to recover from disturbance (*Lower McCloud Watershed Assessment*, 1998).

The preponderance of vegetation appears to be second growth stands, generally 80-100 years old, likely due to previous disturbance from the 1872 and/or 1898 large fires reported to have burned within the Bagley burn footprint (*Lower McCloud River WA*, 1998). Vegetation has been modified by past timber harvest activities in Claiborne, Squaw, Ladybug, and Hawkins Creek drainages as well as extensive harvesting on private lands. Aside from a few main routes through and along the fire perimeter (such as 37N48, 37N68, 37N95, 37N78, etc) and roads constructed for the specific purpose of accessing private timberlands, the bulk of the fire area is essentially unroaded with little modification to the naturally occurring vegetation on Forest Service lands.

The following table shows the acreage burned by the existing forest type across the Bagley fire area. Mixed conifer forests are comprised of ponderosa pine, Douglas-fir, sugar pine, incense cedar, and white fir types that total nearly 25,234 acres (55%) across the fire area. Mixed conifer, Douglas-fir and ponderosa pine types total approximately 38,900 acres or 85% of the forested area affected by the Bagley fire. The remainder is primarily characterized by hardwoods and occurs primarily on southeast-facing slopes within the southern third of the burn area. Hardwoods are also a minor component of many mixed conifer stands throughout the burned area.

Table 1. Vegetation Composition within the Bagley Fire Perimeter

Vegetation Type[1]	Acres
Mixed Conifer-Pine	25234
Douglas-fir/Ponderosa Pine	12075
Black Oak	3196
Scrub Oak	1580
Canyon Live Oak	1495
White Fir	739
Douglas-fir	659
Upper Mont Mixed Chaparral	654
Ponderosa Pine	194
Lower Mont Mixed Chaparral	114
Barren/Grass/Pond	71

Post Fire Condition

Forest Vegetation

The Bagley fire has impacted over 46,000 acres of the Shasta-Trinity National Forest (70% of land within burn perimeter) as well as privately owned and managed land and resources (30% of burn area). According to the Burned Area Reflectance Classification (BARC), 30% of the fire area (approximately 13,800 acres) burned at moderate and high severity resulting in considerable losses of forest vegetation. Reconnaissance and the BARC map showed most forested areas experienced very low to low burn severity (70%). Overall, 11% of the burn area experienced high severity, and the aerial reconnaissance confirmed that the majority of high severity occurred between Claiborne and Squaw Creek drainages and within the Iron Canyon drainage. Isolated patches of mortality and group torching of over-story trees were observed, as well as crown fire runs with complete mortality and ground fuel consumption across the burn area.

As BARC and RAVG models are developed and refined, it is likely that predicted vegetation mortality within moderate to high severity burn areas will increase. Additional tree mortality can be expected in the next 1-5 years as remaining trees die of cambium/root damage from heat, insects and disease infestations and other post-fire conditions.

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 plantation or 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 and increased erosion, including the formation or exacerbation of water repellent layers at or near the soil surface.

[1] Regional Dominance Type 1, extracted from Shasta-Trinity National Forest GIS Library

BARC Modeling – Burn Severity for the Bagley Fire

Table 2. Burn Severity Across All Lands

Soil Burn Severity	Acres	Percent
High	5,314	11%
Moderate	8,695	19%
Low	21,891	48%
Very Low	10,110	22%
TOTAL	46,010	

In the absence of RAVG data, soil burn severity (as predicted by BARC) is the best preliminary predictor of vegetation mortality.

Table 3. Burn Severity Acres by Cover Type Across All Lands

Cover Type	Very Low/Low	Moderate	High
Mixed Conifer	27,746	7,122	3,951
	60%	15%	9%
Hardwoods	3,379	809	498
	7%	2%	1%
Shrubs	735	754	864
	2%	2%	2%

Vegetation

Table 4 displays vegetated acres on Forest Service lands affected by the Bagley Fire. Note that the 2,410 acres that burned at high severity are likely to be deforested. These acres are likely candidates for planting, however some areas may not be contiguous, safely accessible, historically vegetated, or otherwise appropriate for planting.

The 4,604 acres that burned at moderate severity also have a high likelihood of deforestation or pockets of mortality. Moderate severity indicates a mosaic of mortality throughout the area. Therefore, small to large pockets of mortality exist throughout. These often occurred when the fire made a high-intensity fast run up-slope. Depending on the size of mortality pockets, natural reforestation resulting from seeding in by residual conifers may be the most reasonable means to regenerate these stands.

Table 4. Burn Severity Acres by Cover Type Across Forest Service Lands Only

Cover Type	V. Low/Low	Moderate	High
Mixed Conifer	20790	**4604**	**2410**
	45%	10%	5%
Hardwoods	2337	432	286
	5%	1%	1%
Shrubs	407	503	476
	1%	1%	1%

Roughly 1,720 acres of plantations exist on Forest Service lands in the 46,000 burn area. Most plantations were planted in the 80s after timber harvest or wildfire, thus resulting in 20 to 30-year old stands. Due to the uniformity of vegetation characteristics and close proximity to one another, during wildfires plantations often behave similar to shrubs and brush – increasing the likelihood of a hot, fast moving wildfire. Burn severity is displayed below (Table 5).

Commercially thinned stands consist of 288 acres within the Bagley fire perimeter. These stands, thinned under the Iron Canyon LSR Project in the late 1990s, experienced a light underburn, with mosaic mortality in the understory but little to none in the overstory.

Table 5. Burn Severity Acres within Previously Managed Stands on Forest Service Lands Only

Managed Stands	V. Low/Low	Moderate	High	TOTAL
Plantations	687	737	296	1720
Commercially Thinned	286	2	0	288

Existing Conditions - Findings

Suppression and Suppression Rehabilitation

Existing snags and identified potential hazard trees were felled along roads and containment lines in the course of suppression activities. As needed, distributed single and grouped hazard trees were felled in all Divisions. Trees felled across roadways were pushed to the side for later treatment/disposal. Logs and slash have been cleared for access but sometimes exist in or above culvert inlets.

Trees felled along utilized and potential containment lines for burnout activities have been piled or bucked in most cases. Trees (generally 4 to 10-inches in diameter) felled along the Bald Mountain contingency line have been decked.

Snags and Safety

Trees killed by fire have reduced structural integrity and are likely to fall. Fire-killed trees of all age classes continue to fall along roads utilized during the fire and suppression repair; threatening human safety, road and trail access, and culvert efficacy. High-use roads within the fire perimeter that experienced moderate to high severity burns include (but are not limited to) 37N48, 37N95, 37N68, and 37N86. Open recreational Jeep roads and trails that experienced moderate to high severity include 35N07A, 35N46, 36N40 and 37N15Y;fire-killed logs are scattered across these roads.

Forest Stand Mortality

Vegetation burn severity ranged from very low to complete mortality in all stand types on all aspects within the Bagley Fire. Dense conifer stands, especially second growth stands with suppressed vegetation in the understory, experienced a complete stand replacing event. In many cases, there is little to no seed source present within the residual stand. Much of the burn area has a hardwood component contributing to vertical structure and species diversity. Generally, hardwoods and shrubs will respond to surface mortality due to moderate and high severity fire by basal sprouting from the root collar within one year following the burn.

Stands exhibiting the highest level of mortality include those stands to the west (southeast facing slope) of the main Squaw Creek drainage (Happy Hunting Grounds, North Fork Mountain), to the south of Iron

Canyon reservoir (also primarily southeast facing slopes) with scattered pockets west of the reservoir (37N43 and 37N95) as well as scattered pockets of mortality accessible off of Van Sicklin Road (37N48) and associated spurs.

Mixed conifer stands experiencing very low and low burn severity, as well as those stands experiencing low/moderate severity have small pockets or single-tree mortality as a result of the burn. These gaps in canopy will seed in naturally by the residual stand.

In most cases topography is severe (slopes greater than 60%), resulting in limited access.

Prior Harvest Activities

Iron Canyon LSR Thin, situated on the east side of the burn area around Iron Canyon Reservoir, was harvested as a thinning from below in 2003. Stands treated as part of this project experienced a cool underburn with no observed mortality due to the Bagley Fire.

Plantations, specifically those associated with Beetle-D and Hornet (planted in 1981), Hawkins (planted in 1985), Deer-Mica (planted in 1987), and Hawkins II (planted in 1991) experienced moderate to high mortality. While some plantations experienced complete stand replacement, many plantations (especially those located on north-facing slopes that had undergone precommercial thinning) experienced low or mixed severity, eluding total stand replacement.

Contemporary Projects

Prior to the start of the Bagley Fire, the Mt Shasta-McCloud Management Unit was actively planning a large vegetation management project (Lower McCloud Fuels) to improve forest health and treat hazardous fuels near the Wildland Urban Interface. Much of the fire area within the Lower McCloud project area burned with low severity, achieving some of the objectives of the project in planning. Currently the unit is continuing planning for the Lower McCloud Fuels project, incorporating the changed condition as a result of the Bagley Fire.

Future Mortality

While the direct effects of wildfire includes trees killed immediately from the heat of fire (crown kill) evident by lack of needles and/or brown needles, the indirect effects of wildfire on forest resources will result in continued mortality of green trees experiencing root and bole injuries for the next 5 years.

<u>Halo Effect</u>

Much of the area that experienced moderate fire burn severity has little-to-no understory after the burn (total fuel consumption) indicating that the fire likely burned hot and slow. While heat and flame may not have scorched foliage directly, cambium in the root and base of the tree likely experienced heat damage, resulting in additional individual tree mortality expanding out from obvious high severity burn areas.

<u>Insects and Disease</u>

Bark beetles and wood borers are frequently associated with tree mortality following fire. However, it is difficult to adequately assess fire injuries, particularly to the bole and roots. In the absence of significant bole or root injuries, the probability of attack by primary bark beetles is initially low with light defoliation, increases with moderate to heavy defoliation, and often declines with complete defoliation

(Furniss 1965; Miller and Keen 1960; Mitchell and Martin 1980; Wagener 1961). Bark beetles also attack trees with cambium injury but are thought to contribute little to mortality, except in conjunction with defoliation or when a large proportion of the circumference is killed (Ferguson and others 1960; Ryan and Frandsen 1991; Wagener 1961).

Secondary bark beetles (those commonly attracted to severely weakened or recently killed trees, as opposed to primary bark beetles that can infest and kill healthy trees) and wood borers are commonly attracted to burned trees, but their contribution to mortality is thought to be minor (Mitchell and Martin 1980). The primary consequence of wood borer infestation is a reduction in quality of wood, reducing the economic viability of dead and dying trees substantially and quickly.

Recommendations

Future actions should contribute to the following objectives:

1. Establish appropriate forest cover in areas burned into deforested condition (NFMA 1976).
2. Accelerate the establishment of late successional forest structure (STNF 1999).
3. Plant an appropriate mix of coniferous tree species that occur naturally (STNF LSRA).
4. Reduce the hazard to public safety by removing dead and dying trees as a result of the Bagley fire.

Hazard Tree Removal

It is recommended that areas adjacent to high use roads be cleared of hazard trees to protect the safety of local stakeholders, Forest employees and the general public once areas are re-opened for use. High use roads within the fire perimeter that experienced moderate to high severity burns include (but are not limited to) 37N48, 37N43, 37N95, 37N68, and 37N86. Open recreational Jeep roads and trails experiencing moderate to high severity include 35N07A, 35N46, 36N40 and 37N15Y with fire-killed logs scattered across roads. Following or concurrent with these efforts, it is recommended that the Forest offer these hazard trees under a salvage sale or public firewood disposal. Removal of this material (by endlining to the road or manually transporting to a road) is preferred to chipping and/or piling and burning order to reduce the total fuel loading and minimize the impact to the watershed.

Removal of hazard trees would occur consistent with CWD requirements in Forest Plan. Felled hazard trees in Riparian Reserves may be more beneficial to leave in place for erosion control and stability than useful to remove. Consult with earth scientists and/or fuels specialists for site-specific mitigations.

Reforestation

<u>Moderate/High Severity</u>
Artificial reforestation (planting) is recommended for moderately high and high severity burn areas deforested from the Bagley Fire, that were historically fully forested with mixed conifer and Douglas-fir types. It is estimated that around 2,500 acres (between 2,000 and 3,500 acres) are appropriate for planting or fill-in planting following site preparation (includes previously established plantations). Future mortality may provide additional reforestation opportunities. More site specific review is recommended to refine planting perimeters. A review of soil conditions and productivity will also inform the prioritization of reforestation efforts.

Low/Moderate Severity

No planting is recommended at this time. Generally, a residual conifer seed source exists within the project area. These stands will regenerate naturally to initially shrub and hardwood tree species with conifers increasing over time as seed source is established and trees reach cone bearing age. Monitoring of these areas will determine if additional reforestation activities are needed.

Plantations

Approximately 1050 acres of previously planted stands burned at moderate to high severity. Plantations are between 20 and 30 years old, and will likely benefit from planting or fill-in planting. Re-establishing plantations is the first priority in the reforestation effort.

Site Preparation for Planting

Site preparation is appropriate in some areas prior to planting; much of this will focus on removing overhead hazard trees prior to planting activities. As terrain is generally severe, mechanical treatments such as mastication are not a viable option. Where site preparation is deemed necessary for safe and effective planting activities, it will be accomplished by hand felling/piling of dead shrubs and trees. Site preparation also includes minor amounts of hazard tree removal primarily in areas outside of previous plantations. Site preparation may also be implemented concurrent with planting to reduce competing vegetation so that seedlings can become established with minimum competition.

Salvage and Hazard Disposal Opportunities

Inventoried Roadless Areas:

As over half (52%) the federal land affected by the Bagley Fire is Administratively Withdrawn (Inventoried Roadless Areas), commercial salvage opportunities beyond those associated with hazard tree removal is restricted. Public firewood gathering is an option – perhaps concentrating felled trees in designated collection points and/or providing maps to the public for expedited collection. Depending on Forest-employee presence and law enforcement availability, public Free-Use firewood permits may be considered on specified weekends at designated collection points.

Review R5 memorandum, signed November 5, 2009 for further direction on salvage opportunities in IRA. See Appendix B for table referring to delegation of responsibilities for various permitted actions in IRA.

Late-Successional Reserve:

LSR (without concurrent IRA designation) constitutes 36% of the federal land affected by the Bagley Fire and is located in the northeast quadrant of the fire perimeter. As most of the moderate to high severity within this land allocation occurred in established plantations, salvage opportunities beyond roadside hazard tree removal are limited. The greatest potential for salvageable, accessible stands is located in Section 24 (T. 37N, R. 2W) and Sec 30 (T. 37N, R.1W).

Roadside salvage opportunities exist (but are not limited to) on 37N48, 37N43, 37N95, 37N94, 37N54, and their associated spurs. A mixture of commercial salvage and public fuelwood collection points is recommended.

Matrix:
Matrix land (without concurrent IRA designation) constitutes 12% of the federal land affected by the Bagley Fire and is located in the southeast quadrant of the fire perimeter. No salvage is recommended at this time for the following reasons:

1. Area under Matrix designation mostly experienced very low to low burn severity (only 600 acres experienced moderate to high, and is spread across various fingers)
2. Accessibility is limited – the only roads (36N38 and 35N46) present in the Matrix portion of the burn area run north/south and concurrently serve as the eastern or western boundaries for two IRAs.
3. Vegetation is consists primarily of hardwoods (pure and mixed black oak stands) which recover well after low severity fire.

Monitoring
Monitoring of annual mortality over the course of the next 5 years is recommended. On the ground observations as well as aerial bug flights (published annually by Forest Health and Protection) will assist in the monitoring effort.

References

Amman, G. and Ryan, K. (1991). Insect infestation of fire-injured trees in the Greater Yellowstone area. USDA Forest Service, Intermountain Forest and Range Experiment Station, Research Note INT-398, 9 pp.

Forest Wide LSR Assessment (1999). USDA, Shasta-Trinity National Forest. September 9, 1999.

Iron Canyon Watershed Analysis (1996). USDA, Shasta-Trinity National Forest. March 26, 1996.

Land and Resource Management Plan (1995). USDA, Shasta-Trinity National Forest.

Lower McCloud River Watershed Analysis (1998). USDA, Shasta-Trinity National Forest. March 18, 1998

Lower McCloud River Watershed Analysis Update (2011). USDA, Shasta-Trinity National Forest. December

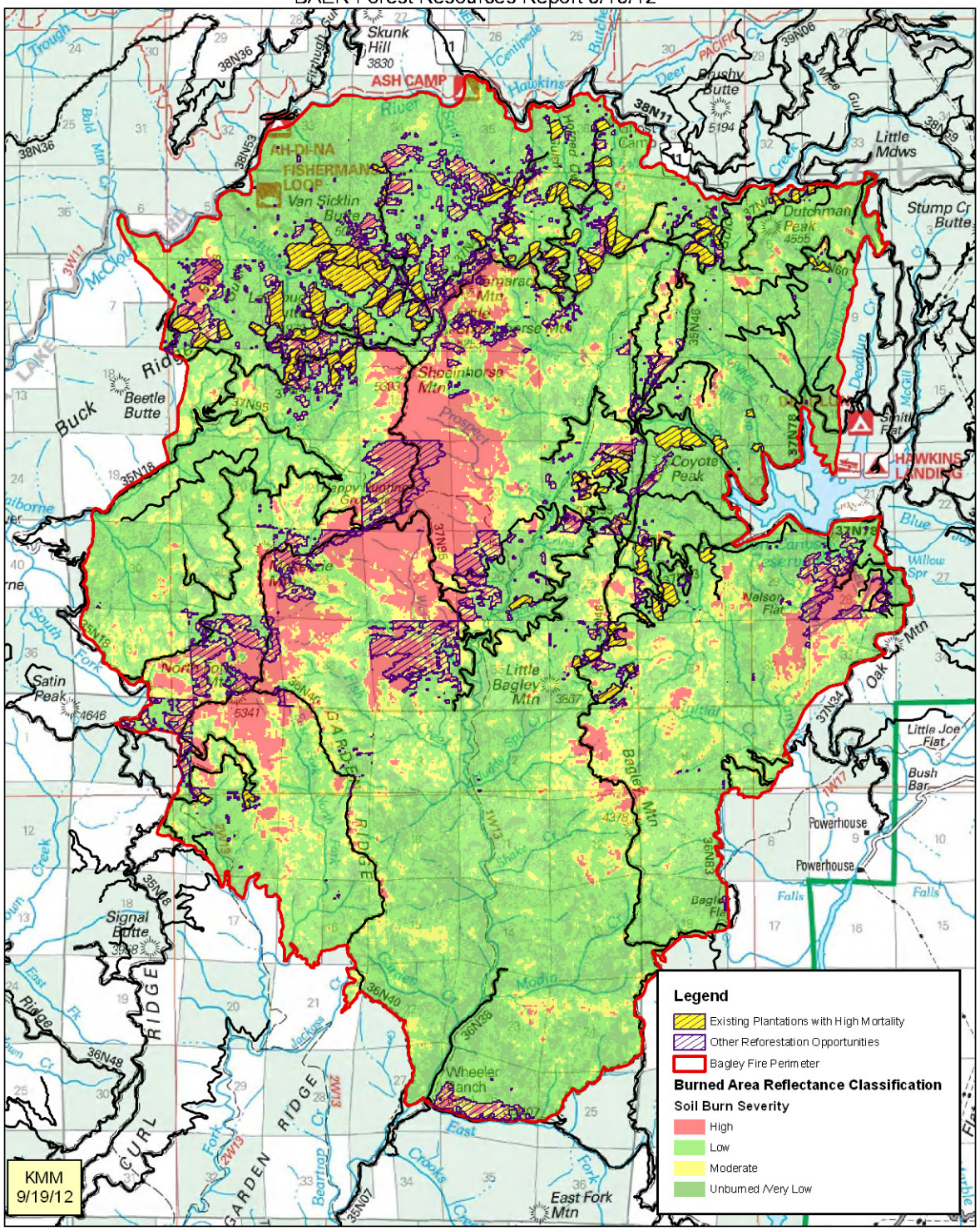
Squaw Creek Watershed Analysis (1999). USDA, Shasta-Trinity National Forest. April 1, 1999.

Appendix A: Maps

MAP 1

Bagley Fire Reforestation Opportunities

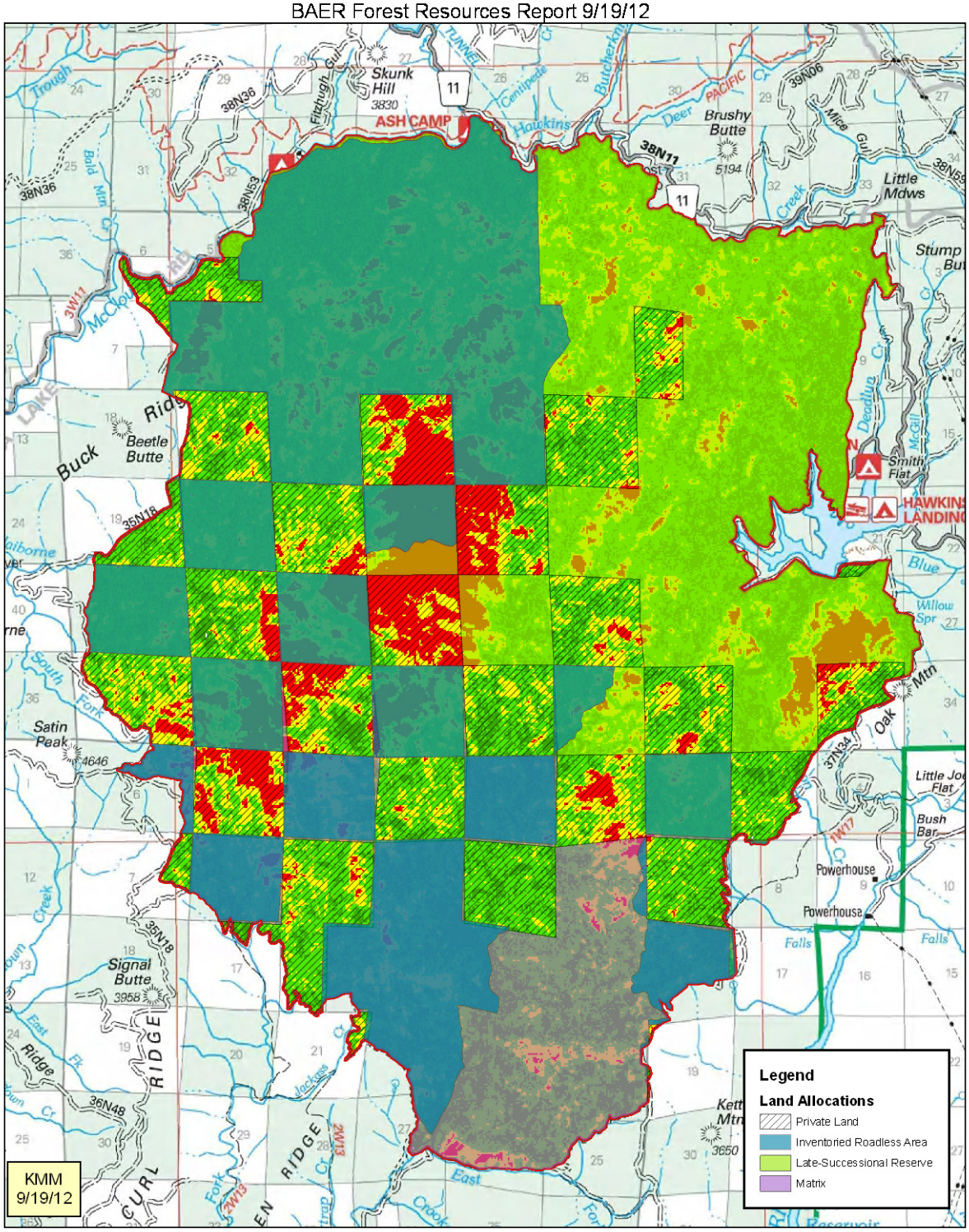
BAER Forest Resources Report 9/19/12



MAP 2

Bagley Fire Land Allocations

BAER Forest Resources Report 9/19/12



Appendix B: IRA Treatment Delegations

Delegation	What	Who	How
Approval reserved to Secretary of Agriculture (5/28/09 memo)	Any road construction or reconstruction except as re-delegated as described below. Any cutting, sale or removal of timber except as re-delegated as described below.	Requires approval by Secretary of Agriculture. Requires review by State.	Submit project briefing paper, map and line officer narrative to Craig Snider, RO-EP. Submit briefing paper and map to Chris Nota, RF Rep. – Sacramento. Forest will be contacted pending outcome of the reviews.
Re-delegated to Forest Service (10/16/09 memo)	Cutting, sale or removal of generally small diameter timber when needed for one of the following: • To improve Threatened, Endangered or Sensitive species habitat. • To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period.	Requires review by RO prior to <u>any</u> public notice or involvement. Consultation with WO may be needed. Requires review by State.	Submit project briefing paper, map and line officer narrative to Craig Snider, RO-EP. Submit briefing paper and map to Chris Nota, RF Rep. – Sacramento. Pending RO review, a WO briefing may be needed.
Re-delegated to Forest Service (8/3/09 memo) plus follow-up WO clarifications.	Necessary timber cutting or removal or any road construction/ reconstruction for emergencies (fire suppression, search & rescue, threats to public health and safety): • Danger trees – imminent threat to public safety (FSH 7709.59, Sec. 41.7) • Trail maintenance (EM-7720-103 USDA Forest Service 1996 (Section 981 - 983, pg. 87-91) http://www.fs.fed.us/.ftproot/pub/acad/dev/trails/trails.htm Timber cutting, sale, or removal incidental to an existing special use permit (does not include road const./reconst.). Cutting, sale or removal for administrative and personal use, as provided for in Title 36, Code of Federal Regulations 223, where personal use includes activities such as Christmas trees and firewood cutting and where administrative use includes providing materials for activities such as construction of trails, footbridges, and fences.	Requires review by Forest Supervisor. Refer controversial projects to RO.	Forest Supervisor reviews projects and assesses public interest/controversy. If unresolved issues persist, coordinate with RO – Craig Snider - to determine whether a RO/WO/State briefing is needed.