North 49 Forest Health Recovery Project

Final Environmental Impact Statement

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Abstract

The US Forest Service, Lassen National Forest (LNF) has prepared the North 49 Forest Health Recovery Project Final Environmental Impact Statement (FEIS). This FEIS analyzes the effects of three action alternatives and a no-action alternative to begin restoring fire adapted forest ecosystems by creating an all-age, multistoried, more fire-resilient forest that approximates pre-settlement conditions. The affected area is comprised of approximately 42,400 acres located south of the Thousand Lakes Wilderness near the community of Old Station, Shasta County, California. This FEIS discloses the direct, indirect, and cumulative environmental effects that would result from the proposed action and alternatives. The alternatives analyzed include the Proposed Action (Alternative 1), the No-action Alternative (Alternative 2), Modified Proposed Action (Alternatives 3), and the Preferred Alternative (Alternative 7). Alternative 7 is the US Forest Service preferred alternative. This alternative more effectively achieves the Purpose, and better address resource issues and concerns such as late seral stage habitat for California spotted owls and American marten by creating a multi-age forest with structural and species diversity.

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List of Acronyms

AMP	Allotment Management Plan
AOC	Area of Concern
APCD	Air Pollution Control District
ARPA	Archaeological Resources Protection Act
AUM	Animal Unit Month
BA	Biological Assessment
BE	Biological Evaluation
BMPs	Best Management Practices
CAA	Clean Air Act
CAAQ	California Ambient Air Quality
CARB	California Air Resources Board
CASPO	California spotted owl
CBD	Crown Bulk Density
CBH	Crown Base Height
CDFA	California Department of Food and Agriculture
CEA	Cumulative Effects Area
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNPS	California Native Plant Society
CRLF	California red-legged frog
CV	Central Valley
CWE	Cumulative Watershed Effects
CWHR	California Wildlife Habitat Relationships
DBH	diameter breast height
DFPZ	Defensible Fuel Profile Zone
EAWS	Ecosystem Analysis at the Watershed Scale
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERA	Equivalent Roaded Acres
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FFE	Fire and Fuels Extension
FFIS	Fire and Fuels Information System
FSH	Forest Service Handbook
FSM	Forest Service Manual
FVS	Forest Vegetation Simulator
GGO	Great Grey Owl
GIS	Geographic Information System
GPAC	Goshawk Protected Activity Center
GPS	Geographic Positioning System
HCRD	Hat Creek Ranger District
HFQLG	Herger-Feinstein Quincy Library Group Forest Recovery Act
HRCA	Home Range Core Area
IDF	Integrated Design Feature

IDT	Interdisciplinary Team
KV	Knutson-Vandenberg
LNF	Lassen National Forest
LOP	Limited Operating Period
LRMP	Land and Resource Management Plan (Forest Plan)
LVNP	Lassen Volcanic National Park
MA	Management Area
MBF	thousand board feet
MIS	Management Indicator Species
MMBF	million board feet
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRHP	National Register of Historic Places
NSAQMD	Northern Sierra Air Quality Management District
NWFP	Northwest Forest Plan (as amended)
NWRA	Noxious Weed Risk Assessment
OHV	Off-Highway Vehicle
PA	Programmatic Agreement
PAC	Protected Activity Center
PFA	Post-fledging Family Area
PG&E	Pacific Gas and Electric
PM	Particulate Matter
RAWS	Remote Automated Weather Station
RHCA	Riparian Habitat Conservation Area
RMO	Riparian Management Objectives
ROD	Record of Decision
RPA	Regional Programmatic Agreement
SDI	Stand Density Index
SHPO	Montana State Historic Preservation Office
SMZ	Streamside Management Zone
SNFPA	Sierra Nevada Forest Plan Amendment
SOHA	Spotted Owl Habitat Area
SOPA	Schedule of Proposed Activities
SOPAC	Spotted Owl Protected Activity Center
SPI	Sierra Pacific Industries
SPM	Standard Protective Measure
SVS	Stand Visualization Simulator
TEP	Threatened Endangered and Proposed
TES	Threatened and Endangered Species
TOC	Threshold of Concern
TWAA	Terrestrial Wildlife Analysis Area

USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
VQO	Visual Quality Objective
WEPP	Water Erosion Prediction Project
WUI	Wildland Urban Interface

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Preface

This document is the Final Environmental Impact Statement (FEIS) for the North 49 Forest Health Recovery Project. A Draft Environmental Impact Statement (DEIS) was made available to the public for comment in April 2006. In the two years since the DEIS was open for comment, several notable changes were made to the document to produce the Final Environmental Impact Statement.

- The format was changed to improve the clarity of the information presented in the document and to assist the reader in easily locating information of interest.
- The Geographic Information System (GIS) layers were updated providing accuracy in mapping and delineated acres.
- Comments submitted on the 2006 DEIS and the 2005 scoping document were assessed and considered for incorporation into the FEIS. New facts, issues, concerns or other information useful in analysis of alternatives was considered in developing the FEIS. Three field trips were conducted into the project area with commenters concerned about the project environmental and socio-economic impacts to assure their comments were clearly understood.
- Chapter 1, the Purpose and Need wa**s not** changed from the DEIS. The Need description was reformatted to clearly convey the need for the North 49 project. Information not specifically addressing the Purpose and Need was moved to the appropriate locations in the FEIS.
- Chapter 2, Alternatives, Including the Proposed Action was reformatted and new information and GIS data was used to improve the accuracy of the action descriptions and treatment acres for each alternative. Although reformatted, actions in Alternatives 1 and 3 were **not** substantially changed from the Draft Environmental Impact Statement to the Final Environmental Impact Statement.
- Alternative 7, the Preferred Alternative, was developed to address the information, issues and concerns that were voiced in the comments and during field trips. New data was incorporated into Alternative 7 and was used to develop actions that more effectively achieved the Purpose and better address resource issues and concerns such as late seral stage habitat for California spotted owls and American marten by creating a multi-age forest with structural and species diversity.
- Chapter 3, Affected Environment was added to provide a basis for understanding resources and conditions that would be affected by management actions within the North 49 Project Area. Affected environment information that had been included in Chapter 4 in the DEIS was improved and updated, and moved to Chapter 3 in the FEIS to provide distinction between the affected environment and environmental consequences.
- Chapter 4, Environmental Consequences has been updated. The effects of action alternatives presented in the DEIS, Alternatives 1 and 3, were re-analyzed incorporating new information and more accurate GIS data. Alternative 7 has been added, and its effects analyzed and compared to the other alternatives. This chapter has improved data and was rewritten to provide clarification of all the alternatives.

Summary

The Lassen National Forest (LNF) proposes the North 49 Forest Health Recovery Project (hereafter called North 49 Project) to improve fire-resiliency, forest health and diversity. The approximately 42,400 acre project area is bounded by the Thousand Lakes Wilderness on the north, California State Highway 44/89 to the southeast, and the Forest boundary on the west. Located to the northwest of Lassen Volcanic National Park, the North 49 Project is on the Hat Creek Ranger District (HCRD) of the Lassen National Forest.

Background

In November of 2005, Notice of Intent (NOI) was published in the Federal Register requesting public input on the Purpose and Need, and Proposed Action for the North 49 Project. A Draft Environmental Impact Statement (DEIS) was prepared and provided to the public for a 30 day comment period in April of 2006.

During development of the North 49 Forest Health Recovery Project EIS, the public had opportunities to contribute comments, ideas, and concerns about the proposed project. This input was used to develop the proposed action and the action alternatives. The Interdisciplinary Team (ID Team) assessed the historical and existing conditions of the project area and the processes that contributed to the area's current condition using an interdisplinary approach. The existing conditions were examined for wildfire risk, forest health, suitable late and early seral wildlife habitat, riparian and watershed conditions, noxious weed and sensitive plants occurrence, presence of heritage resources and road conditions.

The North 49 Project would be managed under the 1992 LNF Land and Resource Management Plan (LRMP), as amended by the Northwest Forest Plan FEIS, Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) (USDA FS and USDI BLM 1994, 2001, 2004), Herger-Feinstein Quincy Library Group Forest Recovery Act (HFQLG) FEIS, FSEIS and RODs (USDA FS 1999a, 1999b, 2003a, 2003b), and the Sierra Nevada Forest Plan Amendment FEIS, FSEIS and RODs (USDA FS 2001a, 2001b, 2004c).

Purpose of and Need for Action

The purpose of the North 49 Project is to begin restoring fire-adapted forest ecosystems by creating an all-age, multistoried, more fire-resilient forest that approximates pre-settlement conditions. For this document, pre-settlement refers to the time prior to the suppression of fire beginning in the early twentieth century. The desired conditions include: (1) open forested areas which act as fuel breaks characterized by fire-resilient tree species, reduced surface fuel loads and ladder fuels where periodic low-intensity surface fires can be safely reintroduced and where wildfires can be safely fought; (2) sustainable forested areas dominated by fire-resilient tree species with supportable tree densities that decrease the risk of mortality from insects, drought and disease, and exhibit multistory structure that provides habitat for late seral species such as California spotted owls, American marten and northern goshawks.

Need to Improve Fire-resiliency

Fire history studies of the Lassen Volcanic National Park and Thousand Lakes Wilderness show different fire return interval and fire severity. The study in Lassen Volcanic National Park suggests that mixed conifer forests had a pre-settlement return interval of 8-16 years. On average these fires were of low to moderate intensity depending on vegetation and location. The Thousand Lakes Wilderness Fire History study shows fire return intervals were from 4-37 years depending on vegetation, elevation and aspect. The severity of these fires was mostly moderate to high. These fires all occurred before the start of fire suppression. The north 49 project area is on the southern boundary of the Thousand Lakes Wilderness. This proximity establishes the expectation that some of the N49 project area would burn with the same moderate to high severity that the wilderness area did historically.

Management practices in the North 49 project area have disrupted the historic fire return interval and contributed to the increase of both surface and ladder fuels. Considering the increase in fuels and the historic severity of fires in the surrounding area, there is a moderate to high chance that an escaped wildfire would be a large high severity fire that would put the safety of suppression personnel, the public, resources, property, and structures at risk.

Need to Improve Forest Health

The North 49 project has an abnormally high density of the trees within the area as well as high mortality due to competition, disease and insects are all indications of an unhealthy forest. Information gathered from surveyors' notes working for the General Land Offices (GLO) during 1881 - 1883 describes a different landscape. Using the GLO surveyors' notes and equations modified from Manies et al. (2001), it was estimated that there were approximately 79 trees per acre in the pre-settlement period. Estimations currently suggest that there are 805 trees per acre within the North 49 Project area. This is more than 5 times the pre-settlement density. High tree densities increase inter-tree competition for essential resources such as water, nutrients and light; causing stress and increased mortality. When trees become stressed they are vulnerable to insects, disease and drought.

Comparison of aerial photographs from 1941 with those from 2005 clearly demonstrates significant encroachment of conifers into meadows, aspen stands, brushfields and riparian areas. Without the continued check by fire, conifers (specifically white fir) have become prolific and established themselves in numbers and in areas historically unseen.

The current condition of the North 49 Project area is not a sustainable forest. Competition between the trees would continue to cause mortality, increasing the amount of surface fuels and increasing the risk for a stand replacing fire. Trees would continue to be stressed making them vulnerable to death from insects, disease and drought. With the continued build-up of fuels and densely packed trees very little vegetation such as grasses, forbs and shrubs would be able to grow beneath the canopy reducing the habitat suitability of the area for small prey species (i.e. mice, wood rats and voles) and their predator species such as California spotted owls, northern goshawks and American martens.

Improve Forest Diversity

The GLO surveys indicate since 1883, the amount of white fir trees in the project area has increased while sugar pine and ponderosa pine trees have decrease. The increased ingrowth of white fir and the loss of the pine has changed the composition of the North 49 Project area from the pre-settlement period. Historically, white fir accounted for approximately 31 percent of the species composition. Today, white fir makes up approximately 68 percent of the species composition. Even more significant is the loss of the pine component. Historically, sugar pine comprised approximately 22 percent of the species composition and yellow pine (a reference to ponderosa and Jeffrey pine) comprised approximately 17 percent, based on the GLO surveyors' notes. Today, sugar pine comprises approximately 2 percent and yellow pine comprises approximately 6 percent of the forest composition. This is a significant factor that influences the sustainability and survival of the forest.

Diversity of tree species within a forest would help prevent the loss of the forest components to insects, disease or drought. Many insects and diseases are species specific, dependent upon a single tree species (i.e. pine). Thus, if there is an outbreak of an insect or an increase of a disease chances are only one species would be affected and not the entire forest. Some tree species respond more effectively to a drought than others and can withstand below normal precipitation. A diverse forest ensures that some trees could survive extreme environmental events such as fire, insects, disease or drought.

Ponderosa, Jeffrey and sugar pine are fire-resilient species possessing thick bark at a relatively small diameter which insulates it from the heat of a moderately intense fire. White fir does not usually obtain a similar bark thickness until it is much older and larger. Heat from a low intensity fires could kill small white fir and heat from a moderately intense fire may kill white fir of mid-sized diameters. Ponderosa, Jeffrey and sugar pine with their thicker bark, would be able to survive the heat from moderately intense fire.

Age diversity is an important component in ensuring the conservation of the forest. A diverse age range of vegetation ensures that there is a newer generation established to replace the older generation. This also provides habitat for a large variety of wildlife species, from those associated with early seral ecosystems to those associated with late seral ecosystems.

One significant issue was identified during scoping. Commenters were concerned that the proposed action might not provide adequate protection of mature, late successional forest characteristics, and plant and wildlife species associated with this type of forested ecosystem. In the draft EIS the ID Team developed Alternative 3 to address this issue. Substantive comments on the draft EIS indicated that the issue had not been adequately addressed. The IDT met with substantive commenters to assure comments on the issue were understood. The IDT evaluated the comments, analyzed new information and data, and explored treatments that resolved the issue while maintaining the ability to implement the project. As a direct result of the substantive comments and new analysis the ID Team developed Alternative 7.

Alternatives

The lack of periodic fires within the North 49 Project area has resulted in an unhealthy forest. Considering the current condition of the forest, the reintroduction of fire as a sole management tool would be impractical,

unmanageable in scope and very likely result in devastating and stand replacing damage to the forest. Under all alternatives analyzed, implementation of vegetation management actions would be accomplished using mechanical treatments to remove the excess fuels, reduce stand densities, and re-establish structural, species and age diversity. There are four fundamental methods that would be used: mechanical tree and biomass removal, mechanical mastication of biomass and fuels, mechanical piling fuels of for managed burning, and burning of pre-treated fuels. The US Forest Service is neither equipped nor funded to treat or mechanically remove large amounts of trees and biomass from National Forests; this would be accomplished by means of timber sale and service contracts. Upon completion of the contract work, Forest Service personnel would re-introduce fire to the area to accomplish pile burning and underburning of safely prepared fuels.

Mechanical treatments considered in this EIS are detailed in prescriptions that would be applied on acres as described in the alternatives. Each prescription is designed to achieve a particular result that accomplishes the purpose and addresses the need of the project. Prior to any timber sales that implement this project, specific marking guidelines would be developed to assure the marking of trees meets the treatment prescriptions. Certified Forest Service personnel would develop the marking guidelines and manage the marking. Companies awarded contracts to cut and harvest vegetation are legally bound to meet the prescription specifications in the contract. This would assure that implementation of the treatments is consistent with the alternative to be implemented.

The Alternatives considered and analyzed include a range of treatments to achieve the purpose and address the need of the project. The alternatives contain different ranges and combinations of treatments that are comparatively analyzed to assist selection of an alternative to be implemented.

Three alternatives including a No Action were analyzed in the DEIS and presented for public comment. In response to public comments, meetings with interested publics, additional resource information and the Forest Service's analysis, an additional alternative, Alternative 7, the preferred alternative, was developed. Along with the other presented alternatives, Alternative 7 is designed to achieve, as close as possible, the stated purpose of the project. In total, the HCRD developed seven alternatives based on internal and external comments. Three alternatives were considered and not analyzed in detail and two alternatives were considered and analyzed along with the Proposed Action and the No-action Alternatives. After reviewing all the action alternatives along with their environment consequences, the responsible official chose Alternative 7 as the preferred alternative.

Key treatments of Alternative 7 are:

- Fuelbreak construction consisting of a strategic system of Defensible Fuel Profile Zones (DFPZ).
- Fuels reduction treatment designed to reduce fire behavior and intensity.
- Area Thinning by individual tree selection designed to begin re-establishing multi-storied, multi-aged landscapes.
- Radial Thinning around old growth trees to remove competition and improve health.
- Pine Restoration Areas designed to enhance the health and vigor of existing sugar pine.

- Group Selection harvesting to improve forest diversity and fire-resiliency by removing diseased, less vigorous, and/or less fire-resilient tree species and replanting with fire-resilient tree species.
- Aspen enhancement by removing encroaching conifers to encourage the sprouting (suckering) of the aspen clone.
- Brushfield treatments to encourage the re-sprouting of the brush.

Comparison of Alternatives

Table S1 presents a comparison of the actions that would occur under each alternative. Table S2 compares the results of actions that would be implemented under each alternative, and their effectiveness of addressing the needs and achieving the purpose described above. Table S3 compares the affects of each alternative on resources of concern. A detailed description of affects by resource is presented in Chapter 4, Environmental Consequences. All comparative metrics listed below are based on the project area except for the wildlife metrics, which are based on the Wildlife Analysis Area of 57,389 acres (See Chapter 4, Terrestrial Wildlife for description of Wildlife Analysis Area).

Table S1. Comparison of Actions

Action	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Thin from Below in DFPZ(acres)	7,793	0	4,886	4,602
Thin from Below (acres)	2,040	0	1,080	0
Modified Thin from Below w/ Retention Islands (acres)	1,121	0	4,988	0
Diversity Thin w/ Retention Islands & Radial Release (acres)	0	0	0	5,222
Lodgepole Pine Thin	0	0	0	383
Group Selection (acres) [1]	1,168	0	680	908
Pine Restoration Areas (acres)	0	0	0	70
Release Thin Plantations(acres)	3,452	0	3,452	3,591
Total Aspen Release Acres[2]	38	0	38	55
Underburn Only (acres)	1,064	0	1,064	1,131
Broadcast Burn (acres)	224	0	224	131
TOTAL TREATMENT ACRES	**16,900**	**0**	**16,412**	**16,093**

Acres summed from master table in Appendix E. [1] Group Selection: areas of intense harvest of two acres or less.[2] Total Aspen Release Acres include a two acre aspen group.

Table S2. Comparison addressing Purpose and Need

Needs Addressed	Alternative 1 (Proposed Action)	Alternative 2 (No-action)	Alternative 3	Alternative 7 (Preferred Action)
Improve Fire-Resiliency (DFPZ)				
Flame Length (feet)	4	6	4	4
Rate of Spread (chains/hour)*	5	9	5	5
Type of Fire	Surface	Passive Crown	Surface	Surface
Suppression Tactic	Direct	Indirect	Direct	Direct

Table S2. Comparison addressing Purpose and Need

Needs Addressed	Alternative 1 (Proposed Action)	Alternative 2 (No-action)	Alternative 3	Alternative 7 (Preferred Action)
Improve Fire-Resiliency (Area Thin)				
Flame Length (feet)	1	4	1	1
Rate of Spread (chains/hour)*	2	5	2	2
Type of Fire	Surface	Passive Crown	Surface	Surface
Suppression Tactic	Direct	Direct	Direct	Direct
Improve Forest Health				
Number of acres post-thinning remaining above 60% SDImax (acres)**	601	10,484	2,522	0
Number of acres of fire-resilient species restoration-Groups (acres)	1,168	0	680	908
Number of acres of aspen treated (acres)	38	0	38	55
Number of acres of Natural pine improvement (acres)	0	0	0	70

* 1 Chain = 66 feet.
** Forests at 60% maximum stand density (SDImax) or greater are in the zone of imminent mortality. At this density, less vigorous trees die due competition and all trees are stressed making them susceptible to large-scale die-off due to drought, insects and disease.

Table S3. Comparison of Effects.

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Silviculture				
Number of acres post-thinning remaining above 60% SDImax (acres)**	601	10,484	2,522	0
Number of acres of fire-resilient species restoration - Groups(acres)	1,168	0	680	908
Number of acres of aspen treated (acres)	38	0	38	55
Number of acres of Natural pine improvement (acres)	0	0	0	70
Fuels (Fire Behavior in Sierra Mixed Conifer Forest in DFPZ)				
Average Flame Length (feet)	4	6	4	4
Average Rate of Spread (chains/hour)*	5	9	5	5
Type of Fire	Surface	Passive Crown	Surface	Surface
Suppression Tactic	Direct	Indirect	Direct	Direct
Average Canopy Base Height (feet)	10	1	10	6
Average Critical Flame Length (feet)	6	1.2	6	4

Table S3. Comparison of Effects.

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Fuels (Fire Behavior in Sierra Mixed Conifer Forest outside DFPZ)				
Average Flame Length (feet)	1	4	1	1
Average Rate of Spread (chains/hour)*	2	5	2	2
Type of Fire	Surface	Passive Crown	Surface	Surface
Suppression Tactic	Direct	Indirect	Direct	Direct
Average Canopy Base Height (feet)	6	1	6	4
Average Critical Flame Length (feet)	4	1.2	4	3
Wildlife				
California spotted owl Suitable Foraging Habitat (acres/% retained)*	13,313 / 62	21,387 / 100	13,769 / 64	17,485 / 82
California spotted owl Suitable Nesting Habitat (acres/% retained)*	6,843 / 77	8,861 / 100	6,976 / 79	7,999 / 90
northern goshawk Suitable Foraging Habitat (acres/% retained)*	1,679 / 94	1,782 / 100	1,676 / 94	1,722 / 97
northern goshawk Suitable Nesting Habitat (acres/% retained)*	20,156 / 67	30,248 / 100	20,745 / 65	25,484 / 84
Marten, Fisher, Fox Suitable Foraging Habitat (acres/% retained)*	2,644 / 56	4,746 / 100	2,720 / 57	6,541 / 138
Marten, Fisher, Fox Suitable Denning Habitat (acres/% retained)*	17,512 / 69	25,502 / 100	18,025 / 71	18,943 / 74
Suitable California spotted owl Habitat in 2400 acre Home Range Core Areas (HRCA) Post-Treatment				
Ashpan Butte HRCA (acres/% retained)	1,489 / 62	1,877 / 78	1,562 / 65	1,594 / 66
Ashpan Flat HRCA (acres/% retained)	1,365 / 57	2,233 / 93	1,423 / 59	1,927 / 80
Bunchgrass Creek HRCA (acres/% retained)	1,264 / 53	2,159 / 90	1,361 / 57	1,613 / 67
Percentage of California spotted owl Habitat in Devil's Garden HRCA (acres/% retained)	1,086 / 45	1,997 / 83	1,179 / 49	1,738 / 72
Percentage of California spotted owl Habitat in N. Battle Creek HRCA (acres/% retained)	1,338 / 56	1,582 / 66	1,338 / 56	1,560 / 65
Red Lake Mountain HRCA (acres/% retained)	1,065 / 44	1,565 / 65	1,080 / 45	1,464 / 61
Superbowl HRCA (acres/% retained)	1,526 / 64	1,596 / 67	1,573 / 66	1,546 / 64
Table Mountain HRCA (acres/% retained)	1,521 / 63	1,986 / 83	1,540 / 64	1,716 / 72

Table S3. Comparison of Effects.

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Hydrology – Threshold of Concern (TOC)				
Number of Watersheds with a very high risk of TOC (ERA > TOC)	0	0	0	0
Number of Watersheds with a high risk of TOC (ERA is 80% to 100% of TOC)	1	1	1	1
Number of Watersheds with a moderate risk of TOC (ERA is 50% to 80% of TOC)	4	2	4	4
Number of Watersheds with a low risk TOC (ERA <50% of TOC)	8	10	8	8
Soils				
Loss of Soil Porosity	Minimal reduction due to thinning; High potential for loss in groups	No change	Minimal reduction due to thinning; High potential for loss in groups	Minimal reduction due to thinning; High potential for loss in groups
Loss of Organic Matter	No effect due to thinning; potential to displace soil	No change	No effect due to thinning; potential to displace soil	No effect due to thinning; potential to displace soil
Loss of Ground Cover	Temporary short-term reduction; partially offset by needle cast	No change	Temporary short-term reduction; partially offset by needle cast	Temporary short-term reduction; partially offset by needle cast
Fisheries/Aquatics				
Central Valley spring-run chinook salmon & steelhead, & critical habitat	Low risk of short-term increases in sediment production. Long-term decreased sediment production	No change in existing levels of sediment production	Low risk of short-term increases in sediment production. Long-term decreased sediment production	Low risk of short-term increases in sediment production. Long-term decreased sediment production
Central Valley fall-run chinook salmon	No change in existing levels of sediment production	No change in existing levels of sediment production	No change in existing levels of sediment production	No change in existing levels of sediment production
Cascades Frog	Very low risk of direct effects. Low risk of short-term increases in sediment production. Long-term deceased sediment production.	No risk of direct effects; no change in existing levels of sediment production.	Very low risk of direct effects. Low risk of short-term increases in sediment production. Long-term deceased sediment production.	Very low risk of direct effects. Low risk of short-term increases in sediment production. Long-term deceased sediment production.

Table S3. Comparison of Effects.

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Rainbow Trout	Low risk of short-term increases in sediment production. Long-term decreased sediment production	No change in existing levels of sediment production	Low risk of short-term increases in sediment production. Long-term decreased sediment production	Low risk of short-term increases in sediment production. Long-term decreased sediment production
Botany				
Astragalus pulsiferae var. *suksdorfii*	Short-term impacts to roadside plants but long-term benefits from thinning adjacent stands	Potential loss due to habitat succession	Short-term impacts to roadside plants but long-term benefit from thinning adjacent stands	Short-term impacts to roadside plants but long-term benefit from thinning adjacent stands
Erigeron inornatus var. *calidipetris*	Short-term adverse impact, long-term benefit from thinning	Potential loss due to habitat succession	Short-term adverse impact, long-term benefit from thinning	Short-term adverse impact, long-term benefit from thinning
Hierochloe odorata	Short-term adverse impact, long-term benefit from thinning and burning	Potential loss due to habitat succession	Short-term adverse impact, long-term benefit from thinning and burning	Short-term adverse impact, long-term benefit from thinning and burning
Riparian Hardwood Species. Alder, Aspen and Willow	Short-term direct impact, long-term benefit from decreased competition, and potential change in age-class distribution.	Potential impact from habitat succession	Short-term direct impact, long-term benefit from decreased competition, and potential change in age-class distribution.	Short-term direct impact, long-term benefit from decreased competition, and potential change in age-class distribution.
Economics				
Estimated Total Project Value (dollars)**	$10,550,000	$0.00	$8,544,384	$17,246,600
Estimated Sawlog Volume (ccf)**	66,709	0	54,042	109,134
Estimated Biomass Volume(ccf)**	66,596	0	44,607	57,366
Net Present Value ($)	-24,216,047	0	-22,883,734	-18,125,144
Range				
Hat Creek Range Allotment	Temporary forage increase	No change	Temporary forage increase	Temporary forage increase
North Battle Creek Range Allotment	Temporary forage increase	No change	Temporary forage increase	Temporary forage increase

Table S3. Comparison of Effects.

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Recreation				
Developed Facilities	Short-term operational noise, incl. helicopters, may temp. affect Battle Creek Campground, but unlikely to affect developed facilities adjacent to east side of project area.	None	Same as Alt. 1	Some temporary operational noise, but effects reduced due to lack of helicopter operations.
Dispersed Recreation: Camping Hunting Fishing Christmas tree cutting Snowmobiling Other winter activities	Harvest activities & operational noise (incl. helicopters) may temp disturb dispersed campers, hunters & wildlife. Treatments may reduce xmas tree cutting areas. No effect to winter activities unless winter logging is agreed to	Increased risk of wildfire could severely impact dispersed campsites, wildlife & fisheries habitat (viewing, hunting, and fishing opportunities), and popular white fir/red fir xmas tree cutting areas	Similar to Alt. 1, although less intensive thinning treatments & fewer group selections would retain more trees suitable for xmas tree cutting and wildlife cover	Similar to Alt.1, but with less effect on dispersed campers & hunters due to lack of helicopter noise. More diverse stand structure would improve wildlife habitat, and future viewing & hunting. Primary thinning treatment would retain xmas tree cutting opportunities
Wilderness	Short-term operational noise (including helicopters) in the background might be audible in the southern portion of 1000 Lakes	No effects due to operational noise. Increased potential of wildfire entering wilderness from the south, severely affecting areas of extreme mortality.	Same as Alt. 1	No effects from helicopter noise, although some temp. operational/road noise may be audible in the distance in the south end, & at higher elevations
Motorized Access/OHV use	Road decomm. or closures to public motorized use would affect mainly short, deadend spurs that do not provide access to dispersed campsites or scenic/loop riding opportunities.	No road closures or decommissioning: No effect to current motorized uses, other than existing cross-country travel restrictions. Motorized activity may affect hunting & wildlife viewing opportunities.	Same as Alt. 1	Same as Alt. 1
Trails	Temp. increase in truck traffic on Backcountry Discovery Trail. No hiking trails within project area	None	Same as Alt. 1	Same as Alt. 1

Table S3. Comparison of Effects.

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Visuals				
Retention: "Not visually evident"	Treatments in DFPZ designed so thinnings maintain continuous forest cover in the foreground, with groups placed in a mosaic in the middle-and back-grounds	No immediate effect. Increased stand density in the future may reduce scenic values. No treatment could contribute to the severity of potential wildfire effects	Same as Alt. 1, although reduced number of group selections would be less evident throughout the middle-and back-ground, and from overlook viewpoints.	Same as Alt. 1 in DFPZ. Area thin Rx provides for multi-story forest structure. Radial thin and pine restoration treatments adjacent to 1000 Lakes would enhance mature forest character and structural diversity
Partial Retention: "Visually subordinate to the natural character of the landscape:	Many areas have been previously thinned – effects would be limited	Same as above	Fewer group selections than Alt. 1 would be less visually evident throughout the treated areas.	Increased diversity of stand structure & species composition would retain natural character in future.
Modification: "Dominant, but conforms to natural character of the landscape"	All treatments meet or exceed standards for modification.	Same as above	Same as above	Same as above
Heritage Resources				
Sites Affected	0	0	0	0

*Wildlife metrics are based on the Wildlife Analysis Area of 57,389 acres (See Chapter 4, Wildlife for description of Wildlife Analysis Area).

** Forests at 60% maximum stand density (SDImax) or greater are in the zone of imminent mortality. At this density, less vigorous trees die due competition and all trees are stressed making them susceptible to large-scale die-off due to drought, insects and disease.

Document Structure

The North 49 Forest Healthy Recovery Project Final Environmental Impact Statement (FEIS) has been prepared according to the Council on Environmental Quality (CEQ) regulations that implement the NEPA (40 Code of Federal Regulations [CFR] 1500-1508).

- **Chapter 1. Purpose and Need for Action:** The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- **Chapter 2. Alternatives, including the Proposed Action:** This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- **Chapter 3. Affected Environment:** This chapter describes the physical and biological characteristics of the project area. Natural and management history, and the resulting existing conditions are detailed.
- **Chapter 4. Environmental Consequences:** This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area.
- **Chapter 5. Consultation and Coordination:** This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement.
- **Appendices:** The appendices provide more detailed information to support the analyses presented in the environmental impact statement.
- **Index:** The index provides page numbers by document topic.

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at the Hat Creek Ranger District office.

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Chapter 1. Purpose of and Need for Action

Introduction

The US Forest Service, Lassen National Forest (LNF) has prepared the North 49 Forest Health Recovery Project, hereafter the North 49 Project, Final Environmental Impact Statement (FEIS). This FEIS analyzes the affects of three action alternatives and a no-action alternative to begin restoring fire adapted forest ecosystems by creating an all-age, multistoried, more fire-resilient forest that approximates pre-settlement conditions. The action alternatives provide different mixes of vegetation management treatments and application areas resulting in different environmental consequences. The affected area is comprised of approximately 42,400 acres located south of the Thousand Lakes Wilderness near the community of Old Station, Shasta County, California. This FEIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

Chapter 1 describes the Forest Service's proposal for the North 49 Project, the reasons why the Forest Service is proposing action at this time and the desired conditions for the project area. This chapter presents the management direction of the LNF and describes the Proposed Action and the Purpose of and Need for the Proposed Action. It has been prepared consistent with guidelines of the Council of Environmental Quality for compliance with the National Environmental Policy Act (NEPA) 940 Code of Federal Regulation [CFR] 500 et seq.).

Project Location

The project area is located west of the community of Old Station and south of the Thousand Lakes Wilderness in Shasta County, California, within the Hat Creek Ranger District of the LNF. It is within all of parts of T31N, R3E; T32N, R3E; T32N, R4E and T33N, R4E (Figure 1). The North 49 Project Area is approximately 42,400 acres bounded to the north by the Thousand Lakes Wilderness, to the west by the Lassen National Forest boundary, to the east by Highway 89/44, and to the south by Highway 44.

Decision Needed

The Forest Supervisor of the Lassen National Forest is the responsible official for deciding on the North 49 Forest Health Recovery Project. The Supervisor can decide (1) to implement this project as proposed, (2) to implement the project based on an alternative to this proposal that was formulated to resolve identified issues, or (3) not to implement the project at this time. The responsible official expects to make a decision on the project as early as the spring of 2008. Implementation could begin as early as the fall of 2008.

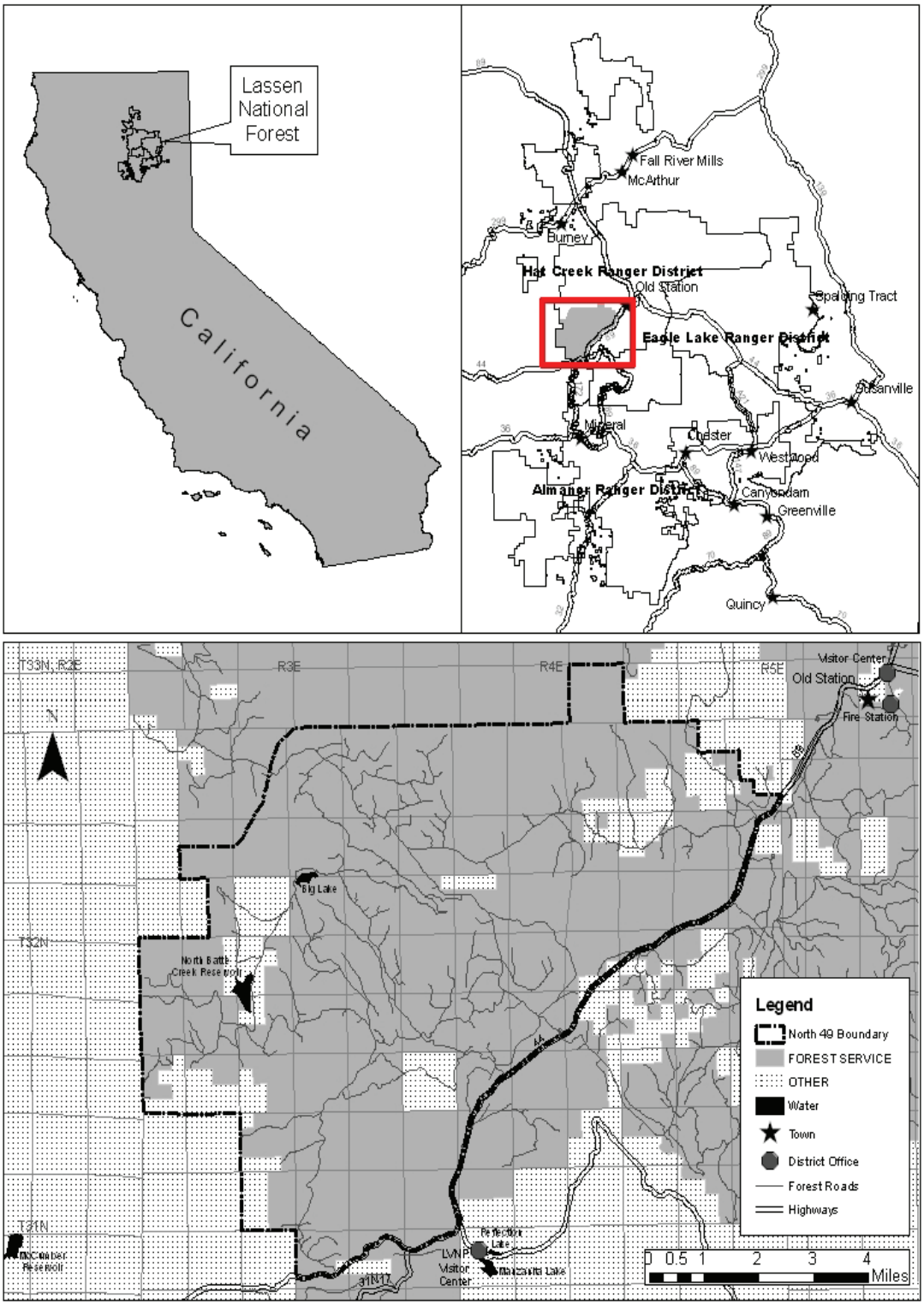


Figure 1. Vicinity Map for the North 49 Project.

Background

In November of 2005, a Notice of Intent (NOI) was published in the Federal Register requesting public input on the Purpose and Need, and Proposed Action for the North 49 Forest Health Recovery Project. A Draft Environmental Impact Statement (DEIS) was prepared and submitted to the public for a 30 day comment period in April of 2006.

During development of the North 49 Project EIS, the public contributed comments, ideas, and concerns about the proposed project. This input was used to develop the proposed action and the action alternatives. The Interdisciplinary Team (ID Team) assessed the historical and existing conditions and processes contributing to the area's current state using an interdisplinary approach. The existing conditions were examined for wildfire risk, sustainable forest health, sustainable late and early seral habitat suitable for wildlife, riparian and watershed conditions, noxious weed and sensitive plants occurrence, and road conditions.

The North 49 Project would be managed under the 1992 LNF Land and Resource Management Plan (LRMP), as amended by the Northwest Forest Plan FEIS, Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) (USDA FS and USDI BLM 1994, 2001, 2004), Herger-Feinstein Quincy Library Group Forest Recovery Act FEIS, FSEIS and RODs (USDA FS 1999b, 1999c, 2003b, 2003c) and the Sierra Nevada Forest Plan Amendment FEIS, FSEIS and RODs (USDA FS 2001c, 2001d, 2004d).

Project Development

Following devastating fire seasons in 1999 through 2002, efforts were increased to manage fuels buildup on the Hat Creek Ranger District (HCRD) by reducing fuels and introducing fire back into the pine forests on the eastside of the district. The LRMP was amended by the Herger-Feinstein Quincy Library Group Forest Recovery Act and the Sierra Nevada Forest Plan Amendment. The amended plan directed the establishment of the Defensible Fuel Profile Zone (DFPZ) network. The DFPZ network was designed to limit the size of large scale wildfires on the landscape and to provide a safe place for firefighters to initiate direct fire suppression by providing fuel breaks. This DFPZ network would extend and connect across the Lassen and Plumas National Forests and the Sierraville Ranger District of the Tahoe National Forest. With efforts to establish a DFPZ network on the eastside reaching conclusion, attention turned to the Sierra mixed conifer forest on the westside of the HCRD. The protection of Lassen Volcanic National Park (LVNP), Thousand Lakes Wilderness, and the community of Old Station from destructive wildfire influenced the prioritization of the DFPZ network on the westside of the District. The first DFPZ construction on the westside was south of State Highway 44 along the western boundary of LVNP leaving an area north of State Highway 44 at risk from wildfire. The need for a DFPZ network was identified north of State Highway 44, south of the Thousand Lakes Wilderness, and along the western boundary of the forest; this area was named North 49. Later alternatives were developed to not only address fuel reduction and forest density concerns, but the sustainability of late seral species habitat such as the California spotted owl, northern goshawk, and American marten.

Purpose of and Need for Action

The purpose of the North 49 Project is to begin restoring fire-adapted forest ecosystems by creating an all-age, multistoried, more fire-resilient forest that approximates pre-settlement conditions. For this document, pre-settlement refers to the time prior to the suppression of fire in 1905. The desired conditions include:

1. Open forested areas that act as fuel breaks characterized by fire-resilient tree species and reduced surface fuel loads and ladder fuels, where periodic low-intensity surface fires can be safely reintroduced and wildfires can be safely fought;
2. Sustainable forested areas dominated by fire-resilient tree species with reduced surface fuel loads and supportable tree densities that decrease the risk of mortality from insects, drought and disease, establishing healthy multistory forests that provide habitat for late seral species such as California spotted owls, American marten and northern goshawks.

Need to Improve Fire-Resiliency

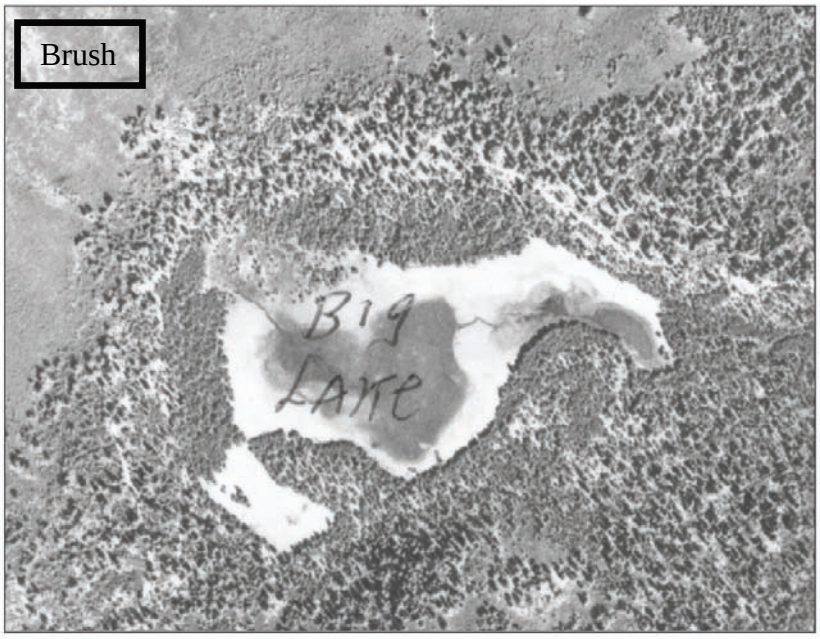
The reduction of fire-resilient pine species and the build-up of fuels have staged the North 49 project area for a potentially landscape-scale forest-replacing fire. Fire history studies in Lassen Volcanic National Park and Thousand Lakes Wilderness show different fire return interval and fire severity. The study in Lassen Volcanic National Park suggests that mixed conifer forests had a pre-settlement return interval of 8-16 years. On average these fires where of low to moderate intensity depending on vegetation and location. The Thousand Lakes Wilderness Fire History study shows fire return intervals were from 4-37 years depending on vegetation, elevation and aspect. The severity of these fires was mostly moderate to high. These fires all occurred before the start of fire suppression. The North 49 Project area is on the southern boundary of the Thousand Lakes Wilderness. This proximity establishes the expectation that some of the North 49 Project area would burn with the same moderate to high severity that the wilderness area did historically.

Management practices in the North 49 Project area have disrupted the historic fire return interval and contributed to the increase of both surface and ladder fuels. Considering the increase in fuels and the historic severity of fires in the surrounding area, there is a moderate to high chance that an escaped wildfire would be a large high severity fire that would put the safety of suppression personal, the public, resources, and property at risk.

Need to Improve Forest Health

The North 49 Project has an abnormally high density of trees within the area as well as high mortality due to competition, disease and insects. These factors are all indications of an unhealthy forest. Information gathered from surveyors' notes working for the General Land Offices (GLO) from 1881 - 1883 describes a different landscape. Using the GLO surveyors' notes and equations modified from Manies et al. (2001), it is estimated there were approximately 79 trees, six inches or greater, per acre in the pre-settlement

period. Current estimates indicate approximately 400 trees, six inches or greater, per acre within the North 49 Project area (Table 1). The number of trees per acre in the North 49 Project area has increased to more than five fold since 1883. High tree densities increase inter-tree competition for essential resources such as water, nutrients and light; causing stress and increased mortality. When trees become stressed they are vulnerable to insects, disease and drought.



Big Lake, CA 1941 (North 49 Project Area)

Big Lake, CA 2005 (North 49 Project Area)

Comparison of aerial photographs from 1941 with those from 2005 clearly demonstrates significant encroachment of conifers into meadows, aspen stands, brushfields and riparian areas. Without the continued check by fire, conifers (specifically white fir) have become prolific and established themselves in numbers and in areas historically unseen.

The current condition of the North 49 Project area is not a sustainable forest. Competition among trees will continue to cause mortality, increasing the amount of surface fuels and increasing the risk for a stand replacing fire. Trees will continue to be stressed making them vulnerable to death from insects, disease and drought. With the continued build-up of fuels and densely packed trees very little vegetation such as grasses, forbs and shrubs will be able to grow beneath the canopy reducing the habitat suitability of the area for small prey species (i.e. mice, voles and small birds) and their predator species such as California spotted owl, northern goshawk and American marten. Meadows, aspen stands and riparian vegetation would continue to be encroached upon by conifers diminishing open habitats used for nesting and forage. Brushfields, in some areas would be replaced by white fir, decreasing habitat for deer, nesting neo-tropical birds and other brush-utilizing species.

Improve Forest Diversity

Species diversity within the North 49 Project area has substantially diminished over the last 125 years. The GLO surveys indicate that white fir has increased more than ten fold while sugar pine and ponderosa pine have decreased. The increased ingrowth of white fir and the loss of the pine have changed the composition of the North 49 Project area from the pre-settlement period. Historically, white fir accounted for approximately 31 percent of the species composition. Today, white fir makes up approximately 68 percent of the species composition. Even more significant is the loss of the pine component. Historically, sugar pine comprised approximately 22 percent of the species composition and yellow pine (a reference to ponderosa and Jeffrey pine) comprised approximately 17 percent, based on the GLO surveyors' notes. Today, sugar pine comprises approximately 3 percent and yellow pine comprises approximately 11 percent of the forest composition. This loss of species diversity dramatically influences the sustainability of the forest by reducing resiliency to fire, drought, insect and disease.

Diversity of tree species within a forest helps prevent the loss of forest components to insects, disease or drought. Many insects and diseases are species specific, dependent on a single tree species (i.e. Jeffrey pine). Thus, if there is an insect or disease outbreak chances are that only one species would be affected and not the entire forest. Some tree species respond more effectively to drought than others and can withstand below normal precipitation. A diverse forest ensures that some trees could survive extreme environmental events such as fire, insects, disease or drought.

Ponderosa and Jeffrey pines are fire-resilient species possessing thick bark at a relatively small diameter which insulates them from the heat of a moderately intense fire. In contrast, white fir does not usually obtain a similar bark thickness until it is much older and larger. Therefore, heat from low intensity fires can kill small to mid-sized diameter white fir and heat from a moderately intense fire may kill white fir of mid to large-sized diameters.

Table 1. Average trees per acre by species in North 49 Project area years 2002 and 1883.

Species	2002		1883	
	Avg TPA	% TPA	Avg TPA	% TPA
White Fir	270.80	68.00	24.79	31.00
Red Fir	25.70	7.00	9.01	11.00
Ponderosa/ Jeffrey Pine	46.00	11.00	13.07	17.00
Sugar Pine	11.50	3.00	17.35	22.00
Cedar	13.00	3.00	4.28	5.00
Lodgepole Pine	30.10	7.00	8.34	11.00
Doug Fir	2.50	0.62	0.00	0.00
White Pine	0.07	0.02	0.00	0.00
Aspen	0.00	0.00	0.45	0.60
Black Oak	0.00	0.00	0.45	0.60
Mahogany	0.00	0.00	1.35	2.00
Total	**399.70**		**9.10**	

A multi-age, multi-storied forest provides a diverse age range and structural diversity that ensures the sustainability of the forest. A newer generation of vegetation would be established to replace the older generation. This also provides habitat for a large variety of wildlife species, including species associated with both early seral and late seral ecosystems.

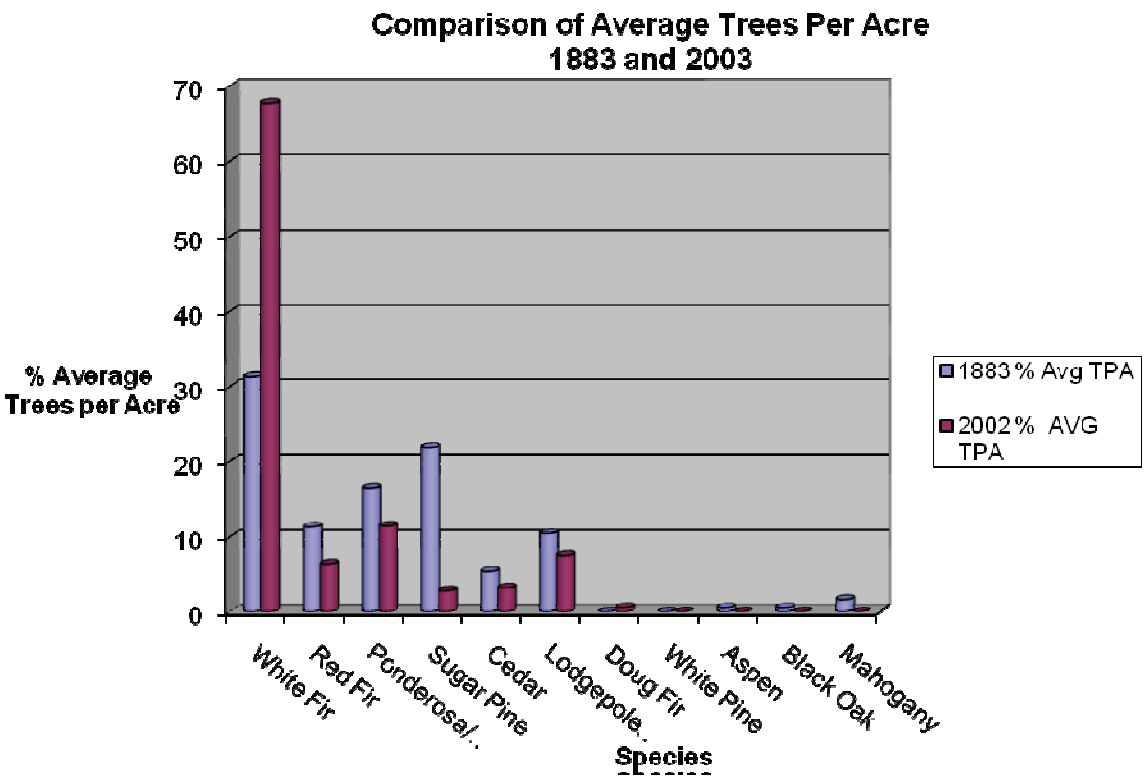


Figure 2. Historic and existing species composition of the North 49 Project area

Public Involvement

The project was first listed as an environmental assessment (EA) in the Schedule of Proposed Actions (SOPA) in February 2004. Comments on the Purpose and Need and Proposed Action were requested from the public and other agencies during scoping in March, 2004. The Forest Service provided an additional opportunity to comment on the Proposed Action from May 11 to June 11, 2004 in accordance with 36 CFR 215.6. A public meeting was held in the Old Station Volunteer Fireman's Hall on June 2, 2004. In August of 2004, an EA and Finding of No Significant Impact were released to the public. The decision was appealed and later litigated resulting in an injunction.

In August, 2005, the Lassen National Forest Supervisor (Responsible Official) made the decision to analyze this project in an EIS. Comments received from the public during 2004 were considered in the development of this EIS. A Notice of Intent (NOI) was published in the Federal Register on November 2, 2005 describing the proposed project, decision to be made and requesting public comments by November 17. A public meeting in the project was held January 25, 2006. A Notice of Availability of the Draft EIS was published in the Federal Register on April 14, 2006. A legal notice was published in the newspaper of record, the Lassen County Times, on April 18, 2006 notifying the public of the availability of the Draft EIS and the 45-day opportunity to comment. The Draft EIS was mailed to state and federal agencies and individuals who commented during scoping.

Comments submitted on the 2006 Draft EIS and the 2005 scoping document were assessed and considered for incorporation into the FEIS. New facts, issues, concerns or other information useful in analysis of alternatives was considered in developing the FEIS. Three field trips were conducted into the project area with commenters concerned about the project environmental and socio-economic impacts to assure that their comments were clearly understood.

Issue Development

The Forest Service ID Team reviewed public comments to identify issues related to the Proposed Action. The Forest Service separated issues into two groups: significant issues, non-significant issues. Significant issues are defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues are defined as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest LRMP, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality regulations at 40 CFR Sec. 1501.7(a)(3) direct federal agencies to, "[I]dentify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review. . . ." Public comments and a listing of non-significant issues and concerns may be found in the project record.

The Forest Service identified the following significant issue during scoping and it was raised again in comments on the Draft EIS. This issue is tracked and analyzed throughout this FEIS.

ISSUE: The Proposed Action and Alternative 3 would degrade old forest habitats, rendering them unsuitable for old forest dependent wildlife including California spotted owl, northern goshawk habitat, Pacific fisher and American marten.

The HFQLG Forest Recovery Act FEIS (1999) defines old forest as follows:

> Old forests are forested areas with a physical structure and ecological processes similar to what would have been common before the year 1850 and before the implementation of current forest management activities. Old forests are characterized by:
>
> a) a significant number of trees that approach their biological maximum age;
>
> b) a complex horizontal and vertical structure, including live and dead vegetation, that has been shaped or maintained by natural disturbances or their functional equivalents;
>
> c) an array of plant and animal species endemic to the region and location; and
>
> d) continuity in the above characteristics over large geographic areas (hundreds of thousands of acres).

The term old-growth forest is frequently used to describe these conditions. However, there are many definitions of old growth which encompass:

> …two broad types of forests that reflect different roles for fire. Some forests are shaped over time by the natural competitive differences among species and individual trees and by small-scale disturbances affecting one or a few trees at a time. In other forests, plant succession processes are disrupted with some regularity by major biological disturbances, such as fire, insects, wind, or even drought, that extend across larger areas. Because each of these broad types includes old-growth forests, we might expect difficulty finding a single definition of old growth suitable for all forests.
>
> Forests in the coastal Pacific Northwest and other areas where climates are wet are typical examples of forests driven largely by natural plant succession and small-scale disturbances. . . . In drier regions, forest types have evolved more in response to disturbance by fire than in response to successional processes in the absence of fire. Old trees become a part of such forests because of adaptations that allow them to survive all but the most severe fires. (Kaufmann et. al., 2007)

Skinner and Taylor et. al. in 2006 found that, "[N]early a century of minimal fire occurrence due mostly to fire exclusion in forests that once experienced

frequent fires, has greatly altered compositional and structural diversity in forest stands and forested landscapes. The reduction in frequency and extent of fire has resulted in an increase in stand density, a shift from fire-tolerant to fire-intolerant species, and has reduced structural heterogeneity."

Using Kaufmann's, and Skinner and Taylor's definitions, the North 49 project area has little if any old forest and proportions of tree species and size classes in the area are now unlike those found historically. However, scattered representatives of all historic species remain today. These species constitute the anticipated dominate seral species for the area.

Suitable habitat for late seral dependent wildlife requires heterogeneity. A heterogeneous forest consists of diverse components including vertical and horizontal structure. Blakesley et al. (1992) concluded that structure and diversity may be more important attributes than either canopy cover or the size of the trees.

The analysis of alternatives considers the attributes of structure and heterogeneity values for suitable habitat. Although these characteristics are evaluated, there is no standard for measurement. Therefore, the California Wildlife Habitat Relationships (CWHR) system continues to be used for wildlife habitat analysis for projects under the HFQLG FEIS as amended by the 2004 Sierra Nevada Forest Plan Amendment Final Supplemental EIS as it maintains consistency for monitoring changes in species habitat. This includes the requirement to not cumulatively reduce late seral dependent species habitat (5M, 5D, and 6) more than 10 percent below 1999 levels (USDA FS 1999). These CWHR types have the highest probability of providing stand structures associated with preferred nesting, roosting and foraging.

For the comparative analysis contained in this EIS, the CWHR system is used to evaluate forest conditions and the suitability of wildlife habitat. This document uses CWHR size class 5 (See Table 2) to differentiate late seral forest. California WHR size class 4 is considered mid-seral. The predominant CWHR size class of forest stands is 4, which accounts for approximately 63 percent of the project area. California WHR size class 5 constitutes 20 percent of the project area.

Table 2. Wildlife Habitat Relationship Strata

Tree Canopy Closure			Tree Size Class		
Closure	**Class**	**Canopy Closure**	**Size**	**Class**	**dbh**
X	Barren	0-9%	1	Seedling	< 1inch
S	Sparse	10-24%	2	Sapling	1 to 6 inch
P	Open	25-39%	3	Pole	6 to 11 inch
M	Moderate	40-59%	4	Small	11 to 24 inch
D	Dense	60-100%	5	Medium/ Large	> 24 inch

In order to determine the suitability of habitat for late seral dependent wildlife, additional habitat attributes need to be considered. Canopy cover in association with size class is a principle indicator of suitable habitat. Approximately 79 percent of forested stands in the project area have moderate (M) to dense (D) canopy cover. California WHR 4M, 4D, 5M, and 5D are the classes predominately utilized by late seral dependent wildlife species in the North 49 Project area. Therefore, the use of the term "late seral dependent wildlife habitat" includes CWHR 4M, 4D, 5M, and 5D for the purposes of this analysis, and is used to track effects on the issue identified above. For a more in-depth discussion on suitable habitat, see Chapter 4 under wildlife.

MEASURE: Intensity of effects on habitat characteristics of late seral dependent wildlife and plant species.

Table 3. Issue 1 units of measure for comparison of affects

Indicator	Measure
Stand density	% Canopy closure sq ft/ac basal area % maximum stand density index
Habitat suitability	Suitable California spotted owl foraging habitat retained Suitable California spotted owl nesting habitat retained Suitable individual California spotted owl HRCA retained Suitable marten, fisher, and fox foraging habitat retained Suitable marten, fisher, and fox denning habitat retained Suitable Northern goshawk foraging habitat retained Suitable Northern goshawk nesting habitat retained

Laws, Regulations, and Policies

All resource management activities described and proposed in this document would be implemented to the extent they are consistent with applicable Federal law, United States Department of Agriculture (USDA) regulations, and Forest Service Policies.

Civil Rights Impact Analysis (USDA Regulation 4300-4)

A Civil Rights Impact Analysis was completed for the HFQLG FEIS (Appendix O). Three categories were analyzed: (1) work force characteristics, (2) attitudes/beliefs/values, and (3) civil rights. Favorable impacts, unfavorable impacts, and mitigations were identified for each of the three categories.

Clean Water Act (Public Law 92-500)

All Federal agencies must comply with the provisions of the Clean Water Act. The Clean Water Act regulates forest management activities near federal waters and riparian areas. The proposed action meets the terms of the Clean Water Act for non-point sources of pollution, primarily pollution caused by erosion and sedimentation. As described in the 1999 HFQLG FEIS, compliance with the Clean Water Act is

accomplished through implementation of Best Management Practices (BMPs) for National Forests in California (USDA FS 2000f).

The State and Regional Water Quality Control Boards entered into agreements with the Forest Service to control nonpoint source discharges by implementing control actions certified by the State Water Quality Control Board and the EPA as BMPs. BMPs are designed to protect and maintain water quality and prevent adverse effects to beneficial uses both on-site and downstream. In addition, the land disturbing activities described in the proposed action would be dispersed in time and space so that the subwatersheds would not reach or exceed the threshold of concern for overall watershed disturbance.

Clean Air Act (Public Law 84-159)

Forest Service managers would follow specified provisions for smoke management whenever fire is prescribed for pile and understory burning. The following documents provide Forest Service managers with the guidance and direction for smoke management to protect air quality: (1) Interim Air Quality Policy on Wildland and Prescribed Fires, issued by the Environmental Protection Agency in 1998; (2) Memorandum of Understanding between the California Air Resources Board (CARB) and the USDA Forest Service, signed on July 13, 1999; and (3) Smoke Management Guidelines in Title 17 of the Code of California Regulations.

The project area lies within the Shasta County Air Quality Management District. As a matter of regional policy (Smoke Management Guidelines in Title 17 of the California Code of Regulation), a smoke management plan would be submitted to Shasta County Air Quality district for approval prior to any prescribed burning occurring in the project area. The community of Old Station lies within proximity of the area where both pile burning and prescribed burning is proposed. Adherence to the smoke management plan for prescribed burning would alleviate negative impacts to communities. By adhering to the smoke management plan approved by the Shasta County Air Quality management District, particulate matter emissions from prescribed burning would not violate California Ambient Air Quality (CAAQ) emission standards.

Endangered Species Act of 1973 (Public Law 93-205)

Section VII of the Endangered Species Act requires Federal agencies to consult with the United States Department of the Interior Fish and Wildlife Service (FWS) and/or the United States Department of Commerce National Marine Fisheries Service (NMFS), whichever is appropriate, during project planning when threatened or endangered species, or their associated critical habitat, may be affected by a project.

Wildlife Consultation

Informal consultation with the Fish and Wildlife Service on effects to terrestrial species has included obtaining lists of endangered, threatened, and proposed species, dated October 2, 2002 received from the FWS in the Quarterly species list sent to the Lassen National Forest. On March 16, 2004, a map and letter describing the North 49 project were sent to the Sacramento office of the USFWS. Kathy Brown of the

Sacramento FWS office was contacted on 4/10/04 and confirmed that the scoping documents had been received and had no comments to make on the scoping documents. Additional lists were obtained from the Fish and Wildlife Service Sacramento field office server (www.fws.gov/sacramento/es/spp_lists) on November 22, 2005. The Northern Region office of the California Department of Fish and Game submitted comment on the North 49 Draft Environmental Impact Statement (DEIS) on May 25, 2006 raising several corrections, issues and concerns with the North 49 project and its documentation. All of these corrections have been made and all of the issues and/or concerns will be addressed through the analysis of the alternatives and in the response to comments with regards to the North 49 project. No additional consultation with the Fish and Wildlife Service is needed, or expected, due to lack of effects to listed terrestrial species.

Fisheries Consultation

Consultation requirements under Section 7 of the ESA, as amended, have been completed with the National Marine Fisheries Service (NMFS) for the North 49 project. NMFS reviewed a July 14, 2004 Biological Assessment for the North 49 project and concurred on August 12, 2004 with a “may affect, not likely to adversely affect” determination for two federally listed anadromous fish. Since the effects of the new (preferred) Alternative 7 on federally listed anadromous fish do not differ from the alternative previously consulted on for the North 49 project, the determination remains the same; and therefore, re-initiation of consultation is not required” (refer to the BA/BE of listed and Forest Service Sensitive Anadromous Salmonids for North 49 Project, Hat Creek Ranger District in the project record).

Essential Fish Habitat (EFH)

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act requires Federal action agencies to consult with the Secretary of Commerce regarding any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH). Although consultation with NMFS on the potential effects of the North 49 project on Essential Fish Habitat is not required (because it was determined in the BA that there would be “no adverse effect”), NMFS did provide their concurrence with this determination in their August 12, 2004 letter. Essential fish habitat was reconsidered in the BA/BE of listed and Forest Service Sensitive Anadromous Salmonids for North 49 Project, Hat Creek Ranger District and concluded there would be “no adverse effect” and therefore, consultation with NMFS is not required.

Federal Insecticide, Fungicide, and Rodenticide Act (7 USC 136 as amended)

The Federal Insecticide, Fungicide, and Rodenticide Act, as amended (7 U.S.C. 136), is the authority for the: registration, distribution, sale, shipment, receipt, and use of pesticides (collective for insecticides, fungicides, and rodenticides). The Forest Service may use only pesticides registered or otherwise permitted in accordance with this act. In addition, the Forest Service in Region 5 must comply with California State laws and regulations regarding pesticides. Also, Forest Service policy in Region 5 is to

only use EPA and California-registered pesticides. The action alternatives include the use of an EPA registered borate compound on cut stumps that are 14 inches diameter and greater for the prevention of annosus root disease. The borate compound is considered a fungicide.

Herger-Feinstein Quincy Library Group Forest Recovery Act of 1998 (Title IV, Section 401)

Forest Supervisors for the Plumas, Lassen, and Tahoe National Forests signed a ROD for the HFQLG FEIS in August 1999. The ROD amended the three Forest LRMPs to establish a pilot project to demonstrate and test the effectiveness of management activities described in the HFQLG Act of October 21, 1998. The North 49 Project incorporates all of the elements of that decision, including the Forest LRMP amendments.

Migratory Bird Treaty Act of 1918 as amended (16 USC 703-712)

The original 1918 statute implemented the 1916 Convention between the United States and Great Britain (for Canada) for the protection of migratory birds. Later amendments implemented treaties between the United States and Mexico, Japan, and Russia. Specific provisions in the statute include the establishment of a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird." Because forestlands provide a substantial portion of breeding habitat, land management activities within the LNF can have an impact on local populations.

National Forest Management Act of 1976 (NFMA; Public Law 94-588)

The National Forest System lands affected by the North 49 Project are subject to management direction in the 1993 LNF LRMP, as amended by the 1999 HFQLG ROD and the 2004 SNFPA ROD. The LRMP, as amended, guides management of all National Forest System lands and resources within the North 49 Project area. It includes direction for forest management, goals and objectives, standards and guidelines, area management direction, and the anticipated outputs of forest products.

The LRMP, as amended, has been reviewed in consideration of the North 49 Project. This project is responsive to guiding direction contained in the LRMP, is consistent with the standards and guidelines contained in the LRMP, and is consistent with the requirements for management prescriptions.

National Historic Preservation Act (Public Law 89-665)

The proposed action is in conformance with regulations of the National Historic Preservation Act (NHPA), 1966, as amended (P.L. 89-665, 80 Stat.915); the National Environmental Protection Act (1969), Archaeological Resources Protection Act of 1979 (ARPA), Native American Grave Protection and Repatriation Act (1990: P.L. 101-601), and American Indian Religious Freedom Act (1978: P.L. 95-341), and as called for by the 1996 First Amended Regional Programmatic Agreement Among The USDA Forest Service, Pacific Southwest Region California State Historic Preservation Officer, And Advisory Council On Historic Preservation Regarding The Process For Compliance With Section 106 Of The National Historic Preservation Act For Undertakings On The National Forests Of The Pacific Southwest Region (Regional PA), and the 2004 Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects (Interim Protocol).

Wild and Scenic Rivers Act (Public Law 90-542, as amended)

The proposed action is consistent with provisions of the Wild and Scenic Rivers Act, which regulates forest management activities within the National Wild and Scenic Rivers System. Specifically, these lands are to be administered in such a manner as to protect and enhance the values that caused them to be included in the system, without limiting other uses that do not substantially interfere with public use and enjoyment of these values. The primary emphasis is given to protecting these lands' aesthetic, scenic, historic, archaeological, and scientific features and to maintaining the free-flowing character of the system river. The Secretary of Agriculture may utilize the general statutory authorities relating to the National Forests to carry out the purposes of this Act.

There are no Wild and Scenic Rivers within the North 49 Project area.

Permits and Coordination

The Forest Service coordinates its activities with Federal, County, and State of California regulatory agencies, including air quality management districts, and water quality control boards. Permits would be required from the air quality management districts prior to prescribed burning. Conditional waivers of the requirement to file a report of waste discharge for timber harvest activities on National Forest lands would be required from the appropriate water quality control boards.

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Chapter 2. Alternatives, Including the Proposed Action

Introduction

This Chapter describes the Proposed Action and alternatives, including a No Action alternative, to achieve the purpose and address the need for action presented in Chapter 1. Comparative information on actions under consideration is presented to identify the choices and decision to be made. There is a description of the development of the alternatives, description of alternatives eliminated from detailed study, comparative information on all alternatives, and the identification of the Forest Service Preferred Alternative.

This chapter is organized in two sections. The first section presents the alternatives considered but eliminated from detailed study. This section provides a description of alternative recommendations received from the public that were considered for detailed analysis but not fully developed as alternatives. An explanation for why they were dropped is presented. The second section describes and compares three action alternatives and a no action alternative considered for the North 49 Forest Health Recovery Project. The alternatives include Alternative 1 - Proposed Action, Alternative 2 - No Action, Alternative 3 – Modified Proposed Action, and Alternative 7 – Preferred Alternative. Alternative 7 was developed to address the issues and concerns identified in substantive comments on the Draft Environmental Impact Statement that was provide for public comment in April 2006. This section also presents the alternatives in comparative form, sharply defining the differences among the alternatives and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (e.g., thinning intensity) and some of the information is based upon the environmental, social, and economic effects of implementing each alternative. Federal agencies are required to rigorously explore and objectively evaluate all reasonable alternatives and briefly discuss the reasons for eliminating any alternatives that were not developed in detail (Title 40 Code of Federal Regulations, Section 1502.14). The Forest Service followed these regulations by developing two action alternatives to the Proposed Action based on issues and concerns identified during the project public scoping and comment processes.

Alternatives Considered but Eliminated from Detailed Study

Under CEQ regulations, Federal agencies are required to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to scoping and the Draft EIS provided suggestions for alternative methods for achieving the purpose and addressing the need. Some of these alternatives may have been outside the scope of the project intent, duplicative of the alternatives considered in detail, or determined to have components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed study for reasons summarized below.

Alternative 4 – Implement the 2001 Sierra Nevada Forest Plan Amendment, maintaining canopy cover at 50 percent or greater and protecting trees of 20 inches dbh or greater

Thinning to a 20-inch upper diameter limit (UDL) or leaving 50 percent canopy across the North 49 Project area would not meet the purpose or address the need of either forest health or forest diversity presented in Chapter 1. Density reduction for forest health using a 20-inch UDL would essentially require the removal of all trees less than 20 inches resulting in DFPZ-like forest across the project. Although useful for fuels and fire management, DFPZs lack young trees that are required for future forests and provide necessary structure for suitable wildlife habitat. As described in Chapter 1, Issue Development, suitable habitat for late seral dependent wildlife requires heterogeneity. A heterogeneous forest consists of diverse components including vertical and horizontal structure. This is not achievable applying a 20-inch UDL. To restore the forest to a condition that is healthy, structurally diverse, and fire resilient, flexibility in tree removal would be needed. A 20 inch UDL does not provide the flexibility necessary to improve forest diversity because it would require the removal of smaller fire-resilient trees species (e.g. ponderosa pine) while retaining larger, over-abundant, less fire-resilient trees species (e.g. white fir).

As described in the Chapter 4, Environmental Consequences under Silviculture, the modified thinning prescription would average a canopy cover of 50 percent. If applied across the project area, the 50 percent canopy cover requirement would favor shade-tolerant species and greatly curtail the ability to increase species diversity. Analysis of this modified thinning prescription reveals that the 50 percent canopy cover leaves more potential ladder and canopy fuels. Additionally, at a 50 percent canopy cover, most of the stand would be approaching 60 percent SDImax immediately after the thinning, which is the zone of imminent mortality. Trees within stands that have an SDImax greater than 60 percent experience a decrease in growth and vigor as trees are stressed for resource. Finally, post-thinning tree spacing would average approximately 14 feet, operability would be restricted and residual tree damage would increase.

Alternative 5 - Non-pesticide annosus treatment alternative

In order to achieve the purpose and address the need presented in Chapter 1, trees and biomass need to be removed from the project area. Fresh cut stumps are susceptible to infiltration by annosus spores that can then move into the root system and infect adjacent trees. Sporax (Borax) is the most cost effective and environmentally neutral treatment against the spread of annosus infection. Sporax applications would follow all State and Federal rules and regulations as they apply to pesticides. The June 2004 US Forest Service Forest Health Report No. R04-01 by J. Kliejunas and B. Woodruff demonstrates the Sporax treatment of stumps 14 inches or larger is the most effective method of reducing the spread of annosus. Kliejunas (1989) cites studies showing that in eastside pine annosus incidence was greatly reduced in boraxed stands vs. non-boraxed stands. Logging in areas that are susceptible to annosus will result in increased levels of annosus <u>if stumps are not treated</u>.

Cutting when annosus spores are lowest has been suggested as an alternative to Sporax use, but there are no data or studies to support the efficacy of such a treatment in California. There is also no literature supporting prescribed burning as a control of annosus in California ecosystems. Stump removal is cost

prohibitive, highly destructive to the site and would cause unnecessary significant impacts to forest soils and watershed resources. Treating with *Phlebiopsis gigantea* is not feasible at this time as it is not registered as a biopesticide either with the US Environmental Protection Agency or the State of California, and there are no efficacy data for California forest conditions. There are data suggesting that *Phlebiopsis gigantea* would not be efficacious in California because it is too dry in summer and fall. This alternative would not achieve the purpose or address the need presented in Chapter 1 because other types of annosus treatment have not proved effective to reduce the risk of the disease. Therefore this alternative was not considered in detail.

Alternative 6 – Alternative to maintaining fuelbreaks that mimic historic fire cycles without the use of chemicals.

The Lassen LRMP, as amended by the 1999 HFQLG ROD and the 2004 SNFPA ROD directs the construction of fuelbreaks consisting of a strategic system of DFPZs. The DFPZs proposed for the North 49 project area are designed and located to be part of a larger strategic system of DFPZs that provides fire suppression personnel relatively safe locations from which to take action against wildfires. Wildfire suppression efforts can be assisted by the availability of DFPZs located along strategic landscape features such as roads and ridgelines. Alternative treatments to DFPZs were analyzed in the 1999 HFQLG FEIS and ROD. DFPZ maintenance within the project area would be achieved through a combination of mechanical and hand-treatment of fuels, piling and burning, and underburning. This EIS does not propose or analyze the use of herbicides or other chemicals to maintain DFPZ fuelbreaks in the North 49 Project area. Therefore, an alternative addressing the use of chemicals to maintain DFPZ fuelbreaks was not considered or studied in detail. A discussion on DFPZ maintenance can be found in Appendix A, the cumulative effects section and would not be part of the decision.

Alternatives Considered in Detail

The lack of periodic fires within the North 49 Project area has resulted in an unhealthy forest. Considering the current condition of the forest, the reintroduction of fire as a sole management tool would be impractical, unmanageable in scope and very likely result in devastating and high severity stand replacing forest fires. Under all alternatives analyzed, implementation of vegetation management actions would be accomplished using mechanical treatments to remove the excess fuels, reduce stand densities, and re-establish structural, species and age diversity. There are four fundamental methods that would be used: mechanical tree and biomass removal, mechanical mastication of biomass and fuels, mechanical piling of fuels for managed burning, and burning of pre-treated fuels. The US Forest Service is neither equipped nor funded to treat or mechanically remove large quantities of trees and biomass from National Forests; this would be accomplished by means of timber sales and service contracts. Upon completion of the contract work, Forest Service personnel would re-introduce fire to the area to accomplish pile burning and underburning of safely prepared fuels.

Mechanical treatments considered in this EIS are detailed in prescriptions that would be applied on acres as described in the alternatives. Each prescription is designed to achieve a particular result that accomplishes the purpose of the project. Prior to any timber sales that implement this project, specific marking guidelines would be developed to ensure the marking of trees meets the treatment prescriptions. Certified Forest Service

personnel would develop the marking guidelines and manage the marking. Companies awarded contracts are legally bound to meet the prescription specifications in the contract. This would assure that implementation of the treatments is consistent with the alternative selected.

The Alternatives considered and analyzed include a range of treatments to achieve the purpose of the project. The alternatives include different ranges and combinations of treatments that are comparatively analyzed to assist selection of an alternative to be implemented.

Corrections and Clarifications to DEIS Alternatives 1 and 3

Comments submitted on the 2006 DEIS and the 2005 scoping document were assessed and considered for incorporation into the FEIS. New facts, issues, concerns or other information useful in analysis of alternatives was considered in developing the FEIS. Although reformatted, Alternatives 1 and 3 were **not** substantially changed from the Draft Environmental Impact Statement to the Final Environmental Impact Statement.

Corrections and Clarifications made to Alternatives 1 and 3 from the Draft EIS to this Final EIS include:

- Treatment acres were adjusted in all alternatives to reflect the refinement of the database.
- The Manzanita Chutes northern goshawk Protected Activity Center (GPAC) was relocated to reflect use as observed through consecutive years of monitoring.
- The number of Group Selection areas was decreased by 5. These groups were located in research plots and would conflict with the ongoing studies.
- The term “ITS Thinning” has been changed to “Area Thin” to distinguish treatment areas.

List of Treatments Proposed in the North 49 Forest Health Recovery Project

The following are descriptions each type of treatment proposed in the North 49 Forest Health Recover Project. Combinations of these treatments are used in the various action alternatives to meet the Purpose and Need of the project. However, no action alternative utilizes all treatments types.

1. Thin from Below in DFPZ

The thin from below in DFPZ prescription is the most aggressive fuels treatment proposed. Within the Defensible Fuels Profile Zone, trees would be removed from 3 inches dbh up to 30 inches dbh until the desired basal area for each forest cover type is reached. The understory and mid-story trees would be the focus of the removal efforts to achieve the reduction in ladder fuels necessary to DFPZ standards. Modeling assumptions for the thin from below in DFPZ treatments included 1) Thin from below using a 30 inch upper diameter limit, 2) Remove primarily trees in suppressed and intermediate crown positions (codominant trees would be removed when needed to meet desired stocking levels), and 3) Thin to a SDI that would effectively reduce intertree competition for approximately 20 years, increase tree growth, remove ladder fuels, and raise average crown base heights.

Following thinning, Forest Service Fuels Specialists would evaluate the fuels to determine which acres would be treated by machine piling and burning, and/or underburning.

Eastside Pine Forest Cover Type

A ponderosa pine forest cover type is dominated by ponderosa and Jeffrey pine and wide spacing between these tree types is necessary for healthy, vigorous growth. Stands with this cover type would be thinned to an approximate basal area of 120 square feet per acre, and canopy cover would range between 37-42 percent. Residual canopy cover within DFPZ would not be reduced below and 35 percent in pine stands. The average tree diameter in treated pine stands would range between 11-16 inches after thinning. Figure 3 displays a visual simulation of a pine stand treated using the thin from below in DFPZ treatments. Some understory to mid-story trees may be reserved in openings within the stand. Pine stands would be thinned to 55 percent of normal basal area per acre (Meyer 1938).

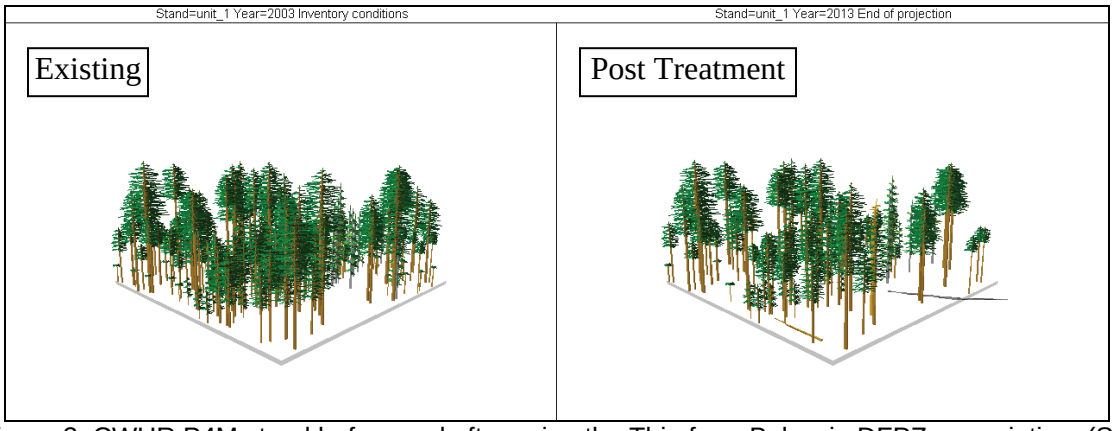

Figure 3. CWHR P4M stand before and after using the Thin from Below in DFPZ prescription. (Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data)

Sierra Mixed Conifer Forest Cover Type

Sierra Mixed Conifer forest cover types are comprised of ponderosa pine, sugar pine, white fir, incense-cedar Douglas fir and black oak. In a majority of the stands in the North 49 project area, white fir, ponderosa pine, sugar pine, and incense-cedar are the primary trees encountered in these stands. There are some stands on the far west edge of the project area that also contain Douglas fir and black oak, but in the- North 49 project area these stands are rare. Sierra mixed conifer stands often have higher stand density than eastside pine stands due to the presence of white fir. Maintaining a stand density that ensures the survival of all species within the Sierra mixed conifer forest cover type is the goal for these stands.

Sierra mixed conifer stands within the DFPZ would have post-treatment residual basal areas ranging between 160-200 square feet per acre. The projected average tree diameter in treated mixed conifer stands would range between 9-22 inches after thinning. Projected post thinning canopy cover would range between 40-52 percent with an average of 45 percent in mixed conifer stands. Residual canopy cover within DFPZ would not be reduced below 40 percent in mixed conifer. Mixed conifer stands would be thinned to 60 percent of normal basal area per acre (Dunning and Reineke 1933).

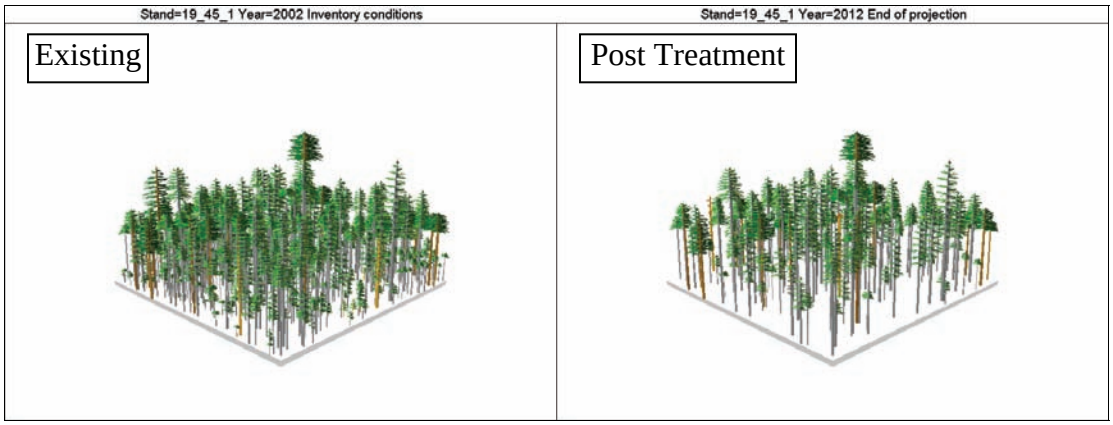

Figure 4. CWHR M3D stand before and after using the thin from below in DFPZ treatments. (Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data)

Lodgepole Pine Forest Cover Type

Lodgepole pine stands would be thinned to an average of 100 square feet per acre (for Alternative 1 and 3) and 80 square feet per acre (for Alternative7). Projected post thinning canopy cover would average 34 percent. Thinning would reduce stocking density in treated stands to approximately 47 percent of Maximum SDI. This is below the zone of imminent mortality.

Following thinning, Forest Service Fuels Specialists would evaluate the fuels to determine which acres would be treated by machine piling and burning, and/or underburning.

2. Modified Thin from Below with Retention Islands

The modified (50 percent canopy cover) thin from below with retention islands treatment would be applied in some areas to meet wildlife habitat needs. Surface fuels would be treated mechanically, by hand, or by prescribed fire as post-thinning conditions dictate, such that fuel continuity would be disrupted. Thinning would be accomplished using tractor-yarding systems. This lower intensity thinning prescription would be designed to retain at least 50 percent canopy cover and maintain 10 percent of each treatment unit in unthinned retention islands. Some fuels treatments such as underburning may occur. Each retention island would range 1/2 – 3 acres in size, occasionally ranging up to 5 acres when conditions dictate. Retention areas would be irregular in shape and located approximately 200 feet from openings such as roads, landings, meadows and group selections. Preferred areas would include several of the following characteristics: the densest canopy of larger trees, large snags (>24 inches dbh), multiple large logs or evidence of pileated woodpecker activity (oblong or keyhole shaped cavities). Stands would be thinned to 68-73 percent of normal basal area per acre (Dunning and Reineke 1933) in order to maintain at least 50 percent canopy cover in areas outside of retention islands. The modified thinning prescription would primarily be applied in the Sierra mixed conifer forest cover type. A small number of lodgepole pine stands/aggregations would also be treated with under this prescription. Finally, the Manzanita Chutes GPAC, which is approximately 204 acres and lies within the DFPZ, would be thinned using the treatment.

Following thinning, Forest Service Fuels Specialists would evaluate the fuels to determine which acres would be treated by machine piling and burning, and/or underburning.

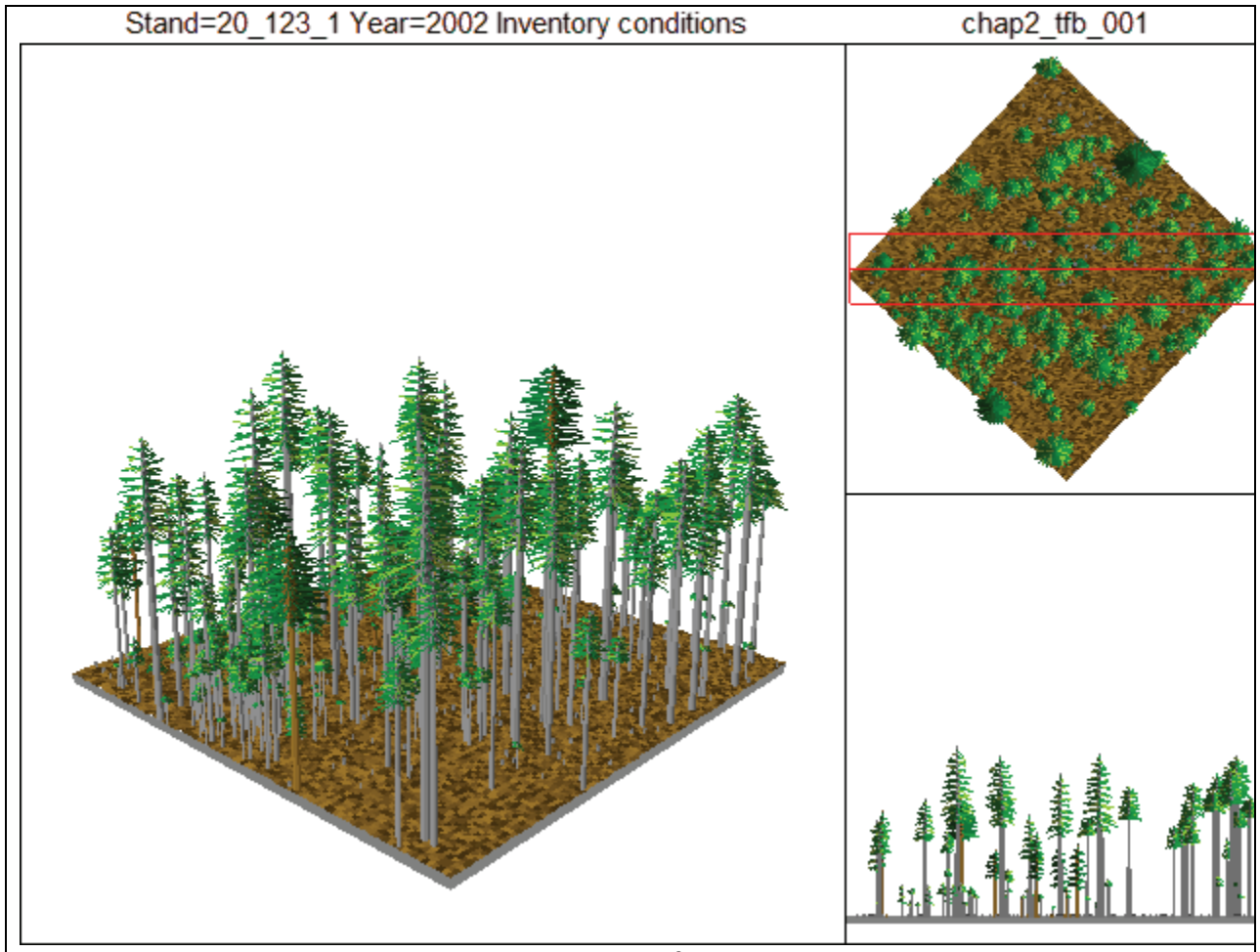

Image generated from Forest Vegetation Simulation modeling.

Figure 5. Example of a modified thin from below

Sierra Mixed Conifer Forest Cover Type

The projected average tree diameter in treated Sierra mixed conifer stands would range between 10-17 inches after thinning. The post-treatment residual basal area in the majority of stands would range between 189-224 square feet per acre. Projected post thinning canopy cover would range between 50-54 percent. Thinning would reduce stocking density in treated stands to a range of 52-64 percent of Maximum SDI.

Lodgepole Pine Forest Cover Type

The projected average tree diameter in treated lodgepole pine stands would average 13.2 inches after thinning. Lodgepole pine stands would be thinned to an average of 180 square feet per acre. Thinning would reduce stocking density in treated stands to approximately 81 percent of Maximum SDI for pine. Pine stands would remain in the zone of imminent mortality and at risk for density related tree mortality post thinning. Projected post thinning canopy cover would be 50-54 percent.

3. Thin from Below

This treatment would be applied outside of the DFPZ. Stands would be thinned to the same standards as the Thin from Below in DFPZ treatment, however, the overall canopy cover would average approximately 50 percent.

Following thinning, Forest Service Fuels Specialists would evaluate the fuels to determine which acres would be treated by machine piling and burning, and/or underburning.

4. Diversity Thin

The diversity thin is made up of three treatment elements: a) structural thinning of the general matrix, b) radial release of large diameter overstory trees, and c) retention islands. Each of these elements is described below in more detail. This combination of activities would promote structural diversity that provides a variety of habitat elements, while protecting and promoting the growth and development of large overstory trees. A percentage of smaller trees would be left for diversity, structure, and to provide the next generation of forest. Up to 15 percent of these stands would be left in retention islands in which no treatment would occur. Canopy cover would be highly variable within these Area Thin units, but would average approximately 40 percent to 50 percent within CWHR 4M, 4D, 5M or 5D stands. In order to meet the long-term project objectives of having stand densities below the zone of imminent mortality for twenty years post treatment, and still achieve structural habitat requirements for late seral habitat dependent species, canopy cover would be reduced below 50 percent, but not drop below 40 percent (SNFPA FSEIS 2004, Standards and Guidelines). The risk for density related tree mortality begins to increase at density levels above 60 percent of maximum SDI.

Following thinning, Forest Service Fuels Specialists would evaluate the fuels to determine which acres would be treated by machine piling and burning, and/or underburning.

a) Structural Thinning

Structural thinning places an emphasis in retaining healthy desirable trees within all size classes. Thinning would be conducted through all size classes less than 30” dbh. Residual basal area densities would be similar to DFPZs (roughly 160 – 180 square feet of basal area in CWHR 4M stands). Where there are few healthy trees in the smaller and midstory size classes, area thinning would appear similar to the thin from below treatments previously described. Unhealthy trees would generally be removed because they do not contribute to the long-term sustainability of the forest.

b) Large Tree Radial Thin

Healthy predominant, “legacy trees”, or dominant overstory trees (>24” dbh) of desirable species (i.e. yellow pine, sugar pine) would have most or all adjacent trees less than 30” dbh thinned away for a distance of 30-50 feet. The exact distance of release would vary depending on physical and site attributes of the “legacy” tree, like drip line or site specific conditions and would not exceed 50 feet. Legacy trees may be grouped together and each individual could receive a radial thin. The objective of the radial thin is to identify and release those few remaining large fire resilient overstory legacy trees from incursion and competition for soil

moisture and nutrients from the more shade-tolerant understory. Radial thin would be applied to 3 to 5 trees per acre, where they occur.

c) Retention Islands

Roughly 15 percent of area thinning units would be kept as retention islands. Retention islands would retain both horizontal and vertical structural diversity, where possible, and provide habitat elements for California spotted owls and forest carnivores. Retention islands would vary in size and bolster stand habitat canopy cover. Each retention island would range from a small clump of trees to more than 5 acres depending on site conditions and would be irregular in shape. The locations of each retention island would be determined in conjunction with Forest Service Wildlife Biologists. Preferred areas would include several of the following characteristics: the densest canopy of larger trees, large snags (>24 inches dbh), multiple large logs or evidence of oblong or keyhole shaped cavities.

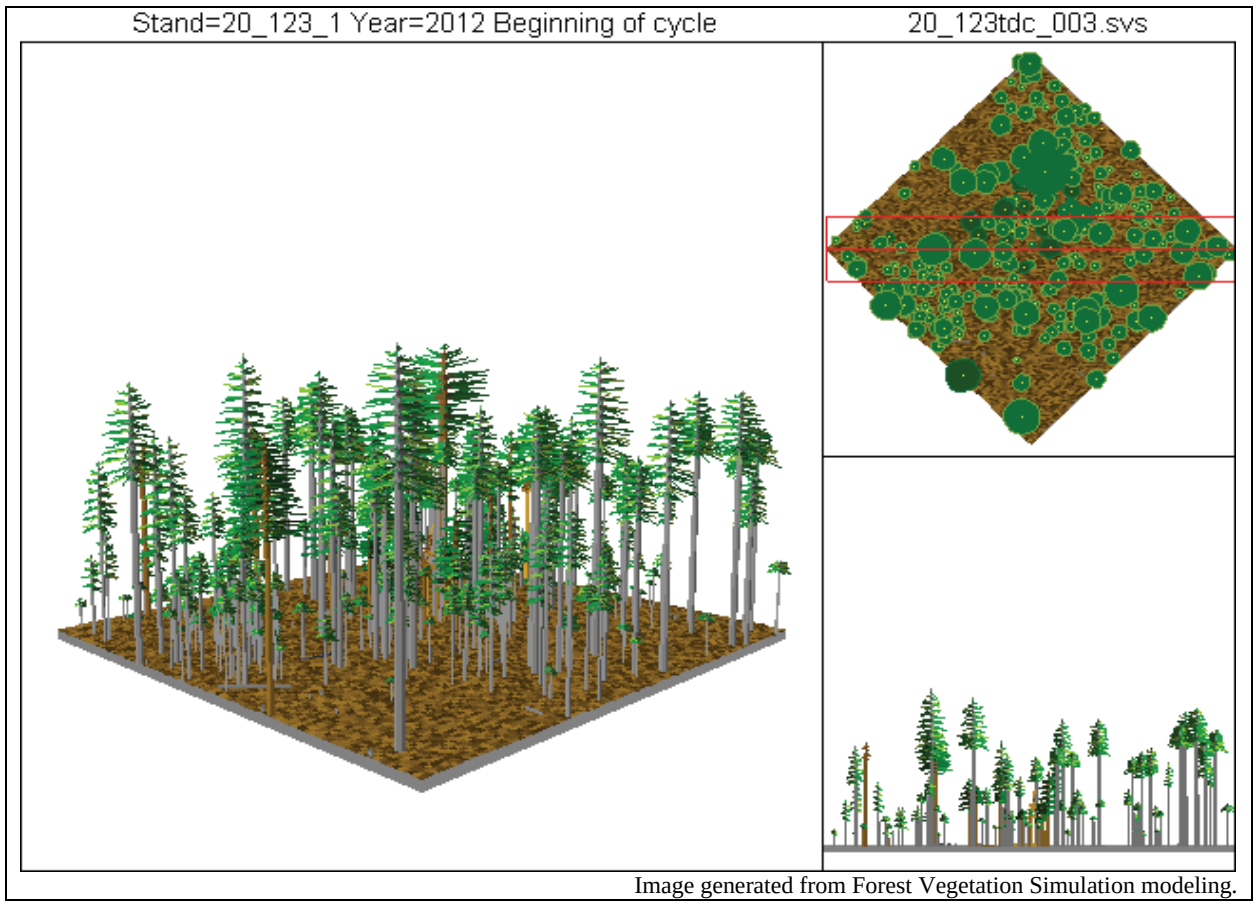

Figure 6. Example of thinning throughout the diameter classes

5. Group Selection

Group selection is an uneven-aged method of regenerating an area. The groups are small areas up to 2 acres in size where all or most of the trees less than 30”dbh are removed to make way for a new generation of trees. Groups improve diversity, future fire-resiliency, and forest health by reducing the overabundance of white fir

in some areas and allowing the regrowth of pine species. Harvest entries would be based on cutting up to 11.4 percent of suitable stands on a 175-year rotation and a 20-year cutting cycle. Determining areas suitable for group selection was based on four main criteria:

- Soils are capable of supporting conifer regeneration;
- Group selection on average should not exceed 11.4 percent of total stand acres;
- Groups contribute to improvements in forest health, productivity and age/structural diversity; and
- Economic considerations (commodity outputs).

The majority of group selections would be harvested using tractor-yarding systems. Where slopes are greater than 35 percent, groups within roaded areas would be harvested using small cable yarders and groups within roadless areas would be harvested using helicopters.

Groups were primarily located in stands typed as size class 4 (11-24 inches) to avoid the largest trees. Less than 10 percent of the group selections would remove trees between 24 and 29.9 dbh.

Seed trees would be left (up to 2 of the largest per acre) when they are available and conditions permit for natural regeneration and to maintain some structural diversity within each group. Seed trees are defined as having good phenotypes and free of dwarf mistletoe. Ponderosa, Jeffrey, and sugar pine would be priority for seed trees when available. The objective would be to leave up to four seed trees (two per acre) in each two-acre group. Group selections were located on the ground to avoid including many trees 30 inches dbh and greater which would necessarily be left standing and contribute to shading. Trees 30 inches dbh and greater within groups would be retained as seed trees regardless of species and condition. It is estimated that the presence of trees 30 inches dbh and greater could result in up to 5 seed trees per acre (10 per group) in a limited number of groups. Post harvest treatments where necessary may include site preparation and / or planting. Where necessary, mechanical site preparation (tractor pile and rip) would be used to prepare a mineral-soil seedbed for natural regeneration and remove competing vegetation on slopes less than 35 percent. Mechanical site preparation would be completed prior to tree planting using a tractor with mounted brushrake. Brush, natural fuels, and logging slash up to 12 inches in diameter would be uprooted and piled for burning. Post harvest treatments in units with slopes greater than 35 percent would include hand cutting and piling to reduce existing fuel loading. Soil scarification would prepare a mineral-soil seedbed for natural regeneration. At least 50 percent of existing ground cover (duff), and all existing downed logs 12 inches and greater in diameter would be retained.

To ensure reforestation success, site preparation may be followed by tree planting (pine) if natural regeneration does not meet requirements. The objective is to reach acceptable stocking levels as soon as possible after site preparation to take advantage of reduced competition. First, third and fifth year stocking examinations would be completed in group selections to monitor seedling survival and stocking, regeneration and animal damage. When necessary, brush would be controlled by manual or mechanical release treatments in the short-term until planted and natural seedlings are tall enough to grow above the brush. Brush would eventually be shaded out as canopy cover increases over time.

Seedling release for survival would be accomplished as needed (using manual or mechanical methods) within 5 years of planting. The environment of small group selection openings is such that the development of shrubs, forbs, and grasses is slow. The shrub and herbaceous plant community is much less diverse and less developed in group selection openings than in clearcuts (McDonald and Abbott 1994). Grasses and forbs would be the primary competitor for soil moisture during the first 3-5 years. Control of grasses and forbs would increase seedling survival and growth and reduce potential for pocket gopher damage. Site preparation (tractor pile and rip) would increase initial tree growth and inhibit establishment of competing shrubs in the short-term. Manual and mechanical release methods would provide control of competing vegetation until the trees become established. Herbicide use is not being considered in this analysis. Manual release methods could include hand grubbing, matting, brush cutting, or tilling.

6. Pine Restoration

Pine Restoration Areas take advantage of existing large pine seed trees to re-introduce natural locally adapted seed sources back into the forest. Pine restoration areas would receive a heavy thin removing all trees under 30 inch dbh except the pine. Following thinning, Forest Service Fuels Specialists would evaluate the fuels to determine which acres would be treated by machine piling and burning, and/or underburning. The Pine Restoration areas would be monitored in the future and appropriate actions would be taken to ensure stocking levels are met in accordance with National Forest Management Act and the species mix is desirable.

7. Release Thin in Pine Plantations

These plantations are even-aged with low age/structure diversity. Thinning would reduce tree stocking and open up growing space. Mechanical thinning and brush removal would expose a mineral soil seedbed. This would create some opportunities for a new age-class to become established. Natural regeneration of shade tolerant white fir may increase near plantation edges where there is a seed source.

Plantations would be thinned to an average residual tree spacing of 16-20 feet or 110-170 trees per acre. Canopy cover would average approximately 40 percent after treatment. Post harvest treatments would include mechanical mastication/crushing or machine piling and burning of existing brush. Brush would not be treated in rocky inoperable areas (10-20 percent in some stands).

8. Aspen Release

Aspen clones are shade-intolerant and require the sun to warm the soil, which encourages the roots to sprout or sucker. In the West, aspen very rarely regenerate by seed, relying primarily on root suckering to establish new shoots. To regenerate existing aspen clones, all conifers 3.0 to 29.9 inches dbh would be removed.

Aspen have shallow root systems that are susceptible to damage from ground disturbance and compaction. Mechanical harvesting, designated skid trails, and whole-tree or tree-length yarding (skidding) would reduce potential for compaction. Tracked mechanical harvesters with mounted booms can reach and fell many trees from a single location without moving. This reduces the amount of travel throughout the stand resulting in less potential for ground disturbance and/or compaction. Large trees that exceed the limitations of the harvester would be hand felled. Skid-trails would be limited in the root zone of the aspen clone. If field surveys reveal that aspen has not regenerated due to soil compaction, a single pass tractor rip of designated

skid trails may be used to stimulate root suckering. In addition, if surveys indicate excessive herbivory of aspen shoots, a temporary fence may be erected around the area to exclude herbivores.

Fuels reduction would also stimulate root suckering by removing the insulating litter layer to permit solar radiation to warm the mineral soil. Therefore, following thinning, Forest Service Fuels Specialists and Silviculturists would evaluate the fuels to determine which acres would be treated to reduce fuels build-up and/or stimulate aspen regeneration. As aspen root systems are also susceptible to damage from concentrated burning, (large hand piles or machine piles) Hand pile construction would be limited in the root zone of the aspen clone. To reduce the potential for future conifer encroachment, young conifers smaller than 3.0 inches dbh would be cut and hand piled for burning.

9. Underburn Only

Prior to the HFQLG act, the Hat Creek Ranger District contracted the Wheel and Highway 44 timber sales to establish fuel breaks along the Highway 44 travel corridor and the National Forest System Road 33N16 which runs through the center of the project area. The tree removal has been completed but the underburning of the area is still to be completed. Currently, the stand structure meets DFPZ standards, but some areas may still need to be underburned.

10. Broadcast Burn

Brushfields are important habitat for many wildlife species including mule deer, neo-topical birds, and furbearers. Historical photographs show many brushfields being replaced by trees (See Chapter 1, Need to Improve Forest Health). Two brushfields have been identified within the North 49 project area which may be broadcast burned after mechanical treatments (mastication/crushing) to reduce conifer encroachment, regenerated the brush and enhance habitat.

11. No Treatment

Treatments would not occur within California spotted owl Protection Activity Centers (PACs) and Spotted Owl Habitat Areas (SOHAs), Off Base Deferred, and RARE II. Trees would not be removed within Riparian Habitat Conservation Areas (RHCA), however, because some RHCA are located within or on the edge of underburning treatment units, fire may back into these areas to some degree.

Alternative 1 - Proposed Action

How the Alternative Was Developed

Alternative 1, the Proposed Action was developed to achieve the purpose and address the needs using a combination of treatments intended to fully implement HFQLG. This alternative is an aggressive fuels treatment and removes a significant amount of biomass from the forest. Treatments follow the standards and guidelines of the SNFPA FSEIS, Appendix A, while focusing on maximum treatment. Compared to Alternatives 3 and 7, the Proposed Action establishes the most group selections, and has the most acres treated using the standard DFPZ thin from below to a 40 percent canopy cover. This alternative has the most area treated using the thin from below treatment.

Acres thinned would be evaluated by Forest Service Fuels Specialists to determine if fuels treatments are needed to reduce surface fuel loading and disrupt fuel continuity. Fuels treatments may include machine piling and burning, and/or underburning.

Treatments in alternative 1 include:

1) Thin from Below in DFPZ – 7,793 acres.
2) Modified Thin from Below with Retention Islands – 1,121 acres.
3) Thin from Below – 2,040 acres.
4) Group Selection – 584 groups for 1,168 acres.
5) Release Thin in Pine Plantations – 3,452 acres.
6) Aspen Release – 38 acres.
7) Underburn Only – 1,064 acres.
8) Broadcast Burns – 224 acres.

The North 49 Project area is approximately 42,400 acres in size. Alternative 1 would treat 16,900 acres, approximately 40 percent of the project area (Figure 8).

Defensible Fuel Profile Zone Layout for Alternatives 1 and 3

A DFPZ would be developed adjacent to National Forest System Roads (NFSR) 32N17, 32N31, and 32N25 from Highway 44 north to the existing DFPZ adjacent to Road 33N16. Another DFPZ would be developed adjacent to NFSR 32N16 from Highway 89 west to the existing DFPZ adjacent to NFSR 33N16. The total DFPZ would be approximately 10,680 acres.

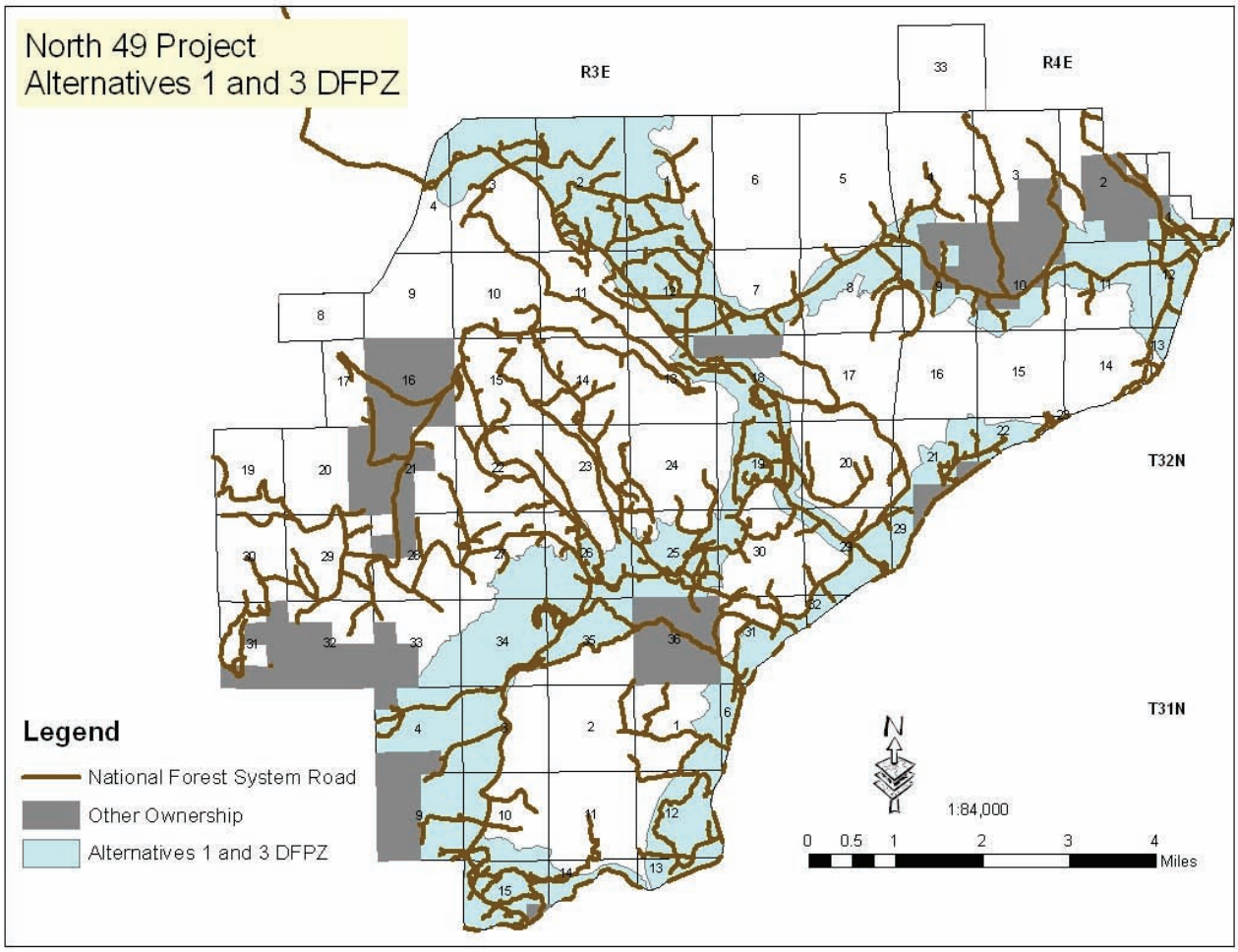

Figure 7. Map showing DFPZs under Alternatives 1 and 3

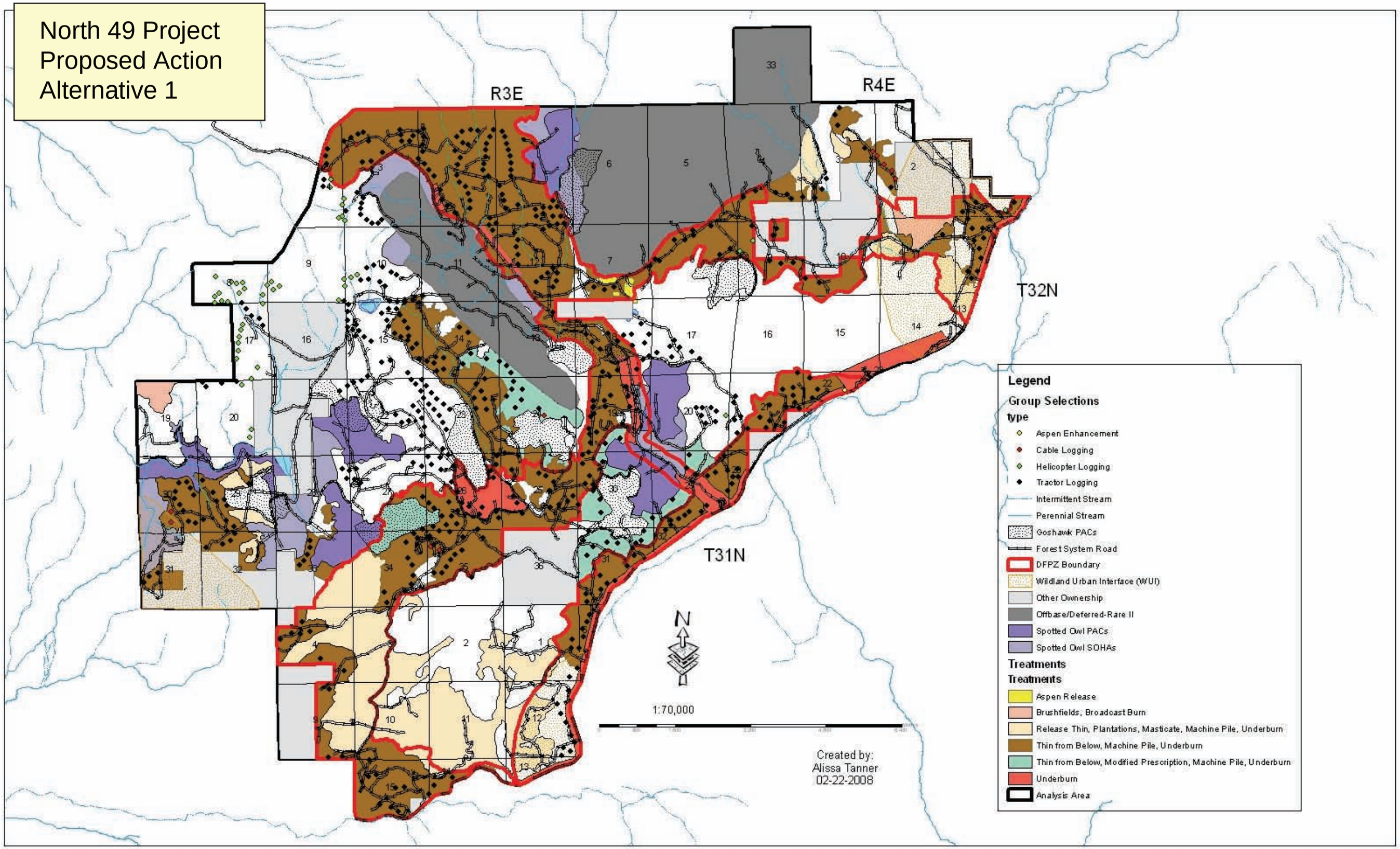

Figure 8. Alternative 1 – the Proposed Action

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Alternative 2 - No Action

Alternative 2 would result from a decision to not implement the North 49 Forest Health Recovery Project. This alternative would not achieve the purpose or address the need of the project, or implement the provisions of the 1992 LNF Land and Resource Management Plan, as amended by the Northwest Forest Plan FEIS, Final Supplemental EIS, the Herger-Feinstein Quincy Library Group Forest Recovery Act FEIS, FSEIS, and the Sierra Nevada Forest Plan Amendment FEIS, FSEIS and ROD.

The no action alternative provides a baseline for comparative analysis of the action alternatives. Although there would be no action to treat vegetation under this project, other activities in the North 49 project area such as road maintenance, fire suppression, firewood cutting, grazing, hunting, and OHV riding would continue. The project needs (described in Chapter 1) to improve fire resiliency, improve forest health, and improve forest diversity, reflect the problems of the current condition of the forest within the project area. Detailed affected environment descriptions for individual resources presented in Chapter 4, Environmental Consequences, further describe existing conditions. Under this alternative, those conditions would continue to exist and the unhealthy condition of the forest would worsen over time.

Figure 9 below demonstrates the current condition of a typical stand in the North 49 project area based on stand exam data. The density of the stand would increase over time.

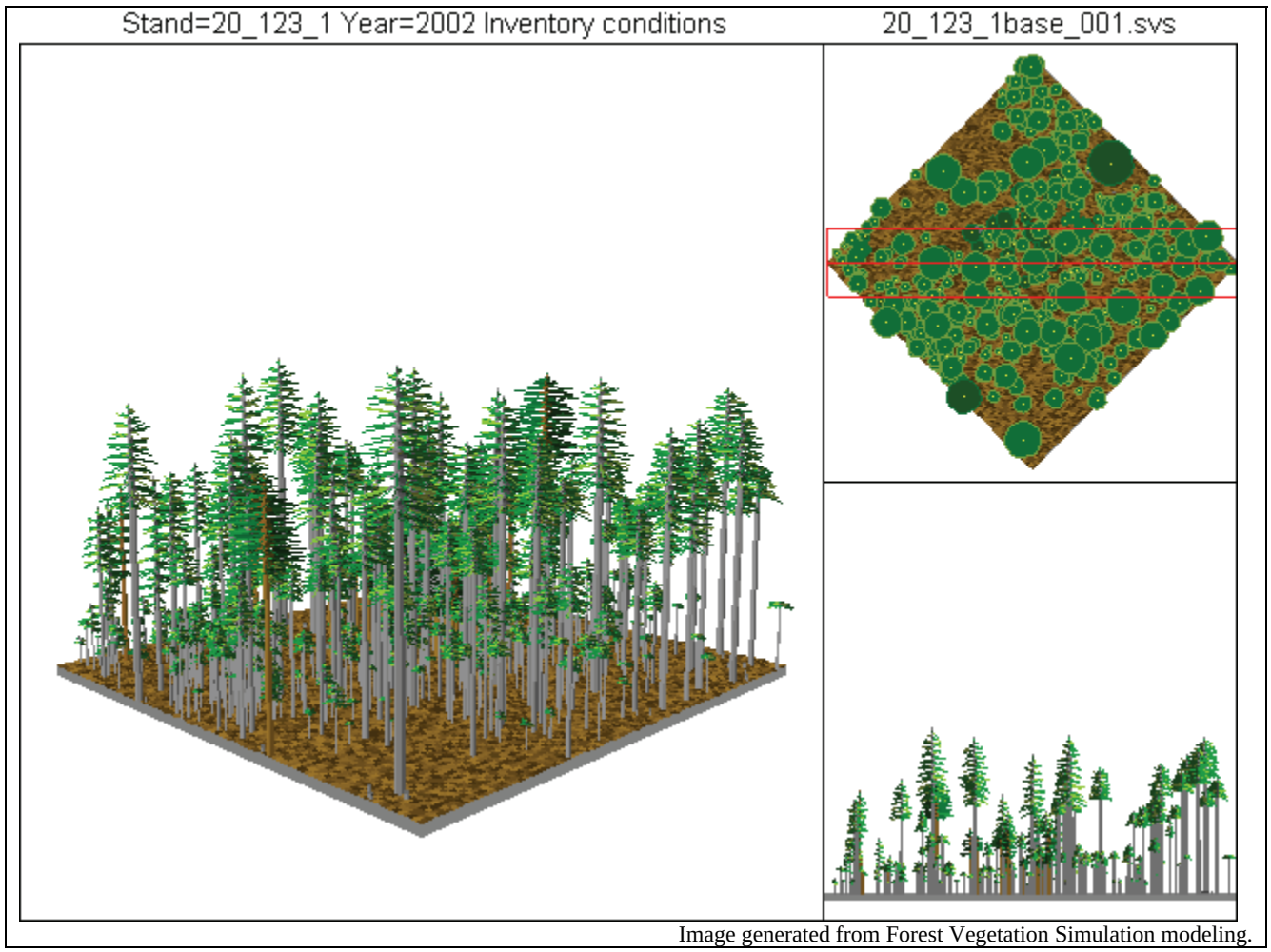

Image generated from Forest Vegetation Simulation modeling.

Figure 9. Example of the current condition

Alternative 3 - Modified Proposed Action

How the Alternative was Developed

Alternative 3 was designed to address a primary concern identified during scoping that the Proposed Action may impact late seral forests rendering them unsuitable for California spotted owl and northern goshawk habitat, and degrading furbearer travel corridors. Compared to Alternatives 1 and 7, Alternative 3 uses the least group selection treatments, and has the most acres treated with the modified thin from below to a 50 percent canopy cover with 10 percent leave islands.

Acres thinned would be evaluated by Forest Service Fuels Specialists to determine if fuels treatments are needed to reduce surface fuel loading and disrupt fuel continuity. Fuels treatments may include machine piling and burning, and/or underburning.

Including the following:

1) Thin from Below in DFPZ – 4,886 acres.
2) Modified Thin from Below with Retention Islands – 4,988 acres.
3) Thin from Below – 1,080 acres.
4) Group Selection – 340 groups for 680 acres.
5) Release Thin in Pine Plantations – 3,452 acres.
6) Aspen Release – 38 acres.
7) Underburn Only – 1,064 acres.
8) Broadcast Burns – 224 acres.

Alternative 3 would treat approximately 16,413 acres or 39 percent of the project area. The DFPZ location in Alternative 3 is the same as in Alternative 1(See Figure 10). Alternative 3 would treat more acres using a lower intensity modified thin, providing 50 percent overstory canopy cover within areas of spotted owl use.

Alternative 3 is designed to place lower intensity modified thinning treatments around the highest density of observed California spotted owl (CSO) areas. The modified thin from below with retention islands would remove forest structure throughout a majority of the stand, leaving only small retention islands with structure. The retention islands would provide cover for the prey of the CSO, northern goshawk, Pacific Fisher and American marten. However, the thin from below aspect of the treatment, removes forest structure which provides heterogeneity deemed necessary for suitable habitat.

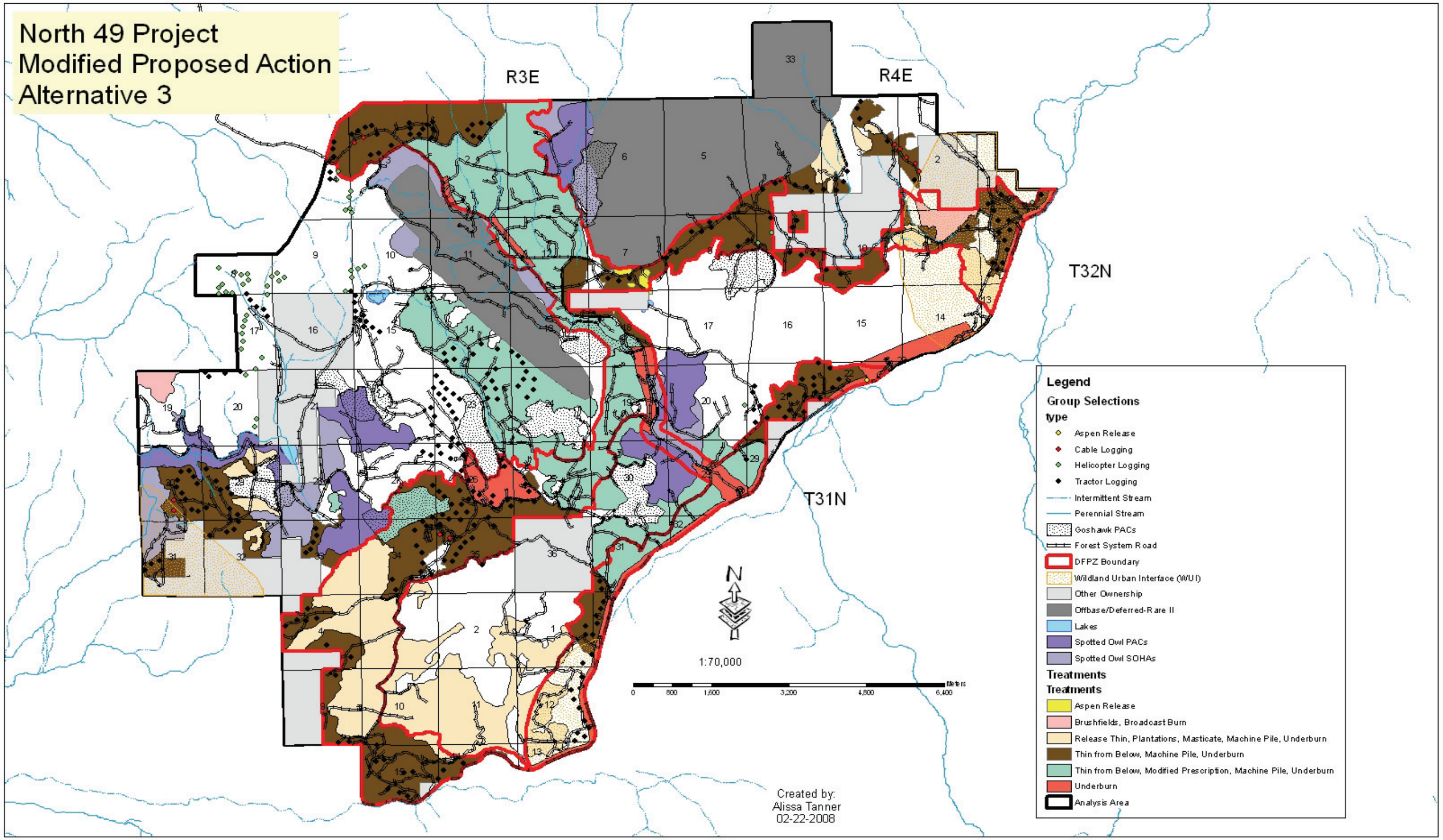

Figure 10. Alternative 3 Modified Proposed Action

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Alternative 7 (Preferred Alternative)

How the Alternative was Developed

Alternative 7, the Preferred Alternative, was developed to more effectively achieve the purpose and address the needs of the project while responding to substantive public comments and issues. As demonstrated in Chapter 1, a single significant Issue was identified and tracked through this EIS. The Issue identified is that the Proposed Action and Alternative 3 would degrade old forest habitats, rendering them unsuitable for old forest dependent wildlife including California spotted owl, northern goshawk habitat, Pacific fisher and American marten. Information gained from public involvement was utilized in the development of Alternative 7. Additional data (e.g. 1883 General Land Office notes) and the best available science was reviewed and used to develop Alternative 7.

Under Alternatives 1and 3, the DFPZ is up to 1.5 miles in width and impacts late seral forests by removing more structural diversity than is necessary to achieve the purposes of the DFPZ network. Under Alternative 7, the DFPZ would be constructed to an average width of ¼ to ½ mile (HFQLG FEIS). In the Manzanita Chutes area where fire history and existing brush indicate a potential for high intensity fire, the DFPZ width would be greater than ½ mile (See Figure 11). The location of the DFPZ changed somewhat to take advantage of natural barriers and previously thinned areas, and to align the DFPZ perpendicular to prevailing winds while duplicating the aggressive DFPZ fuels treatment of Alternative 1. This would help to decrease wildfire behavior by slowing momentum and providing firefighters with safe areas and opportunities to directly attack oncoming wildfires. The DFPZ treatments in Alternative 7 would not include retention islands, which would more effectively reduce fire behavior than the modified thin from below DFPZ sections treated under Alternative 3.

Realignment of the DFPZ reduces the impacts to suitable late seral habitat in five California spotted owl HRCAs by reducing the number of acres treated as DFPZ. Instead these acres would be treated under the Diversity Thin prescription to maintain a richer and more diverse stand structure. The DFPZ realignment also minimizes impacts to furbearer travel corridors by decreasing the number of acres affected by the more aggressive DFPZ treatment.

Treatments follow the standards and guidelines of the SNFPA FSEIS, while retaining suitable habitat. Rather than using a modified thin from below treatment (as in Alternative 3) this alternative utilizes a Diversity Thin treatment. A Diversity Thin prescription would treat through the diameter classes and leave up to 15 percent in retention islands resulting in improved structural diversity. This alternative would retain late seral wildlife habitat and would increase foraging habitat for American marten and other furbearers.

The Preferred Alternative establishes more group selections than Alternative 3 but less than Alternative 1(See Table 4). The location, composition and harvest method of each group identified in Alternative 1 was evaluated for inclusion in Alternative 7. The helicopter groups proposed in Alternative 1 were not included in Alternative 7, because they would impact late seral habitat important for American marten and would be economically limiting. In addition, several groups were not included because of concerns they would reduce suitable habitat necessary for the CSO. Lastly, groups located on unsuitable ground and in established research areas were not included. Groups whose composition included a high number of healthy sugar and/or

yellow pine were assigned a Pine Restoration treatment and would be thinned to enhance existing sugar pine and yellow pine which would act as seed trees to promote the regeneration of pine. Alternative 7 includes approximately 70 acres of Pine Restoration treatments.

The North 49 Project area has large old legacy trees and some of these would receive a radial thin of up to 50 feet to reduce competition and mortality. Although Alternatives 1 and 3 contain 38 acres of aspen release treatment, Alternative 7 would release 55 acres of aspen.

Acres thinned would be evaluated by Forest Service Fuels Specialists to determine if fuels treatments are needed to reduce surface fuel loading and disrupt fuel continuity. Fuels treatments may include machine piling and burning, and/or underburning.

Treatments for Alternative 7 include the following:

1) Thin from Below in DFPZ – 4,602 acres.
2) Diversity Thin – 5,222 acres.
3) Group Selection – 484 groups for 978 acres.
4) Pine Restoration – 70 acres.
5) Aspen Release – 55 acres.
6) Release Thin in Pine Plantations – 3,591 acres.
7) Underburn Only – 1,131 acres.
8) Broadcast Burns – 131 acres.

The North 49 Project area is approximately 42,400 acres in size. The Preferred Alternative would treat 16,093 acres (including 383 acres of lodgepole pine thinning), approximately 38 percent of the project area (Figure 12).

Defensible Fuel Profile Zone Layout for Alternative 7

A DFPZ would be developed adjacent to National Forest System Roads 32N17, 32N31 and 32N24 from Highway 44 north to Big Lake. In addition, a DFPZ would be developed adjacent to Highway 44/89 and continue down Highway 44 to the Lassen National Forest Boundary. The last DFPZ would be developed adjacent to National Forest System Road 33N16 (See Figure 11).

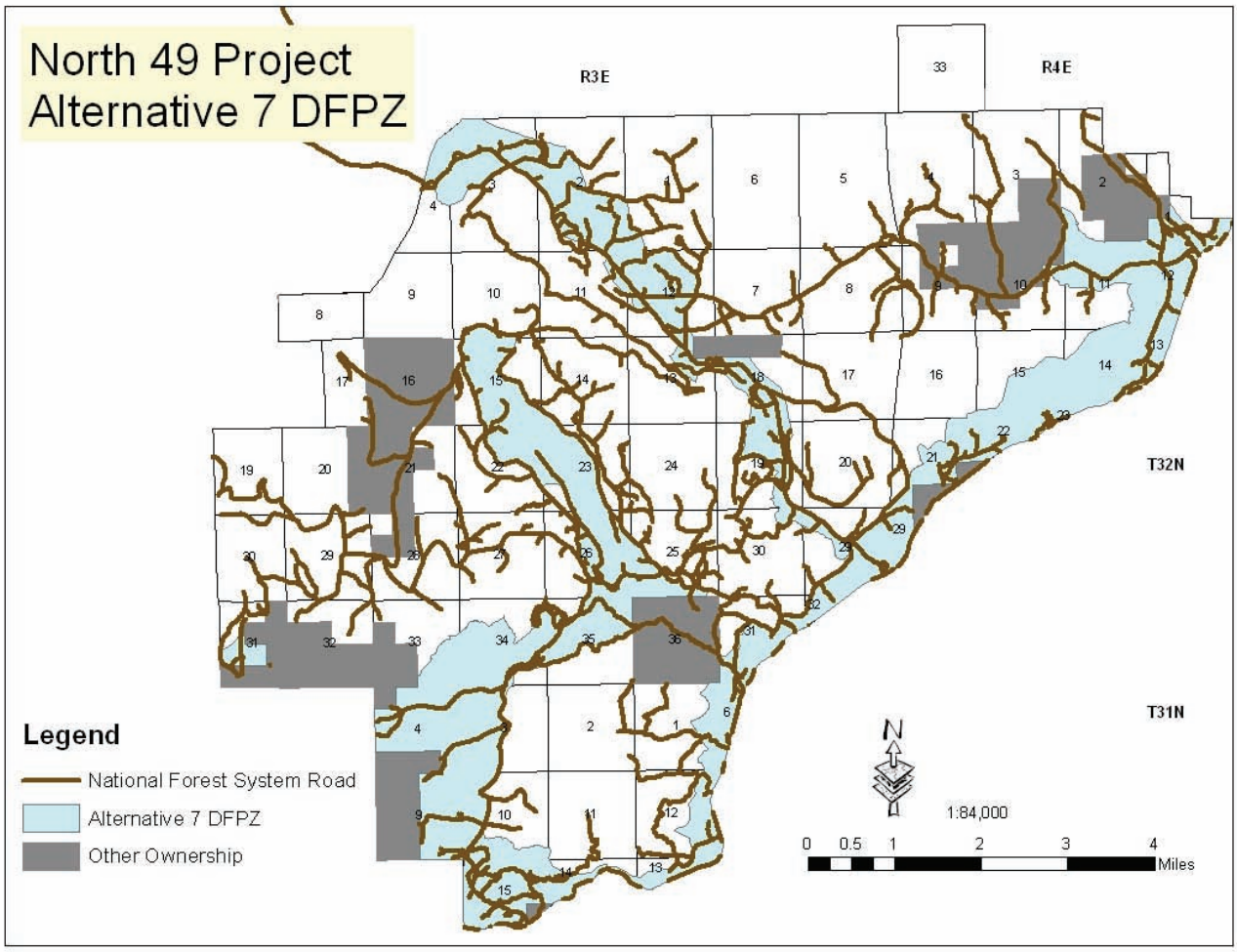

Figure 11. Map showing DFPZs under Alternative 7

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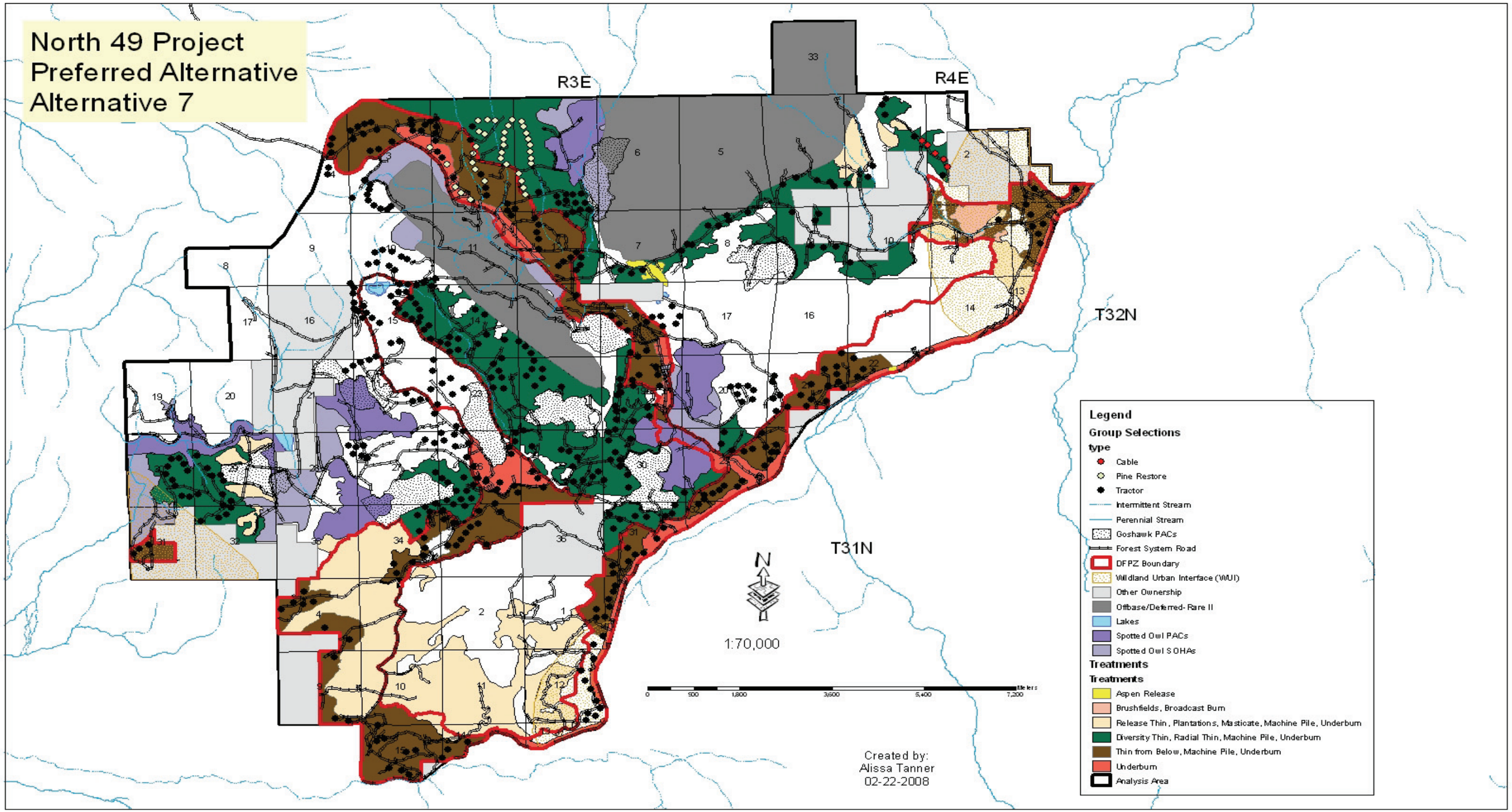

Figure 12. Alternative 7

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Comparison of Alternatives

Table 4 presents a comparison of the actions that would occur under each alternative. Table 5 compares the results of actions that would be implemented under each alternative, and their effectiveness of addressing the needs and achieving the purpose described above. A detailed description of effects by resource is presented in Chapter 4, Environmental Consequences.

Table 4. Comparision of Actions

Action	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Thin from Below in DFPZ(acres)	7,793	0	4,886	4,602
Thin from Below (acres)	2,040	0	1,080	0
Modified Thin from Below w/ Retention Islands (acres)	1,121	0	4,988	0
Diversity Thin w/ Retention Islands & Radial Release (acres)	0	0	0	5,222
Lodgepole Pine Thin	0	0	0	383
Group Selection (acres) [a]	1,168	0	680	908
Pine Restoration Areas (acres)	0	0	0	70
Release Thin in Pine Plantations(acres)	3,452	0	3,452	3,591
Total Aspen Release Acres[b]	38	0	38	55
Underburn Only (acres)	1,064	0	1,064	1,131
Broadcast Burn (acres)	224	0	224	131
TOTAL TREATMENT ACRES	**16,900**	**0**	**16,412**	**16,093**

Acres summed from master table in Appendix E.
[a] Group Selection: areas of intense harvest of two acres or less.
[b] Total Aspen Release Acres include a two acre aspen group.

Table 5. Comparison addressing Purpose and Need

Needs Addressed	Alternative 1 (Proposed Action)	Alternative 2 (No-action)	Alternative 3	Alternative 7 (Preferred Action)
Improve Fire-Resiliency (DFPZ)				
Flame Length (feet)	4	6	4	4
Rate of Spread (chains/hour)	5	9	5	5
Type of Fire	Surface	Passive Crown	Surface	Surface
Suppression Tactic	Direct	Indirect	Direct	Direct
Improve Fire-Resiliency (Area Thin)				
Flame Length (feet)	1	4	1	1
Rate of Spread (chains/hour)	2	5	2	2
Type of Fire	Surface	Passive Crown	Surface	Surface
Suppression Tactic	Direct	Direct	Direct	Direct
Improve Forest Health				
Number of acres post-thinning remaining above 60% SDImax (acres)**	601	10,484	2,522	0
Improve Forest Health				
Acres of fire-resilient species restoration Groups	1,168	0	680	908
Acres of aspen treated	38	0	38	55
Acres of Natural pine improvement	0	0	0	70

** Forests at 60% maximum stand density (SDImax) or greater are in the zone of imminent mortality. At this density, less vigorous trees die due competition and all trees are stressed making them susceptible to large-scale die-off due to drought, insects and disease.

Attributes Common to All Action Alternatives

Road Management

The following is a summary of the proposed improvements to the LNF transportation system needed to accomplish treatments for all action alternatives and mitigate existing adverse effects on water quality and soils:

1. System and Non-system road decommission

Approximately 0.3 miles of existing National Forest System Roads would be decommissioned and rehabilitated. This portion of the existing transportation system is in a poor location within an RHCA. In addition, approximately 0.5 miles of existing non-system roads would be decommissioned and rehabilitated. Rehabilitation would include subsoiling, recontouring, removing any drainage structures, and restoring vegetative cover and/or blocking access. This unauthorized road is in a poor location within a RHCA.

Approximately 30.8 miles of existing non-system roads and approximately 1.5 miles of existing system roads would be administratively decommissioned and closed to all future use.

2. Additions to the permanent National Forest Road System

Approximately 2.2 miles of existing non-system roads would be added to the forest transportation system under maintenance level two. These roads currently exist on the landscape but are missing from the current transportation system. These roads would be open to public use and maintained for high-clearance vehicle traffic.

Approximately 18.9 miles of existing non-system roads would be added to the forest transportation system under maintenance level one. These roads currently exist on the landscape but are missing from the current transportation system. These roads would be for administrative use only and closed to the public.

3. Temporary road construction

Two temporary roads, totaling approximately 0.5 miles, would be needed to implement planned activities and would be decommissioned and rehabilitated in the same year built to avoid potential impacts to water quality and soils. Rehabilitation would include subsoiling, recontouring, removing any drainage structures, and restoring vegetative cover and/or blocking access.

4. Water source improvements

Two existing water sources, Lost Creek and North Fork of Battle Creek below the reservoir, would be improved to provide water needed for the project and to support fire suppression efforts as needed. These water sources will be redesigned to meet BMP 2.21 Water Source Development Consistent with Water Quality Protection. Improvements would include sloping the approach ramp away from the stream and adding a sump to prevent any petroleum products from entering the stream.

5. Dust abatement

In addition to water, alternative dust palliatives may be used, including (but not limited to): magnesium chloride, lignosulfonate, and calcium chloride. Based on water source location and availability of other

treatment methods, the most economical solution would be utilized to reduce dust emissions and stabilize the road surface to provide for efficient haul as well as public health and safety, while limiting environmental impacts.

Table 6 summarizes changes to the transportation system that would be made with this project. Approximately 33.1 miles of existing road would be decommissioned, 21.1 miles of existing road would be added to the current forest transportation system and .5 miles of temporary road would be constructed and then removed following the completion of the project Figure 13 shows the locations of changes to the transportation system.

Table 6. Summary of transportation system activities (miles)

Road Type	Recommendation
Decommissioned and Rehabilitated Roads	0.8 miles
Administratively Decommissioned Roads - No Rehabilitation	32.3 miles
Roads Added to the System Open to the Public	2.2 miles
Roads Added to the System Closed to the Public	18.9 miles
Proposed Temporary Road	0.5 miles

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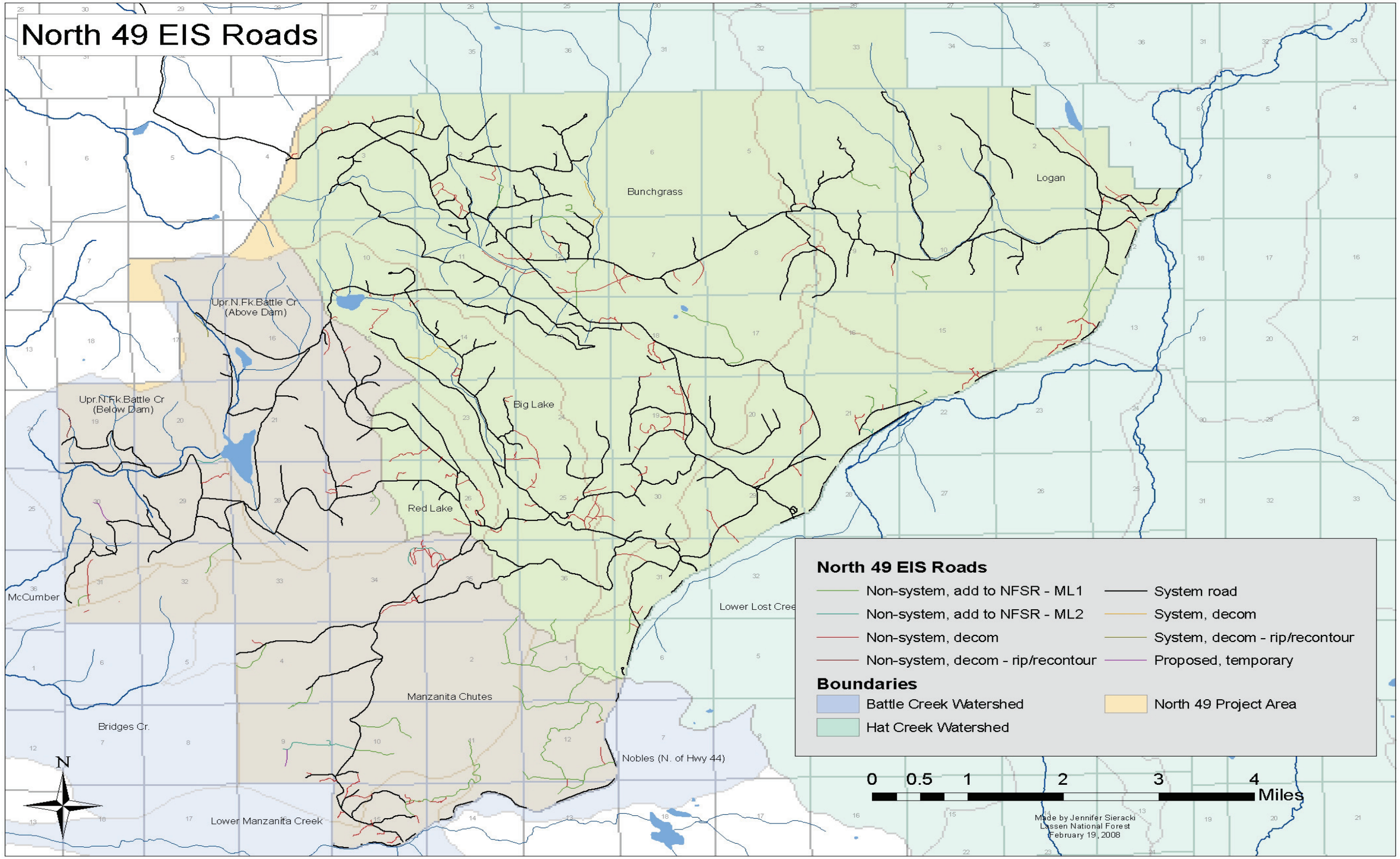

Figure 13. Proposed changes to the transportation system

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Mitigation Measures

In addition to measures in each alternative, the mitigation measures listed below are common to all action alternatives. Mitigation includes a combination of measures to avoid, minimize, reduce or eliminate negative effects to project area resources (40 CFR 1508.20). The following mitigation measures include standards and guidelines, and integrated design features. Integrated design features (IDF) are implementation parameters that would be incorporated into treatment contracts, or used to guide Forest Service personnel in conducting implementation. Integrated design features are developed by resource specialists to assure the avoidance and minimization of effects from the implementation of actions. Environmental consequences presented in Chapter 4 may include IDF's for individual resources. Integrated design features are also included in biological evaluations and biological assessments as mitigation measures designed to protect those resources. Integrated design features are included here because they are incorporated in to all action alternatives.

Best management practices (BMP) are watershed protection measures and techniques taken from Water Quality Management for Forest System Lands in California and are listed in Appendix C. (USDA FS 2000) This document provides guidance and procedures for actions that have a potential to effect watershed resources on national forest system lands throughout the State of California. Appropriate BMPs are determined by a hydrologist and incorporated onto action alternatives as mitigation measures to protect watershed resources including soils, aquatic resources, riparian areas, floodplains, wetlands and mesic meadows.

The following mitigation measures are organized by proposed actions and resources.

Thinning

1. Cut stumps of live true fir and pine trees would be treated with an EPA registered borate compound, which is registered in California for the prevention of annosus root disease. Stumps 14 inches diameter and greater would be treated with the borate compound.
2. Miscellaneous salvage of dead and dying trees would be completed as needed in DFPZs and Area Thin zones. Tree mortality caused by bark beetle activity is present with the potential to increase in densely stocked stands. Only dead and dying trees in excess of those needed for snags and those that pose a hazard to public safety would be removed.

Group Selection Treatments

1. Trees greater than or equal to 30 inches dbh would be retained.
2. Trees adjacent to group selection units that are infected with dwarf mistletoe (Hawksworth rating of 3 and above) would be high priority for removal to reduce the risk of spread to newly established seedlings.

3. Group selections would be placed in stands with an average diameter between 11 to 24 inches dbh (CWHR size class 4). Harvest entries would be based on cutting of suitable stands on a 175-year rotation and a 20-year cutting cycle.
4. Cut stumps of live true fir and pine trees would be treated with an EPA registered borate compound, which is registered in California for the prevention of annosus root disease. Stumps 14 inches diameter and greater would be treated with the borate compound.
5. Whole-tree or tree-length yarding would be required on slopes less than 35 percent. Mechanical site preparation (tractor pile and rip) would be completed to prepare a mineral soil seedbed and remove competing vegetation. Tree planting would be completed to augment natural regeneration. Seedling release for survival would be accomplished as needed (using manual or mechanical methods) within 5 years of planting.

Aspen Enhancement Treatments

1. Where conifer removal would be used to release remnant aspen clones, treatment units would be designated on the ground to maximize sun exposure, soil heating, and reduce potential shading from adjacent conifers. The extent of aspen clones would be determined by identifying remnant aspen trees or snags growing amongst the conifers. Treatment unit boundaries would be designated from the edge of the clone outward 1.5 to 2 times the height of adjacent trees to create openings of sufficient size.
2. All conifers 3 to 30 inches dbh would be removed. To reduce the potential for future conifer encroachment, all young conifers 4 inches dbh and smaller would be cut and hand piled for burning. Aspen units would not be planted with conifer seedlings.
3. Mechanical harvesting, designated skid trails, and whole-tree or tree-length yarding would be required where applicable. Skid trails would be limited in the root zone of the aspen clone. A single pass tractor rip of designated skid trails would be completed post harvest to stimulate root suckering.
4. Concentrations of existing down woody material (up to 9 inches in diameter) would be hand piled and burned to reduce overall fuel loading. Residual aspen and conifers $\geq$ 30 inches dbh would be protected during burning by piling heavy fuels outside the dripline. Construction of hand piles would be limited in the root zone of the aspen clone.
5. Temporary fencing could be constructed to restrict deer access to newly established aspen suckers in order to avoid excessive damage or threat to regeneration success. Temporary fencing would be maintained until established suckers are tall enough to be out of reach of browsing deer (up to10 years).

Fuels Reduction - Prescribed Fire/Mechanical Treatments

1. During implementation of machine piling, small tractors would be used to limit damage to residual trees. Machine piles would be constructed in openings to limit tree scorch during burning.

2. During implementation of underburning, no ignition would occur within RHCAs. Fire would be allowed to back into the RHCAs to achieve low intensity burning. (See also Watersheds/Soils/Fisheries/Aquatic Resources)
3. All burning would be conducted on permissive burn days within the air quality constraints of Shasta County.
4. Firelines (control lines) would be roads, skid trails, natural barriers, handlines or machine lines (ATV or tractor).
5. The brushfields would be broadcast burned. Depending on timing, they could be burned anytime from spring through fall. Some contour mechanical treatments (crushing/mastication) could occur to facilitate the burning operation. The firelines around the brushfields would be a combination of roads, mechanical line and handline. Some brush piling and/or handpiling could take place to improve the fire lines for holding operations.

Wildlife

1. The six largest snags per acre larger than 15 inches dbh would be retained within red fir stands. The 4 largest snags per acre would be retained throughout all other treatment areas (when available) except within primary corridors of DFPZs (1 tree height from road). In addition, 2 to 3 trees per acre with unique branching, spike or multiple tops would be retained (when available). Oaks greater than 8 inches in diameter would be retained.
2. A Limited Operating Period (LOP) would be in effect from March 1st through August 15th within 1/4 mile of known California spotted owl nests.
3. A LOP would be in effect from February 15th through September 15th within 1/4 mile of Goshawk Protected Activity Centers (GPACs).
4. Goshawk territories would have a designated 200-acre protected area around the activity center (GPAC). When thinning in the GPACs, no mechanical treatments would be allowed within a 500-foot radius buffer around any nest tree.
5. An additional 200-acre GPAC, around nesting sites of northern goshawks, would be established if a new territorial goshawk is located during implementation.

Heritage Resources

1. Heritage sites that are in or potentially eligible for listing in the National Register of Historic Places, and that project activities could affect, would be protected using Standard Resource Protection Measures (SRPMs).
    a. Heritage personnel would flag/mark site boundaries for exclusion from project activities. No project activities would occur within the flagged boundaries except as provided for in the remainder of this (Heritage Resources) section.

   b. Buffer zones would be flagged/ marked as needed to provide additional protection to sites.
   c. Foreign non-archaeological material may be placed over sites to prevent surface and subsurface impacts.

2. Forest heritage personnel may also develop and implement additional protection measures, in consultation with the California State Historic Preservation Office.
3. Historic trail segments (and as appropriate other linear sites) would receive protection specific to the site type. Heritage personnel would flag and mark a buffer zone extending 25’ to each side of the trail centerline. All treatment activities, including hand or machine piling for burning, would be excluded from the buffer zone except:
   a. Trees within the buffer zone may be hand-treated or removed with shearing equipment, as long as the mechanical equipment footprint remains outside the buffer zone and trees are not felled onto or dragged across the trail.
   b. Prescribed burning would be allowed through trail buffer zones.
   c. Equipment may cross linear sites (such as historic trails) only where the sites lack integrity. Heritage personnel would identify and flag/mark these locations prior to project implementation.
4. No temporary road construction would occur within cultural sites.
5. Where existing roads cross a site, no maintenance, reconstruction, or ground disturbance (such as ripping) associated with decommissioning would occur within the site boundaries. Individual exceptions for maintenance may be identified if, at the time of flagging, heritage personnel specifically assess the potential for road-related impacts, and thereby determine that maintenance would not affect site attributes (such as artifacts, features, and setting) relevant to its values.
6. Sites crossed by roads would be monitored when they are flagged, and the need for post-implementation monitoring assessed to determine whether road use is affecting the site. In addition, vehicles and/or equipment must remain within the road prism while crossing sites, and no equipment staging would occur within sites.
7. Should applied protection measures prove inadequate, or if the project cannot be adjusted to provide for site protection, any potentially affected historic properties must be evaluated for their eligibility to the National Register of Historic Places (NRHP) before treatment-related impacts occur. Mitigation plans (such as data collection) would be developed if appropriate.
8. Treatment areas having very dense brush may not allow for adequate survey prior to project implementation. The 2001 Programmatic Agreement provides for monitoring during project activities, and the 2004 Interim Protocol provides for survey following brush removal if such removal provides adequate survey conditions. For this project, during-project monitoring would apply only where there is reason to suspect a site in a *specific* location. Post-implementation monitoring would apply where areas not surveyed due to dense brush cover are opened up by the project.

9. Heritage personnel would monitor a sample of heritage resources after project completion, to assess the effectiveness of the SRPMs.
10. Should additional cultural resources be discovered within the treatment area during project implementation, work must stop immediately within 20 meters (approximately 65') of the resource, with the find reported to the District Archaeologist as soon as possible. Work within 20 meters of the resource would resume only when a qualified archaeologist has had the opportunity to view the site and to identify and implement any needed protection measures.

Watershed/Soils/Fisheries/Aquatic Resources

1. In anadromous watersheds (Battle Creek and Old Cow Creek), protection of aquatic habitats is provided under the Long Term Strategy for Anadromous Fish-Producing Watersheds. Under this direction, all perennial streams are assigned a RHCA buffer width of 300 feet on each side of the stream in which Riparian Management Objectives (RMOs) are maintained.
2. For the non-anadromous watersheds, (Hat Creek) protection of aquatic habitat is provided under the 2004 SNFPA FSEIS and ROD. Under these guidelines, all perennial fish-bearing streams are assigned a RHCA buffer width of 300 feet on each side of the stream. Any perennial non-fish bearing streams are assigned a RHCA buffer of 150 feet on each side of the stream.
3. Seasonal streams are assigned a 100-foot RHCA for each side of the stream in both anadromous and non-anadromous watersheds.
4. Meadows greater than one acre will receive a 150-foot buffer. Meadows and wetlands of less than one acre will receive a 100-foot buffer.
5. Riparian species (alder, willow, aspen, etc.) would not be removed;
6. Existing landings and skid trails would be used whenever possible and designated prior to the start of operations. Existing landings would be used only where non-point source sediment movement could be controlled. Existing landings located within RHCAs would be tilled and/or ripped when operations are completed.
7. New roads and landings would be located outside of RHCAs, except for designated stream crossings.
8. Ground based (tractor) logging systems would be used on slopes less than 35 percent. In the Logan Management Area, tractor logging would not occur on cinder cone slopes steeper than 20 percent except after an appropriate evaluation. Cable or helicopter systems would be used on slopes greater than 35 percent.
9. Best Management Practices (see Appendix C) would be followed to ensure water quality objectives and beneficial uses of water are maintained.
10. For the unmapped drainage in the Ashpan area with no sign of recent scour or deposition. Protection measures would consist of a 50 foot buffer at the head of the drainage to protect from headcutting and

a 50 foot buffer for areas of the drainage that contain sediments and where the channel is not boulders or bedrock.

11. Soil moisture conditions in treatment areas located outside of RHCAs will be evaluated using Forest established visual indicators before equipment operations proceed;
12. Aerial extent of detrimental soil disturbance will not exceed 15 percent of the area dedicated to growing vegetation.
13. Subsoiling operations on group selection treatments, detrimentally compacted landings, and detrimentally compacted skid trails will be assessed on a site-specific basis. A soil scientist or hydrologist will be consulted prior to subsoiling operations.
14. Lassen National Forest *Wet Weather Operations* and *Wet Weather Haul Agreement* will be followed during logging operations.
15. Post treatment areas lacking suitable ground cover necessary to prevent erosion and transport of sediment into surface water would be covered with native material so that a minimum of 50 percent ground cover is maintained.
16. Prescribed fire within the RHCAs will be applied as follows:
    a. No ignition within RHCA boundaries.
    b. Fire may back into the RHCA.
    c. Maintain 90 percent ground cover within RHCA.

Threatened, Endangered, Sensitive (TES) and Special Interest Plants

1. All occurrences of *Astragalus pulsiferae* var. *suksdorfii* would be protected from all project activities through flag and avoid methods, with the exception of those plants growing on Road 32N56Y near Ashpan Flat, and any plants north of the Bear Wallow Road (32N16) that are found within the aspen treatment units. All locations will be displayed on contract maps as control areas.
2. Slash piles and burning will be located outside of the *Astragalus pulsiferae* var. *suksdorfii* occurrence found within Aspen treatment units.
3. No hauling or road maintenance activities would be allowed on native surface or unclassified roads found within the extent of the *Astragalus pulsiferae* var. *suksdorfii* occurrence through Bunchgrass Valley.
4. Ditch cleaning would not occur along the Bear Wallow Road (32N16) within the boundaries of the *Astragalus pulsiferae* var. *suksdorfii* occurrence as it pertains to T802 (ditch cleaning) specs.
5. Known *Hierochloe odorata* occurrences will be flagged prior to project implementation and the location displayed on contract maps.
6. All burn piles will be placed at least 25 feet outside of known *Hierochloe odorata* occurrences.

7. During underburning activities, firelines will not be constructed within known *Hierochloe odorata* occurrences.
8. No Sporax would be applied within 25 feet of known Sensitive and Special Interest Plants, or within 25 feet of standing water.
9. Any newly discovered occurrences of TES species would be flagged for avoidance.

Noxious Weeds

1. All off-road equipment would be weed-free prior to entering the forest. Equipment would be staged in weed free areas. Mulch or fill required for the project would be certified weed free.
2. Known noxious weed infestations would be identified, flagged where possible, and mapped for this project. Identified sites within or adjacent to the project area containing isolated patches with small plant numbers would be treated (hand pulled or dug) prior to project implementation. This includes all known occurrences of Klamathweed located within the project area. Occurrences of Scotch broom and squarrose knapweed found adjacent to the project area would be surveyed prior to project implementation and treated if needed. Any larger or unpullable infestations would be avoided by harvesting equipment to prevent spreading weeds within the project.
3. New small infestations identified during project implementation would be evaluated and treated according to the species present and project constraints and avoided by project activities. If larger infestations are identified after implementation, they would be isolated and avoided by equipment, or equipment used would be washed after leaving the infested area and before entering an uninfested area.
4. Post project monitoring for implementation and effectiveness of weed treatments and control of new infestations would be conducted as soon as possible, and for a period of multiple years after completion of the project.

Road Management

1. Roads used for project implementation would receive pre-haul maintenance where deemed applicable by Forest Service engineers and resource specialists. Pre-haul maintenance activities include (but are not limited to): slide and slump repair, ditch cleaning, surface blading, opening roads, surface repair, surface stabilization, drainage structure cleaning and repair, and vegetation removal (brushing).
2. Aggregate surfaced roads would be properly shaped during grading to prevent or reduce the concentration of water.
3. Stream crossings would be upgraded, as identified on a case-by-case basis, to reduce the risk and consequence of road failures.

4. Since there are only two water sources available for this project, it may not be feasible to water all the roads as frequently as necessary to control dust during operations. Therefore, a dust palliative may be applied to prevent the release of dust from the road.
5. Dust palliatives will not be applied within 25 feet of all surface water where feasible.

Chapter 3. Affected Environment

Introduction

This chapter describes the environment of the North 49 Project Area that would be affected by the proposed action or alternative actions if implemented. The affected environment is the foundational setting of current physical and biological resources, and socio-economic conditions potentially affected by, or influencing the planning of this project. The following description provides the basis of understanding the resources and conditions that would change under the implementation of the proposed action or alternative actions presented in Chapter 2. Understanding the affected environment helps link the project's stated Purpose and Need with the potential environmental consequences of the alternatives, and is necessary to understand the comparative analysis presented in Chapter 4, Environmental Consequences.

Geology and Topography

The Forest is named after Lassen Peak, an active volcano located within Lassen Volcanic National Park. Millions of years of volcanic activity have covered about 85 percent of the Forest with volcanic terrain. In the southwestern part of the Forest, this terrain has steep slopes, deeply-cut steams, and some landslide potential. The southern part of the Forest has non-volcanic geology – granitic, metamorphic, and sedimentary rocks. The highest elevations of the Forest were carved by glaciers during the last Ice Age. (LRMP 1992)

The following information is taken from Fire in California's Ecosystems, Chapter 10: Southern Cascades Bioregion by Carl N. Skinner and Alan H. Taylor. The North 49 Project area is part of the Southern Cascades Bioregion which is bounded on the west by the Sacramento Valley and the Klamath Mountains, and on the east by the Modoc Plateau and Great Basin encompassing both Mt. Shasta and Mt. Lassen. The Cascades are geologically young and characterized by prominent volcanic peaks (some recently active) and stand above an extensive mainly basaltic plateau. In parts of the central and southern Cascades, volcanics overlie granitic and metamorphic rocks similar to those of the Klamath Mountains and Sierra Nevada.

Overall, topography in the southern Cascades is gentler than that in the Klamath Mountains of the Sierra Nevada. Elevations range from about 196 feet in the southwestern foothills adjacent to the Sacramento Valley to 14,162 feet at the summit of Mt. Shasta. The topography of the North 49 Project straddles the crest of the Southern Cascades and ranges in elevation from 4,500 to over 7,000 feet. Other notable topographic features include the 10,462 ft Mt. Lassen, the Medicine Lake Highlands, Butte Valley, Hat Creek Valley, Burney Falls, Shasta Valley, and the Pit River canyon. Both the Klamath and the Pit rivers originate east of the Cascade crest and breach the range as they flow westward toward the Pacific Ocean.

The North 49 project area is located in a topographical narrows, often described as the neck-of- the -hourglass. This area is the junction of the southern Cascade Range and the northern Sierra Nevada. This junction is a narrow crest with the front country of the Sacramento Valley to the west and the volcanic overlain Hat Creek Valley and Hat Creek Rim to the east. This is the narrowest section of the crest in the extension of the Cascade and Sierra Nevada ranges. This topographical feature makes the area highly important as a wildlife corridor for north to south movement along the crest.

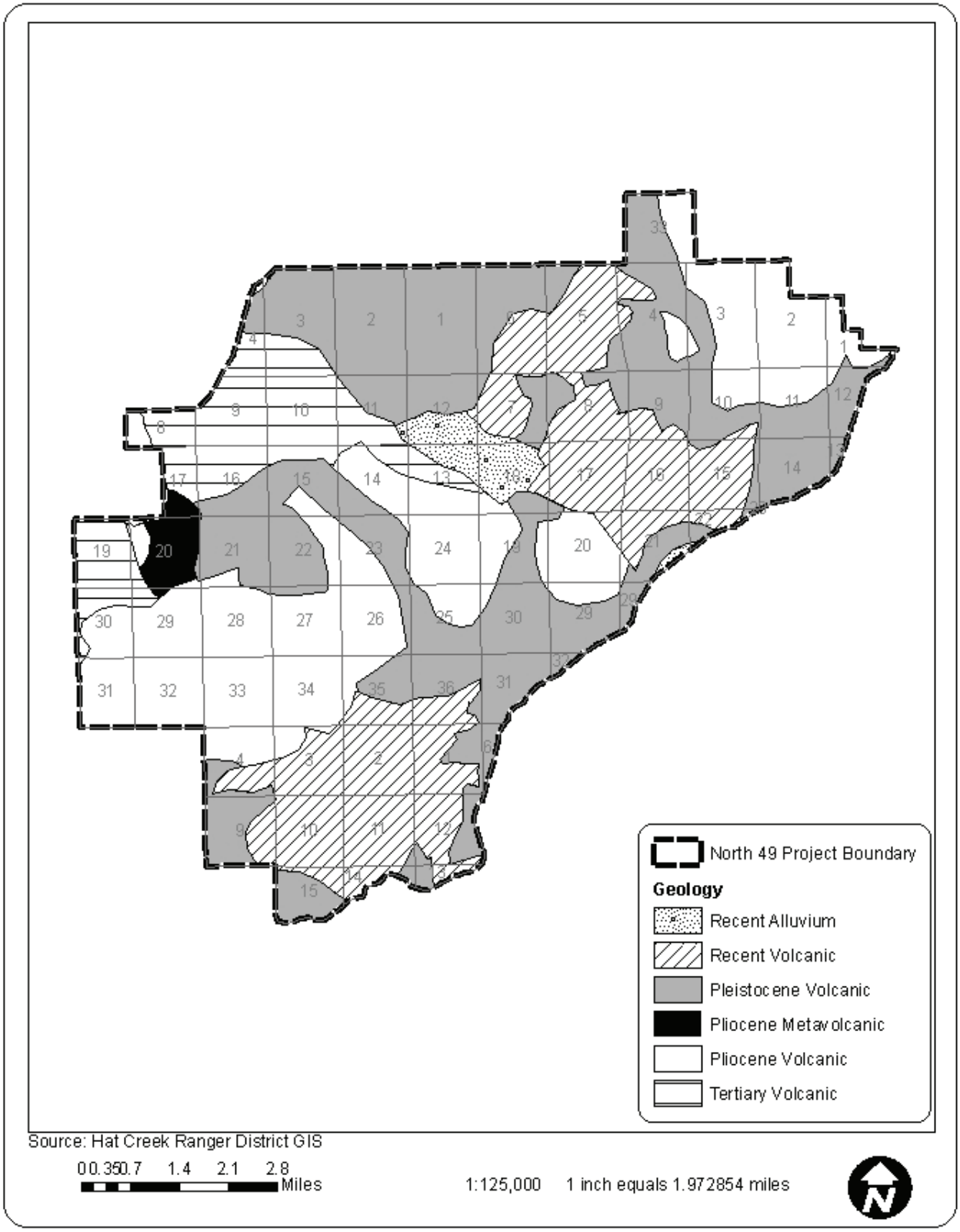

Figure 14. Geology of the project area

The geology of the area is dominated by the volcanics of the High Cascades and Modoc Plateau. While the area is underlain by lake deposits, these have been buried in the project area by ash and lava as part of the

volcanic activity of Mt. Lassen, now within Lassen Volcanic National Park, which is adjacent to the project area to the southeast. Historically documented events influencing the project area include the emergence of Chaos Crags and the collapse of the Chaos Jumble during the 1700s, and the eruptions and mudflows of Lassen Peak in 1915 (Alt and Hyndman, 2000). Earlier events than the 1915 eruption deposited lava in parts of the project area where soil development has been limited, other than small depressions which have captured wind and water-borne soils and act as 'flower pots' (see Figure 14).

Climate

Science has used many terms and systems to classify the world's climate. The use of biomes, "a large geographic area of distinctive plant and animal groups, which are adapted to that particular environment" provides a good base from which to begin characterizing the North 49 Project Area. (http://www.blueplanetbiomes.org/world_biomes.htm)

The North 49 project area is part of the Forest Biome, which encompasses approximately one-third of the earth's land area and accounts for over two-thirds of the leaf area of land plans. The forest biome also contains approximately 70 percent of carbon present in living things. Prior to the last major ice age, the world was dominated by tropical forest, but when the ice receded, the Northern Hemisphere's climate had changed to accommodate a temperate forest dominated by conifers and hardy deciduous trees. The area can further be delineated as Mediterranean forest where precipitation is concentrated in the winter in the form of snow fall and summers are hot and dry. (http://www.ucmp.berkeley.edu/exhibits/biomes/forests.php)

Using historical weather observations from the Manzanita Lake remote automated weather station (Figure 15 and Figure 16) located in the Lassen Volcanic National Park, an inference can be made of the average seasonal weather conditions encountered in the North 49 Project Area. Over the past 50 years the annual precipitation in the North 49 Project Area has averaged 41 inches with a majority of the precipitation falling in the months of October through May. Temperatures range from an average low of 20˚ F in the winter to an average high of 80˚ F in the summer. The prevailing wind direction is out of the southwest with frontal systems frequently pushing winds from the west, northwest. The Cascade Range averages 49.5 lightning strikes per 100 square miles per year (Skinner and Taylor et al. 2006).

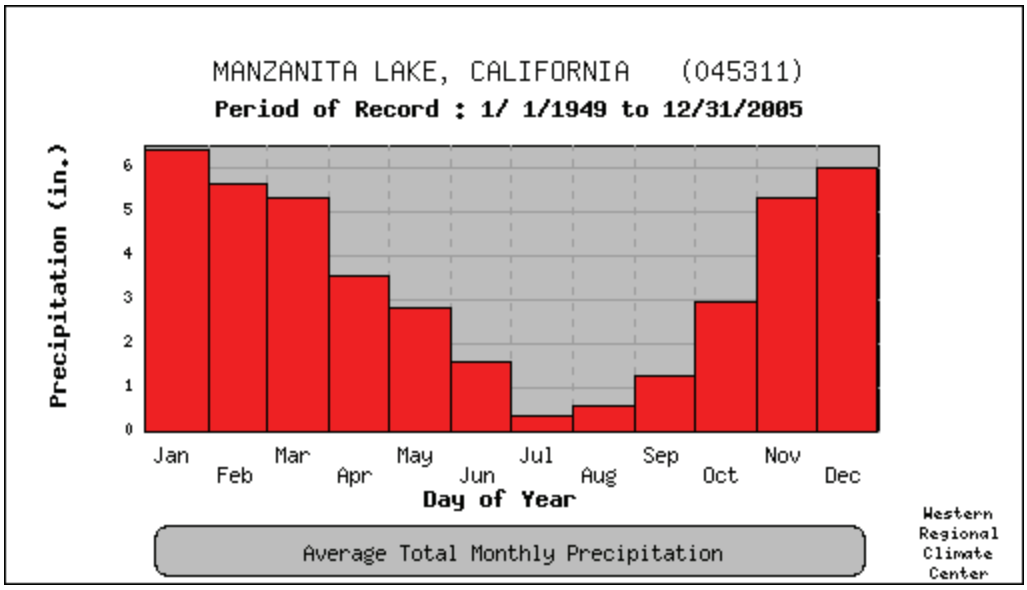

Figure 15. Average monthly precipitation for Manzanita Lake, CA based on data from 1949 through 2005 (http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?camanz+nca)

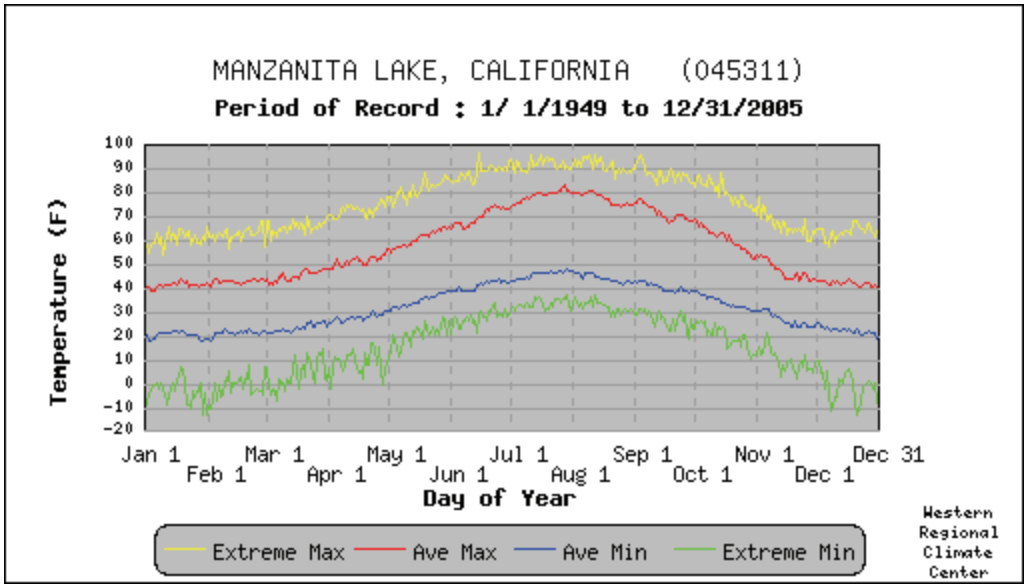

Figure 16. Average monthly temperatures for manzanita Lake, CA based on data from 1949 through 2005 (http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?camanz+nca)

Soils

The soils in the project area all derived from volcanic sources, primarily basalts and andesites. Cinder cones are also fairly prominent on the landscape and scattered glacial deposits can be found in the northwestern part of the project area. The oldest rocks in the project area are Tertiary (over 2 million years old) volcanics found north of Battle Creek Reservoir. Recent (less than 10 thousand years old) volcanics are found in both the south and eastern part of the project area. These areas have a high proportion of surface rock. The geology strongly influences both the soils and hydrology for this area.

The volcanic flows have thin rocky soils that tend to have high water infiltration rates. Due to this high infiltration rate, most of the precipitation runoff goes subsurface quickly.

Most of the soils range from fine sandy loam to gravely sandy loam with many rock fragments. The more recent volcanic areas tend to have thin soils with areas of deeper soils interspersed among the rock outcrops. Overall soils in the project area have a low to medium erosion potential, except in the northern part of the project area, most notably north of Battle Creek reservoir, where many of the soils originate from rhyolitic or weathered andesites and are highly erodable, particularly on steeper slopes when the ground cover is removed.

The North 49 project area has had 23 timber sale projects occur within the project boundary over the last 32 years. Prior to 1976, the area has been logged for railroad and other timber needs. There is evidence in isolated areas of legacy compaction and soil disturbance from both railroad and logging operations over the years. Erosion has occurred on slopes in the north-central area in the vicinity of 33N16 (UTM 0617091/4501670) exposing a gravelly, cobbly, and stony substrates. The erosion is likely due to recent rain-on-snow events.

All areas sampled and observed, with the exception of aforementioned eroded acreage in the north-central portion of the project area, had sufficient ground cover (>90 percent cover) to prevent soil loss from erosion. The area exposed to excessive erosion appears to have lost some soil productivity and has minimal remaining ground cover. No active erosion or sediment movement was observed on any areas surveyed that would indicate a loss in soil productivity. Some erosion and sediment movement was observed on road cuts and fills, culvert drains, and in ditches.

Soil porosity loss was the primary soil disturbance identified on the surveyed sites. Most detrimental loss of porosity was observed on existing landings and main skid trails. Within the ten areas observed, approximately 6 percent (5 of 185) of the tile-spade samples indicated the presence of detrimental soil compaction. The areas that were considered to have been detrimentally compacted were found in skid trails and landings. Soil recovery from detrimental compaction was observed in many of the existing skid trails and landings.

Straight blade machine piling of clearcuts is usually the main cause of soil organic matter loss, and this was not observed in plantation areas. Surface erosion was observed in one sample site and is likely due to previous rain-on-snow events. Surface erosion was not identified on other sampled areas, and soils in the area have a low EHR, so loss of organic matter by erosion is low. In the project area, loss of soil organic matter is limited to landings and the first few hundred feet of the main skid trails leading to landings. However, soil organic matter loss probably exceeds standards only on small portions of the landings and main skid trails. Based on the history of use in the area, and the site-specific sampling, it is assumed that the area meets the standard for soil organic matter.

All sites, with the exception of one sample site, met the LRMP standard for litter and duff of 50 percent or greater ground cover. The majority of sites averaged 1-2 inches of duff and litter over 95 percent of the sampled area. One sample site had experienced erosion and a majority of the fine organic litter and duff were removed. One sample site had a thinner thickness of duff and litter (~ 1 inch) but met standards sufficiently. All ten sampled and observed sites had an average of three 12 inch dbh or greater logs per acre.

Based on the 10 areas sampled, the project area meets the applicable LRMP soil standards for cover, soil organic matter, and litter and duff with the exception of one sample site. The LWM standard was met on all of the areas sampled, and based on other observations; it is likely that the project area meets the LWM standard. The soil standard for porosity was met on 94 percent of the areas sampled. It is expected that if projected across the project work area that percentage may be somewhat lower given legacy compaction.

Hydrology

There is mixed ownership within the watershed among private entities, the Forest Service, the National Park Service, and the State of California. The Forest Service manages most of the land in each of the watersheds except Bridges Creek, Lower Manzanita, and McCumber (Table 7), where private land makes up 94 percent, 97 percent, and 53 percent of those watersheds respectively. These lands are actively managed for timber by SPI, Fruit Growers, Inc. and Beatty. The Forest Service owns 100 percent of the land in Red Lake watershed and 98 percent of the Bunchgrass watershed. The National Park Service manages 28 percent of the land in Nobles sub-watershed and 21 percent of the land in Lower Lost Creek sub-watershed. Those areas may have fuels reduction projects, but no timber harvest activities would occur in those areas.

Table 7. Subwatersheds and land ownership within the project area

Watershed Name	Sub-watershed Number	Sub-watershed Name	Sub-watershed Acres	Land Ownership % of Sub-watershed			Project area acres within Sub-watershed	Percent of Sub-watershed within Project Area
				USFS	Private	Other*		
Battle Creek	BC16	Lower Manzanita Cr.	5,632	47%	53%	0%	504	9
	BC17A	Nobles (N. of Hwy 44)	2,776	72%	0%	28%	1,393	50
	BC18	Bridges Cr.	4,193	1%	94%	5%	485	12
	BC18A	Manzanita Chutes	5,730	81%	19%	0%	5,386	94
	BC19	McCumber	3,837	2%	97%	1%	143	4
	BC20	Upr.N.Fk. Battle Cr (Below Dam)	3,183	77%	5%	18%	2,602	82
	BC20A	Upr.N.Fk. Battle Cr (Above Dam)	4,200	70%	30%	0%	4,175	99
Hat Creek	HC22	Bunchgrass	15,578	98%	2%	0%	11,773	76
	HC23	Logan	15,929	71%	29%	0%	7,589	48
	HC29	Big Lake	3,591	86%	14%	0%	3,591	100
	HC30	Lower Lost Creek	16,202	64%	15%	21%	3,270	20
	HC37	Red Lake	1,092	100%	0%	0%	1,092	100
Old Cow Creek	OCC1	Old Cow Creek Meadows	2,028	89%	6%	5%	193	10

* Other ownership consists of lands administered by the State of California and the National Park Service.

Streams are complex and dynamic systems that reflect the balance between stream flow, sediment input and substrate/bank composition. The balance between these variables is a result of all the natural and man-made characteristics within the watershed. Changes in any of these variables can cause system wide changes. The existing stream conditions are discussed in terms of stream flow, water quality, and stream channel morphology.

There are approximately 8.5 miles of perennial streams and 42 miles of seasonal streams in the project area (Figure 32). The perennial streams are North Fork Battle Creek and some small tributaries to this creek. The flow in North Fork Battle Creek, within the project area, is primarily controlled by the release of water from the North Battle Creek reservoir. This can lead to higher than normal summer flows. Downstream of the dam are springs that also feed the stream.

Elevated temperatures and sedimentation affect water quality. Most sediment delivered to streams comes from a source zone along the streams, often a road or trail. Elevated temperature and sedimentation can affect drinking water quality and fish health and reproduction. US Forest Service surveys in 2000 found overall, condition of the streams were good.

North Fork Battle Creek below the reservoir has a stable boulder/bedrock substrate resistant to erosion (USDA FS 1996). Some reaches have elevated fines probably associated with road problems (USDA FS 2001a). Most reaches have stable banks. Upper North Fork Battle Creek has some small perennial streams associated with springs. All other streams within the project area are seasonal channels, most active during the spring run-off. In the Bunchgrass sub-watershed there are several large drainages with a substrate of cobbles to small boulders on steep slopes. As the slope becomes less steep these streams eventually go subsurface, have no channel and have no surface connectivity to the watershed. Most of the other channels within the project area are small, short segments of channels that carry some snow melt but are not connected to a larger system of stream channels.

Manzanita Creek and Lost Creek are perennial streams that border the project area to the south and east but are outside the project area. Highway 44 disconnects these streams from the project area. There are no cross drains to connect the west side of the Highway to the streams. Most of the project area contains only seasonal streams that have flow primarily in the spring, when the snow melts.

Temperature and elevated sedimentation are common water quality problems in forested areas of the west. However, neither Battle Creek nor Hat Creek are on the state of California’s 303d list for impaired water quality. Surveys in 2000 found overall, condition of the streams was good with most reaches shaded by riparian or coniferous vegetation (USDA FS 2001a).

Most sediment delivered to streams comes from a source zone along the streams, often a road or trail. The road density for most of the subwatersheds is over 2.5 miles/sq. mile of land. However, because of the lack of stream channels within the project area, connectivity between roads and streams is confined to a few sub-watersheds. Road 32N74YA in Upper North Fork Battle Creek (below dam), has two culverts discharging sediment into the stream. Bunchgrass subwatershed has several culverts discharging sediment into streams, including one crossing that has totally washed out.

Riparian Areas, Wetlands and Floodplains

Riparian areas typically follow streams and drainage bottoms. North Fork Battle Creek has the most extensive riparian areas and floodplains with riparian vegetation seen along much of the stream, leaving it well shaded. There are also meadows and wetlands around the North Battle Creek reservoir. Lodgepole pine is encroaching on these meadows. Many springs are found above the Battle Creek reservoir on National Forest System and PG&E land.

In the Hat Creek watershed the most extensive riparian areas and wetlands are found around the small lakes within closed basins. The largest of these lakes are Big Lake, Red Lake and Mud Lake. The wet meadows that surround the lakes have lodgepole pine encroaching into the meadows, drawing down the local water table. In the past these areas were impacted by cattle grazing as cattle preferentially eat the young riparian vegetation.

Vegetation

The North 49 Project area encompasses three ecological zones, mid-montane westside, mid-montane eastside, and upper-montane. Fire exclusion, grazing and logging have dramatically changed fire regimes and forest structure in Cascade ecosystems over the last century.

The North 49 Project area mid-montane zone of the Southern Cascades is quite different on the eastside as compared to the westside of the crest because of the rain shadow effect and differences in temperature. Conifer forests dominate the mid-montane zone on both sides of the range and they are intermixed with woodlands and shrublands. Species composition varies from west to east over the crest.

Mixed species conifer forests dominate the mid-montane zone on the westside. Any of six conifer species, ponderosa pine, Douglas fir, white fir, incense cedar, sugar pine, and Jeffery pine may occur and share dominance (Skinner and Taylor et al. 2006). A sub-canopy of deciduous hardwoods, California black oak, bigleaf maple, and mountain dogwood may occur beneath the conifer canopy. The forest cover is often interrupted by stands of montane chaparral. The most common shrub of the Cascade Range montane chaparral in the North 49 Project area is greenleaf manzanita. Montane chaparral appears to occupy sites that are either unable to support trees due to shallow soils; exposed slopes where cold, high winds and ice damage are common; or sites that have experienced severe fire (Skinner and Taylor et al. 2006).

Extensive areas east of the Cascade crest (mid-montane eastside) are dominated by ponderosa pine, Jeffrey pine, or a combination of both. Other conifers, such as white fir and incense cedar, may be locally important but do not usually attain dominance, especially on the drier sites. Widely scattered, small stands of quaking aspen occur throughout this zone east of the Cascade crest around seeps, on meadow edges, and on young exposed basalt (Skinner and Taylor et al. 2006).

Upper-montane-zone conifer forest and shrublands have similar species composition on both sides of the crest. However, species dominance varies widely and is influenced by total annual precipitation, topography, and substrate. The more common conifers in this zone are Jeffrey pine, ponderosa pine, white fir, red fir, lodgepole pine, and western white pine. Common shrubs include bush chinquapin, greenleaf manzanita, pinemat manzanita, mountain whitethorn, and tobacco brush. As in the mid-montane zone, forest cover can be interrupted by stands of montane shrubs on harsh sites or where there has been a history of severe fires. The

drier portions of the zone are found on the eastern edge of the bioregion. Large seasonally wet, montane meadows are characteristic of the upper-montane zone east of the crest (Skinner and Taylor et al. 2006).

Federally Listed Threatened and Endangered Species

Plant surveys in the North 49 Project area have not found either federally listed threatened or endangered species; however, there are sensitive and special interest plant species present.

Sensitive and Special Interest Plant Species

Table 8 Displays the Sensitive and Special Interest plant species considered in this document. Analysis for Sensitive plant species is also presented in the Biological Evaluation for Sensitive Plants for the North 49 Project, hereby incorporated by reference.

Table 8. Sensitive and Special Interest plant species within the North 49 Project area

Species	Status*	Considered	Reasons
Astragalus pulsiferae var. *suksdorfii* - Suksdorf's milk-vetch	S	Yes	Species present within the project area.
Erigeron inornatus var. *calidipetris* Hot rock daisy	SI	Yes	Species present within the project area.
Hierochloe odorata Vanilla grass	SI	Yes	Species present within the project area.
Penstemon heterodoxus var. *shastensis* Shasta beardtongue	SI	Yes	Species present within the project area.

*Status: FE = Federally Endangered, FT = Federally Threatened, S = Forest Service Sensitive, SI = Special Interest plant species
Source: Biological Evaluation for Sensitive Plant species for the North 49 Project, and species of Interest Plant Atlas

Surveys specifically for the North 49 project were conducted in July and August of 2002-2004, and in July 2007, but additional surveys were also conducted as part of other projects in the project area, a list of these can be found in the Biological Evaluation for the North 49 Project, hereby incorporated by reference. Only one Sensitive plant species *Astragalus pulsiferae var. suksdorfii* (Suksdorf's milkvetch) is known to the project area. Currently, there are three occurrences of this species found within the project area. The North Bunchgrass Valley and Ashpan Flat occurrences both contain an estimated 5,000 to 10,000 plants, while the South Bunchgrass Valley occurrence is much smaller with an estimated 1,000 plants. At all three sites, plants are growing primarily in open, sandy soils within dry meadows and open lodgepole stands. There are also three Special Interest plant species known to occur within the project area; *Erigeron inornatus var. calidipetris* (hot rock daisy), *Hierochloe odorata* (vanilla grass) and *Penstemon heterodoxus var. shastensis* (Shasta beardtongue).

Astragalus pulsiferae var. suksdorfii

Astragalus pulsiferae var. suksdorfii, Suksdorf's milk-vetch, grows in open, loose volcanic substrates in sagebrush scrub and lodgepole or at the edge of eastside pine stands at elevations from 4,525 to 6,575 feet

(Welsh et al. 2002). Habitats where this species is found generally have very low cover from trees, shrubs, or other herbs. *Astragalus pulsiferae var. suksdorfii* is known from 12 occurrences on the Lassen National Forest, one on adjacent private lands, and is disjunct in Washington, where only two small occurrences are known (Welsh et al. 2002). Within the North 49 analysis area there are two large occurrences at Ashpan Flat and Northern Bunchgrass Valley, which is found on both private and Forest Service lands, and a smaller occurrence found in Southern Bunchgrass Valley along the 16 Road. Long-term trends for many occurrences are not known, though an occurrence at the Chester Airport may have been extirpated in 2002 by a runway expansion and another occurrence along Hwy 44 was impacted by highway construction activities in 2004 (USDA FS 2005a).

Erigeron inornatus var. calidipetris

Erigeron inornatus var. calidipetris, hot rock daisy, is a perennial herb that grows in loose sand, lava beds and depression edges in pine/fir woods at elevations from 3,600 to 6,250 feet (CNPS 2001; Hickman 1993). On the Lassen National Forest this species is known from approximately 33 occurrences scattered throughout the eastern half of the forest. Within the North 49 project area, this species is known from five occurrences primarily in and around Bunchgrass Valley, along Road 16, within Ashpan Flat, and east of North Battle Creek Reservoir.

Hierochloe odorata

Hierochloe odorata, vanilla grass, is perennial grass that grows anywhere from meadows and seeps to lodgepole forests, at elevations from 4,900 to 6,000 feet (Hickman 1993). This species is considered very rare in California, where it is known from only five occurrences, two of which are on the Lassen National Forest (CDFG 2007). Within the North 49 project area, this species was found on approximately 1.5 acres east of Bunchgrass Valley, within a lodgepole stand with a heavy accumulation of downed wood.

Penstemon heterodoxus var. shastensis

Penstemon heterodoxus var. shastensis, Shasta beardtongue, is a perennial herb that grows in wet meadows and seeps in upper montane coniferous forests at elevations between 3,500 and 6,950 feet (CNPS 2001). This species is endemic to California, and on the Lassen National Forest it is known from 21 occurrences scattered throughout the forest. Within the project area there is only one known occurrence found along the southern shore of Logan Lake, outside of proposed treatment units.

Silvicultural Resources

Historical Forest Conditions (1883)

Historical references that describe forest structure, composition, and function are important to understanding how these fire-adapted ecosystems evolved and were sustained on the landscape over time. Comparing historical and existing conditions provides a baseline for understanding the desired conditions described in the Lassen LRMP, as amended. Quantitative data on tree species, size, and density is very limited prior to fire suppression and logging activities occurring in the North 49 project area. The only available data to provide quantitative comparison was derived from survey notes taken from the General Land Office (GLO).

The GLO surveys conducted in the project area between 1881 and 1883 provide an indication of forest conditions present at that time. These land surveys consisted of both point surveys that located land section and quarter section corners, as well as line surveys that ran North-South or East-West between the established section corners. The point surveys consisted of establishing points (section or quarter section corner) and measuring and recording the closest suitable bearing trees. Tree species, dbh and distance from the established point (corner) were recorded for 1 to 4 bearing trees per point. Line surveys consisted of measuring and recording the species and diameter of all trees that intersected survey lines, as well as recording the distance between each recorded tree. While the purpose was to conduct land surveys, this line or transect sampling approach is similar to methods used in present day to measure forest vegetation.

This comparison has limitations because the original GLO data does not represent a complete and unbiased survey of all vegetation and trees. However, as the survey locations are exactly known, this allows for comparative present day re-sampling using a similar protocol.

GLO point surveys (bearing trees) indicate that Jeffrey, ponderosa and sugar pine were fairly prevalent, representing just under half of all trees. Shade tolerant white fir and incense cedar comprised a similar proportion of all bearing trees. Tree sizes varied widely with larger trees (24 inches dbh or greater) accounting for more than a third of all trees, not including seedlings or young saplings. Using the GLO surveyors' notes and equations modified from Manies et al. (2001), it was estimated that there were approximately 79 trees per acre in the pre-settlement period. Again, these figures need to be considered with caution as GLO point surveys did not necessarily measure all trees. Trees less than 6 inches dbh, unhealthy trees, or larger "quality timber" trees may not have been selected as bearing trees. Nonetheless, GLO surveys within the project area recorded bearing trees ranging from 3 to 60 inches dbh.

Comparison of Existing and Historical Forest Conditions

Comparison of current stand surveys with results from GLO survey trees indicates there was a higher proportion of Jeffrey, ponderosa, and sugar pine in 1883, while the proportion of white fir was dramatically less. Both GLO bearing trees and survey lines indicated shade intolerant pine represented nearly half of all conifers while shade tolerant white fir accounted for roughly a third. Historic tree species composition calculated from GLO data compared with stand data from 2002 are presented in Table 9, below.

Existing forest conditions are described at length in the following sections as a basis to compare direct, indirect and cumulative effects of the alternatives. A comparison between GLO surveys of the 1880s and current exams shows similar vegetation trends as have been reported elsewhere throughout the Sierra Nevada range and much of the west (Peek et al. 2001, Oliver et al. 1996, McKelvey et al 1996, Skinner and Taylor 2003, Taylor 2000). A summary comparison of general conditions is displayed in Table 10, below.

Stand exams were conducted primarily in areas anticipated to be late seral habitat (see Issue Development in Chapter 1). As such, a less intensive sample was conducted in stands anticipated to not contain late seral habitat (more sparse stands). Exams were not done in brushfields. Current vegetation typing indicates that roughly 85 percent of the project area forest stands have between 40 percent to near 100 percent canopy cover (see further discussion under Stand Structure and Density, below).

Table 9. 1883 species composition within North 49 Project Area per GLO surveys 1881 - 1883

Species	2002		1883	
	Avg TPA	% TPA	Avg TPA	% TPA
White Fir	270.8	68	24.79	31
Red Fir	25.7	7	9.01	11
Ponderosa/ Jeffrey Pine	46	11	13.07	17
Sugar Pine	11.5	3	17.35	22
Cedar	13	3	4.28	5
Lodgepole Pine	30.1	7	8.34	11
Doug Fir	2.5	0.62	0	0
White Pine	0.07	0.02	0	0
Aspen	0	0.00	0.45	0.6
Black Oak	0	0.00	0.45	0.6
Mahogany	0	0.00	1.35	2
Total	**399.7**		**79.1**	

Table 10. Comparison of historic and present day general forest conditions

Forest Component:	Status from 1883 GLO survey	Present Day stand exams*
Tree densities	Average of 79 trees per acre	Average over 400 trees per acre
Prevalence of pine species	Pine account for 50% of tree species	Pine represent less than 15% of all tree species
Prevalence of white fir and cedar	White fir and cedar account for 36% of tree species	White fir and cedar represent 75% of all tree species
Number of large trees	Roughly 18% of trees are 30” dbh or larger	Roughly 7% of all trees are 30” dbh or larger

The observations above demonstrate the need described in chapter 1 for improved forest health, diversity and fire-resiliency:

- Species composition has changed from being roughly half shade intolerant pine species to becoming dominated by shade tolerant species, primarily white fir.
- Stands have grown increasingly dense, primarily through ingrowth of shade tolerant trees up through the understory. Elimination of frequent surface fires has caused a forest density increase that coincides with the onset of fire suppression in 1905.
- Increases in tree stocking are contributing to declining forest health and density related tree mortality. These stands are now highly susceptible to drought-induced tree mortality because of intense inter-tree competition for resources (light, nutrients, and water).
- Remnant, large predominate pine trees are becoming increasingly susceptible to density related tree mortality.

- Aspen and other riparian plants are being shaded out as a result of conifer encroachment.
- Past timber harvest has removed a large percentage of the old pine overstory trees that once existed in the project area.
- Pine species are not regenerating due to the lack of disturbance and dense white fir stocking as a result of fire exclusion.
- The risk of stand replacing wildfires has increased. Small trees and brush serve as ladder fuels that lift fire into the forest canopy increasing fire severity and the potential for damaging crown fires. Heavy surface fuels increase the intensity of surface fire and the residency time at the base of trees, elevating the risk of tree mortality from cambium layer damage.

The above listed forest changes are not sustainable over time. There is an increased risk of large scale insect and disease outbreaks under wide-spread dense stand conditions. The shift away from shade intolerant pine species in favor of shade tolerant white fir will continue without the advent of disturbance (either planned treatments or natural disturbances) that create conditions favorable for pine. The likelihood that wildfires will burn at stand-replacing high intensities is much higher in these dense stands. Natural fire would not likely revert stands to conditions similar to historical conditions, but rather would remove large portions of all trees and create large expanses of openings with few to no remaining overstory trees. Stand densification and shade tolerant conifer encroachment has also resulted in a loss of aspen, an important riparian and wildlife species.

In the North 49 project area today, white fir accounts for up to 90 percent of all sampled trees in some stands. Existing overstory species composition includes Jeffrey and ponderosa pine, sugar pine, incense cedar, white fir, red fir, and Douglas-fir. However, white fir ingrowth dominates the understory and midstory. Shade intolerant pine species are not regenerating under this heavily shaded environment. Additionally, as white fir continues to encroach and stands become increasingly dense, pine overstory trees are at increasing risk of mortality from drought and insect attack.

Lassen Volcanic National Park (LVNP) is located adjacent to the North 49 project area with similar vegetation and soil types. A research study completed in LVNP in 2000 (Taylor 2000) assessed the spatial and temporal variation in fire regime patterns and forest structure. This study concluded that changes in forest structure and composition have occurred in both mid and upper montane forests due to twentieth-century fire exclusion. Forest density increased in Jeffrey pine (JP) and JP-white fir (WF) forests and white fir increased in JP-WF forests and is now replacing Jeffrey pine. Stands are now denser because seedlings and saplings were not thinned by periodic low-intensity surface fires and there has also been a compositional shift from fire-tolerant pine species to fire-intolerant true fir species as a result of fire exclusion. Shrubs have disappeared from some forests and white fir has invaded the understory of forests with mainly Jeffrey pine in the overstory. Elimination of frequent surface fires has caused a forest density increase and a compositional shift that coincides with the onset of fire suppression in 1905. Fire suppression is identified as the major cause of forest change in the Park.

Historical forest composition/structure information was also obtained from the report “Historical Perspectives on Forests of the Sierra Nevada and the Transverse Ranges of Southern California: Forest

Conditions at the Turn of the Century" (McKelvey and Johnston 1991). Other sources of information include the USGS report "Forest Conditions in the Sierra Nevada, California" (Leiberg 1902). The book "Fire in Sierra Nevada Forests, A Photographic Interpretation of Ecological Change Since 1849" (Gruell 2001) also provides photographic evidence using repeat photography to document forest changes in various parts of California, including the shift to shade tolerant tree species, increased tree stocking and fuel loadings, and the decrease in riparian and early successional plant communities.

In the mixed-conifer zone of the Sierra Nevada today, observations suggest that much of the current regeneration consists of true fir and incense cedar. Therefore, few or no stands remain that can be described as natural or pristine. To various degrees, the forest system has been changed from one dominated by large, old, widely spaced trees to one characterized by dense; fairly even-aged stands in which most of the larger trees are 80-100 years old. These forests appear to be unstable and are highly susceptible to drought-induced mortality, as competition for water weakens trees on drier sites, increasing the risk for massive bark beetle infestations. Trajectory into the future is largely unknown, but stand structure can be expected to change markedly over the next 100 years (McKelvey and Johnston 1992).

Figure 17. Typical mixed conifer stand with a high proportion of white fir in the North 49 project area

As a result of fire suppression, past timber harvest, and grazing, to varying degrees, forest structure and composition in the North 49 project area has also changed from being dominated by large, old, widely spaced trees (with a high proportion of pine) to dense, even-aged stands of white fir. Most of the dominant and codominant trees are white fir and approximately 100 years old, which roughly coincides with the beginning of fire suppression on the National Forests in 1905. Large, remnant predominant Jeffrey, ponderosa, and

sugar pine trees (>30 inches in diameter) remain but they are generally widely scattered and small in number. These remaining trees provide structural diversity and a local seed source for future regeneration.

Stumps left from historic logging in the project area are also valuable indicators that bolster the GLO data. Informal examination of stumps throughout the North 49 project area demonstrate a different historic forest made up of larger trees, spread further apart. These remnant stumps are frequently of a pine species and provide evidence of a different historic species composition than is present today.

Existing Project Area Cover types

The project area forest and non-forest cover types are displayed in Table 11. This table reflects acres of each vegetation type on National Forest System and private lands in the entire project area. Subsequent tables that display affects of treatments on vegetation do not display acres of the entire project area but only those acres of vegetation affected by treatment.

Table 11. Project area forest and non-forest cover types

Cover Type	Acres	Percent of Project Area
*Mixed Conifer	29,092	69
Montane Chaparral	4,952	12
Pine Plantations	3,444	8
Barren	2,434	6
Lodgepole Pine	1,059	2
Ponderosa/Jeffrey Pine	865	2
Annual Grasses/Forbs	145	<1
Red Fir	130	<1
Quaking Aspen	110	<1
Water (Lakes)	92	<1
Wet Meadow	63	<1
Black Oak	14	<1
Total Project Area	**42,400**	

Source: Derived from Lassen National Forest GIS (exist_veg) and updated based on stand examination data and field verification.
*Mixed conifer includes stands typed by GIS as white fir and Douglas-fir.

Table 11 displays all of the vegetation cover types identified within the project area. Vegetation in the project area is predominantly even-aged mixed conifer with a heavy component of white fir. Occasional small inclusions of non-forest areas such as rock outcrops also occur within treatment units and serve as naturally occurring fuel breaks. Aspen is known to occur within the project area outside of mapped pure aspen stands, predominantly in small groups or small areas of scattered individuals. In these instances, the aspen are generally overtopped by conifers and appear to be in decline. Pure lodgepole pine stands occur predominantly in cold moist drainages and areas with seasonally high water tables. Lodgepole pine is also a minor component of mixed conifer and true fir stands at mid and upper elevations. Red fir stands occur at the highest elevations within the project area. Mixed conifer and ponderosa pine stands occur throughout the project area.

Mixed conifer stands generally have large numbers of shade tolerant fir and incense cedar in the understory and midstory; and scattered, large diameter overstory pines. The species composition of forested stands will continue to shift toward shade tolerant species such as red fir, white fir, and incense cedar with little or no disturbance. These species regenerate well in the understory. Black oak is a minor component and only occurs on 6 acres in the project area.

Shade intolerant ponderosa pine, Jeffrey pine, sugar pine, and western white pine regenerate best on disturbed sites with exposed mineral soil and full sunlight. Natural disturbances that create large openings, generally one acre or larger, would promote the successful regeneration and growth of shade intolerant pine species.

Observational data indicates that large pine stumps are present throughout the project area as a result of past timber harvest. This data supports other evidence that indicates a compositional increase in shade tolerant tree species has occurred during the past century.

Stand Density and Health

There is a finite carrying capacity for each tree species of a given size for a given area. As trees get bigger, they occupy more space above and below ground and fewer trees will be able to grow on the site. In 1933 Reineke developed the Stand Density Index, which describes and projects stand development using the maximum number of trees per unit area with a given average diameter (dbh). This maximum varies with species and values can be calculated for combinations of numbers of trees and sizes. The maximum stand density is used as a benchmark standard by which all similar specied stands are measured. When estimating current and future forest health it is useful to look at stands in terms of their *maximum stand density* (SDImax*)*.

There are important trigger points within the life of a stand that give indications of how well trees are growing, which can coincide with how healthy they are. For example, when a stand of trees reaches 25 percent of the SDI_{max} we know that trees have begun to compete for resources and the stronger trees will begin to distinguish themselves. As the trees get bigger, they reach a point, (which is about 60 percent of the SDI_{max}) that the site can no longer support their number at that larger diameter and the weaker trees die. This scenario will continue and worsen until an event such as fire, drought, insects, disease, or harvest reduces the number of trees below the 60 percent of SDI_{max}. When a stand of trees is at 60 percent of SDI_{max}, mortality of the smaller trees is likely to occur from inter-tree competition. Maintaining the stand around 35 – 50 percent of SDI_{max} allows for the maximum number of trees to be on the site while still providing adequate resources to maintain health and vigor. These density levels represent fully stocked stands with available growing space and resources such that inter-tree competition does not on the whole affect stand growth. At these densities, inter-tree competition does not severely impact stand growth for a period of generally 20 years or more. Lower densities (nearer to 35 percent of maximum SDI) are desirable for younger stands because they grow more vigorously and individual trees can capitalize on available resources. Lower densities are also desirable to promote healthy regeneration, particularly openings for pine regeneration.

Old legacy pine and cedar trees are documented dying out within the Bunchgrass trailhead area in the northern portion of the project area. Some recently dead trees showed no evidence of beetle infestation or disease, but are tightly surrounded by a sea of young white fir leaving us to speculate that they died due to

lack of nutrients and/or water. The majority of stands proposed for treatment in the North 49 Project area are between 70 to 100 percent of SDI_{max}. Due to the intense competition in these overstocked stands, tree mortality caused by fir engraver (*Scolytus ventralis*), mountain pine beetle (*Dendroctonus ponderosae*) and Jeffrey pine beetle (*Dendroctonus jeffreyi*) is present with the potential to increase.

Bark beetles are native pests that kill conifers. There is the potential for large outbreaks in the project area due to existing overstocked conditions. There are a number of bark beetle species present and active within and adjacent to the project area including: fir engraver beetle, mountain pine beetle, western pine beetle, Jeffrey pine beetle, and pine engraver beetle. Bark beetles are currently at endemic levels within the project area, causing occasional mortality that is usually associated with diseased, damaged, overmature, or stressed trees. Stands that grow increasingly dense increase in the risk of experiencing widespread mortality, generally from a complex of factors that includes a population outbreak of bark beetles. Typically, widespread bark beetle attacks occur in dense stands in conjunction with drought conditions when trees are already under stress. This combination provides a large potential food base of weakened trees. When bark beetles successfully infect a tree, they emit attractant chemicals that attract other nearby bark beetles.

The fir engraver beetle (*Scolytus ventralis*) is a bark beetle that attacks white, red, and grand firs. This bark beetle has the potential to cause the most widespread mortality in the project area because of the dense stocking of white fir. Outbreaks occur at irregular intervals and have been recorded at least once a decade over the last 60 years. The last large outbreak in northern California occurred in the early 1990s. Although, no one knows when outbreaks will develop, lowered resistance of the trees appears to be a contributing factor. When fir engraver populations are endemic, trees are still killed, but losses are less severe. Silvicultural practices aimed at maintaining healthy stand conditions appear to offer the best chance for minimizing engraver caused losses (Ferrell 1986).

The mountain pine beetle (*Dendroctonus ponderosae*) is a bark beetle that attacks and kills lodgepole, ponderosa, sugar, and western white pines. Outbreaks frequently develop in lodgepole pine stands or dense stands of pole-sized ponderosa pine. Lodgepole pine stands that are high risk have an average age exceeding 80 years and an average diameter exceeding 8 inches dbh. In second growth ponderosa pine, high-risk stands have a high stand basal area, single story, and an average diameter exceeding 10 inches dbh (Amman et al. 1990). In the project area, mountain pine beetle mortality is often found in lodgepole pine stands where larger overstory trees are present. Thousands of acres of lodgepole pine stands and pine plantations are at high risk for mortality because they meet the above conditions.

The western pine beetle (*Dendroctonus brevicomis*) and the Jeffrey pine beetle (*Dendroctonus jeffreyi*) are bark beetles that attack and kill ponderosa and Jeffrey pines. These beetles kill trees of all age and vigor classes and both breed in dense overgrown stands of slow growing trees of reduced vigor. Both beetles will kill large overstory trees especially those weakened by excessive intertree competition. The western pine beetle is the most damaging bark beetle in California (Demars et al. 1982). Jeffrey pine beetle is the principal insect enemy of Jeffrey pine (Smith 1971). Overstocked stands in the project area with overstory pine are at high risk for mortality.

The pine engraver beetle (*Ips pini*) is not an aggressive tree killer of pine (in most years), even though large populations commonly infest logging slash, windthrown trees or trees broken by wind or snow. The key

to preventing tree damage is the promotion of healthy forests. Pine engraver beetles infrequently colonize trees in thinned, vigorous stands. During drought years, maintaining stand vigor is even more important. Stands in which basal area has been reduced to 80-100 square feet per acre have been found to be less susceptible to beetle attack (Kegley et al. 1997). Engraver beetle damage has been observed in some pine plantations.

The Douglas-fir tussock moth (*Orgyia pseudotsugata*) is an important defoliator of true firs and Douglas-fir. There was a tussock moth outbreak adjacent to the project in the 1990s resulting in tree mortality. In California, white fir is its preferred host. Defoliation by the tussock moth kills or top kills many trees, weakens additional trees that are eventually killed by bark beetles, and retards tree growth for many years. There is some indication that fir growing on pine sites and fir stands growing on warm, dry sites are most susceptible to damage. Where offsite fir is well established and conversion to the proper tree species is uneconomical, some form of annual population monitoring should be considered to detect population increases. The preferred way to keep losses low is to work toward healthy, thrifty stands, growing on the proper site (Wickman et al. 1981). Annual monitoring is completed throughout the District using sticky, sex pheromone traps to determine population trends. There is one trapping location in the North 49 project area. Tussock moths are found in the project area every year.

The plantations in the Manzanita Chutes area are currently infected with Gouty Pitch Midge, which causes dieback of lateral shoots and weakens tree health and vigor (FHP Report NE02-13). This infestation is directly related to intense intertree and brush competition.

Annosus (*Heterobasidion annosum*) root disease is present in varying degrees in eastside pine and mixed conifer stands on the Ranger District. No specific locations have recently been identified in the project area. The disease is normal in forest ecosystems and contributes to wood decay, decreased growth, tree mortality, and predisposition to bark beetle attack. Annosus root disease spreads from root to root contact of trees of the same species, and through aerial infection via fresh wounds in tree boles or freshly cut stumps. Infected trees suffer root and butt decay and root mortality, resulting in reduced vigor, windthrow, and outright mortality. Because of past cutting practices and absence of fire, many mixed conifer stands previously dominated by pine in the North 49 project area have become dominated by less fire resistant species, especially true firs. Where such a trend has occurred and root disease effects are impacting management goals, it is recommended to reduce the pine-to-fir trend. Regeneration type cultural systems and use of prescribed fire can both be effective at reducing the proportion of shade tolerant true firs and restoring stands to a state more similar to its historic condition (Schmitt et al. 2000).

Heart rot is common throughout stands, especially in older red and white fir trees. Rot also occurs in pines, incense cedar, and Douglas-fir; however, these species are less susceptible. Fir trees are susceptible to brown and white rots caused by fungi. Fungi infect the trees through wounds caused by fire, frost cracks, lightning and mechanical damage. Thrifty, uninjured young fir trees are generally free from heart rot, but rot is common in overmature trees in the project area.

Existing concentrations of old and newly created dead tree or snags occur throughout the project area. Stand averages generally range up to 3 snags per acre greater than 16 inches dbh. The most densely stocked

areas generally have higher snag densities ranging up to 6 or more per acre. The largest snags sampled in proposed treatment stands range between 16-49 inches dbh.

Dwarf mistletoe (*Arceuthobium* spp.) infection occurs throughout the project area and most commonly infects Jeffrey pine, ponderosa pine, white fir and red fir. Most inventoried stands show light to moderate levels of infection. However, there are some areas of pine heavily infected with the pine variety. The average severity of infection of a tree is measured using a 6-point system. The live crown of a tree is divided into thirds and the numbers 0 (no infection), 1 (less than 50 percent infection), or 2 (50 percent infection or more) are assigned to each third of the tree, resulting in a maximum dwarf mistletoe rating (DMR) of 6. Moderately dense white fir and mixed conifer stands support the spread of mistletoe because susceptible host trees are in close proximity to one another. Dwarf mistletoe does not spread well in extremely dense stands however because host vigor and subsequent dwarf mistletoe seed production is low. Stands that are predominantly stocked with susceptible host trees (true fir) or have heavily infected trees in the overstory would develop increasing levels of infection. Mistletoe spreads from tree to tree and especially from overstory to understory trees. Dwarf mistletoe infection will spread through an even-aged stand roughly two feet per year and more quickly when overstories are infected in multi-storied stands. Infection by dwarf mistletoe causes mortality; reduced growth rates, loss of vigor, reduced cone and seed production, and increased susceptibility to other damage agents such as bark beetles (Filip et al. 2000). Severely infected trees (DMR of 5 to 6) can experience as much as a 40 percent growth loss.

Stand Structure

To analyze effects from silvicultural treatments the resultant stand structures were projected into the California Wildlife Habitat Relationships (CWHR) habitat classification system (http://www.dfg.ca.gov/biogeodata/cwhr/). The CWHR system was developed to identify and classify existing vegetation types important to wildlife. The CWHR System is a predictive wildlife model for California's regularly-occurring birds, mammals, reptiles and amphibians. At present, there are 59 wildlife habitats in the CWHR System: 27 tree, 12 shrub, 6 herbaceous, 4 aquatic, 8 agricultural, 1 developed, and 1 non-vegetated.

The predictive model for each species has expert-applied suitability ratings for three life-requisites - breeding, cover and feeding. For each species, each habitat stage is rated as high, medium, low or unsuitable for each of these life requirements. Each special habitat element is also assessed as essential, secondarily essential, preferred or not rated for the species.

The predominant CWHR size class of forest stands in the project area is 4 (See Table 12), which equates to an average stand diameter (diameter at breast height or dbh) between 11-24 inches. Approximately 67 percent of the forest stands are in size class 4. Approximately 85 percent of forested stands have moderate to dense canopy cover exceeding 40 percent cover, which corresponds to CWHR canopy classes M and D (Lassen National Forest GIS existing vegetation layer) respectively.

Table 12. Wildlife Habitat Relationship Strata

Tree Canopy Closure			Shrub Canopy Closure			Herbaceous Canopy Closure		
Closure	**Class**	**Canopy Closure**	**Closure**	**Class**	**Canopy Closure**	**Closure**	**Class**	**Canopy Closure**
S	Sparse	10-24%	S	Sparse	10-24%	S	Sparse	2-9%
P	Open	25-39%	P	Open	25-39%	P	Open	10-39%
M	Moderate	40-59%	M	Moderate	40-59%	M	Moderate	40-59%
D	Dense	60-100%	D	Dense	60-100%	D	Dense	60-100%
Tree Size Class			**Shrub Size Class**			**Herbaceous Size Class**		
Size	**Class**	**dbh**	**Size**	**Class**	**Crown Decadence**	**Height**	**Class**	**Height at Maturity**
1	Seedling	< 1inch	1	Seedling	seedlings or sprouts < 3 years	1	Short	< 12 inch
2	Sapling	1 to 6 inch	2	Young	None	2	Tall	> 12 inch
3	Pole	6 to 11 inch	3	Mature	1 - 25%			
4	Small	11 to 24 inch	4	Decadent	> 25%			
5	Medium/ Large	> 24 inch						

Table 13. Wildlife Habitat Relationship Codes

Habitat	Definition	Habitat	Definition
AGS	Annual Grassland	MHW	Montane Hardwood
ASP	Aspen	MRI	Montane Riparian
DFR	Douglas-Fir	PGS	Perennial Grassland
EPN	Eastside Pine	PPN	Ponderosa Pine
JPN	Jeffrey Pine	RFR	Red Fir
JUN	Juniper	SGB	Sagebrush
LAC	Lacustrine	SMC	Sierra Mixed Conifer
LPN	Lodgepole Pine	WFR	White Fir
MCP	Montane Chaparral	WTM	Wet meadow
MHC	Montane Hardwood-Conifer		

Table 14 displays CWHR size and density classes by vegetation type in the project area (pretreatment) using GIS remote sensing data. GIS data is available for the entire project area and is relatively accurate but it has limitations. Except where forest inventory data was collected, GIS remote sensing data has not been field

verified using empirical data. Remote sensing tends to overestimate tree size and density as compared to forest inventory data. For example, comparison of inventory data with observations in similar stands outside of proposed treatment areas indicates that the total acres of CWHR size class 5 is likely higher than what actually exists. Collected inventory data and field reconnaissance indicate that CWHR size class 5 does not exist within proposed treatment stands.

Direct measurement using site-specific forest inventory data is a more accurate way to classify vegetation but it is costly and time-intensive. Stand exams were focused in proposed treatment stands. Forest inventory data is based on a systematic grid of nested plots where site-specific tree information is collected at the stand level. Plots are distributed throughout an identifiable stand or vegetation aggregation. Plots were stratified within each stand/aggregation and sampled separately where GIS identified a CWHR type change. Plot data for stand/aggregations are averaged and summarized using the FVS program. FVS projections are representative of average stand conditions within an identifiable stand/aggregation.

For this analysis, GIS remote sensing data is used to classify CWHR size and density in areas outside of proposed treatment stands and is not adjusted based on plot data or field verification. The GIS CWHR vegetation type estimates have been adjusted based on field verification. Within proposed treatment stands, forest inventory data is used to classify stand attributes including CWHR type, size, and density and to display effects of proposed treatments.

The CWHR canopy class M and D stands are approaching maximum stocking levels. Other measures of stocking such as trees per acre or basal area (the cross sectional area of a tree bole measured at dbh) per acre can reflect varying densities depending on a stand’s average dbh. For example, a basal area of 100 square feet per acre would indicate a low stand density if the average dbh were 24 inches, but would indicate a higher stand density if the average dbh were 8 inches.

Sierra Mixed Conifer

The average age of sampled dominant trees ranges between 80-130 years old. Remnant large, old trees are now small in number and widely scattered. The average diameter (at breast height or dbh) of all trees in sampled stands ranges between 7-20 inches with an average of 10.5 inches dbh. The largest trees in the project area range up to 40+ inches in diameter. Basal areas range between 200-400 square feet per acre. Average total canopy cover ranges between 36-73 percent (the average is 64 percent). Proposed treatment stands type out as CWHR 3M, 3D, 4M, and 4D.

Pine mixed conifer stand/aggregations with a high component of white fir and a stand density index (SDI) that exceeds 60 percent of maximum are considered to be in the zone of imminent mortality. The majority of proposed mixed conifer treatment stands in the North 49 project area are within this zone (70-100 percent of maximum SDI). These stands are at high risk for epidemic levels of insect or disease induced tree mortality.

Average stocking ranges between 205-979 trees per acre. This correlates to an average spacing of 6 to 14 feet between trees.

The majority of stands are even-aged with low age/structure diversity. Historically, many stands were pine dominated (composed of ponderosa/Jeffrey and sugar pine with associated species). White fir ingrowth is

excessive due to years of fire exclusion. Shade intolerant pine reproduction is limited due to the dense stocking of white fir. Shade intolerant pine species need full sunlight to encourage establishment and growth.

Associated species include snowbrush, deer brush, mountain mahogany, chinquapin, bitter cherry, gooseberry, and squaw carpet.

Past management has included overstory removal, sanitation, and salvage harvests. Regeneration harvests were completed in the early 1990s. Some thinning followed by hand and machine piling has been completed in recent years (see Appendix A).

Ponderosa/Jeffrey Pine

The average age of sampled dominant trees ranges between 80-120 years old. The average diameter of all trees in sampled stands ranges between 7-11 inches. Basal areas range between 127-293 square feet per acre. Average total canopy cover ranges between 43-65 percent. Proposed treatment stands type out as CWHR 3D, 4M, and 4D.

Pine stand/aggregations with a stand density index (SDI) that exceeds 55 percent of maximum are considered to be in the zone of imminent mortality. The majority of proposed pine treatment stands in the North 49 project area are within this zone (59-100 percent of maximum SDI). The majority of these stands are at high risk for epidemic levels of insect or disease induced tree mortality. Stocking ranges between 158-746 trees per acre. This correlates to an average spacing of 8 to 17 feet between trees.

The majority of stands are even-aged with low age/structure diversity. If any brush exists, Greenleaf manzanita is the predominant understory brush species. Associated species include sagebrush, bitterbrush and rabbitbrush.

Lodgepole Pine

The average age of sampled dominant trees ranges between 80-120 years old. The average diameter of all trees in sampled stands is approximately 11 inches. Basal areas average 208 square feet per acre. Average total canopy cover is approximately 71 percent. Proposed treatment stands typed out as CWHR 4D. The average SDI is approximately 98 percent of maximum. The majority of these stands are at high risk for epidemic levels of insect or disease induced tree mortality. Stocking exceeds 300 trees per acre. This correlates to an average spacing of less than 12 feet between trees. Greenleaf manzanita is the predominant understory brush species. Associated species include mountain mahogany, deer brush, chinquapin, bitter cherry, gooseberry, and squaw carpet.

Pine Plantations

The plantations in the North 49 project area were brushfields established as a result of past wildfires. The majority of plantations are located in the Manzanita Chutes area. Some of the older plantations were established in the 1950s. Others were established in the 1960s and 1970s. Planting continued through the 1980s. The site preparation method used was windrowing or mechanically piling brush in long rows for burning. This resulted in soil movement leaving large amounts of topsoil in the windrows. The predominate species planted in all plantations was ponderosa and Jeffrey pine. Other species planted included sugar pine, western white pine, giant sequoia, white fir, and red fir. The predominant understory brush species is

greenleaf manzanita. Most plantations received at least one aerial herbicide release treatment to control brush regrowth in the 1960s and 1970s. Many of these plantations have not been thinned.

The average diameter of trees in plantations ranges between 8-12 inches. Average total canopy cover ranges between 30-80 percent. The average number of trees ranges between 200-400 trees per acre. This correlates to an average spacing of 10 to 15 feet between trees. The plantations proposed for treatment type out as CWHR 3P, 4M, and 4D.

These plantations are densely stocked with trees and brush. Due to this, the majority of plantations in the project area are at high risk for epidemic levels of insect or disease induced tree mortality, and a stand replacing wildfire.

Quaking Aspen

Found mainly within the mixed conifer and lodgepole pine vegetation types, there are remnant small aspen clones located in and around Riparian Habitat Conservation Areas (RHCAs) and adjacent to lava flows and rock outcrops where sub-surface water is present. These clones are on the decline and are not regenerating due to fire exclusion and associated conifer encroachment and shading. Aspen is shade intolerant and needs full sunlight for successful establishment and growth. Aspen regeneration is spotty and generally limited to small openings where sunlight reaches the ground. Conifer crowns have overtopped aspen crowns and account for up to 90 percent of the existing canopy cover.

An aspen clone consists of numerous stems that are genetically alike and began from a single seed that germinated sometime in the past. These clones have been perpetuated on site by disturbance, which allowed the clones to survive and expand. Fire, the natural disturbance regime has been interrupted. This has caused many sites once dominated by aspen to succeed to conifers.

Table 14. Existing CWHR size and density classes in acres by vegetation type in the North 49 project area

Forest Cover Type	Existing Condition																			
	Seed -ling	Sapling (1" - 5.9" dbh)					Pole (6" - 10.9" dbh)					Small (11" - 23.9" dbh)					Medium/Large (> 24" dbh)			
	1	2X	2S	2P	2M	2D	3X	3S	3P	3M	3D	4X	4S	4P	4M	4D	5S	5P	5M	5D
Sierra Mixed Conifer	766	104	36	61	27	15	39	1101	2085	1018	653	83	151	868	4638	14943	3	68	628	6225
Lodgepole pine	0	0	0	0	0	0	0	8	13	12	32	0	10	49	264	670	0	0	0	0
Red fir	0	0	0	0	0	0	0	0	0	0	0	0	0	8	90	19	0	0	9	6
Black Oak	0	0	0	0	0	0	0	0	0	0	7	0	0	6	0	1	0	0	0	0
Total acres	766	104	36	61	27	15	39	1109	2098	1030	692	83	161	931	4992	15633	3	68	637	6231

Source: Lassen National Forest GIS existing vegetation layer. Mixed conifer type includes stands typed by GIS as white fir, ponderosa/Jeffrey pine, Douglas-fir, aspen, and plantations. GIS typing does not recognize stands typed as ponderosa pine and aspen using inventory data, so they are included as mixed conifer. CWHR size classes: 1=seedling (<1”), 2=sapling (1” to 5.9”), 3=pole (6” to 10.9”), 4=small (11” to 3.9”), 5=medium/large (> 24”). CWHR density classes: S=sparse cover (10-24 percent canopy cover), P=open cover (25-39 percent canopy cover), M=moderate cover (40-59 percent canopy cover), D=dense cover (60-100 percent canopy cover), X=unknown.

Fire and Fuels

The periodic recurrence of fire shaped the ecosystem of the Southern Cascades for thousands of years. Because fire was so prevalent in the centuries before Euro-American settlement, many common plants exhibit specific fire adapted traits such as thick bark and fire stimulated flowering, sprouting, seed release and/or germination. Fire affected the dynamics of biomass accumulation and nutrient cycling, and generated vegetation mosaics at a variety of spatial scales (Sierra Nevada Ecosystem Project, Final Report to Congress 1996). There are generally two periods with distinctly different fire regimes in the Cascades. First was a Native American period, before 1905, when fires were generally frequent. This period includes both the pre-historic and the European-settlement periods. The Native American period was followed by the fire-suppression period ensuing with the establishment of the Nation Forest Reserves in 1905 when fire occurrence decreases dramatically (Skinner and Taylor et al. 2006). Of all management activities, fire suppression has been the most pervasive.

The mixed-species conifer forests on the west side of the Cascades have changed since the onset of fire-suppression period. Forest density has increased, and there has been a shift in species composition toward increasing density of fire-sensitive white fir. Many areas that were montane chaparral early in the twentieth century have been invaded by trees, especially white fir, and are now closed forest. It is likely that fire suppression was an important factor in vegetation changes that have reduced the structural diversity of both forest stands and forested landscapes in the mid-montane zone.

In mid-montane eastside, conifer forests have changed, often considerably, coincident with the period of fire suppression. Forest density has increased, and there has been a shift in species composition toward increasing density of pines and more fire-sensitive white fir. Many areas that were montane meadows early in the twentieth century have been invaded by trees, especially Jeffrey and lodgepole pine, and are becoming forests. Fire suppression, interacting with climatic variation and more locally with other land uses such as grazing and logging, has contributed to vegetation changes that have reduced the structural diversity of both forest stands and forested landscapes (Skinner and Taylor et al. 2006).

Fires were probably the key influence that maintained quaking aspen stands before the fire suppression period. Since the onset of fire suppression, many quaking aspen stands have been invaded and overtopped by conifers.

Upper-montane-zone conifer forests appear to be characterized by mixed-severity fire regime. A mixed-severity fire regime consists of small, low-severity fires and larger fires with significant portions of stand-replacing, high-severity effects.

Historic Fires

Fire history for the project area shows that the majority of the fires since 1920 are less than one acre in size. Table 15 shows number and size of fires in the project area since about 1920. Past fires had a variety of causes including lightning, equipment, arson, smoking, and campfires. Fire record keeping began around 1920, with spotty and incomplete documentation at the beginning. Records show 1 to 2 fires per year or 5 to 10 fires per decade in the project area between 1920 and the present.

Table 15. Fire history for the project area since 1920

Fire Class	Fire Size (number of acres)	Number of Fires
A	Spot to 0.25 acres	129
B	0.26 acres to 9.9 acres	12
C	10 acres to 99.9 acres	1
D	100-299.9 acres	None recorded
E	300-999.9 acres	1 fire 430 acres in 1969
F	1,000-4,999.9 acres	Fires in 1917, 1931
G	5,000 acres plus	Fires in 1917

Fire History records Lassen National Forest.

The area also has some large fire history. There are references in the records to large fires that occurred prior to 1920. In 1917 a large fire burned in Manzanita Chutes on both sides of the highway. This was a high intensity brush fire that burned to the top of Red Lake Mountain. There were three other fires ranging between 300 and 1,500 acres that occurred in 1917 on the west side of the proposed project area. There is not much information in the records from 1917 regarding how long the fires burned or under what weather conditions. In 1931 another large fire burned on the north side of highway 44, in the Manzanita Chutes area, to Red Lake Mountain. A fire in 1969 burned about 430 acres between Eskimo Hill and Red Lake Mountain. Generally, these fires have burned from the southwest to the northeast. The majority of the large fires in the project area have occurred in brush fields.

Fire Regimes

A fire regime is a generalized description of the role fire plays in an ecosystem. It is characterized by fire frequency, seasonality, intensity, duration and scale (patch size) as well as regularity or variability (Laverty and Williams 2000). Table 16 shows the five fire regimes that are recognized nationally when describing condition classes. The vegetation in the project area falls into fire regimes 1, 2, 3, and 4. The ponderosa pine, aspen, and some of the lower elevation mixed conifer on drier site ecosystems are in fire regime 1. The meadows in the project area are in fire regime 2. The higher elevation mixed conifer, and wetter site white and red fir ecosystems are in fire regime 3. The brush fields and lodgepole pine stands are in fire regime 4.

There have been several fire-history studies conducted around the project area. One of the studies was conducted in Thousand Lakes Wilderness (which is on the northern boundary of the project area) and the other study was conducted in Lassen National Volcanic Park on Prospect Peak (which is to the south and east of the project area). The study on Prospect peak showed fire regime intervals were determined by aspect and elevation. The fire return interval was more frequent at the lower elevations, with low severity fires. As elevation and aspect changed the fire return intervals became longer and the severity of the fires increases. At Prospect peak fire return intervals are affected by the lava and rock screes from the Cinder Cone eruption, which act as fuel breaks. The Thousand Lakes Fire history study shows something different than Prospect peak. The patterns of fire severity Taylor identified for the Thousand Lakes Wilderness are inconsistent with general models of pre-Euro-American fire regimes in the Sierra Nevada and Cascade Range forests. Fires in the mixed conifer have been previously described as frequent and low to moderate severity. In Thousand

Lakes Wilderness fires in mixed conifer forests burned primarily at high and moderate severity and generated coarse grained structures of even or multi-aged forests at landscape scales (Taylor, 2000). These severe fires in Thousand Lakes Wilderness occurred before the start of fire suppression (1883, 1889, 1918).

Table 16. Fire Regime Groups

Group	Frequency (years)	Vegetation Types	Severity	Percent of area in fire group
I	0-35	Ponderosa pine, other long needle pine species, and dry site Douglas-Fir	Low severity	42%
II	0-35	Drier grassland types, tall grass prairie, and some Pacific chaparral and southern rough ecosystems.	Stand Replacement	1%
III	35-100	Interior dry site shrub communities such as sagebrush and chaparral ecosystems, mixed conifer.	Mixed Severity (will have patches of crown fire)	37%
IV	35-100	Lodgepole pine and jack pine.	Stand Replacement	14%
V	Greater than 200	Temperate rain forest, boreal forest, and high elevation conifer species.	Stand Replacement	0
	No Frequency	Rock, Water, Barren	No Severity	6%

Fire Hazard Assessment

Fire, other disturbances, physical setting, weather and climate shape the structure and function of forests throughout the Western United States. More than 80 years of fire research (Graham, McCaffrey, Jain 2004) shows that:

- fuels (that is composition, amount, structure, moisture content of dead and live vegetation and detritus),
- physical setting (slope, aspect, elevation, relief, soils)
- weather (short and long term wind, humidity, precipitation),
- and climate combine to determine:
    - wildfire intensity (the rate at which a fire is producing thermal energy in the fuel-climate environment, most often measured in terms of temperature and heat yield), and
- severity (the effect the fire has on vegetation, soils, buildings, watersheds, and so forth; most often expressed in terms of the post wildfire condition of the litter, soils, trees).

The two things contributing to the existing fire situation in the project area are fire risk (chance of a fire starting) and fire hazard (slope, topography, fuel loading, vegetation structure and composition). The project area experiences fires caused by both people and lightning, with the majority of the fires starting from lightning. Fire risk due to lightning cannot be changed. Offsetting the risk of fire from people through prevention efforts already exists in the area. Slope and topography cannot be changed. Fire hazard can be

changed by reducing the surface fuels; and by changing the structure and composition of the vegetation by thinning trees and returning the brush to a younger age class.

The probability of ignition is strongly related to fine fuel moisture content, air temperature, the amount of shading of surface fuels, and an ignition source (Rothermel 1983). Stand structure strongly influences all these factors. There is generally a warmer, dryer microclimate in more open stands compared to dense stands. Dense stands tend to provide more shading of fuels, keeping relative humidity higher and air and fuel temperature lower than in more open stands (Graham et al. 2004).

In the HFQLG FEIS maps E and H (1999) the majority of the project area is rated low for fire occurrence. The areas that rate high are around Old Station and the campgrounds, which are adjacent to the project area. The reason these areas rate high is due to person caused fires. On the ignition risk map (number of fire starts), the majority of the project is rated low and the eastern part of the project area rated as moderate. Based on the past history of large fires, fuel types, fire occurrence and elevation, the project area rates low to moderate for fire hazard from carrying a crown fire. Due to heavy surface fuels, much of the project area would rate medium to high for fire hazard for surface fire with a high possibility of extended fire residence time at the base of trees. Increased residence time would kill the tree's cambium layer, greatly increasing the risk of tree mortality without crown fire. The brush fields and plantations rate a high for fire hazard.

Existing Fuels Conditions

Surface fuels consist of grasses, shrubs, litter and woody material lying on the ground. Ladder fuels consist of live and dead small trees and shrubs; live and dead trees branches from larger trees; and needles, mosses, and any other combustible biomass located between the top of the surface fuels and the bottoms of the tree crowns. Crown fuels are suspended above the ground in trees or other vegetation and consist mostly of live and fine material (Graham, McCaffrey 2003).

The surface fuels in the project area have been altered over time by fire suppression, livestock grazing, and timber harvesting. Livestock grazing in the late 1800s stripped soils of grasses, forbs and other palatable browse, which reduced vegetative competition for conifer seedlings, and reduced fine surface fuels which spread fire (Rickman, 2005). With the start of wildfire suppression in the early 1900s, low intensity fires that used to burn and consume surface fuels and thin out small trees and brush were extinguished. This allowed both surface and ladder fuels to increase over time.

The brush fields in Manzanita Chutes have been established since at least the turn of the century. Harvey Abbey, an early Forest Service Ranger in 1908 would count the livestock at Manzanita Chutes because the stock driveway was 100 feet more or less wide, 2.5 to 3 miles long with dense manzanita 5 or 6 feet high on both sides (USDA FS 1996). The last recorded fires in the brush fields at Manzanita Chutes were in 1917 and 1931. These seventy-year-old brush fields are decadent with a high ratio of dead woody material in the brush field.

The plantations in Manzanita Chutes were established between 1959 and 1982. Due to the growth of brush in the understory of the plantations, the fuel is continuous from the ground to the lower limbs of the trees.

The surface fuels in the mixed conifer and ponderosa pine stands have been affected by past timber management practices of thinning from above, clearcutting, wind throw fuels reduction, seed step shelterwood, multiproduct thinning, intermediate sanitation, overstory removal, and insect salvage removal. Table 17 shows fuel models currently found in the project area and the associated surface fuels measured in tons per acre. This has occurred over 31,639 acres of the project area (total acres treated on national forest lands from appendix A) the fuels from the clearcutting and shelterwood projects have been treated, using a combination of machine piling and broadcast burning. These treatments occurred within 2 to 3 years following the timber sales. In the multiproduct sales, (Wheel, Highway 44, and Redlock) the tops and limbs of the trees were yarded to the landing, chipped and removed. The remaining surface fuels were machine piled and there is still some underburning to be finished associated with these projects. The Wind Throw Fuels Reduction sale was the result of wind throw that occurred during the winter of 1996. The timber sale treated the majority of the wind throw that occurred, by removing the merchantable material and machine piling the tops, in areas that where accessible. There is still trees and tops that; due to accessibility; were never treated, creating pockets of heavy dead and down material. The insect salvage (Bellow Insect Salvage TS) removed dead and dying trees on 1000 acres by Bear-Wallow Butte. The slash treatment for this project was lop and scatter to a depth of 18 inches. This treatment is based on the fact that over 30 to 50 years the slash will decompose. However, this slash has not yet decomposed and is also creating pockets of heavy dead and down material in the project area. The other treatments that occurred in the project area are intermediate sanitation and overstory removal. For these projects some of the slash was treated using machine piling and burning following completion of the timber sale. The untreated slash from these various projects is contributing to pockets of heavy dead and down material in the project area. The Snowmobile Park, Ashpan parking SSTS and Ashpan Realignment TS projects do not contribute any surface fuels build up to the project area because they involved parking lot construction or road realignments.

The ladder and crown fuels in the project area have also been affected by timber management practices and fire suppression. Fire suppression has allowed ladder fuels to increase as small tree and brush growth was not reduced by frequent low intensity fires. Some of the timber management practices of the past removed the larger, fire tolerant species, and allowed the shade tolerant species to grow in the understory. These trees are creating ladder fuels and contributing to the crown fuels.

Table 17. Surface fuel loads (measured in tons per acre) and fuel models in the project area

Vegetation Type	Fuel Model	0-.25 inch material	.26-1 inch plus material	1.01-3 inch material	3+ inch and greater*	Woody material	Total
White fir/Mixed conifer	FM 8	1.5 -2.0	1.0-1.30	2.5-3.26	2.0-20.0	0	7.0-26.5
Ponderosa Pine	FM 9	2.29-3.79	.41-.54	.15-.20	1.0-10..0	0	3.85-11.5
Mixed Conifer	FM 10	3.01-3.91	2.0-2.60	5.01-6.51	5.0-49.0	2.0-2.6	17.02-64.0
Lodgepole	FM 10	3.91	2.60	6.51	4.0-18.0	2.6	19.6-33.6
Brush Fields	FM 6	1.5-2.0	2.5-3.2	2.0-2.6	1-4	0	7.0-11.8
Plantations	FM4	5-6.5	4-5.2	2-2.6	1-4	5.0-6.5	17-24.8

All data taken from FMA (Fuels Management Analysis) and photo series.
All material is weighed in tons/acre.
*Surface fuels greater than 3 inches contribute towards intensity and spotting but are not part of the fire behavior model.

Terrestrial Wildlife

General Wildlife

The North 49 Project area is composed of diverse habitats including brushfields, plantations, lava fields, meadows, and forest stands sized from young pole stands to primarily even-aged mature mixed conifer stands. Forest tree species include ponderosa pine, Jeffrey pine, sugar pine, lodgepole pine, black oak, Douglas fir, red fir and white fir. The area contains a variety of wildlife species. Important common wildlife species are described below. Mule deer and black bear are management indicator species (MIS) and evaluated in a MIS report for this EIS. A summary of that analysis is included in Chapter 4, Environmental Consequences.

Mule deer (*Odocoileus hemionus*)

Mule deer are the only recorded ungulate (hoofed) species within the project analysis area. They will inhabit several different habitat types within the project boundaries including forest, oak woods, brush and plantation areas, and meadows depending upon the activity (cover, both protective and thermal; foraging, bedding). Deer may be found throughout the project area in the summer.

Black Bear (*Ursus Americanus*)

Black bear are the only bear found in the project area and are thought to be sparsely distributed throughout the project area. Black bears are omnivorous and feed on small mammals, and a broad variety of vegetation including manzanita berries acorns, and other vegetation.

Mountain Lion (*Felis concolor*)

The mountain lion is the largest cat in California. The tawny colored puma is distributed throughout the forested and brushy mountains of northern California, including the North 49 project area. Mountain lions feed heavily on deer, but occasionally take smaller prey such as rabbits and squirrels.

Bobcat (*Felis rufus*)

A spotted cat with a short tail, bobcats occur throughout California, including the North 49 Project area. Bobcats utilize a broad range of habitats, including mountains, forests, brush, riparian areas and mountain meadows and lake edges. Opportunistic in its diet, bobcats often prey upon mice, wood rats, squirrels, gophers, and small birds.

Neo-tropical terrestrial birds

A variety of migratory neo-tropical terrestrial birds such as thrushes, sparrows, wrens, and finches, utilize the North 49 project area for migration and breeding habitat. Nesting is concentrated in brush fields and along meadow edges where a variety of habitat provides cover and foraging habitat.

Forest Service Region 5 Sensitive Species

Forest Service Region 5 sensitive species are described below and evaluated in this EIS. The effects of the proposed action and alternatives on sensitive species are analyzed in Chapter 4, Environmental Consequences. There are no known federally listed threatened or endangered wildlife species in the North 49 Project area

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle was removed from the federally threatened list on June 28, 2007. There are no bald eagle territories within the wildlife analysis area. However, bald eagles do utilize North Battle Creek Reservoir for foraging. The closest known nesting territory is located approximately six miles southwest of North Battle Creek Reservoir and approximately three miles outside of the Wildlife Analysis Area at McCumber Reservoir (4,091 ft. elevation). There is no known history of bald eagles nesting at North Battle Creek Reservoir. This may be caused by the relatively high elevation (5,600 feet) of the lake. Egg-laying in the Pit River territories begins in late February or early March (Jenkins 1992). North Battle Creek Reservoir is typically frozen over during this time. Heavy snows usually occur at the North Battle Creek Reservoir through April with occasional snows into May. Bald eagle nests within the middle Pit River drainage all have a view of the closest permanent water body and average 424 meters from fish-bearing water (range=6-1000m) (Jenkins 1992, Table 3, Pg. 59). Bald eagles also require very large trees for their nests, utilizing 44.2 dbh for nest trees along the Pit River (Jenkins 1992). With the exception of the western shore, North Battle Creek Reservoir is primarily bordered by lodgepole pine that is insufficient in size to support an eagle nest. There appears to be few, if any, suitable nest trees adjacent to North Battle Creek Reservoir.

California spotted owl (*Strix occidentalis occidentalis*)

On October 12, 2000, the U.S. Fish and Wildlife Service announced a 90-day finding on the petition to list the California spotted owl as threatened or endangered (Federal Register, Vol. 65, No. 198, 60605-60607). The USFWS found that the petition presents substantial information indicating that listing the species may be warranted. The USFWS 12-Month Findings for a Petition to List the California spotted owl (Strix occidentalis occidentalis) (Federal Register Volume 68, No. 31, 7580-7608) stated: After the USFWS reviewed the best available science and commercial information available the USFWS found that the petitioned action was not warranted. The Finding statement leaned heavily on the fact that the original SNFPA FEIS and ROD (2001) and its associated California spotted owl strategy set management direction to be implemented across the Sierra Nevada. The Findings did recognize two factors, “The first is a management review of the SNFPA (USDA Forest Service 2002) and the second is planning for implementation of an Administrative Study on the Lassen and Plumas National Forests that would evaluate the effects of extensive fuels treatment on the California spotted owl (67 FR 72136)… “We will monitor the development of management direction, offer scientific assistance, and review the effects at a later date, if necessary.” (FWS 68 FR 7604).

Changes to the 2001 SNFPA spotted owl strategy were brought about by the 2004 SNFPA ROD. The 2004 SNFPA owl strategy includes the 5-year HFQLG pilot project, as implemented and directed on pages 66 – 69 of the 2004 ROD. Per that direction, the HFQLG Forests would consider owl PACs, SOHAs, Offbase/Deferred, LSOG 4 and 5, and CWHR classes 5M, 5D, and 6 in project design and implementation of

HFQLG vegetation projects. SNFPA standards and guidelines for Home Range Core Areas (HRCAs) do not apply to the Pilot Project Area and vegetation projects.

The comprehensive adaptive management strategy to investigate the effect of fuels treatments and group selection silvicultural on California spotted owls, referred to as the "Plumas /Lassen Administrative Study", is still part of the owl strategy within the pilot project area. No portions of the North 49 Wildlife Analysis Area occur within the administrative study area.

The latest published information regarding the California spotted owl, in terms of population status, distribution, population and habitat trends, and species requirements can be found within the above mentioned Federal Register (Vol 70, No 118/June 21, 2005/Proposed Rules) and additional updated information was provided in Federal Register (Vol. 71, No.100/May 24, 2006). Based on this updated information, a total of 2,306 California spotted owl territories have been documented, 1,865 of which are known within the Sierra Nevada Range, including 1,399 territories on the Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, and Sequoia National Forests, 129 territories in national parks, 14 territories on BLM lands in the Sierra Nevada, four are on California State Commission Land, three are in State Parks, one is on California Department of Forestry (CDF) land, one is on Native American land, and 314 are on private land.

A second petition to protect the spotted owl as an endangered species under the Endangered Species Act was filed with the USFWS on September 1, 2004. This resulted in a 90 day finding that listing the California spotted owl may be warranted (Federal Register/Vol. 70, No. 118, June 21, 2005/Proposed Rules), and initiated a 12-month status review to determine if listing the species is warranted. Substantial changes in information justifying further detailed study by the USFWS include: 1) revisions to the 2001 SNFPA in the 2004 SNFPA, 2) revisions to the California State Forest Practices Code, 3) possible changes to the draft meta-analysis of the population dynamics of spotted owl in the final, published meta-analysis, 4) impacts of recent fires and anticipated future fires in spotted owl habitat; and 5) further range expansion of the barred owl threatening site occupancy, reproduction, and survival of California spotted owls.

The Draft 2006 Meta analysis "Demography of the California spotted owl in the Sierra Nevada: Report to the US Fish and Wildlife Service on the January 2006 Meta-Analysis" (referred to as Blakesly et al.2006) is the most current and comprehensive summary of population trends for the California spotted owl. It has been prepared to help in the decision process for the potential listing of the California spotted owl. The 2006 meta-analysis was similar to the 2001 meta-analysis (Franklin et al. (2004) but included 5 years of additional data (2001-2005), excluded the San Bernadino study, and included a population viability analysis. This 2006 meta-analysis indicates that (1) there is no strong evidence for decreasing population trends from any of the demographic studies. In general lambda (λ), the finite rate of population change, where $\lambda < 1$ indicates a declining population, was not different from that of a stationary population; (2) only the Lassen population decreased significantly based on the 95 percent confidence interval with steady decreases from 1995-1998, and 2002-2004, suggesting the Lassen owl population may be declining; (3) the population viability analysis (PVA) indicated two of the four study areas (Lassen and Sierra) are likely to experience population declines within 7 years and very unlikely to experience population increases under current population trends, but there was great uncertainty in the PVA analyses for time intervals of >10 years; (4) positive trend in adult survival in all studies and estimates of apparent survival increased with time; (5) spotted owl management needs to

maintain a high survival rate of territorial owls in order to maintain spotted owl populations, but that management directed at increasing reproductive output and subsequent recruitment may be the most successful way to maintain or increase spotted owl populations in the Sierra Nevada, as long as these actions do not decrease adult survival. Population growth rate (lambda) can be viewed as the sum of apparent survival probability and the per capita recruitment rate. The study indicates high adult survival and that the majority of immigrating owls onto the study areas considered in the meta-analysis "were likely natal dispersers rather than breeding dispersers."

In responding to this petition, the USFWS conducted a comprehensive study of the California spotted owl populations. It assessed the best scientific and commercial information available; reviewed comments and information received during two public-comment periods; and consulted with recognized spotted-owl experts and Federal and state resource agencies, including an interagency Science Team. On May 15, 2006 the USFWS concluded that the California spotted owl should not be listed as a threatened or endangered species under the ESA (Federal Register 50 CFR 17, Volume 71, Number 100, and May 24, 2006). The USFWS considered the information presented in the 2006 meta-analysis and found that populations of California spotted owl in the Sierras showed little evidence of a decline, and concluded that the owls' status in the Sierra Nevada is not deteriorating as is evidenced by the increasing adult survival and stationary trend of the populations.

The LNF LRMP EIS estimated habitat capacity for the spotted owl on the Lassen to be 39 pairs. The LNF LRMP set a minimum management objective of providing suitable habitat for a Forest-wide network of 40 spotted owl habitat areas (SOHAs). Prior to 1999, the Lassen NF supported 111 spotted owl Protected Activity Center's (PAC's)/SOHAs across Lassen NF according to the HFQLG FEIS. Owl surveys conducted across the Lassen since 1999 has resulted in additional owl PACs, resulting in a new total of 184 PACs/SOHAs according to the Lassen NF spotted owl layer. Approximately 25 PACs are located on the Hat Creek Ranger District.

There are no reliable total population estimates for the California spotted owl (70 Federal Register 35609, FR 71, No. 100). The number of spotted owl territories has been used as an index to indicate the range of the species and where they occur. "This number is actually a cumulative total of all sites known to be historically or currently occupied by at least one spotted owl. This total increases over time as owls move to new territories and as researchers survey new areas, even though many territories with sufficient suitable habitat are not occupied at the present and some territories no longer have sufficient suitable habitat to support spotted owls. … Thus, the number of territories should not be viewed as a population estimate for the taxon "(70 Federal Register 35609, FR 71, No. 100).

The Plumas Lassen Administrative Study (PLAS) spotted owl module has been gathering owl presence/occupancy information within specific survey areas (SA) on the LNF for the last five years. In 2004, the study located 50 spotted owl sites. Of these 50 spotted owl sites, 43 had pairs and 7 had single owls. Therefore, pairs occupied 86 percent of the sites monitored in 2004, while single owls occupied 14 percent. In 2005, 103 spotted owl sites were located. Of the 103 sites, 76 contained pairs, 17 contained unconfirmed pairs (one member of pair confirmed as territorial single, plus single detection of opposite sex bird), and 10 single owls. Therefore, in 2005, pairs occupied 74 percent of the sites, 16 percent were occupied by unconfirmed

pairs and 10 percent by single owls. In 2006, 66 spotted owl sites were located. Of the 66 sites, 56 contained pairs, 2 contained unconfirmed pairs (one member of pair confirmed as territorial single, plus single detection of opposite sex bird), and 8 single owls. Therefore, in 2006, pairs occupied 85 percent of the sites, 3 percent were occupied by unconfirmed pairs and 12 percent by single owls. In 2007, 71 spotted owl sites were located. Of the 71 sites, 62 contained pairs, 3 contained unconfirmed pairs (one member of pair confirmed as territorial single, plus single detection of opposite sex bird), and 6 single owls. Therefore, in 2007, pairs occupied 87 percent of the sites, 4 percent were occupied by unconfirmed pairs and 9 percent by single owls. Table 18 discloses the number of pairs (confirmed and unconfirmed) and territorial single California spotted owls on the Lassen NF in three PLAS survey areas (SA) that are the closest to the North 49 Wildlife Analysis Area.

Table 18. Number of pairs and territorial single California spotted owls on the Lassen NF, California in three PLAS survey areas (SA), 2005-2007

Year	SA-11		SA-12		SA-14	
	Pairs	Singles	Pairs	Singles	Pairs	Singles
2005	4	0	10	1	8	1
2006	3	0	1	7	7	0
2007	3	0	8	0	5	1

Habitat requirements for this species (described below) can be found in the CASPO Technical Report (Verner, et al.1992), within the SNFPA FEIS and 70 Federal Register of June 21, 2005. Standards and Guidelines for owl habitat management, within the HFQLG Pilot Project Area, are found in SNFPA FSEIS ROD (2004) Table 2.

Spotted owls preferentially use areas with at least 70 percent canopy cover, use habitats with 40 to 69 percent canopy cover in proportion to their availability, and spend less time in areas with less than 40 percent canopy cover than expected if habitat were selected randomly (70 Federal Register 35610).

Suitable nesting habitat on the west side of the Sierra Nevada is found in foothill riparian/hardwood forest (1.6 percent of known sites), ponderosa pine/hardwood forest (6.7 percent of known sites), mixed-conifer forest (81.5 percent of known sites) and red fir forest (9.7 percent of known sites). In general, stands typically have two or more canopy layers, dominant and co-dominant (20-30 inches) trees in the canopy averaging at least 24 inches in dbh, at least 70 percent canopy closure, and higher than average levels of very large, old trees, and higher than average levels of snags and downed woody material (70 Federal Register 35610). Owls consistently use stands with significantly greater canopy closure, total live tree basal area, basal area of hardwoods and conifers, snag basal area, and dead-and-downed wood when compared with random locations within forests (Verner et al, 1992). (Table 19). Nests and roosts within the Sierra Nevada occur within the following CWHR classes (USDA Forest Service 2001): 32 percent in CWHR 6, 18 percent in structural class 5M, 14 percent as 4D, 11 percent as 4M, 9 percent as 5D, 7 percent as 5P, and 5 percent as 4P, with 2 percent or less of the 5S, 4S, 3D, 3M, and 3P classes (USDA Forest Service 2001). Owl nests were consistently located in sites with 75 percent canopy cover, 300 stems/ha, and 40,000 cubic meters/ha of foliage volume (USDA Forest Service 2001).

Table 19. Range of mean values of some attributes in suitable habitat for spotted owls in Sierra Nevada mixed-conifer forests (from Verner et al. 1992:96 and USDA Forest Service 2001)

Attribute	Nesting & Roosting Habitat	Foraging Stands
Percent Canopy Cover[a]	70-95	50-90
Total live tree basal area[b]	185-350	180-220
Total snag basal area[c]	30-55	15-30
Basal area of large snags[b,c]	20-30	7-17
Downed woody debris[d]	10-15	10-15

[a]Mostly in canopy >30 feet high, including hardwoods;
[b]Square feet per acre;
[c]Dead trees >15 inches dbh and >20 feet tall;
[d]Tons per acre

The four nest types used regularly by the spotted owl are:

1. cavity nests placed in natural cavities resulting from decay;
2. broken-topped trees and snags;
3. platform nests placed on remnant platforms built by other species, or on debris accumulations; and
4. dwarf mistletoe brooms.

Data analyzed from 124 nest sites within the Sierra indicated that nest trees averaged 45 inches dbh, and more than 70 percent of all nest trees surveyed were larger than 30 inches dbh (Verner et al. 1992). Sixty-three percent of nests were in live trees, and 37 percent were in snags.

For purposes of this analysis, the following affected CWHR types provide **suitable nesting habitat** capability: Eastside Pine, Jeffrey Pine, Lodgepole Pine, Montane Hardwood-Conifer, Ponderosa Pine, Red Fir, Sierra Mixed Conifer and White Fir (6, 5D, 5M). These CWHR types have the highest probability of providing stand structures associated with preferred nesting, roosting and foraging. The threshold between canopy cover values that contribute to or detract from occurrence and productivity is a value near 50 percent (USDA Forest Service 2001, Hunsaker et al. 2002). For the North 49 Project, all 5M is considered owl nesting habitat.

Suitable foraging habitat is found in the same forest types listed above for nesting habitat (CWHR 6, 5D, 5M) as well as 4D, and 4M. Stands considered to be suitable for foraging have at least two canopy layers, dominant and co-dominant (20-30 inches) trees in the canopy averaging at least 12 inches in dbh, at least 40 percent canopy closure, and higher than average levels of snags and downed woody material (70 Federal Register, June 21, 2005). Although canopy covers down to 40 percent are suitable for foraging, they appear to be only marginally so (based on owl occurrence and productivity threshold at around 50 percent canopy cover, Ibid). By maintaining a canopy cover above 40 percent and using the structural thinning described in Chapter 2, the diversity thin would retain forest structural attributes and heterogeneity that provide suitable foraging habitat for spotted owls. In the red fir type, stands with 30 percent or greater canopy cover should be considered suitable for foraging (USDA Forest Service 2001). For the North 49 Project, all 4M (40-59 percent canopy cover) is considered owl foraging habitat while red fir (RFR) 4P (25-39 percent canopy cover) is not considered owl foraging habitat.

The most common prey species for spotted owls are northern flying squirrel (*Glaucomys sabrinus*) and dusky-footed woodrat (*Neotoma fuscipes*). The common foods of northern flying squirrels (primarily fruiting bodies of underground fungi and arboreal lichens) are usually found in mature and older forests. The abundance of underground fungi is known to be strongly associated with the presence of well-developed soil organic layers and a large volume of decaying logs. In addition, higher snag densities may be important to flying squirrel densities, since flying squirrels often use old woodpecker cavities as den sites.

Woodrats are typically associated with brush fields, early successional habitats with a mixed conifer/oak component, and in stands with a mix of overstory trees and brush. Brush is usually dominated by thick leaved evergreen species. Woodrats sometimes move from brush fields into the edges of forest where spotted owls forage (USDA Forest Service 1993). On the Plumas NF, woodrat density consistently responds in a linear fashion to the density of mature (>13 inches dbh), black oak trees; increase in density of black oaks results in increased density of woodrats (USDA Forest Service 2006).

Northern Goshawk (*Accipiter gentilis*)

The latest published information regarding the goshawk, in terms of population status, distribution, population and habitat trends, and species requirements can be found within SNFPA FEIS 2001 (Chapter 3, Part 4.4.2.2), and in Chapter 3.2.2.4 of the SNFPA FSEIS 2004. A total of 588 northern goshawk-breeding territories have been reported from Sierra Nevada National Forests. As of 2007, the Lassen NF corporate GIS coverage includes 105 goshawk Protected Activity Centers (PAC). These numbers represent goshawks that have been found as a result of both individual project inventories to standardized protocols, as well as nest locations found by other incidental methods.

The LNF LRMP EIS stated that the Lassen has the capacity for 113 Goshawk pairs. The 1993 LNF LRMP calls for a network of 113 nesting territories to provide for the viability of the goshawk. It is uncertain as to whether this figure is accurate; the Forest has been developing territories (pre-SNFPA) and now 200 acre gPACs (USDA Forest Service 2004) for all newly discovered goshawk-breeding sites. The current 2007 numbers of 105 PACs is just under the minimum objectives, and the predicted capacity of 113 PACs. So it is believed that the current density of goshawk territories is contributing to goshawk viability within the LNF.

Population trends of northern goshawks in the Sierra Nevada are unknown, although numbers are suspected to be declining due to habitat reductions and loss of territories to timber harvest (Bloom et al. 1986 in SNFPA FEIS). Based on several studies (Bloom et al., 1986, Reynolds et al. 1992, Kennedy 1997, Squires and Reynolds 1997, Smallwood 1998, DeStefano 1998, all in SNFPA FEIS) there is concern that goshawk populations and reproduction may be declining in North America and California due to changes in the amount and distribution of habitat or reductions in habitat quality. Northern goshawk surveys have occurred within the Wildlife Analysis Area. In 2003 and 2004 the North 49 Project Area, was surveyed to the two year protocol standards (“Survey Methodology for northern goshawks in the Pacific Southwest Region” (USDA Forest Service 2000)). These surveys resulted in the delineation of four new gPACs. A total of nine gPACs are in the Wildlife Analysis Area.

Great Gray Owl (*Strix nebulosa*)

Historic sightings are recorded for all counties in the Cascade Range in California and the Sierra Nevada as far south as Tulare Co. The present known population is centered in Yosemite National Park. Nesting activity on the Stanislaus National Forest has been documented at five distinct locations. There have also been several recent sightings on the Sierra National Forest, including a successful nest site in 2002. Recent sightings of great gray owls have also been recorded in or near the Modoc, Plumas, Tahoe, Eldorado, and Toiyabe NFs.

Potentially suitable habitat for the great gray owl is scattered across the Forest. The great gray owl requires the following for nesting and foraging (USDA FS 2000):

1. Mid- or late-succession conifer forests containing large, broken-top snags (> 24 in. dbh, particularly red and white firs) in the forest matrix in sufficient numbers (5-6 snags/acre) to provide nest sites. Old and decadent black oaks have been used for nesting at lower elevations.
2. Suitable nest sites located < 300 yards from montane meadows or grass-forb forage types between 2,000 and 8,000 feet in elevation.
3. Canopy closure greater than 60 percent in at least portions of the forest stands adjacent to meadows or other openings.
4. Meadows or openings that have sufficient herbaceous cover to support pocket gophers and microtine rodents. There should be a minimum of 5-10 inches of residual cover at the end of the summer to maintain suitability. Meadows with standing water remaining at mid-summer are not suitable.

Within the Wildlife Analysis Area on National Forest lands there are approximately 705 acres of habitat providing suitable nesting habitat capability and approximately 143 acres of habitat providing suitable foraging habitat capability (Table 20).

Table 20. Acres of suitable great gray owl nesting and foraging habitat within the Wildlife Analysis Area on National Forest System lands

CWHR Type*	Habitat Type	Acres in Wildlife Analysis Area
Other (SGB and S/P forested stands)	Foraging	39
Meadows (AGS, PGS & WTM)	Foraging (optimal)	104
Total	Foraging	143
4M	Nesting	100
4D	Nesting	422
5M	Nesting (optimal)	0
5D	Nesting (optimal)	183
Total	**Nesting**	**705**

*4=small 11-24"dbh, 5=medium/large >24"dbh. D= Dense Canopy Cover > 60%, M= Moderate Canopy 40-59%, P= Open Canopy 25-39%, S= Sparse Canopy 10-24%, AGS= Annual Grasslands, PGS= Perennial Grasslands, SGB= Sagebrush, WTM= Wet Meadow.

As explained above, it is acknowledged that the acres reflected in Table 20 could be inexact estimates of habitat availability.

Big Lake and its associated meadow complex are approximately 33 acres in size. Vegetation is low sedge, usually less than 10 inches high. The meadow fringes have been utilized for woodcutting, and dispersed

camping and do not appear to provide suitable nest locations. The adjacent mixed conifer timber stands were thinned during the Redlock Timber Sale in 2002. Surveys for great gray owls were conducted in the Wildlife Analysis Area in 2003 and 2004 focusing on the Big Lake area. No great gray owls were detected.

Mesocarnivores

Habitat requirements for forest carnivores can be found in California WHR (Zeiner et al, 1990), habitat capability models (Freel, 1991) and in Ruggerio et al. (1994). Habitat requirements and risks are further described within the SNFPA.

Approximately 50 percent of the LNF has been systematically surveyed, by the Pacific Southwest Research Station (PSW), District Biologists/Wildlife Technicians and Contractors, to protocol ("American marten, Fisher, Lynx and Wolverine: Survey Methods for Their Detection" (Zielinski and Kucera 1995)) for mesocarnivores using track plates and camera stations (LNF GIS database). There have been approximately 6,550 trap-nights of camera and/or track plate work across the Hat Creek Ranger District at 237 locations. In excess of 14,000 additional trap-nights have occurred on the Eagle Lake Ranger District and in excess of 3,200 trap-nights have occurred on the Almanor Ranger District. To date, there have been no fisher or California wolverine detections associated with these survey efforts.

The North 49 Wildlife Analysis Area has been surveyed several times over the years for mesocarnivores using both camera stations and track plates as detailed in Zielinski and Kucera (1995) and was surveyed to protocol ("American marten, Fisher, Lynx and Wolverine: Survey Methods for Their Detection" (Zielinski and Kucera 1995)) using baited photo stations in 2001, 2002 and 2003. To date two target mesocarnivores have been detected in the Wildlife Analysis Area using these methods. Table 21 below shows the stations surveyed within the Wildlife Analysis Area, which includes the visits conducted to protocol. These surveys were conducted for 1,448 trap-nights over approximately 10 years.

Open roads and improperly closed roads adversely affect mesocarnivores by:

1. allow access to areas and cause disturbance to these animals from human intrusion and removal of snags and downed logs through wood gathering activities;
2. increase vehicle/animal encounters resulting in roadkill;
3. can fragment habitat and affect the ability of animals to use otherwise suitable habitat on opposing sides of the road (Duncan Furbearer Interagency Workgroup 1989).

There may be a threshold value for road density (miles of open road per square mile) above which the habitat cannot sustain certain wildlife species but studies specifically addressing these effects on marten or fisher have not yet been addressed (USDA Forest Service 2001). Early habitat models (Freel, 1991) indicated that to provide high habitat capability for marten, open road densities should be less than 1mile/square mile, while 1-2 miles/square mile provided moderate habitat capability; more than 2 miles was providing low-no habitat capability. Models indicate that open road densities should be less for fisher. The current road density within the Wildlife Analysis Area is approximately 2.5 miles of open road per square mile. The action alternatives call for the decommissioning of 1.8 miles of existing system road and 31.3 miles of non-system road. The action alternatives also call for adding 21.1 miles of existing non-system road to the forest

transportation system (system roads). A half mile of new temporary road would be constructed, all of which would be closed at project completion.

Table 21. Mesocarnivore Survey Locations within the Wildlife Analysis Area

Site Code[a]	Location[b]	Trap-nights[c]	Results
3-HC-94	Ashpan Butte	75	Ermine, bobcat, spotted skunk
5-HC-95	North Battle Creek	27	Black Bear
1-HC-96	Ashpan	55	**Marten**, Douglas squirrel
2-HC-97	Table Mtn	101	**Marten**, spotted skunk, feral cat, squirrel
15-HC-97	Redlock Ridge	6	No animals
10-HC-97	North Battle Creek	25	No animals
44-HC-98	Manzanita Chutes	9	No animals
43-HC-98	Mud Lake	15	No animals
41-HC-98	Devil's Rock Garden	11	No animals
37-HC-98	Grayback Ridge	22	No animals
35-HC-98	Bunchgrass Creek	5	No animals
32-HC-98	North Battle Creek	18	Deer
28-HC-98	Superbowl PAC	18	Deer
23-HC-98	Devils garden SOHA	12	No animals
13-HC-98	Manzanita Creek	34	No animals
12-HC-98	Red Lake	47	No animals
05-HC-00	Ashpan	73	No animals
32-HC-01	Manzanita Creek	32	Black bear
31B-HC-01	Manzanita Creek	6	Black bear
30-HC-01	Ashpan/Red Lake	16	Squirrel, chipmunk
29-HC-01	Ashpan/Red Lake	16	Squirrel, chipmunk
28-HC-01	Ashpan/Red Lake	16	Squirrel, chipmunk
27-HC-01	Ashpan/Red Lake	16	Squirrel, chipmunk
26-HC-01	Ashpan/Red Lake	16	Squirrel, chipmunk
25-HC-01	Ashpan/Red Lake	16	Squirrel, chipmunk
27-HC-02	Manzanita Chutes	24	Gray fox, raven
01-HC-02	Table Mountain	85	Black bear, coyote
13-HC-03	Grayback Ridge	13	No animals
12-HC-03	Grayback Ridge	91	Black bear
11-HC-03	Logan Gulch	54	Badger, Douglas squirrel
10_HC-03	Little Logan Butte	44	Black bear, turkey vulture
9-HC-03	Little Logan Butte	10	Black bear, turkey vulture
8-HC-03	Ashpan	7	No animals
7-HC-03	Bunchgrass Valley	3	No animals
6-HC-03	Logan Lake	56	Coyote, deer, black bear
5-HC-03	Ashpan	66	**Marten, red fox**
4-HC-03	Bunchgrass	71	**Marten**
3-HC-03	Ashpan Flat	135	Bobcat, turkey vulture
2-HC-03	Ashpan Butte	79	Bobcat, coyote
1-HC-03	Ashpan Butte	63	No animals
	Total trap-nights:	**1,448**	

[a]The first number is a sequential identifier, the HC signifies the District (Hat Creek), and the last number is the year. 07-HC-02 would thus be the seventh camera set on Hat Creek Ranger District in 2002.
[b]Closest general geographic location.
[c]A trap night is 1 operational camera or track plate operated for one day.

Forest carnivores use snags and down wood for cover and denning as well as foraging. One of the objectives of the action alternatives is to reduce fuel loading. High densities of snags and down logs are unfavorable for fuels management. However, snags and logs are important habitat elements for forest carnivores and their prey. Larger snags and logs provide more habitats per piece and last longer (Ruggiero et al.1994). The SNFPA FSEIS ROD provides guidelines which calls for the retention of between three and six snags per acre over 15 inches dbh and maintaining between three large down logs per acre (eastside) or 10-15 tons of large downed woody material per acre (westside).

Pacific Fisher (*Martes pennanti pacifica*)

The USFWS completed an initial 90-day review of a petition submitted by 20 groups seeking to list the pacific fisher as endangered in Washington, Oregon and California. After reviewing the best available scientific information, the USFWS found that substantial information indicated that listing the pacific fisher as endangered in its West Coast range may be warranted (USFWS news release July 10, 2003). After a 12-month status review, the West Coast population of the fisher is designated as a candidate species by USFWS (Federal Register April 8, 2004 Volume 69, #68), but listing under the Endangered species Act is precluded by other, higher priority listing actions.

In the Pacific States, fishers were historically more likely to be found in low to mid-elevation forests up to 8,200 feet (Ibid). In the southern Sierra Nevada pacific fisher most often occur at elevations between 4000-8000 feet (Freel 1991, USDA Forest Service 2004). The current distribution of fisher within California suggests that the once continuous distribution is now apparently fragmented into two areas separated by a distance that greatly exceeds reported fisher dispersal ability. Methodologies used to detect fisher in numerous survey efforts have failed to detect this species in an area between Mt. Shasta and Yosemite National Park (Zielinski et al, 1995). These authors strongly suggest that the absence of fisher detections within this large 240-mile area is because they do not occur in the areas surveyed. This gap in distribution may be effectively isolating the southern Sierra Nevada population from the rest of the fisher range in Northern California. Since 1990 there have been no detections or confirmed sightings of fisher within this 240 mile gap of the Sierra Nevada (Note: gap is identified as 240 miles in SNFPA FEIS 2001, 260 miles in Federal Register 2004). The North 49 project area is located within this "gap".

Reintroduction of fisher to the central and northern Sierra has been proposed and has strong support in the scientific and research community. The Pacific Southwest Region, Forest Service supports reintroduction and will actively pursue partnerships in this effort as a feature of the SNFPA management strategy (USDA Forest Service 2004).

The loss of structurally complex forest and the loss and fragmentation of suitable habitat by roads and residential development has likely played a significant role in both the loss of fishers from the central and northern Sierra Nevada and its failure to recolonize these areas (USDA Forest Service 2001). Elimination of late-successional forest from large portions of the Sierra Nevada and Pacific Northwest has probably significantly diminished the fisher’s historical range on the west coast (Fed Register, 2004). Additional factors identified in the range reduction of fisher include a combination of legal trapping in the first half of the 20th century and occasional incidental trapping since 1954, timber harvest and associated road building,

development of trans-Sierra highways, increased recreational use of the Sierra Nevada and porcupine poisoning campaigns conducted during the 1950s and 1960s (Lamberson, et al. unpublished report 2000).

District records, from prior to the 1980s, show a hair observation from near Ashpan Butte and visual observations in the vicinity of Manzanita Lake. There are occasional incidental sightings of animals that may be fishers but none of these sightings have been verified (verified = trapped animal, photo, track, or sighting by reliable observer) on the LNF. More recently, fishers appear to be absent from the Forest.

There have been no good population estimates for fisher in California, Oregon, and Washington, so it is unknown precisely how many fishers exist but indications are that the likely extant fisher populations are small (Ibid). Lamberson et al. (unpublished report 2000) states that the Sierra Nevada fisher population is "likely to be no less than 100 and probably no more than 500 individuals".

The 2004 SNFPA FSEIS ROD identifies large trees, large snags, large down wood and higher than average canopy closure as habitat attributes important to fisher. CWHR types 4M, 4D, 5M, 5D and 6 are identified as being important to fisher. A vegetated understory and large woody debris appear to be important for their prey species. Preferred fisher forest types include montane hardwood conifer, mixed conifer, Douglas fir, redwood, montane riparian, Jeffrey pine, ponderosa pine, lodgepole pine, subalpine conifer, aspen, eastside pine and possibly red fir. The higher elevation forests are less suitable for fishers because of the deep snowpacks (USDI Fish and Wildlife Service 2004). Table 22 displays the acres of suitable fisher habitat present in the Wildlife Analysis Area.

Table 22. Acres of suitable fisher habitat on National Forest Land within Wildlife Analysis Area

Species	CWHR Type*	Wildlife Analysis Area (Acres)
Fisher	4M, 5M	4,746
	4D, 5D	25,502
Total		**30,248**

*4=small 11-24"dbh, 5=medium/large >24"dbh. D= Dense Canopy Cover > 60%, M= Moderate Canopy 40-59%, DFR=Douglas-fir, LPN=Lodgepole Pine, MHW=Montane Hardwood, RFR=Red Fir, SMC=Sierra Mixed Conifer, WFR = White Fir.

The physical structure of the forest and prey associated with forest structures are thought to be the critical features that explain fisher habitat use. Powell (Fed. Register 2004) states that forest type is probably not as important to fishers as the vegetative and structural aspects, and fishers may select forests that have low and closed canopies. Numerous studies, as referenced in the 2004 SNFPA FSEIS, indicate that canopy closure over 60 percent is important, and fishers preferentially select home ranges to include high proportions of dense forested habitat. The fisher's need for overhead cover is very well documented in the April 8, 2004 Federal Register. Fishers select stands with dense canopy cover which provides security cover from predators, increases snow interception, lowers the energetic costs of traveling between foraging sites, and preferred prey species may be more abundant and vulnerable in areas of higher canopy closure (Ibid). A number of studies have shown that fishers avoid areas with little forest cover or significant human disturbance and prefer large areas of contiguous interior forest (Ibid).

Rest site structures used by fishers include: cavities in live trees, snags, hollow logs, fallen trees, canopies of live trees, broken top trees, platforms formed by mistletoe or large and deformed branches. Trees used for resting were among the largest diameter trees available, including conifers, snags and hardwoods. Standing trees (live and dead) were the most common resting structures, with black oak the most frequent species used in a Sierra study (Zielinski, et al, 2004). Most den sites are found in live trees. Of 19 tree den sites documented in California, the average diameter was 45-inch dbh for conifers and 25-inch dbh for hardwoods (April 8, 2004 Federal Register).

Fishers in the Pacific States appear to be dietary generalists and may be flexible in their requirements for foraging habitat (Ibid). Stands supporting a complex of down woody material including large down logs and multi-layered vegetative cover are important in foraging habitat. This high structural diversity is associated with prey species richness and abundance. Shrubs also provide food (fruits and berries) for both prey and for fishers. Fishers can be found where the shrub cover is 40-60 percent, but fishers can also avoid areas with too much low shrub cover because it may adversely affect the hunting success of fishers (Ibid).

Habitat fragmentation has contributed to the decline of fisher populations because they have limited dispersal distances and are reluctant to cross open areas to re-colonize historical habitat (Ibid). There is no evidence that fishers are successfully dispersing outside known population areas in California and Oregon. This is possibly due to the extent of habitat fragmentation, developed or disturbed landscapes, and highways/interstate corridors (Ibid). Based on studies of home range sizes, estimates of potentially suitable and contiguous habitat that must be present before an area can sustain a population of fishers range from 31,600 acres in California, 39,780 acres in the northeastern United States, and 64,000 acres in British Columbia (April 8, 2004 Federal Register). These same studies also showed a positive association between fisher presence and forest stand area, detecting fishers more frequently in stands over 247 acres and 126 to 247 acres than in smaller stands (Ibid).

Numerous and heavily traveled roads are not desirable in order to avoid habitat disruption and/or animal mortality. Roads may decrease prey and food availability for fisher (Allen 1987) due to decreases in prey populations resulting from road kills and/or behavioral barriers to movement. The access provided to forested areas by roads leads to increased human disturbances from resource use and extractive activities resulting in an overall degradation of habitat.

American Marten (*Martes americana*)

The distribution of American marten, a mature-forest specialist, has substantially changed since the early 1900s and this distribution appears to have decreased in the northern Sierra Nevada and southern Cascade region and populations appear to be discontinuous. Comparing the historical and contemporary locations centered on Plumas County indicate large gaps between detections that were not present historically. Zielinski points out that these gaps are largely areas composed of National Forests that have received more impacts from humans, including timber harvest, road building and – until the mid-1950s – trapping. The reduction in marten distribution is probably more closely linked to the influence of timber harvest and forest management during the historical and the contemporary periods. Based on Zielinski (2005), trends in marten detections in Plumas County, and by inference PNF, from the early 1900s to the late 1900s are downward, primarily due to relatively small amounts of late seral/old-growth forest attributes.

In the Sierra Nevada, marten are most often found above 7,200 feet, but the species core elevation range is from 5,500 to 10,000 feet (USDA Forest Service 2001). Martens prefer coniferous forest habitat with large diameter trees and snags, large down logs, moderate-to-high canopy closure, and in interspersion of riparian areas and meadows (USDA Forest Service 2001). Martens generally avoid habitats that lack overhead cover; they select stands with 40 percent canopy closure for both resting and foraging and usually avoid stands with less than 30 percent canopy closure (Ibid). Foraging areas are generally in close proximity to both dense riparian corridors (used as travel ways), forest meadow edges, and include an interspersion of small (<1 acre) openings with good ground cover used for foraging (Ibid).

Important forest types include mature mesic forests of red fir, mixed conifer-fir, lodgepole pine, Jeffrey pine and eastside pine (USDA Forest Service 2001). CWHR types 4M, 4D, 5M, 5D and 6 are identified as moderately to highly important for the marten (Ibid). The red fir zone forms the core of marten occurrence in the Sierra Nevada (Ibid). Table 23 displays the acres of habitat present in the Wildlife Analysis Area.

Table 23. Acres of suitable marten habitat on National Forest Land within Wildlife Analysis Area

Species	CWHR Types*	Wildlife Analysis Area (Acres)
Marten	4M, 5M	4,746
	4D, 5D	25,502
Total		**30,248**

*4=small 11-24"dbh, 5=medium/large >24"dbh. D= Dense Canopy Cover > 60%, M= Moderate Canopy 40-59%, DFR=Douglas-fir, LPN=Lodgepole Pine, MHW=Montane Hardwood, RFR=Red Fir, SMC=Sierra Mixed Conifer, WFR = White Fir.

Small openings and regenerating stands (including plantations) are used by marten as foraging habitat (Ibid). These openings are of optimum value when they occupy a small percent of the landscape and occur adjacent to mature forest stands (CWHR 4D, 5M, 5D, and 6). Small openings within a forested matrix may be more conducive to marten populations than large contiguous openings (Ibid).

Numerous and heavily traveled roads are not desirable in order to avoid habitat disruption and/or animal mortality. Roads may decrease prey and food availability for marten as well as fisher (Allen 1987) due to prey population decreases resulting from road kills and/or behavioral barriers to movement.

Numerous surveys conducted within the Wildlife Analysis Area beginning in about 1992 have detected the presence of marten, with the majority of these detections occurring from the Ashpan Flat area northwest to the Huckleberry Mountain area.

Sierra Nevada Red Fox (*Vulpes vulpes necator*)

Sierra Nevada red fox inhabit forested areas interspersed with riparian and meadow habitat, and brush fields. Preferred forest types include red fir, lodgepole pine and sub alpine fir in the higher elevations of the Sierra Nevada (Schempf and White 1977). In the northern Sierra Nevada, most records occur in fir and mixed conifer types, with a large number of sightings also in pine and lodgepole. In the southern Sierra, most sightings were in mixed conifer forests, although lodgepole pine and fir were also important (Schempf and White 1977).

Sierra Nevada red fox are found between 4,000 and 12,000 feet in elevation but are seldom seen below 5,000 feet, and are most often found above 7,000 feet, (USDA Forest Service 2001) inhabiting the Hudsonian and Canadian life zones (Schempf and White 1977). They move seasonally from the higher elevations in the winter to mid-elevation forests during the summer. This species historically occurred at low densities, averaging perhaps one per square mile, and it is unlikely that it was ever common (USDA Forest Service 2001).

Sierra Nevada red fox may be more tolerant of openings than either marten or fisher, as they would hunt in open areas. Predator avoidance in the open may not be a problem for this native fox (Duncan Furbearer Interagency Working Group 1989). Opportunistic hunters, their diet is omnivorous over most of the year, but meat is the most prevalent food in winter (Schempf and White 1977).

As of 1977, Sierra Nevada red fox populations were thought to be maintaining themselves at a low level or perhaps declining (Schempf and White 1977). There is little information presently available to either justify or counter that assumption. There are very few recent sightings (1980-2008) of this species within its current range. However, Sierra Nevada red fox are known to occur within the Wildlife Analysis Area. Red fox have also been reported at Brokeoff Meadows and near Onion Springs south of the Wildlife Analysis Area. Recent research on red foxes around Lassen Volcanic National Park (LVNP), by John D. Perrine attending the University of California, Berkeley, used radio-tracking to locate red fox in the Brokeoff Mountain portion of LVNP. Data on a limited number of foxes appears to show denning occurring at relatively high elevations within the LVNP and winter activities occurring at lower elevations on the LNF (Perrine 2005). It may be that red foxes in the LVNP area are altitudinal migrants. That is they use different habitats in the winter than in the summer. It appears likely that red fox are using the southern portions of the Wildlife Analysis Area and potentially using the proposed treatment areas. The open nature of the industrial timberlands west of the LNF boundary may be too open for this species. Generally, little is known about the habits and life history of this species and its connectivity with other populations of Sierra Nevada red fox to the south.

Red fox were detected at two locations in the Wildlife Analysis Area. One red fox was photographed by a state highway worker at the junction of Hwy 44 and the 16 Road in December 2001. The other detection was made by remote camera near the junction of the Red Lake Road and Hwy 44 in 2003.

California Wolverine (*Gulo gulo luteus*)

The USFWS completed an initial 90-day review of a petition submitted by 6 organizations seeking to list the wolverine in the contiguous United States as threatened or endangered under the Endangered Species Act of 1973, as amended. After reviewing the best available scientific information, the USFWS found that there was not substantial scientific or commercial information indicating that listing the wolverine as endangered may be warranted (USFWS news release October 21, 2003, and Federal Register Vol. 68, No. 203, October 21, 2003). The USFWS will not be initiating any further status review in response to this petition.

The wolverine is considered a scarce resident of California. Its historic habitat is distributed from Del Norte and Trinity counties east through Siskiyou and Shasta Counties, and south through the Sierra Nevada to Tulare County (Zeiner et al. 1990). Most sightings in the North Coast mountains fall within the 1600 to 4800

ft. elevational range. In the northern Sierra Nevada, most sightings fall between 4300 to 7300 ft., and in the southern Sierra Nevada, from 6400 to 10,800 ft. (Zeiner et al. 1990).

In the North Coast region, wolverines have been observed in Douglas fir and mixed conifer habitats, and probably also use red fir, lodgepole, wet meadow, and montane riparian habitats (Schempf and White 1977, Zeiner et al. 1990). Habitats used in the northern Sierra Nevada include mixed conifer, red fir, and lodgepole pine. The species probably also uses subalpine conifer, alpine dwarf-shrub, wet meadows, and montane riparian (White and Barrett 1979, Zeiner et al. 1990). In the southern Sierra Nevada, habitat preference includes lodgepole pine, red fir, mixed conifer, subalpine conifer, alpine dwarf-shrub, barren, and probably wet meadows, montane chaparral, and Jeffrey pine (Zeiner et al. 1990).

Wolverines are wide ranging species with very large home ranges. Researchers have generally agreed that wolverine “habitat is probably best defined in terms of adequate year-round food supplies in large, sparsely inhabited wilderness areas, rather than in terms of particular types of topography or plant associations" (Ruggerio et al.1994). Wolverines are generally considered a solitary species, with adults apparently associating only during the breeding season (Butts 1992). Home ranges of opposite sexes overlap (Powell 1979, in Ruggiero 1994). However, partial overlap of home ranges of some wolverines of the same sex is common (Ruggiero et al. 1994). Studies indicate that home ranges in North America may vary from less than 38.6 square miles to over 347.5 square miles. Males have larger territories than females. Individuals may move great distances on a daily basis; 15 to 30 miles a day is common for males, and some individuals have moved 60 to 70 miles in a single day. Except for females providing for offspring, or males seeking mates, movement is generally motivated by food (Ruggiero et al. 1994). Although wolverines are primarily nocturnal, diurnal movement is often recorded. During summer, long distance movements appear to be restricted to night when temperatures are cooler (Hornocker and Hash 1981).

Forest cover may be an important habitat requirement but they "are found in a variety of habitats and do not appear to shun open areas..." (Ibid 1994). Hornocker and Hash (1981) indicated that wolverines may be reluctant to cross openings, i.e.: clearcuts, burned areas, meadows but also noted that wolverines "occasionally crossed clearcuts...usually crossed in straight lines and at a running gait...,” These researchers also noted that "...no difference in movements, habitat use, or behavior was noted between wolverines occupying the half of the area that was logged and the half that was not." Winter cover is not as critical for wolverines as for marten and fishers because they move down in elevation following prey. Wolverines are solitary animals that avoid human contact and are rarely seen. Management actions such as roads, recreational activities, mineral extractions, and other activities that decrease wild, isolated refugia, continue to threaten wolverine habitat, as well as disrupting habitat use patterns within an individual's home range.

The current wolverine range in California is unknown, largely because it has been over 50 years since verifiable evidence has been collected in California (USDA Forest Service 2001). Despite systematic attempts to detect wolverines, no empirical evidence was obtained that wolverines were present in sampled habitats. Occasional sightings by reliable observers continue to be reported statewide. There is one incidental sighting recorded in the District wildlife atlas that occurred prior to April 1979. There have been no confirmed sightings of wolverine on the LNF since at least 1980. There have been 29 incidental unverified sightings of

wolverine on the LNF. Some of these sightings have later been identified from plaster casts of the tracks as being juvenile bears.

The North 49 Wildlife Analysis Area is well roaded, has been logged in the last 50 years, receives a high degree of human use, and essentially does not provide “sparsely inhabited wilderness”. There have been no sighting reports of wolverine within or near the Wildlife Analysis Area.

Pallid Bat (*Antrozous pallidus*), Townsend's Big-eared Bat (*Corynorhinus townsendii*), and Western Red Bat (*Lasiurus blossevillii*)

Pallid Bat (*Antrozous pallidus*)

Pallid bats occur in a wide variety of habitats, including grasslands, shrublands, and woodlands to mixed conifer forests (USDA Forest Service 2001). They are most abundant below 6000 feet elevation, but have been recorded up to 10,000 feet in the Sierra Nevada (Ibid). They are most common in open, dry habitats with rocky areas for roosting. They day roost in caves, crevices, mines, and occasionally in hollow trees/snags, crevices in oaks, and snags (Ibid). They prefer rocky outcrops, cliffs, and crevices with access to open habitats for foraging. Philpott (1997) emphasizes the importance of oak woodlands for foraging. The SNFPA FEIS (2001) emphasizes the protection and enhancement of both westside foothill oaks and montane oaks to provide for pallid bats. The reduction of hardwoods, both from manual removal and competition from conifers, reduces foraging habitat for pallid bats, yet hardwood and hardwood-conifer stands that contain thick understory vegetation between ground level and eight feet prevents flight and hence use of the area for foraging (Ibid).

There is no indication that there has been a change in the range or distribution of the pallid bat (USDA Forest Service 2001). There are currently scattered records of pallid bat on the Lassen NF. In 2001-2004, bat surveys using mist nets were conducted on the Eagle Lake RD (ELRD) of the LNF. Approximately 80 sites were surveyed and approximately 2,613 individual bats were trapped. A total of 112 pallid bat individuals were caught at 37 of these sites (Duff et al.in prep.). In addition, 13 pallid bat maternity roosts were located on the ELRD using radio-telemetry. All the maternity roosts were in trees, including one aspen, 3 incense-cedars, 8 ponderosa and 1 Jeffrey pine. Average diameter of the roost trees was 30.3 inches dbh, the smallest diameter roost was the 12.7 inches dbh aspen; the smallest diameter conifer roost tree was a 23.5 inches dbh ponderosa pine. There have been no surveys for this species within the Wildlife Analysis Area. It is unknown if pallid bats are present. It is possible that pallid bats occur within the Wildlife Analysis Area. Open areas for foraging comprise about 16 percent of the Wildlife Analysis Area.

Townsend's Big-eared Bat (*Corynorhinus townsendii*)

Townsend’s big-eared bats occupy a wide variety of habitats (older forest, desert, grasslands/plains, riparian, coastal). Roosting habitat requires caves, mines, abandoned human structures, and rock crevices; water for drinking is required. They forage in a variety of habitats, including riparian areas, old forests, and mixed hardwood-conifer forest. They feed primarily on flying insects, specializing in moths, and it usually captures prey in flight, or by gleaning from foliage of brush or trees and feeds along habitat edges. They prefer mesic (wet) habitats. They are usually found below 6000 feet but has been found up to 10,000 feet elevation.

Townsend's big-eared bats form maternity colonies of up to several hundred females. These colonies show a high degree of roost fidelity, and, if undisturbed, colonies may occupy the same roost indefinitely (USDA Forest Service 2001). Its colonial nature places this bat at high risk with a single disturbance causing detrimental harm to potentially large populations (Philpott, 1997).

This species has suffered a substantial decline in population over the last 40 to 60 years, with approximately 52 percent of historical maternity roosts no longer occupied; 40 percent of these known sites had been destroyed or rendered unsuitable (USDA Forest Service 2001). They forage in a variety of open habitats as well as riparian habitat. The single most important non-structural requirement for roost sites for this species is absence of human disturbance (USDA Forest Service 2001).

In 2001-2004, bat surveys using mist nets were conducted on the Eagle Lake RD (ELRD) of the LNF. Approximately 80 sites were surveyed and approximately 2,613 individual bats were trapped. Included in this total were three individuals of this species, all females, which were trapped at a pond near Summit Camp, at the north foot of Antelope Mountain. Individuals were trapped in each of two years, two in 2003 and one in 2004. Occurrence in both years, and because one female in 2003 was lactating, indicate that these were more than just transient bats. The nearest potential roosting habitat to this site is the Brockman Flat lava flow area on the west side of Eagle Lake, located about 4 miles (about 6 km) to the west of the trap location. This is within the foraging range of females from roosts, albeit towards the upper end of the range (Dobkin et al. 1995, Pierson et al.1999). This trap location is approximately 32 miles east from the nearest boundary of the Wildlife Analysis Area, and approximately 33 miles east from the nearest area proposed for treatment.

There have been no surveys for this species within the Wildlife Analysis Area. It is unknown if Townsend's big-eared bats are present. It is possible that Townsend's big-eared bats occur within the Wildlife Analysis Area. Surveys for this species are problematic. These bats have a quiet call and tend to forage above the canopy tops. This makes detection by electronic device difficult. It appears likely that the eastern portions of the Wildlife Analysis Area are being utilized by this species.

Western Red Bat (*Lasiurus blossevillii*)

Western red bats are usually found west of the Sierra Nevada/Cascade crest, most often below 3000-foot elevation, with migrants found outside their normal range. Roosting habitat includes forests and woodlands including mixed conifer forests. They roost primarily in trees, less often in shrubs. Roosts are often in edge habitats adjacent to streams, fields, or urban areas. They are dependent on riparian and riparian edge and mosaic habitats. They appear to be highly associated with intact riparian habitat, particularly willows, cottonwoods, and sycamores (USDA Forest Service 2001). They tend to roost out on the edge of the foliage, and mostly in the largest cottonwoods (Pierson 1998 in SNFPA FEIS 2001).

There is no indication that there has been any change in the range or distribution of this species (USDA Forest Service 2001). There are few records of western red bats on the Lassen NF. In 2001-2004, bat surveys using mist nets were conducted on the Eagle Lake RD (ELRD) of the LNF. Approximately 80 sites were surveyed and approximately 2,613 individual bats were trapped. Included in this total was one western red bat. There have been no surveys for this species within the Wildlife Analysis Area. It is unknown if western

red bats are present. It is also unknown if western red bats utilize any of the aspen patches that are present within the Wildlife Analysis Area. It is possible that western red bats occur within the Wildlife Analysis Area.

Shasta Hesperian Snail (*Vespericola Shasta*)

This mollusk is found in the vicinity of Shasta Lake and its tributaries. It is known to occur in the Pit River. This species is restricted to isolated locations along the immediate damp margins of streams, seeps, springs, marshes, moist bottomlands or mouths of caves where perennial dampness and cover can be found. It has also been found associated with upland, moist microclimates within the Chalk Mountain Late Successional Reserve, north of the Pit River. There have been no detections of Shasta Hesperian snails within the Wildlife Analysis Area.

Northwestern Pond Turtle (*Clemmys marmorata*)

The northwestern pond turtle (NWPT) was historically found in a wide variety of wetland habitats west of the Sierra Nevada and Cascade ranges. Typically, it is found in large, slow-moving streams or lakes and ponds. The ponds within the Wildlife Analysis Area are ephemeral with the exception of North Battle Creek Reservoir. With an approximate elevation of 5,600 feet, North Battle Creek Reservoir appears too cold to support this species. Pond turtles are generally found below 6000 feet (SNFPA FEIS 2001). The perennial streams in the Wildlife Analysis Area are relatively high gradient flows. Adjacent private lands to the west do not appear to provide suitable habitat either. There have been no detections of northwestern pond turtles within the Wildlife Analysis Area. The nearest source populations for the North Battle Creek watershed are probably located in the lower reaches of Battle Creek 10-15 air miles to the west

Fish and Other Aquatic Species

The project area is roughly 42,400 acres in size, located within portions of the Battle, Old Cow Creek, and Hat Creek watersheds. Positioned in the Southern Cascade Mountains of Northern California, the topography of the area is dominated by Lassen Peak at 10,457 feet. Elevations range between 5,100 and 7,064 feet above sea level. Mean annual precipitation is approximately 45 inches per year at the Forest boundary west of Manzanita Chutes and up to 75 inches at higher elevations. The climate consists of hot dry summers and cold winters with most of the precipitation occurring in the form of snow, except in areas below 6,000 feet, which are subject to rain-on-snow events (Napper 2002). Battle Creek and Old Cow Creek Meadow watersheds support anadromous fish downstream of the forest boundary and flow to the west. Most of the subwatersheds in the Hat Creek watershed are small closed basins and not hydrologically connected to other subwatersheds at the surface by stream channels. The closed basins include Bunchgrass, Red Lake and Big Lake. While outside the project area Logan and Lost Creek watersheds are hydrologically connected by streams with the larger Hat Creek watershed, the parts within the project area do not have surface channels connecting to Lost Creek or Hat Creek.

The only perennial streams within the project area on Forest Service land are North Fork Battle Creek, and a small tributary to this creek. The flow in North Fork Battle Creek is controlled by the release of water from the reservoir. This leads to higher than normal summer flows.

Lost and Hat Creeks are two perennial fish-bearing streams that border the project area. Manzanita Creek is seasonally flowing in the vicinity of where it borders the project area to the southeast. This stream is separated from the project area by Highway 44.

Most of the project area contains only seasonal streams that have flow primarily during the spring when the snow is melting. Lakes and ponds are relatively shallow depressions that may be seasonal during dry years.

Aquatic Habitat

Aquatic features are limited in the project area and include a few miles of perennial streams, several miles of seasonally-flowing channels, and perennial and seasonal ponds and wetlands. The most distinctive aquatic and riparian feature is North Fork Battle Creek, which flows from North Battle Creek Reservoir. This stream was surveyed using Lassen National Forest's Streamscape Stream Survey Protocol in 2000 (USDA LNF 2001), and habitat elements considered as indicators of aquatic ecosystem health were documented. The following table summarizes these elements, existing condition at time of survey, and comparative desired condition.

Table 24. North Fork Battle Creek Existing and Desired Condition

Element	Desired Condition	Existing Condition
Riparian Vegetation	Target is upward trend in vegetation, to target of age classes, structural diversity and cover representative of good condition for the vegetative community.	Riparian hardwoods include alder with a diversity of age classes, and sparse aspen, which is mostly decadent.
Shade/ Water Temperature	Stable or upward trend to percentages obtainable for the potential natural vegetative community. Generic target for shade is 75% average for reach ("forested" reaches). No increase in water temperature (due to management activities) over reference (historical) conditions.	Average stream shade 77%
Substrate	Fines (sediment < 2 mm in diameter) <15%	Average pooltail fines 14%
Pool Frequency	Pool-riffle sequence appears appropriate for watershed and channel type; no loss of pools apparent; stream channel not braided	33 pools/mile; no channel braiding
Pool Quality	No decrease in residual pool depth as a result of management. Pool depth vs. basin size comparable to "reference streams"	Average residual pool depth 0.46 meters (no historical data for comparison)
Large Woody Debris	Sufficient in quantity to sustain physical complexity and/or channel stability.	130 pieces/mile
Large Wood Recruitment	Vegetation in RHCAs is within natural range of variability for the site potential natural community.	80% "good", 18% "fair", 2% "poor" rating
Streambank Condition	>80% stable streambanks	Qualitative surveys indicate overall bank stability is ~72%
Chemical Contamination	None	None

Aquatic Species

All aquatic species observed in the area are common species, and include Pacific treefrog (*Hyla regilla*), western toad (*Bufo boreas*), long-toed salamander (*Ambystoma macrodactylum*), garter snake (*Thamnophis* sp.), peaclams (*Sphaeriids*), and springsnails (*Pyrgulopsis*). Rainbow trout (*Onchorynchus mykiss*), a Forest Service Management Indicator Species (MIS) occurs in North Fork Battle Creek. No federally-listed or Forest Service Sensitive species have been documented either currently or historically, although potential habitat for Cascades frog (FS Sensitive) may occur on Forest Service lands.

Downstream of the project area, at least 13 and 17 miles respectively, the Battle Creek and Old Cow Creek watersheds support federally-listed and FS Sensitive anadromous fish. Likewise, Hat Creek at least 20 miles downstream of the project area supports the federally-listed Shasta crayfish.

Table 25 lists the Threatened, Endangered, Sensitive and MIS species analyzed for potential effects by the North 49 project. Refer to the two Biological Assessments/Biological Evaluations (BA/BEs) for aquatic TES species prepared for this project, and the Aquatic Management Indicator Species (MIS) report, which are hereby incorporated into this document by reference. Of the species listed in Table 25; the Central Valley steelhead, Central Valley spring-run Chinook salmon, Central Valley fall-run Chinook salmon, Cascades frog and rainbow trout are considered in this document. The other Forest Service sensitive and federally listed species were determined to be not affected by the North 49 project, and therefore are not addressed further in this document.

Table 25. Aquatic Threatened, Endangered, Sensitive and Management Indicator Species

Species	Status	Considered	Rationale
Central Valley steelhead (*Oncorhynchus mykiss*)	FT	Yes	Project area 13+ miles above reaches accessible to CV steelhead and spring-run (USDA FS 1997). Potential for sedimentation and water temperature changes minimized to a negligible level.
Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*)	FT	Yes	Project area 13+ miles above reaches accessible to CV steelhead and spring-run (USDA FS 1997). Potential for sedimentation and water temperature changes minimized to a negligible level.
Winter-run Chinook salmon (*Oncorhynchus tshawytscha*)	FE	No	Designated critical habitat 27 miles downstream of project area. Programmatic determination (concurred with by National Marine Fisheries Service). (USDC NMFS 1998)
Central Valley fall-run Chinook salmon (*Oncorhynchus tshawytscha*)	S	Yes	Habitat accessible to this species 23+ miles downstream of project area (USDA FS 1997).
Shasta crayfish (*Pacifastacus fortis*)	FE	No	Nearest population is 20+ miles downstream (USDI 1998). No downstream effects are expected as project area subbasins in the Hat Creek watershed are closed basins (for further discussion, see the nonanadromous BA/BE)
Cascades frog (*Rana cascadae*)	S	Yes	No observations of this species have been reported historically or currently within the project area, although individuals may exist.(Lassen NF Amphibian Surveys 1993-2003) Known historically nearby in LVNP. (Fellers and Drost 1993) although present occurrence is limited (Fellers 2003); occurs in Old Cow Creek Meadow (USDA FS 2007). Potential for effect from actions near potentially suitable habitat (montane ponds, potholes in meadows, lakes and streams).
California red-legged frog (*Rana aurora draytonii*)	FT	No	Species not documented historically or currently in the Battle Creek, Hat Creek, or Old Cow Creek watersheds (Jennings and Hayes 1996). Project area located above 5000' elevation, (outside the species geographic range) (USDI 2002). The project area between 5000-5500' elevation (required for site assessments under HFQLG) is limited; habitat determined unsuitable No observations of this species have been reported from repeated surveys in and near the project area (Lassen NF Amphibian Surveys 1993-2003)
Hardhead (*Mylopharodon conocephalus*)	S	No	Project area is outside species' geographic range (Moyle 2002).

Species	Status	Considered	Rationale
Mountain yellow-legged frog (*Rana muscosa*)	S	No	Project area is outside species' geographic range (Vindum and Koo 2003). No observations of this species have been reported from repeated surveys in and near the project area (Lassen NF Amphibian Surveys 1993-2003).
Foothill yellow-legged frog (*Rana boylii*)	S	No	Project area is outside species' geographic range (Central Valley drainages below 4500' elevation) (McFarland 2000). No observations of this species have been reported from repeated surveys in or near the project area (Lassen NF Amphibian Surveys 1993-2003).
Eagle Lake rainbow trout (*Oncorhynchus mykiss aquilarum*)	S	No	Species endemic to the Eagle Lake Basin (Moyle 2002). Project area is outside species' geographic range.
California floater (*Anodonta californiensis*)	S	No	Project area lacks potentially suitable habitat (slow, perennial rivers and large lakes with mud-sand substrate, at low elevation). (Taylor 1981, Frest & Johannes 1995) General area has been surveyed for this species with no observations reported. (Brim Box 2002)
Great Basin ramshorn (*Helisoma newberryi newberryi*)	S	No	Project area lacks potentially suitable habitat (large lakes and rivers, large spring sources and spring-fed creeks; with cold, well-oxygenated water, mud substrate, and slow water velocities) (Frest & Johannes 1993, 1995) General area has been surveyed for this species with no observations reported. (Brim Box 2002)
Montane peaclam (*Pisidium ultramontanum*)	S	No	Project area lacks potentially suitable habitat (large perennial water bodies (slow, spring-influenced rivers, streams, lakes, spring pools) with sand or gravel substrate) (Frest & Johannes 1993, 1995) General area has been surveyed for this species with no observations reported. (Brim Box 2002)
Scalloped juga (*Juga occata*)	S	No	Project area lacks potentially suitable habitat (large rivers at low elevations, with swift, unpolluted, cold, well-oxygenated waters with cobble/boulder substrates) (Frest & Johannes 1993, 1995) General area has been surveyed for this species with no observations reported.(Brim Box 2002)
Topaz juga (*Juga acutifilosa*)	S	No	Project area lacks potentially suitable habitat (perennial springs and outflows with unpolluted, cold, well-oxygenated water and stable gravel/boulder substrate) (Frest & Johannes 1993, 1995) General area has been surveyed for this species with no observations reported.(Brim Box 2002)
Northwestern pond turtle (*Clemmys marmorata*)	S	No	Addressed in Wildlife Biological Evaluation.
Delta smelt (*Hypomesus transpacificus*)	FT	No	Project area is outside species' geographic range (USDI 1993).

Species	Status	Considered	Rationale
Sacramento splittail (*Pogonichthys macrolepidotus*)	FT	No	Project area is outside species' geographic range (USDI 1999).
Conservancy fairy shrimp (*Branchinecta conservatio*)	FE	No	Project area is outside species' geographic range (USDI 1994).
Vernal pool fairy shrimp (*Branchinecta lynchi*)	FT	No	Project area is outside species' geographic range (USDI 1994).
Vernal pool tadpole shrimp (*Lepidurus packardi*)	FE	No	Project area is outside species' geographic range (USDI 1994).
Nugget pebblesnail (*Fluminicola seminalis*)	S	No	General area has been surveyed for this species with no observations reported (Brim Box 2002) Project area lacks potentially suitable habitat (rivers at low elevations with cool, clear, flowing water and gravel-cobble substrate) (Furnish & Monthey 1998)
Rainbow trout (*Oncorhynchus mykiss*)	MIS	Yes	Habitat in project area limited to North Fork Battle Creek. Potential for sedimentation and water temperature changes minimized to a negligible level.

(FT)-Federally Threatened: (FE)-Endangered[1]: (S)-Forest Service Sensitive[2] (MIS) Management Indicator Species
USDI Fish and Wildlife Service Webpage. Sacramento Fish and Wildlife Office, Endangered Species by National Forest. http://www.fws.gov/sacramento/es/spp_lists/NFActionPage.cfm

[1] USDI Fish and Wildlife Service. 2002. Species List for the Lassen National Forest. April 6, 2002. (1-1-02-SP-1574)
[2] Sprague, G.L. 1998. Regional Forester's List of Sensitive Plant and Animal Species (June 10, 1998). USDA Forest Service, Region 5

Federally Listed Threatened and Forest Service Sensitive Anadromous Fish

Central Valley Fall-Run and Spring-Run Chinook Salmon

Chinook salmon are anadromous and semelparous (adults die after spawning once). Their life history is variable in terms of age at seaward migration, length of time spent in fresh water, estuarine and oceanic residence, ocean distribution and migratory patterns, and age and season of spawning migration.

Central Valley Spring-run Chinook salmon (federally listed as threatened) adults migrate from the ocean during March and April, and "hold" over in deep pools throughout the summer. Adults congregate in pools at least one to three meters deep, with a large amount of cover (especially "bubble curtains" and bedrock ledges), some stream shade, moderate velocities, and proximity to gravel beds suitable for spawning. Spawning occurs from late August through October, and adults die soon after. Salmon prefer riffles, runs, and pool tails for spawning that are relatively silt-free for good egg survival. Eggs and sac fry remain within the nesting gravels (or "redds") for several months, depending on water temperature (temperatures must range between 42 and 56 degrees F for egg and fry survival). In Deer and Mill Creeks, emergence of fry from the gravel is likely to occur through March or April (Harvey 1995; Harvey 1996) although data is limited. Once the fry emerge from the gravel, they may begin migrating downstream (toward the ocean) immediately or remain in the stream for several months to more than a year. Salmon fry feed in low velocity slack water, moving to somewhat deeper and higher velocity areas as they grow larger.

Fall-run chinook salmon migrate from the ocean and enter the tributary streams between October and December, with the peak run occurring in early November. They spawn within a few days to a few weeks of entering the streams, and adults die shortly thereafter.

Central Valley Steelhead

California Central Valley winter-run steelhead (federally listed as threatened) migrate from the ocean between November and March. Winter-run steelhead generally spawn January through March, but spawning can extend into spring and possibly early summer months (McEwan and Jackson 1996). In general, habitat requirements for steelhead are similar to those for Chinook salmon. However, they prefer spawning substrate slightly smaller than salmon, and eggs and fry are less tolerant of fines. Water temperatures that ensure successful reproduction range between 39 and 55 degrees F. Depending on water temperatures, steelhead eggs may incubate in redds for 1.5 to four months before emerging from the gravels. Adults either die after spawning, or return to the ocean between April and June. In general, juvenile steelhead usually remain in fresh water for one to two years before migrating to the ocean.

Anadromous Fish Habitat Account

Seven of the subwatersheds within the project area are tributaries within the Battle Creek system, a watershed recognized as having the best potential for restoring salmon and steelhead within the Central Valley.

Battle Creek is comprised of two main branches, the North Fork Battle Creek (approximately 29.5 mi. in length) from headwaters to the confluence with the South Fork and, the South Fork Battle Creek (approximately 29 mi. in length) from the headwaters to the North Fork confluence. The mainstem valley

reach from the confluence of the South Fork and North Fork to the Sacramento River is approximately 15 miles in length. Numerous tributaries also feed the South and North Forks of Battle Creek.

The following paragraph on the general hydrology and geology of Battle Creek was extracted from the Battle Creek Salmon and Steelhead Restoration Plan (Kier 1999).

The geology and hydrology of Battle Creek is unique among the tributaries to the upper Sacrament River downstream of Shasta Dam. Battle Creek has the largest base flow or dry-season flow of any of the tributaries to the Sacramento River between the Feather River and Keswick Dam on the Sacramento River. The spring-fed nature of Battle Creek ensures that an average September flow of 255 cfs (cubic feet per second) reaches the Sacramento River from the 356 square mile drainage area. The creek and its tributaries drain the volcanic slopes of Mt. Lassen located at the top center of the watershed. The volcanic formations and ancient stream channels buried by lava flows store a portion of the wet season runoff and convey it to the streams in the dry season via numerous cold springs. Salmon and steelhead present in the lower watershed is supported by large quantities of groundwater accretions.

Within the lower watershed, a complex water conveyance system is owned and operated by Pacific Gas and Electric (PG&E). The Battle Creek Hydroelectric Project (FERC #1121) consists of five powerhouses, two small storage reservoirs, three forebays, five diversions on the N.F. Battle Creek, three diversions on the South Fork Battle Creek, numerous tributary and spring diversions, and a network of some 20 canals, ditches, flumes, and pipelines (Kier 1999).

Within the project area watersheds, surface erosion is the dominant erosional process and the process of greatest concern related to proposed management activities relative to effects on downstream anadromous fish habitat. In the project area, the majority of surface erosion is linked to road drainage.

On the North Fork Battle Creek, a natural barrier, located approximately 13 miles downstream of the Lassen National Forest boundary is the limit of habitat accessible to listed anadromous fish (presently, habitat is limited further downstream at Eagle Canyon Dam).

Based on the maximum restored habitat potential for fall-run Chinook salmon (Forest Service Sensitive species), their upstream limit would be below Eagle Canyon Dam (Kier 1999), and approximately 23+ miles below the LNF boundary. Presently, however, their upper range in the North Fork Battle Creek is limited even further downstream due to management operations at the Coleman National Fish Hatchery near the confluence with the Sacramento River.

A small portion of the project area (about 193 acres) is located in the Old Cow Creek subwatershed, within the larger Cow Creek drainage. The Old Cow Creek subwatershed represents about 0.7 percent of the Cow Creek drainage. Cow Creek is a large, free-flowing tributary to the Sacramento River. Five large tributaries, including Old Cow Creek, flow in a southwesterly direction and form the mainstem of Cow Creek. These tributaries have been documented as providing existing and potentially enhanceable habitat for chinook salmon and steelhead. Studies of Cow Creek anadromous fish habitat have identified, in portions of the watershed, factors that could be potentially adverse to anadromous fish, including: water quality, entrapment, elevated water temperatures, physical barriers, degradation of spawning areas, low water flows, and predation. (SHN 2001).

The upstream extent of anadromous fish habitat in the Old Cow Creek watershed is about 17 miles downstream of the forest boundary, and at least 18 miles downstream of the project area.

Critical Habitat

Critical habitat for Central Valley steelhead and Central Valley spring-run chinook salmon was originally designated by NOAA Fisheries in February 2000 (65 FR: 7764); was subsequently withdrawn in April 2002 (67 FR: 21587); and re-designated effective in January 2006 (70 FR: 52488). Under the previous designation, critical habitat encompassed accessible reaches of all rivers (including estuarine areas and tributaries) within the range of each ESU. This habitat included all waterways, substrate, and adjacent riparian zones below longstanding, naturally impassible barriers (i.e. natural waterfalls in existence for at least several hundred years) and specific dams. Under the new designation, for the watersheds that are in the vicinity of the Lassen National Forest, habitat is the same accessible reaches as described above, but includes only the stream channels with a lateral extent as defined by the ordinary high-water line or bank-full elevation. In the Battle Creek subwatershed (and the subject area of this document, and more specifically, the N. F. Battle Creek), designated critical habitat 13 + miles downstream of the Lassen National Forest boundary. For Cow Creek, designated critical habitat for steelhead is about 17 miles, and for spring-run chinook salmon about 32 miles, downstream of the forest boundary.

Essential Fish Habitat

Based upon a NOAA Fisheries finding (September 21, 2000) and U.S. Forest Service concurrence (November 7, 2000), the ESA Section 7 consultation process used by the Forest Service for Federal activities can be used to satisfy Essential Fish Habitat (EFH) consultation. Thus, for this action, the biological assessment also suffices as the EFH assessment.

In the anadromous fish producing watersheds of the Lassen National Forest, EFH for chinook salmon (including listed and non-listed runs), includes the same areas designated as critical habitat for Central Valley spring-run chinook salmon. Thus, within the Battle and Old Cow Creek watersheds, EFH is also downstream of the project area being addressed in this document.

Forest Service Sensitive Species

Cascades Frog

The Cascades frog is a mountain frog most common in small pools adjacent to streams flowing through subalpine meadows. They also inhabit sphagnum bogs and fens, seasonally-flooded, forested swamps, small lakes, ponds, and marshy areas adjacent to streams (Leonard et al. 1993). In Oregon, Cascades frogs are abundant in ephemeral ponds that transition into meadows by the end of summer (Lassen NF 2003), but they probably cannot survive in ephemeral situations where at least some of the substrate does not remain saturated (Lassen NF 2003). Hibernation occurs underwater or in saturated ground, presumably because frogs cannot survive the level of water loss sustained if dry terrestrial hibernation sites were used (ibid). Adult and juvenile frogs use a broad range of habitat types (e.g. streams, lakes, meadows, etc.), but breeding sites are generally associated with small, shallow vegetated ponds or wet meadows that provide warmer water temperatures conducive to embryo and tadpole development (Lassen NF 2003). Breeding begins soon after snow and ice

have melted (generally, March to April, depending on elevation) and egg masses are laid unattached to vegetation and only partially submerged in shallow water (Lassen NF 2003). Oviposition habitat is open, shallow water that remains unshaded during the hours of strong sunlight (Lassen NF 2003). Upon entering metamorphosis, larvae voluntarily select the highest environmental temperatures (28.8 degrees C/84 F) (ibid). Tadpoles metamorphose in about two months (Nussbaum et al. 1983).

The Cascades frog occurs in the Cascades range of Washington, Oregon, and northern California. Historically, the Cascades frog was distributed in California from the Shasta-Trinity region eastward toward the Modoc Plateau and southward to the Lassen region and upper Feather River system (Jennings and Hayes 1994). The known elevational range of the Cascades frog in California extends from 760 feet to 8250 feet (ibid).

In northern California, north of the McCloud River, the Cascades frog seems to be doing well (Lassen NF 2003). In the southern-most part of its range, however, roughly south of the McCloud River (ibid), recent research has shown that this frog is extremely rare (Fellers and Drost 1993; Jennings and Hayes 1994).

In the vicinity of the Lassen National Forest, Cascades frogs were known historically within tributaries of Deer and Butte Creeks as well as tributaries of the North Fork and West Branch Feather River, Mill Creek, and headwater tributaries to the S. Fork of Battle Creek (Lassen NF 2003). They were also locally abundant in at least 16 locations within the Lassen Volcanic National Park (LVNP) (Fellers and Drost 1993), which lies adjacent to the Lassen National Forest.

Within the last 15 years, Cascades frogs (either reproducing populations or single observations) have been found in subwatersheds of the Pit River (in the area of the Northwest Forest Plan), Deer Creek, Butte Creek (EA 1995; EA 1996; Fellers 1995; Fellers 1998), North Fork Feather River (G. Smith 1998, personal communications; H. Brown 1998, personal communications; Vindum and Koo 2008), and Old Cow Creek (USDA 2007). In addition, surveys within the LVNP over the last 10 years have found limited numbers of Cascades frogs in three locations (Fellers unpublished data). Although modest reproduction has been documented within some of the populations, the status of the Cascades frog within the area of the forest remains tenuous (Fellers 1998).

Although nearly all watersheds within the Lassen National Forest boundary may contain suitable habitat for the Cascades frog, forest-wide amphibian surveys have failed to locate additional populations (including single observations) outside subwatersheds of the Deer, Pit, Butte, Old Cow Creek, and North Fork Feather River systems; which documents a decline in the distribution of Cascades frog over time in the southern end of its range.

Populations of Cascades frogs are not known historically within the North 49 project area. The closest locations of Cascades frogs are historical accounts, roughly 0.5 miles south of the project area, within LVNP in the Manzanita Creek subwatershed of the Battle Creek watershed. Recent surveys in this area have failed to observe Cascades frogs (Fellers and Drost 1993; Fellers unpublished data). Other nearby historical and current locations in LVNP are at least 5 miles south of project area (Fellers and Drost 1993; Fellers unpublished data).

The nearest existing population of Cascades frogs is roughly 1.5 miles northwest of the project boundary in Old Cow Creek Meadows (private land). The next closest population is outside the forest boundary at Cutter Meadow, Old Cow Creek watershed, about 3.5 miles northwest of the North 49 project area. All other known current locations of Cascades frogs are roughly between five and 25 miles from the project area.

Overview of amphibian surveys conducted within and near the North 49 project area.

Within the LVNP, surveys were conducted in 1991 at 50 localities, both where the species occurred historically (16 sites) and in areas judged to represent suitable habitat (34 sites). In spite of intensive efforts, only 2 adult frogs were found at one locality (Fellers and Drost 1993). A total of 231 surveys have also been conducted in LVNP between 1993 and 2002 (Fellers unpublished data). From these surveys, a total of 12 visits resulted in observations of limited numbers (ranging from 1-6 individuals) of Cascades frogs. All occurrences were limited to three locations within the North Fork Feather River watershed, at least six miles from the project area.

Surveys have also been conducted outside of LVNP, at sites within and near the North 49 project area since 1995. Table 26 summarizes recent amphibian surveys conducted along waterbodies containing the most suitable potential habitat for the Cascades frog within and near the North 49 project area.

In summary, drainages with historical occupancy of the Cascades frog as well as areas of potential suitable habitat near the vicinity of the North 49 project area have been formally surveyed over the past 17 years; and have been found only in two locations in the Old Cow Creek watershed, outside of the North 49 project area.

Habitat Account

Populations of Cascades frogs (primarily new metamorphs) on the Lassen National forest occupy wetland, boggy type habitat in meadows with standing water or ponds, although subadults and adults are found elsewhere in stream environments. Therefore, both lentic and lotic habitats are considered potentially suitable.

In the North 49 project area, most aquatic features are seasonal, unconnected, and support little to no riparian vegetation or perennial aquatic habitat. These aquatic features are not likely to support Cascades frogs because they are mostly seasonal in nature, highly isolated with no habitat connectivity, and Cascades frogs have not been found in these areas during surveys. The exception is North Fork Battle Creek and some of its tributaries. While surveys have not located frogs in this drainage, and boggy meadow habitat is limited, these streams do provide habitat as they support riparian vegetation and are perennial in nature.

Table 26. Summary of Herpetofauna Surveys Conducted within and adjacent to the North 49 Project Area, observations of Rana sp.

Survey Source	Survey Objective	Survey Date	Subwatershed/ Water Body	Rana sp. present
G. Fellers, Biological Resources Division, USGS	Determine presence of Rana species	7-10-95	HC29/Big Lake Meadow	None
		7-10-95	HC29/Big Lake Pond	None
		9-03-96	HC23/Big Spring	None
		9-10-96	HC23/Logan Lake	None
		7-14-97 7-15-97	HC30/Lost Creek (total of 3.5 mi. surveyed)	None
		7-11-95	HC22/Mud Lake	None
		7-10-95	HC37/Red Lake	None
J. V. Vindum & M. S. Koo, California Academy of Sciences	Determine presence of all herpetofauna species	2003	HC30/Lost Creek	None
			HC23/Hat Creek	None
			HC22/Mud Lake	None
			BC16/Lower Manzanita Creek	None
			HC37/Unnamed Pond North of Red Lake	None
			HC37/Red Lake	None
			BC20/NF Battle Creek Below Dam	None
			HC22/Upper Bunchgrass Creek	None
			HC29/Big Lake	None
			OCC1/Huckleberry Lake and Creek	None
Lassen National Forest M. McFarland (Forest Fisheries Biologist)	Incidental observations during a field interdisciplinary team meeting	8-13-97	HC29/Big Lake	None
	Follow-up site visit	8-22-02	HC29/Big Lake	None
	Incidental observations during a field interdisciplinary team meeting	8-13-95	HC37/Red Lake	None
USDA Forest Service, Pacific Southwest Research Station, Redwood Sciences Laboratory (J. Stead & K. Pope)	Assess reproductive output of existing R. cascadae populations in the Mt. Lassen region	2007	OCC1/Old Cow Creek (private land within forest boundary)	Rana cascadae

Lassen National Forest Management Indicator Species

Rainbow Trout

Detailed information on rainbow trout for the Lassen NF is documented in the North 49 Project MIS Report, and the Lassen NF MIS Report (USDA FS 2006), which are hereby incorporated by reference.

Rainbow trout are native to Pacific slope drainages from Alaska to Baja California (Fuller 1997, Moyle 2002). They are presently the most abundant and widespread native salmonid in western North America, having achieved success with a flexible life history pattern and adaptation to a wide variety of habitats (Moyle

2002). Moyle (2002) describes resident rainbow trout as a catchall designation for hundreds of non-anadromous wild rainbow trout populations that exist throughout California and are, most likely, of mixed hatchery and native origin; the term has no validity as a taxonomic unit (except to indicate the presumed mixture within the rainbow trout populations).

Rainbow trout was chosen as an indicator species for habitat characteristics consisting of water and riparian areas associated with streams (LRMP FEIS p. 4-125, LRMP p. 3-43, 46). It is both a Special Interest and Harvest Species (FEIS pg 3-98).

Monitoring results indicate the distribution of rainbow trout across the forest is stable.

Habitat Account

Rainbow trout inhabit both lotic and lentic waters. Because they require cool, well-aerated running water to spawn successfully, they cannot establish self-sustaining populations in lakes without inflow or outflow streams.

Important habitat elements for rainbow trout include adequate oxygen, cool water temperatures, spawning gravels with relatively low percentages of fine particles, and a variety of physical habitat characteristics (pool depth, cover, etc.) important during various life stages.

Behnke (1992) describes four types of habitat that rainbow trout need during their life: spawning, rearing, adult, and overwintering habitats. Spawning habitat, which is typically small, cool-water streams, must have adequate gravel beds. This means that there must be enough gravel for the redd, and the gravel must not be too fine or it will not let oxygen to the eggs. The water flow must not be too rapid. Very rapid water flow will carry the gravel of the redd, and the eggs, downstream.

Rearing habitat must have adequate protective cover. At this stage of life, the fish is extremely susceptible to predation. The area must have water of low velocity. The fish are not yet strong enough to fight heavy currents for long periods of time. There must also be adequate food sources. A large amount of growth occurs during this time. Trout will usually stay in rearing habitat from birth to the second year of life.

Adult habitat, which is generally used by trout during the second year of life, usually has water depths of 0.3 meters or greater. It is usually an area in which rapid-flow water meets calm water. This allows the fish to rest in the calm water and search for food and cover in the faster water. The cover in these areas often includes boulders, logs, vegetation, and undercut stream banks.

Overwintering habitat areas are usually in deep waters. Stream fish move down to larger rivers, while lake fish move into deeper parts of the lake. The water tends to be low velocity in these areas. There has to be a large amount of protective cover. These areas also need to have an adequate amount of food.

Regardless of the habitat they are in, rainbow trout can utilize a high amount of dissolved oxygen in the water (up to 80 percent saturation). Optimal temperature is between 7 and 17°C. Rainbow trout will die at temperatures above 28 degrees Celsius. Optimal pH for trout survival is between 7 and 8.

To varying levels, anthropogenic disturbances such as mining, logging, road building, and grazing have and are affecting the habitat for rainbow trout. Of primary concern is the delivery of fine-grained sediment to stream channels; thus, increasing stream turbidity, degrading spawning gravels, and reducing pool habitat.

Increases in the delivery of sediment to streams are also the primary management concern on the Lassen NF. Increased sediment delivery is associated with forest roads, and ground disturbing activities such as timber harvest and mechanical fuels reduction. Sediment may also be increased when ground cover is reduced by activities such as grazing and prescribed fire, or wildfire. Also of concern on the Lassen are activities that remove stream canopy to the level that would cause water temperatures to increase significantly. Canopy reduction can be caused by grazing, timber harvest and fuels reduction, and road construction.

The LNF LRMP defined habitat relationships in a Habitat Capability Model (HCM) (p. 0-19) and considers several attributes in defining habitat capability, including but not limited to water temperature, stream channel stability, pool characteristics (depth, cover), water surface shade, and spawning area substrate (percent gravel, percent fines).

Other variables are also listed in the HCM (e.g. average water width, depth and velocities); however, only water temperature, water surface shade, spawning area substrate, pool depth, and stream channel stability are given further discussion on rainbow trout habitat status and trend. These variables were chosen because they: 1) represent the best variables used in the initial modeling process to address the following critical question, “what environmental variable, when changed, will affect the capability of an area to support a management indicator species and 2) they are measured in the Stream Condition Inventory protocol. The purpose of this inventory protocol is to collect intensive and repeatable data from stream reaches to document existing stream condition and make reliable comparisons of stream reaches over time.

Recent analyses indicate that 73 streams, encompassing more than 361 miles of stream habitat on the Lassen NF lands are documented as being occupied by rainbow trout. Monitoring results indicate that the condition of rainbow trout habitat across the forest is stable or slightly improving.

Current Condition of the Key Habitat Factor(s) in the Analysis Area: Rainbow trout habitat on Forest Service land in the project area is limited to a three mile portion of North Fork Battle Creek. The majority of this stream was surveyed in 2000. Habitat survey results, in terms of the key habitat elements for rainbow trout discussed above, are summarized below.

Table 27. North Fork Battle Creek Existing and Desired Condition

Habitat Element	Desired Condition	Existing Condition
Water Temperature/ Shade	Stable or upward trend to percentages obtainable for the potential natural vegetative community. Generic target for shade is 75% average for reach ("forested" reaches). No increase in water temperature (due to management activities) over reference (historical) conditions.	Average stream shade 77%
Substrate	Fines <15%	Average pooltail fines 14%
Pool Depth	No decrease in residual pool depth as a result of management; pool depth vs. basin size comparable to “reference streams”	Average pool depth 0.46 meters; no evidence of channel braiding
Channel Stability	>80% stable streambanks	Qualitative surveys indicate overall bank stability is ~72%

Lakes and ponds in the North 49 Project area are relatively shallow depressions that may be seasonal during dry years. Seasonal streams, lakes and ponds provide habitat for amphibian and reptile life including Pacific treefrog (*Hyla regilla*), western toad (*Bufo boreas*), long-toed salamander (*Ambystoma macrodactylum*), and garter snake (*Thamnophis* sp.).

Rainbow trout (*Onchorynchus mykiss*), a Forest Service Management Indicator Species (MIS) occurs in North Fork Battle Creek and North Battle Creek Reservoir. Battle Creek and Old Cow Creek Meadow watersheds support anadromous fish downstream of the forest boundary and flow to the west. Most of the subwatersheds in the Hat Creek watershed are small closed basins and not hydrologically connected to other subwatersheds at the surface by stream channels. The closed basins include Bunchgrass, Red Lake and Big Lake.

Range

The North 49 Project area overlaps portions of two livestock grazing allotments on the Hat Creek Ranger District, including the North Battle Creek and Hat Creek Allotments. The current status of these allotment permits is listed in the table below.

Table 28. Current allotment status

Allotment Name	Livestock Class	Livestock Kind	Livestock Numbers	Season of Use	Status
N. Battle Creek	Cattle	Cow/Calf	80	7/1-9/30	Active
Hat Creek	Cattle	Cow/Calf			Vacant

Source: Hat Creek Ranger District 2230 Permit Files

North Battle Creek Allotment: All of the North Battle Creek Allotment lies within the western portion of the North 49 Project area. The permit for the allotment is 80 cow calf pairs from 7/1 to 9/30. The existing permittee's headquarters is located in Shasta County, CA.

Hat Creek Allotment: The North 49 Project area overlaps approximately fifty percent of the acres of the Hat Creek Allotment. The allotment was grazed under two separate permits in past years. One permit was cancelled in 1999 for exceeding the allowed non-use for personal convenience (over three years of non-use). Authorization under this permit was for 50 cow-calf pairs between June 16 and September 15. The permittee's ranch headquarters was located in Hat Creek, CA. Grazing authorization was cancelled on the second permit in 2004 due to permit non-compliance. Authorization under this permit was for 88 cow-calf pairs between June 16 and September 15. The permittee had their ranch headquarters in Millville, CA.

Livestock grazing mainly occurs on areas that have been determined to be capable for livestock grazing, which mainly consists of transitory range on the North Battle Creek Allotment. Large portions of the allotment are non-capable for grazing because of steep topography, dense timber stands, or distance from water. The table below displays acres by allotment and capable range acres. Rangeland suitability will be determined under a separate environmental analysis, as described under the Existing Condition Section.

Table 29. Rangeland Capability by Allotments

Allotment Name	Acres w/i North 49 Project Area	Allotment Acres			Capable Acres		
		Total	NFS	Other	Total	NFS	Other
N. Battle Creek	18,229	18,229	15,314	2,915	1,605	1,099	506
Hat Creek	24,100	24,100	21,254	2,846	598	439	159
Hat Creek	~ ~ ~	48,031	46,158	1,873	8,728	7,771	957

Source: Lassen NF Range Files

Available forage for cattle on the allotments is associated with the following range types: wet meadow and riparian, dry meadows, medium soil perennial dry land bunchgrass, shallow soil perennial dry land bunchgrass and woodland chaparral browse. Most of the riparian areas are surrounded by conifer forest including lodgepole pine, which are in various stages of encroachment.

Key Areas

Key areas are established throughout the allotments. The key areas on active allotments are monitored to ensure standards and guidelines are being met and to provide a basis for any adjustments that may be necessary. The main key areas established on the allotments are listed below.

Table 30. Key Areas for monitoring range use

Allotment	Key Area No.	Key Area Name
North Battle Creek	KANB1	North Battle Creek
	KANB2	Big Lake
	KANB3	Red Lake
Hat Creek	KAHC1	Lost Creek # 1
	KAHC2	Lost Creek # 2
	KAHC3	Lost Creek # 3
	KAHC4	Lost Creek # 4
	KAHC5	Small Meadow
	KAHC6	Lassen National Park Boundary
	KAHC7	Bunch Grass Flat
	KAHC8	Mud Lake
	KAHC9	Ash Pan

Source: Hat Creek Ranger District 2210 Allotment Files
*Note: Some Key areas are outside of the North 49 Project area, but within the Allotments.

Heritage Resources

Prehistory

The specific area's prehistoric chronology needs further study. Patterns of use of the area would be expected to be complex since the project 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 7,500 years ago; until about 3,000 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 treatment 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 project area are rare, but consistent with use beginning by 5,000-3,000 BC.

Ethnography

Lassen Peak, a prominent local landmark a little to the southeast of the project area, has been viewed as a boundary point between three groups: the Atsugewi, the Southern Yana, and the Northeastern Maidu. Current information indicates that the project area falls within the traditional territory of 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. The Southern Yana, occupying areas west of the Atsuge, may have used the Battle Creek drainage (on the west side of the treatment area) at times, and the Northeastern Maidu may also have used the area at times. 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, Johnson 1978, 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). 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. 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, Waechter et al. 2003).

The Atsugewi, like the Yana, followed a yearly round of seasonal transhumance, settling in protected valleys during the winter and making spring, summer, and fall movements to take advantage of seasonally available resources (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 treatment area and the deep snows present in winter suggest that it would have been occupied only during warmer seasons.

For the treatment area, ethnographic information indicates that a small portion was within a traditional sugar pine nut collection area associated with Wilcox Mountain. The Lost Creek area, including a small

portion of the treatment 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). The Thousand Lakes area, generally north of the treatment area, is documented as a power place. In consultation, Atsuge representatives have not expressed any concerns regarding the gathering areas (which would not be expected to be damaged, and which might be enhanced, by the proposed treatments).

History

Fur trappers were among the first Euro-Americans to venture into the vicinity of the project 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).

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 project area.

The namesake for the Nobles 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.

A later transportation route partly within the project area is the Old Military Road to Fort Crook. The army constructed Fort Crook in 1857 to help protect travelers on the Shasta-Yreka Road, and the Lockhart Ferries. At least a portion of this route is now a Forest Service road.

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 Mount Lassen roughly southeast of the project area, may have been destroyed in Mount Lassen's 1910s eruptions. Historic fence remnants in the project area suggest historic grazing activities.

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). Cut stumps and at least one former road segment suggest historic logging in the treatment area.

Hydroelectric power was in demand in California by the early twentieth century, with the Shasta Power Company operating in the area by 1902. Ditch/flume segments within the project area reflect this activity.

Other historic activities within the project area almost certainly included recreational activities. These activities probably left limited traces on the land, but probably included hiking, camping, hunting, and fishing.

Telephone line remnants probably reflect, potentially among other things, Forest Service administration of the project area. The former location of Big Springs Fire Station, which may have been in place in some form by 1907, is also near the project area.

Recreation

The 2004 Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement and Record of Decision includes a diverse analysis of recreation opportunities and data on economics , statistics and capacities for the Sierra Nevada National Forests, including the Lassen National Forest (LNF). The listed activities are examined for the forest and the FSEIS contains data including visitor days of use, expected increase in demand, and direct and indirect economic benefits. Recreation use is important in the mix of resources provided by the LNF. The 1993 LNF LRMP states goals to provide a wide range of outdoor recreation, interpretive services and facilities, and diverse opportunities for off highway vehicle recreation and winter sports.

The largest recreation complex near the North 49 project area is the designated Hat Creek Recreation Area, which stretches for 15 to 20 miles along Highway 89, directly north and east of the project area. This popular recreation area, which is the focal point of visitor activity on the Hat Creek Ranger District, is associated with trout fisheries of Hat Creek and Lost Creek, as well as unique geologic features of the volcanic landscape. Developed facilities include six campgrounds, two day use areas, a fishing access trail, two interpretive overlooks/picnic areas, two geologic interpretive trails, and a busy visitor information center with seasonal staffing to provide maps, permits, tours, and interpretive programs for the local and visiting public (Figure 18).

Directly to the north, the project area borders Thousand Lakes Wilderness. This small wilderness area contains 16,335 acres, 22 miles of trails, and numerous lakes stocked with trout. Use is heavy during the accessible season, which runs approximately June 15 to October 15.

Directly southeast of the project area lies Lassen Volcanic National Park (LVNP). Lassen Peak, within the park, dominates the landscape. “The Crossroads”, an interagency information and interpretive center that features highlights of both LNF and LVNP, is located at the northwest entrance to the park, at the junction of Highway 44/89. Visitation to the park during summer and autumn months is steady, though relatively light in comparison with other major destination National Parks.

Recreation Opportunity Spectrum

The LNF uses the Recreation Opportunity Spectrum (ROS) (USDA FS 1986) to classify and manage recreation opportunities based on the physical, social, and managerial setting of the project area. The North 49 project activities are entirely in a Roaded Natural (RN) setting where resource modifications and utilization practices are evident but harmonize with the natural environment. This recreation opportunity is measured

against the recreational uses within the project area. Since the Roaded Natural ROS allows for modifications to the resources, recreation users are accustomed to seeing the types of activities proposed under the North 49 project.

Dispersed recreation accounts for the largest amount of recreation activity in the North 49 project area, and dispersed use is projected to increase along with forest, state and national trends (CA P and R 2002). Activities include camping, hunting, fishing, hiking, horseback riding, off-highway vehicle (OHV) use, driving for pleasure/sightseeing, forest products gathering, snowmobiling, and winter snowplay. Winter snowmobile areas are funded through a partnership with the California Department of Parks and Recreation under a grant program supporting operation and maintenance of over-snow vehicle (OSV) trails and staging areas. Between mid-November and mid-December, crowds of locals and visitors search the North 49 area for Christmas trees, since the road system accesses an abundance of the sought-after “silvertips” (red fir); tree cutting permit sales on the district average approximately 4,500 per year. Mushroom picking is another forest product gathering activity known to occur when conditions allow, both for personal and commercial use. Permits are required for gathering forest products, but are not a major source of revenue. Hunting in the project area is primarily for black-tailed deer. Fishing occurs in North Battle Creek and North Battle Creek Reservoir. Facilities for dispersed uses are limited to roads and dispersed (primitive) campsites.

Since 1999, more than 250 members of the northern California chapters of the Boy Scouts of America (BSA) have gathered at a dispersed area near Eskimo Hill in mid-February for a winter survival skills training and campout. This is authorized annually as a non-commercial group event, and a contingent of scouts returns each summer to clean up buried winter detritus from this area, as well as at Eskimo Hill, demonstrating their support of the national memorandum of understanding (MOU) between the USFS and BSA, and a no-trace camping ethic. Other activities within the project area that are authorized under Special Use Permits include numerous apiaries, and one outfitter-guide conducting bear hunts.

Developed recreation within the actual project area is limited. Pacific Gas and Electric (PG&E) operates a moderately developed campground on PG&E lands surrounding North Battle Creek Reservoir. A small portion of this campground is located on National Forest System lands, where PG&E is permitted to operate and manage six additional walk-in campsites. North Battle Creek Campground receives moderate to heavy use throughout the accessible season (late May to mid-October). In recent years, OHV use of roads and skid trails in the surrounding national forest has increased substantially.

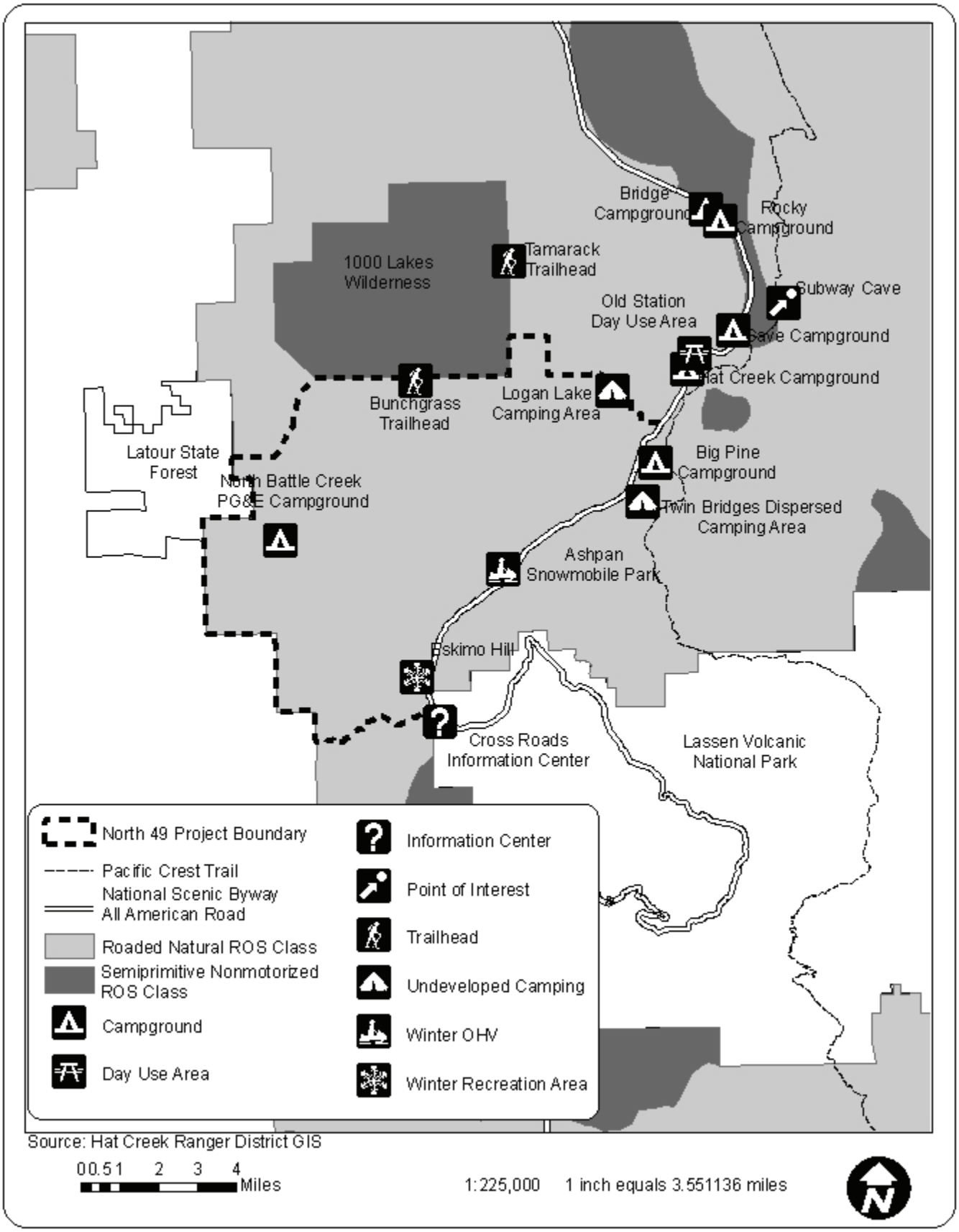

Figure 18. Recreation facilities within the North 49 Project area

Developed facilities within the project area owned by the Forest Service primarily serve winter recreation activities. Ashpan Snowmobile Park, located just off Highway 44/89 approximately 4 miles northeast of the north entrance to LVNP, is the staging area for a system of OSV trails. Amenities include large parking areas, restrooms, a warming hut, groomer shed, and informational kiosks. Eskimo Hill Snowplay Area, within 1 mile of the park entrance, provides a parking area, restrooms, and fire rings for visitor use, which is often quite heavy between December and March.

Trails for motorized use are extensive throughout the project area. The Ashpan snowmobile trail system is comprised of 45 miles of groomed trails that are entirely within the project area. These trails utilize Forest Service roads 33N16, 32N30, 32N31, 32N24, 32N36, 32N46, 32N25, 32N44Y, and 32N17. Associated with the Ashpan system are an additional 40 miles of groomed trails located in Latour State Forest, congruent with the west boundary of the project area. These connected trail systems are also accessed through Ashpan. Groomed trails and locator signs are maintained by volunteers and FS personnel through partnerships with snowmobile clubs and the State of California. Limited Operating Periods (LOPs) are imposed by Forest Order from December 26 to April 1 to facilitate grooming. LOPs may be lifted earlier than April 1 if sufficient snow depth (approximately 18 inches) is not present. In addition to local use, riders travel to the area from Redding and the central valley, and as far as Reno, NV.

A portion of the Back Country Discovery Trail (BCDT) traverses the project area from north to south. This route is comprised of Forest Development Roads 16 and 17, and the connecting forest road 32N24. Discovery points leave the main route directing vehicular travelers to points of interest. The BCDT was established to provide access to more remote areas of the “back country,” generally utilizing gravel and dirt roads and OHV trails with linkages to the Scenic Byways system. They are intended to enhance opportunities for quality outdoor recreation by providing a system of sport utility vehicle (SUV), high clearance and off-highway vehicle roads and trails throughout the forest.

The LNF is currently entering the third year of the National OHV Route Designation Process. Historically, all roads and skid trails on the forest have been used by motorized and mechanized vehicles. In 2005, the forest accounted for and mapped as many roads and trails as was possible using the global positioning system (GPS). This included extensive public involvement to identify trails of which the forest was not aware. The next phase of this process, to be completed in 2006, would continue FS coordination with the public and resource specialists to identify a system of designated routes and riding areas that would be used in the future.

Access for recreation use is mostly from State Highway 89/44 on the south and east sides of the project; and less so from Highway 299E on the north side of the project via Shasta Co. Road 4M001 (Tamarack Road). Dispersed use occurs along all roads, as no barriers restrict access or use except those imposed by topography. Main forest roads generally are in good condition, but the condition of minor, unclassified roads varies greatly.

Wilderness borders the north side of the project area. Bunchgrass Trailhead, located within the project area at the end of Road 32N45, provides the only access to Thousand Lakes Wilderness from the south.

Air Quality

The North 49 Project airshed is located between two sensitive airsheds, Thousand Lakes Wilderness and Lassen Volcanic National Park (LVNP). Due the sensitive nature of these Class I airsheds and the close proximity to the community of Old Station, prescribed fire would be managed following Shasta County Air Quality regulations. The North 49 Project airshed is influenced by a westerly airflow from the northern Sacramento Valley up and across the Cascade crest.

Air quality within the project area is generally within national and state standards for visibility, particulate levels (PM10), and pollutants. The project area's air quality is affected by pollutants from downwind population centers and agriculture in the Sacramento Valley, and adjacent private forest activities producing seasonal dust and smoke; as well as residential and recreational dirt road traffic and wood stoves in the foothills. Air quality is also affected by management activities within the project area, such as road dust from recreational use and smoke from recreational campfires. These effects are short term (less than 24 hours) and localized. Air quality is also influenced by traffic from Highway 44, which may raise carbon monoxide and ozone levels along the travel corridors.

Visual Resources

The LNF uses the visual quality management to classify visual resources. There are three visual quality objectives (VQOs) within the North 49 project area: retention, partial retention and modification. The majority of the project area is within the VQO of modification, where activities in the foreground and middle ground are dominant, but appear natural. Those areas identified as partial retention would be managed in the foreground to maintain diversity of tree, shrub, forb and other grass species common to the area in irregular shaped patterns to retain the appearance of unmanaged timber and to achieve a range of age and size classes up to 36 inch dbh in multi-storied stands. Those areas identified as partial retention would be managed in the middle-ground where the effects of management activities may be noticeable, but should not attract attention. Those areas identified as retention would be managed in the foreground to maintain diversity of tree, shrub, forb and other grass species common to the area in irregular shaped patterns to retain the appearance of unmanaged timber and to achieve a range of age and size classes up to 48 inch dbh in multi-storied stands. Those areas identified as retention would be managed in the middle-ground to retain the appearance of continuous forest cover in timber stands.

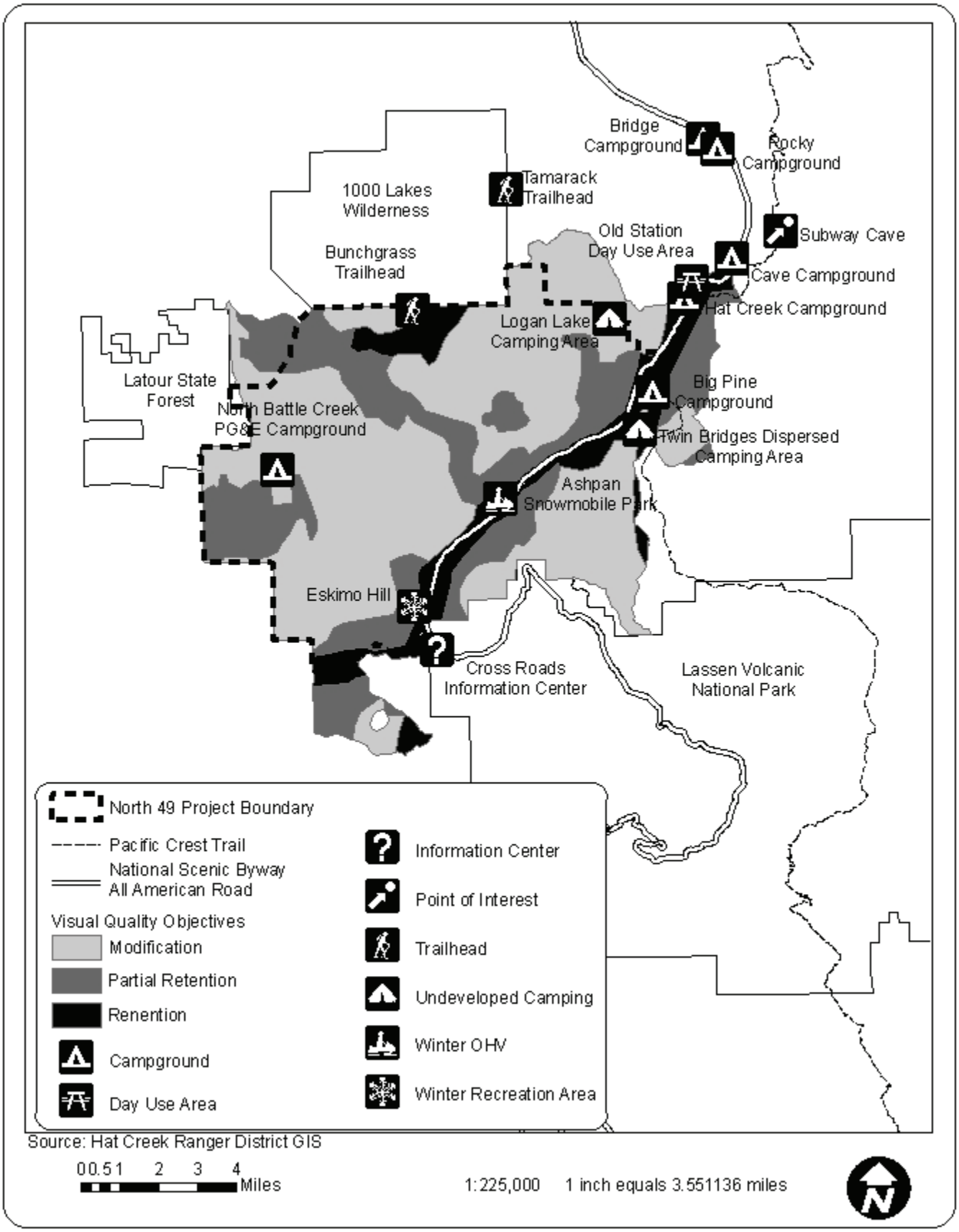

Figure 19. Visual Quality Objectives within the project area

Socio-Economics

Management activities on the Lassen National Forest have impacts on the economic conditions of local communities through changes in employment and income. The economic analysis area for the North 49 Forest Health Recovery Project is defined as a three county region (Shasta, Lassen, and Plumas) and according to the 2000 census the total population in the three county area is 217,908. The activities associated the North 49 project would require human power in the North 49 Economic Analysis Area. This would occur in the form of employment in the area. Such modifications to local employment and income may be stimulated directly by the labor required to accomplish the management activities, as well as indirectly through changes in inter-industry and household purchases in response to any direct change in the composition on an industry.

Analysis Area

The economic analysis area potentially affected by the proposed vegetation management activities of the North 49 Forest Health Recovery Project is defined as a three county region identified by the ID Team.

Shasta County: Located in northern California at the north end of the Sacramento Valley, Shasta County is easily accessible from the Sacramento and San Francisco Bay areas. Recreational activities provide a significant portion of the county's economic stimulus. Shasta County is also becoming home to an increasing retiree population seeking solitude from highly populated metro areas in central and southern California.

Lassen County: Located in north-east California, this sparsely populated county's abundant natural resources help support the county's two primary industries: timber and tourism. Agriculture is also a significant industry in the county, producing 1.2 percent of California's alfalfa crop (Center for Economic Development: Lassen County, 2006).

Plumas County: Located in north-eastern California, a variety of outdoor recreational opportunities drives the tourism industry in Plumas County, accounting for a large part of local economic stimulus. The area is easily accessible by residents of the Sacramento and San Francisco Bay areas for a variety of recreational opportunities.

Demographics

According to the 2000 census the total population in the three county area is 217,908. Based on 2006 population estimates, the analysis area experienced a population growth rate of 8.3 percent between 2000 and 2006, exceeding both California and the United States. The majority of the growth occurred in Shasta County, with 10.2 percent, whereas the rates of change in Lassen and Plumas Counties were 2.6 percent and 2.1 percent respectively. The majority of the analysis area population resides in Shasta County; and the majority of Shasta County residents live in Redding. Redding provides a variety of shopping venues and health and human services that do not exist in other parts of the analysis area. In recent years Redding has become a prime retirement location in northern California, which has impacted the rate of population growth in Shasta County. Lassen and Plumas counties are dominantly rural.

The majority of the individuals (91.3 percent) in the three county region are Caucasian; individuals of Latino origin make up the second largest ethnic population at 6.8 percent, and Native Americans are the third largest at 4.7 percent. At the county level, Lassen County has the most ethnically diverse population with 13.8 percent of residents of Latino origin and 9.1 percent of African American decent. The ethnic make-up of Shasta, Lassen and Plumas counties is very different from the state of California as a whole. California has a large proportion of individuals from Latino and Asian decent, 32.4 percent and 12.3 percent respectively. Shasta, Lassen and Plumas Counties have a higher percentage of Native Americans, ranging from 4.2 percent to 4.8 percent, compared to 1.9 percent at the state level. At the county level, Caucasian remains the dominant race, with 92.5 percent, 83.3 percent and 94.3 percent of residents in Shasta, Lassen and Plumas Counties, respectively.

Employment

The most recent US Census employment data in the analysis area is for the year 2000. Given the changes in population, and possible changes to industry composition, a secondary data source is utilized to report employment and income. Minnesota IMPLAN Group (MIG) reports annual economic data for all counties in the United States. The most current IMPLAN data available is 2006, which is the data utilized throughout this analysis. MIG utilizes national, state and local data sources to report county level employment, and includes full-time, part-time, seasonal and self employment. IMPLAN employment data is reported simply as jobs, not full time equivalents (FTE's), thus one person with multiple jobs will show up more than once in the data. This prohibits the comparison to local population data provided by the US Census.

According to the 2006 IMPLAN data, total employment in the three county area is 112,241 jobs; 79 percent of that employment is in Shasta County (89,096 jobs). The largest employing sector in each county is the government. Proportionally, government is a much larger employer in Lassen County with 44 percent of total employment, versus 24 percent in Plumas County and 15 percent in Shasta County. "Retail Trade" and "Health and Social Services" are important sectors for overall employment in Shasta County, generating 14 percent and 13 percent of jobs respectively. Substantial employment in these industries is required to service the increasing retiree population. "Construction" and "Accommodation and Food Services" are also large employing industries in Shasta County, generating 9 percent and 8 percent of jobs respectively. The distribution of employment in Shasta County suggests that it is primarily a service based economy and likely to be resilient to changes in Forest Service.

In terms of total employment, the "Ag, Forestry, Fish and Hunting" industry is not a major factor in the analysis area. Proportionally, only 2, 4, and 2 percent of total county employment is generated from this industry in Shasta, Lassen and Plumas Counties respectively. However, rural areas such as Lassen and Plumas Counties are much less resilient to job loss; thus changes in employment in this industry may have a greater impact than a similar change in employment in Shasta County.

Unemployment is greater in all counties of the analysis area than at the State and National levels. Lassen County has the highest rate at 8.0 percent and Shasta County has the lowest at 6.6 percent. Unemployment at the State and National levels is 4.9 and 4.6 percent respectively.

Income

Another indicator of the overall health of the local economy is household income. Typical of rural areas, each county has a lower income per household than the state average, ranging from $68,876 in Plumas County to $79,402 in Shasta County.

Also of relevance is the aggregate income reported for each economic sector. Total income is the sum of employee compensation, proprietors' income and other property income and is estimated at $6,616 million in 2006. Similar to the distribution of county employment reported above, Shasta County generates the largest proportion of local area income at 78 percent, with 12 percent in Lassen County and 10 percent in Plumas County. In terms of total income by sector, the "Government" sector, which included the USDA Forest Service, has the highest percentage of local income; accounting for 24, 61, and 32 percent of Shasta, Lassen and Plumas Counties' total income respectively. The "Agriculture, Forestry, Fishing and Hunting" sector only accounts for a small proportion of total income in each county; 1 percent, 4 percent and 1 percent in Shasta, Lassen and Plumas Counties respectively.

Chapter 4. Environmental Consequences

Introduction

This Chapter is organized by resource topic and presents a comparative analysis of the effects that would occur from implementation of the proposed action or alternatives on the physical, biological, social, and economic aspects of the human environment. Scientific and analytical information is used to provide comparative analysis of the effects on each resource. The effects on silvicultural resources are analyzed at the beginning of this chapter and provide a foundation for the analysis of the resources that follow.

Implementation of the North 49 Project is expected to occur over a period of ten to fifteen years, spreading the effects over that time. Although individual timber sales that would implement the actions can be scheduled for a particular year, the purchaser may take several years to conduct the work with possible time extensions. Upon completion of a timber harvest, implementation of fuels treatments would depend upon the evaluation of fuels conditions by fuels experts. The introduction of fire for fuels treatment would occur over time based on assessed conditions and needs.

Because the implementation of actions would be spread over an estimated fifteen-year period, the effects of actions would occur over that temporal spread. Following implementation, the treated forest would respond by increasing growth resulting in increased tree diameter and canopy closure, and increased crown bulk density. Generation of young trees and shrubs would occur in the understory resulting in increased structure and improvement to wildlife habitat.

The following analysis does not separate the implementation of actions over time and considers them all to occur in a single year. Therefore, the analysis presents the greatest degree of possible direct effects, and assures that effects are not minimized by uncertain temporal adjustments.

Table 31 below compares the affects of each alternative to resources of concern. A detailed description of affects by resource is presented in the body of this chapter. All comparative metrics listed below are based on the project area except for the wildlife metrics, which are based on the Wildlife Analysis Area of 57,389 acres (See Chapter 4, Wildlife for description of Wildlife Analysis Area).

Table 31. Comparison of effects

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Silviculture				
Number of acres post-thinning remaining above 60% SDImax (acres)**	601	10,484	2,522	0
Number of acres of fire-resilient species restoration (acres)	1,168	0	680	908
Number of acres of aspen treated (acres)	38	0	38	55
Number of acres of pine improvement (acres)	0	0	0	70
Fuels (Fire Behavior in Sierra Mixed Conifer Forest in DFPZ)				
Average Flame Length (feet)	4	6	4	4
Average Rate of Spread (chains/hour)*	5	9	5	5
Type of Fire	Surface	Passive Crown	Surface	Surface
Suppression Tactic	Direct	Indirect	Direct	Direct
Average Canopy Base Height (feet)	10	1	10	6
Average Critical Flame Length (feet)	6	1.2	6	4
Fuels (Fire Behavior in Sierra Mixed Conifer Forest outside DFPZ)				
Average Flame Length (feet)	1	4	1	1
Average Rate of Spread (chains/hour)*	2	5	2	2
Type of Fire	Surface	Passive Crown	Surface	Surface
Suppression Tactic	Direct	Indirect	Direct	Direct
Average Canopy Base Height (feet)	6	1	6	4
Average Critical Flame Length (feet)	4	1.2	4	3
Average Flame Length (feet)	1	4	1	1

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Wildlife				
California spotted owl Suitable Foraging Habitat (acres/% retained)*	13,313 / 62	21,387 / 100	13,769 / 64	17,485 / 82
California spotted owl Suitable Nesting Habitat (acres/% retained)*	6,843 / 77	8,861 / 100	6,976 / 79	7,999 / 90
northern goshawk Suitable Foraging Habitat (acres/% retained)*	1,679 / 94	1,782 / 100	1,676 / 94	1,722 / 97
northern goshawk Suitable Nesting Habitat (acres/% retained)*	20,156 / 67	30,248 / 100	20,745 / 65	25,484 / 84
Marten, Fisher, Fox Suitable Foraging Habitat (acres/% retained)*	2,644 / 56	4,746 / 100	2,720 / 57	6,541 / 138
Marten, Fisher, Fox Suitable Denning Habitat (acres/% retained)*	17,512 / 69	25,502 / 100	18,025 / 71	18,943 / 74
Suitable California spotted owl Habitat in 2400 acre Home Range Core Areas (HRCA) Post-Treatment				
Ashpan Butte HRCA (acres/%)	1,489 / 62	1,877 / 78	1,562 / 65	1,594 / 66
Ashpan Flat HRCA (acres/%)	1,365 / 57	2,233 / 93	1,423 / 59	1,927 / 80
Bunchgrass Creek HRCA (acres/%)	1,264 / 53	2,159 / 90	1,361 / 57	1,613 / 67
Percentage of California spotted owl Habitat in Devil's Garden HRCA (acres/%)	1,086 / 45	1,997 / 83	1,179 / 49	1,738 / 72
Percentage of California spotted owl Habitat in N. Battle Creek HRCA (acres/%)	1,338 / 56	1,582 / 66	1,338 / 56	1,560 / 65
Red Lake Mountain HRCA (acres/%)	1,065 / 44	1,565 / 65	1,080 / 45	1,464 / 61
Superbowl HRCA (acres/%)	1,526 / 64	1,596 / 67	1,573 / 66	1,546 / 64
Table Mountain HRCA (acres/%)	1,521 / 63	1,986 / 83	1,540 / 64	1,716 / 72
Hydrology – Threshold of Concern (TOC)				
Number of Watersheds with a very high risk of TOC (ERA > TOC)	0	0	0	0
Number of Watersheds with a high risk of TOC (ERA is 80% to 100% of TOC)	1	1	1	1
Number of Watersheds with a moderate risk of TOC (ERA is 50% to 80% of TOC)	4	2	4	4
Number of Watersheds with a low risk TOC (ERA <50% of TOC)	8	10	8	8

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Soils				
Loss of Soil Porosity	Minimal reduction due to thinning; High potential for loss in groups	No change	Minimal reduction due to thinning; High potential for loss in groups	Minimal reduction due to thinning; High potential for loss in groups
Loss of Organic Matter	No effect due to thinning; potential to displace soil	No change	No effect due to thinning; potential to displace soil	No effect due to thinning; potential to displace soil
Loss of Ground Cover	Temporary short-term reduction; partially offset by needle cast	No change	Temporary short-term reduction; partially offset by needle cast	Temporary short-term reduction; partially offset by needle cast
Fisheries/Aquatics				
Central Valley spring-run chinook salmon & steelhead, & critical habitat	Low risk of short-term increases in sediment production. Long-term decreased sediment production	No change in existing levels of sediment production	Low risk of short-term increases in sediment production. Long-term decreased sediment production	Low risk of short-term increases in sediment production. Long-term decreased sediment production
Central Valley fall-run chinook salmon	No change in existing levels of sediment production	No change in existing levels of sediment production	No change in existing levels of sediment production	No change in existing levels of sediment production
Cascades Frog	Very low risk of direct effects. Low risk of short-term increases in sediment production. Long-term deceased sediment production.	No risk of direct effects; no change in existing levels of sediment production.	Very low risk of direct effects. Low risk of short-term increases in sediment production. Long-term deceased sediment production.	Very low risk of direct effects. Low risk of short-term increases in sediment production. Long-term deceased sediment production.
Rainbow Trout	Low risk of short-term increases in sediment production. Long-term decreased sediment production	No change in existing levels of sediment production	Low risk of short-term increases in sediment production. Long-term decreased sediment production	Low risk of short-term increases in sediment production. Long-term decreased sediment production
Botany				
Astragalus pulsiferae var. *suksdorfii*	Short-term impacts to roadside plants but long-term benefits from thinning adjacent stands	Potential loss due to habitat succession	Short-term impacts to roadside plants but long-term benefit from thinning adjacent stands	Short-term impacts to roadside plants but long-term benefit from thinning adjacent stands
Erigeron inornatus var. *calidipetris*	Short-term adverse impact, long-term benefit from thinning	Potential loss due to habitat succession	Short-term adverse impact, long-term benefit from thinning	Short-term adverse impact, long-term benefit from thinning

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Hierochloe odorata	Short-term adverse impact, long-term benefit from thinning and burning	Potential loss due to habitat succession	Short-term adverse impact, long-term benefit from thinning and burning	Short-term adverse impact, long-term benefit from thinning and burning
Riparian Hardwood Species. Alder, Aspen and Willow	Short-term direct impact, long-term benefit from decreased competition, and potential change in age-class distribution.	Potential impact from habitat succession	Short-term direct impact, long-term benefit from decreased competition, and potential change in age-class distribution.	Short-term direct impact, long-term benefit from decreased competition, and potential change in age-class distribution.
Economics				
Estimated Total Project Value (dollars)	$10,550,000	$0.00	$8,544,383	$17,246,600
Estimated Sawlog Volume (ccf)	66,709	0	54,042	109,134
Estimated Biomass (ccf)	66,596	0	44,607	57,366
Net Present Value ($)	-24,216,047	0	-22,883,734	-18,125,144
Range				
Hat Creek Range Allotment	Temporary forage increase	No change	Temporary forage increase	Temporary forage increase
North Battle Creek Range Allotment	Temporary forage increase	No change	Temporary forage increase	Temporary forage increase
Recreation				
Developed Facilities	Short-term operational noise, incl. helicopters, may temp. affect Battle Creek Campground, but unlikely to affect developed facilities adjacent to east side of project area.	None	Same as Alt. 1	Some temporary operational noise, but effects reduced due to lack of helicopter operations.
Dispersed Recreation: Camping Hunting Fishing Christmas tree cutting Snowmobiling Other winter activities	Harvest activities & operational noise (incl. helicopters) may temp disturb dispersed campers, hunters & wildlife. Treatments may reduce xmas tree cutting areas. No effect to winter activities unless winter logging is agreed to	Increased risk of wildfire could severely impact dispersed campsites, wildlife & fisheries habitat (viewing, hunting, and fishing opportunities), and popular white fir/red fir xmas tree cutting areas	Similar to Alt. 1, although less intensive thinning treatments & fewer group selections would retain more trees suitable for xmas tree cutting and wildlife cover	Similar to Alt.1, but with less effect on dispersed campers & hunters due to lack of helicopter noise. More diverse stand structure would improve wildlife habitat, and future viewing & hunting. Primary thinning treatment would retain xmas tree cutting opportunities

Affected Resource	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Wilderness	Short-term operational noise (including helicopters) in the background might be audible in the southern portion of 1000 Lakes	No effects due to operational noise. Increased potential of wildfire entering wilderness from the south, severely affecting areas of extreme mortality.	Same as Alt. 1	No effects from helicopter noise, although some temp. operational/road noise may be audible in the distance in the south end, & at higher elevations
Motorized Access/OHV use	Road decomm. or closures to public motorized use would affect mainly short, dead-end spurs that do not provide access to dispersed campsites or scenic/loop riding opportunities.	No road closures or decommissioning: No effect to current motorized uses, other than existing cross-country travel restrictions. Motorized activity may affect hunting & wildlife viewing opportunities.	Same as Alt. 1	Same as Alt. 1
Trails	Temp. increase in truck traffic on Backcountry Discovery Trail. No hiking trails within project area	None	Same as Alt. 1	Same as Alt. 1
Visuals				
Retention: "Not visually evident"	Treatments in DFPZ designed so thinnings maintain continuous forest cover in the foreground, with groups placed in a mosaic in the middle-and back-grounds	No immediate effect. Increased stand density in the future may reduce scenic values. No treatment could contribute to the severity of potential wildfire effects	Same as Alt. 1, although reduced number of group selections would be less evident throughout the middle-and back-ground, and from overlook viewpoints.	Same as Alt. 1 in DFPZ. Area thin Rx provides for multi-story forest structure. Radial thin and pine restoration treatments adjacent to 1000 Lakes would enhance mature forest character and structural diversity
Partial Retention: "Visually subordinate to the natural character of the landscape:	Many areas have been previously thinned – effects would be limited	Same as above	Fewer group selections than Alt. 1 would be less visually evident throughout the treated areas.	Increased diversity of stand structure & species composition would retain natural character in future.
Modification: "Dominant, but conforms to natural character of the landscape"	All treatments meet or exceed standards for modification.	Same as above	Same as above	Same as above
Heritage Resources				
Sites Affected	0	0	0	0

*Wildlife metrics are based on the Wildlife Analysis Area of 57,389 acres (See Chapter 4, Wildlife for description of Wildlife Analysis Area).

** Forests at 60% maximum stand density (SDImax) or greater are in the zone of imminent mortality. At this density, less vigorous trees die due competition and all trees are stressed making them susceptible to large-scale die-off due to drought, insects and disease.

Silvicultural Resources

This analysis is based on field reconnaissance of the project area from 2003 through 2007 and a variety of data sources including: aerial photography, District GIS files, and forest inventory data (stand exams). Treatments described in Chapter 2 for the proposed action and alternatives were analyzed using the Forest Vegetation Simulator (FVS) program (US FS 2004a) and provide a basis for comparing environmental impacts of the alternatives.

The FVS program is a predictive model that uses existing forest inventory data to describe the average stand conditions and changes over time. This model simulates a wide range of silvicultural treatments for most major forest tree species, forest types, and stand conditions. The effects of the proposed treatments are based on FVS projections and are representative of the typical stand.

The arrangement of the Silviculture Resource Section is similar to the format in Chapter 2. This section is structured to first show the direct and indirect effects of all proposed treatments, followed by a comparison of the alternatives and their effects. Lastly, there is disclosure of the cumulative effects on the silvicultural resources in the North 49 analysis area.

Effects from Proposed Treatments

Below are the direct and indirect effects of the treatments proposed in the North 49 Forest Health Recovery Project. Alternative 2 was analyzed for the effects that would occur from not treating the project area.

Thin from Below In DFPZ Treatment Effects

Direct Effects

Eastside Pine Forest Cover Types

In Eastside pine forest cover types, the thin from below treatment would reduce stocking density in treated stands to a range of 40-55 percent of maximum SDI. This range is just below 60 percent SDImax where competition for resources becomes more severe and overall tree growth begins to slow resulting in density related tree mortality. This is referred to as the zone of imminent mortality. Projected post-thinning canopy cover in Eastside Pine stands would range between 35-42 percent with an average tree diameter of 11-16 inches dbh. Thinned stands would retain between 70-281 trees per acre with a residual basal area of approximately 120 square feet per acre. This correlates to an average spacing of 16-20 feet between trees.

Sierra Mixed Conifer Forest Cover Types

In the Sierra Mixed Conifer forest cover type, the thin from below treatment would reduce stocking density in treated stands to a range of 41-53 percent of Maximum SDI. The projected post thinning canopy cover would be approximate 40 percent with an average tree diameter of 11-22 inches dbh. The post treatment residual basal areas proposed for each stand would range between 160-170 square feet per acre. This correlates to an average spacing of 16-20 feet between trees.

The focus would be on removing suppressed and intermediate trees. Thinning would generally convert size class 3 stands (average diameter 6-10.9 inches) to size class 4 (average diameter 11-23.9 inches) as a

result of removing excessive amounts of small diameter ingrowth. Figure 4 displays a visual simulation of a mixed conifer stand treated using the thin from below treatment.

Following is an example from the Forest Vegetation Simulator (FVS). Stand 19-45, classified as CWHR SMC3D (Sierra Mixed Conifer) is located in the DFPZ and treated using the thin from below treatment. The model was adjusted to allow the ingrowth of seedlings after 20 years to represent the effects of initial fuels treatments and possible future maintenance in DFPZs. Average stand attributes such as canopy cover and trees per acre are displayed and projected 20 years into the future.

Table 32. Projected Attributes for stand 19-45 using the Thin from Below in DFPZ Treatment

	CWHR	QMD	CC	TPA	BA/Ac	SDImax
Existing Condition	SMC3D	8.9”	73%	664	290	99%
Post Thinning	SMC4M	13.0”	45%	180	166	49%
20 years	SMC4M	16.9”	51%	153	238	63%

Source FVS projections using forest inventory data. CWHR = Type, Size, Density, QMD = Quadratic Mean Diameter, TPA = Trees Per Acre, CC = Percent Canopy Cover, BA/Ac. = Basal Area Per Acre, SDImax = Percent of Maximum Stand Density Index,

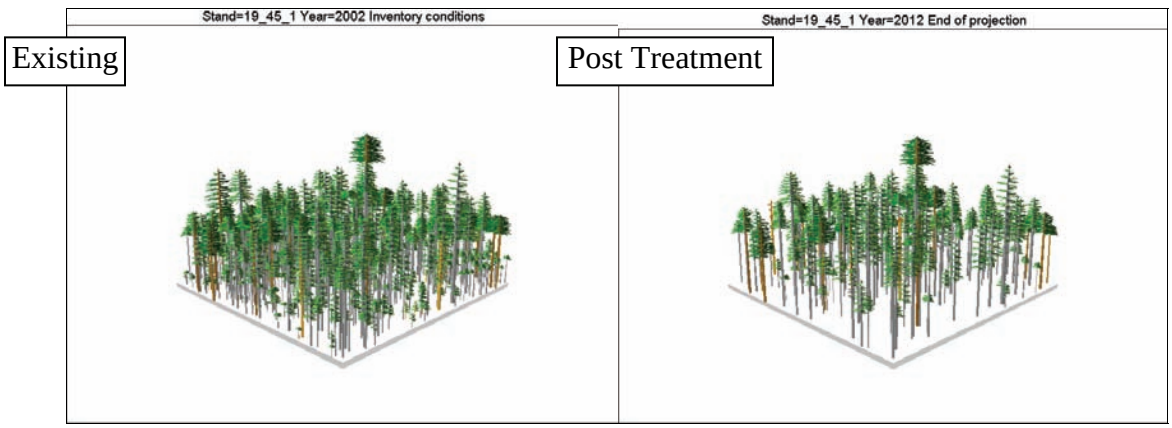

Figure 20. CWHR M3D stand before and after using the thin from below treatment. (Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data)

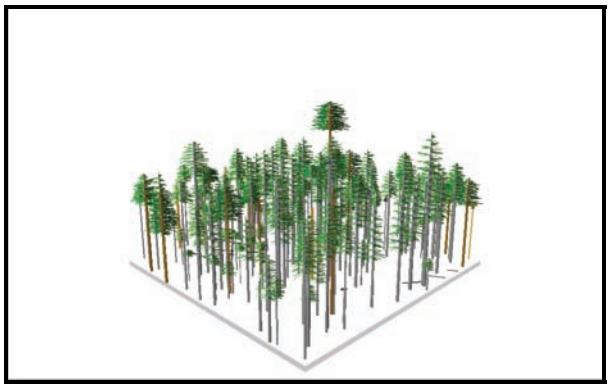

Figure 21. Stand 19-45, 20 years after thinning using the thin from below treatment. Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data.

Using the thin from below treatment in the example stand 19-45 (See Figure 21) changes the vegetation size class from CWHR 3D to 4M and would remain 4M for at least 20 years. In a given stand of trees, the

Quadratic Mean Diameter (QMD) is the diameter at breast height of the tree with the average basal area. Quadratic mean diameter growth would increase as residual trees utilize newly available growing space. In the example stand above, canopy cover would decrease from 73 percent to 45 percent as a result of thinning but would grow back to 51 percent in 20 years. Tree stocking would decrease to 180 trees per acre. Thinning would reduce basal area to 166 square feet per acre, which would grow back to 230 square feet per acre in year 20 (See Table 32).

Modeling projections in stand 19-45 indicate that thinning would reduce stocking density to 49 percent of Maximum SDI using the thin from below treatment. This density improves tree health and vigor allowing trees to grow below the zone of imminent mortality for approximately 18 years. Post-thinning tree spacing would average approximately 16 feet. This would be in the minimum range of 16-20 feet between trees where operability would not be overly restrictive and the risk for residual tree damage from mechanical fuels treatments would be minimized.

Lodgepole Pine Forest Cover Type

For Alternatives 1 and 3, the projected average tree diameter in treated lodgepole pine stands would average 13.5 inches after thinning. Lodgepole pine stands would be thinned to an average of 100 square feet per acre for an average spacing of 21 feet. Thinning would reduce stocking density in treated stands to approximately 47 percent of Maximum SDI for pine. Projected post thinning canopy cover would be 34 percent. Thinning would generally change CWHR 4D to 4P. Reducing the density of the stand would increase the availability of water, sunlight and nutrients for the remaining trees, promoting increased growth, vigor and health.

Under Alternative 7 these lodgepole pine stands would be thinned down to approximately 80 square feet of basal area (60 percent reduction) to reduce stand susceptibility to beetle attack. Under current densities and beetle activity, it is unknown whether thinned trees can respond quickly enough with increased tree vigor to repel beetle attacks. It is known that without treatment, mortality will likely continue unchecked, killing desirable trees and creating undesirably high fuel loads.

The projected average tree diameter in treated lodgepole pine stands would average approximately 14 inches after thinning. Thinning would reduce stocking density in treated stands to approximately 35 percent of maximum SDI for pine. Projected post thinning canopy cover would be near 30 percent. Lodgepole pine stands would be thinned to promote the vigor of residual trees to resist bark beetle attack.

Indirect Effects

Eastside Pine and Sierra Mixed Conifer Forest Cover Types

Thinned stands would increase forest health and individual tree growth. Enlarging the growing space for residual trees would add to the amount of crown (leaf surface area) that is available for photosynthesis and augment the crown to bole ratio. This would enhance diameter growth on the residual trees, as the trees would be able to absorb and use more nutrients. This would result in larger diameter trees in a shorter time period. In the majority of stands where canopy cover is temporarily reduced to 40-50 percent, it is predicted that residual overstory canopy growth would result in 50 percent total canopy cover within 20 years.

Thinning would favor the removal of dwarf mistletoe infected trees; however, to maintain desired stocking and canopy cover, some infected trees would remain in the stands. Remaining infected overstory trees would continue to serve as a source for the infection of adjacent and understory trees. Group selection may also decrease levels of overall stand infection by removing individual infected trees and pockets of infected trees; however, infected trees remaining on the edge of groups would serve as a host and spread mistletoe to regeneration in the group area.

Thinning may decrease stand mortality caused by bark beetles by removing diseased and injured trees. Diseased and injured trees are most susceptible to bark beetle caused mortality. Thinning also reduces inter-tree competition, which can improve resistance to beetle caused mortality.

Timber harvest has the potential to increase annosus root disease through freshly cut stumps. Stump infection would be minimized by treating the freshly cut stump surfaces with a light coating of borate compound (Kliejunas, 2004). All action alternatives would include stump treatments using an Environmental Protection Agency registered borate compound, which is also registered by the State of California for the prevention of annosus root disease. True firs are especially susceptible to annosus root disease (Kliejunas, 2004). The proposed thinning and group selection treatments would favor the retention of pine over white fir. This would help reduce the spread of root disease by reducing root-to-root contact between host tree species (true fir) as well as reducing host populations. Cut stumps of live true fir and pine trees 14 inches in diameter and greater would be treated with the borate compound.

Heart rot is most common in old trees, especially red and white fir. Old, large diameter trees (30 inches dbh and greater) would be retained. Harvest operations and burning are likely to cause damage, such as bark scrapes, broken limbs and fire scars, to a minor component of residual trees. These injuries can provide points of entry for heart rot disease. Trees less than 30 inches in diameter with heart rot would be targeted for removal initially decreasing the levels of heart rot within the treated stands. However, new infections of heart rot would likely develop as a result of tree injuries caused during harvest operations or prescribed burning.

Brush regrowth would have the potential to increase where openings are created. Two of the most common brush species found in the project area (greenleaf manzanita and deer brush) are shade-intolerant. Shade-intolerant plants do not grow well or thrive in shaded, low sunlight environments. Brush regrowth response after underburning, machine piling, and mastication would be restricted where there is sufficient overstory canopy cover. Increased residual overstory tree health and growth as a result of thinning would increase canopy cover over time. Because canopy cover post thinning would generally not be reduced below 40 percent in the majority of forested stands, brush regrowth should not increase substantially from existing in most areas. Where understory tree canopy cover reductions do increase sun exposure, there may be an increase in the growth of fine herbaceous vegetation and shade-intolerant brush species. Treatments that include prescribed burning would increase nutrient availability, further stimulating the growth of understory vegetation.

Indirect Effects of Prescribed Fire on Trees

Conifers in areas treated by prescribed fire may be susceptible to bark beetle attack for 1-2 years, especially if the residual trees are weakened due to fire-related injuries to the crown or cambium. Attacks by red turpentine beetle (*Dendroctonus valens* LeConte) are common in pine stands following fire. The primary places of the

insect's attack are freshly cut stumps or the bases of trees that are dying. The next-most-frequent places of attack are the exposed roots and the bases of trees that are weakened by mechanical damage, fire, lightning, or the activity of other insects. In these places it may multiply and threaten nearby trees (Smith, 1971). Prescribed fire intensity may be less where mechanical machine piling or mastication treatments are used initially, resulting in less potential for fire related injuries and bark beetle attack. There is the potential to cause basal wound damage to residual trees during mechanical treatments. These types of injuries, when small in size and numbers, would generally not increase a stands susceptibility to bark beetle attack. The beneficial effects to conifers from prescribed fire include increased nutrient availability and reduced risk of damage or loss to wildfires.

Lodgepole Pine Forest Cover Type

Thinning Lodgepole pine stands to a residual basal area of 100 square feet per acre would improve the stands resistance to the mountain pine beetle, but still leave them vulnerable. Current survey of the lodgepole pine stands indicate that mountain pine beetle has reached an epidemic population (Cluck, 2007). Maintaining these stands at 100 square feet per acre would provide trees spacing at 20 feet. This spacing would still provide the mountain pine beetle the opportunity to engage in a behavior known as switching. When one mountain pine beetle successfully invades a tree, it releases a pheromone attracting other beetles to this ideal breeding area. In time, the tree would fill with beetles and a different pheromone would be released repelling approaching beetles away from the infested tree. The approaching beetles would then switch to a large neighboring tree within 20 feet of the infested tree and attack it. In this case, even the healthiest lodgepole pine tree would not be able to repel this full attack and pockets of beetle killed trees would develop.

Lodgepole pine trees in the North 49 project area produce non-serotinous cones. Non-serotinous cones are neither sealed by resin nor require fire to open them and release seeds. Cones on a lodgepole pine open when the seed is mature. Opening these stands up to a basal area of 100 square feet per acres would provide limited opportunities for regeneration.

Thinning stands to an average basal area of 80 square feet per acre increases the tree spacing to approximately 23 feet. This distance is would decrease the mountain pine beetles' ability to engage in switching and send the beetles into a dispersal pattern reducing the likelihood that they would attack an adjacent tree. Opening the canopy up to 80 square feet per acre increases the opportunity for regeneration.

Modified Thin from Below with Retention Islands Treatment Effects

Direct Effects

Eastside Pine Forest Cover Types

In Eastside pine forest cover types, the thin from below treatment would reduce stocking density in treated stands to a range of 80-85 percent of maximum SDI. This range is just below 60 percent SDImax where competition for resources becomes more severe and overall tree growth begins to slow resulting in density related tree mortality. This is referred to as the zone of imminent mortality. Projected post-thinning canopy cover in Eastside Pine stands would range between 50-54 percent with an average tree diameter of 12-14

inches dbh. Thinned stands would retain a basal area of approximately 146-162 square feet per acre. This correlates to an average spacing of 16 feet between trees.

Sierra Mixed Conifer Cover Types

The projected average tree diameter in treated mixed conifer stands would range between 10-17 inches after thinning. The post-treatment residual basal area in the majority of stands would range between 189-225 square feet per acre. Projected post-thinning canopy cover would range between 50-54 percent. Thinning would reduce stocking density in treated stands to a range of 51-65 percent of SDImax. Most of these stands would be approaching 60 percent of Maximum SDI. This lower intensity thinning would be less effective at stocking control because it is expected that most of these stands would grow back into the zone of imminent mortality (greater than 60 percent of Maximum SDI) in 10-15 years.

For example, the CWHR 3D stand 21-25 is located outside of the DFPZ and treated using the modified thin from below with retention islands treatment. Vegetation typing in stand 21-25 would change from CWHR 3D to 4M and remain 4M for at least 20 years. Canopy cover would decrease from 66 percent to 50 percent as a result of thinning and grow back to 53 percent in 20 years. Trees stocking would only decrease to 223 trees per acre in order to maintain 50 percent canopy cover. Thinning would reduce basal area to 195 square feet per acre, which would grow back to 250 square feet in 20 years.

Modeling projections in a CWHR 3D stand 21-25 indicate that thinning would reduce stocking density to 58 percent of Maximum SDI using the modified treatment. This stand would reach 60 percent of Maximum SDI approximately 2 years after thinning and 69 percent in 20 years. Post-thinning tree spacing would average approximately 14 feet. Operability would be more restricted and residual tree damage from mechanical fuels treatments could be increased. The potential for residual tree damage from equipment increases as average spacing decreases below the minimum range 16-20 feet between trees.

Table 33. Projected Attributes for Stand 21-25 using the Modified thin from below with retention islands Treatment

	CWHR	QMD	CC	TPA	BA/Ac	SDImax
Existing Condition	SMC3D	10.6”	66%	472	290	93%
Post Thinning	SMC4M	12.6”	50%	223	195	58%
20 years	SMC4M	16.0”	53%	179	250	69%

Source FVS projections using stand inventory data. CWHR = Type, Size, Density, QMD = Quadratic Mean Diameter, TPA = Trees Per Acre, CC = Percent Canopy Cover BA/Ac. = Basal Area Per Acre, SDImax = Percent of Maximum Stand Density Index,

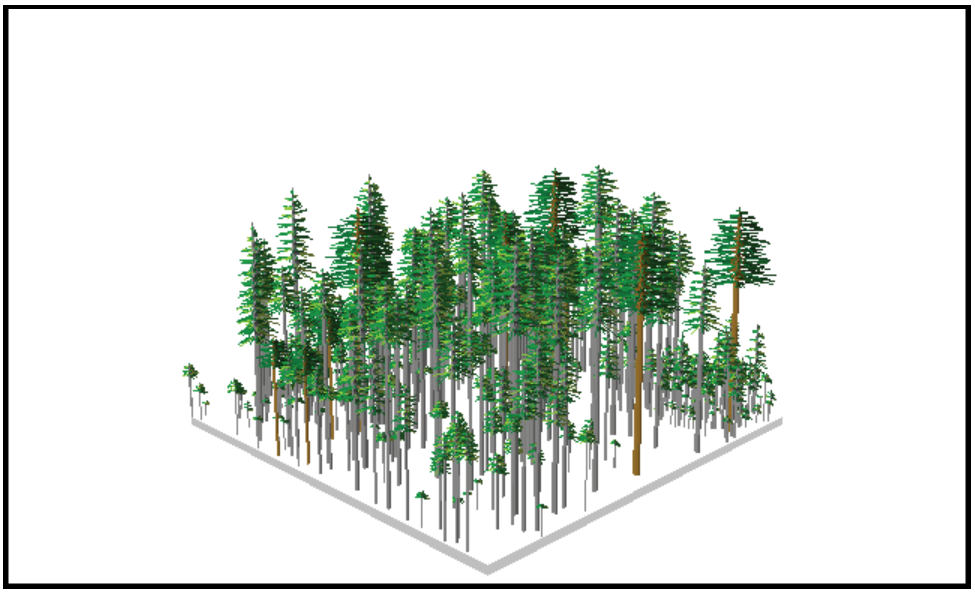

Figure 22. Stand 21-25, existing condition. Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data.

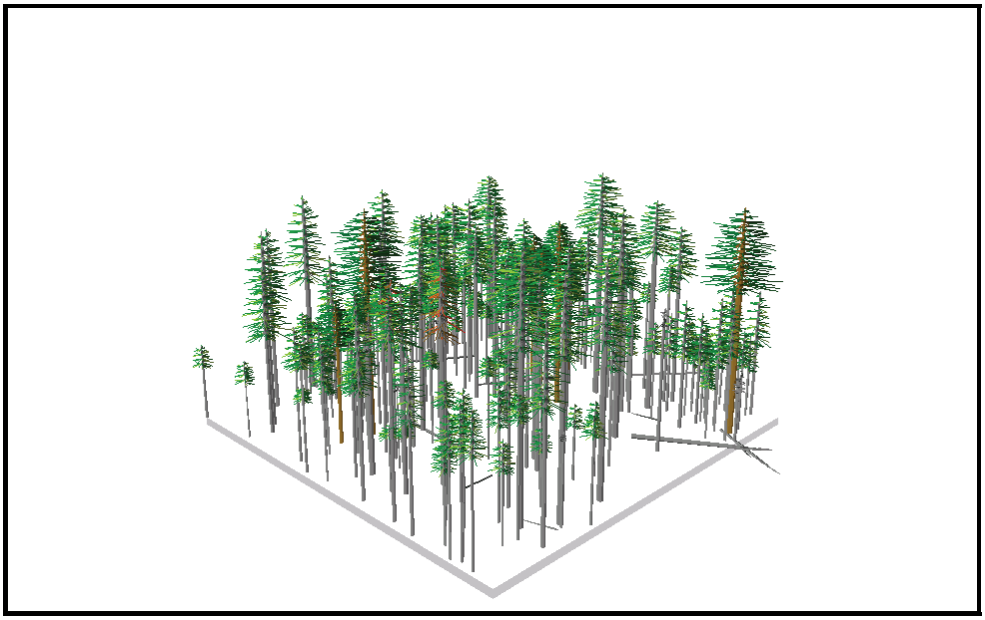

Figure 23. Stand 21-25, 20 years after thinning using the modified thin from below treatment. Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data. Fuel loading is beginning to increase as a result of density related tree mortality.

The Table 33 projection only represents the portions of the stand proposed for thinning and does not include no-treatment retention islands (10 percent of stand area). Tree stocking levels in the unthinned areas would continue to be excessive, resulting in continued growth stagnation, continuing inter-tree competition for limited resources, an overall decrease in stand vigor, and an increasing susceptibility to insects and disease.

The SVS simulations in Figure 22 and Figure 23 represent stand 21-25 existing and 20 years after treatment using the modified thin from below with retention islands treatment.

Lodgepole Pine Forest Cover Type

The projected average tree diameter in treated lodgepole pine stands would average 13.2 inches after thinning. Lodgepole pine stands would be thinned to an average of 180 square feet per acre. Thinning would reduce stocking density in treated stands to approximately 81 percent of Maximum SDI for pine. Lodgepole pine stands would remain in the zone of imminent mortality and at risk for density related tree mortality post thinning. Projected post thinning canopy cover would be 50-54 percent.

Indirect Effects

Eastside Pine and Sierra Mixed Conifer Forest Cover Type

Treating stands using the modified thin from below with retention islands treatment would result in fewer acres being thinned to stocking levels that would generally remain below 60 percent of Maximum SDI for approximately 20 years. These stands would remain at high risk for mortality due to insects, disease and drought.

In the Sierra mixed conifer forest cover type, the overstory would remain dominated by white fir providing a seed source. Given that the white fir can survive in denser stands than pine and is shade-tolerant, new white fir seedling would continue to establish under the canopy. Most white fir seedlings would likely die, but a few may survive increasing the stand density. What little growing space was freed-up during thinning would be quickly taken up by both new seedlings and the expanding overstory.

The white fir in the stand would dominate the pine at these densities converting the stand to pure white fir. This would dramatically reduce the overall forest diversity of the North 49 project area, making these converted stands susceptible to both surface and crown fire. In addition, the genetic material from the pines that once thrived in this area would be lost with the conversion of these stands to white fir.

Lodgepole Pine Forest Cover Type

Thinning Lodgepole pine stands to a residual basal area of 180 square feet per acre would put these stands at risk from mountain pine beetle. Current survey of the lodgepole pine stands indicate that mountain pine beetle has reached an epidemic population (Cluck, 2007). Maintaining these stands at 180 square feet per acre would provide trees spacing at 15 feet. Damage from harvest operations due to the tight spacing could lead to increased risk from beetle mortality and a reduction in stand health. In addition, the tight spacing provides the mountain pine beetle the opportunity to engage in a behavior known as switching. When one mountain pine beetle successfully invades a tree, it releases a pheromone attracting other beetles to this ideal breeding area. In time, the tree would fill with beetles and a different pheromone would be released repelling approaching beetles away from the infested tree. The approaching beetles would then switch to a large neighboring tree within 20 feet of the infested tree and attack it. In this case, even the healthiest lodgepole pine tree would not be able to repel this full attack and pockets of beetle killed trees would develop.

Thin from Below Treatment Effects

Direct Effects

The direct effects of the thin from below treatment outside the DFPZ are identical to the modified thin from below with retention island treatment described above, except that it would lack retention islands.

Indirect Effects

The indirect effects of the thin from below treatment outside the DFPZ are identical to the modified thin from below with retention island treatment described above, except that it would lack retention islands.

Diversity Thin Treatment Effects

Direct Effects

Sierra Mixed Conifer Forest Cover Type

The projected average tree diameter in treated mixed conifer stands would range from 12-20 inches after thinning. The post-treatment residual basal area in the majority of stands would range from 150 - 165 square feet per acre. Projected post-thinning canopy cover would range from approximately 43-46 percent. Thinning would reduce stocking density in treated stands to a range of approximately 40-43 percent of maximum SDI.

This treatment retains trees in the smaller diameter classes. These small trees would generally have crown separation from overstory trees reducing the potential for them to act as ladder fuels that lift fire into the forest canopy. This would not be the case however in retention islands, where small and large trees would create continuous canopy. Across the stand, fuel continuity between the crowns of trees would be broken up, but would include pockets of varying crown densities (see the Fire and Fuels).

Figure 24 and Figure 25 depict FVS modeling of structural thinning in a CWHR 4M and 4D mixed conifer stands, respectively. Average stand diameter increases by roughly 2 inches in both stands post thinning. This reflects that, while trees are removed from all size classes less than 30 inches dbh, thinning is predominantly in the smaller trees and more large trees are left, causing the average stand diameter to shift upward. Residual canopy cover averages near 40 – 45 percent and residual basal area ranges from approximately 150 square feet in the 4M stand, and 190 square feet in the 4D stand. The reduction in canopy cover moves the CWHR 4D stand to a class 4M stand after thinning. Residual stand densities are approximately 42 – 45 percent of maximum SDI. Stand densities are projected to reach near 55 percent of maximum SDI in twenty years, below the upper desired threshold of 60 percent of maximum SDI.

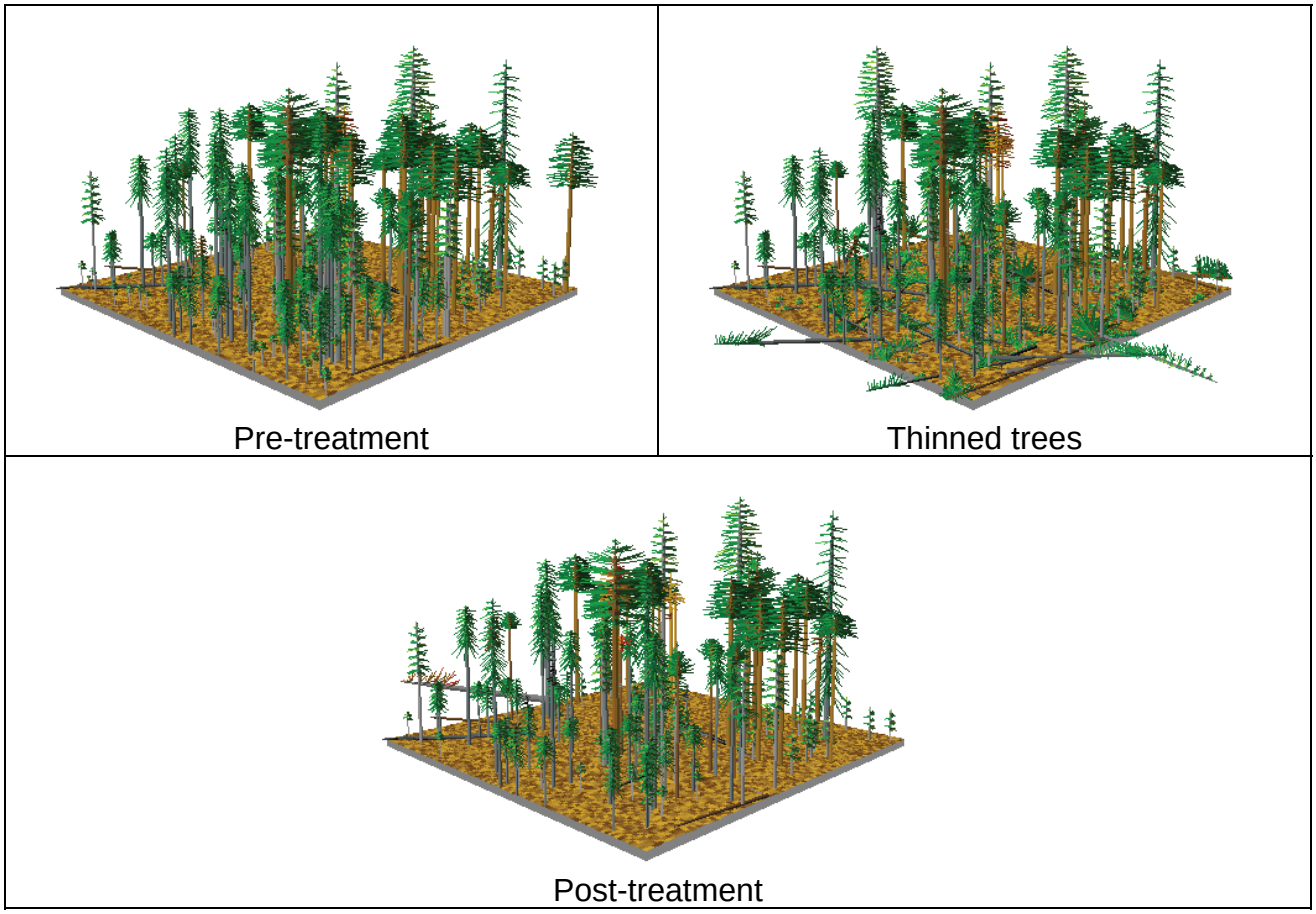

Figure 24. FVS modeling depiction of structural thinning in a CWHR 4M stand

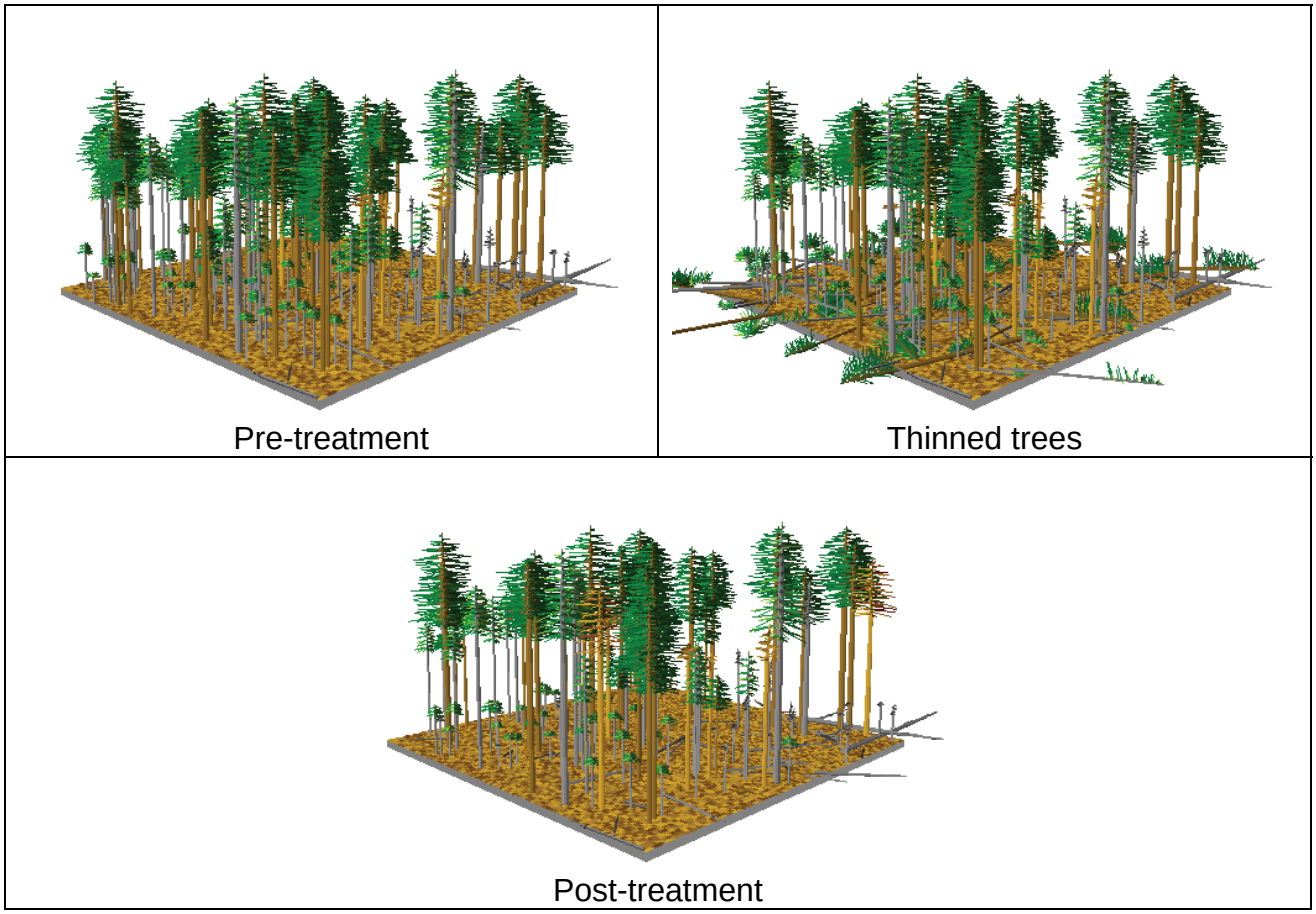

Figure 25. FVS modeling depiction of structural thinning in CWHR 4D stand

Radial Thinning within the Diversity Thin

One of the components of the diversity thin is radial thinning of large pines. The direct effects of removing all or a majority of the trees within a 30 to 50 foot radius on large legacy trees would be an immediate reduction in inter-tree competition for resources such as water, nutrients and to a lesser extent sunlight. The reduction in competition would improve the growth, vigor, and health of the trees (Fajardo, et.al., 2007).

Indirect Effects

Small areas of more tightly spaced trees (primarily in the structural thinning areas) would have a higher risk of damage from mechanical equipment through bole scars that expose the cambium. Retention islands would not be entered with mechanical harvest equipment and are not expected to be damaged from harvest operations. Thinning would favor retention of healthy trees free of disease and damage. Overall tree growth and vigor is expected to increase in the thinned stands. With the exception of retention islands within area thinning, all thinning treatments are generally expected to reduce stand densities below 60 percent of maximum SDI for 20 years.

The risk for density related tree mortality would remain high over time within retention islands. Retention islands could also provide habitat and conditions that support bark beetle populations that could attack trees in adjacent thinned areas. The effects of high stand density within retention islands may be ameliorated due to their small size and relative large proportion of edge environment (the amount of area of a retention island that is adjacent to the less dense thinning matrix). The diversity thin treatment would retain a lower average crown base height as well as dense pockets of ladder and canopy fuels within retention islands.

Thinning should decrease stand mortality caused by bark beetles. Thinning would remove diseased and injured trees, which are most susceptible to bark beetle caused mortality and also reduce tree competition, which can improve resistance to beetle caused mortality.

The diversity thin provides more opportunities to retain pine in various size classes. Stands with mixed species and size classes are healthier. Many insects and diseases are species and/or size specific therefore; stands with heterogeneity are more resilient and sustainable. Retaining pine within the stand preserves the local genetic pool providing opportunities to maintain a healthy pine component for the future.

Radial Thinning within the Diversity Thin

The indirect effect of radial thinning around large legacy trees provides small opening in the canopy giving shade-intolerant trees opportunities for regeneration.

Group Selection Treatment Effects

Direct Effects

The existing microclimate within proposed group selection units would be altered in the short term at the site level. This could include increased soil moisture levels, increased solar radiation, increased soil and air temperature, and reduced relative humidity as a result of opening up the canopy. Many of these changes are desired and needed to facilitate successful regeneration of shade-intolerant pine species.

Ponderosa/Jeffrey pine requires full sunlight to regenerate and grow at maximum potential. Because of the small size of the group selections, there would be an edge effect (shade from residual trees around the edge of the group). Pine height growth would be higher in 2-acre openings as compared to smaller openings and natural seedling regeneration would be more numerous.

The simulations in Figure 26 represent development of a group selection unit over a 90-year period. Seed trees are retained and 150 ponderosa pine seedlings per acre are planted after harvest. Planted seedlings are thinned at age 50 (2062). True fir, incense cedar and other species would seed in naturally. This group would type out as CWHR size class 5 or 6 pine stand in 2092 (multi-layered, size class 5 over layer of size class 4).

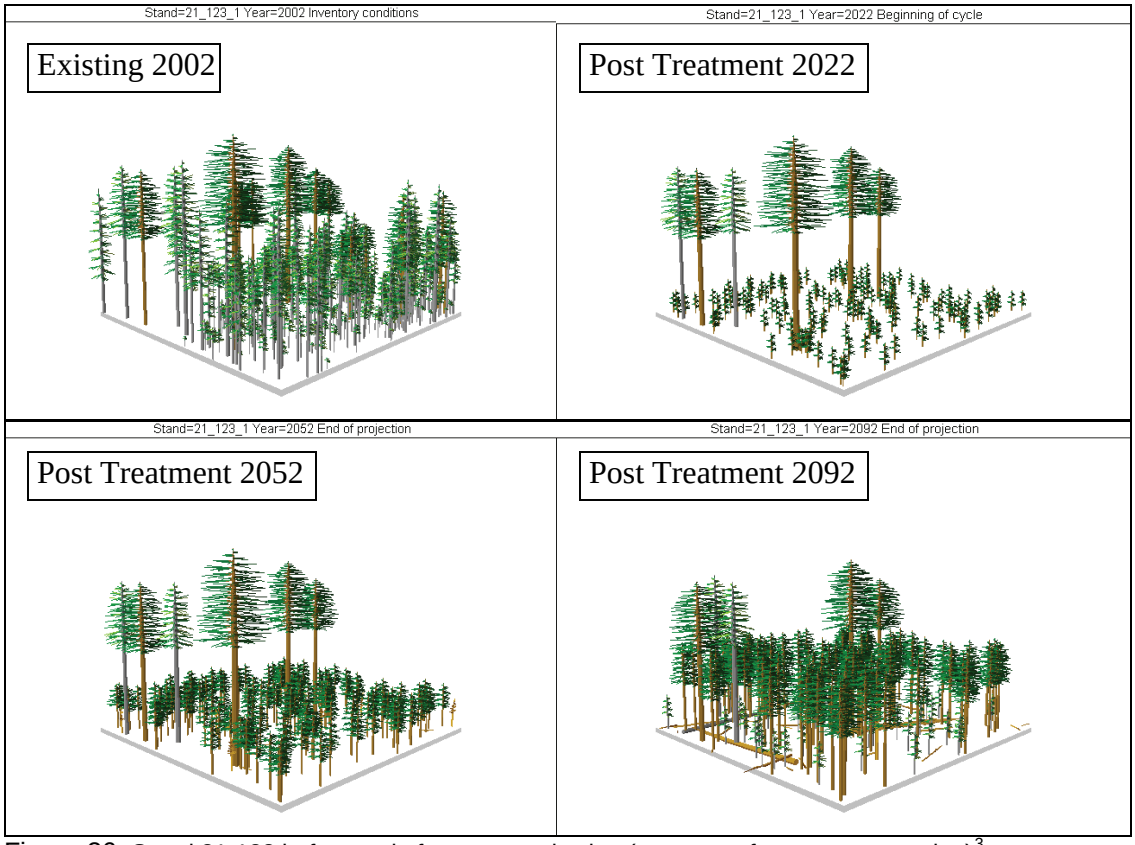

Figure 26. Stand 21-123 before and after group selection (one acre of a two acre opening)[3].

Indirect Effects

Group selections, because of their limited size, would be influenced by surrounding trees. Larger openings provide more area free of edge effects and hence more available site resources (McDonald and Reynolds, 1999). Higher density and better seedling development tends to occur in the central portion of the openings away from surrounding trees. Edge effect from the adjacent trees and small opening size and retention of overstory trees could inhibit growth in some seedlings by reducing light and moisture availability. As the new pine stands become established, the canopy would begin to close, which would begin to restore pre-treatment microclimate conditions over time.

[3] Stand Visualization System (SVS) simulations based on modeling of stand exam data.

Group selection treatments have the potential to increase populations of the pine engraver beetle. Large populations commonly infest logging slash, windthrown trees, or trees broken by wind or snow. When populations are low, the beetle may kill or top-kill widely scattered single trees or small groups of trees. However, if large populations build, mortality of live trees can be serious. Proper slash treatments such as lop and scatter, chipping, and piling, and timing of treatments should minimize the slash and downed logs that serve as suitable habitat and maintain populations at endemic levels. Alternative 1 includes slash treatments to minimize habitat for the pine engraver beetle.

Pine Restoration Treatment Effects

Direct Effect

Pine Restoration treatment are similar to group selections in their direct effects except there may be a slightly higher canopy cover (See above). These pine restoration areas would be heavily thinned to enhance existing sugar pine and yellow pine which would act as seed trees to promote the regeneration of pine.

Indirect Effects

The indirect effects of the pine restoration treatment are similar to group selection, but would retain more seed trees. This slightly higher canopy cover could potentially slow seedling regeneration. The pine restoration treatment improves species and structural diversity across the stand. Stands with mixed species and size classes are healthier and more resilient. Retaining pine within the stand preserves the local genetic pool providing opportunities to maintain a healthy pine component for the future.

Pine Plantations Treatment Effects

Direct Effects

These plantations are even-aged with low age/structure diversity. Thinning would reduce tree stocking and open up growing space. Average residual tree spacing would be 16-20 feet with 110-170 trees per acre. Canopy cover would be reduced to approximately 40 percent. Mechanical thinning and brush removal would expose a mineral-soil seedbed. This would create some opportunities for a new age-class to become established. Natural regeneration of shade-tolerant white fir may increase near plantation edges where there is a seed source.

The effect of brush treatments within pine plantations would be a reduction in the amount of surface, ladder and canopy fuels and a disruption in fuel continuity. This would reduce risk for damage or loss from a stand replacing wildfire. The effects of thinning the pine plantation would be a reduction in intertree competition for resources. Tree growth and vigor would improve and the risk for epidemic levels of tree mortality would decrease.

Indirect Effects

Indirect effects would be similar to the thin from below in DFPZ (See above). Reduction in brush from mastication within pine plantations would increase the availability of resources for released pine trees. Tree growth and vigor would improve and the risk for epidemic levels of tree mortality would decrease. Acceleration of tree growth would lead towards larger crowns providing more shade and inhibiting brush

development under the canopy. Damage from Gouty Pitch Midge which causes dieback of lateral shoots and weakens tree health and vigor would also be reduced.

Aspen Release Treatments Effects

Direct Effects

Removing competing conifers to maximize sun exposure and reducing the insulating litter/surface fuel layer to stimulate potential for sprouting would create conditions conducive to restoring or expanding remnant aspen clones. Aspen is shade-intolerant. Increased soil temperatures are needed to stimulate suckering and full sunlight is needed for good sucker growth. Creating openings to maximize sun exposure, soil heating, and reduce potential shading from adjacent conifers would facilitate the natural regeneration of aspen.

The existing microclimate at the site level (within proposed aspen units) would be altered in the short term. This could include increased soil moisture levels, increased solar radiation, increased soil and air temperature, and reduced relative humidity as a result of opening up the canopy. Many of these changes are desired and needed to facilitate successful regeneration of aspen. These changes would be limited in extent. These aspen release units are designed to mimic natural disturbances (primarily fire). Based on distribution of remnant aspen stands and historical records and photos, the current distribution and abundance of healthy, functioning aspen stands are outside the range of natural variability.

Indirect Effects

Removing competing conifers along with periodic underburning would improve and maintain plant species diversity over the long term by restoring and expanding aspen in the project area. As the new aspen stands become established, the canopy would begin to close, which would restore pre-treatment microclimate conditions.

Aspen shoots are often preferred browsed by herbivores. Prolonged intense herbivory could negatively impact the clones’ health and ability to successfully regenerate

Alternative 2 – No Action Effects

Alternative 2 would not directly impact the key issue resource of late seral wildlife habitat. However, there could be adverse impacts over time from continued degradation of forest health, a lack of species and structural diversity, and the potential for large forest replacing wildfires.

Management practices in the North 49 Project area have disrupted the historic fire return interval and contributed to the increase of both surface and ladder fuels. Considering the increase in fuels and the historic severity of fires in the surrounding area, there is a moderate to high chance that an escaped wildfire would be a large high severity fire that would put the safety of suppression personal, the public, resources, and property at risk.

The current condition of the North 49 Project area is not a healthy, sustainable forest. Competition among trees will continue to cause mortality, increasing the amount of surface fuels and increasing the risk for a stand replacing fire. Trees will continue to be stressed making them vulnerable to death from insects, disease and drought. With the continued build-up of fuels and densely packed trees very little vegetation such as

grasses, forbs and shrubs will be able to grow beneath the canopy reducing the habitat suitability of the area for small prey species (i.e. mice, voles and small birds) and their predator species such as California spotted owl, northern goshawk and American marten. Meadows, aspen stands and riparian vegetation would continue to be encroached upon by conifers diminishing open habitats used for nesting and forage. Brushfields, in some areas would be replaced by white fir, decreasing habitat for deer, nesting neo-tropical birds and other brush-utilizing species.

Species diversity within the North 49 Project area has substantially diminished over the last 125 years. The GLO surveys indicate that white fir has increased more than ten-fold while sugar pine and ponderosa pine have decreased. The increased ingrowth of white fir and the loss of the pine have changed the composition of the North 49 Project area from the pre-settlement period. Historically, white fir accounted for approximately 31 percent of the species composition. Today, white fir makes up approximately 68 percent of the species composition. Even more significant is the loss of the pine component. Historically, sugar pine comprised approximately 22 percent of the species composition and yellow pine (a reference to ponderosa and Jeffrey pine) comprised approximately 17 percent, based on the GLO surveyors' notes. Today, sugar pine comprises approximately 3 percent and yellow pine comprises approximately 11 percent of the forest composition. This loss of species diversity dramatically influences the sustainability of the forest by reducing resiliency to fire, drought, insect and disease.

Direct Effects

Forest Vegetation Simulator projections using forest inventory data were used to model the effects of Alternative 2 on four stands. Stand attributes were projected out 20 years. In three of the stands, vegetation typing would not change from existing in the next 20 years. In stand 21-18 canopy cover reductions caused by tree mortality changes M4D to M4M. Tree mortality causes canopy cover reductions of 2-6 percent in all stands at the end of 20 years. Average tree per acre reductions over the next 20 years ranges from 11 to 116 trees per acre. These trees die and become snags before they eventually fall and contribute to increased surface fuel loading. See the Fire and Fuels section in this chapter for discussion of increased fuel loading and lowering CBHs and their effects on fire behavior.

In stands 22-8, 21-18, and 20-45 basal area growth is declining as mortality begins to exceed annual growth as measured in cubic feet. In all stands, SDI continues to decrease as tree mortality increases. With little or no disturbance, growth rates in areas near or above 70 percent of Maximum SDI would continue to decrease. Average stand density would slowly decline until a large-scale disturbance caused by a combination of drought, tree mortality, and or wildfire. Some CWHR density M stands would slowly shift into canopy density D where site resources can support these densities. The more likely scenario is that density class D stands would eventually become M stands as tree mortality continues to reduce canopy cover. The more open stands (CWHR canopy density P and S) would generally grow at faster rates due to less inter-tree competition. Their growth rates would be dictated more by factors of site quality rather than stand density. Natural disturbance could change the CWHR size class distribution. Pockets of mortality due to insects, disease, windfall, or wildfire could create CWHR class 1 stands. Mortality of understory trees due to competition, insects, or disease, and growth of residual overstory trees would increase size class; however, selective bark beetle mortality of large diameter trees could cancel this affect and reduce the size class of

stands. As stands reach and persist at maximum densities, they would remain at high risk of widespread mortality from insect and disease outbreaks and/or wildfire. The following tables display existing and 20 year projected stand attributes for each stand.

The following figures display SVS simulations that represent existing and 20 year projected conditions for stands 19-45 and 22-8.

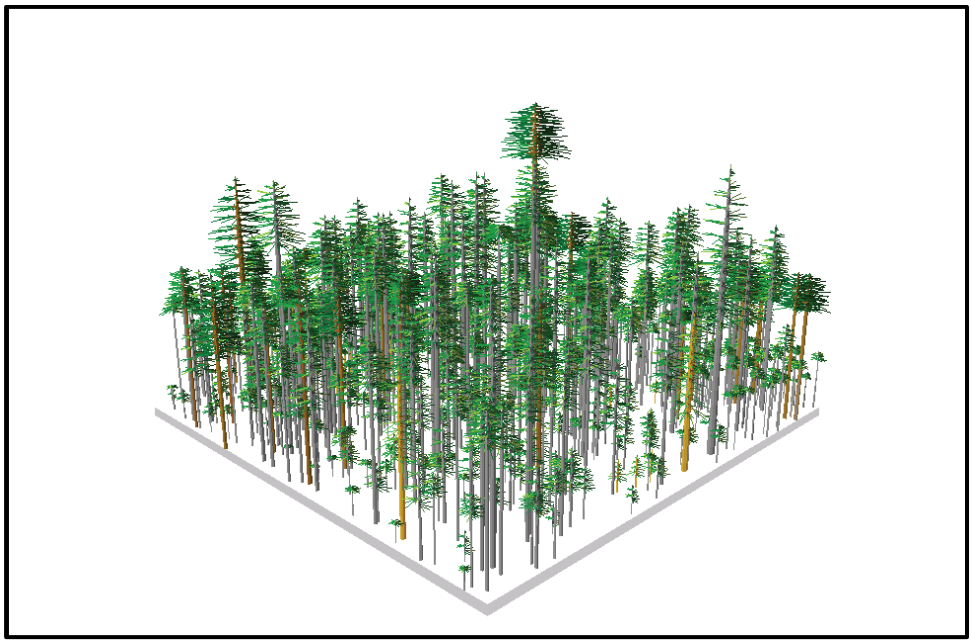

Figure 27. Stand 19-45 existing condition. Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data.

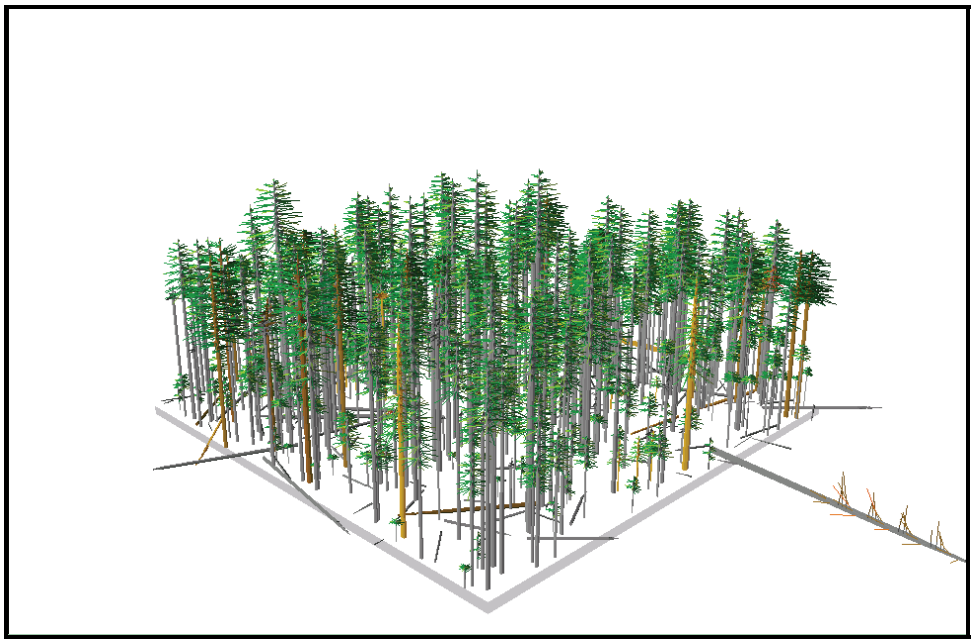

Figure 28. Stand 19-45 in 20 years. Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data. Larger overstory trees as well as small trees in the understory have died and are contributing to increased surface fuel loading.

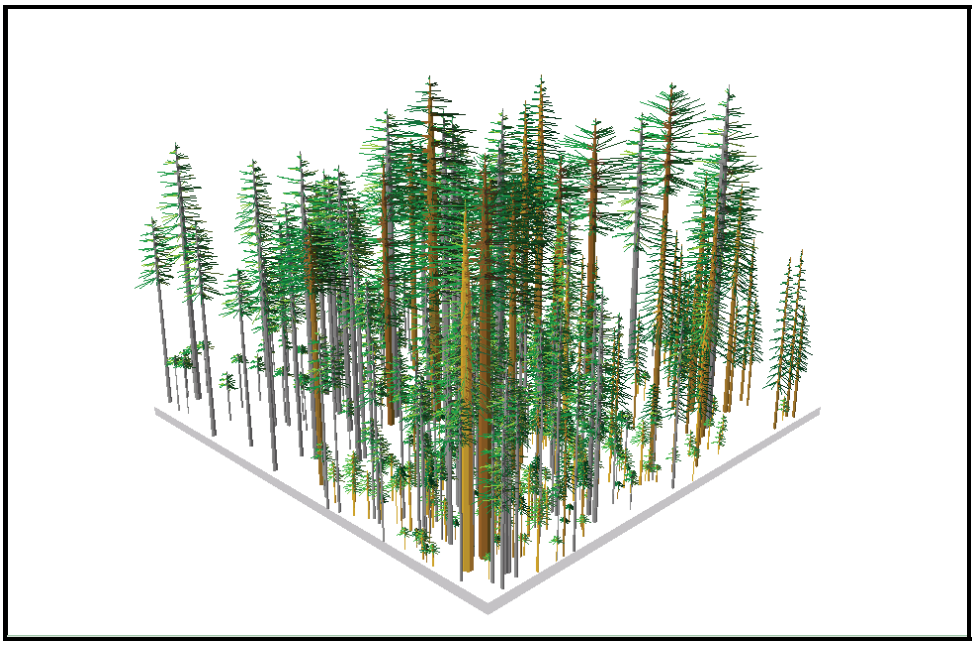

Figure 29. Stand 22-8 existing condition. Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data.

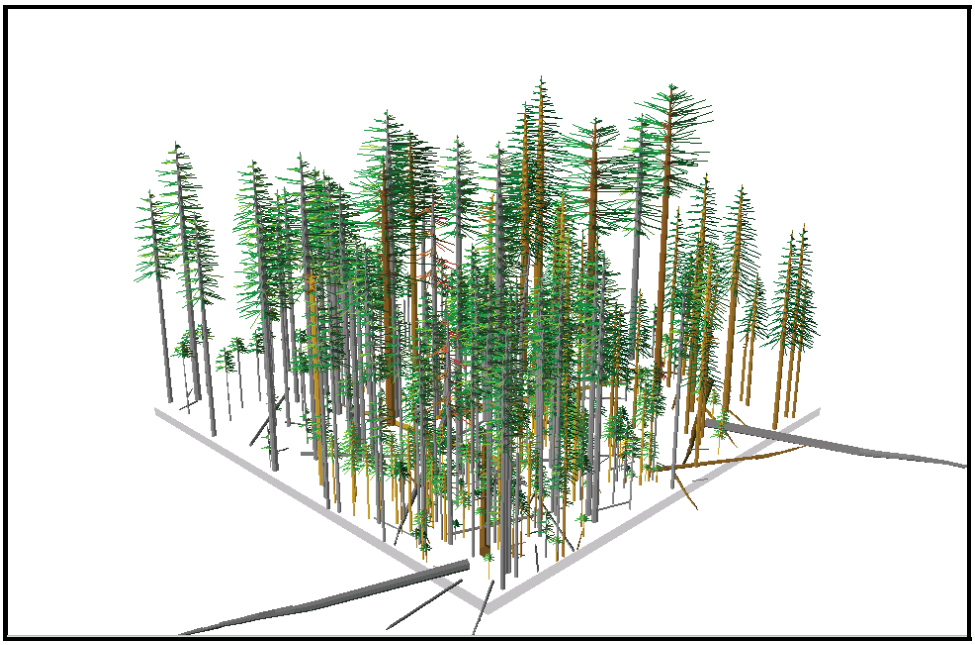

Figure 30. Stand 22-8 in 20 years. Stand Visualization System (SVS) simulations based on FVS modeling of stand exam data. Larger overstory trees as well as small trees in the understory have died and are contributing to increased surface fuel loading.

Table 34. No-Action – Existing Stand Conditions

Stand	CWHR	QMD	CC	CBH	TPA	BA/Ac	SDImax
19-45	M3D	8.9”	73%	5 ft	664	290	99%
22-8	M4D	11.4”	70%	4 ft	473	335	104%
21-18	M4D	13.9”	61%	5 ft	296	311	89%
20-45	P4M	11.4”	58%	7 ft	272	311	92%

Source FVS projections using forest inventory data. CWHR = Type, Size, Density, QMD = Quadratic Mean Diameter, TPA = Trees Per Acre, CC = Percent Canopy Cover, CBH = Crown Base Height, BA/Ac. = Basal Area Per Acre, SDImax = Percent of Maximum Stand Density Index,

Table 35. No-Action – Projected Stand Conditions in Year 20

Stand	CWHR	QMD	CC	CBH	TPA	BA/Ac	SDImax
19-45	M3D	10.9”	68%	3 ft	461	301	95%
22-8	M4D	13.0”	67%	3 ft	357	301	97%
21-18	M4M	15.2”	55%	3 ft	223	280	78%
20-45	P4M	13.6”	56%	3 ft	223	195	88%

Source FVS projections using forest inventory data. CWHR = Type, Size, Density, QMD = Quadratic Mean Diameter, TPA = Trees Per Acre, CC = Percent Canopy Cover, CBH = Crown Base Height, BA/Ac. = Basal Area Per Acre, SDImax = Percent of Maximum Stand Density Index,

Indirect Effects

The No Action alternative would result in the indefinite postponement of DFPZ construction, thinning, and group selection. The heightened risk of severe, stand replacing wildfire that could result in total loss of resources would remain.

There would be no opportunity to restore these fire-adapted ecosystems. Periodic, low-intensity fire would not be reintroduced. Excessive white fir ingrowth would continue. Species diversity would decline, as shade- intolerant pine species are shaded out of these stands. These forests would remain outside of their range of natural variability in respect to historical species composition, forest structure, and the natural processes of periodic low intensity fire.

Stand density index (SDI) in forested stands and plantations would remain in the zone of imminent mortality. Tree stocking levels in the unthinned areas would continue to be excessive, resulting in continued growth stagnation, continuing intertree competition for limited resources, an overall decrease in stand vigor, and an ever-increasing susceptibility to insects and disease. The high risk for epidemic levels of tree mortality would continue. These conditions cannot be sustained into the future without a major disturbance such as catastrophic tree mortality and/or stand altering wildfire.

Location, severity, and length of drought are important factors in determining mortality levels due to insects and disease. Mortality would typically result in openings that range from less than ¼ to more than 50 acres in size. Mortality related to insects and disease would have multiple possible consequences. Declining forest health, increasing fuel loading and a continuing need to enter stands to conduct salvage operations.

There would be fewer large, old trees and fewer mid-diameter trees, which represent the pool from which large trees of the future would come. Possible increase in snags could be a hazard to public safety. Loss of canopy cover could increase understory brush growth and associated fire hazard

The loss of large, old, predominant trees over 30 inches in diameter would continue. Species and structural diversity and a valuable seed source would continue to decline across the project area.

Group selections would not be implemented at this time. There would be no opportunity to improve species, age, and structural diversity by providing a favorable environment for the establishment of shade intolerant pine species. Seral stage diversity in the project area would remain as it currently exists unless changed by wildfires or other catastrophic events.

Conifer encroachment would continue and the health of remnant aspen clones would decline. If current trends continue, aspen clones would disappear from the area over time. There would be no opportunity to improve aspen species diversity and forest structure to approximate pre-settlement conditions.

The severity and extent of dwarf mistletoe infections would increase throughout the project area. White fir dwarf mistletoe would increase in dense stands with a high proportion of white fir in the understory and midstory. Infected overstory pine located adjacent to openings could infect pine regeneration.

The risk of bark beetle outbreaks causing large-scale mortality in large, remnant overstory pines would increase over time, as stands grow increasingly dense. This would run counter to the desired condition of stands dominated by fire resistant pine in the overstory. Of particular concern are mountain, Jeffrey and western pine beetles because of their aggregating behavior. When there is an abundance of food (trees that are successfully attacked), pine beetle population outbreaks can occur and cause large-scale mortality across forest stands (Demars, 1982). Stands at most risk in the project area those stands with high levels of stocking (60 percent of Maximum SDI or more), especially during periods of extended drought. Stands would remain very susceptible to catastrophic fir engraver beetle and/or Douglas-fir tussock moth outbreaks.

Gouty Pitch Midge infestations would continue in the Manzanita Chutes plantations causing continued dieback of lateral shoots and weakening tree health and vigor. This infestation is directly related to intense intertree and brush competition. Plantation investments would remain at high risk for tree mortality or total loss from wildfire.

Comparison of Alternatives

The major difference in effects between the alternatives relate to the effectiveness of thinning treatments, the amount of groups and the associated acreages (See Table 31). Minor differences would include operability and risk for residual tree damage, changes to crown base heights and crown bulk densities, and the unthinned retention islands.

Thinning

Under Alternative 1, the thin from below treatment would be applied to approximately 90 percent of the acres to be thinned. The remainder would be treated with the modified thin from below with retention islands. Alternative 3 is similar to Alternative 1, but treats 53 percent of the proposed thinning acres with the thin from below treatment and 47 percent with the modified thin from below with retentions islands treatment.

Alternative 7 treats 47 percent with the thin from below treatment and 53 percent with the diversity thin treatment. See the alternative maps in Chapter 2 for treatment locations.

Alternative 1 creates an effective fuel break across the landscape and reduces the stand densities below the zone of imminent mortality throughout most of the treated area because of the large number of acres treated with the thin from below treatment. Thinning from below removes most of the understory and mid-level canopy, which eliminates heterogeneity and provides limited opportunities to improve species and structural diversity. The modified thin from below with retention islands treatment is applied to a small portion of the treated area however it utilizes the thin from below concept which diminishes heterogeneity. Structural diversity may only be maintained within the isolated retention islands. Stand densities in the modified thin areas would remain high with over 600 acres remaining above 60 percent SDImax, in the zone of imminent mortality. This high relative density greatly increases the risk to agents of mortality including insects, disease, drought and fire. There would be a potential for large- scale forest losses, up to 600 acres, which would impact the landscape and suitable habitat.

Alternative 3 utilizes the thin from below in DFPZ treatment to establish an effective fuel break with reduced stand densities across 50 percent of the treated area. Approximately, 50 percent of the treated area in Alternative 3 utilizes the modified thin from below with retention islands even within the DFPZ. These retention islands within the DFPZ create areas that could display extreme fire behavior and compromise firefighter safety. The retention islands do provide opportunities to maintain structural diversity. However, in Alternative 3, heterogeneity is still lost across much of the landscapes because the area is still being thinned from below. The modified thin leaves treated acres with higher stand densities, over 2500 acres within the zone of imminent mortality. This high relative density greatly increases the risk to agents of mortality including insects, disease, drought and fire. There would be a greater potential for large- scale forest losses, over 2500 acres, which would impact the landscape and suitable habitat.

The location of the DFPZ in Alternative 7 was changed to take advantage of natural barriers and previously thinned areas, and to align the DFPZ perpendicular to prevailing winds while duplicating the aggressive DFPZ fuels treatment of Alternative 1. The realignment of the DFPZ reduces the impacts to suitable late seral habitat in five California spotted owl HRCAs and minimizes the number of acres treated as DFPZ. Alternative 7 utilizes the thin from below treatment within the DFPZ providing an effective fuel break and reducing stand densities below the zone of imminent mortality. Outside the DFPZ, Alternative 7 uses the diversity thin to enhance structural and species diversity across the landscape while still reducing stand densities below the zone of imminent mortality. By maintaining trees in various size classes, heterogeneity and species diversity is retained and young trees are available for recruitment. Retention islands would be left in units which are treated with the diversity thin. These islands would constitute up to 15 percent of the stand and be additional areas of structural diversity and bolster stand heterogeneity. These islands would maintain a higher stand density that could put them at risk from insects, drought and/or disease.

Alternative 7 applies radial thins of 30-50 feet around remnant trees to free them of inter-tree competition and encourage improved growth and vigor. Without intervention, these last vestiges of the pre-settlement forest would be at risk of mortality from encroaching white fir. Research concludes that removing competing trees from around the remnant trees improves their health, growth and vigor (Fajardo, et.al., 2007).

Group Selection and Pine Restoration Treatments

Alternative 1 proposes to utilize the group selection treatment to create 1,168 acres regenerated pine stands, which would improve the structure and species diversity of the project area. Approximately 86 acres would be harvested using a helicopter on slopes greater than 35 percent. Helicopters are commonly used to remove logs on steep slopes; however, the cost would be prohibitive in this situation. Several groups are located within research areas and would not be harvested. The groups in Alternative 1 would remove all trees within the groups regardless of species except 2 seed trees per acre and would be replanted with pine. Thus groups that already display high pine content would still be harvested and seedlings planted in their place. Although this would improve structural diversity, cutting of pine to plant pine would not improve species diversity. Healthy, well established sugar and yellow pine would be removed to plant sugar and yellow pine seedlings. The established sugar and yellow pine have genetics that are adapted to the area and to remove them would be a loss to the local genetic pool.

Alternative 3 proposes to create 680 acres of group selections to regenerate pine, which would improve the structure and species diversity of the area. Structural diversity would increase as would species diversity except where groups were placed in pine. However, this would occur on 488 acres less than Alternative 1.

Alternative 7 proposes to create 908 acres of group selections to regenerate pine while evaluating the locations of the groups. The focus of the group selection treatment would be white fir dominated stands where the pine component had been reduced or lost. Groups were either eliminated or moved from Northern goshawk PACs and California spotted owl HRCAs to reduce habitat impacts. The helicopter groups were eliminated because they were cost prohibitive and impacted late seral habitat. Groups were moved out of the research areas into adjacent stands in need of greater diversity. Groups that were identified as having a high yellow and sugar pine component would not be treated with the group selection prescription, except were severe mistletoe infection occurs. Instead, these pine dominated areas would receive the Pine Restoration treatment to enhance the existing pine component and give the established sugar and yellow pine the opportunity to pass on their site specific genetic information to the next generation.

Pine Release in Plantations

Alternatives 1, 3 and 7 are the same for pine release in plantations. The acres for Alternative 7 are slightly different due to current information and more accurate mapping.

Aspen Release

Alternatives 1 and 3 both treat 38 acres of aspen which includes a 2 acre group along the highway. Neither the 2 acre group nor 38 acres would sufficiently afford the identified clones room to expand.

When treating aspen it is recommended that managers locate the farthest extent of the clone to determine its area. Removing conifers within the clone and clearing an area of up to 150 feet around it is recommended to provide room to grow. Alternative 7 increases the acreage around the aspen clone along the highway to five acres. This would be sufficient to give the aspen clone room to grow. The aspen clone in the center of the project would be expanded to 50 acres to maximize regeneration. Additionally, this aspen clone appears to be heavily browsed and by expanding the opening for the clone, it has more opportunities to expand quickly and reduce the impacts of the browse.

Volume Comparison

Under all alternatives, select trees would be harvested to meet the purpose and need of the project. The harvested trees would be classed as either saw timber or biomass. Biomass consists of all trees harvested between 3 inches and 9.9 inches dbh which is ground into chips for cogeneration plants or paper. Saw timber consists of trees harvested between 10 inches and 29.9 inches dbh which is cut into dimensional lumber or used for house logs. Less than 1 percent of the trees harvested will be greater than 24 inches dbh. The amount of volume harvested is an estimate from the Forest Vegetation Simulator model and actual volume harvested would vary. The model projects harvest volumes based on the stand inventory data. Stand data was predominately collected in late seral stands to assure adequate information was available to evaluate the effects on late seral dependant species.

Volume estimates from the model could overestimate harvested volumes because of the focus on attaining data in dense stands. In addition, the model did not take into account that harvested trees may have defects such as rot and deformities that would reduce the amount of total usable volume. For these reasons, it is better to consider harvest volume estimates generated by the model as indicators for comparative analysis and as not definitive values.

Forest Vegetation Simulator projects harvest volumes on a per acre basis. For each treatment, the harvest volume per acre was averaged for all stands. This average harvest volume per acre was multiplied by the planned treatment acreage under each alternative for an estimate of total volume harvested.

The modified thin from below was projected to harvest the least volume per acre because a portion of the stands would be left untreated and because trees would be removed from the smallest sizes classes until an approximate canopy cover of 50 percent is achieved. The thin from below in DFPZ has a higher projected volume per acre harvest because of the less restrictive canopy requirement, trees are removed from the smallest sizes classes until an approximate canopy cover of 40 percent is left. In general, the thin from below treatment and the modified thin from below would remove mostly understory and intermediate trees with only some overstory trees being removed. The diversity thin, which reserves trees in all size classes to provide structure and diversity, would remove a portion of trees across the diameter range allowed for harvest (3.0 – 29.9). An additional element of the diversity thin is the radial release of large legacy pine trees. Many of these remnant trees are surrounded by 80-100 year old, 11-24 inch white firs that have flourished with fire suppression and are competing for limited resources. The removal of white fir in the radial release in conjunction with the thin through the diameter classes increases the estimated harvested volume over both the modified thin from below with retention islands and thin from below treatments

Stand Structure

To assist readers familiar with the California Wildlife Habitat Relationships (CWHR) habitat classification system, the effects from the silvicultural treatments and the resultant stand structures were projected into the this habitat classification system (Wildlife habitats -Clifornia wildlife habitat relationships system).

Below are the comparative acres of CWHR sized and density classes existing and post-treatment presented by alternative.

Table 36. Existing CWHR size and density classes in acres by vegetation type in the North 49 project area

Forest Cover Type	Existing Condition																			
	Seed -ling	Sapling (1" - 5.9" dbh)					Pole (6" - 10.9" dbh)					Small (11" - 23.9" dbh)					Medium/Large (> 24" dbh)			
	1	2X	2S	2P	2M	2D	3X	3S	3P	3M	3D	4X	4S	4P	4M	4D	5S	5P	5M	5D
Sierra Mixed Conifer	766	104	36	61	27	15	39	1101	2085	1018	653	83	151	868	4638	14943	3	68	628	6225
Lodgepole pine	0	0	0	0	0	0	0	8	13	12	32	0	10	49	264	670	0	0	0	0
Red fir	0	0	0	0	0	0	0	0	0	0	0	0	0	8	90	19	0	0	9	6
Black Oak	0	0	0	0	0	0	0	0	0	0	7	0	0	6	0	1	0	0	0	0
Total acres	766	104	36	61	27	15	39	1109	2098	1030	692	83	161	931	4992	15633	3	68	637	6231

Source: Lassen National Forest GIS existing vegetation layer. Mixed conifer type includes stands typed by GIS as white fir, ponderosa/Jeffrey pine, Douglas-fir, aspen, and plantations. GIS typing does not recognize stands typed as ponderosa pine and aspen using inventory data, so they are included as mixed conifer. CWHR size classes: 1=seedling (<1”), 2=sapling (1” to 5.9”), 3=pole (6” to 10.9”), 4=small (11” to 3.9”), 5=medium/large (> 24”). CWHR density classes: S=sparse cover (10-24 percent canopy cover), P=open cover (25-39 percent canopy cover), M=moderate cover (40-59 percent canopy cover), D=dense cover (60-100 percent canopy cover), X=unknown.

Table 37. Alternative 1 post treatment CWHR size and density classes in acres by vegetation type in the North 49 project area

Forest Cover Type	Alternative 1																			
	Seed -ling	Sapling (1" - 5.9" dbh)					Pole (6" - 10.9" dbh)					Small (11" - 23.9" dbh)					Medium/Large (> 24" dbh)			
	1	2X	2S	2P	2M	2D	3X	3S	3P	3M	3D	4X	4S	4P	4M	4D	5S	5P	5M	5D
Sierra Mixed Conifer	1887	104	36	61	27	15	39	1101	2085	1018	653	83	151	868	9926	8755	3	68	2210	4423
Lodgepole pine	0	0	0	0	0	0	0	8	13	12	32	0	10	558	264	161	0	0	0	0
Red fir	0	0	0	0	0	0	0	0	0	0	0	0	0	8	90	19	0	0	9	6
Black Oak	0	0	0	0	0	0	0	0	0	0	7	0	0	6	0	1	0	0	0	0
Total acres	1887	104	36	61	27	15	39	1109	2098	1030	692	83	161	1440	10280	8936	3	68	2219	4429

Source: Lassen National Forest GIS existing vegetation layer. Mixed conifer type includes stands typed by GIS as white fir, ponderosa/Jeffrey pine, Douglas-fir, aspen, and plantations. GIS typing does not recognize stands typed as ponderosa pine and aspen using inventory data so they are included as mixed conifer. CWHR size classes: 1=seedling (<1”), 2=sapling (1” to 5.9”), 3=pole (6” to 10.9”), 4=small (11” to 23.9”), 5=medium/large (> 24”). CWHR density classes: S=sparse cover (10-24 percent canopy cover), P=open cover (25-39 percent canopy cover), M=moderate cover (40-59 percent canopy cover), D=dense cover (60-100 percent canopy cover), X=unknown.

Table 38. Alternative 3 post treatment CWHR size and density classes in acres by vegetation type in the North 49 project area

Forest Cover Type	Alternative 3																			
	Seed -ling	Sapling (1" - 5.9" dbh)					Pole (6" - 10.9" dbh)					Small (11" - 24" dbh)					Medium/Large (> 24" dbh)			
	1	2X	2S	2P	2M	2D	3X	3S	3P	3M	3D	4X	4S	4P	4M	4D	5S	5P	5M	5D
Mixed Conifer	1388	104	36	61	27	15	39	1101	2085	1018	653	83	151	868	9912	9153	3	68	2209	4538
Lodge pole pine	0	0	0	0	0	0	0	8	13	12	32	0	10	49	264	670	0	0	0	0
Red fir	0	0	0	0	0	0	0	0	0	0	0	0	0	8	90	19	0	0	9	6
Black Oak	0	0	0	0	0	0	0	0	0	0	7	0	0	6	0	1	0	0	0	0
Total acres	1388	104	36	61	27	15	39	1109	2098	1030	692	83	161	931	10266	9843	3	68	2218	4544

Table 39. Alternative 7 post treatment CWHR size and density classes in acres by vegetation type in the North 49 project area

Forest Cover Type	Alternative 7																			
	Seed -ling	Sapling (1" - 5.9" dbh)					Pole (6" - 10.9" dbh)					Small (11" - 23.9" dbh)					Medium/Large (> 24" dbh)			
	1	2X	2S	2P	2M	2D	3X	3S	3P	3M	3D	4X	4S	4P	4M	4D	5S	5P	5M	5D
Mixed Conifer	1716	104	36	61	27	15	39	1101	2085	1018	653	83	151	868	8922	9901	3	68	1953	4708
Lodge pole pine	0	0	0	0	0	0	0	8	13	12	32	0	10	558	264	161	0	0	0	0
Red fir	0	0	0	0	0	0	0	0	0	0	0	0	0	8	90	19	0	0	9	6
Black Oak	0	0	0	0	0	0	0	0	0	0	7	0	0	6	0	1	0	0	0	0
Total acres	1716	104	36	61	27	15	39	1109	2098	1030	692	83	161	1440	9276	10082	3	68	1962	4714

Cumulative Effects

The area considered for silvicultural cumulative effects is the project area. The project area boundary is defined on the north by the Thousand Lake Wilderness and to the south and east side by Highway 44/89. The west side of the project area is defined by Latour State Forest and private property. Stand and site conditions elsewhere (outside of the treated stands) generally have little effect on treated stands, with the exception of effects on forests insect populations. Activities and management since 1975 within the project area are considered in this analysis because the effects of the past silvicultural treatments are still occurring (i.e. improved health and vigor of thinned stands, regeneration of clearcuts, establishment of pine stands). Management activities and events prior to this are considered in this analysis in so far as they have shaped current forest conditions. The existing forest conditions are the result of past management and treatments that has changed the forest structure and composition since settlement of the project area in the late 1800s.

Fire suppression and grazing have resulted in an increase in the number of small diameter trees. Grazing and its associated soil disturbance provide suitable soil conditions for seedling establishment. Logging disturbance also creates canopy openings and scarifies the soil, which can lead to seedling establishment. Periodic wildfires, which could have consumed some of the small trees, have been suppressed. Forests of the Sierra Nevada have developed fuel ladders, accumulations of surface fuels, and there has been an increase of shade-tolerant conifers such as white fir (Verner and McKelvey, 1993) in the forest understory. This is true of the North 49 Project area as well.

More recent timber harvests (1975 – 2006) within the North 49 Project Area and adjacent National Forest Lands have harvested approximately 34,109 acres of timber through regeneration harvests, overstory removal and sanitation silvicultural treatments (Table 40). On private and state lands within the North 49 Project Area and adjacent National Forest Lands there has been timber harvested through clearcutting, commercial thinning, group selection, sanitation, selection (single tree), shaded fuelbreak, shelterwood, and a combination of the above over the past ten years (Table 41). Timber harvesting had impacts on soils in several ways; compaction resulting from road, skid, and landing construction; removal or displacement of topsoil; loss of soil due to mass movement or surface erosion.

Table 40. Harvest activities in the North 49 Project Area and adjacent National Forest Lands since 1975

	North 49 Project Area and adjacent National Forest Lands				
	1975 - 1979	**1980 - 1989**	**1990 -1999**	**2000 - 2006**	**Total acres**
Green Sales - acres	3,837	10974	7761	2661	**25,233**
Salvage - acres	1520	2659	4153	194	**8,526**
Mastication - acres	0	0	0	350	**350**
Total – acres	**5,357**	**13633**	**11914**	**3205**	**34,109**

Table 41. Harvest Activities in the North 49 Project Area and adjacent Private and State Lands (1997-2007)*

Activity	North 49 Project Area and adjacent Private and State Lands			
	Private Land Use (Fruit Growers Supply Company)	Private Land Use (Sierra Pacific Industries)	State Land Use	Total % of Land Use By Treatment Type
Clearcutting - %	4	39	0	**14**
Commercial Thinning - %	1	19	2	**7**
Group Selection - %	0	0	88	**30**
Sanitation - %	2	0	0	**1**
Selection (single tree) - %	13	0	0	**4**
Shaded Fuelbreak - %	0	9	0	**3**
Shelterwood - %	0	33	10	**14**
Shelterwood & Commercial Thinning - %	53	0	0	**18**
Shelterwood & Sanitation - %	27	0	0	**9**
Total – %	**100**	**100**	**100**	**100**

*Records of Timber Harvesting Plans (THPs) for the California Department of Forestry and Fire Protection (CDF) are only kept for the past ten years.

Insect salvage removes commercially valuable dead trees killed by bark beetles. Intermediate sanitation focuses on removing trees that are damaged, diseased, have small live crowns or otherwise exhibited low vigor and growth rates that were at risk of dying within ten years. Intermediate thinning includes thinning from below and above. Thinning from below removes predominantly smaller trees and retains healthy larger overstory trees. Thinning from above removes decadent or poorly growing overstory trees to release healthy smaller trees from the midstory and understory; healthy overstory trees are retained as well. Overstory removal focuses on removing overstory trees that are damaged, diseased, and/or exhibited low vigor and growth rates. Regeneration harvesting including clearcuts, seedsteps, and shelterwoods remove all trees within the area and are up to 40 acres in size. Seedsteps and shelterwoods retain some of the trees as seed trees. These treatments were commonly used to treat areas infected with dwarf mistletoe. These treatments were used to improve forest health and growth at the same time they have also contributed to the loss of the large ponderosa and sugar pine that once dominated the landscape and are now slowly disappearing from the project area.

In 2007, one commercial woodcutting permit was issued for the Hat Creek RD allowing the removal of 1 to 10 cords of wood. An additional 887 personal woodcutting permits were also issued. Approximately 2,880 Christmas tree permits were sold on the Hat Creek RD for 2007. It is known that commercial woodcutting, personal woodcutting and Christmas tree cutting has and does occurred within the North 49 Project Area but the amounts are not quantifiable.

Activities such as Christmas tree cutting, cutting of posts and poles, and firewood have and will continue to have little effect on stand structures except within small localized settings. Christmas tree cutting generally selects for healthy open grown fir seedlings that may otherwise grow into mid or overstory trees; however,

cutting is concentrated in a narrow band along a few accessible roadways. While firewood cutting occurs throughout much of the project area, the level of removal of dead wood has no appreciable effect on stand growth or understory regeneration. Ground disturbance from vehicles accessing firewood can injure small trees as well as expose mineral soil as a seed bed for new seedlings, however live overstory trees still provide the most dominant influence on understory development.

From 1917 through 2006 there have been approximately 147 fires with the majority of the fires being under an acre in size. These past fires have had a variety of causes such as lightning, equipment, arson, smoking, and campfires. Generally, the majority of the large fires occur in brushfields burning in-line with the prevailing winds which flow from the southwest to the northeast (Mayer, 2008).

Present or Reasonably Foreseeable Future Activities

Present and future HFQLG and non-HFQLG projects planned that overlap with the North 49 Project area may have cumulative impacts. After these HFQLG projects are implemented, the area would be guided by the direction described for the other Sierra Nevada national forests (USDA Forest Service 2004).

Table 42. Reasonably Foreseeable Projects on the Lassen National Forest within the North 49 Project area

Reasonably Foreseeable Projects	Implementation Year	Status
Sandy Roadside Hazard	2007	On-going
Eskimo Hill Winter Recreation Area	2008 +	Planning
Big Bug Small Sale	2008 +	Planning
North 49 DFPZ maintenance	2010 - 2040	-

Grazing would be expected to continue on National Forest lands at current levels. There are two livestock grazing allotments (Hat Creek and North Battle Creek) that overlap into the North 49 Project area of which one is active. One hundred percent of the North Battle Creek allotment is within the project area. Eighty cow/calf pairs are authorized from July 1st thru September 30th. The vacant Hat Creek allotment overlaps approximately fifty percent of the North 49 Project area. This activity would continue to contribute to minor impacts on woody riparian habitats as it continues to meet current standards for use.

Future activities on National Forest lands include ongoing hazard tree removal projects (Sandy Roadside Hazard, etc.), snags that present hazards to road traffic, regardless of size, are routinely removed for public safety. If implemented, the Eskimo Hill Winter Recreation Area Improvement project would remove select trees to improve safety for recreationists and have little cumulative impacts on silvicultural resources. Big Bug is a Small Salvage Sale would remove dead and dying lodgepole pine trees infested with mountain pine beetle in an effort to restrict the beetles' population growth. The project is small in size and would not significantly change overstory vegetation within the project.

Future activities on private and state lands are displayed in Table 43. These timber projects would extensively treat approximately 7,212 acres adjacent to and within the North 49 Project area. A Caltrans project which entails widening highway 44/89 by shaving rock points and removing some trees along a 0.2 miles stretch is expected to have negligible effect on silvicultural resources.

Table 43. Reasonably Foreseeable Projects on Private and State Lands within the North 49 Project area and adjacent lands.

Reasonably Foreseeable Projects	Implementation Year	Status	Acres	Treatment Types
2002 South Cow Timber Harvest Plan (THP) – Latour Demonstration State Forest	2002	On-going	1,632	1,332 ac. – GS, 300 ac. – Shelterwood
2004 Grace Lake THP – PG & E	2008 +	On-going	1,135	Sanitation, Salvage, Single Tree Selection
2005 Lost Creek THP – Fruit Growers Supply Company	2005 +	On-going	2,669	1,303 ac. – Shelterwood & Sanitation, 499 ac. Shelterwood & Commercial Thinning, 612 ac. Single Tree Selection, 167 ac. Clearcutting, and 88 ac. Sanitation
2005 Cherry THP – Sierra Pacific Industries	2007 - 2010	On-going	1,073	820 ac. Clearcutting and 253 ac. Shaded Fuelbreak
2005 Manzanita Flat THP – Sierra Pacific Industries	2007 - 2010	On-going	703	703 ac. Clearcutting
Eskimo Project – CalTrans	2006 +	On-going	N/A	Widen Hwy. 44/89 for safety reasons – 0.2 miles affected, accomplished by shaving rock points and removing some trees for road daylighting purposes.

The DFPZ is designed to be effective for a period of 10-years. The earliest maintenance treatment to maintain effectiveness is expected to be approximately 10 years from completion of the initial DFPZ, based on a review of similar projects completed since the mid 1990s. The direct, indirect, and cumulative effects of the foreseeable maintenance (hand, mechanical and prescribed fire treatments) would be similar to those described in the HFQLGFRA FSEIS (pages 47 – 305). The future maintenance for the proposed action is projected to include 11,862 acres of prescribed fire and 69 acres of no treatment.

National Forest Management Act (NFMA) Compliance

The silvicultural treatments developed for the proposed action address timber stands (lands) that are suited for timber production and comply with 36 CFR 219.12 (Suitable uses and provisions required by NFMA). No harvesting would occur on lands designated as off base or deferred, which includes Spotted Owl Habitat Areas (SOHAs), Wilderness and Designated Roadless Areas. The proposed vegetation manipulation of tree cover, as recommended by the treatments, is consistent with the multiple-use goals and standard and guidelines established in the Lassen National Forest LRMP, as amended. Necessary actions would be implemented to ensure the successful regeneration of shade intolerant pine and aspen species within group selection openings. Treatment areas were not chosen because they would generate the greatest amount of dollars or timber output. The analysis discloses the effect of proposed treatments on residual trees and prescribes specific protection measures as integrated design features. Best Management Practices (BMPs) would be followed so there would be no permanent impairment of site productivity as a result of this project. The rate of soil erosion would not increase as a result of these actions (see watershed and soils portion of this

chapter). Standard operating procedures along with specific design features are incorporated to protect wildlife habitat, aesthetic, and other resource values. Species habitat and viability would be maintained. Consultation with the National Marine Fisheries Service has been completed. Harvest plans are practical in terms of transportation and harvesting requirements, and total costs of preparation, logging, and administration.

The area considered for silvicultural cumulative effects is the project area as described under Alternative 1. Cumulative effects would be similar to Alternative 1 except that fewer acres would be treated overall including fewer acres of thin from below and group selections. DFPZ treatments under alternatives 1 and 7 would be more effective as compared to Alternative 3 because the thin from below treatment would be applied. The thin from below treatment would raise crown base heights (CBH) and reduce crown bulk densities (CBD) more than the modified thin from below with retention islands treatment and it would not retain 10 percent of the DFPZ in non-treatment retention islands as proposed under Alternative 3. Projected DFPZ maintenance treatments and their timing would be the same as under Alternative 1. The diversity thinning in alternative 7 is not part of the DFPZ network. Diversity thinned stands would (where available) retain trees of multiple heights, but would not retain trees that would act as ladder fuels to the overstory canopy. By managing the selection of small trees and clumps of trees, the overall fuel connectivity of the landscape would be disrupted as compared to untreated stands. The area thinning treatments, which include structural thinning, would support the DFPZ network by providing areas of lessened fire behavior as compared to untreated stands as observed during the Cone Fire (2002) in the high diversity treatment units of the Blacks Experimental Forest on the Lassen National Forest.

Terrestrial Wildlife

This section presents an analysis of effects on wildlife species of concern and compares the effects of each alternative. A description of the analysis area, timeframe and methodology is followed by a general description of effects on wildlife and wildlife habitat from the proposed action and alternative actions. Effects on sensitive species are presented individually to clearly demonstrate the effects to each species.

No federally listed threatened or endangered wildlife species are known to exist in the North 49 Project area or within the Wildlife Analysis Area.

Information provided here on affects to terrestrial wildlife is the preponderance of information presented in a Biological Assessment/Biological Evaluation (BA/BE) on terrestrial wildlife for the North 49 Project that is on file as part of the project administrative record. The information below contains all the analysis and affects on wildlife from the BA/BE. Primarily duplicative or non contributing information was not included in this EIS.

Summary of Determinations

Action Alternatives

The action alternatives would protect and maintain key sensitive species habitat areas through project design, specifically spotted owl PACs and SOHAs, would not be treated, disturbance would be limited through implementation of the necessary Limited Operating Periods (LOPs), and riparian areas and meadows would

be managed by designating RHCAs and meeting BMPs during implementation. Nevertheless, impacts to National Forest lands resulting from the North 49 Project are expected to contribute to cumulative impacts on certain sensitive wildlife species. See Table 44 for a summary of the determinations.

These project level effects determinations are consistent with the determinations reached in the SNFPA 2004 ROD by meeting the following three conditions:

1. The project is designed in accordance with all Forest Plan design criteria as analyzed in the SNFPA FSEIS 2004 ROD, Table 2;
2. The spatial location and timing of this project, when considered cumulatively with all other projects affecting sensitive species and sensitive habitat in the HFQLG area, have been displayed and analyzed and results in a determination consistent with that reached in the SNFPA FSEIS 2004 ROD;
3. Available new information that was not available in the SNFPA FSEIS 2004 ROD has been included in this project level analysis and this new information leads to the same conclusion as that within the SNFPA FSEIS 2004 ROD.

Table 44**.** Summary of Effects of Proposed Action on Sensitive Animal Species that Potentially Occur on the Lassen National Forest

Species	Alternative 1, 3 & 7	Alternative 2 No Action
BIRDS		
Bald eagle (*Haliaeetus leucocephalus*)	WNA	WNA
California spotted owl (*Strix occidentalis occidentalis*)	MAI	WNA
Northern goshawk (*Accipiter gentilis*)	MAI	WNA
Great gray owl (*Strix nebulosa*)	MAI	WNA
MAMMALS		
American marten (*Martes americana*)	MAI	WNA
Pacific fisher (*Martes pennant pacifica*)	MAI	WNA
California wolverine (*Gulo gulo luteus*)	WNA	WNA
Sierra Nevada red fox (*Vulpes vulpes necator*)	MAI	WNA
Pallid bat (*Antrozous pallidus*)	MAI	WNA
Townsend's big-eared bat (*Corynorhinus townsendii*)	MAI	WNA
Western red bat (*Lasiurus blossevillii*)	MAI	WNA
INVERTEBRATES		
Shasta Hesperian Snail (*Vespericola Shasta*)	WNA	WNA
REPTILES		
Northwestern pond turtle (*Clemmys marmorata marmorata*)	WNA	WNA

WNA = Will Not Affect, MAINLA= May Affect but Is Not Likely to Adversely Affect Individuals or their designated critical habitat, MAI = May Affect Individuals, but is not likely to result in a trend toward Federal listing or loss of viability, LRTTFL = May affect individuals, and is Likely to Result in a Trend Toward Federal Listing or loss of viability

Analysis Areas

The proposed treatment area is located in predominately Sierra mixed conifer forest habitat. The Treatment Area is defined as the units to be treated. This includes treating approximately 10,716 acres of DFPZ 5,014

acres of Area Thinning and up to 1,170 acres of group selections which includes a two acre aspen group, totaling 16,900 acres based on Alternative 1. The Project Area is defined as the treatment area plus an additional larger land base and equals approximately 42,400 acres. This project area is located at elevations ranging from about 4,600 feet to 7,100 feet. For the purpose of this BA/BE, the Wildlife Analysis Area is defined as the project area (which includes treatment areas) plus an additional larger land base. The additional larger land base was determined by potential indirect and cumulative effects on California spotted owl Protected Activity Center (PAC) and Home Range Core Area (HRCA) distribution. So the Wildlife Analysis Area goes out to and encompasses the closest PACs/HRCAs to the project area. The Wildlife Analysis Area totals approximately 57,389 acres (Figure 31) of which 45,991 acres are National Forest Lands. This Wildlife Analysis Area is also being used for all other wildlife species analyzed in this BA/BE since the effects of the project to those species would not extend beyond the Wildlife Analysis Area boundary for the California spotted owl. All direct, indirect and cumulative effects discussed, occur within this 57,389 acre Wildlife Analysis Area. The direct and indirect effects of each alternative, together with the additive or cumulative effects of each alternative, have been considered in evaluating impacts to Sensitive Species and Sensitive Species habitat.

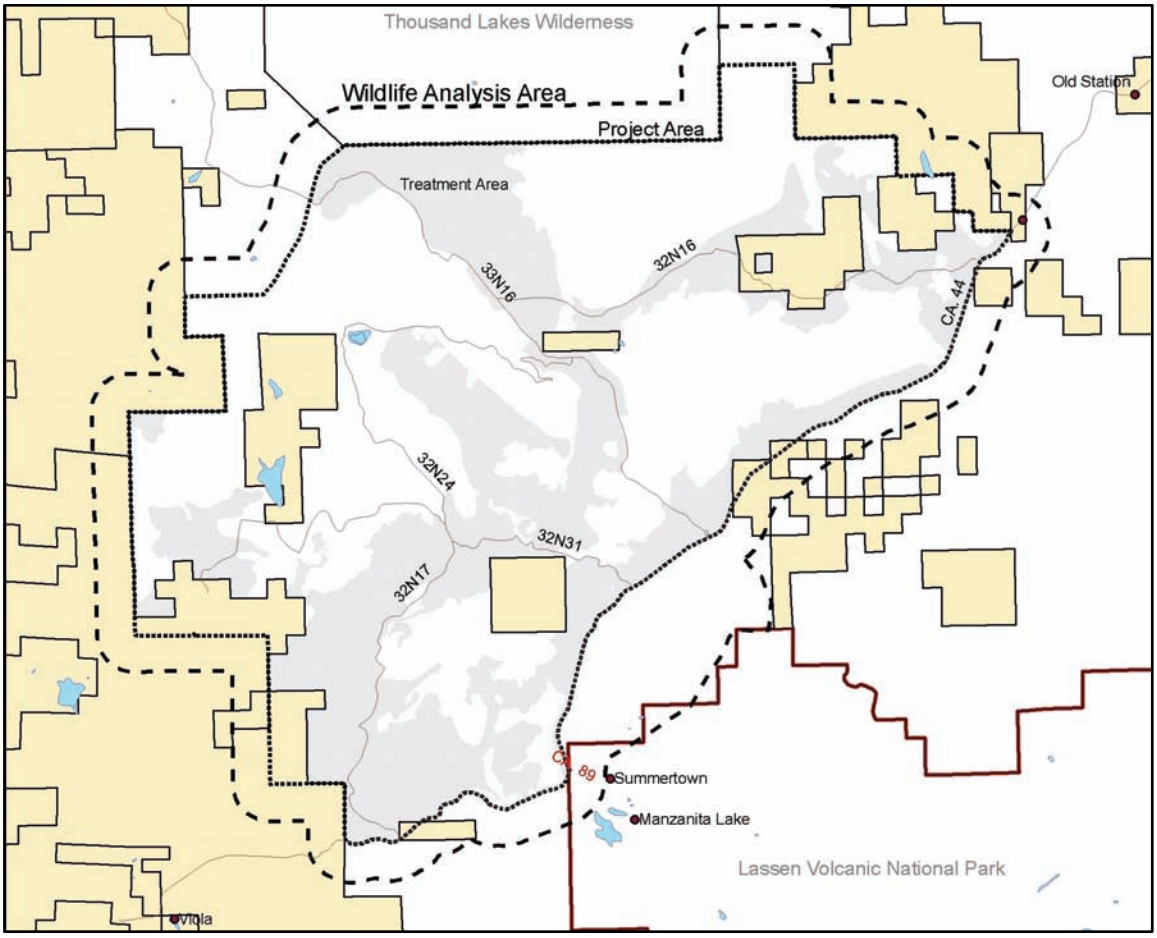

Figure 31. North 49 Wildlife Analysis Area, project area and treatment area (solid color).

Timeframe for Analysis

The timeframe used for determining cumulative effects depends on the length of time that lingering effects of the past actions would continue to impact the species in question. For the North 49 project, general information based on the history of the area and sight specific information based on available data, going back approximately 30 years and forward approximately 5 years was incorporated.

Analysis Methodology

The North 49 Project was reviewed using aerial photographs, digital orthophoto quadrangles (DOQs), vegetation layer spatial datasets, species specific spatial datasets and known information to help determine suitable habitat for Sensitive species (i.e. California spotted owls, northern goshawks, etc). In the field, areas identified as suitable habitat are surveyed to the following R5 protocols and acceptable standards:

- "Protocol for Surveying for Spotted Owls in Proposed Management Activity Areas and Habitat Conservation Areas March 12, 1991 (Revised February 1993)"
- "Survey Methodology for northern goshawks in the Pacific Southwest Region, U.S. Forest Service" (USDA Forest Service 2000)
- "Survey Protocol for the Great Gray Owl in the Sierra Nevada of California, May 2000" (USDA Forest Service 2000)
- "A Willow Flycatcher Survey Protocol for California, May 29, 2003" (Bombay, et al. 2003)
- "American marten, Fisher, Lynx and Wolverine: Survey Methods for Their Detection" (Zielinski and Kucera 1995)

Species nest sites and locations were recorded using Global Positioning System (GPS) and incorporated into spatial datasets. For the analysis of effects, changes to suitable habitat and impacts to protected activity centers (PACs)/territories were determined by using a spatial dataset of the vegetation layer combined with type of treatments (i.e. mechanical thinning, group selection, aspen release, structural thin, etc). The California Wildlife Habitat Relationships (CWHR) habitat classification system was used to analyze effects of the proposed action and alternatives. The CWHR system was developed to identify and classify existing vegetation types important to wildlife. The CWHR System is a predictive wildlife model for California's regularly-occurring birds, mammals, reptiles and amphibians. At present, there are 59 wildlife habitats in the CWHR System: 27 tree, 12 shrub, 6 herbaceous, 4 aquatic, 8 agricultural, 1 developed, and 1 non-vegetated.

The predictive model for each species has expert-applied suitability ratings for three life-requisites - breeding, cover and feeding. For each species, each habitat stage is rated as high, medium, low or unsuitable for each of these life requirements. Each special habitat element is also assessed as essential, secondarily essential, preferred or not rated for the species.

The analysis of alternatives considers the attributes of structure and heterogeneity values for suitable habitat. Although these characteristics are evaluated, there is no standard for measurement. Therefore, the California Wildlife Habitat Relationships (CWHR) system continues to be used for wildlife habitat analysis for projects under the HFQLG FEIS as amended by the 2004 Sierra Nevada Forest Plan Amendment Final Supplemental EIS as it maintains consistency for monitoring changes in species habitat. This includes the

requirement to not cumulatively reduce late seral dependent species habitat (5M, 5D, and 6) more than 10 percent below 1999 levels (USDA Forest Service 1999). These CWHR types have the highest probability of providing stand structures associated with preferred nesting, roosting and foraging.

For the comparative analysis contained in this EIS, the CWHR system is used to evaluate forest conditions and the suitability of wildlife habitat. This document uses CWHR size class 5 (See table below) to differentiate late seral forest. California WHR size class 4 is considered mid-seral. The predominant CWHR size class of forest stands is 4, which accounts for approximately 63 percent of the project area. California WHR size class 5 constitutes 20 percent of the project area.

Appendix B displays all pre-treatment and estimated proposed post treatment vegetation information currently available within the Wildlife Analysis Area. All vegetation information is displayed using the California Wildlife Habitat Relationships (CWHR) vegetation codes (Appendix C defines these codes) and serves as the baseline acres for analysis.

Table 45. Summary of CWHR 4M, 4D, 5M, 5D acres within the Wildlife Analysis Area derived from vegetation layer (all acres are approximate and NFS lands only)

CWHR Type*	Wildlife Analysis Area
DFR4M	2
DFR5D	8
LPN4D	622
LPN4M	153
MHW4D	1
RFR4D	80
RFR4M	184
RFR5D	74
RFR5M	37
SMC4D	12,409
SMC4M	2,752
SMC5D	6,227
SMC5M	450
WFR4D	4,291
WFR4M	893
WFR5D	1,790
WFR5M	275
Total	**30,248**

*4=small 11-24"dbh, 5=medium/large >24"dbh. D= Dense Canopy Cover > 60%, M= Moderate Canopy 40-59%, DFR=Douglas-fir, LPN=Lodgepole Pine, MHW=Montane Hardwood, RFR=Red Fir, SMC=Sierra Mixed Conifer, WFR = White Fir.

General Effects to Wildlife and Wildlife Habitat

This section evaluates effects to all wildlife species, including sensitive species, that are know to occur or could occur in the wildlife analysis area. Effects are primarily related to changes to available habitat and are

analyzed on that basis. Direct effects include immediate changes in habitat conditions and disturbance or harassment to individuals, including direct mortality, during project activities. It is assumed in this analysis that all action alternatives would be implemented as stated, in compliance with all rules and regulations governing land management activities, including the use of the appropriate Limited Operating Periods (LOP). Direct disturbance, including mortality to individual animals addressed in this document is highly unlikely, due to survey efforts for selected species, incorporation of LOPs where appropriate, and implementation of Forest standards and guidelines. Indirect effects include effects that occur later in time or beyond the action area of the project. Indirect effects can also include effects to a species prey base.

Effects on Terrestrial Habitat for all Action Alternatives

Direct and Indirect Effects

Thinning from Below in DFPZ

Defensible Fuel Profile Zone construction would be accomplished through thinning from below and the reintroduction of fire into the ecosystem. Thinning from below concentrating on small diameter fuel ladders is useful in that this treatment reduces overstocking, largely the result of fire suppression (Agee 1993, USDA-Sierra Nevada Forest Plan Amendment 2001). The removal of ≤8 inches dbh conifers would generally result in little or often no impact on current canopy closures. What losses are incurred within the under story would be quickly regained in the over story as reduced competition for resources allows dominant and co-dominant (20 inches-30 inches) trees to grow faster.

Mechanical thinning that involves the cutting of some co-dominant (20 -29.9 inches) conifers remove both large structure and canopy cover. This change in canopy cover would be sufficient to result in acres changing to a lower canopy cover class immediately following treatment of dense stands. Mechanical thinning to achieve the desired condition within DFPZs (action alternatives), as per Table 2 of the SNFPA FSEIS ROD 2004, and designed as per North 49 Alternatives 1, 3 and 7 would result in the following:

1. CWHR 4M, 4D: Stands within DFPZs supporting CWHR types 4M (40-59 percent canopy cover) and CWHR types 4D (60-100 percent canopy cover) are projected to become 40-50 percent canopy cover (M) post thinning.
2. CWHR 5M, 5D: Stands within DFPZs supporting CWHR types 5M (40-59 percent canopy cover) and CWHR types 5D (60-100 percent canopy cover) are projected to become 40-50 percent canopy cover (M) post thinning.

Mechanical thinning with biomass removal, simplifies the complexity and structure of the stand, opening up the stand by treating the lower and mid-level vegetative layers, removing more structures that provide the vegetative layering, deformities, snags and future decadence, reducing the closed nature of the stand which provides diverse microclimates spotted owls seek to control exposure and changes in ambient temperature for roosting. Biomass removal can degrade/remove hiding cover in the lower and mid canopy often used by young spotted owlets. Feller-bunchers used to remove biomass also create open paths, and disrupt down woody material, through crushing, moving, etc. Thus biomass removal in suitable habitat would result in habitat degradation, and would be analyzed as a direct reduction in suitable habitat for owls, goshawks and mesocarnivores, etc.

Thinning Treatments Outside the DFPZ (Area Thin)

Alternatives 1 and 3 thinning treatments outside the DFPZ would be accomplished through thinning from below while Alternative 7 would thin throughout the diameter classes. All alternatives would reduce overstocking, largely the result of fire suppression (Agee 1993, USDA-Sierra Nevada Forest Plan Amendment 2001). The removal of ≤8 inches dbh conifers would generally result in little or often no impact on current canopy closures. What losses are incurred within the under story would be quickly regained in the over story as reduced competition for resources allows dominant and co-dominant (20 inches-29.9 inches) trees to grow faster.

Mechanical thinning that involves the cutting of some co-dominant (20-29.9 inches) conifers removes both large structure and canopy cover. This change in canopy cover would be sufficient to result in acres changing to a lower canopy cover class immediately following treatment of dense stands. Mechanical thinning to achieve the desired condition within Area Thin (action alternatives), as per Table 2 of the SNFPA FSEIS ROD 2004, and designed as per North 49 Alternatives 1, 3 and 7 would result in the following:

1. CWHR 4M, 4D: Stands within AT supporting CWHR types 4M (40-59 percent canopy cover) and CWHR types 4D (60-100 percent canopy cover) are projected to become 45-50 percent canopy cover (M) post thinning.
2. CWHR 5M, 5D: Stands within AT supporting CWHR types 5M (40-59 percent canopy cover) and CWHR types 5D (60-100 percent canopy cover) are projected to become 45-50 percent canopy cover (M) post thinning.

Snags and LWD would be as described under Fuels Treatment/DFPZ.

Group Selection

Historically, Sierra mixed conifer forest landscapes probably consisted of a complex array of mostly small, even-aged aggregations and/or stands representing a wide range of age and size classes (Verner et al. 1993, page 253). Lightning fires that affected small areas (ranging in size from a single tree to groups of trees to several acres) probably were relatively common and an important influence on stand structure (Ibid, page 247). Patches of fire-induced openings (and other stand disturbance elements such as bark-beetle kill) produced a variable, irregular patchwork of even-aged groups, most from less than an acre to several acres in size. Consequently a relatively fine-grained pattern of variability, modified by topography existed at a landscape scale (Ibid, page 247). Group Selection harvest methods could create gaps and openings in the forested stands ½ to 2 acres in size that could approximate pre-settlement stand structure (Ibid, page 271).

The group selection treatments would result in the creation of forest openings and gaps that would have most conifers below 30 inch dbh removed (except desirable regeneration and oaks/hardwoods are retained as described in proposed action). Where ½ to 2 acre groups are implemented, the existing CWHR type (4M, 4D, 5M, 5D) is replaced in each small group unit with a small opening supporting brush/seedling/sapling type habitat (CWHR 1), while some of the surrounding conifer stands, the groups are located in, would be treated with DFPZ, WUI or Area thinning (thinning areas outside DFPZ) treatments.

Groups could increase the edge to interior ratio; that is the stand provides less continuous forest cover and interior habitat and becomes a stand of multiple edges, beneficial to species that prefer edges to the detriment

of forest interior species (Harris, 1984; Forest Fragmentation website). Remaining forested patches between the groups (often referred to as the matrix) appear to be nothing more than corridors between the gaps, as interspersion and juxtaposition of groups increases the contrast of the created edges. Edge effects of these induced ecotones on both the microclimate and on wildlife can extend into the forested patches beyond what is actually created by the group (Harris, 1984; Hunter, 1990; Forest Fragmentation website). Furthermore, some of these remnant corridors are then subjected to skid trails, DFPZ, WUI and Area Thinning treatments, further reducing the amount of continuous forest cover. The combination of group openings, along with DFPZ, WUI, and Area Thinning treatments, skid trails and landings, would create a mosaic of forest that may not be suitable for forest interior habitat species (defined as species that require large patches of a relatively homogenous multi-layered habitat structure), that may be negatively affected by management practices that fragment larger patches of habitat into smaller patches with numerous edges (Harris, 1984; Scalet, et al, 1996). Sensitive species considered forest interior species include spotted owl and fisher (Hunter 1990) goshawk, and marten (Luman and Neitro, 1979).

It is unknown at what threshold the amount of edge to interior habitat results in use, marginal use or non-use by late seral species. It is reported that martens (an late seral species) have not been found in landscapes with greater than 25 percent of the area in openings, even where suitable habitat (dense forested habitat) connectivity exists (SNFPA 2001). Conversely, it is reported that small open areas and regenerating stands are used by marten as foraging habitat, but are of optimum value when they occupy a small percent of the landscape and occur adjacent to mature forested stands meeting requirements for denning and resting habitat. It is suggested that small dispersed tree harvest units within a forested matrix should have less impact on marten populations than large continuous clearcuts and, in some instances may prove beneficial (Ibid). Thus there is some undefined range or threshold of small openings within forested matrix that will allow continued habitat use by this forest carnivore.

Alternative 1 creates 1,168 acres of groups across approximately 11,172 available acres of mechanical harvest treatment area equaling a group density of approximately 10.5 percent. Alternative 3 creates 682 acres of groups across 10,646 acres of mechanical harvest treatment area equaling a group density of approximately 6.4 percent, while Alternatives 7 creates 978 acres of groups across 9,511 acres of mechanical harvest treatment area equaling a group density of approximately 10.3 percent. Thus groups are more dispersed across the landscape with Alternatives 3 than with Alternatives 1 and 7, with groups more clumped in the landscape with Alternative 1.

Aspen Enhancement

Aspen enhancement treatments that involve the cutting of all the conifers ≤ 30 inches dbh (Alternative 1, 3 and 7) remove both large structure and canopy cover. This change in canopy cover would be sufficient to result in acres changing to a lower canopy cover class immediately following treatment. Mechanical thinning to achieve the desired condition within aspen stands (action alternatives) and designed as per North 49 Alternatives 1, 3 and 7 would result in the following:

1. CWHR M: Aspen stands supporting CWHR types M (40-59 percent canopy cover) are projected to become 10 percent to 24 percent canopy cover (S).

2. CWHR D: Aspen stands supporting CWHR types D (60-100 percent canopy cover) are projected to become 10 percent to 24 percent canopy cover (S).

The aspen treatment in all alternatives would result in the creation of forest openings and gaps that would have 1) all conifers below 30 inch dbh removed. Where aspen treatment are implemented, the CWHR 4M, 4D, 5M, 5D is replaced in each unit with a small opening supporting brush/seedling/sapling type habitat (CWHR 1), while some of the surrounding conifer stands, the aspen treatments are located in, would be treated with DFPZ, WUI or Area thinning treatments.

Alternatives 1 and 3 enhance approximately 38 acres of aspen, while Alternative 7 enhances about 55 acres of aspen. Since aspen in the west are considered second only to riparian areas in terms of biodiversity (Kay 1997), these aspen release treatments would be important ecologically within the Wildlife Analysis Area, Alternative 7 enhances more aspen than all the other alternatives.

Snags

The loss of snags important for wildlife is expected with logging and prescribed fire; however snag recruitment is also expected with retention of 30 inches+dbh conifers and some recruitment due to fire kill. The net result of snag loss and gain is undetermined. However, the three action alternatives call for the retention of snags at SNFPA Standards (4 to 6 snags/acres, ≥15 inches dbh).

With any of the three action alternatives, within the DFPZ, Wildland Urban Interface (WUI), and Area Thin units (excluding groups) the project is leaving four to six of the largest snags/acre in the treatment area, primarily within the RHCA s and retention islands. As shown in the 1999 HFQLGFRA FEIS, DFPZ integrity and firefighter safety can be compromised by the amount and distribution of snags within the DFPZ, but that four to six per acre, located strategically within the DFPZ can provide an effective DFPZ.

After accounting for group selection treatments outside thinning areas and the different level of retention islands throughout the alternatives, Alternative 1 treats approximately 525 more acres than Alternative 3, while Alternative 7 treats about 1,004 acres less than Alternative 3 throughout the project area. Assuming equal distribution and density of snags across the Wildlife Analysis Area, Alternative 7 maintains more snags than all the other alternatives.

Large Woody Debris

Thinning activities and underburning may prevent and/or can allow for the control of catastrophic wildfires by reducing fuel loading and ladder fuels. Fuel reduction activities may also cause a loss in the availability of Large Woody Debris (LWD). The effects of the losses in LWD would be mitigated for by the retention of logs as described in the SNFPA FSEIS standards and guidelines. Table 46 shows the approximate number of down logs by average dbh needed to meet 10-15 tons/acre SNFPA Guideline. These retention standards were designed to meet the needs of wildlife. There is also a potential for future recruitment of LWD due to snag falling within DFPZs. The three action alternatives call for the retention of LWD at SNFPA Standards where available (10-15 tons/acre ≥12 inches diameter and 10 feet long).

Table 46. Approximate number of down logs 10 feet long by average dbh needed to meet 10-15 tons/acre SNFPA guideline

Average dbh	Number of down logs
12	24 to 30
14	18 to 24
16	14 to 20
18	10 to 14
20	8 to 12
22	6 to 8
24	4 to 6
26	4 to 6
28	4 to 6
30	4 to 6
> 30	2 to 4

Sporax

Sporax (borax) would be applied to true fir and pine stumps ≥14 inches dbh in mechanically harvested units in DFPZs, WUIs, Group Selections, and Area Thin treatment areas. Use rates would be about one pound to 50 square feet of stump surface. Based on the Pesticide Fact Sheet prepared by Information Ventures, Inc (1995), this rate is considered non-toxic to vertebrate species. The potential for borax leaching into ground-water or surface water contamination is low; it is practically nontoxic to fish, aquatic invertebrate animals, birds and mammals. Borax does not build up (bioaccumulate) in fish, inferring no build up in other vertebrate species. Thus Sporax applied to stumps should not impact wildlife, including Sensitive Species, or their prey base.

Cumulative effects

Past Activities

The analysis of cumulative effects of the proposed action and alternatives evaluates the anticipated changes to wildlife habitat from the existing condition (existing condition reflects the changes of all activities that have occurred in the past) within the Wildlife Analysis Area. Past actions in the area include grazing, timber harvest and recreation use. See Appendix A for the cumulative effects list with specific project names, etc.

More recent timber harvests (1975 – 2006) within the Wildlife Analysis Area have harvested approximately 34,109 acres of timber through regeneration harvests, overstory removal and sanitation silvicultural treatments (Table 47). On private and state lands within the Wildlife Analysis Area there has been timber harvested through clearcutting, commercial thinning, group selection, sanitation, selection (single tree), shaded fuelbreak, shelterwood, and a combination of the above over the past ten years (Table 48). Timber harvesting had impacts on soils in several ways; compaction resulting from road, skid, and landing construction; removal or displacement of topsoil; loss of soil due to mass movement or surface erosion.

Table 47. Harvest activities in the North 49 Wildlife Analysis Area on National Forest Lands since 1975

	Wildlife Analysis Area				
	1975 - 1979	**1980 - 1989**	**1990 -1999**	**2000 - 2006**	**Total acres**
Green Sales - acres	3,837	10974	7761	2661	**25,233**
Salvage - acres	1520	2659	4153	194	**8,526**
Mastication - acres	0	0	0	350	**350**
Total – acres	**5,357**	**13633**	**11914**	**3205**	**34,109**

In 2007, one commercial woodcutting permit was issued for the Hat Creek RD allowing the removal of 1 to 10 cords of wood. An additional 887 personal woodcutting permits were also issued. Approximately 2,880 Christmas tree permits were sold on the Hat Creek RD for 2007. It is known that commercial woodcutting, personal woodcutting and Christmas tree cutting has and does occurred within the Wildlife Analysis Area but the amounts are not quantifiable.

Table 48. Harvest Activities in the North 49 Wildlife Analysis Area on Private and State Lands over the Past 10 Years*

Activity	**Wildlife Analysis Area**			
	Private Land Use (Fruit Growers Supply Company)	**Private Land Use (Sierra Pacific Industries)**	**State Land Use**	**Total % of Land Use By Treatment Type**
Clearcutting - %	4	39	0	**14**
Commercial Thinning - %	1	19	2	**7**
Group Selection - %	0	0	88	**30**
Sanitation - %	2	0	0	**1**
Selection (single tree) - %	13	0	0	**4**
Shaded Fuelbreak - %	0	9	0	**3**
Shelterwood - %	0	33	10	**14**
Shelterwood & Commercial Thinning - %	53	0	0	**18**
Shelterwood & Sanitation - %	27	0	0	**9**
Total – %	**100**	**100**	**100**	**100**

*Records of Timber Harvesting Plans (THPs) for the California Department of Forestry and Fire Protection (CDF) are only kept for the past ten years.

From 1917 through 2006 there have been approximately 147 fires with the majority of the fires being under an acre in size. These past fires have had a variety of causes such as lightning, equipment, arson, smoking, and campfires. Generally, these fires have burned from the southwest to the northeast with the majority of the large fires occurring in brush fields (Mayer 2008).

Most of the recreation use within the Wildlife Analysis Area consists of dispersed activities by individuals and small groups, which include hiking, horseback riding, mountain biking, pleasure driving, ATV's, snowmobiles, cross country skiing, snow play, wildlife watching, hunting, fishing, camping,

picnicking, firewood gathering, and occasionally mushroom picking. There is one developed fee-use PG and E Campground (North Battle Creek Campground), one free – use car top boat launch (North Battle Creek Reservoir), one snowmobile parking area (Ashpan Winter OHV) that includes restrooms, a warming hut, groomer shed, and informational kiosks, a winter recreation area (Eskimo Hill) that provides a parking area, restrooms, and fire rings for visitor use and a portion of the Thousand Lakes Wilderness that contains16,335 acres, 22 miles of trails, and numerous lakes stocked with trout within the Wildlife Analysis Area. All but the winter recreation area and the Thousand Lakes Wilderness are in the project area. The Wildlife Analysis Area is also within deer hunting zones C3 and C4, which allocated 8,575 deer tags in 2007 covering hunting zones C1 through C4.

Present or Reasonably Foreseeable Future Activities

Present and future HFQLG and non-HFQLG projects planned that overlap with the Wildlife Analysis Area may have cumulative impacts to wildlife, fisheries and amphibians (Table 49 and Table 50). After these HFQLG projects are implemented, the area would be guided by the direction described for the other Sierra Nevada national forests (USDA Forest Service 2004).

Table 49. Reasonably Foreseeable Projects on the Lassen National Forest within the Wildlife Analysis Area

Reasonably Foreseeable Projects	Implementation Year	Status
Sandy Hazard	2007	On-going
Stonehenge	-	On-going
Old Station WUI	2008 +	Planning
Lost Rock/ Shotput Service Contract	2008 +	Planning
South Bunch Forest Health Recovery Project	2008 +	Planning
North 49 DFPZ maintenance	2010 - 2040	-

Grazing would be expected to continue on National Forest lands at current levels. There are two livestock grazing allotments (Hat Creek and North Battle Creek) that overlap into the Wildlife Analysis Area of which one is active. One hundred percent of the North Battle Creek allotment is within the project area. Eighty cow/calf pairs are authorized from July 1st thru September 30th. The vacant Hat Creek allotment overlaps approximately sixty percent of the Wildlife Analysis Area. This activity would continue to contribute to minor impacts on woody riparian habitats as it continues to meet current standards for use.

Future activities on National Forest lands include ongoing work within the Stonehenge, plantation maintenance, and hazard tree removal projects (Sandy Hazard, etc.). Little to no change in overstory vegetation is anticipated with these projects. However, all snags that present hazards to road traffic, regardless of size, are being, or would be, removed. Removal of these snags would have a negative effect on individual animals that use snags, yet these hazard trees make up a very small amount of the total snag component in the Wildlife Analysis Area.

Table 50. Reasonably Foreseeable Projects on Private and State Lands within the Wildlife Analysis Area

Reasonably Foreseeable Projects	Implementation Year	Status	Acres	Treatment Types
2002 South Cow Timber Harvest Plan (THP) – Latour Demonstration State Forest	2002	On-going	1,632	1,332 ac. – GS, 300 ac. – Shelterwood
2004 Grace Lake THP – PG & E	2008 +	On-going	1,135	Sanitation, Salvage, Single Tree Selection
2005 Lost Creek THP – Fruit Growers Supply Company	2005 +	On-going	2,669	1,303 ac. – Shelterwood & Sanitation, 499 ac. Shelterwood & Commercial Thinning, 612 ac. Single Tree Selection, 167 ac. Clearcutting, and 88 ac. Sanitation
2005 Cherry THP – Sierra Pacific Industries	2007 - 2010	On-going	1,073	820 ac. Clearcutting and 253 ac. Shaded Fuelbreak
2005 Manzanita Flat THP – Sierra Pacific Industries	2007 - 2010	On-going	703	703 ac. Clearcutting
Eskimo Project – CalTrans	2006 +	On-going	N/A	Widen Hwy. 44/89 for safety reasons – 0.2 miles affected, accomplished by shaving rock points and removing some trees for road daylighting purposes.

Additional potential projects (Old Station WUI and South Bunch), involve fuel treatments and fall partly within the Wildlife Analysis Area near Old Station and Lassen Volcanic National Park. However, no site specific planning has occurred. Planning could potentially occur in 2008. The effects of these projects are expected to be similar to the North 49 project effects but on a smaller scale. However, site-specific analysis of direct, indirect and cumulative effects of these projects would be documented in a separate analysis.

Future activities on private and state lands are displayed in Table 50 above. These timber projects would extensively treat approximately 7,212 acres adjacent to and within the Wildlife Analysis Area. These project activities are expected to eliminate late seral species habitat and/or simplify the complexity and structure of the stands by removing structures that provide the vegetative layering, deformities, snags and future decadence, reducing the closed nature of the stand which provides diverse microclimates for late seral dependant species. The Eskimo project which entails widening highway 44/89 by shaving rock points and removing some trees along a 0.2 miles stretch is expected to have negligible effect on wildlife habitat.

The Personal Use Firewood program on the LNF is an ongoing program that has been in existence for years and is expected to continue. This program allows the public to purchase a woodcutting permit to remove firewood from National Forest lands. Much of this wood material either consists of down logs found in the forest, along forest roads, and within cull decks created by past logging operations, or as standing snags. The North 49 project area, as well as the Wildlife Analysis Area is open to woodcutting. Snags and logs would continue to be removed, resulting in the cumulative loss of these habitat components across the landscape. Snags are recruited annually from live trees through natural processes at a rate that may sustain this loss within the Wildlife Analysis Area; snag and log removal is most common along, or within a short distance

from, open roads. Closure of roads under the action alternatives would reduce the area accessible for woodcutting. The past and future effect of these actions has and would be to shift forest successional stages to somewhat earlier stages, while generally retaining continuous forest cover.

The DFPZ is designed to be effective for a period of 10-years. The earliest maintenance treatment to maintain effectiveness is expected to be approximately 10 years from completion of the initial DFPZ, based on a review of similar projects completed since the mid 1990s. The direct, indirect, and cumulative effects of the foreseeable maintenance (hand, mechanical and prescribed fire treatments) would be similar to those described in the HFQLGFRA FSEIS (pages 47 – 305).

The future maintenance for the proposed action is projected to include 11,862 acres of prescribed fire and 69 acres of no treatment. Viability determinations for threatened, endangered and late seral associated sensitive species, based on the effects of DFPZ maintenance, and are found on pages 139 – 140 of the HFQLGFRA FSEIS, Chapter 3 – Affected Environment and Environmental Consequences.

Recreational use is expected to continue at the current rate which is moderate to high during the accessible season, which runs from approximately late May to mid-October (summer) and December to March (winter). The current rate includes approximately 4 Special Use Permits that are within the Wildlife Analysis Area. These include hunting outfitters and guides, annual waterline replacements, weather station maintenance, and Boy Scouts of America (BSA) winter survival skills training and campout.

General Effect of Alternative 2 (No Action)

No direct effects (disturbance or habitat changes) on wildlife species are expected to result from the No Action alternative. Potential indirect effects relate to the long-term effects on stand structures, riparian areas and the increased possibility of catastrophic wildfire due to implementing the No Action alternative. The effects of a catastrophic wildfire are speculative, but a high intensity, wind driven fire could result in the direct loss of 1-8 spotted owl Protected Activity Centers (PACs), 1-11 goshawk PACs, elimination of existing late seral habitat (5M, 5D, 6), as well as alteration of riparian zones with potential increases in soil erosion above normal levels. Direct mortality of wildlife would occur, but the magnitude of this mortality is unknown.

The BA/BE for HFQLGFRA FEIS (1999) stated that any alternative that would reduce the threat of large, stand replacement fires by creating conditions that would reduce the fire size and intensity, would benefit forest and aquatic dependent species. Large fires create large- scale fragmentation across landscapes that removes suitable habitat, isolates habitat parcels, and creates large openings that could prevent species occupancy, emigration and immigration. Alternative 2 does not move the habitat in a direction to reduce the threat of large stand replacement fires. There would be no action taken to decommission up to 33.1 miles of road.

Management Indicator Species

A Management Indicator Species (MIS) report was prepared for the North 49 Forest Health Recovery Project. The conclusions of the MIS report are presented here. The full report is on file as part of the project administrative record and is incorporated by reference. The purpose of the MIS report is to evaluate and disclose the impacts of the North 49 Project on the MIS identified in the Lassen National Forest Land and

Resource Management Plan (LRMP) (USDA Forest Service 1993). This report documents the potential effects of four alternatives: Alternative 1 (the Proposed Action), Alternative 2 (No Action), Alternative 3 and Alternative 7.

Project-level effects on MIS are analyzed and disclosed as part of environmental analysis under the National Environmental Policy Act (NEPA). This involves examining the impacts of the proposed project alternatives on MIS habitat by discussing how direct, indirect, and cumulative effects will change the quantity and/or quality of habitat in the Wildlife Analysis Area.

The MIS whose habitat would be either directly or indirectly affected by the North 49 Project are carried forward in the MIS analysis, which evaluates the direct, indirect, and cumulative effects of the proposed action and alternatives on the habitat of these MIS. The MIS selected for Project-Level MIS analysis for the North 49 Project are: American marten, Black bear, California spotted owl, Hairy woodpecker, Mule deer, Northern goshawk, Pacific fisher and Pileated woodpecker.

Table 51. Summary of Preliminary Conclusions for the Management Indicator Species – Terrestrial Wildlife Species that Potentially Occur on the Lassen National Forest

Species	Habitat Trend	Population Trend
BIRDS		
California spotted owl (*Strix occidentalis occidentalis*)	WNA	SNA
Hairy woodpecker (*Picoides villosus*)	WNA	SNA
Northern goshawk (*Accipiter gentilis*)	WNA	SNA
Pileated woodpecker (*Dryocopus pileatus*)	WNA	SNA
MAMMALS		
American marten (*Martes americana*)	WNA	SNA
Black bear (*Ursus americanus*)	WRSA	SNA
Mule deer (*Odocoileus hemionus*)	WRSA	SNA
Pacific fisher (*Martes pennant pacifica*)	WNA	SNA

WNA = Would Not Alter, SNA=Should Not Alter, WRSA=Would Result in Some Alteration

Sensitive Species

As stated above, no federally listed threatened or endangered wildlife species are known to exist in the North 49 Project area or within the Wildlife Analysis Area. Table 52 describes all sensitive species that could potentially occur within the project area. Species that have been located within the project area and/or suitable habitat is present in the project area and/or the project area is within the range of the species, will be analyzed further for potential impacts, even if surveys did not locate individuals.

Table 52. Potential occurrence of USDA Forest Service Region 5 sensitive species and their habitats in the Wildlife Analysis Area

Species Name Species Status	Elev. Range (feet)	Habitat	Potential Threats	Suitable Habitat w/in Wildlife Analysis Area	Detection w/in Wildlife Analysis Area	Analysis synopsis
Birds						
Bald eagle *Haliaeetus leucocephalus* Forest Service R5 Sensitive	Sea level – 7000	Throughout northern and central CA. Wintering and nesting habitat associated with lakes, reservoirs, rivers or large streams. Needs large, old trees near water for nesting.	Removal of nesting habitat, high recreation use on lakes, DDT in eggshells, disturbance near nest sites.	Yes	Yes	Analyzed in text. Present in project area.
California spotted owl *Strix occidentalis occidentalis* Forest Service R5 Sensitive	1000 – 7440	Sierra Nevada province in CA. Needs at least 40% canopy closure and an average dbh of 30 inches for nesting.	Timber harvest, fire suppression, excessive build-up of fuels, decline in snag density.	Yes	Yes	Analyzed in text. Present in project area. Surveyed for in 2002 & 2003.
Northern goshawk *Accipiter gentilis* Forest Service R5 Sensitive	2500 – 10000	Throughout northern CA and Sierra Nevada; Dense mature conifer and deciduous forests interspersed with meadows, other openings and riparian areas. Found in Mixed Conifer to Lodgepole Pine	Logging, catastrophic (stand replacing) fire	Yes	Yes	Analyzed in text. Present in project area. Surveyed for in 2003.
Great gray owl *Strix nebulosa* Forest Service R5 Sensitive	2500 –9000	Western Sierra Nevada's with 60% in Mariposa and Tuolumne Co. Breeds in Yosemite NP area. Found in montane meadows surrounded by dense forest of medium to large mixed conifer and red fir.	Grazing, logging of suitable nest trees and buffer.	Yes	No	Analyzed in text. Surveyed for in 2003 & 2004. No detections.
Willow flycatcher *Empidonax trailii brewsteri* Forest Service R5 Sensitive	2000 – 8000	Western Sierra Nevada. Found in, willow-dominated riparian areas, including moist meadows with perennial streams and smaller spring-fed or boggy areas.	Grazing, adjacent land use, brown-headed cowbird parasitism, reduction in nesting habitat	Yes	No	Analyzed in text.

Species Name Species Status	Elev. Range (feet)	Habitat	Potential Threats	Suitable Habitat w/in Wildlife Analysis Area	Detection w/in Wildlife Analysis Area	Analysis synopsis
Mammals						
American marten *Martes americana* Forest Service R5 Sensitive	>6000	Found in mesic, late successional coniferous forests. Dens are in trees, snags, downed logs and rocks in structurally complex late serals.	Forest fragmentation, logging, fire, climate, land use patterns, metapopulation dynamics	Yes	Yes	Analyzed in text. Present in project area. Surveyed for in 2001, 2002 & 2003.
Pacific fisher *Martes pennanti pacifica* Forest Service R5 Sensitive Federal Candidate Species	4900 – 7900	Forests with high canopy closure and structural elements of late successional old-growth forest. Closely associated with water or riparian habitats (328 ft). Rest sites include large standing conifers or hardwoods. Dens occur in cavities of standing large diameter conifers or hardwoods (snags or live trees).	Forest fragmentation, logging, fire, climate, land use patterns, metapopulation (a group of spatially separated populations) dynamics	Yes	No	Analyzed in text. No known records in Wildlife Analysis Area. Surveyed for in 2001, 2002 & 2003.
Sierra Nevada red fox *Vulpes vulpes necator* Forest Service R5 Sensitive	5000 – 12000	Red fir and Lodgepole pine in subalpine and alpine fell-fields of the Sierra Nevada. Similar to marten and fisher. Dens seem to be in rock/talus slides or earthen excavations/holes.	Conversion of late serial stage forest to early serial stage forest, which favors competitors such as coyote and non-native red fox.	Yes	Yes	Analyzed in text. Present in project area. Surveyed for in 2001, 2002 & 2003.
California wolverine *Gulo gulo luteus* Forest Service R5 Sensitive	6400 – 10800	Use a variety of habitats. Dens include snow-covered roots, standing or down logs with large cavities, holes under coarse woody debris, old beaver lodges, bear dens or rocky areas.	Recreation, vehicles, decrease in wild areas, logging, fires, mining, decrease in deer population.	Yes	No	Analyzed in text. No confirmed historical sightings on forest. Surveyed for in 2001, 2002 & 2003.
Pallid bat *Antrozous pallidus* Forest Service R5 Sensitive	< 6000	Uses a variety of habitats. Depends on oak woodlands for foraging. Roosts in mines, snags, and in crevices in oaks	Roost disturbance, loss of oak habitat, pesticide use and grazing, loss of suitable nesting & roosting snags.	Yes	No	Analyzed in text.

Species Name Species Status	Elev. Range (feet)	Habitat	Potential Threats	Suitable Habitat w/in Wildlife Analysis Area	Detection w/in Wildlife Analysis Area	Analysis synopsis
Townsend's big-eared bat *Corynorhinus townsendii* Forest Service R5 Sensitive	< 10000	Found throughout the Sierra Nevada. Inhabits isolated areas with low human disturbance.	Human disturbance in caves, mines and historical buildings.	Yes	No	Analyzed in text.
Western red bat *Lasiurus blossevillii* Forest Service R5 Sensitive	< 3000	Dependent on edge habitats adjacent to riparian areas. Roosts in foliage.	Removal of riparian habitat, pesticides, water impoundments, fire. Loss of roosting trees, such as cottonwood/aspen.	Yes	No	Analyzed in text.
Invertebrates						
Shasta Hesperian Snail *Vespericola shasta* Forest Service R5 Sensitive	< 3000	Has been found in moist bottom lands, such as riparian zones, springs, seeps, marshes, and in the mouth of caves	Altered stream flow regimes and introduced exotic predators (fish).	Yes	No	Analyzed in text.
Reptiles						
Northwestern pond turtle *Clemmys marmorata marmorata* Forest Service R5 Sensitive	< 4700	Aquatic habitat in spring and summer. Adjacent upland habitat fall and winter. In rivers, needs slow flowing areas with deep underwater refugia and emergent basking sites. Migration, hibernation, and nesting occur on land up to 330 feet from riparian area.	Non-native fauna, non-native turtles through competition and disease, bullfrogs and predatory fish, vehicles, timber harvest, mining, fire, grazing, water alteration and diversion, fishing.	Yes	No	Analyzed in text.

California Spotted Owl (*Strix occidentalis occidentalis*)

Areas of Concern

The CASPO Technical Report (Verner et. al 1992) identified Areas of Concern (AOC) within the range and distribution of the California spotted owl. These AOC's are identified simply to indicate potential areas where future problems may limit owl populations and where future problems may be greatest if the owl's status were to deteriorate. Two AOC's identified in the CASPO Report are within the boundaries of the LNF (page 46-49 of CASPO Report):

- Area of Concern 1: In Lassen County, within the LNF. The reason for the concern is that the habitat in this area is discontinuous, naturally fragmented, and poor in quality due to drier conditions and lava-based soils.
- Area of Concern 2: In Northern Plumas County, within the LNF. The reason for the concern is a gap in known distribution, mainly on private lands, which extends east to west in a band almost fully across the width of the owl's range.

The North 49 project is located within one of these AOC's; AOC 1 overlaps the project area and AOC 2 is approximately 9 miles to the south/southeast. The factors identified for the 2 AOC's above are not applicable to the North 49 project area, based on the fact that the project area contains approximately 24,124 acres out of 37,431 acres or 64 percent suitable habitat (CWHR 4D, 4M, 5D, and 5M) thus not lacking in suitable habitat or serving as bottleneck (due to a lack of dispersal habitat). For these reasons the project area does not meet the criteria as an AOC as described in Verner et al. (1992).

Wildlife Analysis Area

California spotted owl Protected Activity Centers (soPACs) were established for owl activity centers based on criteria described in the CASPO Technical Report (Verner et al.1992) and CASPO IG EA (USDA, 1993), as well as within the SNFPA (2001). Home range cores were delineated for each of these soPACs in based on criteria from the SNFPA. A total of eight soPACs and three1000-acre base SOHA are located in the Wildlife Analysis Area. California spotted owl PACs and HRCAs have been delineated for this SOHA and are included in the total of eight soPACs and HRCAs in the Wildlife Analysis Area. The soPACs near Ashpan Butte and those near North Battle Creek Reservoir have complex observational histories. Each of these two areas appears to contain multiple territories. Because spotted owls are not reliably identified at an individual level, observational data does a poor job of delineating individual territory boundaries. Territories that occur within close proximity often have overlapping home ranges (Verner et al. (1992)). This analysis for the North 49 project consolidates the analysis for the Ashpan territories (Ashpan Butte and Ashpan Flat) and the North Battle Creek Reservoir territories (North Battle Creek, Superbowl, and Red Lake Mountain) in order to reduce complexity for the reader. In those instances where separation of territories is important for clarity they will be referred to by their individual territory names (e.g. Ashpan Flat and Ashpan Butte). Table 53 shows the soPAC histories of the soPACs in the Wildlife Analysis Area.

Spotted owl surveys have occurred within the Wildlife Analysis Area. In 2002 and 2003, the North 49 Project was surveyed to the two-year protocol standards (Protocol for Surveying for Spotted Owls in

Proposed Management Activity Areas and Habitat Conservation areas, 1991, revised 1993). No new PACs were developed based on these survey efforts.

Surveys are also utilized to monitor reproductive status. There are three reproductive outcomes of the surveys: Presence – a single owl is located, Occupancy – a pair of owls are located, and Reproductive – young or an active nest are located. Surveys may also fail to detect spotted owls.

Known reproductive success is low in all of the territories. Bunchgrass Creek and the Ashpan complex have shown a relatively high level of occupancy (43 percent and 53 percent respectively) as compared to other territories in the Wildlife Analysis Area or the average for all surveyed territories on the Hat Creek Ranger District (32.5 percent).

Table 53. California spotted owl PAC History in the Wildlife Analysis Area

Year	Ashpan*	Bunchgrass Creek	Devil's Rock Garden	North Battle Creek*	Table Mountain
1989	Presence	Presence	No detections	Presence	Not Surveyed
1990	Occupancy	Presence	Occupancy	No detections	Not Surveyed
1991	Occupancy	Presence	Not Surveyed	Occupancy	No detections
1992	Presence	Not Surveyed	Not Surveyed	No detections	No detections
1993	No detections	Not Surveyed	Presence	No detections	Presence
1994	Occupancy	Presence	Presence	Presence	Not Surveyed
1995	Occupancy	Presence	Occupancy	Occupancy	Presence
1996	Occupancy	Occupancy	No detections	Presence	No detections
1997	Occupancy	Occupancy	Presence	Presence	Presence
1998	Occupancy	Reproduction	No detections	No detections	Presence
1999	Occupancy	Occupancy	No detections	Presence	Reproduction
2000	Presence	Not Surveyed	Not Surveyed	Not Surveyed	Presence
2001	Presence	Presence	Not Surveyed	No detections	No detections
2002	Presence	Occupancy	No detections	Reproduction	No detections
2003	Presence	Presence	Presence	No detections	Presence
2004	Not Surveyed	Occupancy	Not Surveyed	Not Surveyed	No detections
2005	Occupancy	Presence	Presence	Occupancy	No detections
2006	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed
2007	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed

*Ashpan lumps the soPAC history for Ashpan Butte and Ashpan Flat.
*North Battle Creek lumps the soPAC history for North Battle Creek, Red Lake Mountain and Superbowl.

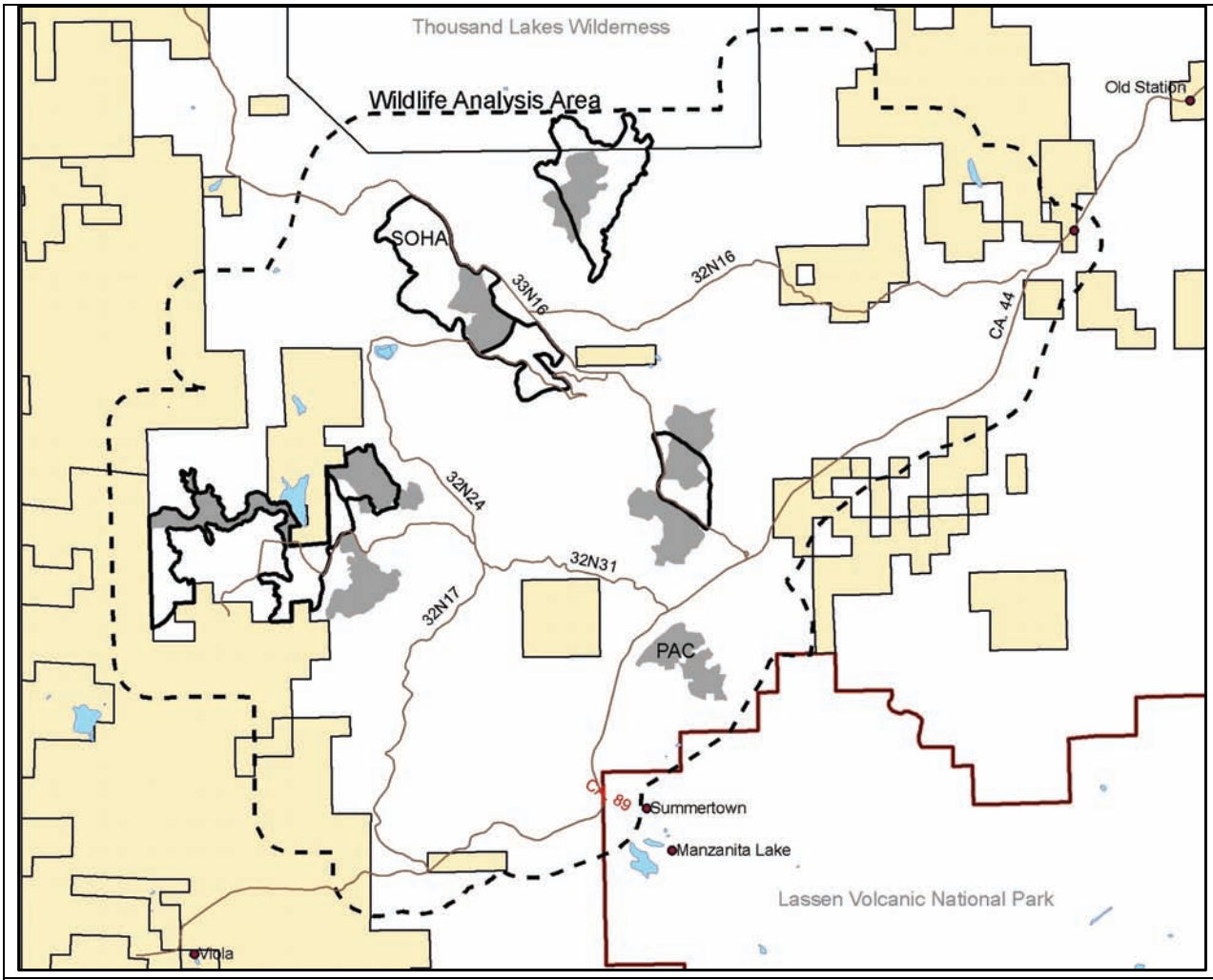

Figure 32. North 49 Wildlife Analysis Area with 300 acre California spotted owl Protected Activity Centers (PACs) (solid color) and 1,000 acre Spotted Owl Habitat Areas (SOHAs) (black outline)

Table 54 shows high capability suitable California spotted owl habitat in the Wildlife Analysis Area (45,991 NF acres). Within the Wildlife Analysis Area there is approximately 30,248 acres of suitable spotted owl nesting/foraging habitat (CWHR 5D, 5M, 4D, and 4M).

Table 54. Acres of High Capability Suitable California spotted owl Habitat on National Forest Land within Wildlife Analysis Area

CWHR Type*	Habitat Type	Acres in Wildlife Analysis Area
4M	Foraging	3,984
4D	Foraging	17,403
5M	Nesting	762
5D	Nesting	8,099
Total	**Suitable**	**30,248**

*4=small 11-24"dbh, 5=medium/large >24"dbh. D= Dense Canopy Cover > 60%, M= Moderate Canopy 40-59%.

CWHR habitat vegetation layer used for the habitat analysis was derived from aerial photo interpretation. Stand exam plot data gathered in the treatment area indicated that the derived Quadratic Mean diameter (QMD) for all trees (>1.0 inches). Vegetation data from aerial photo interpretation uses crown diameter as a proxy for dbh, which is used to determine CWHR size class, which equates to the diameter of overstory trees (those visible in the photo). Stand inventory data utilizes a derived QMD to estimate size class making it difficult to crosswalk between the vegetation data and the plot data because of different methods for quantifying size class. Stand Inventory considers stocking and diameter of smaller, subordinate canopy trees, thus providing a more conservative estimate of CWHR size class. This difference between the current CWHR classification and the stand exam plots represents uncertainty in the accuracy of the amount of each CWHR habitat type in the Wildlife Analysis Area. The stand exam plot data was run through the Forest Vegetation Simulator model (FVS), and for the most part, all vegetation layer CWHR size classes matched the appropriate size class based on the QMD for all trees >10 inches dbh. But it is acknowledged that there are some disparities and that the acres reflected in Table 45 could be inexact estimates of habitat availability. The CWHR classification continues to be used as the habitat baseline for wildlife habitat analysis during the life of the HFQLG project as it maintains consistency for monitoring changes in species habitat over the life of the HFQLG Pilot Project. This includes the requirement to not cumulatively reduce late seral dependent species habitat (5M, 5D, and 6) more than 10 percent below 1999 levels (USDA Forest Service 1999).

Direct effects of the Action Alternatives

Potential direct effects on the spotted owl may result from the modification or loss of habitat or habitat components. Direct mortality could occur if nest trees are felled but this would be exceedingly rare. The proposed action and alternatives would not cut or remove nest trees. In addition, disturbances associated with logging, temporary road building, or other associated activities within or adjacent to occupied habitat may disrupt nesting, fledging, and foraging activities. Implementation of Limited Operating Period (LOP) around known spotted owl nests would remove the effects to existing owl pairs associated with direct disturbance on treatment units and access routes.

Based on the vegetation layer and the CWHR model, about 19 percent or 8,861 acres within the Wildlife Analysis Area (45,991 NF acres) may be considered suitable spotted owl nesting habitat (5M, 5D, and 6), and about 46.5 percent or 21,387 acres may be considered suitable foraging habitat (4M and 4D).

Habitat Suitability

Changes to suitable habitat as a result of implementing fuels treatments in all action alternatives and area thin treatments in Alternative 1 and 3 would occur due to the removal of large structural components and reduction in canopy cover to 40 - 50 percent. The more open canopied forested stands still retain the minimum canopy cover for suitable habitat but become unsuitable due to the removal of the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.) (see Table 55). DFPZ treatments will bring canopy cover down to 40 percent, the minimum to be classified as M, therefore the minimum to be considered foraging habitat. However, the removal of other important habitat components such as snags and vertical layering further diminish habitat value and render it unsuitable for foraging. Stands treated as area thin also decrease in habitat value due to a reduction in canopy cover to 45-50 percent and the removal of other important habitat components. There may also be some additional risk associated with

isolated torching events during prescribed fire that could kill additional trees thus further opening up the canopy, and reducing foraging and nesting opportunities. Area thin treatments in Alternative 7 would retain the minimum canopy cover for suitable habitat as well as the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.). This would be accomplished through dense retention islands, open growing large overstory trees (large tree radial thin), moderately dense stands and open group selections of young regeneration.

Blakesley (2003) states, "[N]est success was positively associated with the presence of large remnant trees within the nest stand." Ninety percent of the nest trees were ≥76 cm dbh (30 inches dbh) and averaged 117 cm dbh (46 inches dbh) (Blakesley, 2003). In addition to their value for nesting success, Moen and Gutierrêz found that stands used by owls for roosting contained trees greater than 100 cm dbh (39 inches dbh) more frequently then randomly selected stands (1997). The Radial Thinning and Pine Restoration treatments in Alternative 7 would retain and invigorate larger trees in the project area.

Table 55 shows the above mentioned changes to California spotted owl nesting and foraging habitat by alternative within the Wildlife Analysis Area.

Based on figures in Table 55, Alternative 1 reduces foraging habitat on 7,946 acres out of 21,387 acres, reduces nesting habitat on 2,006 acres out of 8,861 acres; Alternative 3 reduces foraging habitat on 7,500 acres out of 21,387 acres and reduces nesting habitat on 1,883 acres out of 8,861 acres; Alternative 7 reduces foraging habitat on 3,844 acres out of 21,387 acres and reduces nesting habitat on 852 acres out of 8,861 acres. Thus the amount of habitat retained post project (63 percent - 82 percent foraging and 77 percent - 90 percent nesting) allows opportunities for future dispersal, nesting and foraging within the Wildlife Analysis Area.

Irwin and Rock (2004) found that probability of stand use by spotted owl increased strongly as basal area rose from 80 to 320 square feet/acre (optimum range 160-320 square feet/acre) and was positively influenced by the number of trees/acre that were >26 inches dbh. With the implementation of Alternative 7 in treatment areas (DFPZ and Area Thin), the residual basal area in 4M would be approximately 158 square feet/acre and approximately 172 square feet/acre in 4D based on the Forest Vegetation Simulator (FVS) model (see Silviculture section above). Current large tree (>24 inches dbh) densities range from 7 to 26 per acre; averaging 18 large trees per acre. These figures represent what is projected to remain on site immediately after project implementation.

Table 55. Comparison of Action Alternatives 1, 3 & 7 on Spotted Owl Nesting & Foraging Habitat (4M, 4D, 5M, 5D) within the Wildlife Analysis Area

	Alternative 1 (PA)			% (Alt. 1) Remaining in Wildlife Analysis Area	Alternative 3			% (Alt. 3) Remaining in Wildlife Analysis Area
	Acres				Acres			
	DFPZ*	GS/ Aspen Release	Area Thin*		DFPZ*	GS/ Aspen Release	Area Thin*	
Foraging Habitat								
4M	-1,326	-163	-269	55.9%	-1,326	-105	-279	57.1%
4D	-3,913	-773	-1,502	64.4%	-3,863	-447	-1,480	66.7%
Total Foraging Change	**-5,239**	**-936**	**-1,771**	**62.8% retained (-37.2%)**	**-5,189**	**-552**	**-1,759**	**64.9% retained (-35.1%)**
Nesting Habitat								
5M	-146	-20	-38	73.2%	-156	-2	-38	74.3%
5D	-1,210	-200	-392	77.6%	-1,191	-104	-392	79.2%
Total Nesting Change	**-1,356**	**-220**	**-430**	**77.4% retained (-22.6%)**	**-1,347**	**-106**	**-430**	**78.7% retained (-21.3%)**

	Alternative 7			% (Alt. 7) Remaining in Wildlife Analysis Area
	Acres			
	DFPZ*	GS/ Aspen Release	Area Thin	
Foraging Habitat				
4M	-837	-156	+2,191	130.1%
4D	-2,195	-656	-2,191	71.0%
Total Foraging Change	**-3,032**	**-812**	**0**	**82.0% retained (-18.0%)**
Nesting Habitat				
5M	-46	-16	+727	187.3%
5D	-614	-176	-727	81.3%
Total Nesting Change	**-660**	**-192**	**0**	**90.4% retained (-9.6%)**

Within the North 49 project area, the action alternatives would result in an increase in low-contrast fragmentation. Canopy closure would be reduced within the DFPZ and Area Thin units but would maintain a continuity of large trees within treated stands and across the landscape. According to the 1993 CASPO IG EA (Page IV-81), within stand fragmentation of the small tree canopy (trees <20 to 30 feet) is less of a concern than large tree or late seral attribute removal because:

1. historical understory densities were discontinuous;
2. this habitat component can return relatively quickly (versus large overstory layer); and
3. creating this type of fragmentation can help avoid larger scale, high contrast fragmentation of forested stands due to wildfire.

The key to lessening impacts of fragmentation within DFPZs and Area Thin treatments is to maintain forest cover composed of the largest, fire resistant conifer species, while also providing structural attributes needed for prey species (snag/large logs). Removal of trees up to 29.9 inches dbh would occur, with the overall objective of leaving enough dominant and co-dominant (20-29.9 inches) trees to provide from 40-50 percent canopy cover. This tree retention opens up the treated stand but does not isolate stands from surrounding forest or create habitat islands isolated by non-forest, thus increasing the likelihood for successful dispersal of wildlife. All action alternatives are designed to retain these attributes within DFPZs and Area Thin treated areas.

Group selection openings would create low-high density openings within stands, but each group would retain structural elements (if present) such as conifers over 30 inches dbh, hardwoods and down logs up to 10-15 tons/acre, that would reduce within stand fragmentation and contribute to decreasing the size of the forest opening. Group selection openings up to two acres meet the definition of continuous forest cover with the retention of all conifers over 30 inches dbh, 30 to 40 percent of the basal area consisting of the largest of the healthy trees and the largest snags, eight snags per acre (minimum of 20 square feet basal area of snags per acre) (CASPO IG EA, page IV-62, 1993). “This interpretation is made because group selection tends to mimic natural regeneration patterns and other harvests (intermediate harvests), while variable in appearance, tend to leave sufficient forest vegetation that a perception of continuous forest cover is maintained” (CASPO IG EA, page IV-62, 1993). This is the assumption used in the programmatic analysis for the HFQLGFRA FEIS (1999), assuming group selection harvest at a ten-year treatment cycle (5.7 percent of the land base) up to a 20-year treatment cycle (11.4 percent of the land base). Groups at this level could mimic naturally occurring gaps within forested stands. However, groups in the North 49 project do not retain 30 to 40 percent of the basal area consisting of the largest of the healthy trees and the largest snags, eight snags per acre (minimum of 20 square feet basal area of snags per acre) as suggested by CASPO IG EA, page IV-62, 1993.

The density of group selection openings within stands potentially increases edge effects, reduces forest interior habitat, and creates a condition in which otherwise suitable owl habitat becomes less suitable because it is adjacent, and/or surrounded by, non-habitat. Franklin et al. (2000) found a positive relationship with the amount of edge between owl habitat and non-habitat and that Northern spotted owls showed higher reproductive success in sites with intermediate numbers of owl habitat patches intermixed with non-habitat areas. Blakesley (2003) on the other hand reported a model of reproductive output showing a weak negative relationship with elevation and amount of non-owl habitat within the nest area. It is unknown at what threshold the amount of edge to interior habitat results in use, marginal use or non-use by late seral species, including spotted owls. In terms of acres treated, Alternative 3 treats 328 less acres of owl habitat with groups than Alternative 7 and treats 498 less acres of owl habitat in groups than Alternatives 1.

All alternatives propose to construct approximately 0.5 miles of temporary road, all of which would be closed post harvest. There would be a no increase in habitat fragmentation with the temporary road

construction, no temp road construction would occur within soPACs. In addition, 33.1 miles of existing road would be decommissioned (0.8 miles decommissioned and rehabilitated, 32.3 miles administratively decommissioned). Actions including road decommissioning would be implemented on this new temporary road construction as well as 33.1 miles of existing road, to create conditions to allow for vegetation recovery and reduce within stand gaps created by road openings. Overall this would decrease habitat fragmentation.

Protected Activity Centers (soPACs) & Spotted Owl Habitat Areas (SOHAs)

There are three 1000 acre SOHAs and eight 300 acre soPACs located within the Wildlife Analysis Area. SoPACs are designated from aerial photos and additional acres are the result of designating the best available habitat in relationship to geographical features and stand continuity. SoPACs are delineated based on guidelines provided in the SNFPA FEIS 2001 ROD and the SNFPA FSEIS 2004 ROD page 37. Where there is insufficient suitable habitat (6, 5D, 5M, 4D and 4M), to meet the 300 acres guideline for a PAC, the next best vegetation sizes and types are included. No fuels treatments, including DFPZ construction, group selection, aspen release, and area thin treatments would occur within the designated 1000 acre SOHA or 300 acre PACs. The three SOHAs and eight PACs equal approximately 4,631 acres owl habitat that would be retained and remain suitable within the Wildlife Analysis Area on National Forest lands.

Territory

The recommended minimum threshold by Bart (1995) is to maintain >30 percent suitable habitat within the 4,500 acre home range. Table 56 shows the amount of suitable habitat within each 4,500 acre territorial home range potentially affected by the North 49 project.

Based on the figures in Table 56, Alternative 1 reduces suitable habitat on 8,790 acres out of 27,108 acres; Alternative 3 reduces suitable habitat on 8,084 acres out of 27,108 acres; Alternative 7 reduces suitable habitat on 3,616 acres out of 27,108 acres.

Of the eight owl territories (Table 56) with Alternative 1, all would retain more than 40 percent suitable habitat with the average suitable habitat retained being 50.9 percent (suitable habitat retained ranges from 39.4 percent (Red Lake Mountain) to 60.0 percent (Superbowl)). With Alternative 3, all eight owl territories would retain more than 40 percent of suitable habitat with the average suitable habitat retained being 52.8 percent (suitable habitat retained ranges from 39.7 percent (Red Lake Mountain) to 61.6 percent (Superbowl)) and with Alterative 7, all eight owl territories would retain more than 50 percent of suitable habitat with the average suitable habitat retained being 65.3 percent (suitable habitat retained ranges from 53.8 percent (Red Lake Mountain) to 74.6 percent (Ashpan Flat)). Based on the figures in Table 56, all alternatives currently exceed and would remain slightly above the minimum threshold recommended by Bart (1995).

Table 56. Suitable Habitat (4M/4D/5M/5D) impacted within each 4,500 acre Territory

Territory	Acres of Territory by CWHR type		Total Acres in each Territory	Current % of Suitable Habitat in each Territory	Total Acres Reduction in Suitable Habitat in the Territory			Total % Suitable Habitat Retained in the Territory		
	Other - AGS,WTM , 2D-S, 3D-S, 4P-S, 5P-S	Suitable Habitat 4M, 4D, 5M, 5D			Alt.1 Suitable Habitat 4M, 4D, 5M, 5D	Alt.3 Suitable Habitat 4M, 4D, 5M, 5D	Alt.7 Suitable Habitat 4M, 4D, 5M, 5D	Alt.1 % of Suitable Habitat Retained	Alt.3 % of Suitable Habitat Retained	Alt.7 % of Suitable Habitat Retained
Ashpan Butte	1,065	3,435	4,500	76	-1,041	-945	-622	53	55	63
Ashpan Flat	557	3,943	4,500	88	-1,456	-1,342	-588	55	58	75
Bunch-grass Creek	444	4,056	4,500	90	-1,924	-1,706	-817	47	52	72
Devil's Rock Garden	1,099	3,401	4,500	76	-1,600	-1,455	-674	40	43	61
North Battle Creek	1,396	3,104	4,500	69	-569	-551	-60	56	57	68
Red Lake Mountain	1,759	2,741	4,500	61	-969	-955	-322	39	40	54
Superbowl	1,292	3,208	4,500	71	-506	-434	-120	60	62	69
Table Mountain	1,280	3,220	4,500	72	-725	-696	-413	55	56	62
Total All	**8,892**	**27,108**	**36,000**	**75**	**-8,790**	**-8,084**	**-3,616**	**51**	**53**	**65**

Home Range Core Areas (HRCA)

The Record of Decision for the SNFPA FEIS (2004) prescribes a HRCA of 2,400 acres for the Hat Creek Ranger District of the Lassen National Forest. The closest comparable research on the California spotted owl using this HRCA scale is found in Blakesley (2003) who studied a HRCA of 2,011 acres (814 ha). Blakesley (2003) utilized an 814 ha core area based on an estimated size of spotted owl breeding season core areas on the Lassen NF. Blakesley found that 78 percent of the area contained in spotted owl core areas was composed of forested stands dominated by trees ≥30 cm (11.9 inches) dbh and with ≥40 percent canopy closure. Comparing Blakesley's study area attributes with those in the North 49 Wildlife Analysis Area, the 30 cm dbh (11.9 inches) or greater is equivalent to CWHR tree size class 4 (11-24 inches). Utilizing the CWHR system, canopy closure of moderate cover (M) is 40 to 59 percent, and dense cover (D) is 60 to 100 percent. Blakesley demonstrated these conditions provided suitable habitat within her study area.

Lee and Irwin (2005), using a HRCA of 1062 acres (430 ha), concluded there was a possible minimum requirement for reproduction. Their research indicates that a majority of nesting territories contained more than 50 percent intermediate (CWHR M) and dense (CWHR D) canopy closure, averaging 70 percent of the territory. Lee and Irwin fitted a regression model to their data, which suggested a lower threshold of 56 percent of the territory with no increasing benefit to reproduction from additional amounts of intermediate and dense canopy closure. It is important to note that Lee and Irwin's study considered the effects of fuels treatment on California spotted owls.

Our study was motivated by concerns about proposed fuels treatments possibly having a negative effect, either short- or long-term, on spotted owls through reductions in canopy cover at the landscape scale. We focused on the types of treatments that have been proposed in the Sierra Nevada to reduce the risk of wildland fire by removing ground fuels and forest understories. . . . None of the simulated trajectories moved beyond the range of observed variation in the original data, suggesting that expected effects on owl reproduction would be essentially immeasurable. Our simulation results lend credence to the hypothesis that modest fuels treatments are compatible with territory-level canopy cover needs for spotted owl reproduction in the Sierra Nevada (Lee and Irwin, 2005).

Table 57 shows the amount of suitable habitat within each 2,400 acre home range core area (HRCA) potentially affected by the North 49 project.

Table 57. Suitable Habitat (4M/4D/5M/5D) impacted within each 2,400 acre HRCA

HRCA	Acres of HRCA by CWHR type		Total Acres in each HRCA	Current % of Suitable Habitat in each HRCA	Total Acres Reduction in Suitable Habitat in the HRCA			Total % Suitable Habitat Retained in the HRCA		
	Other - AGS,WTM , 2D-S, 3D-S, 4P-S, 5P-S	Suitable Habitat 4M, 4D, 5M, 5D			Alt.1 Suitable Habitat 4M, 4D, 5M, 5D	Alt.3 Suitable Habitat 4M, 4D, 5M, 5D	Alt.7 Suitable Habitat 4M, 4D, 5M, 5D	Alt.1 % of Suitable Habitat Retained	Alt.3 % of Suitable Habitat Retained	Alt.7 % of Suitable Habitat Retained
Ashpan Butte	523	1,877	2,400	78	-388	-315	-283	62	65	66
Ashpan Flat	167	2,233	2,400	93	-868	-810	-306	57	59	80
Bunch-grass Creek	241	2,159	2,400	90	-895	-798	-546	53	57	67
Devil's Rock Garden	403	1,997	2,400	83	-911	-818	-259	45	49	72
North Battle Creek	818	1,582	2,400	66	-244	-244	-22	56	56	65
Red Lake Mountain	835	1,565	2,400	65	-500	-485	-101	44	45	61
Superbowl	804	1,596	2,400	67	-70	-23	-50	64	66	64
Table Mountain	414	1,986	2,400	83	-465	-446	-270	63	64	72
Total All	**4,205**	**14,995**	**19,200**	**78**	**-4,341**	**-3,939**	**-1,837**	**56**	**58**	**69**

Based on the figures in Table 57, Alternative 1 reduces suitable habitat on 4,341 acres out of 14,995 acres; Alternative 3 reduces suitable habitat on 3,939 acres out of 14,995 acres; Alternative 7 reduces suitable habitat on 1,837 acres out of 14,995 acres.

Based on the figures in Table 57, all alternatives are currently above the lower threshold of 56 percent necessary for reproduction suggested by Lee and Irwin (2005). Of the eight owl HRCAs (Table 57) all would retain more than 40 percent suitable habitat with the average suitable habitat retained being 55.5 percent (suitable habitat retained ranges from 44.4 percent (Red Lake Mountain) to 63.6 percent (Superbowl)). With Alternative 3 all eight owl HRCAs would retain more than 45 percent of suitable habitat with the average suitable habitat retained being 57.6 percent (suitable habitat retained ranges from 45.0 percent (Red Lake Mountain) to 65.5 percent (Superbowl)) and with Alterative 7 all eight owl HRCAs would retain more than 60 percent of suitable habitat with the average suitable habitat retained being 68.5 percent (suitable habitat retained ranges from 61.0 percent (Red Lake Mountain) to 80.3 percent (Ashpan Flat)).

Nest Core

Several researchers have evaluated the spatial scale at which northern spotted owls respond to habitat (Hunter et al.1995, Bingham & Noon 1997, Meyer et al.1998, Franklin et al. 2000 and Zabel et al. 2003). Blakesley (2003) has provided insight into spatial availability of habitat for California spotted owls. Each of these studies found that areas within ~200 ha (500 acres) of nests were influential in determining occupancy and/or fitness. Blakesley (2003) states that occupancy, apparent survival, and nesting success all increased with increasing amounts of old-forest characteristics and that reproductive output decreased with increasing amount of non-habitat within the nest core area (nest core area = 203 ha scale, or 500 acres surrounding nest sites). Based on these studies, one could argue that management actions that reduce high-quality spotted owl habitat within a 500-acre area around known nests could present more risk to owls than activities occurring outside of this area. There would be no activities within the 300-acre PACs with the North 49 Project. Table 58 shows the amount of suitable habitat within each 500 acre nest core area potentially affected by the North 49 project.

Based on the figures in Table 58, Alternative 1 reduces suitable habitat on 298 acres out of 3,413 acres; Alternative 3 reduces suitable habitat on 255 acres out of 3,413 acres; Alternative 7 reduces suitable habitat on 18 acres out of 3,413 acres.

Table 58.Suitable Habitat (4M/4D/5M/5D) impacted within each 500 acre Nest Core

Nest Core	Acres of Nest Core by CWHR type		Total Acres in each Nest Core	Current % of Suitable Habitat in each Nest Core	Total Acres Reduction in Suitable Habitat in the Nest Core			Total % Suitable Habitat Retained in the Nest Core		
	Other - AGS,WTM, 2D-S, 3D-S, 4P-S, 5P-S	Suitable Habitat 4M, 4D, 5M, 5D			Alt.1 Suitable Habitat 4M, 4D, 5M, 5D	Alt.3 Suitable Habitat 4M, 4D, 5M, 5D	Alt.7 Suitable Habitat 4M, 4D, 5M, 5D	Alt.1 % of Suitable Habitat Retained	Alt.3 % of Suitable Habitat Retained	Alt.7 % of Suitable Habitat Retained
Ashpan Butte	15	485	500	97	-20	0	0	93	97	97
Ashpan Flat	1	499	500	100	-27	-24	-3	94	95	99
Bunchgrass Creek	6	494	500	99	-59	-53	-15	87	88	96
Devil's Rock Garden	1	499	500	100	-115	-103	0	77	79	100
North Battle Creek	245	255	500	51	-20	-20	0	47	47	51
Red Lake Mountain	141	359	500	72	-57	-55	0	60	61	72
Superbowl	107	393	500	79	0	0	0	79	79	79
Table Mountain	71	429	500	86	0	0	0	86	86	86
Total All	**587**	**3,413**	**4,000**	**85**	**-298**	**-255**	**-18**	**78**	**79**	**85**

Of the eight owl nest cores (Table 58) with Alternative 1 all would retain more than 45 percent suitable habitat with the average suitable habitat retained being 77.9 percent (suitable habitat retained ranges from 47.0 percent (North Battle Creek) to 94.4 percent (Ashpan Flat)). With Alternative 3 all eight owl nest cores would retain more than 45 percent of suitable habitat with the average suitable habitat retained being 79.0 percent (suitable habitat retained ranges from 47.0 percent (North Battle Creek) to 97.0 percent (Ashpan Butte)) and with Alterative 7 all eight owl nest cores would retain more than 50 percent of suitable habitat with the average suitable habitat retained being 84.9 percent (suitable habitat retained ranges from 51.0 percent (North Battle Creek) to 99.8 percent (Devil's Rock Garden)).

Indirect Effects

As part of a strategic system of defensible fuel profile zones, this project would reduce the potential for high-severity wildfires, which could eliminate vast tracts of habitat for this species.

Home ranges of neighboring spotted owls commonly overlap (Verner et al. 1992: 149). The action alternatives that eliminate or modify habitat, possibly could cause a shift in owl home range use, increasing the potential for intraspecific competition between neighbors. The increased competition associated with using the same restricted habitat parcels could impact owl behavior, possibly affecting nesting and reproduction. Because of this, directly affected territories and HRCAs could have an indirect affect on adjacent soPACs/HRCAs not directly affected by the proposed action, especially if the directly affected territory or HRCA overlaps with another territory or HRCA. There are a total of 8 soPACs/HRCAs within the Wildlife Analysis Area (including three SOHA); 8 directly affected (Figure 32).

With an average reduction of 843/1,099 acres of suitable habitat per HRCA/territory with Alternative 1 (derived from Table 56 and Table 57) and an average reduction of 492/1,011 acres and 230/452 acres of suitable habitat per HRCA/territory with Alternatives 3 and 7 respectively, it is anticipated that owl behavioral and competitive interactions may increase, which could impact owl activity and occupancy of PAC/HRCAs. Although the HRCAs and territories are well distributed across the Wildlife Analysis Area, they are also confined across the North 49 Project area by large blocks of unsuitable habitat as a result of old lava flows and past fire history.

It is uncertain as to whether the same number of owl sites occupied in 2003 and 2005 (five and seven) would be occupied within the Wildlife Analysis Area post project. Because soPACs and SOHAs are avoided by treatments and the majority of the habitat within the 2,100 acre plus HRCAs would not be affected by treatments, it is reasonable to assume that occupancy would be maintained.

Fuel treatments including thinning and prescribed burning would result in a shift in stand microclimate that would have a negative impact to flying squirrels (Lehmkuhl et al.2006). These treated stands would have fewer trees, a less complex and more open canopy structure (<50 percent canopy cover), resulting in a higher variability stand microclimate, all of which create more xeric conditions that would likely lower availability and biomass of truffles. Retention of down woody material and the largest trees may retain some level of lichen and truffle diversity and biomass, providing flying squirrel forage resources within treated stands. With regular maintenance through prescribed burning every 10 or so years, downed wood would be hard to retain in the long term, resulting in lower density of truffles. These potential losses would be offset by the benefit

that fuel treatment could have for reducing the large scale loss of habitat through wildfire. Less than 35 percent (15,258 to 16,060 of 45,991 acres) of the National Forest land within the Wildlife Analysis Area would be treated with the North 49 Project, while 29,931 to 30,733 acres of National Forest terrestrial forested habitat would not be treated. Location of treatment acres are constrained across the landscape for various resource reasons (PACs and SOHAS for example) such that this untreated habitat is spread across the Wildlife Analysis Area and thus would unlikely impact the distribution and viability of flying squirrel populations.

It is unknown as to how some of the important prey species preferred by spotted owls (woodrats and flying squirrels) would respond to group selection harvest units. With reforestation, as the brush/seedling habitat matures, woodrats may recolonize sooner as they are known to utilize earlier successional habitats (CWHR Version 8.0, and G.Rotta, personal communication). Downed logs created by the retention of snags would provide down woody structures that would provide habitat for prey species. Flying squirrels would likely be absent within the group selection openings but could possibly utilize the edges to their advantage, and would eventually inhabit these areas as the forest matures. It is unknown if these small openings within the forest would be used for foraging by spotted owls. Reforestation should shorten the timeframe to develop forested stands as well as accelerate the development of late seral conditions that owls prefer when compared to natural succession.

Habitat modeling conducted for the SNFPA FEIS and subsequent FSEIS to project trends in woodrat and flying squirrel habitat as a result of implementing fuels reduction activities and group selection harvest within the Sierra Nevada range, indicated that populations of both species would apparently increase slightly over current conditions, but the difference in populations in either the short or long-term would be very small.

In terms of acres treated, with the subsequent potential for snag removal, Alternative 1 treats approximately 140 more acres than Alternative 3; thus fewer snags could be removed (due to hazards, operability, etc) with Alternative 3. Alternatives 7 treat approximately 662 less acres than Alternative 3, thus this action alternative potentially retains the most snags of the three action alternatives.

Edges created by groups within suitable owl habitat may reduce the use of foraging habitat by spotted owls and may increase use by great horned owls, an effective competitor and predator of the spotted owl. Responses of prey species, as well as spotted owl use of group openings is one of the main objectives of the post implementation monitoring that would be conducted by PSW research through the administrative study. The post project monitoring would provide information as to the change in great horned owl use and occupancy and contribute knowledge as to the coexistence of these two species.

Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the action alternatives evaluates the impact on Sensitive wildlife from the existing condition within the Wildlife Analysis Area. The past actions in the Wildlife Analysis Area that contributed to the existing condition include grazing, timber harvest, and recreation use.

Grazing would be expected to continue on National Forest lands at current levels. There are two livestock grazing allotments (Hat Creek and North Battle Creek) that overlap into the Wildlife Analysis Area of which

one is active. One hundred percent of the North Battle Creek allotment is within the project area. Eighty cow/calf pairs are authorized from July 1st thru September 30th. The vacant Hat Creek allotment overlaps approximately sixty percent of the Wildlife Analysis Area. This activity would continue to contribute to minor impacts on woody riparian habitats as it continues to meet current standards for use thus potentially affecting the diversity within spotted owl habitat.

Future activities on National Forest lands include ongoing work within the Stonehenge, plantation maintenance, and hazard tree removal projects (Sandy Hazard, etc.). Little to no change in overstory vegetation is anticipated with these projects. However, all snags that present hazards to road traffic, regardless of size, are being, or would be, removed. Removal of these snags would have a negative effect on individual animals that use snags, yet these hazard trees make up a very small amount of the total snag component in the Wildlife Analysis Area.

Future activities on private and state lands are displayed in Table 50 above. These timber projects would extensively treat approximately 7,212 acres adjacent to and within the Wildlife Analysis Area. These project activities are expected to eliminate spotted owl habitat and/or simplify the complexity and structure of the stands by removing structures that provide the vegetative layering, deformities, snags and future decadence, reducing the closed nature of the stand which provides diverse microclimates for spotted owls. The Eskimo project which entails widening highway 44/89 by shaving rock points and removing some trees along a 0.2 miles stretch is expected to have negligible effect on spotted owl habitat.

The three action alternatives in the North 49 project could contribute to a cumulative reduction in spotted owl nesting habitat. It is uncertain as to what influence these various reductions in habitat would do to owl activity and occupancy within the Wildlife Analysis Area. As noted in the direct/indirect effects section, spotted owl PACs/SOHAs would not be entered for North 49 Project activities, to conserve habitat for these species, and additional soPACs and HRCAs would be created in the future, if warranted by new site-specific owl information.

The cumulative effect of HFQLG pilot project actions, such as the proposed action, and other vegetation management actions in the Sierra Nevada was assessed in the SNFPA FSEIS, to which this assessment is tiered. The habitat modeling used for this assessment was intended to indicate the direction, magnitude and time frames (general trends) of change and was not intended to provide precise information. The SNFPA FSEIS (pages 260-280) acknowledged that suitable foraging habitat provided by CWHR size class 4 stands would diminish in early decades under SNFPA, but would be offset by increases in acreage of CWHR size class 5 and 6 stands. According to projections (FSEIS Chapter 4, table 4.3.2.3g, pg. 269); total spotted owl habitat in the HFQLG planning area would increase 11 percent twenty (20) years after SNFPA implementation. By year 50, the net gain would have dropped to 6 percent, and by year 130 there would be a net reduction of 7 percent in the pilot project area. In the Sierra Nevada bioregion as a whole, however, total habitat would increase 13 percent by year 20, 18 percent by year 50, and 20 percent for year 130. Within the HFQLG planning area, full implementation of HFQLGFRA under SNFPA 2004 ROD is projected to result in roughly 65,000 fewer acres of suitable habitat in year 20 than with SNFPA 2001 ROD (Alternative S1 in 2004 SNFPA FSEIS). This is primarily due to implementation of group selection harvest and the fact that standards and guidelines for CWHR 4M and 4D do not have any minimum canopy cover requirements and have a 30 percent (DFPZ) - 40 percent (AT) basal area retention standard. Also, under the 2004 ROD, the

canopy cover in CWHR class 5M, 5D and 6 stands are more likely to drop to 40 percent in DFPZs. (SNFPA FSEIS Chap 4, page 269). Because the spotted owl population is currently within the 95 percent confidence limits of a stable population (Franklin et al.2003 in SNFPA FSEIS 2004), the SNFPA FSEIS and BA/BE concluded that these cumulative habitat changes (within the range of the California spotted owl within both the Sierra Nevada and the HFQLG planning area) would not result in a trend toward listing or loss of viability of the California spotted owl.

Forest Vegetation Simulator (FVS) modeling of stand exam data indicates tree growth and subsequent habitat recovery follows the trends projected in the SNFPA FSEIS. All action alternatives that implement fuel treatments and area thin treatments in the North 49 project result in providing suitable owl habitat over time (year 20) (see Silviculture section above). Individual groups are also expected to be CWHR 3 by 20 years with structurally suitable habitat occurring beyond year 40.

Large scale changes in owl habitat as a result of recent wildfires and anticipated future fires in spotted owl habitat has been identified as a potential threat affecting spotted owl distribution (70 Federal Register, 35613, June 21, 2005). An annual average of 4.5 PACs have been lost or severely modified by wildfire since 1998 in the range of the California spotted owl (SNFPA FSEIS Chapter 3, page 145). Based on Table 3.2.2.3b within the SNFPA FSEIS no soPACs on the LNF have been lost due to fire effects.

The Personal Use Firewood program on the LNF is an ongoing program that has been in existence for years and is expected to continue. This program allows the public to purchase a woodcutting permit to remove firewood from National Forest lands. Much of this wood material either consists of down logs found in the forest, along forest roads, and within cull decks created by past logging operations, or as standing snags. The North 49 project area, as well as the Wildlife Analysis Area is open to woodcutting. Snags and logs would continue to be removed, resulting in the cumulative loss of these habitat components across the landscape. Snags are recruited annually from live trees through natural processes at a rate that may sustain this loss within the Wildlife Analysis Area; snag and log removal is most common along, or within a short distance from, open roads. Closure of roads under the action alternatives would reduce the area accessible for woodcutting. The effect of this action would be to shift forest successional stages to somewhat earlier stages, while generally retaining continuous forest cover which would have a nominal affect on the California spotted owl.

The petition to list the California spotted owl identified West Nile Virus (WNV) as a serious potential threat to owls and the need to monitor its effects on owls (70 Federal Register, June 21, 2005). West Nile Virus has not yet been detected in a wild spotted owl (Ibid). In 2004 researchers tested for WNV (California spotted owls in the Eldorado study area, Northern spotted owls in the Willow Creek Study area) and from 2004 to 2006 blood samples were taken from California spotted owls on the Plumas and Lassen National Forests. None of these owls tested positive for WNV exposure (Ibid, Plumas-Lassen Administrative Study (PLAS), 2007). The USFWS found there was no substantial information that WNV may threaten the continued existence of spotted owl (70 Federal Register, 35612, June 21, 2005 and 71 Federal Register, 29886, May 24, 2006).

The documented range expansion of the barred owl has been hypothesized as a contributing factor in the decline in Northern spotted owls, through both hybridization as well as replacing the Northern spotted owl in

some areas. It is thought that this range expansion and subsequent Northern spotted owl displacement is related to of forest fragmentation and the barred owls ability to adapt better to a mosaic of habitats. The latest information regarding barred owls versus Northern spotted owls can be found in Pearson and Livezey (2003). Some of the key points that this paper identifies are summarized here: 1) Northern spotted owls are more likely to abandon a site if barred owls take up residence close to that site, 2) that a combination of habitat lost due to timber harvest and the presence of barred owls may work together to put (northern) spotted owl pairs at risk of losing their territories; 3) there is an increasing amount of evidence that barred owls sometimes may kill Northern spotted owls, and 4) barred owls can cause a reduction in the Northern spotted owl populations by physically excluding them from historic sites and making those sites unavailable for recolonization.

Barred owls have expanded their range in California as far south as Sequoia National Park, and in the last two years (2004/2005) the known range of barred owls has expanded 200 miles southward in the Sierras (70 Federal Register, 35613, June 21, 2005). The USFWS has concluded that barred owls constitute a potential threat to site occupancy, reproduction, and survival of the California spotted owl, but that there currently is not enough information to conclude that hybridization with barred owls poses a threat (Ibid). In their May 15, 2006 finding of the 12 month status review, the USFWS concluded that the California spotted owl should not be listed as a threatened or endangered species under the ESA (FR, Vol 71, N0. 100, May 24, 2006). This conclusion was based in part on the fact that barred owl movement into the Sierra Nevada has been at a much slower rate than their movement into other parts of western North America.

According to Keene (2007) of the Plumas Lassen Administrative Study (PLAS) spotted owl module, there have been 41 barred owl detections in the northern Sierra Nevada (El Dorado NF north) since 1989, thirty-six of which have been in the last five years. Of these thirty-six most recent detections, 18 have been barred owls and 18 have been sparred (barred X spotted hybrid). Within the PLAS study area within the HFQLG area, there have been 22 detections in the last five years (11 barred and 11 sparred). A barred owl was detected approximately 17 miles south of the North 49 Wildlife Analysis Area in 2007. This is the closest sighting of a barred owl to the North 49 Wildlife Analysis Area.

Barred owls readily respond to spotted owl calls (Forsman et al. 1984, McGarigal and Fraser 1985, Hamer 1988, Reid et al. 1999; all referenced in Pearson and Livezey 2003). No barred owls were discovered in either the spotted owl or great gray owl surveys conducted within the North 49 project area. Based on the studies that have been conducted in the northern spotted owl range, barred owls seem to be more adaptable to habitat perturbations within suitable spotted owl habitat than spotted owls themselves. The potential exists for the barred owl to establish and compete with spotted owls within the North 49 project area.

The North 49 Project is located within one of the CASPO identified Areas of Concern (AOC). This project would improve the habitat conditions in AOC 2 and would not improve or exacerbate any of the habitat conditions within AOC 1.

Direct Effects of Alternative 2 (No Action)

There would be no direct effects on spotted owl or spotted owl habitat, as no activities would occur that would cause disturbance to nesting or foraging birds, nor any impacts to the existing habitat conditions.

Indirect Effects

Indirect effects of no action include the potential for future wildfire and its impact on habitat development and recovery. The fuel loads that would be left by this alternative would make potential wildfires in the area difficult to suppress and create a more intense burn, which could lead to increased rates of spread resulting in potential loss of suitable owl nesting habitat and other important habitat attributes such as large trees, large snags and down woody material. If a large fire occurred suitable owl habitat could become patchy and could lead to reduced or lower abundance of owls within the Wildlife Analysis Area.

With the current LNF woodcutting program, the project area would be open to public woodcutting 12 months a year, limited only by available access. Uncontrolled public use within the areas used by spotted owls, especially during the nesting season, could cause disturbance that could disrupt and preclude successful nesting. No roads would be closed or decommissioned with this alternative.

Cumulative Effects

The No Action Alternative for the North 49 Project would not provide for the long-term protection of spotted owl habitat from catastrophic fire. There would be no actions designed to reduce the risk of high intensity wildfire. Total wildfire acres and high intensity wildfire acres are anticipated to increase from current levels under this alternative (based on analysis conducted in SNFPA (2001)), which could lead to lower owl abundance from existing condition within the Wildlife Analysis Area. There would be no thinning that could enhance the growth of dominant and co-dominant (20 inches-30 inches) trees that may provide future habitat availability.

Summary

The best scientific evidence suggests that California spotted owl populations are either declining gradually or stable, but perhaps leaning toward decline (Franklin 2003, Dunk 2005). On May 15, 2006, after a 12 month status review, the USFWS concluded that the California spotted owl should not be listed as a threatened or endangered species under the ESA (FR, Vol 71, N0. 100, May 24, 2006). The USFWS considered the information presented in the 2006 meta-analysis and found that populations of California spotted owl in the Sierras showed little evidence of a decline, and concluded that the owls' status in the Sierra Nevada is not deteriorating as is evidenced by the increasing adult survival and stationary trend of the populations.

It is acknowledged that the actions proposed with the North 49 project would reduce suitable owl habitat. It is acknowledged that there are some disparities in habitat typing between CWHR and stand inventory data and that the acres of 4M, 4D, 5M and 5D could be inexact estimates of habitat availability. This data is the best information available for evaluating landscape-level changes in habitat types and for the evaluation of site-specific impacts to owl core areas.

Within the North 49 Wildlife Analysis Area, approximately 66 percent (30,246 of 45,991 acres) of the National Forest land is composed of CWHR types considered suitable owl habitat. Post Project (Alternative 1/Alternative 7) approximately 67 percent (Alt.1)/84 percent (Alt.7) (20,296/25,552 of 30,246) of the Wildlife Analysis Area would be composed of these same CWHR types. None of the eight soPACs/SOHAs would be modified, thus maintaining the most important owl habitat for breeding and probably adult survival. Adult occupancy in the currently occupied soPACs and SOHAs is not expected to decline, would be maintained as

viable soPACs. The decline in owl habitat as a result of the North 49 Project within owl Home Range Core Areas and in habitat across the Wildlife Analysis Area could increase risk to natal dispersal and short term owl recruitment. Thus, based on soPAC and habitat availability, the current adult population and distribution within the Wildlife Analysis Area would continue post project, but no short term increase in spotted owls is expected. These soPACs, SOHAs, and the remaining 67 percent (Alt.1)/84 percent (Alt.7)of the suitable habitat (includes soPACs/SOHAs suitable habitat) would be in a more fire resilient condition than currently exists, thus providing for a longer term increased retention and recruitment of large tree habitat over the Wildlife Analysis Area.

The 2006 meta-analysis concludes that the potential consequences of the Forest Service management plan to spotted owls are unknown because:

1. the extent of vegetation manipulations is largely under the control of local managers and will likely vary across the Sierra Nevada; and
2. threshold levels of quality habitat necessary to maintain individual pairs of spotted owls on a site are largely unknown.

The recommendations from the meta-analysis are to develop well designed experimental studies coupled with the spotted owl demographic studies. The PLAS administrative study is mentioned as quasi-experimental limiting the scope of the results of the studies.

Lee and Irwin (2005) using a combination of population data from the southern Sierra Nevada, and canopy cover measurements and forest simulation models, demonstrated that modest fuels treatments (mechanical thinning plus fuel-break construction) in the Sierra Nevada would not be expected to reduce canopy cover sufficiently to have measurable effects on owl reproduction. They predicted that with mechanical thinning plus fuel break construction treatments (including DFPZ construction scenario) in combination with either no fire or mixed –lethal fire scenarios would not degrade canopy conditions in productive owl territories, nor impeded improvement of non-productive territories. In contrast, lethal fire simulations produced a pronounced and lasting negative effect. The general trend with all fuel treatments was towards higher proportions of intermediate canopy covers (40-69 percent canopy cover) and lower proportions of sparse canopy cover (0-39 percent) over time, whereas lethal fire scenarios produced sparse canopy cover discernible 4 decade later. “The immediacy of the fire threat creates an urgency to act even as key uncertainties remain” (Lee and Irwin, 2005). On May 15, 2006, after a 12 month status review, the USFWS concluded that the California spotted owl should not be listed as a threatened or endangered species under the ESA. This conclusion was based in part on the best available data that indicated “most California spotted owl populations in the Sierra Nevada are stable or increasing and adult survival rates show an increasing trend” and that “Forest fuels reduction activities, notably those provided for in the Sierra Nevada Forest Plan Amendment of 2004, may have a short-term impact on owl populations. But fuels reduction would have a long-term benefit to California spotted owls by reducing the risk of catastrophic wildfires that pose a major threat to California spotted owl habitat”.

There are slight difference in the effects to owl habitat between Alternatives 1, 3, and 7 in regards to implementation of actions designed to create DFPZs, implementing group selection, aspen release and area thin treatments. The main difference between alternatives is that Alternative 7 was designed to retain the

minimum canopy cover for suitable habitat as well as retain the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.). This would be accomplished through dense retention islands, open growing large overstory trees (large tree radial thin), moderately dense stands and open group selections of young regeneration.

Determination – California Spotted Owl

Action Alternatives

The North 49 Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the California spotted owl. This determination is based on the following:

1. PAC avoidance;
2. retention of 62.8 percent to 82.0 percent of existing foraging habitat and 77.4 percent to 90.4 percent of existing nesting habitat on 45,991 acre of National Forest lands within the Wildlife Analysis Area (Alternatives 1, 3 & 7) of which 30,246 acres (8,861 acres nesting and 21,387 acres foraging) are considered suitable habitat. This retention of nesting and foraging habitat outside existing PACs would provide opportunities for future occupancy and population expansion;
3. retention of an average of 64.4 percent to 85.4 percent of the existing suitable habitat within the each territory;
4. retention of an average of 71.0 percent to 87.7 percent of the existing suitable habitat within the each HRCA;
5. retention of an average of 91.3 percent to 99.5 percent of the existing suitable habitat within the each nest core;
6. creation of a network of fuel reduction areas (DFPZs) designed to reduce the loss of habitat due to wildfire.

It is acknowledged that implementation of alternatives involve some risk to habitat and subsequent uncertainty with regards to owl activity. Alternative 1 poses greatest risk and uncertainty, with 3 and 7 having less risk respectively. Alternative 2 is not without risk to spotted owl habitat, as no action is taken to reduce existing fuel levels, create areas that could allow for better and more efficient fire suppression efforts, and leaves existing owl habitat vulnerable to large scale fragmentation as a result of wildfire.

No Action

The North 49 Project will not affect the California spotted owl.

Northern Goshawk (*Accipiter gentilis*)

Wildlife Analysis Area

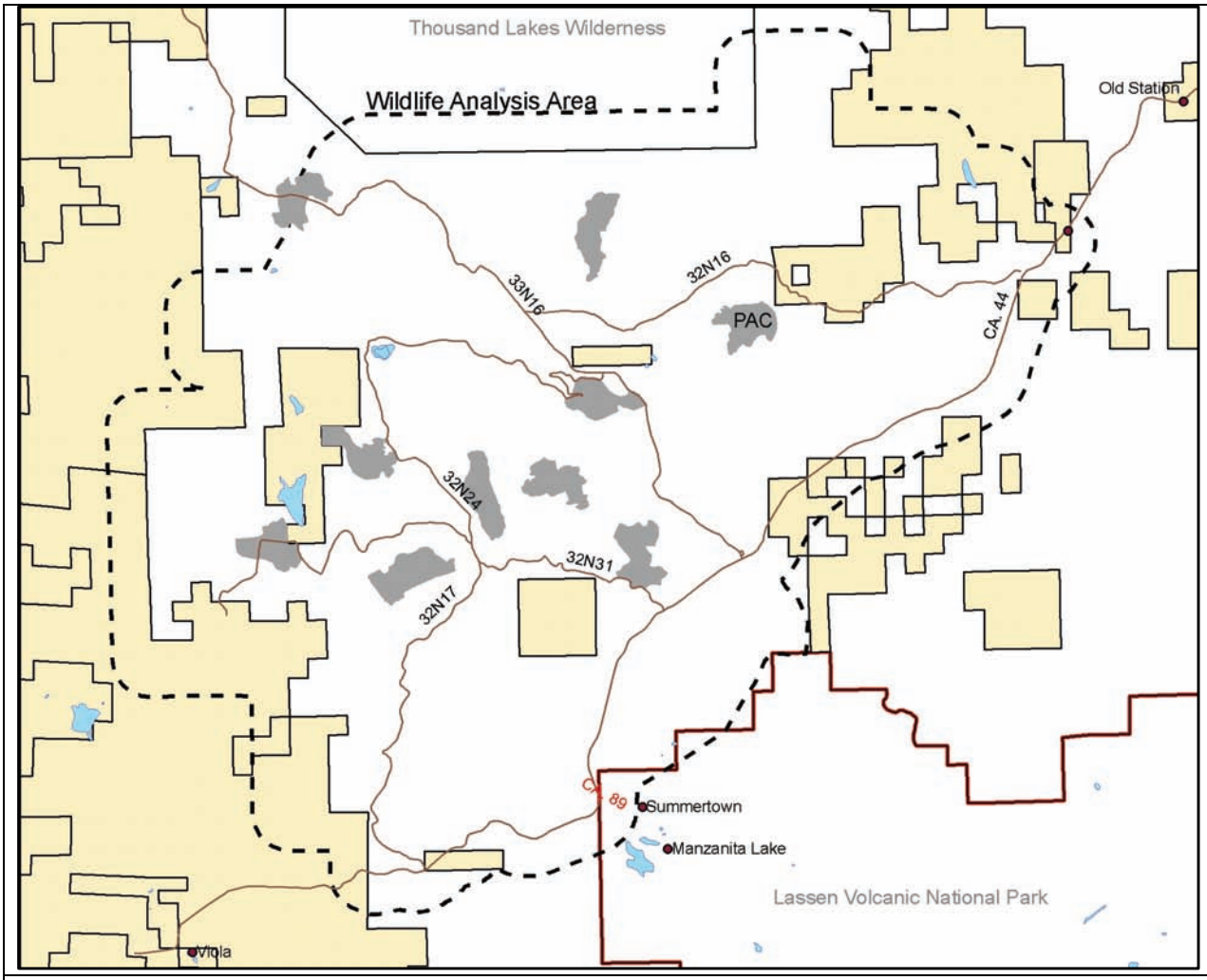

Figure 33. North 49 Wildlife Analysis Area with 200 acre northern goshawk Protected Activity Centers (PACs) (solid grey)

Table 59. gPAC History for northern goshawks within Wildlife Analysis Area

Year	Ashpan	Battle Springs	Bear Wallow Butte	Bunchgrass Valley	Devil's Rock Garden	Grayback	Huckleberry	Manzanita Chute	North Battle Creek	Red Lake
1996	Detection –2 young		Not Checked		Detection – Nest Site			Discovered – Pair		
1997	Checked - Status Unknown		Not Checked		Checked - Status Unknown			Detection – Nest Site, 3 young	Not Checked	
1998	Checked - Status Unknown		Not Checked		Detection – Single			Checked - Status Unknown	Checked - Status Unknown	
1999	Detection – Nest Site		Results Unknown		Checked - Status Unknown			Detection – Single	Not Checked	
2000	Detection – Nest Site		Results Unknown		Checked - Status Unknown			Not Checked	Not Checked	
2001	Checked - Status Unknown		Results Unknown		Checked - Status Unknown		Not Checked	Not Checked	Not Checked	Discovered – 1 young
2002	Not Checked		Not Checked		Not Checked		Not Checked	Not Checked	Not Checked	Surveyed – No Detections
2003	Detection – Nest Site, 2 young	Discovered – Pair	Detection – 1 young	Discovered – 1 young	Surveyed - No Detections		Detection – Single	Detection – Nest Site	Detections – Nest Site	Discovered – Pair
2004	Results Unknown	Results Unknown	Results Unknown	Results Unknown	Results Unknown	Discovered – 2 young, fledged	Detection – 2 young, at least one fledged	Results Unknown	Results Unknown	Results Unknown
2005	Checked - Status Unknown	Not Checked	Checked - Status Unknown	Checked - Status Unknown	Checked - Status Unknown	Checked - Status Unknown	Detection – Pair	Checked - Status Unknown	Checked - Status Unknown	Checked - Status Unknown
2006	Detection –1 young	Not Checked	Not Checked	Not Checked	Not Checked	Checked - Status Unknown	Checked - Status Unknown	Not Checked	Detection – Nest Site	Detection – 2 young
2007	Not Checked	Not Checked	Not Checked	Not Checked	Not Checked	Not Checked	Not Checked	Not Checked	Not Checked	Not Checked

Data sets from studies in the western US (Woodbridge and Detrich 1994, DeStefano et al. 1994, Reynolds et al. 1994, Reynolds and Joy 1998) establish a range of crude densities from 1 territory/2,123 acres to 1 territory/4,003 acres; territory centers are roughly 1.9 to 2.3 miles apart. These crude densities include both suitable and unsuitable habitat within the study areas. The crude densities for goshawk territories in the North 49 Wildlife Analysis Area, based on PACs identified in Table 59, are much lower than these figures:

- 1 territory/6,377 acres in the entire Wildlife Analysis Area,
- 1 territory/5,110 acres on National Forest lands in the Wildlife Analysis Area,
- or 1 territory/3,367 acres based on total suitable nesting habitat on National Forest lands in the Wildlife Analysis Area.

Territory centers range from dense (1.0 mile apart in the Red Lake area) to scattered (4.0 miles apart). Based on the density and spacing of known goshawk territories, it appears that the crude density of goshawk territories within the North 49 project may be less than what has been reported in the literature. The large blocks of unsuitable habitat created by past fire activity and the lava reefs may contribute to lower densities and increased spacing.

Northern goshawks are currently being managed under the LNF LRMP guidelines as amended by the SNFPA FSEIS ROD (2004), pages 66-67 and Table 2. Habitat requirements for this species can be found within the SNFPA FEIS and summarized below.

The northern goshawk requires mature conifer and deciduous forest with large trees, snags, downed logs and dense canopy closure for nesting. Forests with moderately open overstories, open understories interspersed with meadows, brush patches, other natural or artificial openings and riparian areas are preferred for foraging. Recent studies indicate that goshawks typically select for canopy closures greater than 60 percent for nesting (Hall 1984, Richter and Callas 1996, Keane 1997). The following affected CWHR types provide high nesting habitat capability: Sierra Mixed Conifer, White Fir, Montane Hardwood-Conifer, and Montane Riparian (6, 5D, 5M, 4D, 4M), Ponderosa Pine, Jeffrey Pine, and Lodgepole Pine (5D, 5M, 4D, 4M) and Red Fir (5D, 5M). The following CWHR types are rated as providing moderate nesting habitat capability: Aspen (6, 5D, 5M, 4D, 4M), Douglas-fir (6, 5D, 5M, 4D, 4M), Eastside Pine (5D, 5M, 4D, 4M, 3D, 3M), Red fir (4D, 4M), and Lodgepole Pine (3D, 3M) (SNFPA FEIS Vol3, Chap.3, part 4.4 pg 116).

Within the Wildlife Analysis Area there are approximately 29,974 acres of habitat providing high nesting habitat capability (Table 60). As explained above under Table 54 for spotted owl, it is acknowledged that the acres reflected in Table 60 could be inexact estimates of habitat availability.

Table 60 Acres of High & Moderate Capability northern goshawk Nesting Habitat on National Forest Land within Wildlife Analysis Area

CWHR Type*	Habitat capability	Acres in Wildlife Analysis Area
4M	High nesting	3,798
4D	High nesting	17,323
5M	High nesting	762
5D	High nesting	8,091
Total	High nesting	29,974
3M	Moderate nesting	18
3D	Moderate nesting	41
4M	Moderate nesting	186
4D	Moderate nesting	80
5M	Moderate nesting	0
5D	Moderate nesting	8
Total	Moderate nesting	333
Total All	All nesting	30,307

*3=pole 6-11”dbh, 4=small 11-24"dbh, 5=medium/large >24"dbh. D= Dense Canopy Cover > 60%, M= Moderate Canopy 40-59%.

Direct Effects of the Action Alternatives

Potential direct effects on the Northern goshawk may result from the modification or loss of habitat or habitat components, and rarely from direct mortality if nest trees are felled. The proposed action and alternatives would not cut or remove nest trees. In addition, disturbances associated with logging, temporary road building, or other associated activities within or adjacent to occupied habitat may disrupt nesting, fledging, and foraging activities (Richardson and Miller 1997). Implementation of Limited Operating Periods (LOPs) around known goshawk nests would remove the effects associated with direct disturbance on treatment units and access routes.

Proposed activities could cause short-term displacement and disruption during the time equipment is present and underburning activities are taking place if there are unknown nest sites unprotected by PACs and LOPs.

Based on the California Wildlife Habitat Relationships (CWHR) model, about 30,307 acres or 66 percent within the Wildlife Analysis Area on National Forest lands may be considered suitable goshawk nesting habitat (3M, 3D, 4M, 4D, 5M, 5D)(Table 60). Dunk and Keane (unpublished analyses) found that the probability of a stand being a nest site increased with increasing amounts of 4D and 5D. In the North 49 Wildlife Analysis Area, 27 percent of the above nesting habitat is composed of 5D, 3 percent is composed of 5M, 57 percent is composed of 4D and 13 percent is composed of 4M. An additional 4 percent or 1,782 acres may be considered suitable foraging habitat (ASP, DFR, EPN, JPN, LPN, MHC, PPN, RFR, SMC, and WFR in 3M, 3D, 4P and 5P) on National forest lands in the Wildlife Analysis Area. This Wildlife Analysis Area encompasses 45,991 acres of National Forest lands and was chosen in order to put habitat treatments within the context of the surrounding landscape. As mentioned previously, uncertainty exists in the amount of nesting habitat that is actually available within the Wildlife Analysis Area, but using vegetation layer mapped data provides consistency throughout this analysis.

In a recently published monograph on northern goshawks in the interior Pacific Northwest (McGrath et al, 2003), it was reported that goshawk nests occurred in the lower 1/3 of slopes and in drainage bottoms more than expected based on availability (and less than expected on the upper 1/3 slopes and ridgetops, although the upper 1/3 was not completely avoided but used half as often as would be expected based on the availability of such areas). The goshawk habitat for the North 49 Wildlife Analysis Area was not stratified or analyzed using McGrath method because it is uncertain as to its application to goshawks in the Sierra Nevada, nor is the data available for the goshawk nest sites on the Plumas that would indicate whether nest sites fall into the McGrath parameters. This is pointed out to identify that the availability of goshawk habitat within the Wildlife Analysis Area may potentially be overestimated.

Changes to suitable habitat as a result of implementing fuels treatments in all action alternatives and area thin treatments in Alternative 1 and 3 would occur due to the removal of large structural components and reduction in canopy cover to 40 - 50 percent. The more open canopied forested stands still retain the minimum canopy cover for suitable habitat but become unsuitable due to the removal of the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.) (see Table 61). DFPZ treatments will bring canopy cover down to 40 percent, the minimum to be classified as M, therefore the minimum to be considered foraging habitat. However, the removal of other important habitat components such as snags and vertical layering further diminish habitat value and render it unsuitable for foraging. Stands treated as area thin also decrease in habitat value due to a reduction in canopy cover to 45-50 percent and the removal of other important habitat components. There may also be some additional risk associated with isolated torching events during prescribed fire that could kill additional trees thus further opening up the canopy, and reducing foraging and nesting opportunities. Area thin treatments in Alternative 7 would retain the minimum canopy cover for suitable habitat as well as the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.). This would be accomplished through dense retention islands, open growing large overstory trees (large tree radial thin), moderately dense stand and open group selections of young regeneration. Table 61 shows the above mentioned changes to Northern goshawk nesting and foraging habitat by alternative.

Table 61. Comparison of Action Alternatives 1, 3 & 7 on northern goshawk Nesting (4M, 4D, 5M, 5D) and Foraging Habitat within the Wildlife Analysis Area

	Alternative 1 (PA)			% (Alt. 1) Remaining in Wildlife Analysis Area	Alternative 3			% (Alt. 3) Remaining in Wildlife Analysis Area
	Acres				Acres			
	DFPZ*	GS/ Aspen Release	Area Thin*		DFPZ*	GS/ Aspen Release	Area Thin*	
Forage Habitat								
3M	-16	0	+10	99.3%	-16	0	+10	99.3%
3D	-26	0	-21	88.2%	-26	0	-14	89.9%
4P	0	-50	0	89.1%	0	-60	0	87.0%
5P	0	0	0	100.0%	0	0	0	100.0%
Total Foraging Change (acres)	**-42**	**-50**	**-11**	**94.2% retained (-5.8%)**	**-42**	**-60**	**-4**	**94.1% retained (-5.9%)**
Nesting Habitat								
4M	-1,326	-163	-269	55.9%	-1,326	-105	-279	57.1%
4D	-3,913	-773	-1,502	64.4%	-3,863	-447	-1,480	66.7%
5M	-146	-20	-38	73.2%	-156	-2	-38	74.3%
5D	-1,210	-200	-392	77.6%	-1,191	-104	-392	79.2%
Total Nesting Change (acres)	**-6,595**	**-1,156**	**-2,201**	**67.2% retained (-32.8%)**	**-6,536**	**-658**	**-2,189**	**69.0% retained (-31.0%)**

	Alternative 7			% (Alt. 7) Remaining in Wildlife Analysis Area
	Acres			
	DFPZ*	GS/ Aspen Release	Area Thin	
Forage habitat				
3M	-22	0	+37	101.8%
3D	-10	0	-37	88.2%
4P	0	-28	0	93.9%
5P	0	0	0	100.0%
Total Foraging Change (acres)	**-32**	**-28**	**0**	**96.6% retained (-3.4%)**
Nesting Habitat				
4M	-837	-156	+2,191	130.1%
4D	-2,195	-656	-2,191	71.0%
5M	-46	-16	+727	187.3%
5D	-614	-176	-727	81.3%
Total Nesting Change (acres)	**-3,692**	**-1,004**	**0**	**84.5% retained (-15.5%)**

* Reductions shown here are due to the removal of the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.) leading to unsuitable foraging and nesting habitat.

Based on figures in Table 61, Alternative 1 reduces foraging habitat on 103 acres out of 1,782 acre, reduces nesting habitat on 9,952 acres out of 30,307 acres; Alternative 3 reduces foraging habitat on 106 acres out of 1,782 acres and reduces nesting habitat on 9,383 acres out of 30,307 acres; Alternative 7 reduces foraging habitat on 60 acres out of 1,782 acres and reduces nesting habitat on 4,696 acres out of 30,307. In terms of habitat changes to 4D and 5D (assuming higher probability of goshawk use of these types based on the findings of Dunk and Keane's unpublished analyses), 77.6 to 81.3 percent of the CWHR 5D would be retained with action alternatives and 64.4 to 71.0 percent of CWHR 4D would be retained.

Protected Activity Centers (PACs)

Implementation of the action alternatives during the nesting season around known nest sites could cause disturbance that could disrupt nesting behaviors and potentially lead to nest failure. The risk of this occurring is tempered by the delineation of a gPAC around known nest sites and/or implementation of a LOP prohibiting disturbing activities from occurring within ¼ mile from nest sites.

Portions of two gPACs would be entered with the alternatives 1 and 3 and a portion of one gPAC would be entered with alternative 7. The entries for alternative 1 and 3 would be to thin a total of approximately 289 acres and underburn 6 acres. Alternative 7 would thin 37 acres of mostly smaller lodgepole pine. These treatments would maintain connectivity of the DFPZ and promote diversity in a portion of the Bunchgrass Valley gPAC which is dominated by lodgepole pine. Based on Table 62, between 35 acres and 179 acres of suitable habitat within these gPACs would be reduced with the proposed action alternatives.

Northern goshawk PACs are designated from aerial photos and additional acres are the result of designating the best available habitat in relationship to geographical features and stand continuity. GPACs are delineated based on guidelines provided in the SNFPA FEIS 2001 ROD and the SNFPA FSEIS 2004 ROD page 38. Where there is insufficient suitable habitat (6, 5D, 5M, 4D and 4M), to meet the 300 acres guideline for a gPAC, the next best vegetation sizes and types are included. Habitat alteration by the proposed action alternatives and the associated risks to known goshawk occupancy within individual gPACs is displayed in Table 62.

Table 62. Suitable Habitat (4M/4D/5M/5D) impacted within 2 Directly Affected gPACs

gPAC	Acres of gPAC by CWHR type		Total Acres in each gPAC	Acres of gPAC Treated*	% of gPAC Treated*	% of gPAC Untreated*	Total Acres Reduction in Suitable Habitat in the gPAC		
	Other - AGS,WTM, 2D-S, 3D-S, 4P-S, 5P-S	Nesting - 4M, 4D, 5M, 5D					Alt.1 Nesting - 4M, 4D, 5M, 5D	Alt.3 Nesting - 4M, 4D, 5M, 5D	Alt.7 Nesting - 4M, 4D, 5M, 5D
Bunchgrass Valley	3	202	205	90	44%	56%	-82	-82	-35
Manzanita Chutes	5	253	258	184	71%	29%	-179	-179	0
Total All	**8**	**455**	**463**	**274**	**59%**	**41%**	**-261**	**-261**	**-35**

Indirect Effects

No new road construction would occur within gPACs. As part of a strategic system of defensible fuel profile zones, this project would reduce the potential for high-severity wildfires, which could eliminate vast tracts of habitat.

It is an unknown as to how some of the important prey species preferred by goshawks (small mammals, birds) would respond to opening up forested stands with DFPZ and group selection harvest units. Based on CWHR modeling, it is known that several bird species respond favorably to either less dense forested stands and/or openings within forested stands, while some do not (HFQLGFRA FEIS, Appendix I). The increased diversity and edges created by groups within forested stands may provide foraging habitat that would increase use of the landscape by goshawks. Responses of prey species, including small mammals and passerine bird use of group openings is one of the main objectives of the post implementation monitoring that would be conducted by PSW research through the administrative study. Post project monitoring would provide information as to the response by these prey species to DFPZ and group selection harvesting.

Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the action alternatives evaluates the impact on sensitive wildlife from the existing condition within the Wildlife Analysis Area. The past actions in the Wildlife Analysis Area that contributed to the existing condition include grazing, timber harvest, and recreation use.

Cumulative effects on the Northern goshawk are similar to those described for the California spotted owl. Cumulative effects on the goshawk could occur with the incremental loss of the quantity and/or quality of habitat for this species. Overall, increases in urbanization, increases in recreational use of Forest Service system lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for this species. High intensity stand replacement fires have contributed and would continue to contribute to loss of habitat for this species.

The North 49 project potentially contributes to a cumulative reduction in goshawk nesting habitat. It is uncertain as to what influence these various reductions in habitat would do to goshawk activity and occupancy within the Wildlife Analysis Area. However, it is not anticipated that this cumulative habitat reduction would result in loss of occupancy or productivity of known goshawk PACs, based on the location of project activities to known gPACs and the distribution of known gPACs across the Wildlife Analysis Area, and retention of at least 67 percent of available suitable nesting habitat distributed across the Wildlife Analysis Area on National Forest lands post project implementation.

Direct Effects of Alternative 2 (No Action)

There would be no direct effects on goshawk or goshawk habitat, as no activities would occur that would cause disturbance to nesting or foraging birds, nor any impacts to the existing habitat conditions.

Indirect Effects

Indirect effects of no action include the potential for future wildfire and its impact on habitat development and recovery. The fuel loads that would be left by this alternative would make potential wildfires in the area

difficult to suppress and create a more intense burn, which could lead to increased rates of spread resulting in potential loss of suitable goshawk nesting habitat and other important prey habitat attributes such as large trees, large snags and down woody material.

With the current LNF woodcutting program, the project area would be open to public woodcutting 12 months a year, limited only by available access. Uncontrolled public use within the areas used by goshawks, especially during the nesting season, could cause disturbance that could disrupt and preclude successful nesting.

Cumulative Effects

The No Action Alternative for the North 49 Project would not provide for the long-term protection of goshawk habitat from catastrophic fire. There would be no actions designed to reduce the risk of high intensity wildfire. The total acres of wildfire and acres of high intensity wildfire are anticipated to increase from current levels under this alternative (based on analysis conducted in SNFPA (2001). There would be no thinning that could enhance the growth of dominant and co-dominant (20 inches-30 inches) trees that may provide future habitat availability.

Determination – Northern Goshawk

Action Alternatives

The North 49 Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the northern goshawk. This determination is based on the following:

1. Retention of 66.2 percent to 84.5 percent of existing nesting habitat (30,307 acres) on 45,991 acre of National Forest lands within the Wildlife Analysis Area (Alternatives 1, 3 and 7). This retention of nesting habitat outside existing gPACs would provide opportunities for future occupancy and population expansion;
2. Creation of a network of fuel reduction areas designed to reduce the loss of habitat due to wildfire.

No Action

The North 49 Project will not affect the northern goshawk.

Bald Eagle (*Haliaeetus leucocephalus*)

Direct and Indirect effects of the Action Alternatives

The project appears to have no direct affects to bald eagles. The western shore of North Battle Creek Reservoir appears to have trees of sufficient size to support the large nests built by bald eagles, however these trees are within a Spotted Owl Habitat Area (SOHA) and would not be affected or removed by the project. There would be no affects to perch trees along the lake because this area is encompassed within no treatment areas (SOHA, California spotted owl Protected Activity Center (soPAC)). The treatment units within 500 meters of the reservoir fall within a California spotted owl limited operating period (LOP) which, allows no logging operations to occur from 3/1 thru 8/15. Thus, foraging activities would not be disturbed during this period. The area greater than 500 meters from the lake drops in elevation, does not have a view of the lake,

and is thus unsuitable for roosting, perching or nesting. The proposed plantation thinning within 1000 meters of the west side of the lake does not have trees of sufficient size to provide roosting, perching or nesting locations.

Cumulative effects

Because the North 49 project would have no direct or indirect effects there are also no cumulative effects.

Direct effects of Alternative 2 (No Action)

There would be no direct effects on bald eagles or bald eagle habitat, as no activities would occur that would cause disturbance to nesting or foraging birds, nor any impacts to the existing habitat conditions.

Indirect effects

Indirect effects of no action include the potential for future wildfire and its impact on habitat development and recovery. The fuel loads that would be left by this alternative would make potential wildfires in the area difficult to suppress and create a more intense burn, which could lead to increased rates of spread resulting in potential loss of suitable bald eagle nesting habitat and other important habitat attributes such as large trees, large snags and down woody material. Thus potentially suitable habitat for a bald eagle territory could become patchy or unevenly distributed with this alternative, and could lead to reduced or lower abundance of bald eagles within the Wildlife Analysis Area. No roads would be closed or decommissioned with this alternative.

Cumulative effects

The No Action Alternative for the North 49 project would provide no long-term protection of bald eagle habitat from catastrophic fire. There would be no actions designed to reduce the risk of high intensity wildfire. Total wildfire acres and high intensity wildfire acres are anticipated to increase from current levels under this alternative (based on analysis conducted in SNFPA (2001), which could lead to lower eagle abundance from existing condition within the Wildlife Analysis Area. There would be no thinning that could enhance the growth of dominant and co-dominant (20 inches-30 inches) trees that may provide future habitat availability.

Determination – Bald Eagle

Action Alternatives

The North 49 Project will not affect the bald eagle. This determination is based on the following:

1. No bald eagle nesting territories in the Wildlife Analysis Area;
2. No thinning activities within 500 meters or 1,640 feet of North Battle Creek Reservoir;
3. Creation of a network of fuel reduction areas designed to reduce the loss of habitat due to wildfire;
4. Implementation of SAT guidelines, meeting RHCA standards and compliance with Riparian Management Objectives would safeguard against any increased sedimentation that could have short-term affects to foraging habitat.

No Action

The North 49 Project will not affect the bald eagle.

Great Gray Owl (*Strix nebulosa*)

Wildlife Analysis Area

Table 63. Acres of suitable great gray owl nesting and foraging habitat within the Wildlife Analysis Area on National Forest System lands

CWHR Type*	Habitat Type	Acres in Wildlife Analysis Area
Other (SGB and S/P forested stands)	Foraging	39
Meadows (AGS, PGS & WTM)	Foraging (optimal)	104
Total	Foraging	143
4M	Nesting	100
4D	Nesting	422
5M	Nesting (optimal)	0
5D	Nesting (optimal)	183
Total	**Nesting**	**705**

*4=small 11-24"dbh, 5=medium/large >24"dbh. D= Dense Canopy Cover > 60%, M= Moderate Canopy 40-59%, P= Open Canopy 25-39%, S= Sparse Canopy 10-24%, AGS= Annual Grasslands, PGS= Perennial Grasslands, SGB= Sagebrush, WTM= Wet Meadow.

As explained above under Table 54 for spotted owl, it is acknowledged that the acres reflected in Table 20 could be inexact estimates of habitat availability.

Big Lake and its associated meadow complex are approximately 33 acres in size. Vegetation is low sedge, usually less than 10 inches high. The meadow fringes have been utilized for woodcutting, and dispersed camping and do not appear to provide suitable nest locations. The adjacent mixed conifer timber stands were thinned during the Redlock Timber Sale in 2002. Surveys for great gray owls were conducted in the Wildlife Analysis Area in 2003 and 2004 focusing on the Big Lake area. No great gray owls were detected.

Direct Effects of the Action Alternatives

Potential direct effects on the great gray owl may result from the modification or loss of habitat or habitat components through thinning (reduce canopy cover and availability of future nest trees), and through underburning (snag/log and tree removal (safety hazards, etc.)). Disturbances associated with logging, temporary road building, or other associated activities within or adjacent to occupied habitat may disrupt nesting, fledging, and foraging activities. Implementing limited operating periods within 600 feet of occupied meadow habitats and restricting harvest activity within ½ mile of nest sites (if discovered) would reduce or completely eliminate potential disturbance impacts to this species from the proposed action.

Based on the vegetation layer and the CWHR model, about 1.5 percent or 705 acres within the Wildlife Analysis Area (45,991NF acres) may be considered suitable great gray owl nesting habitat (4M, 4D, 5M, 5D, and 6 within 300 yards of a meadow) (USDA Forest Service 2004), and about 0.3 percent or 143 acres may be considered suitable foraging habitat (meadows and open forested stands (CWHR S and P)). In the North 49 Wildlife Analysis Area, 26 percent or 183 acres of the above nesting habitat is composed of 5D (optimal), 0 percent or 0 acres is composed of 5M (optimal), 60 percent or 422 acres is composed of 4D, and 14 percent or 100 acres is composed of 4M. Additionally in the North 49 Wildlife Analysis Area, 73 percent or 104 acres of the above foraging habitat is composed of meadow (optimal) and 27 percent or 39 acres is composed of other (sagebrush and CWHR S/P) stands.

Table 64. Comparison of Action Alternatives 1, 3 & 7 on Great Gray Owl Nesting Habitat (4M, 4D, 5M, 5D) within the Wildlife Analysis Area

	Alternative 1 (PA)			% (Alt. 1) Remaining in Wildlife Analysis Area	Alternative 3			% (Alt. 3) Remaining in Wildlife Analysis Area
	Acres				Acres			
	DFPZ*	GS/ Aspen Release	Area Thin*		DFPZ*	GS/ Aspen Release	Area Thin*	
Nesting Habitat								
4M	-43	-8	-2	47.0%	-43	-8	-2	47.0%
4D	-106	-43	-23	59.2%	-110	-21	-25	63.0%
5M	0	0	0	100.0%	0	0	0	100.0%
5D	-28	-17	-16	66.7%	-28	-7	-18	71.0%
Total Nesting Change	-177	-68	-41	59.4% retained (-40.6%)	-181	-36	-45	62.8% retained (-37.2%)

	Alternative 7			% (Alt. 7) Remaining in Wildlife Analysis Area
	Acres			
	DFPZ*	GS/ Aspen Release	Area Thin	
Nesting Habitat				
4M	-10	-8	+72	154.0%
4D	-28	-46	-72	65.4%
5M	0	0	+10	110.0%
5D	-23	-17	-10	72.7%
Total Nesting Change	-61	-71	0	81.3% retained (-18.7%)

* Reductions shown here are due to the removal of the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.) leading to unsuitable nesting habitat.

Changes to suitable habitat as a result of implementing fuels treatments in all action alternatives and area thin treatments in Alternative 1 and 3 would occur due to the removal of large structural components and reduction in canopy cover to 40 - 50 percent. The more open canopied forested stands still retain the minimum canopy cover for suitable habitat but become unsuitable due to the removal of the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.) (see Table 64). DFPZ treatments will bring canopy cover down to 40 percent, the minimum to be classified as M, therefore the minimum to be considered foraging habitat. However, the removal of other important habitat components such as snags and vertical layering further diminish habitat value and render it unsuitable for foraging. Stands treated as area thin also decrease in habitat value due to a reduction in canopy cover to 45-50 percent and the removal of other important habitat components. There may also be some additional risk associated with isolated torching events during prescribed fire that could kill additional trees thus further opening up the

canopy, and reducing foraging and nesting opportunities. Area thin treatments in Alternative 7 would retain the minimum canopy cover for suitable habitat as well as the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.). This would be accomplished through dense retention islands, open growing large overstory trees (large tree radial thin), moderately dense stand and open group selections of young regeneration. Table 64 shows the above mentioned changes to great gray owl nesting habitat by alternative.

Based on figures in Table 64, Alternative 1 reduces nesting habitat on 286 acres of 705 acres or 40.6 percent; Alternative 3 reduces nesting habitat on 262 acres of 705 acres or 37.2 percent; Alternative 7 reduces nesting habitat on 132 acres of 705 acres or 18.7 percent.

Indirect Effects

Group selection openings created within the same watersheds as the existing suitable habitat could provide additional foraging habitat. Project activities are not expected to result in indirect effects, nor are they expected to create conditions that would not allow for occupancy and establishment of a great gray owl territory around the suitable meadow habitat within the project area.

Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the action alternatives evaluates the impact on Sensitive wildlife from the existing condition within the Wildlife Analysis Area. The past actions in the Wildlife Analysis Area that contributed to the existing condition include grazing, timber harvest, and recreation use.

Cumulative effects on the great gray owl are similar to those previously described for the California spotted owl.

Cumulative effects on the great gray owl could occur with the incremental loss of the quantity and/or quality of habitat for this species. Overall, increases in urbanization, increases in recreational use of Forest Service system lands, and the utilization of natural resources on private, state and federal lands may contribute to habitat loss for this species. High intensity stand replacement fires have contributed and would continue to contribute to loss of habitat for this species.

Grazing would be expected to continue on National Forest lands at current levels. There are two livestock grazing allotments (Hat Creek and North Battle Creek) that overlap into the Wildlife Analysis Area of which one is active. One hundred percent of the North Battle Creek allotment is within the project area. Eighty cow/calf pairs are authorized from July 1st thru September 30th. The vacant Hat Creek allotment overlaps approximately sixty percent of the Wildlife Analysis Area. This activity would continue to impact meadow vegetation thus potentially affecting prey species (voles and pocket gophers) abundance and availability due to the lack of suitable breeding, foraging and hiding cover.

The North 49 project potentially contributes to a cumulative reduction in great gray owl nesting habitat. It is uncertain as to what influence these various reductions in habitat would do to great gray owl activity and occupancy within the Wildlife Analysis Area. However, it is not anticipated that this cumulative habitat reduction would have any effect on great gray owls, based on the lack of highly suitable nesting habitat and

retention of at least 59 percent of available suitable nesting habitat distributed across the Wildlife Analysis Area on National Forest lands post project implementation.

Direct Effects of Alternative 2 (No-action)

There would be no direct effects on great gray owls or great gray owl habitat, as no activities would occur that would cause disturbance to nesting or foraging birds, nor any impacts to the existing habitat conditions.

Indirect Effects

Indirect effects of no action include the potential for future wildfire and its impact on habitat development and recovery. The fuel loads that would be left by this alternative would make potential wildfires in the area difficult to suppress and create a more intense burn, which could lead to increased rates of spread resulting in potential loss of suitable great gray owl nesting habitat and other important prey habitat attributes such as large trees, large snags and down woody material.

With the current LNF woodcutting program, the project area would be open to public woodcutting 12 months a year, limited only by available access. Uncontrolled public use within the areas used by great gray owls, especially during the nesting season, could cause disturbance that could disrupt and preclude successful nesting.

Cumulative Effects

The No Action Alternative for the North 49 Project would not provide for the long-term protection of great gray owl habitat from catastrophic fire. There would be no actions designed to reduce the risk of high intensity wildfire. The total acres of wildfire and acres of high intensity wildfire are anticipated to increase from current levels under this alternative (based on analysis conducted in SNFPA (2001). There would be no thinning that could enhance the growth of dominant and co-dominant (20-30 inches) trees that may provide future habitat availability.

Determination – Great Gray Owl

Action Alternatives

The North 49 Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the great gray owl. This determination is based on the following:

1. retention of 59.4 percent to 81.3.6 percent of existing suitable nesting habitat (705 acres) on 45,991 acres of National Forest lands within the Wildlife Analysis Area (Alternatives 1, 3 & 7);
2. creation of a network of fuel reduction areas designed to reduce the loss of habitat due to wildfire.

No Action

The North 49 Project will not affect the great gray owl.

Mesocarnivores

Direct effects of the Action Alternative on Mesocarnivores

A population is defined as a group of individuals of the same species occupying a defined area at the same time (Hunter, 1996). Regarding wolverine and possibly the fisher, all of which have very large home ranges, the LNF would probably contribute to the population within the Sierra Nevada mountain range, if individuals were found on the Forest. Numerous systematic surveys using various accepted methodologies, spatially conducted over 50 percent of the LNF, indicate that the Lassen does not now contribute to the Sierra Nevada populations of these two forest carnivores; they are either non-existent or in such small numbers that the known detection methodologies are inadequate to determine presence. A small population of Sierra Nevada red fox exists on the Lassen NF primarily located within/adjacent to the Lassen Volcanic National Park (LVNP). Sierra Nevada red foxes have not been detected anywhere else on the Lassen for 10 + years. Based on known detections of Sierra Nevada red fox on the LNF, no changes in Sierra Nevada red fox occupancy or distribution on the LNF would occur as a result of the North 49 project.

Potential direct effects on these carnivores from vegetation management activities consist of modification or loss of habitat or habitat components, especially in regards to denning/resting habitat and foraging/travel habitat. Additional direct effects are possible behavioral disturbance to denning from logging, road-building, or other associated activities (refer to HFQLGFRA BA/BE).

Changes to suitable habitat as a result of implementing fuels treatments in all action alternatives and area thin treatments in Alternative 1 and 3 would occur due to the removal of large structural components and reduction in canopy cover to 40 - 50 percent. The more open canopied forested stands still retain the minimum canopy cover for suitable habitat but become unsuitable due to the removal of the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.) (see Table 65). DFPZ treatments will bring canopy cover down to 40 percent, the minimum to be classified as M, therefore the minimum to be considered foraging habitat. However, the removal of other important habitat components such as snags and vertical layering further diminish habitat value and render it unsuitable for foraging. Stands treated as area thin also decrease in habitat value due to a reduction in canopy cover to 45-50 percent and the removal of other important habitat components. There may also be some additional risk associated with isolated torching events during prescribed fire that could kill additional trees thus further opening up the canopy, and reducing denning/resting opportunities. Area thin treatments in Alternative 7 would retain the minimum canopy cover for suitable habitat as well as the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.). This would be accomplished through dense retention islands, open growing large overstory trees (large tree radial thin), moderately dense stand and open group selections of young regeneration. Table 65 shows the above mentioned changes to American marten, Pacific fisher and Sierra Nevada red fox denning and foraging habitat by alternative.

Based on the vegetation layer, about 55 percent or 25,502 acres within the Wildlife Analysis Area (45,991 NF acres) may be considered suitable denning habitat (4D, 5D and 6), and about 10 percent or 4,746 acres may be considered suitable foraging habitat (4M and 5M) (Table 65).

Table 65. Comparison of Action Alternatives 1, 3 & 7 on American marten, Pacific Fisher and Sierra Nevada Red Fox Suitable Habitat (4M, 4D, 5M, 5D) within the Wildlife Analysis Area.

	Alternative 1 (PA)			% (Alt. 1) Remaining in Wildlife Analysis Area	Alternative 3			% (Alt. 3) Remaining in Wildlife Analysis Area
	Acres				Acres			
	DFPZ*	GS/ Aspen Release	Area Thin*		DFPZ*	GS/ Aspen Release	Area Thin*	
Foraging Habitat								
4M	-1,326	-163	-269	55.9%	-1,326	-105	-279	57.1 %
5M	-146	-20	-38	73.2%	-156	-2	-38	74.3 %
Total Foraging Change	**-1,472**	**-183**	**-307**	**58.7 % retained (- 41.3 %)**	**-1,482**	**-107**	**-317**	**59.8 % retained (- 40.2 %)**
Denning Habitat								
4D	-3,913	-773	-1,502	64.4 %	-3,863	-447	-1,480	66.7 %
5D	-1,210	-200	-392	77.6 %	-1,191	-104	-392	79.2 %
Total Denning Change	**-5,123**	**-973**	**-1,894**	**68.7 % retained (-31.3 %)**	**-5,054**	**-551**	**-1,872**	**70.7 % retained (- 29.3 %)**

	Alternative 7			% (Alt. 7) Remaining in Wildlife Analysis Area
	Acres			
	DFPZ*	GS/ Aspen Release	Area Thin	
Foraging Habitat				
4M	-837	-156	+2,191	130.1 %
5M	-46	-16	+727	187.3 %
Total Foraging Change	**-883**	**-172**	**+2,918**	**139.3 % retained (+ 39.3 %)**
Denning Habitat				
4D	-2,195	-656	-2,191	71.0 %
5D	-614	-176	-727	81.3 %
Total Denning Change	**-2,809**	**-832**	**-2,918**	**74.3 % retained (- 25.7 %)**

* Reductions shown here are due to the removal of the needed structural components (snags, vertical and horizontal layering, down woody debris, etc.) leading to unsuitable foraging and denning habitat.

For marten, fisher and red fox habitat, based on Table 65, Alternative 1 reduces 4D and 5D (denning habitat) on 7,990 acres of 25,502 acres, reduces 4M and 5M (foraging habitat) quality on 1,962 acres of 4,746 acres; Alternative 3 reduces 4D and 5D habitat on 7,477 acres of 25,502 acres and reduces 4M and 5M quality on 1,906 acres of 4,746 acres; Alternative 7 reduces 4D and 5D quality on 6,559 acres of 25,502 acres and reduces 4M and 5M quality on 1,055 acres of 4,746 acres. Projected activities within red fir habitat (habitats proposed for entries are Red Fir 4D, 4M, 4P, 5D, and 5M) indicate the following:

- Alternative 1: up to 4 acres in group selection, 28 acres of DFPZ and 0 acres of Area Thin treatments

- Alternative 3: up to 4 acres in group selection, 28 acres of DFPZ and 0 acres AT treatments
- Alternative 7: up to 0 acres group selection, 17 acres of DFPZ and 11 acres AT treatments

Retention of conifer trees >30 inches dbh, and retention of all hardwoods would provide structural attributes selected by fisher for denning and resting sites. Down woody debris would be retained at 10-15 tons/acre in the largest logs. Snags would be retained at four to six snags per acre.

Zielinski et al. (2004) reported that fisher used large trees, large conifer snags and large hardwoods supporting cavities or platforms for rest sites, and suggested that fishers require multiple resting structures distributed throughout their home ranges. Zieleinski et al. suggested that "managers can maintain resting habitat for fishers by favoring the retention of large trees and the recruitment of trees that achieve the largest sizes". With all action alternatives no trees over 30 inches dbh would be removed, four of the largest snags per acre would be maintained (except group selections) and all hardwoods would be retained. Conifers retained possessing one or more of the following characteristics that are of value for wildlife: large limbs extending into the openings and meadows; mistletoe brooms higher than 20' from the ground; multiple tops; bole sweep; broken tops; heart rot; snags; etc would decrease the risk of deleterious effects to old-forest related wildlife over the North 49 project area in the long term (Dunk, 2005).

Indirect effects

All alternatives propose to construct approximately 0.5 miles of temporary road. In addition, 1.8 miles of existing road and 31.3 miles of non-system road would be decommissioned. All new temporary roads, as well as 33.1miles of existing system and non-system roads, would be decommissioned to create conditions to allow for vegetation recovery and to reduce gaps created by road openings. This should also reduce human activities that often lead to decreased habitat capability for carnivores (snag and log removal thru woodcutting, and disturbance). Open road density within the Wildlife Analysis Area would decline under all action alternatives from the existing approximately 2.5 miles/square mile to about 2.2 miles/square mile, which is still providing for low habitat capability for forest carnivores. As part of a strategic system of defensible fuel profile zones, this project would reduce the potential for high-severity wildfires, which could eliminate vast tracts of habitat for these species. Overall this would decrease habitat fragmentation.

It is an unknown as to how some of the important prey species preferred by marten, fisher and red fox (small mammals, birds) would respond to group selection harvest units. The increased diversity and edges created by groups within forested stands may provide increased foraging opportunities for marten, fisher and red fox. Responses of prey species, including small mammals and passerine bird use of group openings and DFPZs is one of the main objectives of the administrative study conducted by PSW.

Cumulative effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the action alternatives evaluates the impact on Sensitive wildlife from the existing condition within the Wildlife Analysis Area. The past actions in the Wildlife Analysis Area that contributed to the existing condition include grazing, timber harvest, and recreation use.

Cumulative effects on the mesocarnivores are similar to those previously described for the California spotted owl.

Cumulative effects on forest carnivores could occur with the incremental reduction of the quantity and/or quality of habitat for this species. Overall, increases in urbanization, increases in recreational use of Forest Service system lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for this species. High intensity stand replacement fires, and the firefighting practices (dozer lines, etc.) used by land managers to control them, have contributed and would continue to contribute to loss of habitat for these species.

The North 49 project potentially contributes to a cumulative reduction in suitable marten, fisher and red fox habitat. It is uncertain as to what influence these various reductions in habitat would do to potential future marten, fisher and red fox activity and occupancy within the Wildlife Analysis Area. These cumulative reductions are not expected to increase any large scale, high contrast fragmentation above existing levels. Thus habitat connectivity is maintained across the Forest north to south from Lassen Volcanic National Park.

The greatest concern for pacific fishers in the Sierra Nevada range is the risk of further fragmentation due to large stand replacing fire (SNFPA FSEIS 2004, page 244). The design features of DFPZs retain habitat elements within the range of those used by fisher for foraging and dispersal such that they are not likely to create large barriers to further expansion and connectivity for fisher (Ibid, page 243). DFPZs are created to reduce the potential for large stand replacing fires.

The fisher does not appear to inhabit the HFQLG area and even if fisher were reintroduced into northern California, it would probably be several years after reintroduction before available habitats would become fully occupied (SNFPA FSEIS 2004, page 243). Based on the home range and stand size reported in the April 8, 2004 Federal Register, it appears as if the North 49 Wildlife Analysis Area supports large blocks of contiguous suitable habitat. Based on studies of home range sizes referenced in the above-mentioned Federal Register, estimates of potentially suitable and contiguous habitat that must be present before an area can sustain a population of fishers range from 31,600 acres in California, 39,780 acres in the northeastern United States, and 64,000 acres in British Columbia. Based on the vegetation layer and GIS, it appears as if the North 49 project falls short of this acreage figure under existing conditions, 30,248 acres of 4M, 4D, 5M, 5D habitats in the Wildlife Analysis Area. Thus the North 49 project area may not support habitat attributes needed to contribute to the potential for recovery of the species in this area of the LNF.

Since no California wolverines are believed to exist in, or near, the Wildlife Analysis Area, no direct, indirect or cumulative impact are expected for the California wolverine.

Direct Effects of Alternative 2 (No-action)

There would be no direct effects on forest carnivore habitat, as no activities would occur that would cause disturbance to denning, resting, dispersing or foraging animals, nor any impacts to the existing habitat conditions.

Indirect effects

Indirect effects of no action include the potential for future wildfire and its impact on habitat development and recovery. The fuel loads that would be left by this alternative would make potential wildfires in the area difficult to suppress and create a more intense burn, which could lead to increased rates of spread resulting in

potential loss of suitable forest carnivore habitat and other important prey habitat attributes such as large trees, large snags and down woody material.

With the current LNF woodcutting program, the project area would be open to public woodcutting 12 months a year, limited only by available access. Uncontrolled public use within the areas used by marten and red fox, especially during the denning season, could cause disturbance that could disrupt and preclude successful denning.

Cumulative effects

The No Action Alternative for the North 49 Project would not provide for the long-term protection of forest carnivore habitat from catastrophic fire. There would be no actions designed to reduce the risk of high intensity wildfire. Total wildfire acres and high intensity wildfire acres are anticipated to increase from current levels under this alternative (based on analysis conducted in SNFPA (2001)). Large scale habitat fragmentation created as a result of wildfire could preclude the North 49 Wildlife Analysis Areas from continuing to provide habitat for martens and red foxes and potentially contributing to fisher recovery.

Determination – Mesocarnivores

Action Alternatives

The North 49 Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for any of the American marten, Pacific fisher and/or Sierra Nevada red fox. This determination is based on the following:

1. retention of 68.7 percent to 74.3 percent of existing suitable denning habitat on 45,991 acres of National Forest lands within the Wildlife Analysis Area (Alternatives 1, 3 & 7);
2. creation of a network of fuel reduction areas designed to reduce the loss of habitat due to wildfire.

It is also my determination that the North 49 Project would not affect the California wolverine.

No Action

The North 49 Project will not affect the mesocarnivores (American marten, Pacific fisher, Sierra Nevada red fox and California wolverine).

Pallid Bat (*Antrozous pallidus*), Townsend's Big-eared Bat (*Corynorhinus townsendii*), and Western Red Bat (*Lasiurus blossevillii*)

Effects of the Action Alternatives to bats

The implementation of Management Area direction and habitat treatments and allocations for California spotted owl, northern goshawk, forest carnivores, and willow flycatchers, including the retention of large trees, retention of hardwoods, snags and LWD and maintaining aquatic/riparian ecosystem processes, would provide many of the habitat attributes necessary to support the sensitive bat species. Potentially suitable habitat may exist within the project area for all three of these bat species (Pallid, Townsend’s big-eared and Western red bats).

Direct effects

Direct effects from the proposed actions are possible if any of these species occurs in the project area. Destruction of active roosts through felling or removal of small trees with hollows could displace or harm individual bats. Chain saw activity or the use of heavy equipment causing ground vibrations may cause noise and tremor disturbance significant enough to cause temporary or permanent roost abandonment resulting in lowered reproductive success. These effects would be most severe during the breeding season (May 20 to August 15) when the potential exists for disturbance to active breeding females and maternity colonies. If any of these sensitive bat species breed in the area, project activities during the breeding season could affect individual bats, including direct mortality. These bats have been known to utilize large conifer snags and tree hollows as day roosting sites, so some roosting habitat may be lost. Habitat attributes such as large live trees, and large snags could be removed or modified by the proposed action alternatives. Hazard trees, including snags, along the road, and those removed for safety reasons, could result in direct mortality of bat species that may be roosting within the tree or snag. However, with all action alternatives no trees over 30 inches dbh would be removed, four to six of the largest snags per acre would be maintained (except group selections) and all hardwoods would be retained. Conifers retained possessing one or more of the following characteristics that are of value for wildlife: large limbs extending into the openings and meadows; mistletoe brooms higher than 20’ from the ground; multiple tops; bole sweep; broken tops; heart rot; snags; etc; all habitat attributes that provide for bat nesting, roosting and/or foraging habitat.

Due to the small size of bats, and the difficulty of surveying for them, it is hard to determine where they are roosting. Because they are insectivores, removal of logs may reduce the amount of microhabitat available for wood boring beetles that may be utilized as prey.

No riparian tree species, including cottonwood and aspen, are planned for removal. There would be no habitat disruption of or modification to rock outcrops, caves and mining adits. No man-made structures that could provide habitat for bats are planned for removal or modification, other than roads and culverts, both of which do not provide habitat.

Indirect effects

No permanent roads would be constructed so no long-term increases in human activity are expected as a result of this action. As part of a strategic system of defensible fuel profile zones, this project would reduce the potential for high-severity wildfires, which could eliminate vast tracts of habitat for these species. Prey base for bats (insects) may have some site-specific short-term reductions post underburning due to direct mortality of eggs, larvae, pupae and adults from fire. However, post fire conditions have been shown, in many instances, to increase plant vigor (Lyon and Stickney 1976, Debyle 1984, Stein et al. 1992). It has also been shown that many herbivore insects preferentially feed on and have increased reproductive success and fitness on more vigorous plants and plant parts, “the plant vigor hypothesis” (Price 1991, Spiegel and Price 1996). Therefore, post fire conditions may increase the forage base available to bats.

Cumulative effects

No populations of sensitive bat species are known to occur in the project area, but based on surveys conducted across the Forest in various habitats, their presence is suspected. Cumulative effects on bats could occur with the incremental loss of the quantity and/or quality of habitat for this species. Overall, increases in

urbanization, increases in recreational use of Forest Service system lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for this species. High intensity stand replacement fires, and the firefighting practices (dozer lines, etc.) used by land managers to control them, have contributed and would continue to contribute to loss of habitat for this species. Construction and strategic placement of DFPZ's can reduce the threat of large scale habitat altering, stand replacing fires, thus providing some protection to residual habitat attributes like large trees, large snags, and buildings across the landscape for bat species use. This action would be a benefit to all bat species through some protection of the residual habitat attributes.

Direct Effects of Alternative 2 (No-action)

There would be no direct effects on bats or bat habitat, as no activities would occur that would cause disturbance to denning bats, nor any impacts to the existing habitat conditions.

Indirect effects

Indirect effects of no action include the potential for future wildfire and its impact on habitat development and recovery. The fuel loads that would be left by this alternative would make potential wildfires in the area difficult to suppress and create a more intense burn, which could lead to increased rates of spread resulting in potential modification of suitable bat habitat including the loss of large trees, large snags and down woody material.

With the current LNF woodcutting program, the project area would be open to public woodcutting 12 months a year, limited only by available access. Uncontrolled public use within the areas used by bats, especially during the breeding season (maternity roosts), could cause disturbance that could disrupt and preclude successful recruitment of young.

Cumulative effects

The No-action Alternative for the North 49 Project would not provide long-term protection of bat habitat from being greatly altered by a catastrophic fire. There would be no actions designed to reduce the risk of high intensity wildfire. There would be no thinning that could enhance the growth of dominant and co-dominant (20 inches-30 inches) trees that may provide future habitat availability.

Determination – Bats

Action Alternatives

The North 49 Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the bats (Pallid bat, Townsend's big-eared bat and Western red bat). This determination is based on the following:

1. No known populations of bats (Pallid bat, Townsend's big-eared bat and Western red bat) in the Wildlife Analysis Area;
2. creation of a network of fuel reduction areas designed to reduce the loss of habitat due to wildfire;

3. implementation of SAT guidelines, meeting RHCA standards and compliance with Riparian Management Objectives would safeguard against any affects to potential habitat, such as riparian hardwoods, snags, and conifers with characteristics valued by wildlife, in these areas.

No Action

The North 49 Project will not affect the bats (Pallid bat, Townsend's big-eared bat and Western red bat).

Shasta Hesperian Snail (*Vespericola Shasta*)

Direct and Indirect effects of the Action Alternatives

It appears unlikely that this species occurs within the Wildlife Analysis Area. The Wildlife Analysis Area is separated from the Pit River by a considerable distance. Although Hat Creek and Lost Creek lie within the Wildlife Analysis Area, and ultimately connect with the Pit River, there is no hydrological connection between Hat and Lost Creeks and the water bodies within the project area. In general, the Wildlife Analysis Area appears to have better drained soils and more open vegetative conditions than the known occurrence areas north of the Pit River. Assuming the Shasta Hesperian snail was to occur within the Wildlife Analysis Area, the species would be restricted to Riparian Habitat Conservation Areas (RHCAs) and protected by the design features being implemented to protect riparian features thus precluding impacts to the species. Because of these protections and the low probability of occurrence, it appears that impacts to this species are highly unlikely.

Determination – Shasta Hesperian Snail

Action Alternatives

The North 49 Project will not affect the Shasta Hesperian Snail. This determination is based on the following:

1. No detections of Shasta Hesperian snails in the Wildlife Analysis Area;
2. creation of a network of fuel reduction areas designed to reduce the loss of habitat due to wildfire;
3. implementation of SAT guidelines, meeting RHCA standards and compliance with Riparian Management Objectives would safeguard against any increased sedimentation that could have short-term affects to potential habitat.

No Action

The North 49 Project will not affect the Shasta Hesperian Snail.

Northwestern Pond Turtle (*Clemmys marmorata*)

Direct and Indirect effects of the Action Alternatives

Potential direct effects to upland habitats include thinning of stands and underburning, both removing vegetative cover and terrestrial structural components across the stand. If Northwestern pond turtle are present, some individuals could be affected by harvest activities during migrations to upland egg laying and overwintering sites. There is no suitable habitat for the Northwestern pond turtle within the Wildlife Analysis

Area. There have been no detections of Northwestern pond turtles within the Wildlife Analysis Area so the risk to the species is remote.

Determination – Northwestern Pond Turtle

Action Alternatives

The North 49 Project will not affect the Northwestern pond turtle. This determination is based on the following:

1. No detections of Northwestern pond turtles in the Wildlife Analysis Area;
2. creation of a network of fuel reduction areas designed to reduce the loss of habitat due to wildfire;
3. implementation of SAT guidelines, meeting RHCA standards and compliance with Riparian Management Objectives would safeguard against any increased sedimentation that could have short-term affects to potential habitat.

No Action

The North 49 Project will not affect the Northwestern pond turtle.

Fire and Fuels

Effects on fire risk and behavior in the North 49 Project area are based on changes to fire fuels which would occur from implementation of the proposed action or alternatives as described in Chapter 2.

Analysis Methodology

Desired Fuels Conditions and Fire Behavior

Managing fuels is paramount in moving the forest toward the desired condition of a fire-resilient and healthy forest. According to the fire behavior characteristics modeled in General Technical Report INT-143, 1983, (Rothermel 1983) flame lengths four feet and under can be safely fought with engines and hand crews. Fuels greater than three inches in diameter create resistance to control by slowing down fire line construction rates. Table 66 shows the desired tons per acre in the project area by fuel type and vegetation type that will achieve four foot or less flame lengths.

Table 66. Desired surface fuel loads (measured in tons per acre) and fuel models in the project area

Vegetation Type	Fuel Model	0-.25 inch material	.26-1 inch plus material	1.01-3 inch material	3+ inch and greater*	Woody material	Total
White fir/Mixed conifer	FM 8	1.05	0.7	1.75	1.0-10.0	0	4.5-13.5
Ponderosa Pine	FM 9	2.04	0.29	0.11	1.0-5.0	0	3.4-7.4
Mixed Conifer	FM 10	2.10	1.4	3.51	1.0-10.0	1.4	9.4-19.4
Lodgepole	FM 10	2.10	1.4	3.51	1.0-10.0	1.4	9.4-19.4
Brush Fields	FM 6	1.05	1.74	1.40	1-2	0	5.1-6.1
Plantations	FM9	2.04	0.29	0.11	1-2	0	3.4-4.4

All data taken from FMA (Fuels Management Analysis) and photo series.
All material is weighed in tons/acre.
*Surface fuels greater than 3 inches contribute towards intensity and spotting but are not part of the fire behavior model.

Fire Weather

The Manzanita Lake Remote Automated Weather Station (RAWS) located approximately one half mile to the south of the project area was selected to obtain 90th percentile weather for use in fire behavior modeling. Table 67 displays 90th percentile weather data for the Manzanita Lake RAWS station. The 90th percentile weather represents the “average worst” weather conditions for days when fires occur during fire season. Fire season on the Lassen National Forest on average starts around the middle of May and ends around the middle to end of October. The 90th percentile conditions would be in effect on 10 percent of all the days that large fires occur on the Hat Creek Ranger District. The 90th percentile weather indices were obtained from station recordings at Manzanita Lake RAWS station between 1967 and 2005,

Table 67. 90th percentile fire weather variables and values

Fuel/Weather Variable	90th percentile values
Temperature	82 degrees
Relative Humidity	12%
Wind speed at 20 feet	11 mph
1 hour fuel moisture	3%
10 hour fuel moisture	4%
100 hour fuel moisture	5%
Slope	10%
Herb. Fuel Moisture	75%
Woody Fuel Moisture	90%

Analysis Tools Used

To model fire behavior at the stand level Crown Mass was used. Crown Mass is one of the tools inside Fuels Management Analyst Suite (2005). Crown Mass uses the work of Alexander (1988), Ryan and Reinhardt (1988) Beukema et al. (1999), Rothermel (1972), Andrews (1989) and Finney (1998) to display the following fire behavior outputs: 1) surface fire rate of spread, 2) surface fireline intensity, 3) surface flame length, 4) crown fire initiation potential, 5) crown fire type, 6) crown bulk density, and 7) crown to base height.

Crown Mass also has some assumptions built into the program. Crown Mass assumes crown loading is evenly distributed vertically within the canopy. Crown Mass also assumes that fire would spread vertically through the densest portion of the canopy, that surface fuels are homogenous across the landscape, topography is homogenous, weather is homogenous, and the fire is a single point source (it does not take into account spotting).

Brush fields and plantations were modeled using the Behave fire program.(Behave Plus 2005) Behave assumes the following information: 1) surface and vertical fuels are homogenous across the landscape, 2) topography is homogenous across the landscape, 3) weather is homogenous across the landscape, 4) the fire is a single point source (it does not take into account spotting), and 5) Fire spreads in an elliptical shape.

Both the Behave and Crown Mass models use Rothermels spread equation that was developed in 1972. This is the only spread equation that is used in fire behavior modeling.

Direct Effects Common to Alternatives 1, 3, and 7

Fire Regimes

Fire regimes do not change following manipulation of the vegetation and surface fuels. The project area would still have fire regimes 1, 2, 3, and 4 (see Table 16 in Chapter 3 for definitions of the fire regimes). The ponderosa pine, aspen and some of the lower elevation mixed conifer on drier site ecosystems would remain in fire regime 1. The meadows would remain in fire regime 2. The higher elevation mixed conifer on wetter sites, white fir and red fir would remain in fire regime 3. The brush fields and lodgepole pine stands would remain in fire regime 4.

Fire Hazard Assessment

The two things contributing to the existing fire situation in the project area are fire risk and fire hazard. The project area is subject to fires caused by people and lightning. The risk of fire from lightning cannot be changed and prevention efforts already exist in the area to reduce the risk of human-caused fire. All three action alternatives reduce the fire risk in the project area by treating surface fuels, and changing the vegetative structure and composition.

Direct and Indirect Effects on Fire and Fuels

Vegetation (fire/fuels)

Ponderosa Pine: Ponderosa pine is adapted to fire. It is also drought tolerant. It has thick bark and open crown structure that allows it to survive most fires. Mature trees will self-prune, leaving a smooth bole, which reduces aerial fire spread. Burning would be conducted in this project area in the spring, early summer, or fall.

There would be some scorching of the crowns as a result of underburning. An effect of the scorching would be pruning of the lower branches, which would raise the crowns of the trees. Raising the heights of the tree crowns from the ground would make it harder for crown fire initiation (Habeck 1992).

Jeffrey Pine: Jeffrey pine has adapted to withstand low severity fires. It has thick, corky bark that withstands high temperatures and has a tall, erect bole free of lower limbs. The buds develop thick scales that are able to withstand considerable amounts of heat. Moderate to high severity fires will kill pole size and smaller Jeffrey pine. Burning would be conducted in this project area in the spring, early summer, or fall. There would be some scorching of the crowns as a result of underburning. An effect of the scorching would be the pruning of the lower branches, raising the crowns of the trees. Raising the heights of the tree crowns from the ground would make it harder for crown fire initiation (Habeck 1992).

Douglas-fir: Douglas-fir can survive moderately intense fires. It has thick corky bark on the lower bole and roots that protect the cambium from damage. Seedlings and saplings are susceptible to and may be killed by even low-intensity ground fires (Uchytil 1991).

Sugar Pine: Mature sugar pine is very resistant to low to moderate severity fires. It has adapted a thick, fire resistant bark and open canopy that retards aerial fire spread. Young sugar pines are susceptible to low to high severity fires (Habeck 1992).

White fir: Sapling and pole size white firs are sensitive to fire due to the thin bark, low growing branches, and shallow roots. As the trees mature, the bark becomes thicker and fire resistant (Uchytil 1991).

Incense Cedar: Incense cedar seedlings and saplings are readily killed by fire. In studies conducted in northern California, a low severity fire killed nearly all seedlings and saplings. Mature incense cedars' thick bark offers protection from excessive heat. Most studies find that only a high intensity surface fire can kill an occasional mature incense cedar (Habeck 1992).

Red Fir: Seedlings of red fir are easily killed by fire. Low intensity fires kill seedlings and saplings of red fir. The bark of older red fir is thick and fire resistant. The needles and branch tips are resistant to fire. Larger California red fir are able to withstand low severity fire but are killed by high severity fires (Cope 1993).

Lodgepole Pine: Lodgepole pine is usually killed by fire due to its thin bark and shallow root system. Lodgepole pine burns in a stand replacement manner, and following fire, it initially establishes in even-aged stands. Smaller scale disturbances following establishment of the stand (windfall, disease, insects) result in lodgepole pine becoming uneven-aged in structure (Cope 1993).

Aspen: Aspen has little heat resistance and is easily top killed by fire. Following a fire, root systems of the top killed trees send up a profusion of sprouts. Fire assists the sprouting of aspen by removing canopy and blackening the soil which increases heat absorption. Large quaking aspen can survive a low-severity surface fire. Fuels are usually moister in quaking aspen stands and quaking aspen stands can act as natural fuel breaks. Quaking aspen are not able to sustain a crown fire (Howard 1996). The aspen improvement in Alternatives 1, 3 and 7 would not affect the overstory trees because the handpiles would be created outside the drip line of the aspen trees.

Underburning following thinning would result in some of the seedling/sapling white fir, red fir, incense cedar, and Douglas-fir dying from the low intensity ground fire. The low intensity ground fire could also result in some sugar pine seedlings/saplings dying within a year following the underburning. The low intensity fire would cause pruning of the trees, thereby raising the base to live-canopy-height.

Machine piling would not have the same effects on vegetation as underburning. Crown height would not be raised by machine or grapple piling. There could be some incidental seedling and sapling mortality from the machines running them over. The machine piles or grapple piles would be constructed in openings away from the drip line of the tree canopy, preventing crown scorch. Creating the piles a distance from the trees would protect tree boles from killing heat.

Plantations

The plantations are comprised of young conifers (ponderosa pine) and brush (primarily manzanita). Thinning, mechanical treatment of the brush and underburning of the plantations would make the plantations resistant to a low to moderate severity fire.

Brushfields

The brush fields in the project area are mostly greenleaf manzanita mixed with ceanothus and other brush species. Associated species include tobacco brush, chinquapin, bitter cherry, gooseberry, and squaw carpet. The two brush fields would be broadcast burned.

Greenleaf manzanita is adapted to fire. It has volatile oils in its leaves, low moisture in its leaves in the summer, and persistence of dead branches and stems. Sprouting from the root burl follows burning of the plant. In some areas, sprouting occurs from seed source in the soil after scarification has occurred (Zimmerman 1991).

Ceanothus species are adapted to fire. Seeds retain their viability for several decades and following a fire to scarify the seeds, they will sprout. The plant also has the ability to sprout from the root crown, if there is no damage to the root crown from fire (Howard 1997, Anderson 2001).

In the areas where the brush would be mechanically treated by mastication, the brush would come back by sprouting from the root burl/root crown. Depending on shade and weather conditions this brush would start to come back within one to two years. In the first 10 to 20 years, due to the new growth of the plants and the lack of dead woody material in the brush fields, a fire would burn with low intensity and in a spotty manner. After about 20 years of age, there would start to be enough woody dead material in the brush to carry a surface fire through the brush field. As the brush field continues to age, more dead material would build up and a fire would change from a moderate to a high intensity fire.

Fire Behavior

The direct effects for fire behavior are common to all three alternatives for the brush fields, plantations and areas treated to 40 percent canopy cover. The difference among the three alternatives is the thinning treatment. Fire behavior is modeled using the surface fuels and environmental conditions (fuel moisture, wind speed, slope). The models show if a fire can move from the surface to the crowns of the trees. The most effective strategy for reducing crown fire occurrence and severity is to (1) reduce the surface fuels, (2)

increase height to live crown, (3) reduce canopy bulk density, and (4) reduce the continuity of the forest canopy (Graham et al. 2004). All three action alternatives treat the surface fuels, reduce the ladder fuels and reduce the crown bulk density.

This additional mortality could increase fire behavior as the trees die, became snags, fall and add to the surface fuel. The additional mortality is not expected to increase fire behavior because fire wood cutters remove dead trees close to roads; maintenance of the DFPZ and Area Thin units during the 20 year period removing additional fuels; and removal of dead trees through the district salvage sale program.

Fire behavior was determined for the conifer stands using the Fuels Management Analysis (FMA) program to predict fire crowning. Brush fields and plantations were modeled using Behave. Brush fields were modeled as a fuel model 6 because they are not as dense as the plantations, nor do they have fuel loads as heavy as the plantations. Plantations were modeled as a fuel model 4 (brush model) pretreatment and a fuel model 9 (timber model – long needled pine) post treatment. A brush model was used for the plantation because it best represents the current condition of the plantation; which is brush growing up into the pine trees, creating a continuous vertical fuel bed. The manzanita in the plantation contributes to the fire behavior due to the volatile oils in the plant. Behave Plus (2005) was used to model these areas using 90th percentile weather data (Table 68).

Table 68. Predicted fire behavior before and 1 year following treatment (Alternatives 1, 3 and 7)

Vegetation Type	Fuel Loading (0-3 inch material)*	Flame Length (ft)	Rate of Spread (chains/hour)
Before treatment			
Brush Fields	6.0 tons per acre	6.0 feet	31 chs/hr
Plantations	16.0 tons per acre	20 feet	68 chs/hr
After treatment			
Brush Fields	2 tons per acre	4 feet	22 chs/hr
Plantations	3.5 tons per acre	3 feet	8 chs/hr

Fire Behavior developed using Behave Plus 3.0.1

As Table 68 shows, by reducing the fuel loading in the brush fields and plantations the flame length is reduced from 6 to 20 feet, (which would require the fire to be fought with indirect fireline requiring mechanical equipment and air tankers), to 4 foot flame lengths, which hand crews and engines can successfully attack directly, meeting the desired condition. Without the treatments the fire could move between 31 to 68 chains per hour, requiring 1-2 bull dozers, 3-6 engines and 3-5 hand crews to construct indirect fireline, which would mean ordering equipment from other forests and cooperators[4]. A fire moving between 8 and 22 chains per hour requires 2-3 engines and 1 hand crew to construct fireline, which would not require ordering extra equipment. Direct fireline is constructed directly on the edge of the fire. Indirect fireline (creating fireline a distance from the fire) would result in a larger, more costly fire. The ability to construct fireline directly on the edge of a fire results in a smaller fire.

[4] A cooperator is a fire resource from another agency.

The plantations and brush fields were modeled for expected fire behavior 20 years post treatment. In modeling the fire behavior in the plantations, maintenance was assumed in the form of an underburn around year ten following the initial treatment.

Table 69. Predicted fire behavior 1 year after treatment and 20 years after treatment (all action alternatives)

Vegetation Type	Fuel Loading (0-3 inch material)*	Flame Length (ft)	Rate of Spread (chains/hour)
Treatment Year 1			
Brush Fields	2.0 tons/acre	Less than 3 feet	22 chs/hr
Plantations	3.5 tons/acre	3 feet	8 chs/hr
20 years later			
Brush Fields	5.1 tons/acre	5 feet	26 chs/hr
Plantations	3.5 tons/acre	3 feet	8 chs/hr

Fire Behavior developed using Behave Plus 3.0.1

Table 69 shows that fire behavior at year 20 in the plantations would decrease from the existing condition. The expected flame lengths in existing condition are 20 feet, meaning firefighters could not construct direct fireline. The post treatment plantations have an expected flame length of 3 feet on which firefighters could directly construct fireline. At year 20 flame lengths are expected to be 3 feet.

Depending on the site and the weather conditions during the 20 year period the brush field could have enough dead and down material in it to consider treating the brush field with fire. Fire behavior at 20 years would exhibit lower flame lengths and rate of spread than the existing condition. Brush fields need to have dead and down material present to carry fire. A 20 year brush field has a low to moderate amount of dead and down material.

Four stands were used in the Crown Mass modeling, as shown below to demonstrate fire behavior in individual stands. Effects were modeled one year and 20 years post treatment. The stands are identified using the Districts stand numbering system. Stand 19-53 is located east of the 16 road, below the boundary for the Thousand Lakes Wilderness, and is a mixed conifer stand. Stand 20-45 is a ponderosa pine stand that is located to the north of Highway 44 and to the west of the Bear-Wallow Butte road. Stand 20-08 is located near the junction of Highway 44 and the 17 road and is a mixed conifer stand. Stand number 21-0018 is located to the west of Grayback Ridge and to the east of the Redlock timber sale.

Critical flame length is the point necessary for a fire to move from a surface fire to the crowns of the trees (torching). Critical flame length is based on the vegetation in the stand, surface fuels, and the canopy base height. Passive crown fire is when several trees or groups of trees will have fire move all the way to the crowns but the crown fire cannot be sustained nor will it move through the stand of trees. A surface fire is a fire that does not carry into the crowns of the trees, but remains on the ground consuming the surface fuels.

Table 70. Predicted fire behavior one, and 20 years after thinning and underburning for selected stands

Fire Behavior	Alternative 2 (No Action)		Alternative 1		Alternative 3		Alternative 7	
	1 year	20 year	1 year	20 years	1 year	20 years	1 year	20 years
Stand Number 19-53 Mixed Conifer in DFPZ								
	1 year	20 year	1 year	20 years	1 year	20 years	1 year	20 years
Flame length (feet)	6.2	6.2	3.5	3.5	3.5	3.5	3.5	3.5
Rate of spread (chs/hr)	8.6	8.6	4.6	4.6	4.6	4.6	4.6	4.6
Type of fire	passive crown	passive crown	surface	surface	surface	surface	surface	surface
Canopy base height (feet)	1 feet	1	10	10	10	10	6	6
Critical flame length(feet)	1.2	1.2	6	6	6	6	4.2	4.2
Stand Number 21-147 Mixed Conifer Not in DFPZ								
	1 year	20 year	1 year	20 years	1 year	20 years	1 year	20 years
Flame length (feet)	3.5	6.2	1.0	1.4	1.0	1.4	1.4	3.5
Rate of spread (chs/hr)	4.6	8.6	1.7	2.1	1.7	2.1	2.1	4.6
Type of fire	passive crown	passive crown	surface	surface	surface	surface	surface	surface
Canopy base height (feet)	1	1	6	20	6	20	4	18
Critical flame length(feet)	1.2	1.2	4.2	9.6	4.2	9.6	3.2	9.0
Stand Number 20-45 Ponderosa Pine in DFPZ								
	1 year	20 year	1 year	20 years	1 year	20 years	1 year	20 years
Flame length (feet)	6.5	6.5	2.1	2.1	2.1	2.1	2.1	2.1
Rate of spread (chs/hr)	26.4	26.4	5.2	5.2	5.2	5.2	5.2	5.2
Type of fire	passive crown	passive crown	surface	surface	surface	surface	surface	surface
Canopy base height (feet)	10	10	20	24	20	24	20	24
Critical flame length(feet)	6	6	11.9	12	11.9	12	11.9	12
Stand Number 22-08 Mixed Conifer in DFPZ								
	1 year	20 year	1 year	20 years	1 year	20 years	1 year	20 years
Flame length (feet)	6.2	6.2	3.5	3.5	6.2	3.5	3.5	3.5
Rate of spread (chs/hr)	8.6	8.6	4.6	4.6	4.6	4.6	4.6	4.6
Type of fire	passive crown	passive crown	surface	Surface	surface	Surface	surface	Surface
Canopy base height (feet)	4	4	18	17	18	17	18	17
Critical flame length(feet)	3.2	3.2	8.6	8.6	8.6	8.6	8.6	8.6

As Table 70 shows[5], reducing the surface fuels reduces the surface fire behavior. In the mixed conifer stands, flame lengths went from 6.4 feet (untreated) to 3.6 feet (post treatment). By treating the surface fuels, the flame lengths are reduced to less than 4 feet, which meets the standards and goals of the 2004 SNFPA of four foot or less flame length under 90th percentile weather. Treating the surface fuels also reduces the fireline intensity (as shown by the reduced flame lengths). As was stated by Martin "fireline intensity is one of the factors that will determine the ability of a coniferous forest to have a crown fire". In the pine stand, flame lengths went from almost four feet to two feet. The thinning of the stands, as Table 70 shows increases the canopy base height (the measurement from the ground to the bottom of the canopy of the stand). Thinning the stands removes the ladder fuels, making it harder for a fire to move from the surface to the canopy. Reducing surface fuels and thinning the timber stands reduces the fire from passive crowning to surface fires. Table 70 shows there is a reduction in the rate of spread of a fire due to treatment of the surface fuels. By reducing the rate of spread of a wildfire, the fire in the treated areas would be smaller when the crews get there, and slower moving. A smaller and slower moving fire would require fewer fire crews to contain it. Because the projected flame lengths are four feet or less, fire crews could work directly at the fires edge to keep the fire smaller.

Thinning the stands, followed by fuels treatment, could result in a microclimate change that would encourage the growth of grasses and forbs over a 2 to 5 year period. This has been observed on other thinning and underburning projects on the District. Underburning would encourage this same type of growth. Underburning the stands would also increased nutrient cycling, making more nutrients available for the remaining vegetation. This change in microclimate and fuels could also change the kind of fire behavior that would occur in the stands. The fires could spread more rapidly (due to the grasses and forbs) but would be of lower intensity and easily extinguished. The mixed conifer ecosystem is adapted to fire. Therefore, the majority of the vegetation in the mixed conifer ecosystem would survive a low intensity fire.

In order for the crowns to be involved in the fire, the surface fire must have enough intensity to heat the canopy of the trees. Intensity of the surface fire must be high, foliar moisture content of the live vegetation must be low, crown base heights must be low enough to interact with the surface fire, and crown bulk density must be high enough to sustain a fire once it gets into the crowns (Sierra Nevada Final Environmental Impact Statement 2001 Volume 2, Chapter 3 page 288). Once a fire gets into the crown of the trees, the probability of sustained crown fire ignition is determined by rate of spread and crown bulk density (Alexander 1988, Van Wagner 1977). Wind and slope determine potential crown fire spread (Rothermel 1991), while species composition and structure determine crown bulk density.

Table 70 shows the expected fire behavior twenty years post treatment. Surface fuel loadings will increase over time due to the accumulation of needles, pine cones, branches, and dead vegetation. Due to the underburning of the project area for maintenance, surface fuels loading will not increase to the point where flame lengths would not meet the desired condition of 4 feet or less. Mortality that occurs within the stand (from drought, insects, disease, and windthrow) is not expected to increase the surface fuel loads due to the

[5] In the 13 Fire Behavior Models (see Aids to Determining Fuel Models for ESTIMATING Fire Behavior, Anderson, General Technical Report INT-122 April 1982) the surface fuels that are measured in the Fire Behavior Model are the 0-3 inch fuels. Surface fuels greater than 3 inches contribute towards intensity and spotting but are not part of the fire behavior model.

districts salvage sale program, underburning of the project area for maintenance, and fire wood cutters. Canopy base heights increase over the 20 year period due to the growth of the trees and underburning for maintenance pruning the lower limbs in the canopy.

Group selection units are not a treatment designed to meet the need of hazardous fuels reduction. The group selection units are small enough in size (2 acres or less) that a high intensity wildland fire would either burn around them or spot across them. The group selection units would have little to no effect on an approaching crown fire. Group selection creates an opening in the stand that results in a microclimate change. This microclimate change (more sunlight) would encourage the growth of grasses and forbs. Within 5 to 10 years brush would replace the grass and forbs. If the release of the brush in the groups does not take place, the combination of brush and increased drying due to sunlight could result in a moderate to high severity fire within the group.

Differences among Alternatives 1, 3, and 7 for Fuels and Fire

For the purpose of the Fuels and Fire analysis, DFPZ treatment includes the thin from below in DFPZ, underburn only acres, modified thin from below with retention islands, a portion of the broadcast burn, and a portion of the release thin in plantations. The difference among alternatives 1, 3, and 7 for fuels and fire management is the location of the DFPZ. In alternatives 1 and 3 the DFPZ is in the same location. In alternative 7 the DFPZ would be moved to take advantage of thinning and fuels treatment that had already been accomplished, and some natural fuel breaks such as lava rock. The DFPZ would also be narrower along the 16 road. Alternatives 1 and 3 treat 10,680 acres of DFPZ and alternative 7 treats 7,320 acres of DFPZ. Alternative 7 treats 7,740 acres of area thin (thinning in areas outside of the DFPZ) and alternatives 1 and 3 treat 4,923 acres of area thin. In all alternatives the surface fuels are treated in the DFPZs and the area thinning, which reduces the fire behavior in the stands post treatment.

Table 71. Comparison of hazardous fuels treatments by alternative

Action	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 7 (Preferred Action)
Treatment Acres for Reducing Hazardous Fuels				
DFPZ Underburn Only (acres)	872	0	872	1,131
DFPZ Release Thin Plantations(acres)	1,678	0	1,678	1,545
DFPZ Thin from Below (acres)	7,703	0	4,886	4,482
DFPZ Modified Thin from Below (acres)	0	0	2,817	0
DFPZ Modified Thin from Below Goshawk PAC (acres)	204	0	294	0
DFPZ Mechanical Thin Goshawk PAC (acres)	90	0	0	30
DFPZ Broadcast Burn (acres)	133	0	133	131
Total Fuels Reduction (acres)	**10,680**	**0**	**10,680**	**7,320**

Cumulative Effects Common to Alternatives 1, 3, and 7 for Fuels and Fire

The area for the cumulative effects analysis discussion is the project area. The reason for using the project area is that fuels are the same both inside and outside the project area. The same fire regimes, fuel models and condition classes occur outside the project boundary as occur inside the project boundary.

Fire regimes have not been changed by the past actions, and would not be changed by the planned or the future actions of the project area.

Past Actions: There have been 31,639 acres of past actions in the project area. The Wheel timber sale and the Redlock timber sale were both thin from below sales that required whole tree yarding. The ladder fuels and canopy fuels (crown bulk density) in both these project areas have been reduced. Parts of both projects have had the surface fuels treated with machine pile and burn treatments. The other activities removed the larger overstory trees from the project area. Many of the trees removed were fire adapted species (pine species, Douglas-fir). When the overstory trees were removed, the slash was left on site and ladder fuels were not treated. In some of these projects the slash was treated and in the rest of the projects the slash was not treated and is contributing to an increase in the surface fuels.

The past actions of increasing the surface and ladder fuels by timber management practices and fire suppression have contributed to the current condition of the project area. In addition, when the Manzanita Chutes was planted, the brush was not treated after the plantation became established.

Present Actions: Underburning for both Redlock and the Highway 44/16 road DFPZ remains to be completed. Stonehenge prescribed burn, Cabin Project, and Deep Red project are to the south of the proposed project area (across highway 44). Both the Cabin and Deep Red projects have fuels treatments of underburning, machine piling and brush burning.

The North 49 project areas treated would reduce the surface fuels through a combination of machine pile and burn and underburning. In the event of a wildfire, the fire would burn with a lower intensity because the surface fuels have been treated. Thinning in the project area would address the ladder fuels and raise the canopy base heights. The thinning treatments, by targeting removal of the white fir, would help the project area become able to withstand fire by leaving the fire adapted pines in the timber stands. The combination of treating the surface fuels, reducing the white fir and thinning would help move the stands towards condition class 2. The North 49 DFPZs are the first set of DFPZs north of highway 44/89 and west of Highway 89. The North 49 DFPZs would not tie in with any DFPZs completed under the North Coble, Pittville, South Station, Blacks Ridge or Big Jacks project due to topography (lava flows covered in brush) and highways. The Cabin and Deep Red DFPZs were constructed along the 17 road south of highway 44/89. The North 49 DFPZs and Cabin/Deep Red DFPZs would tie together at the junction of the 17 road with Highway 44/89 (see Figure 34).

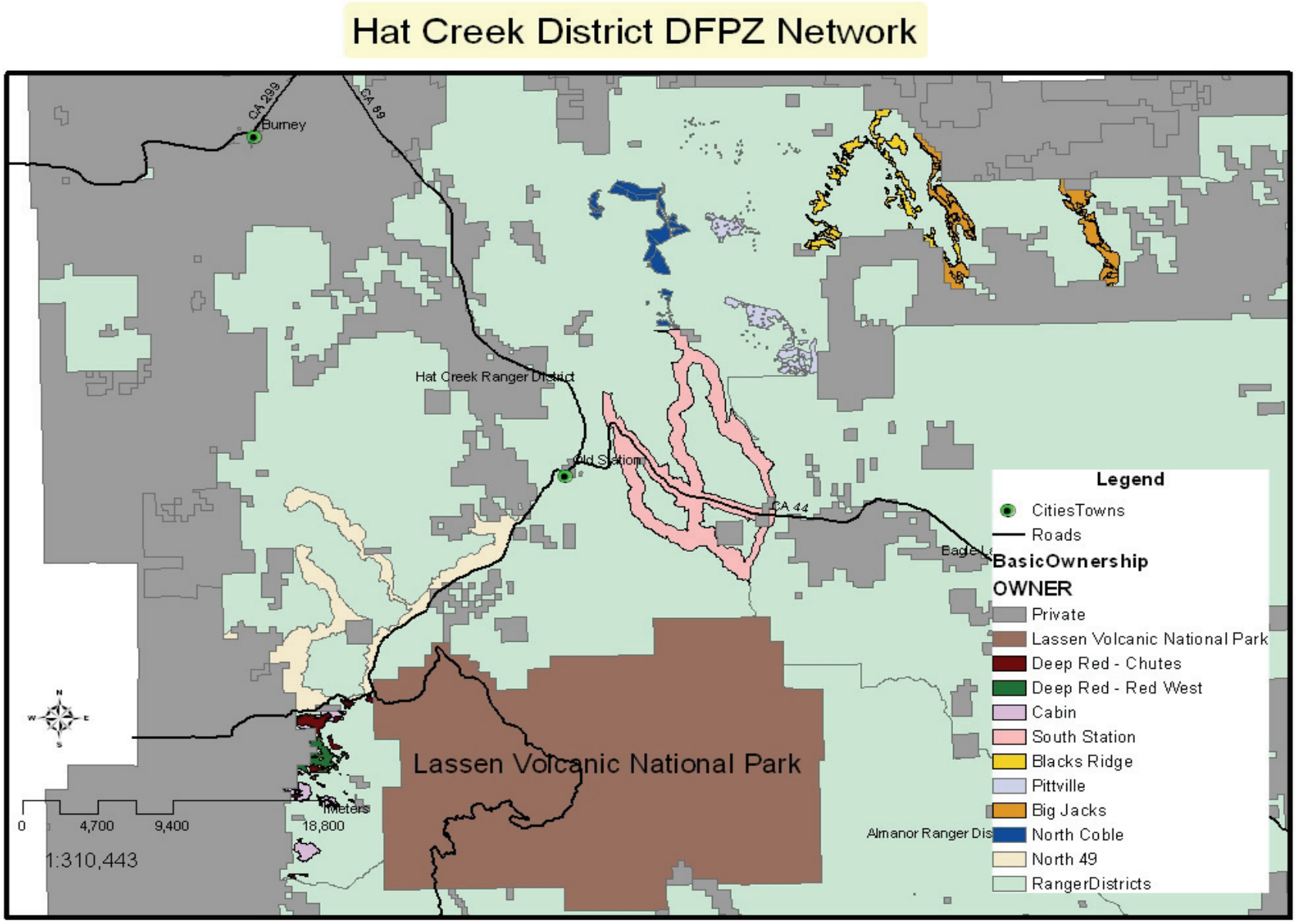

Figure 34. Map of Hat Creek District DFPZ network

Future actions: Future actions would be maintenance of the DFPZs in the North 49, Cabin and Deep Red project. See Appendix A for the discussion of maintenance. The Area Thin units would also be underburned. Depending on the site and conditions, maintenance underburning could start 10- 15 years after completion of the first underburn. The effects to vegetation from the underburning would be the same as in the proposed action. The underburning of the Area Thin units and maintenance of the DFPZs (see Appendix A) would maintain the stands in condition class 2 and help move them towards condition class 1. Maintenance underburning of the project area would keep surface fuel loads from increasing to the point where flame lengths would exceed the desired condition of 4 feet or less. Mortality within the stands (from drought, insects, disease, and windthrow) would not be expected to increase the surface fuel loads due to the District's salvage sale program, maintenance underburning of the project area, and firewood cutting.

Effects of Alternative 2 – No Action

Fire Regime

Under the No Action alternative, the fire regimes would remain the same (see fire regime definitions in Chapter 3). The vegetation in the project area would fall into fire regime 1, 2, 3, and 4. The ponderosa pine, aspen, and some of the lower elevation mixed conifer on drier site ecosystem are in fire regime 1. The meadows in the project area are in fire regime 2. The higher elevation mixed conifer on wetter sites, white fir and red fir forests is in fire regime 3. The brushfields and lodgepole pine stands are in fire regime 4.

Fire Hazard Assessment

The two things contributing to the existing fire situation in the project area are fire risk and fire hazard. The project area is subject to fires caused by people and lightning. Under the No Action alternative, the number of fires from lightning would vary from year to year and could not be changed. Prevention efforts already exist in the area to reduce the risk of human-caused fire.

Fuel loads for the timber stands in this project area would continue to increase from needles, branches, dead vegetation, and tree mortality. Under the existing conditions, the plantations at Manzanita Chutes and the brush fields would continue to have the potential to burn as a high intensity wildfire. As the brush in both the brush fields and plantations continues to age over the next 20 years the dead and down in the brush would continue to increase. Due to the health issues in the plantations, there is expected to be some mortality that would increase the dead and down material, with trees dying, and then over time falling down. Trees 15 inches dbh and smaller last only 2-3 years as snags before they become a surface fuel.

Fire Behavior

The fire behavior in the project area is expected to increase. Table 72 shows how fuel loads (both surface fuel and ladder fuels) increase enough to change surface fire to passive crown fire and passive crown fire to active crown fire. What would change over the 20 years is canopy base height, which would decrease from the continued in growth of shade tolerant species. This change in vegetation would decrease the flame length necessary to move a fire from the surface to the canopy. This decrease would make it easier to establish a passive to active crown fire.

Table 72. Expected fire behavior 20 years in the future

Fire behavior	Stand 19-45 (mixed conifer)	Stand 20-45 (pine stand)	Stand 22-08 (mixed conifer)	Plantations	Brush fields
Rate of Spread (chs/hr)	33.4	9.9	18.8	88	41.0
Flame Length (feet)	87.2	5.4	14.6	25	8
Type of fire	Active Crown Fire	Passive Crown fire	Passive Crown Fire	Active Crown Fire	Surface
Canopy Base height (feet)	3	3	3	0.5	N/A
Critical Flame Length (feet)	2.6	2.6	2.6	N/A	N/A

Fire behavior developed from FMAplus and Behave.

Comparing Table 72 to Table 70 shows that in 20 years fires have the potential to be larger and costlier to suppress. This is based on an increase in flame length in the brush fuel models over time. Flame lengths increase as dead and down material increase. Table 72 also shows that in the plantations flame lengths are expected to increase 5 feet and in the brush they are expected to increase 2 feet. Rate of spread also increases in the plantation from 68 chains per hour to 88 chains per hour and in the brush from 31 chains per hour to 41 chains per hour. This increase in flame length and rate of spread would require more firefighting equipment to suppress a fire. Fires have the potential to be larger and costlier in 20 years.

Direct and Indirect Effects on Fire and Fuels

The No Action alternative would not reduce the fire hazard in the project area. The chance of an ignition in the project area would remain the same. Fire starts occur in a random manner in the project area and would continue to do so in the future. The number of starts in the project area is expected to remain about the same in the future. Both surface and ladder fuels would continue to increase, which would increase the risk of a high intensity fire, should a fire get established. The Manzanita Chutes area is currently at high risk of a high intensity fire due to the plantations, brush, fuels, and topography (south to west slopes exposed to the prevailing wind).

Flame lengths in the timber (using Behave and 90th percentile weather) are expected to be 6.4 feet, requiring indirect fireline and equipment. Indirect fireline takes longer to construct and results in a larger, more expensive fire. Brush fields in the area would continue to become more decadent. Flame lengths in the brush fields are expected to be 15 feet or more, requiring indirect fireline using bulldozers. Air tankers and helicopters would also be needed to safely fight the fire. The plantations with brush in the project area would remain as a continuous fuel bed from the ground up. Flame lengths in these plantations are expected to be 23 feet, requiring air tankers and bulldozers to fight the fire.

In the event of a large fire in the project area (burning under extreme conditions), depending on the location of the fire start, fire could impact Thousand Lakes Wilderness, private lands, Battle Mountain Reservoir, campgrounds, dispersed campgrounds, and wildlife habitat.

Cumulative Effects on Fire and Fuels

The area for the cumulative effects analysis discussion is the project area. The reason for using the project area is that fuels are the same both inside and outside the project area. The same fire regimes, fuel models and condition classes occur outside the project boundary as occur inside the project boundary.

Past Actions: There have been 31,639 acres of past actions in the project area. The Wheel timber sale and the Redlock timber sale were both thin from below sales that required whole tree yarding. The ladder fuels and canopy fuels (crown bulk density) in both these project areas have been reduced. Parts of both projects have had the surface fuels treated with machine pile and burn treatments. These treatments have taken stands that were in condition class 3 and moved them into condition class 2. The other activities removed the larger overstory trees from the project area. Many of the trees removed were fire adapted species (pine species, Douglas-fir). When the overstory trees were removed, the slash was left on site and ladder fuels were not treated. In some of these projects the slash was treated and in the rest of the projects the slash was not treated and is contributing to an increase in the surface fuels. Removing the overstory fire adapted trees, increasing in ladder fuels, and suppressing fires has left these stands in condition class 2 and 3.

The past actions of increasing the surface and ladder fuels by timber management practices and fire suppression have contributed to the current condition of the project area. In addition, when the Manzanita Chutes was planted, the brush was not treated after the plantation became established.

Present Actions: Underburning for both Redlock and the Highway 44/16 road DFPZ remains to be completed. Stonehenge prescribed burn, Cabin Project, and Deep Red Project are to the south of the proposed project area (across highway 44). Both the Cabin and Deep Red projects have fuels treatments of underburning, machine piling and brush burning. Under Alternative 2, the North 49 DFPZ project would not be completed. There would be no connection between the DFPZs constructed under Deep Red and Cabin.

Future actions: Future actions would be maintenance of the DFPZs in the Cabin and Deep Red project.

Air Quality

The greatest potential to affect air quality would result from burn treatments described in Chapter 2. Effects on air quality that could result from implementation of the proposed action or alternatives are analyzed below.

Direct and Indirect Effects on Air Quality Alternative 1

Under this Alternative, 16,900 acres (of thinning, brush fields treatments, and group selection) would be treated by fire after the initial timber harvest. This is 488 acres more than Alternative 3 and 807 acres more than Alternative 7. These acres would be treated as part of the Districts prescribed fire program and, as such, all burning would be take place on permissive burn days. Because these acres would be treated as part of the District’s program of work, the thinning projects would be implemented over a 2-3 year time span. Depending on weather conditions and timing of other projects, it could take between 5 and 7 years to treat following completion of the thinning. Underburning would take place in the fall and spring, machine pile burning and landing pile burning would take place in the fall. Because the burns would happen after completion of the thinning over a 5 to 7 year time period, there would be no difference on the effects to air quality. Currently Shasta County meets National Air Quality Standards (NAAQS).

Direct and Indirect Effects on Air Quality Alternative 3

Under this alternative, 16,412 acres (thinning, brush fields treatments and group selections) would be treated by fire. This is 488 acres less than Alternative 1 and 319 acres more than alternative 7. All burning would take place on permissive burn days. Because these acres would be treated as part of the District's program of work, the thinning projects would be implemented over a 2-3 year time span. Depending on weather conditions and timing of other projects, it could take between 5 and 7 years to treat following completion of the thinning. Underburning would take place in the fall and spring, machine pile burning and landing pile burning would take place in the fall. Because the burns would happen after completion of the thinning over a 5 to 7 year time period, there would be no difference on the effects to air quality. Currently Shasta County meets National Air Quality Standards (NAAQS).

Direct and Indirect Effects on Air Quality Alternative 7

Under this alternative, 16,093 acres (thinning, brush fields treatments and group selections) would be treated by fire, which is the same amount of acres as Alternative 3. Alternative 7 is 807 acres less than Alternative 1, and 319 acres less than alternative 3. All burning would take place on permissive burn days. Because these acres would be treated as part of the District's program of work, the thinning projects would be implemented over a 2-3 year time span. Depending on weather conditions and timing of other projects, it could take between 5 and 7 years to treat following completion of the thinning. Underburning would take place in the fall and spring, machine pile burning and landing pile burning would take place in the fall. Because the burns would happen after completion of the thinning over a 5 to 7 year time period, there would be no difference on the effects to air quality. Currently Shasta County meets National Air Quality Standards (NAAQS).

Direct and Indirect Effects Common to Alternatives 1, 3 and 7

Fugitive dust could result from logging operations such as skidding and hauling during dry seasons. Contractual requirements for standard road watering procedure would mitigate much of the problem. There would also be fugitive dust from local residents recreating in the project area, firewood cutting and hunting.

Thousand Lakes Wilderness and Lassen Volcanic National Park (LVNP) are class one airsheds. Due to the location of this project to the north of LVNP, there is a slight chance of the smoke entering the park. The majority of the burning would take place under a southwest airflow, which would move smoke to the northeast, away from LVNP. By burning on permissive burn days, with good smoke dispersion, LVNP should not be impacted by smoke. Thousand Lakes wilderness is much closer to the project area. There is a chance that smoke from the prescribed fires could enter the Thousand Lakes Wilderness. However, by burning on permissive burn days with good smoke dispersion, Thousand Lakes Wilderness should not be impacted by smoke.

Cumulative Effects Common to All Action Alternatives for Air Quality

The area for the cumulative effects analysis discussion is the project area, Thousand Lakes Wilderness to the north, Lassen Volcanic Park to the south, the project boundary to the west and Old Station to the east. This cumulative effects analysis area was developed based on prevailing winds flows (from the southwest), the location of class one airsheds, and the location of population centers.

Past actions affecting air quality for the past five years in the project area include burning landing piles and miscellaneous handpiles on both federal and private lands on permissive burn days. Because wind events and storms take place (that move or remove the particulates from the air), the impacts from smoke events are short term (less than 2 weeks) and are not cumulative. There has been fugitive dust created from individuals recreating in the area. There have been no large fires in the project area, although in 1999 and 2002 the air quality was impacted by large fires burning elsewhere in northern California and Oregon. These smoke events, depending on the prevailing winds and the high pressure system aloft, lasted from 2-3 days to 1-2 weeks. Again due to the westerly flow of winds and precipitation events dispersing the smoke, there are no cumulative impacts from smoke.

The proposed underburning/machine piling and burning would occur after thinning is complete. It is estimated that the underburning would take 5-7 years to complete. As long as burning were conducted on permissive burn days and within the air quality constraints of Shasta County, there should be no effect to the air quality of the project area. A wildfire within the project area, or to the south and west, including wildfires on other forests within the region, could impact the air quality of the area.

Foreseeable future actions include prescribed burning as part of DFPZ maintenance on the proposed North 49 project and other projects in the adjoining areas (Deep Red, Cabin) (see Appendix A for maintenance schedule of the DFPZs). The other future project is the burning of Stonehenge. The DFPZ maintenance on the North 49 project, Deep Red and Cabin, would involve underburning. The underburning would all take place on permissive burn days that allow for smoke dispersion so there would be no effect (either short or long term) to the air quality of the area.

The Area Thin units would be underburned at the same time maintenance is taking place in the DFPZs. Because this would be a second entry underburn, there would be less surface fuel than the first entry. This should reduce smoke impacts to the area. As long as burning is conducted within the air quality constraints of Shasta County, there should be no effect to the project area. The LVNP should not be impacted by these activities because, while the LVNP lies south of the project area, the prevailing wind is from the southwest, which would move the smoke to the northeast. With less smoke produced by the second entry and with the LVNP being to the south of the project area, there would be little chance of smoke entering the LVNP. There would also be less chance of smoke impacting the Thousand Lakes Wilderness with the second entry as the underburning would produce less smoke, compared to the initial underburning operations, and would be conducted on permissive burn days with good smoke dispersion.

Direct, Indirect and Cumulative Effects on Air Quality Alternative 2

The area for the cumulative effects analysis discussion is the project area, Thousand Lakes Wilderness to the north, Lassen Volcanic National Park (LVNP) to the south, the project boundary to the west and Old Station to the east. This cumulative effects analysis area was developed based on prevailing wind flows (from the southwest), the location of class one airsheds, and the location of population centers.

The No Action alternative would not create a short-term impact to the local areas from prescribed fire. The air quality within the project area would remain within national and state levels for visibility, particulate levels, and pollutants. The air quality within the project area could still be affected by pollutants from downwind population centers such as the towns of Red Bluff and Redding, by agriculture in the valley and

adjacent private forest activities. Air quality would also be influenced by traffic from Highway 44, which could raise carbon dioxide and ozone levels along the travel corridors. There also would be fugitive dust from local residents recreating in the project area, firewood cutting and hunting. The risk of a major air quality impact from a large wildfire burning in the area would increase as the fuel load increases.

In the event of large wildfires burning in the project area, the amount of smoke created is increased for several reasons: more acres burn in a short period of time, burning under hotter and drier conditions increases surface fuel consumption, and green needles from the ladder fuels and canopy contribute to smoke production. Due to summertime inversions, the smoke from wildfires gets trapped in the valleys for long periods of time (2 to 3 weeks), as occurred during the summers of 1987, 1992, 1999, and 2000 (personal observations of local residents). During the summers of 1987, 1992, 1999, and 2000, large fires burned in northern California. These fires burned to the south and the west of the project area within several hundred miles and impacted the project area by reducing visibility. Depending on the weather conditions and for how long the fires burn the visibility can be impacted for 2 to 3 weeks at a time. This smoke, depending on duration and particulate matter, can create health problems for the young, elderly and sick. This smoke also impacts the local communities, the campgrounds and the wilderness areas by reducing visibility. Due to westerly winds and precipitation events the smoke is dispersed and does not have a cumulative impact to the analysis area.

Past actions affecting air quality for the past five years in the project area include burning machine piles, landing piles and miscellaneous handpiles on both federal and private lands. This burning took place on permissive burns days. Because wind events and storms take place, the impacts from smoke are short term (less than 2 weeks) and are not cumulative. There has been fugitive dust created from individuals recreating in the area. There have been no large fires in the project area, but in 1999 and 2002 the air quality was impacted from large fires burning elsewhere in northern California and Oregon. These smoke events, depending on the prevailing winds and the high pressure system aloft, lasted from 2-3 days to 1-2 weeks. Again due to the westerly flow of winds and precipitation events dispersing the smoke, there are no cumulative impacts from smoke.

Present Actions include prescribed burning of other projects in the adjoining areas (Deep Red, Cabin, and Stonehenge). Underburning of the Wheel/Highway 44 and Redlock projects is incomplete. The DFPZ maintenance on the Deep Red and Cabin projects will involve underburning. Prescribed fire projects in the adjoining areas will take place on permissive burn days for Shasta County that will allow for good smoke dispersion, so there are no short or long term effects to the project area.

Future Actions that are foreseeable are the maintenance burning of the DFPZs completed under the Cabin and Deep Red projects.

Soils and Hydrology

The information on soils and hydrology presented below is extracted from a Soil Specialist Report and a Watershed Report conducted in the North 49 Forest Health Recovery Project. The full reports are on file as part of the administrative record and are incorporated here by reference. The soils and watershed analysis includes a review of pertinent regulations and analysis of possible adverse effects to soil and water.

Analysis Area

The analysis area for direct and indirect effects is the project area, approximately 42,400 acres. This includes 37,173 acres of National Forest System Lands. Major stream drainages include North Fork Battle Creek in the western side of the project area with Lost Creek and Hat Creek bordering the project area to the east and Manzanita Creek bordering the project area to the south. For cumulative effects the analysis area includes all sub-watersheds with over one percent of the sub-watershed within the project area.

Table 73. Subwatersheds and land ownership within the project area

Watershed Name	Sub-watershed Number	Sub-watershed Name	Sub-watershed Acres	Land Ownership % of Sub-watershed			Project area acres within Sub-watershed	Percent of Sub-watershed within Project Area
				USFS	Private	Other*		
Battle Creek	BC16	Lower Manzanita Cr.	5,632	47%	53%	0%	504	9
	BC17A	Nobles (N. of Hwy 44)	2,776	72%	0%	28%	1,393	50
	BC18	Bridges Cr.	4,193	1%	94%	5%	485	12
	BC18A	Manzanita Chutes	5,730	81%	19%	0%	5,386	94
	BC19	McCumber	3,837	2%	97%	1%	143	4
	BC20	Upr.N.Fk. Battle Cr (Below Dam)	3,183	77%	5%	18%	2,602	82
	BC20A	Upr.N.Fk. Battle Cr (Above Dam)	4,200	70%	30%	0%	4,175	99
Hat Creek	HC22	Bunchgrass	15,578	98%	2%	0%	11,773	76
	HC23	Logan	15,929	71%	29%	0%	7,589	48
	HC29	Big Lake	3,591	86%	14%	0%	3,591	100
	HC30	Lower Lost Creek	16,202	64%	15%	21%	3,270	20
	HC37	Red Lake	1,092	100%	0%	0%	1,092	100
Old Cow Creek	OCC1	Old Cow Creek Meadows	2,028	89%	6%	5%	193	10

* Other ownership consists of lands administered by the State of California and the National Park Service.

There is mixed ownership within the watershed among private entities, the Forest Service, the National Park Service, and the State of California. The Forest Service manages most of the land in each of the watersheds except Bridges Creek, Lower Manzanita, and McCumber (Table 7), where private land makes up 94 percent, 97 percent, and 53 percent of those watersheds respectively. These lands are actively managed for timber by SPI, Fruit Growers, Inc. and Beatty. The Forest Service owns 100 percent of the land in Red Lake watershed and 98 percent of the Bunchgrass watershed. The National Park Service manages 28 percent of the

land in Nobles sub-watershed and 21 percent of the land in Lower Lost Creek sub-watershed. Those areas may have fuels reduction projects, but no timber harvest activities would occur in those areas.

Regulatory Framework for Analysis

The regulatory framework guiding this analysis is provided by the Lassen LRMP as amended. For the sub-watersheds in the Battle Creek and Old Cow Creek watersheds, the long-term strategy for anadromous fish-producing watersheds as contained in the SNFPA FEIS (USDA FS 2001a) provides direction for riparian and watershed protection measures. For the sub-watersheds within Hat Creek watershed, the SAT guidelines as defined in the HFQLG ROD (USDA FS 1999b), guides riparian protection measures. Further direction is provided by Region 5 Best Management Practices (BMPs, 2000). For soils, the 2004 Sierra Nevada Framework (USDA FS 2004) amends the standard for large woody material to 3 logs per acre.

The State and Regional Water Quality Control Boards entered into agreements with the U.S. Forest Service to control nonpoint source discharges by implementing control actions certified by the State Water Quality Control Board and the EPA as best management practices (BMPs). BMPs are designed to protect and maintain water quality and prevent adverse effects to beneficial uses both on-site and downstream. In addition, the land disturbing activities would be dispersed in time and space so that the subwatersheds would not reach or exceed the threshold of concern for overall watershed disturbance. A complete list of applicable BMPs for this project can be found in Appendix C of this document.

Information Sources

Soil and hydrology field surveys occurred in the summer of 2002, with additional soil survey in 2007. These surveys evaluated soil properties, soil compaction and disturbance, cover and woody debris. Surveys also looked for roads with connected disturbed areas potentially adding to sediment problems of streams. In the spring of 2005 further field work was conducted to field check GIS data for streams and verify presence or absence of water.

GIS information and past, present and reasonably foreseeable timber sale information was supplied by the Hat Creek district. Information on harvest of private timber lands was supplied by the timber companies Sierra Pacific Industries and Fruit Growers, Inc. and summarized by District personnel.

Beneficial Uses

Beneficial uses for the watersheds contained in the project area include power generation, agriculture (irrigation and stock watering), warm and cold freshwater habitat, cold water migration, warm and cold water spawning, wildlife habitat and recreation. There are no 303d waterbodies within the project area. The State and Regional Water Boards entered into agreements with the U.S. Forest Service to control nonpoint source discharges by implementing control actions certified by the State Water Board as BMPs. It is the intent that the BMPs identified for this project will maintain water quality within these sub-watersheds and prevents adverse effects to beneficial uses, either locally or downstream.

Effects on Soils

Direct, Indirect and Cumulative Effects of Alternative 2 – No Action

The following analysis of the cumulative effects of past, ongoing, and reasonably foreseeable future actions on soils is for the whole North 49 project area. This is the management area where soil disturbing activities are proposed, and is of a practical size for evaluation and management of sub-watersheds, topography and soil family complexes. The North 49 Project Area Boundary was used as the geographical boundary for cumulative effects because it is land dedicated to growing vegetation where soil productivity standards can be applied. A sufficient number of site specific evaluations were completed to ensure a reasonable determination of existing soil conditions.

Past actions are reflected in the current condition of the soil resource as assessed previously under Affected Environment. The build up of fuels and the risk of a high intensity wildfire has the greatest potential to affect soil productivity.

Increased biological activity associated with the accumulation of a thicker duff and litter layer could accelerate the recovery of compacted soils from previous entries. Although ground cover would also increase, cover is already at levels more than sufficient to protect soils from erosion. LWM would increase gradually over time.

However, increases in duff, litter, and LWM would also be additions to the existing high fuel loading. This high fuel loading would result in abnormally intense wildfires. The effects of wildfire on soils are not the same as for prescribed burns.

Wildfire has a greater potential than prescribed fire to affect long-term soil productivity (McNabb and Cromack 1990). Compared to prescribed burns, wildfires are more intense, consume more organic matter, burn longer, occur when soils are drier, and have higher levels of volatilization and convective losses. Adverse effects of fire on soils increase with increasing burn intensity, and the effects are proportional to the amount of surface duff and soil organic matter consumed (DeBano 1979). Frequent, high intensity fires—except on sites adapted to such fire regimes—reduce nutrient reserves and can initiate a decline in long term soil productivity. Intense wildfires also create large openings. This can result in a loss of host plants for mycorrhizal fungi which can lengthen the time it takes to reinocculate the site (Borchers and Perry 1990). As fire intensity increases, increasing amounts of N—and, to a lesser extent; P and S—are volatilized and lost to the atmosphere. Other nutrients may be lost in large fires of high intensity as convective fly ash in the smoke plume (Clayton and Kennedy 1985).

The plant nutrient most affected by fire is nitrogen. At temperatures below 200°C no measurable N is lost; above 500°C, all N is volatilized. McColl and Powers (1984) summarized N losses for different burn intensities. Under severe burns, N losses ranged from 72 to 99 percent, but under moderate intensity burns, losses ranged from 11 to 38 percent. An intense wildfire may volatilize the equivalent of 200 years of N input as precipitation (Powers 1979). Losses of sulfur and phosphorus are proportional to nitrogen losses, but smaller, about 5-9 percent of nitrogen loss. Sulfur is important in decomposition of organic matter and in nitrogen metabolism. Sulfur is of concern because it is not fixed, but is added to the ecosystem abiotically through precipitation and mineral weathering. The origin of atmospheric S is fossil fuel consumption, acid

deposition, and volcanic eruptions. Soils that are subjected to intense wildfire more frequently than every 100 years may experience productivity decline (McNabb and Cromack 1990).

An intense wildfire would destroy soil organic matter near the surface (McNabb and Cromack 1990; Boyer and Dell 1980). The loss of ground cover and the formation of hydrophobic soils following wildfire would increase the risk of accelerated erosion and a consequent loss of topsoil and soil organic matter. The low EHRs and gentle slopes in the North 49 Project area mitigate this effect to some extent.

The effects of an abnormally intense wildfire could have a major effect on long-term soil productivity.

General Direct Effects of the Action Alternatives

The treatments are described in detail in the silvicultural section of this chapter. Table 74 displays the direct effects of the various treatments under the three action alternatives. These direct effects would be mitigated by the project IDFs.

Table 74. Summary of direct effects of proposed treatments on soil resources

Proposed Treatment	Alternatives Treated	Ground Cover	Soil Porosity	Soil Organic Matter	Litter and Duff	Large Woody Material
A) Area Thin: Broadcast Burn, Brushfields	1, 3	temporary short - term reduction; partially offset by needle cast	no effect	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
B) Area Thin: Release Thin, Plantations, Masticate, Machine Pile, Underburn	1, 3, 7	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
C) Area Thin: Thin from Below, Machine Pile, Underburn	1, 3	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
D) Area Thin: Modified Thin from Below w/ Retention Islands Machine Pile, Underburn	1, 3	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
E) Area Thin: Underburn	1, 3	temporary short - term reduction; partially offset by needle cast	no effect	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
F) Area Thin: Aspen Release	7	temporary short - term increase; reduction due to increased oxidation	minimal reduction expected in new landings and skids trails	no effect	temporary short - term increase; reduction due to increased oxidation	no effect
G) Area Thin: Diversity Thin Machine Pile, Underburn	7	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment

Proposed Treatment	Alternatives Treated	Ground Cover	Soil Porosity	Soil Organic Matter	Litter and Duff	Large Woody Material
H) DFPZ: Aspen Release	1, 3, 7	temporary short - term increase; reduction due to increased oxidation	minimal reduction expected in new landings and skids trails	no effect	temporary short - term increase; reduction due to increased oxidation	no effect
I) DFPZ: Release Thin, Plantations, Masticate, Machine Pile, Underburn	1, 3, 7	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
J) DFPZ: Modified Thin from Below w/ Retention Islands Machine Pile, Underburn	1, 3	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
K) DFPZ: Thin from Below, Machine Pile, Underburn	1, 3, 7	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
L) DFPZ: Underburn	1, 3, 7	temporary short - term reduction; partially offset by needle cast	no effect	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
M) DFPZ/WUI: Broadcast Burn, Brushfields	1, 3, 7	temporary short - term reduction; partially offset by needle cast	no effect	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment

Proposed Treatment	Alternatives Treated	Ground Cover	Soil Porosity	Soil Organic Matter	Litter and Duff	Large Woody Material
N) DFPZ/WUI: Release Thin, Plantations, Masticate, Machine Pile, Underburn	1, 3, 7	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
O) DFPZ/WUI: Thin from Below, Machine Pile, Underburn	1, 3, 7	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
P) DFPZ/WUI: Underburn	1, 3, 7	temporary short - term reduction; partially offset by needle cast	no effect	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
Q) WUI: Thin from Below, Machine Pile, Underburn	1, 3, 7	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
R) WUI: Underburn	1, 3	temporary short - term reduction; partially offset by needle cast	no effect	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
S) WUI: Release Thin, Plantations, Masticate, Machine Pile, Underburn	7	temporary short - term reduction; partially offset by needle cast	minimal reduction expected in new landings and skids trails	no effect	temporary short- term reduction; partially offset by needle cast	potential reduction from burning; partially offset by snag recruitment
T) Group Selection	1, 3, 7	reduced	high potential for porosity loss; greater harvest level (more skid and landings), machine site prep	potential to displace soil to burn piles while machine piling	reduced by multiple equipment passes	reduction; risk of damage by to existing LWM by equipment operations; some offset by snag recruitment

General Indirect Effects of Action Alternatives on the Soil Resource

Soil Compaction: Any soil compaction associated with new landings and skid trails would decrease infiltration and could reduce hydrologic function, increase the risk of soil erosion, and reduce soil buffering capacity.

Thinning: The canopy reduction resulting from thinning would increase surface soil temperatures. This would increase the rate of oxidation of surface duff and litter and promote a thinner litter layer. However, a thinner litter layer may have existed under historical levels of more frequent fires. A thinner litter layer would also result in a faster rate of spread for fire, with shorter residence times. This would deliver less heat to the soil and reduce the potential for soil damage.

Underburning: The frequent, low intensity fires typical of prescribed burns increase soil productivity over the long term (Klemmendson et al. 1962). Low intensity burns can increase soil nitrogen. Heating and combustion increases ammonia (Dunn and DeBano 1977) making it readily available for plant uptake. Nitrification is also stimulated by reduction of repressive tannins and by increases in ammonium (Powers 1979).

Group Selection: Loss of canopy in group treatments would increase surface soil temperatures. This would increase the rate of oxidation of surface organic matter, reducing ground cover and duff and litter. This effect would persist for 10 to 15 years until newly planted trees begin to shed enough needles to develop surface cover. Where groups are located on steeper slopes the loss of ground cover could lead to erosion and a loss of soil organic matter. Machine piling and burning could lead to concentration of soil nutrients under burn piles.

Mastication: The thick mulch created by mastication would lower surface soil temperatures. This would promote the accumulation of soil organic matter. The mulch created by mastication would accelerate the recovery of skid trails that are slightly too moderately compacted, including those from previous entries. Mastication operations would break up and mix the existing duff and litter. This could increase the rate of oxidation of surface organic matter. The mulch created by mastication would result in less intense but longer burning fires. This would deliver more heat to the soil and increase the potential for soil damage.

Piling and Burning: Machine piling and burning would result in less litter and duff material in treatment area. The burning of machine piles, depending on size, would transmit more intense and isolated heat to the soil, potentially damaging. Less duff and litter material resulting from machine piling and burning may result in the decreased formation of soil organic matter and extend the recovery time for compacted regions of skid trails and landings.

Most of these potential indirect effects on soils would be minor and would not have an effect on long-term soil productivity. Frequent underburning has the potential to increase soil productivity over the long-term.

Cumulative Effects of the Action Alternatives

The affects of action alternatives on the North 49 Project area are analyzed and the cumulative effects past, ongoing, and future reasonably foreseeable future actions on soils are described. This is the management area where soil disturbing activities are proposed, and is of a practical size for evaluation and management of sub-watersheds, topography and soil family complexes. The North 49 Project Area Boundary was used as the

geographical boundary for cumulative effects because it is land dedicated to growing vegetation where soil productivity standards can be applied. A sufficient number of site specific evaluations were completed to ensure a reasonable determination of existing soil conditions.

Past actions are reflected in the current condition of the soil resource as described under Affected Environment. The future actions with the greatest potential to affect soil productivity are the treatments for the North 49 area shown in Appendix A, Table A-8.

Soil Cover: Present cover is well above the minimum levels in the LRMP soil standards except in the north-central area near 33N16 (UTM 0617091/4501670). Soils here have experienced excessive erosion from rain-on-snow events. In spite of short-term losses of cover following prescribed burns, cover is expected to be sufficient to protect soils from erosion. Soils in the project area typically have low EHRs and slopes are gentle.

Soil Porosity: Despite the numerous harvest entries into the area, the current level of detrimental soil compaction is generally low. This is mainly because soils have a moderate to low susceptibility to compaction because of rock content and soil textures. Planned repeated entries have the potential for additive effects because it is not always possible to confine traffic to existing skid trails and landings. Other projects in the area could incrementally add to soil disturbance and compaction. It is also difficult to predict the effects that changes in technology and economics might have on future equipment to harvest, yard, and process materials. These changes could be either positive or negative in terms of soil impacts. With implementation of the IDFs it should be possible to avoid detrimental effects on soil porosity.

Soil Organic Matter: The proposed project and management direction would result in the movement toward historical conditions with more frequent but less intense fires which would increase nutrient cycling (McColl and Powers 1984; Klemmendson et al. 1962; Powers 1979). This will cause soil organic matter to increase over time.

Litter and Duff: As stands become more open through thinning, and with continued underburning and maintenance underburns, the litter and duff will become thinner, less dense, and patchier. Current standards will still be met, but the character and qualities of the duff and litter will change.

Large Woody Material (LWM): Overall, LWM standards are currently just barely met within the area. Over time, repeated underburns would very likely lead to even lower levels of LWM. Even the best efforts to protect LWM during underburns, thinnings, and group selections would not be 100 percent successful. Over time, the amount of LWM should approach levels more typical of historical fire regimes.

The Region 5 Soil Quality Standards recommend that thresholds for LWM be developed by ecosystem type. At this time the historical level of LWM for frequently underburned eastside forests is unknown, but is probably lower than the current LRMP standard. Although LWM is known to provide wildlife habitat, diversity, and sites of refuge for soil macro- and microorganisms, its contribution to overall soil productivity is unknown and believed to be trivial. Recommended thresholds for LWM will change as research determines the function and appropriate levels of LWM for eastside ecosystems.

Summary: At the present time the North 49 Project area meets the Forest standard to limit the areal extent of detrimental soil disturbance to 15 percent or less of the area dedicated to growing vegetation. With the proper

application of IDFs, the cumulative effects of past, ongoing, and reasonably foreseeable future actions would not cause this standard to be exceeded.

Comparison of Alternatives

Alternative 1 Compared to Alternative 3

Under Alternative 1 mechanized treatments would occur on 713 more acres than under Alternative 3. Under Alternatives 1and 3 soils would exhibit a low to moderate detrimental compaction risk rating (Soil Specialist Report) with implementation of IDFs and BMPs.

In terms of mechanical treatments, less acreage is treated in Alternative 3 by approximately 713 acres. This decrease includes 271 acres of group selection. With the exception of mechanized Aspen Release treatments, burning of machine piled woody material and underburning will reduce post operation fuel loads.

Integrated design features (IDFs) to operate when soils are dry and are resistant to soil compaction will apply to both Alternatives. The differences between the two alternatives in acres treated mechanically are small. For these reasons, the effect of mechanized treatments on soils would essentially be the same for both alternatives.

The main difference in mechanized treatments is related to the Group Selection treatments. Acres treated by underburning and mastication would be essentially the same under both alternatives. There would be no difference between the two alternatives in the effects of the non-mechanized treatments.

Alternative 1 Compared to Alternative 7

Under Alternatives 1and 7 soils would exhibit a low to moderate detrimental compaction risk rating (Soil Specialist Report) with implementation of IDFs and BMPs.

Under Alternate 7, mechanized treatments would occur on 684.4 less acres than under Alternative 1.

In terms of mechanical treatments, the main difference between the two action alternatives is the 588.4 acres of mechanized thinning excluding Group Selection (T). With the exception of mechanized Aspen Release treatments, burning of machine piled woody material and underburning will reduce post operation fuel loads.

Integrated design features to operate when soils are dry and are resistant to soil compaction will apply to both alternatives. The differences between the two alternatives in acres treated mechanically are relatively small. For these reasons, the effect of mechanized treatments on soils would essentially be the same for both alternatives.

The main difference in mechanized treatments is related to the Group Selection treatment. Acres treated by underburning and mastication would be essentially the same under both alternatives. There would be essentially no difference between the two alternatives in the effects of the non-mechanized treatments.

Alternative 3 compared to Alternative 7

Under Alternate 7 mechanized treatments would occur on only 29 more acres than under Alternative 3. Alternative 7 also prescribes 139 more acres of Mastication (B, I, N, and S) and 148 acres of Group Selection. Alternative 3, however, provides for underburning in 544 more acres than prescribed in Alternative 7.

In terms of mechanical treatments, there exists a trade-off between the mechanized work (main difference between the two action alternatives is the 705 acres of mechanized work at 119.3 acres and the 148 acres of Group Selection treatments. With the exception of mechanized Aspen Release treatments, burning of machine piled woody material and underburning will reduce post operation fuel loads.

Integrated design features to operate when soils are dry and are resistant to soil compaction will apply to both Alternatives. The differences between the two alternatives in acres treated mechanically are small. For these reasons, the effect of mechanized treatments on soils would essentially be the same for both alternatives.

Acres treated by underburning and mastication would be essentially the same under both alternatives. There would be no difference between the two alternatives in the effects of the non-mechanized treatments.

No Action Alternative to the Three Action Alternatives

The differences between the No Action alternative and the three action alternatives are related to fire behavior and soil compaction. The thinning and underburning proposed under all action alternatives would move the area toward historic fire frequencies. The open stands and frequent low intensity underburns would enhance soil productivity. The No Action alternative would maintain—and over time increase—the risk of a severe intensity wildfire. This would severely damage soils and could lead to a long-term decline in soil productivity. The No Action alternative avoids increasing soil bulk density through equipment movement. However, if the Action alternatives are completed properly with oversight from a soil scientist, soil productivity existing prior to in-field operations can be maintained.

Summary of Direct, Indirect, and Cumulative Effects on Soils

Action Alternatives 1, 3 and 7

The action alternatives, combined with past, current, or reasonably foreseeable future actions, would not cause a reduction in long-term soil productivity.

The proposed activities under the two action alternatives involve ground-disturbing activities with mechanized equipment, including timber harvest, thinning, mastication, and site preparation. Levels of detrimental soil disturbance from past activities are generally low, and within LRMP soil standards. Proposed treatments are on sandy to loamy soils with high rock content. These soils have a low to moderate susceptibility to compaction and a low to moderate erosion hazard, and occur on gentle slopes. With implementation of IDFs, treatments involving mechanized equipment under either of the proposed alternatives would have no measurable direct effects to long term soil productivity.

The direct effect of the prescribed burning proposed under the action alternatives would be a temporary reduction of soil cover, duff, and litter. Needlecast and litterfall would offset this temporary reduction. Thinning and underburning would create open stands with a thinner duff and litter layer. This would allow

low intensity underburns with short residence times. Over time, frequent, low intensity underburns would enhance soil productivity.

Alternative 2, No Action

The no action alternative, combined with past, current, or reasonably foreseeable future actions, could increase the risk of a high intensity wildfire which would reduce soil productivity. Repeated high intensity wildfires on soils in the project area could initiate a decline in long-term soil productivity. This alternative would have no direct effects on the soils.

Indirect effects would include accumulation of duff, litter, and LWM. This would allow recovery of soils compacted in the past. However, the accumulation of duff, litter, and LWM would add to the already high fuel loading. This high fuel loading would increase the risk of wildfire and result in abnormally intense wildfires when they occur. Wildfire has a greater potential than prescribed fire to damage soils and to affect long-term soil productivity. Compared to prescribed burns, wildfires are more intense, consume more organic matter, burn longer, occur when soils are drier, create larger openings, volatilize nutrients, and have high levels of convective losses. The loss of cover, destruction of surface organic matter, and potential formation of hydrophobic soils following high intensity wildfire can lead to loss of topsoil and organic matter.

Effects on Hydrology and Water Resources

Direct and Indirect Effects of Alternative 1 – Proposed Action, Alternative 3-Modified Proposed Action, and Alternative 7

Streamflow Regime

Changes in stand and vegetation density result in changes to the amount of water lost due to interception, sublimation of snow and evapotranspiration. The increase in flow due to harvest lasts only until the vegetation becomes reestablished (Keppler 1998). The effects of treatments on stream flow are the same for all alternatives. It is unlikely that enough vegetation would be removed under any action alternative to noticeably increase water yield for the project area. Given the geology of the project area, and the lack of surface water, even if more vegetation was removed it is unlikely to affect surface flows. As there is no measurable change in stream flow at the project level, there is unlikely to be cumulative effects to streamflow from this project.

Water Quality

The effects of treatments on water quality are the same for all action alternatives. The State and Regional Water Boards entered into agreements with the U.S. Forest Service to control non point source discharges by BMPs (USDA FS, 2000). It is the intent that the BMPs identified for this project will maintain water quality within these sub-watersheds and prevents adverse effects to beneficial uses, either locally or downstream. Proper implementation of BMPs has been proven to be effective at protecting water quality on the Lassen National Forest. In 2007, BMPs associated with vegetation management activities were effective 93 percent of the time (Appendix). This includes BMPs for landings, skid trail, road maintenance, and prescribed fire to name a few. Problems were associated with roads.

Table 75. Proposed road work within the North 49 project area

Sub-watershed	Decom. Non-System Roads	Decom. System Roads	Total Non-system roads to ML 1	Total Non-system roads to ML 2	Temporary roads
	miles	miles	miles	miles	miles
Big Lake	4.7	0.6	0.3		
Bridges Cr.	0.1		0.3		
Bunchgrass	10.3	0.9	2.9		
Logan	3.2		1.9		
Lower Lost Creek	3.17		1.75	0.2	
Lower Manzanita Cr.	1.4		1.16		
Manzanita Chutes	3.5		3.4	1.7	0.2
McCumber	0.3		0.2		
Nobles (N. of Hwy 44)	0.4		6.5		
Old Cow Creek Meadows	0.10				
Red Lake	1.94				
Upr.N.Fk.Battle Cr (Above Dam)	1.20	0.34	0.35		
Upr.N.Fk.Battle Cr (Below Dam)	1.09		0.28	0.31	0.32
Total	**31.28**	**1.82**	**18.94**	**2.18**	**0.53**

Decom. stands for decommissioning and includes road decommissioning via administrative designation or removing the road bed (rip/re-contour)
ML 1 stands for maintenance level 1
ML 2 stands for maintenance level 2

Sources of sediment associated with roads and landings within the project area would be reduced under all action alternatives. Upgrading drainage features as identified in the integrated design features would also reduce non-point sources of sediment. According to West (2002), roads in forested lands are the number one source of potential non-point source of pollution. The primary pollutant is eroded sediment from unpaved roads, fill slopes, and cut slopes. Road maintenance would occur and the culverts in the Bunchgrass sub-watershed discharging sediment into Bunchgrass Creek would be repaired. One of the culverts in Upper North Fork Battle Creek that is discharging sediment into a stream would be removed during road decommissioning. Three chronic sources of erosion and sedimentation would be eliminated in the Battle Creek watershed through ripping/re-contouring of 0.78 miles of system road and non-system roads. Non-system routes include 320319UC02 and UNW582 in Upper North Fork Battle Creek (Below Dam) and FS road 32N18A in Upper North Fork Battle Creek (Above Dam). There may be a short-term increase in sediment during road decommissioning; however implementation of BMP 2.26 and proper installation of temporary BMPs (i.e. wattles, mulch, and sediment fences) would prevent sediment from reaching a surface water body. Approximately 18.9 miles of non-system roads would be converted to maintenance level 1 roads, whereby traffic would be restricted to administrative use via gates or other barriers. Reducing traffic levels through this

designation would reduce erosion from these roads and potential sedimentation from 1.2 miles of unclassified roads within RHCAs (Reid and Dunne, 1984). Approximately 2.2 miles of non-system roads would be converted to maintenance level 2 roads.

Elevated sediment delivery to the fluvial system is not likely to occur due to the location of skid trails, landings and temporary roads outside of RHCAs. Approximately 0.53 miles of temporary roads are planned outside of the RHCAs within Manzanita Chutes and NF Battle Creek (Below Dam). During construction of these temporary roads, BMPs 2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 2-7, and 2-11 will be followed to reduce the risk of sediment reaching a surface water body. All temporary roads will be decommissioned upon completion of the treatment area, following BMP 2-26. Sale administrators will use pre-existing landings in locations that prevent non-point source sediment from reaching a surface water body. They would follow BMPs 1-12 and 1-16. In addition, sale administrators would implement prescribed BMPs that ensure logging operations are conducted when soil moisture is low and the potential for compaction is minimized. Best management practices identified address concerns relative to the operating period of timber sale practices. Best management practices 1-13 addresses erosion prevention and control measures during timber sale operations.

These practices are also included in the timber sale contract under provision C6.3 Plan of Operation, which is required. This is a general plan of operation which the purchaser submits annually and includes timber harvesting, erosion control, and road construction time frames and methods. Contract provision B6.6 enables the sale administrator to close down operations due to rainy season or other adverse operation conditions, in order to protect resources. Other BMPs are designed to ensure that management activities that include site preparation and prescribed burning are also designed and implemented to avoid adverse effects on soil and water quality. Specific guidelines for soil cover retention and soil conditions during the implementation of these activities are included in burn plans and contracts.

Stream and meadow buffers associated with Riparian Habitat Conservation Areas would be implemented on streams, seeps, springs, and meadows (BMP1-8 Streamside Management Zone Designation and Table 76). Buffers serve to trap sediment and maintain adequate shade to ensure that water quality direction for temperature is maintained (Rashin et al., 2006; Keim and Schoenholtz, 1998; and Rivenbark and Jackson, 2004).

Table 76. RHCA widths for the North 40 project area

Watersheds	Feature	RHCA Width (feet)
Battle Creek and Old Cow Creek	Perennial streams	300
Hat Creek	Perennial fish-bearing streams	300
Hat Creek	Perennial non-fish bearing streams	150
Battle Creek, Hat Creek, and Old Cow Creek	Seasonal streams	100
Battle Creek, Hat Creek, and Old Cow Creek	Meadows greater than one acre	150
Battle Creek, Hat Creek, and Old Cow Creek	Meadows and wetlands of less than one acre	100

Note: Battle Creek and Old Cow Creek are anadramous s watersheds.

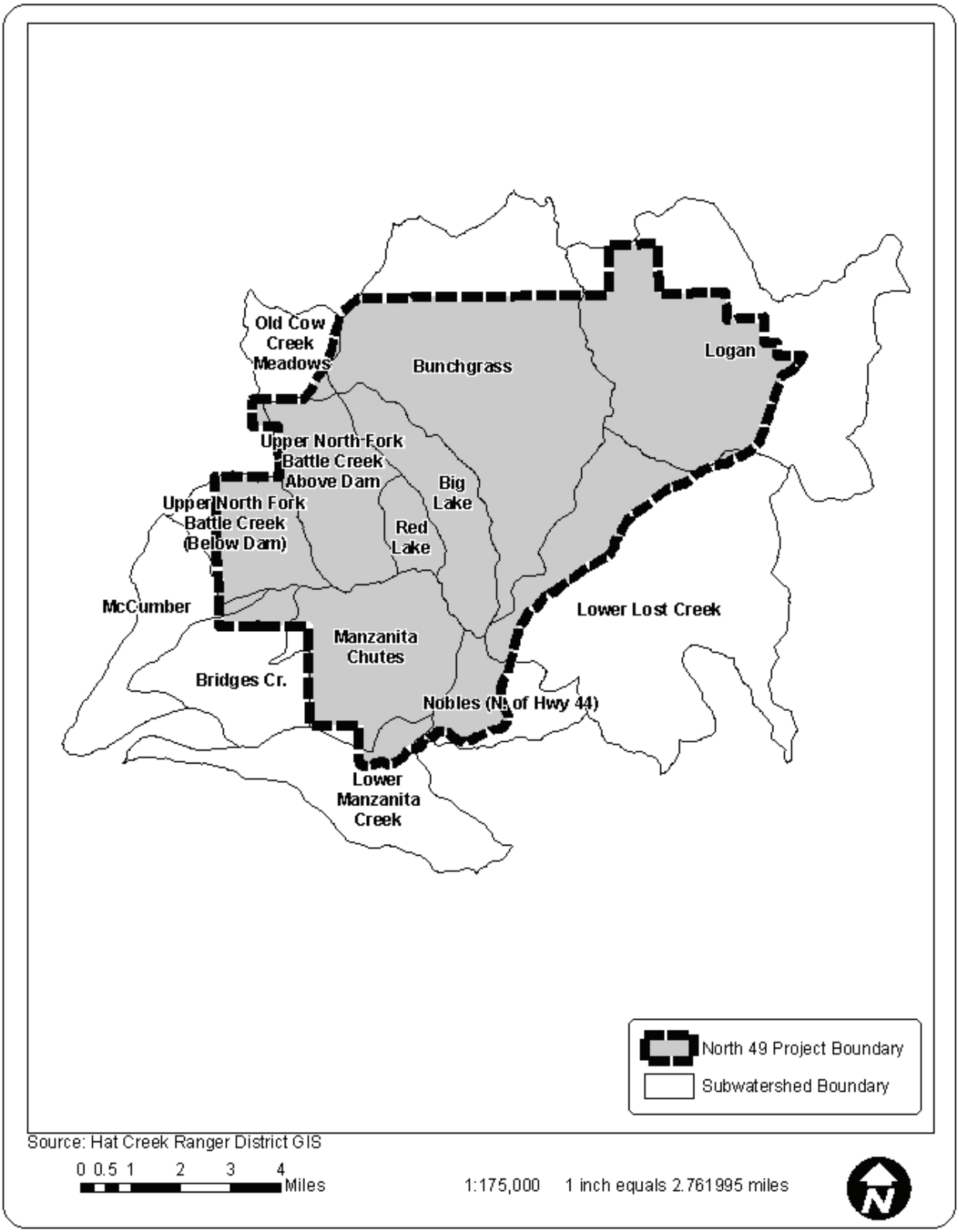

Figure 35. Subwatersheds within and adjacent to the North 49 Project Area

Sporax

Sporax® is a white, odorless, crystalline product. The active ingredient in Sporax® is borax, a naturally occurring mineral made of sodium, boron, oxygen, and water. Borax is used in fertilizer formulations to supply the essential nutrient boron, as a laundry booster and water softener, as a general purpose cleaner, and in fire retardants. Boron compounds occur widely in nature; boron is found in most natural soils. Borax is practically nontoxic to humans, to birds, to fish, and to aquatic invertebrate animals. The proper use of the product to control Annosus root disease poses a low risk of adverse human or environmental risks. Because of its low oral and dermal toxicity, the chemical is a Class III (CAUTION) pesticide. However, because the active ingredient is an eye irritant, the label carries the DANGER signal word. As with any chemical, improper use may pose health hazards, and Sporax® should be used with care. Sporax® would be sprinkled on cut stumps following label directions and would be applied 25 feet away from standing water (IDF). To ensure Sporax® doesn't enter any surface water bodies, BMPs 2-12, 5-7, 5-8, 5-9, 5-10, 5-11, 5-12, and 5-13 would be implemented.

Dust Abatements

Because the water sources may not provide adequate water for dust abatement, calcium chloride or magnesium chloride may be used in lieu of water. Bolander et al. (1999) summarized the environmental effects of various dust palliatives including the previously mentioned (Table 77).

Table 77. Environmental effects of dust abatement treatments calcium chloride and magnesium chloride

Compound	Water Quality Impact	Fresh water aquatic impact	Potential concerns
Calcium Chloride (deliquescent)	Generally negligible if the proper buffer zone exists between treated area and water	May develop at chloride concentrations as low as 400 ppm for trout, up to 10,000 ppm for other fish species	Spills of liquid concentrate
Water Absorbing: Magnesium Chloride (deliquescent)	Generally negligible if the proper buffer zone exists between treated area and water	May develop at chloride concentrations as low as 400 ppm for trout, up to 10,000 ppm for other fish species	Spills of liquid concentrate
Water Absorbing: Sodium Chloride (hygroscopic)	Generally negligible if the proper buffer zone exists between treated area and water	May develop at chloride concentrations as low as 400 ppm for trout, up to 10,000 ppm for other fish species	Spills of liquid concentrate

Based on their findings, it appears that the greatest risk is from a spill and concentrations need to exceed 400ppm to have an impact on aquatic species. To ensure stored sodium chloride, doesn't reach a water body, BMP 2-12 shall be implemented. This BMP ensures that chemicals are stored outside of RHCA's. It is also recommended that dust palliatives be applied to roads at least 25 feet away from surface water bodies (IDF). Furthermore, BMPs 5-7, 5-8, 5-9, 5-10, 5-11, 5-12, and 5-13 would be implemented. Implementation of these BMPs and IDF should ensure that water quality for aquatic organisms is not impacted.

Water Withdrawal Site

Alternatives 1, 3 and 7 include upgrading a water withdrawal site on the North Fork of Battle Creek and on Lost Creek (outside the project area). These water sources would be redesigned to meet BMP 2.21 Water Source Development Consistent with Water Quality Protection. This may include, but is not limited to sloping the approach ramp away from the stream and adding a sump to prevent hydrocarbon contamination of the stream. The Lassen LRMP also requires that flows of 2 cubic feet per second (cfs) be maintained. Given that the site would be upgraded to meet BMPs and minimum flows required by the forest plan would be maintained, it is unlikely that adverse effects would occur from updating these water drafting sites.

Channel Morphology (Bed and Bank Stability)

No changes in flow or sediment are expected from any of the action alternatives. Riparian habitat conservation areas would buffer streams from management activities. To reduce fuels and maintain current conditions, thinning of upland vegetation or fuel treatments could occur within some RHCAs where roads disrupt the hydrologic function of the RHCAs. However, no bank stabilizing vegetation would be removed. No machine piling would be allowed in RHCAs and 90 percent of ground cover would be maintained. In Upper Battle Creek where the roads to be decommissioned parallel or cross streams, these sources of sediment would be disconnected from the stream system, leading to local improvement in channel condition. Given the small acres of treatment near streams no adverse effects to channel morphology is expected from this project at the site-specific or cumulative scale.

Riparian Areas and Wetlands

Harvesting within RHCAs will not occur. No wetlands would be entered. Although FSR 32N18A will not be used as part of the sale, it will be decommissioned under both action alternatives leading to long-term improvement in riparian function. The road is located in an area with many springs within Upper Battle Creek watershed (T32N, R3E, and S17). Prescribed fire will occur in 484 acres of RHCAs. BMP 6-3 will be implemented and fire will back into riparian areas (IDF). In 2007, BMPs for prescribed fire were 100 percent effective at preventing sedimentation into streams. Proper implementation of BMPs should prevent sedimentation of streams.

Alternative 2 – No Action

Direct /Indirect and Cumulative Effects to Water Resources

Streamflow Regime

In the short-term stream flows would remain about the same. In the long-term (greater than 30 years), flows below the dam in the North Battle Creek could decrease as stand and vegetation density increases and more water is intercepted and lost to evapotranspiration. In the event of a large wildfire, peak flows in this area could increase until vegetation was reestablished. In Hat Creek watershed peak flows could increase in the event of a wildfire but as many of the sub watersheds are small closed basins, and many the streams in the other sub watersheds tend to go subsurface before connecting to a larger stream, it is unlikely they would increase enough for surface water to leave the project area. As there is no additional activities from this alternative it would not add to cumulative effects.

Water Quality

Three chronic sources of sediment to surface water bodies from roads would not be eliminated from 0.78 miles of unclassified routes and system roads via ripping/re-contouring 320319UC02 and UNW582 in Upper North Fork Battle Creek (Below Dam) and FS road 32N18A in Upper North Fork Battle Creek (Above Dam). Neither 18.9 miles of unclassified routes would be brought on to the forest's system road inventory as ML 1, nor would 2.2 miles of unclassified routes converted be to ML 2. Drainage would not be improved and traffic levels would remain the same. Consequently, sedimentation from 1.2 miles of these 21.1 unclassified routes within RHCAs would not be reduced.

Because vegetation management activities and prescribed fire would not occur, current temperature regimes and water chemistry (Dissolved Oxygen, pH, concentration of nutrients) would not change. There would be no risk of sediment reaching surface water bodies as a result of those activities.

In the event of a large wildfire, water quality would be detrimentally affected by removal of vegetation; the main impact would be increased sedimentation and possibly increased temperatures until vegetation was re-established. As there is no additional activities from this alternative it would not add to cumulative effects.

Sporax

Because Sporax would not be applied, there would be no risk of Sporax reaching a surface water body as a result of the N49 project.

Dust Abatements

Increased logging traffic would not occur on these roads and there would be no need to use control dust abatements for dust control. Consequently, there would be no need to use calcium chloride or magnesium chloride. Thus, there would be no potential for such compounds to reach a surface water body.

Water Withdrawal Site

Upgrading water withdrawal sites on the North Fork of Battle Creek and on Lost Creek to meet BMPs would not occur. There would be no change from existing conditions.

Channel Morphology (Bed/Bank Stability)

This alternative would have no direct effect on channel stability. Stream crossings and road drainage structures modify channel morphology. Any present problems from road/stream interactions would continue. In the event of a large wildfire channels would need to adjust to changes in flows and sediment.

Riparian Areas and Wetlands

There would be no changes in riparian or wetland function under the no action alternative. FSR 32N18A would not be decommissioned and the hydrologic function of the springs impacted by this road would continue to be impacted by the road.

Cumulative Effects

Cumulative effects analysis area for water resources is based on sub watersheds because these areas drain to a common point. The area of these watersheds is small enough that the effects from project activities are not diluted by the size of the analysis area. Cumulative watershed effects (CWE) include past, present and future ground disturbing activities foreseeable within the analysis area. The analysis area includes federal, state and private land ownership within the sub-watersheds listed in Table 7. Past activities in the analysis area that have the potential to impact watershed and soils resources. Included are timber sales on federal, state and private land, grazing, recreational activities, OHV use and snowmobiling, road maintenance and building. Private land within the sub-watersheds is primarily commercial timber land.

Present and future activities include timber harvest, livestock grazing, recreation, fuels management and wildfire suppression. The DFPZ within the project area will be maintained. Development will continue on private ownership downstream of the project area. Restoration projects are planned within the Battle Creek watershed. Cumulative watershed effects can occur on site or downstream of land disturbing activities.

Cumulative watershed effects may be either beneficial or adverse and can result from synergistic or additive changes in watershed structures and processes caused by multiple land management activities within a watershed. Changes in flow regimes, especially peak flows, and sediment introduced to streams can combine to upset the dynamic sediment transport and stream flow equilibrium conditions. In addition, management practices can alter soil condition. This may affect infiltration rates and increase the amount of compacted soils within a sub-watershed. Modification of surface ground cover can also change run-off rates and erosion processes. All of these factors have the ability to create cumulative watershed effects.

The use of integrated design features and Watershed Management Objectives are tools to avoid adverse cumulative effects and to ensure that beneficial uses of water are maintained.

Watershed Disturbance

Watershed disturbance includes timber harvest, fire, and roads. District records provided information on forest service timber sales and brush mastication projects within the project. Timber harvest plans from the California Department of Forestry and Fire in Redding, CA were used to calculate the type, timing, and extent of private timber harvesting within each sub watershed.

Table 78. Pre-project and post-project road densities per sub-watershed. Post-project road density is the same for Alternatives 1, 3, and 7

Subwatershed	Area	Pre-project Road Density	Post-project Road Density	Change in road density
	sq. miles	mi/sq. mile	mi/sq. mile	
Big Lake	5.61	3.60	2.66	-0.93
Bridges Cr.	6.55	0.04	0.03	-0.01
Bunchgrass	24.34	2.42	1.96	-0.46
Logan	24.89	2.51	2.39	-0.13
Lower Lost Creek	25.32	2.24	2.11	-0.13
Lower Manzanita Cr.	8.80	2.47	2.32	-0.15
Manzanita Chutes	8.95	1.71	1.33	-0.39
McCumber	6.00	0.09	0.04	-0.05
Nobles (N. of Hwy 44)	4.34	1.37	1.27	-0.10
Old Cow Creek Meadows	3.17	2.07	2.04	-0.03
Red Lake	1.71	4.43	3.30	-1.14
Upr.N.Fk.Battle Cr (Above Dam)	6.56	2.67	2.44	-0.23
Upr.N.Fk.Battle Cr (Below Dam)	4.97	2.65	2.43	-0.22

Road density includes all roads within the Forest's GIS layers for system roads and non-system road on February 4, 2008.

Roads are a disturbance on the landscape, which we have quantified with GIS and road surveys. Table 78 and Table 79 summarize the road density of system and non-system roads per sub watershed. Pre-project road density ranges between 0.04 miles per square miles in Bridges Creek to 4.43 miles in Red Lake (Table 78). Road decommissioning of 31.28 unclassified routes and 1.82 miles of system roads would reduce road density in each sub-watershed (Table 79). Most of the road decommissioning would occur in Bunchgrass sub-watershed as 11.23 miles have been proposed for road decommissioning (Table 79). Post-project road density would decrease the most in Red Lake from 4.43 miles per square miles to 3.30 miles per square miles; and in Big Lake from 3.60 miles per square miles to 2.66 miles per square miles (Table 78).

Table 79. Pre-project and post-project road mileage per sub-watershed. Post-project road mileage is the same for Alternatives 1, 3, and 7.

Subwatershed	Total Roads	Post-project roads	Decommission (Change in Roads)
Big Lake	20.18	14.94	-5.24
Bridges Cr.	0.26	0.19	-0.08
Bunchgrass	58.85	47.62	-11.23
Logan	62.55	59.37	-3.18
Lower Lost Creek	56.68	53.51	-3.17
Lower Manzanita Cr.	21.72	20.37	-1.35
Manzanita Chutes	15.33	11.86	-3.47
McCumber	0.54	0.26	-0.28
Nobles (N. of Hwy 44)	5.93	5.50	-0.43
Old Cow Creek Meadows	6.57	6.48	-0.10
Red Lake	7.57	5.62	-1.94
Upr.N.Fk.Battle Cr (Above Dam)	17.54	16.00	-1.54
Upr.N.Fk.Battle Cr (Below Dam)	13.17	12.08	-1.09

Sales on forest service, private, and state lands were incorporated in the cumulative watershed effects model. Table 80 summarizes the major disturbance or land management activity within each sub watershed.

Table 80. Primary land disturbance within each subwatershed

Sub-watershed	Land Owner	Disturbance
Bridges Cr.	SPI	Cherry Sale (2007), Manzanita Creek (2000), Manzanita Flat (2007), other unnamed sales (1998-2009)
Lower Manzanita Cr.	SPI	Cherry Sale (2007), Deer Flat (2007), Manzanita Creek (2000), Manzanita Flat (2007), other unnamed sales (1998-2009)
	USFS	Cabin (2007) and Red Shoe (2003-2005)
Manzanita Chutes		Bridge Creek (1995), Cherry Sale (2007), Manzanita Creek (2000), Manzanita Flat (2007), other unnamed sales (1998-2009)
McCumber	SPI	Bridge Creek (1995), Cherry Sale (2007), Cub (2005), Manzanita Flat (2007), other unnamed sales (1998-2009)
Nobles (N. of Hwy 44)	Roads	5.9 miles of roads
Upr.N.Fk.Battle Cr (Above Dam)	Roads	17.6 miles of roads
Upr.N.Fk.Battle Cr (Below Dam)	SPI	Cub (2005)and other unnamed sales (2005-2006)
Big Lake	Fruit Growers , Inc.	Lost Creek (2007)and other unnamed sales (2007)
Bunchgrass	USFS	Ash TS (1991), Devils Garden Buyout TS (1986), and Wheel T.S. (2000)
Logan	USFS	Bellow Insect TS (1997), Camp Hazard Salvage T.S. (2003), and Hwy 44 Fuel break T.S. (2000)
Lower Lost Creek	USFS	Ash TS (1991), Hwy 44 Fuel break TS (2000), Lostrock/Shotput Group Selection (1996), Steamboat Insect Salvage TS (1993), Twin Windthrow SSTS (1998), Lost Rock/Shotput (2008), Hawkeye Sanitation/Salvage T.S. (1990)
Red Lake	USFS	Redlock (2003)
Old Cow Creek Meadows	USFS	6.6 miles of roads

Cumulative Watershed Effects

Cumulative watershed effects (CWE) take into account the effects of all the alternatives in addition to all past, present, and foreseeable activates. It assesses timber activities on forest service and non-forest service lands, roads, wildfire, prescribed fire, and salvage logging to name a few of the activities. Such activities are assessed as they have the greatest potential to cause erosion of hill slopes and sedimentation of surface water bodies. The geographic scope of the CWE for this analysis includes the entirety of the 13 sub watersheds, included within the North 49 project boundary.

The method used for quantifying cumulative watershed effects is the Equivalent Roaded Acre Model (ERA), developed for national forests in Region 5. The model can be compared to an accounting ledger as it tracks disturbance in a watershed over time. It accounts for all activities, such as roads, harvest activities, and wildfire. The effect of each activity on the landscape except roads changes over time as the watershed recovers from that activity. The model doesn't differentiate whether the disturbance or activity occurred

within the upper, middle, or lower part of the watershed. It does not calculate the amount of sediment that can reach a stream or indicate where sediment might reach a water body. The ERA model does assign a risk that cumulative effects from activities may occur. For ease, it was assumed that all treatments would occur in year one, which is unrealistic. In reality, timber activities would occur over a course of five years, the maximum length of most timber projects. Prescribed fire would follow those activities. In effect, treatments could occur over a period of 3 to 10 years. Consequently, the model presents the effects that would result from all treatments occurring in a single year.. The exception to this method was applied to Manzanita Chutes, whereby proposed treatments would affect 59 percent of total sub-watershed (3,365 acres of 5,729 acres (Table 81)).

Table 81. Modeling of ERA percent for Manzanita Chutes under Alternative 7*

			2009	2010	2011	2012	2013	2014	2015
Treatment	**Total acres**	**1/3 acres**	**Total Acres Treated**						
All Radial Thin	164	54	54	108	164				
All Thinning	3123	1031	1031	2062	3123				
Underburn	3123	1031	0	0	0	0	1031	2062	3123
Group Tractor	78	26	26	52	78				

*Total acres represent the cumulative acres treated by that year. For example, in 2010, 52 of the 78 acres proposed for group tractor would have been treated.

Cumulative Watershed Effects Risks for Alternatives 1, 3, and 7

Effects on watersheds are primarily evaluated based upon the potential for soil disturbance. As described under the effects on soils, the primary concerns are from implementation activities such as road construction, skid trails and landings. The removal of vegetation during these activities has the potential to increase erosion and sediment transport into water courses and associated habitats. Operation of equipment on these areas has the potential to increase soil compaction which could decrease water infiltration into the ground and could reduce hydrologic function. As described above, cumulative effects on watersheds are evaluated in terms of Equivalent Roaded Acres (ERA). The threshold of concern (TOC) corresponds to 12 percent ERA throughout a subwatershed. (See subwatershed map) All of the existing levels of disturbance within the project area are below the 12 percent TOC. The analysis of the action alternatives raises the ERAs in some subwatersheds, but they all remain below the 12 percent threshold. Risk of impacts to watersheds is presented in terms of a percentage of the threshold of concern.

This cumulative effects analysis includes all subwatersheds that have any acreage within the North 49 project area. As described in the section on soils, three subwatersheds, Bridges Creek, McCumber Creek and Lower Manzanita Creek, are primarily outside the North 49 project area and are privately owned lands outside the administrative boundary of the Forest. These subwatersheds are included in this evaluation for cumulative effects analysis purposes.

Very High CWE risk (ERA %> TOC)

There would be no watersheds with a very high cumulative watershed effects risk.

High CWE risk (ERA% is 80 to 100% of TOC)

Under each alternative Bridges Creek would be at high risk of cumulative watershed effects as result of activities on private land. None of the action alternatives would cause Bridges Creek to be at a high CWE risk.

- Equivalent Roaded Acres percent would remain the same at 10 as result of the N49 project.
- Activities on private land owned by SPI account for Bridges Creek being at a high risk for cumulative watershed effects (Table 80. Primary Land Disturbance within sub watersheds).
- Private landowners own 94 percent of the land within the Bridges Creek sub-watershed, which has an area of 4,193 acres. The Forest Service owns 1 percent of the land in the sub-watershed.

Moderate CWE Risk (ERA% is 50 to 80% of TOC)

Under Alternatives 1, 3, and 7; Big Lake, Lower Manzanita Creek, Manzanita Chutes, and Red Lake sub watersheds would be at moderate CWE risk.

Big Lake and Red Lake would change from low risk to moderate risk for CWE.

Lower Manzanita Creek would have an increase in ERA from 8 percent to 9 percent, but CWE risk would not change.

For Manzanita Chutes, Alternatives 1, 3 ,and 7 would add 1.2 percent to the ERA in 2009, as only 1/3 of the treatments, excluding prescribed fire, would be implemented. Equivalent Roaded Acres would equal 7.6 percent. Equivalent Roaded Acres would peak between 9.2 percent and 9.5 percent in 2015, as all treatments and prescribed fire would have been implemented. Alternatives 1, 3, and 7 would contribute 6.9 percent to 7.2 percent to ERA percent. ERA on non-FS lands would decrease 3 fold from 6.1 percent in 2007 to 2.0 percent in 2015.

Cumulative Watershed Effects for Alternative 2 - No Action Alternative

There would be no watersheds with a very high CWE risk.

High CWE Risk (ERA% is 80 to 100% of TOC)

As explained in the previous section, Bridges Creek would be the only sub-watershed with a high CWE risk.

Moderate CWE Risk (ERA% is 50 to 80% of TOC)

Lower Manzanita Creek and Manzanita Chutes would be the only sub-watersheds with a moderate CWE risk. Timber sales on private and forest service land account for this risk.

- Between 2003 and 2009, FS activities aside will have treated 24 percent of the entire Lower Manzanita sub-watershed (1,326 acres).

- Between 1994 and 2007, private landowners would have treated 35 percent of the entire Lower Manzanita sub-watershed (2,002 acres).
- Private landowners within Manzanita Chutes are treating 100 percent of the land they own (1,088 acres).

A comparison of CWE by alternative is displayed in Table 82.

Table 82. Cumulative Watershed Effects Risk as a result of the North 49 project in year 2009

Sub-watershed	No action	Alternative 1	Alternative 3	Alternative 7
Upr.N.Fk.Battle Cr (Below Dam)	Low	Low	Low	Low
Upr.N.Fk.Battle Cr (Above Dam)	Low	Low	Low	Low
Red Lake	Low	Moderate	Moderate	Moderate
Old Cow Creek Meadows	Low	Low	Low	Low
Nobles (N. of Hwy 44)	Low	Low	Low	Low
McCumber	Low	Low	Low	Low
Manzanita Chutes	Moderate	Moderate	Moderate	Moderate
Lower Manzanita Cr.	Moderate	Moderate	Moderate	Moderate
Lower Lost Creek	Low	Low	Low	Low
Logan	Low	Low	Low	Low
Bunchgrass	Low	Low	Low	Low
Bridges Cr.	High	High	High	High
Big Lake	Low	Moderate	Moderate	Moderate

Fisheries and Aquatic Resources

This section presents a comparative analysis of effects on fish and other aquatic species of concern and compares the effects of each alternative on those species. Information provided here on effects to fish and aquatic resources is derived from a Biological Evaluation prepared for the North 49 Forest Health Recovery Project. The report is contained in the project administrative record and is incorporated here by reference.

Summary of the Action Alternatives (Alternatives 1, 3, 7)

Table 83 and Table 84 summarize activities proposed in the anadromous fish-producing watersheds of the North 49 project and their proximity to aquatic areas. Acreage and mileage totals are approximate.

The differences between Alternatives 1, 3, and 7 within the Battle Creek watershed are limited to the amount of thinning (including different thinning treatments), group selection, and prescribed burning acreages. Road treatments and other activities remain identical across all alternatives. Total thinning acreage remains the same in Alternatives 1 and 3, and decreases by about 214 acres in Alternative 7. Group selection acres are highest in Alternative 1 and lowest in Alternative 7, with a difference of 86 acres. Prescribed burning acres are the same in Alternative 1 and 3, decreasing by about 299 acres in Alternative 7.

Table 83. Summary of North 49 Activities within the Battle Creek Watershed.

Activity/Treatment Type	Alternative 1 Total (RHCA)	Alternative 3 Total (RHCA)	Alternative 7 Total (RHCA)
Thinning (various Rx, other activities)	5,518 acres (0)	5,518 acres (0)	5,304 acres (0)
Group Selection	300 acres (0)	270 acres (0)	214 acres (0)
Prescribed Burning	5,699 acres (51)	5,699 acres (51)	5,400 acres (51)
Water Source Improvements	1 (1)	1 (1)	1 (1)
Non-system road added to system ML1	12.1 miles (0)	12.1 miles (0)	12.1 miles (0)
Non-system road added to system ML2	2 miles (0.2)	2 miles (0.2)	2 miles (0.2)
Non-system road administratively decommissioned	7.4 miles (<0.1)	7.4 miles (<0.1)	7.4 miles (<0.1)
Non-system road decommissioned (rip/recontour)	0.5 mile (0.2)	0.5 mile (0.2)	0.5 mile (0.2)
System road decommissioned (rip/recontour)	0.3 mile (0.3)	0.3 mile (0.3)	0.3 mile (0.3)
Temporary Road	0.5 mile (0)	0.5 mile (0)	0.5 mile (0)

Table 84. Summary of North 49 Activities within the Old Cow Creek Watershed.

Activity/Treatment Type	Alternative 1 Total (RHCA)	Alternative 3 Total (RHCA)	Alternative 7 Total (RHCA)
Thinning (various RX, other activities)	15 acres (0)	15 acres (0)	15 acres (0)
Group Selection	6 acres (0)	6 acres (0)	6 acres (0)
Non-system road administratively decommissioned	0.1 mile (0)	0.1 mile (0)	0.1 mile (0)

Treatments do not change between alternatives within the Old Cow Creek watershed Treatments within RHCAs do not change across alternatives. For the anadromous watersheds, these treatments are:

- 51 acres of prescribed low-intensity burning along portions of tributaries to North Fork Battle Creek,
- 0.15 mile of non-system road converted to system road (road to North Battle Creek Reservoir, within reservoir RHCA),
- 0.04 miles of road administratively decommissioned (within North Battle Creek Reservoir RHCA),
- 0.47 miles of road decommissioned (rip/recontour) along portions of tributaries to North Fork Battle Creek,
- and improvement of one water drafting site on North Fork Battle Creek to meet Best Management Practices (BMPs).

Due to the relatively minor changes in acreages, and because the locations and acreages of treatments within the RHCAs are the same in Alternatives 1, 3, and 7, there are no anticipated differences in potential effects to federally listed aquatic species between them. The changes in thinning treatments in Alternative 7 do not change the effects to those factors analyzed for aquatic resources; therefore effects from Alternative 7 are the same as those for Alternatives 1 and 3.

Anadromous Fish

The subwatersheds of the project area are important to downstream anadromous fish habitat in Battle Creek and Old Cow Creek because of the water, energy, nutrients, and bedload they produce. Accessible anadromous habitat is at least 13 miles downstream, so changes in conditions at any point in the upper watershed (both adverse and beneficial) are attenuated as they move downstream. Nonetheless, changes in conditions upstream can influence the downstream systems, though all but extreme changes upstream are not likely to be measurable downstream. The desired condition is to maintain and restore instream flows sufficient to sustain conditions of aquatic habitats and keep sediment regimes as close as possible to those with which aquatic biota evolved (USDA FS 2001). Though quality of habitat for anadromous fish is the concern, assessment of effects were made at the smaller subwatershed scale. The assumption is that moving toward desired conditions at the smaller scale would also meet desired conditions for downstream anadromous fish.

Elements from the Modified (2003) Matrix of Pathways and Indicators for evaluating the effects of human activities on anadromous salmonid habitat and Checklist were the basis for evaluating direct and indirect effects of the North 49 project. Descriptions of the indicators are discussed in detail in the updated (2003) Matrix of Pathways and Indicators (refer to BA/BE of listed and Forest Service Sensitive Anadromous Salmonids for North 49 Project, Hat Creek Ranger District in the project record). Elements from the matrix were used to assess the proposed project. These include: watershed condition (road density/location, disturbance history, riparian reserves/RHCAs, and drainage network increase), substrate/sediment, water temperature/shade, chemical contamination, large woody debris and recruitment, and streambank condition.

Direct Effects to Anadromous Fish

There would be no direct effect or impacts to any life history stage of listed anadromous fish. The proposed projects would not occur within habitat occupied by listed anadromous fish, as their distribution is at least 13 miles downstream of the project area.

Indirect Effects to Anadromous Fish

Although the proposed activities would not occur within habitat occupied (or accessible) to listed anadromous fish, there is the potential for indirect effects to occur. Many of the proposed activities are ground disturbing in nature, thus, it is possible that erosion could increase in treated areas. Therefore, the risk of impacts to listed anadromous fish and critical habitat located downstream of the project area is primarily related to the potential for sediment delivery to streams. This analysis addresses the potential for increased surface erosion and focuses on the potential for sediment delivery to streams.

Watershed Condition

Indicators that provide information on the overall watershed condition are related to the cumulative watershed effects analysis and focus on past management activity throughout the watershed, as well as activities within the near-stream area. In comparing the existing condition to key watershed attributes, defined as Watershed Management Objectives (4) and developed in consultation with NOAA Fisheries under the long-term strategy

for anadromous fish-producing watersheds, the existing conditions (Table 85 and Table 86) are within acceptable limits of desired condition in most anadromous subwatersheds.

Table 85. Watershed Management Objectives for LNF anadromous fish producing watersheds

Element	Objective
Equivalent Roaded Acres (ERAs)	ERAs resulting from management actions occupy less than 12% of the total sub-watershed.
Road Density	Less than 2.5 miles/square mile within a sub-watershed.
Near-stream Road Density*	Roads occupy less than 3% of all near-stream areas within a sub-watershed.
Channel Crossings	Less than 2 road crossings per mile of stream.
Near-stream Disturbance**	Disturbance from management activities occupies less than 5% of all near-stream areas within a subwatershed.

Near-stream Area: An area encompassing a stream channel and land adjacent to both sides of the channel. For seasonally flowing streams, the near-stream area encompasses approximately 150' on each side of the channel. For perennial streams, the near-stream area encompasses approximately 300' on each side of the channel.
*Near-stream Road Density: The percentage of near-stream areas that are occupied by roads.
**Near-stream Disturbance: The percentage of near-stream areas with soil compaction or disturbance from roads, skid trails, landings, or other management activities.

Existing levels of watershed disturbance are represented by the Equivalent Roaded Acres (ERA) values presented in Table 86. The data indicates that there are low levels of existing disturbance in the project area watersheds. All of the existing levels of disturbance are below the 12 percent threshold of concern (TOC). The analysis of the action alternatives raises the ERAs in some subwatersheds, but they all remain below the 12 percent threshold.

Table 86. Equivalent roaded acre (ERA) threshold in anadromous watersheds, existing condition and proposed action (PA) alternatives

Watershed	Subwatershed Name	ERA Threshold (%)	Existing ERA (%)	Alternative 1 (ERA %)	Alternative 3 (ERA %)	Alternative 7 (ERA %)
Battle Creek	Bridges Creek	12	10	10	10	10
	Lower Manzanita Cr.	12	8	9	9	9
	Manzanita Chutes	12	6	8	8	8
	McCumber	12	5	5	5	5
	Nobles (N. of Hwy 44)	12	1	5	5	5
	Upr.N.Fk.Battle Cr (Above Dam)	12	1	2	2	1
	Upr.N.Fk.Battle Cr (Below Dam)	12	2	5	6	4
Old Cow Creek	Old Cow Creek Meadows	12	3	3	3	3

Six of the eight anadromous subwatersheds have road densities less than the 2.5 mi/sq mile criteria. Both Upper North Fork Battle Creek watersheds (above and below the dam) exceed 2.5 mi/sq mile, but road density would be reduced to meet the objective with implementation of the action alternatives. All eight watersheds have near-stream road density within the project area well below the desired threshold value of

three percent. Road density (in total, as a result of the action alternatives) would result in a net reduction of 8.2 miles in the anadromous subwatersheds.

Table 87. Existing and proposed road densities for the North 49 Project subwatersheds*

Subwatershed	Existing Road Density (mi/sqmi)	Road Density (mi/sqmi) under Action Alternatives
Old Cow Creek Meadows (OCC1)	2.07	2.04
Upper NF Battle Creek – Above Dam (BC20A)	2.67	2.44
Upper NF Battle Creek – Below Dam (BC20)	2.65	2.43
McCumber (BC19)*	0.09	0.04
Manzanita Chutes (BC18A)	1.71	1.33
Bridges Creek (BC18)*	0.04	0.03
Lower Manzanita Creek (BC16)	2.47	2.32
Nobles Creek (BC17A)	1.37	1.27

*For purposes of this analysis road density is defined as the sum of system roads and identified existing non-system roads (per square mile). New roads are defined as raw land construction. As such, the proposed action is in compliance with the Term and Condition 8.d.I as contained in NOAA FISHERIES LNF LRMP Programmatic Biological Opinion (1998, as amended 2000).

While the number of channel crossings per mile has not specifically been calculated, the highest number of existing crossings is in the North Fork Battle Creek below the dam subwatershed where one of the existing crossings would be eliminated. In total, there would be a net reduction of two stream crossings within the anadromous watersheds of the project area (Table 88).

Table 88. Watershed attributes within the Project Area (existing and proposed)

Subwatershed	Existing Channel Crossings	Channel Crossings after PA	Miles of Road within RHCA	Miles of Road within RHCA after PA	Existing % Near-stream Road Density	% Near-stream Road Density after PA
Old Cow Creek Meadows (OCC1)	0	0	0.0	0.0	0	0
Upper NF Battle Creek – Above Dam (BC20A)	7	6	1.9	1.6	1.4	1.2
Upper NF Battle Creek – Below Dam (BC20)	8	7	1.6	1.5	1.2	1.1
McCumber (BC19)	0	0	0.0	0.0	0	0
Manzanita Chutes (BC18A)	0	0	0.0	0.0	0	0
Bridges Creek (BC18)	0	0	0.0	0.0	0	0
Lower Manzanita Creek (BC16)	0	0	0 but Hwy 44 parallels project area	0.0	0	0
Nobles Creek (BC17A)	0	0	0.0	0.0	0	0

Near-stream disturbance was not calculated for the streams, but the disturbances are closely related to the presence of near-stream roads, most of which were constructed in the past to facilitate timber harvest. Therefore, the subwatersheds with the greatest amount of near-stream road disturbance are also likely to have the highest amount of other near-stream disturbances (past timber harvest activity). These subwatersheds

include Upper North Fork Battle Creek above and below the dam. These near-stream disturbances would be reduced by reducing the number of road crossings in these drainages and reducing the number of miles, thus moving the subwatersheds toward the goals of the long-term strategy and watershed management objectives.

Substrate/Sediment

The majority of non-point sources of sediment are linked to road drainage and road design. The specific management activities and their relevant potential effects (potential short and long term, negative and positive) are discussed in more detail below.

No new road construction is needed for project implementation; existing system and selected non-system roads would be used. Non-system roads were evaluated and proposed for either addition to the system, or to be decommissioned. Non-system roads proposed for addition to the system were determined to be existing routes that would not require major construction activities to upgrade them to either maintenance level 1 or 2 roads. These road miles would be designed following Best Management Practices (USDA FS 2000). About 0.2 mile of the road leading to the North Fork Battle Reservoir is in the reservoir's RHCA. All other roads proposed for addition to the system are located outside of RHCAs. Temporary roads would be located outside RHCAs.

Approximately 7.4 miles of non-system road are proposed to be decommissioned administratively. This includes blocking vehicular access to the routes and allowing them to heal and revegetate. This includes about 0.04 mile segment within the reservoir's RHCA.

About 0.8 miles of road will be decommissioned using ripping/recontouring methods to rehabilitate the roadbeds, with about 0.5 miles located within RHCAs. Road decommissioning within RHCAs is beneficial to watershed and riparian function in the long-term, but results in disturbance within the RHCAs and, thus, has a potential for increasing sediment input to streams in the short-term. Decommissioning would involve establishing proper drainage and tilling of compacted areas along the road prism. These actions would speed up the recovery of compacted soils and would restore most of the soil hydrologic function.

The amount of sediment produced by the road restoration actions discussed above would be minimized by project design standards, including implementation of BMPs, resulting in an insignificant (undetectable) amount of sediment input to seasonal and/or perennial stream channels in the short term. The insignificant amount of sediment that may enter the (mostly) seasonal stream channels as a result of the proposed road-related projects may be flushed downstream by the first flows occurring within channels following a storm event. However, based on the scope of the disturbances, and particularly the insignificant amount of project-related sediment that is anticipated, an increase in sediment input to downstream areas would not be detectable. Furthermore, these actions would result in a net reduction of sediment in the short- and long-term as road drainage is immediately improved following project implementation. In North Battle Creek the roads to be decommissioned are located in and adjacent to RHCAs where there is a chronic source of sediment delivery to the fluvial system. Removal of these roads would eliminate this source. Upgrading drainage features where needed would also reduce non-point sources of sediment.

Prescribed low-intensity burning of about 51 acres within RHCAs is proposed to reduce existing heavy fuel loading, without generating ground disturbance, removing shade trees or riparian hardwoods. To

minimize effects on soil quality, integrated design features and BMPs would be implemented. This activity would also be beneficial, as the risk of high intensity burning in the event of a wildfire (which could result in adverse effects to aquatic habitat such as increased sedimentation) would be reduced.

Fireline construction, broadcast burn and brush reduction outside RHCAs are also actions that could generate sediment. To ensure that sedimentation does not occur, the objectives cited in BMP 6-3 relative to fireline construction would be incorporated. Specific items to be addressed include width of the handline, direction of waterbars, and spacing to ensure reduced length of slope so that sedimentation does not occur. Monitoring for implementation and effectiveness would be conducted to assess the effect of the fireline and to identify if any rehabilitation treatments needed to be implemented prior to seasonal precipitation. This monitoring would be a component of the BMPEP F-25 monitoring for prescribed burning.

Outside of RHCAs, the effect of proposed thinning on the sediment regime would be the potential increase in surface erosion from compacted landings, skid trails and roads. The Forest Plan limits detrimental soil impacts to 15 percent of any treatment unit and requires that treatments occur only when the soil is most impervious to impacts. By maintaining minimum levels of ground disturbance, re-using old skid trails and landings from past entries, installing erosion control features on skid trails, and landings to divert runoff when needed, soil erosion would be minimized. Any new roads, skid trails, and landings needed for thinning would be located outside of RHCAs as well. In steeper areas with higher risk of erosion helicopter logging or cable logging would be used to minimize erosion. Sediment delivered to the fluvial system is not likely to occur due to the location of skid trails, landings and temporary roads outside of RHCAs. These RHCAs serve to trap sediment as it begins to move off-site. If any existing landings within RHCAs would be used for this entry they would be ripped and/or stabilized post harvest.

In summary, with implementation of the action alternatives there is a low risk of short-term increases of sediment from ground disturbing activities, with anticipated long-term decreases in sediment from road decommissioning. Due to watershed condition, implementation of BMPs during project activities, and the limited amount of ground disturbance proposed within RHCAs, the risk of increased erosion and sedimentation resulting from project implementation of all action alternatives is considered low. Since instream disturbance would not occur, an increase in sediment production from these activities is not anticipated.

Temperature/Shade

The project proposes no tree removal within RHCAs and does not propose to remove trees from the near-stream areas; therefore no effect on temperature and shade is expected.

Chemical Contamination

The action alternatives include the possibility of using an alternative method of dust abatement such as application of magnesium or calcium chloride. Magnesium chloride is applied for dust control and surface stabilization. Magnesium chloride is highly soluble and moves through the soil with water. Generally the principle ions of the compound disassociate (magnesium and chloride) and move through the environment. Except in rare circumstances, magnesium would not migrate far from the site of application; therefore, its toxicity pertains only to the immediate area around the application site. When applied using manufacturer’s

guidelines, it is unlikely that waters near the site of application could have concentrations high enough to cause growth or survival problems for fish. However, fish avoidance would be expected within 25 feet of the application area (Heffner 1997). Similar responses may occur with application of calcium chloride. There are no federally listed anadromous species within the analysis area; therefore no effects to these species would be expected.

A connected activity to the action alternatives is application of borate compound to cut tree stumps. Potential chemical contamination to anadromous fish from borate application is not expected to occur because 1) the species does not occur in the project area; 2) application would not occur within RHCAs, which would prevent the compound from reaching waterways and aquatic habitat; and 3) at normal application rates without no-treatment buffers near waterways, potential levels of borate in run-off water, if any, would be well below the level where adverse effects would be expected to occur (USDA 2006).

Large Wood Recruitment

Large wood is important to the aquatic environment because it routes and stores sediment, provides habitat complexity, and acts as a substrate for biological activity. In the Upper Battle Creek watershed, the presence of in-channel wood rated high (and appeared to represent a natural range of variability) as did large wood recruitment (USDA FS 2001b). Since no trees would be removed within the RHCAs of any stream, no changes in large woody debris recruitment are expected from any of the action alternatives.

Streambank Condition

No ground disturbing activities are proposed within RHCAs along streams, with the exception of 0.47 miles of road decommissioning (rip/recontour); thus, streambank condition should be maintained, or improved, over the long term. In streams where road crossings would be removed and/or improved, streambank conditions should improve.

The action alternatives include upgrading a water withdrawal site on the North Fork of Battle Creek. This water source would be redesigned to meet BMP 2.21 Water Source Development Consistent with Water Quality Protection. This may include sloping the approach ramp away from the stream and adding a sump to prevent hydrocarbon contamination of the stream. This would lower the risk of hydrocarbon contamination of the stream at this site. With application of BMPs, upgrading of the water withdrawal site should not result in a deterioration of streambank condition.

Reduced Risk of Stand Replacing Fire

The objective of the treatments is to reduce fuel loadings as a means to increase the resiliency of treated stands; and by strategically placing treatments in the landscape, move fire toward its historic patterns and intensities. Such a result is expected to benefit the watershed, by reducing the risk of erosion, and impacts to aquatic habitat that can follow large, stand replacing fires.

Cumulative Effects to Anadromous Fish

The ESA defines cumulative effects in 50 C.F.R. 402.02 as “those effects of future State or private activities, not involving Federal Activities that are reasonably certain to occur within the action area of the Federal

action subject to consultation". Future Federal actions would be analyzed through separate Section 7 consultations and are not considered in this section. The cumulative effects analysis area is limited to the Battle Creek and Old Cow Creek subwatersheds within the project area, with limited discussion pertaining to anadromous fish habitat further downstream in these watersheds. Activities downstream of the forest boundary in these large watersheds are discussed in general. The temporal scale for this cumulative effects analysis is 20 years past, and 30 years into the future.

There are no state owned lands within the project area. The watershed history includes two large fires that occurred in 1918 and 1931 in the Manzanita Chutes area and extended from Red Mountain up to Deep Hole burning approximately 10,000 acres each time. It is both a combination of past fire history that created more brushfields and in some areas due to the thin, rocky volcanic soils the climax vegetation is brush.

Timber harvest in the project area has been active over the years. District records provided information on a few sales and brush mastication projects in the area that include: Greyback (1990-93), Superbowl (1991-93), Mud (1993-95) Manzanita Chutes (1996), Wheel (1998-2000), Deep Red (2002), Redlock (2002-03), Cabin (ongoing), private timber harvesting on SPI, fruit growers, and other private land holdings. The project treatments include salvage and thinning and regeneration harvest. More detailed information can be found in Appendix A.

At the larger scale of the Battle Creek watershed, restoration efforts involving private, state and federal entities are planned in the near future and would improve critically important habitat for anadromous fish in Battle Creek. Most notable of the planned restoration efforts is the modification of Pacific Gas and Electric Company (PGandE) Hydroelectric Project facilities, operations, and instream flows. The purpose of the Restoration Project (the portion below the natural fish barriers) is to restore approximately 42 miles of habitat in Battle Creek plus an additional six miles of habitat in its tributaries while minimizing the loss of clean and renewable energy produced by the Hydroelectric Project.

The method used by the project hydrologist for quantifying cumulative watershed effects was equivalent roaded acre (ERA) model, used by National Forests in California. (Refer to the hydrology section and the appendix for a description of this model.) Based on the ERA calculations in Table 86 and field inventory of overall watershed condition and stability indicators, cumulative watershed effects are not anticipated in the majority of watersheds as a result of this project. The decommissioning of roads and trails lowers the road densities in several sub-watersheds of Battle Creek allowing them to meet anadromous watershed management objectives.

Due to the high amount of harvest presently occurring on private timber lands in the Battle Creek watershed, and planned for the near future, Bridges Creek subwatershed could potentially be over threshold after planned harvest on private occurs between 2007 and 2010. None of the action alternatives would cause Bridges Creek to be at high risk of cumulative watershed effects. The area to be treated is relatively flat and the soils are considered low potential for erosion. Given these conditions and the small acreage that would be harvested with this project, this project is unlikely to adversely affect watershed conditions in this subwatershed (refer to hydrology analysis).

Summary of Effects to Anadromous Fish

In summary, the proposed action alternatives are not expected to have direct or indirect adverse impacts to listed anadromous species or critical habitat. Indirect positive effects that may occur from road decommissioning and sediment reduction are not expected to have any measurable effect downstream. The proposed action may have an effect too small to measure, yet have an incremental effect on anadromous habitat when considered along with future private land activities.

Alternative 2 (No Action) - Direct, Indirect and Cumulative Effects to Anadromous Fish

Under Alternative 2, roads within RHCAs that are currently contributing sediment to streams would not be improved; therefore, sediment would continue to impact streams at the existing rate. There would be no ground-disturbing activities that could increase existing sediment production. Aquatic habitat would remain in its current condition and trend.

Also, the risk for large-scale wildfire would continue to rise as stands become increasingly dense and ladder fuels naturally increase. The potential effects of wildfire to the aquatic environment include an increase in sediment and ash, loss of riparian vegetation resulting in increased temperatures and loss of large woody debris.

The no action alternative represents the current baseline for the project area. The ERA that currently exists in the area is below threshold and further recovery from past actions would be anticipated to continue on Forest Service land. On private land harvest would continue and Bridges Creek subwatershed could potentially still go over threshold based on planned harvest on private ground before 2010.

Determinations and Conclusions

Anadromous Fish and Critical Habitat

The preferred alternative (Alternative 7) is not expected to have direct or indirect adverse impacts to listed anadromous species or critical habitat. Indirect positive effects that may occur from road decommissioning and sediment reduction are not expected to have any measurable effects downstream. The proposed action may have an immeasurable, yet incremental effect on anadromous habitat when considered along with future private land activities.

The following factors led to the determination of effects of the proposed action to federally-listed and Forest Service sensitive anadromous fish species:

- There are no direct effects to anadromous fish.
- Habitat utilized by Central Valley spring-run chinook salmon and Central Valley steelhead in lower portions of Battle and Cow Creeks is well downstream (13+ miles) of the Lassen National Forest (LNF) boundary and the project area.
- As fall-run chinook salmon utilize habitat in lower portions of Battle Creek, well downstream (23+ miles) of the LNF boundary, there would be no effect of the actions to this species.

- Potential indirect effects are limited to a low risk of short term increases in sediment production, with anticipated reduction in sediment over the long term. The mitigation measures incorporated into the design of the proposed action (such as standards and guidelines, BMPs, limited activities in the RHCAs) minimize to a negligible level, the potential for sedimentation.

Therefore, implementation of the North 49 project may affect, but is not likely to adversely affect Central Valley steelhead, the Central Valley spring-run chinook salmon, and/or their critical habitat. Implementation of the North 49 project would have no effect to the Central Valley fall-run chinook salmon (Forest Service Sensitive Species).

Chinook Salmon Essential Fish Habitat (EFH)

EFH for chinook salmon includes areas designated as critical habitat for the listed CV spring-run chinook salmon. For reasons described above, there will be **"no adverse effect"** to EFH.

Sensitive Species

Cascades Frog

Direct Effects

Habitat with the highest likelihood of being occupied by the Cascades frog (and specifically, during the project implementation period) includes wetted areas (lakes, ponds, wet meadows, streams) and the near-water (bank) zones which are utilized by frogs for basking. Because, surveys have not detected Cascades frog within even the most suitable habitat in the project area, the risk of direct impact to individuals is considered very low. With the integrated design features, only low-intensity underburning would occur in suitable habitats. The wetted areas would not burn during low-intensity burning, so frogs residing in these areas would not be directly affected by this activity.

Although the migration habitats of Cascades frogs are not completely understood (Brown 1997; DFG), it is assumed for this analysis that if there was movement, it is likely to occur early spring (at the time of breeding) and possibly late fall prior to hibernation and, in areas that will be largely protected by RHCAs. Since some treatments (e.g. underburning, road treatments) are proposed in the outer areas of the RHCAs for riparian restoration, however, there is a slight risk of direct mortality to Cascades frogs if individuals occupied the areas where treatment was occurring.

Designation of Riparian Habitat Conservation Areas (RHCAs) would provide a high level of aquatic and riparian protection. These areas consist of those portions of the watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing waterbodies such as lakes and ponds, wetlands, streams and stream processes. Potentially suitable habitat for the Cascades frog would be indirectly benefited by designation of the RHCAs as a whole. Where certain actions are proposed within RHCAs, however, there is potential for habitat to be indirectly (positively and/or negatively) affected. Potential indirect effects to Cascades frog habitat are likely to be associated with changes in stream channel morphology, substrate and changes in water quality. The following is a summary of potential effects to aquatic/riparian habitat elements that (until better life history information is available) are also believed to be applicable to potential suitable habitat for the Cascades frog.

No ground disturbing activities are proposed within RHCAs along streams, with the exception of 0.47 miles of road decommissioning (rip/recontour) and 0.74 miles of non-system road upgraded to system road. About 1.52 miles of road within RHCAs would be closed to vehicular access, allowing these areas to revegetate. Overall, streambank condition should be maintained, or improved, over the long term. In streams where road crossings would be removed and/or improved, streambank conditions should improve.

Water draft site improvements would not include in-channel disturbance, and are limited to creating approach ramps and sumps that would prevent sediment and hydrocarbons from entering Lost Creek and Battle Creeks during water pumping operations, thus having a beneficial effect to these stream systems. With application of BMPs, upgrading of the water withdrawal site should not result in a deterioration of streambank condition.

Potential Cumulative

On a worldwide basis, acid precipitation, ultraviolet radiation, and global climate change have all been suggested as causes to the decline of amphibians. For the Cascades frog, however, local conditions may explain the cause in decline for this species at the southern end of its range. In Lassen Volcanic National Park and Lassen National Forest, Fellers et. al. (2008) suggest that the presence of non-native predatory fish, disease, and pesticide drift are likely factors that have acted together to cause the near-total loss of the Cascades frog in this area. The proposed project would not contribute to an increase of any of these factors in the project area.

Cumulative effects to Cascades frog are discussed here at the subwatershed and the larger watershed scales. The geographical analysis area boundary is the area of the thirteen subwatersheds for this project, which include portions of the larger Hat, Battle, and Old Cow Creek watersheds. The time period used for including past actions is 20 years before present, and 30 years into the future. The list of past, present, and reasonably foreseeable future actions can be found in Appendix A, which is hereby incorporated by reference. In summary, these actions include timber management, plantation management, prescribed burning, recreation maintenance, recreation use, road maintenance, and DFPZ maintenance.

The actions were analyzed in a cumulative watershed effects analysis for this project (refer to hydrology discussion). Based on this analysis, the Old Cow Creek subwatershed was rated as having a low risk of adverse cumulative watershed effects. Since only about 20 acres, or less than one percent, of this subwatershed would be affected by ground disturbing activities, the action alternatives would not incrementally add to the risk of cumulative effects to Cascades frogs that reside downstream of the project area in Old Cow Creek Meadows.

Of the remaining subwatersheds, seven rated as having a low risk of adverse cumulative watershed effects. Potential cumulative effects to Cascades frogs' habitat in these areas would not be expected to occur.

Four subwatersheds rated as having a moderate risk of adverse cumulative watershed effects. These are Big Lake, Red Lake, Lower Manzanita Creek, and Manzanita Chutes. Of these, only Big Lake and Red Lake are known to contain potentially suitable habitat for Cascades frogs. Implementation of the action alternatives may incrementally add to the risk of cumulative effects to Cascades frog habitat in these subwatersheds.

The Bridges Creek subwatershed would be the only subwatershed with a high risk of adverse cumulative watershed effects. Only 1 percent of this area is on Forest Service land, and none of the action alternatives would incrementally add to the risk of cumulative effects. The high risk rating is the result of past and future planned activities on private lands. There is no potentially suitable habitat for Cascades frogs within the Forest Service portion of this subwatershed; and it is unknown whether any habitat is located downstream of the Forest Service boundary.

The proposed actions were designed to minimize potential adverse effects to the watersheds, in recognition of current watershed condition. The integrated design features and other portions of the proposed action should minimize the risk of potential erosion and sedimentation. Due to the fact that Cascades frogs are not known to occur within the project area, there is a low risk of cumulative effects to this species from implementation of the action alternatives.

Summary of Action Alternatives

Cascades frogs are not likely to be directly affected because they have not been found in the project area, and few existing populations have been found at the scale of the Lassen National Forest. Potential indirect effects are limited to a low risk of increased sediment production, with anticipated decreased sediment production in the long term. Project activities should result in maintained or slightly improved habitat conditions for this species in the long term.

Table 89 summarizes activities proposed within the North 49 project area, and their proximity to aquatic areas. Acreage and mileage totals are approximate.

Table 89. Summary of North 49 Activities on cascade frogs

Activity/Treatment Type	Alternative 1 Total (RHCA)	Alternative 3 Total (RHCA)	Alternative 7 Total (RHCA)
Thinning (various RX, other activities)	14406 acres (0)	14406 acres (0)	13798 acres (0)
Group Selection	1168 acres (0)	680 acres (0)	978 acres (0)
Aspen Release	38 acres (0)	38 acres (0)	55 acres (0)
Water Source Improvements	2 (2)	2 (2)	2 (2)
Prescribed Burning	15694 acres (547)	15694 acres (547)	15059 acres (552)
Non-system road added to system ML1	18.9 miles (0.5)	18.9 miles (0.5)	18.9 miles (0.5)
Non-system road added to system ML2	2.2 miles (0.3)	2.2 miles (0.3)	2.2 miles (0.3)
Non-system road administratively decommissioned	30.8 miles (0.9)	30.8 miles (0.9)	30.8 miles (0.9)
System road administratively decommissioned	1.5 miles (0.6)	1.5 miles (0.6)	1.5 miles (0.6)
Non-system road decommissioned (rip/recontour)	0.5 mile (0.2)	0.5 mile (0.2)	0.5 mile (0.2)
System road decommissioned (rip/recontour)	0.3 mile (0.3)	0.3 mile (0.3)	0.3 mile (0.3)
Temporary Road	0.5 mile (0)	0.5 mile (0)	0.5 mile (0)

The differences among Alternatives 1, 3, and 7 are limited to the amount of thinning (including different thinning treatments), group selection, prescribed burning, and aspen release. Alternative 3 proposes fewer acres (-488) of group selections and a modified thin from below with retention islands treatment, as compared with Alternative 1. Alternative 7 proposes about 600 less acres of thinning with a modified thin from below with retention islands treatment, 190 less acres of group selection, 17 more acres of aspen release, and 635 fewer acres of prescribed burning treatments as compared with Alternative 1. The locations of treatments are roughly the same across all the action alternatives.

There is only one difference between all action alternatives with the amount and location of activities within RHCAs, and this is limited to the addition of four acres of prescribed burning under Alternative 7. Because the locations of treatment within RHCAs are identical in alternative 1 and 3 and almost the same for alternative 7 potential effects to the cascade frog across the alternatives should be the same.

Management Indicator Species

Rainbow Trout Habitat

Direct Effects

There would be no direct effects to rainbow trout habitat, as no activities are proposed specifically within the North Fork Battle Creek RHCA, with the exception of improvement of the existing water drafting site. Improvements would be limited to construction of an approach ramp and sump, which would keep sediment and hydrocarbons from entering the stream during water pumping operations. No in-channel activities would occur. Stream shade, substrate, pool quality, and streambank stability would not be altered by these activities.

Indirect Effects

Potential indirect effects to rainbow trout habitat are limited to increased sediment production from ground disturbing activities, which could influence substrate, pool quality, and streambank stability.

The majority of non-point sediment sources are linked to road drainage and design. With all action alternatives, no new road construction would occur. Non-system roads would either be brought onto the system, or decommissioned. No road treatments occur within RHCAs, with the exception of 0.2 mile of road within the North Battle Creek reservoir’s RHCA, less than 0.1 mile of road that would be closed and left to revegetate, and 0.8 miles that would be ripped and recontoured. The location of roads outside of RHCAs decreases the risk of sediment entering streams.

Decommissioning would involve establishing proper drainage and tilling of compacted areas along the road prism. These actions would speed up the recovery of compacted soils and would restore most of the soil hydrologic function, and reduce non-point sources of sediment.

Other sources of increased sediment could include prescribed burning. Low-intensity underburning would occur in portions of RHCAs along North Fork Battle Creek tributaries. Since 90 percent ground cover would be retained after treatment and no ground disturbance would occur, increased sediment production from this activity is not expected. Burning would be beneficial in reducing fuel loads that could burn at high intensity should a wildfire occur, which could increase sediment production.

Outside of RHCAs, the effect of proposed thinning and associated treatments on the sediment regime would be the potential increase in surface erosion from compacted landings, skid trails and roads. The Forest Plan limits detrimental soil impacts to 15 percent of any treatment unit and requires that treatments occur only when the soil is most impervious to impacts. By maintaining minimum levels of ground disturbance, re-using old skid trails and landings from past entries, installing erosion control features on skid trails, and landings to divert runoff when needed, soil erosion would be minimized. Any new roads, skid trails, and landings needed for thinning would be located outside of RHCAs as well. In steeper areas with higher risk of erosion helicopter logging or cable logging would be used to minimize erosion. Sediment delivered to the fluvial system is not likely to occur due to the location of skid trails, landings and temporary roads outside of RHCAs. These RHCAs serve to trap sediment as it begins to move off-site. If any existing landings within RHCAs would be used for this entry they would be ripped and/or stabilized post harvest.

In summary, potential indirect effects to rainbow trout habitat are limited to a low risk of increased sediment production in the short term, with anticipated sediment reduction in the long term. Due to implementation of BMPs during project activities, and the limited amount of ground disturbance proposed within RHCAs, the risk of increased erosion and sedimentation resulting from project implementation of all action alternatives is considered low.

Cumulative Effects

Cumulative effects to rainbow trout habitat are discussed here at the subwatershed and the larger watershed scales. The geographical analysis area boundary is the area of the thirteen subwatersheds for this project. The time period used for including past actions is 20 years before present, and 30 years into the future. The list of past, present, and reasonably foreseeable future actions can be found in Appendix A, which is hereby incorporated by reference. In summary, these actions include timber management, plantation management, prescribed burning, recreation maintenance, recreation use, road maintenance, and DFPZ maintenance.

The actions were analyzed in a cumulative watershed effects analysis for this project (refer to hydrology discussion). Based on this analysis, the subwatersheds affecting North Fork Battle Creek have a low risk of adverse cumulative watershed effects. This finding would remain the same at the scale of the project area, since no other rainbow trout habitat is present.

The proposed actions were designed to minimize potential adverse effects to the watersheds, in recognition of current watershed condition. The integrated design features and other portions of the proposed action should minimize the risk of potential erosion and sedimentation. There is a low risk that the proposed action would contribute toward cumulative effects; however, a slight increase or decrease in sediment is not expected to change the current rainbow trout habitat condition.

Alternative 2 (No Action) - Direct, Indirect and Cumulative Effects to Rainbow Trout Habitat

Alternative 2 is the no action alternative, where none of the proposed activities would occur. There would be no risk of direct or indirect effects to rainbow trout habitat.

With the no action alternative, roads within RHCAs that are currently contributing sediment to streams would not be improved; therefore, sediment would continue to impact streams at the existing rate. Rainbow trout habitat would remain in its current condition and trend.

Also, the risk for large-scale wildfire may continue to rise as stands become denser and ladder fuels naturally increase. The potential effects of high-intensity, large wildfires to the aquatic environment include an increase in sediment and ash, loss of streamside and riparian vegetation, and loss of large woody debris. These changes could negatively alter water temperature, substrate, pool quality, and streambank stability.

The no action alternative represents the current baseline for the project area. The percentage of ERAs that currently exist in the area is below threshold and further recovery from past actions would be anticipated to continue on Forest Service land. Harvest on private land would continue, and Bridges Creek subwatershed could potentially still go over threshold based on planned harvest on private ground before 2010. Activities in this subwatershed would not affect rainbow trout habitat on the Lassen National Forest, however.

Botany

This section presents a comparative analysis of effects to Region 5 Sensitive plant species, as well as Lassen National Forest, Special Interest Plant and Botanical Management Indicator Species (MIS), and compares the effects of each alternative on these species. Information provided here on the effects to Region 5 Sensitive plant species is described in a Biological Evaluation prepared for the North 49 Forest Health Recovery Project. Information on the effects Lassen National Forest Botanical Management Indicator Species found within the project area is described in a MIS Report for Botanical Species prepared for the North 49 Forest Health Recovery Project. Both the Biological Evaluation and MIS Report are contained in the administrative record and are incorporated here by reference.

Sensitive and Special Interest Plants

Alternative 1– Proposed Action

Direct Effects

Astragalus pulsiferae var. suksdorfii (Sensitive)

Direct effects involve physical damage to the plants or their habitat, such as crushing, breaking, or burning the plants; burning them under displaced slash or duff; as well as disturbing or compacting the soil. Such damage can kill the plants. With the implementation of Integrated Design Features, few direct effects to *Astragalus pulsiferae var. suksdorfii* are expected. All occurrences would be flagged and avoided by all project activities, but direct effects would occur to those individuals growing in and along roadsides within the project area, due to aspen enhancement, as well as road maintenance and hauling activities. While the roads within the North Bunchgrass Valley occurrence would not be used during project implementation, the Bear Wallow Road (32N16), which bisects the northern portion of the occurrence would be used as a haul route and would therefore receive maintenance prior to project implementation. Road maintenance activities primarily involve surface blading of the roadbed itself, where few if any individuals are growing, but impacts to plants growing alongside the roadbed and in the adjacent ditch could occur at this time. The Integrated Design Feature of

restricting ditch cleaning along the Bear Wallow Road within the boundaries of the *Astragalus* occurrence should minimize any potential impacts to this large occurrence of 5,000 to 10,000+ individuals. All totaled numbers on National Forest System land within the occurrence exceed 10,000 individuals, but numbers in similar habitat on the adjacent private lands are unknown. The entire mapped occurrence is approximately 16 acres with another 59 acres of potential habitat found on private and Forest Service lands within Bunchgrass Valley, so any impacts to the few plants growing along the Bear Wallow Road would not affect the viability of this occurrence within the project area. Treatment of the aspen stand adjacent to the Bear Wallow Road may also cause incidental impacts to plants growing along the road near this stand. However, there would be few additional impacts to this species by the treatment of this stand, since the majority of the occurrence is found outside of the proposed aspen unit, and only those plants growing along the road would be potentially impacted.

Within the Ashpan Flat occurrence however, there are plants growing both in and along the 32N56Y road, which delineates the northern extent of this occurrence. This road is also being used as a haul route and individual plants may be potentially impacted by its use and associated maintenance activities. With a total population size of 5,000 to 10,000 plants scattered over more than 25 acres, the loss of a few individuals along this road would not be detrimental to the overall viability of this occurrence.

The implementation of Alternative 1 should not pose any long-term impacts to *Astragalus pulsiferae var. suksdorfii*, since many times this species can be found in old landings and skid trails, as well as system roads, which illustrates the ability of this species to withstand a moderate amount of disturbance and its preference for open habitats with little competition. After project completion, plants growing adjacent to impacted roads would provide a seed source for potential recolonization of these areas. In addition, while occurrences of *Astragalus pulsiferae var. suksdorfii* would not be underburned as part of the proposed action, it is possible that individual plants were missed during surveys and would be impacted by prescribed burning activities. Any project associated burning would have only minor impacts to *Astragalus pulsiferae var. suksdorfii* plants, due to the open habitat this species prefers. Even if some of the plants did burn, they would probably sprout back from underground root systems, since the fire is likely to be relatively cool, due to the lack of surface fuels within the majority of these occurrences. Furthermore, past burning along Hwy 44 within a known occurrence of *Astragalus pulsiferae var. suksdorfii* showed no adverse effects to this species within burned areas (Bovee 2007).

Special Interest Plant Species

There would be no direct effects to *Penstemon heterodoxus var. shastensis* because the only known location occurs outside proposed treatment units. Only one location of *Hierochloe odorata* was found within the project area north of Bunchgrass Valley within a lodgepole stand proposed for thinning, machine pile and underburn treatments. This occurrence consists of approximately 2,000+ stems growing among heavy slash from dead and dying lodgepole trees, scattered over approximately 1.5 acres. Alternative 1 has the potential to directly impact this occurrence since thinning of the lodgepole stand may cause the plants to be run over, crushed or killed during project implementation. In addition, prescribed burning activities would also have direct effects to this species, but since *Hierochloe* is a grass with deep creeping rhizomes (Hitchcock 1951); it

is likely that a low intensity fire would simply stimulate the grass to grow and spread throughout the newly treated and open stand.

There would also be some direct effects to *Erigeron inornatus var. calidipetris* by the implementation of Alternative 1. This species is currently found scattered throughout and adjacent to Bunchgrass Valley, Ashpan Flat, east of North Battle Creek Reservoir and along Road 16 in open sandy soils stands with lodgepole. Within Bunchgrass Valley and Ashpan Flat it is partially associated with the Sensitive species *Astragalus pulsiferae var. suksdorfii* (Suksdorf's milkvetch). As a result, the majority of the occurrences within these areas would be protected from project activities, due to the implementation of Integrated Design Features for the rare Suksdorf's milkvetch. In addition, the scattered locations of this species found east of North Battle Creek Reservoir are not within thinning treatment activities and would only be potentially impacted by three scattered group selection units. All of the remaining occurrences could be directly impacted by project implementation activities, including thinning, burning and road maintenance. However, even with the potential impacts to individuals from the implementation of Alternative 1, occurrences within Bunchgrass Valley and other protected sites should provide an adequate seed source for recolonization after the project is completed.

Indirect Effects

Indirect effects (either positive or negative) to Sensitive or Special Interest plants could occur by changing the fire regime, vegetation structure of the habitat or can occur from noxious weed invasion. There would be no indirect effects to *Penstemon heterodoxus var. shastensis*, since the known occurrence is found outside of treatment units. Therefore, indirect effects from the implementation of Alternative 1 are not a concern for this species.

Alternative 1 could have beneficial indirect effects to all Sensitive and Special Interest plant species, since thinning the forest and reducing woody fuels in the project area could help maintain populations of these species and their habitat by reducing the severity of a potential wildfire. While thinning of the adjacent lodgepole dominated stands around occupied *Astragalus pulsiferae var. suksdorfii*, *Erigeron inornatus var. calidipetris* and *Hierochloe odorata* habitat would help to lower the intensity of a potential wildfire, much of the habitat for *Astragalus pulsiferae var. suksdorfii* and *Erigeron inornatus var. calidipetris* is not likely to burn during a wildfire event, due to the low vegetative cover found throughout these areas. In addition, if a low intensity fire did go through occupied habitat, it is possible that both species would sprout back from underground roots. However, since *Hierochloe odorata* is currently found in a stand with heavy fuel loading, a wildfire may cause detrimental impacts to this occurrence in its current state, due to the potential for a hotter, more intense fire in stands with high accumulations of down woody debris. While the exact impact a fire will have on this species is not known, it likely that a very hot fire could destroy the rhizomes and potentially the entire occurrence under severe wildfire conditions.

Depending on the species, changes in the vegetation structure to Sensitive or Special Interest plant habitat within the project area may have either beneficial or negative impacts. Indirect effects to *Astragalus pulsiferae var. suksdorfii* and *Erigeron inornatus var. calidipetris* are likely to be beneficial, since both species tend to be found in habitat that is fairly open, such as gaps in denser forests, which would be created

by the implementation of Alternative 1. Thinning of adjacent overstocked stands would open the canopy, create gaps, and could potentially provide additional habitat for these species within treated areas. In addition, since the only other occurrence of *Hierochloe odorata* on the forest is growing along a stream in an open meadow, it can be assumed that increased light from thinning activities in the lodgepole stand where the North 49 occurrence is found would potentially increase the density and possibly the spread of this species within the stand.

Another potential indirect effect is an increase in noxious weeds or other undesirable non-native species as a result of project activities. At this time there are no known Sensitive or Special Interest plant occurrences threatened by noxious weeds within the project area. Klamathweed and Scotch broom are the only known California Department of Food and Agriculture listed noxious weed species that occur near treatment units within the North 49 Project area (Appendix B), but both species are either restricted to roadsides or are found outside of known rare plant locations. Thinning and burning treatments implemented as part of Alternative 1 would create open microsite and sometimes macrosite habitats of reduced shade and soil cover, making conditions for noxious weed establishment more favorable. Since these species are often more aggressive than the natives, they can quickly dominate a site. Increased weeds in logged and burned areas may compete with Sensitive and Special Interest plants and other desirable species, making the habitat less suitable for the desirable plants. The risk is highest within DFPZ treatments units, which are located along roads adjacent to known noxious weed occurrences. The Noxious Weed Risk Assessment completed for this project determined an overall moderate risk of potential weed spread with the implementation of the Alternative 1 (Appendix B). However, the standard practice of equipment cleaning, and Integrated Design Features of avoiding or treating noxious weed infestations within the project area would reduce these potential effects. In addition, all known small occurrences within the North 49 project area are currently under treatment (Appendix B), further reducing any potential impacts to Sensitive and Special Interest plants species by the implementation of Alternative 1.

Borax (Sporax®) treatment, for annosus root disease is also proposed for use within the North 49 Project area, and would be applied to fresh-cut conifer stumps 14 inches diameter or greater. At high enough soil concentrations borax can be toxic to plants. However, when used as proposed to selectively treat stumps, borax soil concentrations would not approach levels that are known to be toxic to plants (USDA Forest Service 2006). Project Integrated Design Features specify that Sporax would not be applied within 25 feet of Sensitive or Special Interest plant occurrences. Therefore, the proposed use of borax would not affect these species.

Cumulative Effects

With the implementation of the Integrated Design Features, no direct or indirect effects to *Penstemon heterodoxus var. shastensis* would be expected. Therefore, cumulative effects are not a concern for this species from the implementation of Alternative 1. The project boundary was chosen as the cumulative effects analysis area for all remaining Sensitive and Special Interest plant species, due the lack of knowledge of specific habitat requirements for these species or their historic range within the project area. Past, ongoing or future vegetation treatments on private lands may also have had cumulative impacts to Sensitive and Special

Interest plant species, but since survey requirements and mitigations for occurrences are not known, the type and extent of the impact to these species cannot be quantified.

Past Actions

Past vegetation management actions (Appendix A) within the North 49 Project area have resulted in a variety of disturbances across the landscape. Prior to 1989, botanical surveys for Lassen National Forest projects were not conducted as intensively as project surveys are today, due to the lack of botany personnel on the Forest. In addition, periodic changes to the Regional Sensitive plant list, and the ever increasing knowledge of rare species and their habitat means that surveys today are more thorough than those conducted in the past. For all of these reasons, past vegetation projects may have potentially had direct and indirect effects to Sensitive and Special Interest plants within the project area that would add cumulatively to impacts from the implementation of Alternative 1.

There are two past activities, the Wheel (1997-2000) and Ash (1981-1991) TS projects that may have caused short-term impacts to *Astragalus pulsiferae var. suksdorfii* plants within the project area (Appendix A). However, these past silvicultural treatments may have had long-term beneficial impacts to this species which responds favorably to openings in the canopy. These projects both occurred in the Ashpan Flat area and primarily involved overstory removal and thin from below treatments. An old landing is also present within this occurrence and was most likely used during one of these past timber projects, prior to the discovery of this species within the area. *Astragalus* plants within these areas were vigorous and fairly dense, especially within the old landing site, most likely due to the decrease in competition and the openings created by harvest activities.

In addition, there were seven past silvicultural projects that may have impacted portions of four occurrences of *Erigeron inornatus var. calidipetris* within the North 49 Project area (Appendix A). The Wheel (1997-2000), Ash (1981-1991), Ashpan (1977-1982), Superbowl (1988-1991), Battle (1976), and Mudlake Lodgepole (1976) TS projects, as well as the Eskimo Windthrow Salvage (1996-1997) project most likely contained *Erigeron inornatus var. calidipetris* plants within their boundaries prior to treatment activities. However, this species can also benefit from treatments that open up the canopy, and since occurrences are found scattered throughout the central part of the project area, both in and out of past project units, it’s likely that any past treatments were not detrimental to the viability of this species within the North 49 project area. Nonetheless, these impacts would add cumulatively to those impacts from the Alternative 1.

Finally, the *Hierochloe odorata* occurrence in Bunchgrass Valley may have been affected by the Mudlake Lodgepole (1997) TS project, since it is possible that the past timber sale within this occurrence was the cause of the current heavy fuel loading and subsequent habitat degradation within this occurrence. Treatments proposed for Alternative 1 should benefit this occurrence by removing the excess slash and debris from the site, and should help to stimulate the growth and spread of this rare grass within the unit.

While all of these species were most likely affected by past silvicultural treatments, since then plants have recovered and even benefited from the decrease in canopy cover and competition within treated units. Any past impacts to these species will add cumulatively to those impacts that will occur with the implementation

of Alternative 1, but since all known occurrences within the project area are currently healthy, these impacts will not add negative to the viability of these species within the project area or throughout their range.

Ongoing Actions

Ongoing vegetation management actions, special uses, and recreation maintenance projects, (Appendix A) were surveyed to similar standards as the North 49 Project. Integrated Design Features were developed when needed to ensure the viability or to minimize the impacts to Sensitive and Special Interest plant species in the project area. However, ongoing range management activities could have potential effects to Sensitive or Special Interest plant species within the project area. Since there are currently no known occurrences of *Astragalus pulsiferae var. suksdorfii* found within the active North Battle Creek Allotment, impacts from ongoing cattle grazing are not occurring at this time. Grazing impacts to the *Hierochloe odorata* occurrence east of Bunchgrass Valley were recorded in 1996, prior to the cancellation of the Hat Creek Allotment grazing permit, thus ongoing impacts from cattle grazing to this species are not a concern. Grazing could also have incidental impacts to *Erigeron inornatus var. calidipetris*, but since this species is fairly common and is found scattered throughout the central portion of the of the project area, impacts are believed to be minor, though such impacts can add cumulatively to those in the Alternative 1. In addition, only those occurrences found east of North Battle Creek Reservoir, primarily along the 32N31 road are currently found in an active grazing allotment. As a result, the majority of the occurrences throughout the project area are not being impacted by the ongoing range management program.

Other ongoing actions within the project area such as road maintenance, Christmas tree and woodcutting permits, and the various recreation activities within the project area may have contributed only incidental effects on these species, if any. It is possible that ongoing road maintenance activities have impacted individuals of *Astragalus pulsiferae var. suksdorfii* and *Erigeron inornatus var. calidipetris*, which are growing along roadsides within the project area. These incidental effects should not add cumulatively to those described in Alternative 1, since the same roads are being maintained during project implementation. In addition, since both of these species prefer openings in lodgepole, it is possible that woodcutting has had a beneficial effect on these species through the creation of openings in the canopy skid trails, which these species have been shown to utilize in dense stands.

Foreseeable Future Actions

Future actions would have similar effects to Sensitive and Special Interest plant species as the North 49 Project, since all projects have either been surveyed to similar standards as the North 49 Project or would be prior to project implementation, and known sites of all potential species for which viability may be concern would either be avoided or design features would be created to minimize the impacts to these species by project activities. In addition, at this time there are no known occurrences of any Sensitive and Special Interest plant species discussed in this document found within surveyed upcoming projects such as the South Bunch Forest Health and Recovery Project. As a result, any future projects would not add cumulatively to potential impacts to Sensitive or Special Interest plant species from implementation of the North 49 Project.

In summary, Alternative 1 would treat approximately 16,900 acres through a variety of methods across the landscape. While the proposed project would have some direct effects to *Astragalus pulsiferae var.*

suksdorfii plants growing along the Bear Wallow (32N16) and 32N56Y roads, these effects are allowable under the current management treatment for this species. In addition, since all occurrences are large, with an estimated 5,000-10,000 plants in the North Bunchgrass Valley and Ashpan Flat occurrences and approximately 1,000 individuals within the South Bunchgrass Valley occurrence, overall cumulative effects to this species are minor, and would not contribute to the loss of viability of this species within the project area or its range on the forest. Of the 12 occurrences currently known in California most remain stable, with the exception of the Robbers Spring occurrence along Hwy 44, which was impacted in 2004 by California Department of Transportation (CalTrans) road widening activities, and the Chester Airport occurrence on private lands, which was impacted by runway expansion activities in 2002.

There is only one known occurrence of *Hierochloe odorata* found within the project area. This occurrence would probably benefit from the removal of overstory trees and the clean up of heavy fuels throughout its habitat, which are most likely preventing its spread within the stand. While there would be direct effects from the implementation of the Proposed Action to this species, there should also be corresponding beneficial indirect effects from the removal of overstory trees, the clean up of the residual downed logs in the area, and stimulation of this perennial grass by underburning activities. Therefore, the implementation of Alternative 1 should not affect the viability of this species even when added cumulatively to past, ongoing and future impacts within the project area.

Potential cumulative effects from the implementation of Alternative 1 for *Erigeron inornatus var. calidipetris* should also not be a concern, since impacts would be scattered throughout the project area and the core of the occurrences would be protected by the flag and avoid Integrated Design Feature for *Astragalus pulsiferae var. suksdorfii*, or are outside of thinning treatment units. Overall, E*rigeron inornatus var. calidipetris* is stable and quite common within the project area and any short-term impacts to a portion of these occurrences during project implementation would not affect the viability of these species over the long-term, even when added cumulatively to past, ongoing or future impacts within the project area.

Alternative 2 – No Action

Direct Effects

There would be no direct effects to *Astragalus pulsiferae var. suksdorfii*, *Erigeron inornatus var. calidipetris*, *Hierochloe odorata*, or *Penstemon heterodoxus var. shastensis* from the No Action Alternative other than those associated with current ongoing actions.

Indirect Effects

Indirect effects of no action would be those associated with the potential for noxious weed infestation, continued habitat succession, and the increase potential for a sever wildfire within the project area. In the Noxious Weed Risk Assessment for the North 49 Project it was determined that current habitat vulnerability is low, and that non-project dependant vectors present a moderate to high risk in the absence of the proposed action (Appendix B). In addition, the two noxious weed species found in or near proposed treatment units are low priority species for treatment. Because all treatable noxious weed occurrences within the project area

would be treated regardless of the alternative chosen, increased threat from noxious weeds with the implementation of the No Action alternative is not a concern.

The No Action Alternative may have minor negative impacts to *Astragalus pulsiferae var. suksdorfii* and *Erigeron inornatus var. calidipetris*, due to habitat succession, but these should be insignificant since the majority of these plants are growing in loose sandy soil areas devoid of trees, and are therefore not likely to be affected by encroaching conifers. However, future increases in canopy cover and the continued accumulation of down wood within the *Hierochloe odorata* occurrence could be detrimental to this species, which is a rapid spreader from underground root stock (Walsh 1994). Currently, this species is hindered in its spread throughout the stand by a heavy down wood component, which will continue to increase over time with the implementation of the No Action Alternative. Continued habitat succession would not be an issue for *Penstemon heterodoxus var. shastensis*, because this species would not be affected by an increase in canopy cover within its riparian meadow habitat.

Finally, it is impossible to determine where, when and how a wildfire may enter an area, making any calculations of effects of wildfire to Sensitive and Special Interest plant populations unpredictable. Many times the effects of fire suppression can have larger impacts to Sensitive and Special Interest plants and their habitat than the wildfire itself, and actual effects to Sensitive and Special Interest plant species often depends on fire timing and intensity. With the No Action Alternative, stands would not be thinned or burned. As a result, both ladder and surface fuels would continue to increase over time, leading to an increase in the risk of a high intensity wildfire. However, the majority of *Astragalus pulsiferae var. suksdorfii* and much of the habitat for *Erigeron inornatus var. calidipetris* is not likely to burn during a wildfire event, due to low vegetative cover.

There could be negative indirect affects from the increased potential of a catastrophic wildfire within the *Hierochloe odorata* occurrence, due in part to the heavy fuel loading currently found within the stand. which will most likely increase the potential for a hotter fire within the occurrence. Since this species is a perennial grass a very hot fire, particularly in the fall, may kill the basal buds and hinder regeneration of this species within the stand (Walsh 1994). This potential increases with continued fuel loading that could be expected with the implementation of the No Action Alternative.

Cumulative Effects

As with Alternative 1, the project area was chosen as the cumulative effects analysis area for Sensitive and Special Interest plant species for the No Action Alternative. Cumulative effects for past, ongoing and foreseeable future actions for the No Action Alternative would be identical to those discussed for Alternative 1. Unlike Alternative 1 though, there would be no direct effects to *Astragalus pulsiferae var. suksdorfii, Erigeron inornatus var. calidipetris, Hierochloe odorata*, or *Penstemon heterodoxus var. shastensis* and few indirect effects from habitat succession and the continued risk of wildfire by the implementation of the No Action Alternative. As a result, there would be fewer impacts to these species by the selection of the No Action Alternative as compared to Alternative 1, when added cumulatively to past, ongoing and future foreseeable actions.

Alternative 3

Direct Effects

Direct effects from the implementation of Alternative 3 to *Astragalus pulsiferae var. suksdorfii, Hierochloe odorata* and *Penstemon heterodoxus var. shastensis* would be similar to those described in Alternative 1. However, there will be fewer impacts to *Erigeron inornatus var. calidipetris*, due to the elimination of approximately 10 group selection units located within known occurrences of this species throughout the project area. While seven of these units will be treated with the thinning treatments prescribed in the adjacent stands, three of the groups within the occurrence east of Battle Creek Reservoir were dropped completely. As a result, there will be fewer impacts to this species with the implementation of Alternative 3.

Indirect Effects

Indirect effects to Sensitive and Special Interest Plant species from the implementation of Alternative 3 on potential changes the fire regime would be similar the effects discussion for Alternative 1. In addition, as with Alternative 1, there would be also be no indirect effects to *Penstemon heterodoxus var. shastensis*, and since thinning treatments are the same within the *Hierochloe odorata* occurrence as those described in Alternative 3, effects to this species will be comparable to those described in Alternative 1. However, this Alternative may have less beneficial affects to rare plant habitat, due to the higher canopy cover requirements proposed for Alternative 3. Since Alternative 3 proposes to thin to a lower intensity by maintaining at least 50 percent canopy cover within stands containing or adjacent to occurrences of *Astragalus pulsiferae var. suksdorfii* and *Erigeron inornatus var. calidipetris*, there may be fewer benefits to these species, as compared to Alternative 1, where the canopy cover would average between 30-40 percent in pine stands after treatment. There may also be a less risk of spreading noxious weeds within the implementation of Alternative 3 as compared to Alternative 1, due to the decrease in group selection treatment units within the project area.

Cumulative Effects

As with Alternative 1, the project area was chosen as the cumulative effects analysis area for Sensitive and Special Interest plant species for Alternative 3, due to the Integrated Design Feature of flag and avoidance for known sites of *Astragalus pulsiferae var. suksdorfii*, and the lack of knowledge of specific habitat requirements, or historic range for all species in the project area. Cumulative effects for past, ongoing and foreseeable future actions for Alternative 3 would be identical to those previously discussed within Alternative 1. Since there are no direct or indirect effects to *Penstemon heterodoxus var. shastensis*, cumulative effects are not a concern for this species, with the implementation of Alternative 3. As with Alternative 1, there could be some impacts to *Astragalus pulsiferae var. suksdorfii, Erigeron inornatus var. calidipetris* and *Hierochloe odorata* and from the implementation of Alternative 3 and these impacts and may add cumulatively to past, ongoing and future actions discussed within the project area. Direct impacts from the implementation of Alternative 3 though should be smaller than those described within Alternative 1, due to the decrease in group selection units. However, there will be less long-term benefits to *Astragalus pulsiferae var. suksdorfii* and *Erigeron inornatus var. calidipetris*, since stands will be thinned less intensely creating a higher canopy cover within the project area. Overall, any direct or indirect impacts to these species

from the implementation of Alternative 3 should not affect the viability of these species in the project area or throughout their range.

Alternative 7 – Preferred Alternative

Direct Effects

Direct effects from the implementation of Alternative 7 to Sensitive and Special Interest plant species and would be similar to those described in Alternative 1. As with Alternative 1, no direct effects to *Penstemon heterodoxus var. shastensis* are expected with the implementation of Alternative 7. The Integrated Design Feature of flag and avoid would continue to protect known sites of *Astragalus pulsiferae var. suksdorfii* and *Erigeron inornatus var. calidipetris*, but since haul routes would still be used, impacts to those plants growing along roads in the project area would remain. In addition, the potential impacts from the implementation of group selection treatments within *Erigeron inornatus var. calidipetris*, and the direct impact of thinning within the *Hierochloe odorata* occurrence will remain the same as those described in Alternative 1.

Indirect Effects

Indirect effects are the same for *Penstemon heterodoxus var. shastensis* and *Hierochloe odorata* as described in the Alternative 1 and 3, but Alternative 7 may provide greater, long-term affects to *Astragalus pulsiferae var. suksdorfii* and *Erigeron inornatus var. calidipetris*, which benefit from treatments which open up the canopy. This Alternative will create more clumps and gaps within the landscape through radial thinning treatments and thinning throughout the size classes, as opposed to the uniform thinning from below treatments found within Alternative 1 and 3. As a result, treatments proposed for Alternative 7 have the potential to provide scattered openings thought the majority of habitat adjacent to or within known occurrences of these species.

Cumulative Effects

Once again the project area was chosen as the cumulative effects analysis area for Sensitive and Special Interest plant species for Alternative 7, due to the Integrated Design Feature of flag and avoidance for known sites of *Astragalus pulsiferae var. suksdorfii*, and the lack of knowledge of specific habitat requirements, or historic range for all species in the project area. Cumulative effects for past, ongoing and foreseeable future actions for Alternative 7 would be identical to those previously discussed within Alternative 1. Once again, since there are no direct or indirect effects to *Penstemon heterodoxus var. shastensis*, cumulative effects are not a concern for this species with the implementation of Alternative 7. As with Alternative 1, there will be some impacts to *Astragalus pulsiferae var. suksdorfii, Erigeron inornatus var. calidipetris* and *Hierochloe odorata* and from the implementation of Alternative 7, and these impacts and may add cumulatively to past, ongoing and future actions discussed within the project area. Direct impacts from the implementation of Alternative 7 to all species will be similar to those described in Alternative 1. However, there may be more long-term indirect benefits to *Astragalus pulsiferae var. suksdorfii* and *Erigeron inornatus var. calidipetris*, due to the clump gap treatment proposed for a majority stands adjacent to or with known occurrences of these species. Overall, any direct or indirect impacts to these species from the implementation of Alternative 7 should not affect the viability of these species in the project area or throughout their range.

Determinations for Sensitive Plant Species

With implementation of project Integrated Design Features to flag and avoid for the North 49 Project, Alternative 7 may affect individuals of *Astragalus pulsiferae var. suksdorfii*, but is not likely to result in a trend toward Federal listing as Threatened or Endangered or loss of viability for this species.

Botanical Management Indicator Species

Management Indicator Species (MIS) for the Lassen NF plant species are identified in the LRMP, Response to Comments (USDA 1993). The MIS analyzed for the Project were selected from this list of MIS identified in the LRMP, as indicated below in Table 90. In addition, Table 90 identifies the reason each MIS was identified in the LRMP (2rd column) and discloses whether or not the MIS is potentially affected by the North 49 Project (3th column).

Table 90. Management Indicator Species, Lassen NF, and selection of MIS for project-level analysis for the North 49 Project

Management Indicator Species	LRMP Habitat Indicator	Category for Project Analysis [a]
Willows	Riparian	3
Alders	Riparian	3
Cottonwoods	Riparian	2
Aspen	Riparian	3
Bitterbrush	Eastside Pine	3

[a] Category 1: MIS whose habitat is not in or adjacent to the project area and would not be affected by the project.
Category 2: MIS whose habitat is in or adjacent to project area, but would not be either directly or indirectly affected by the project.
Category 3: MIS whose habitat would be either directly or indirectly affected by the project.

Category 2: Cottonwoods (*Populus balsamifera ssp. trichocarpa*) were added as a MIS plant species for Riparian Areas. Within the North 49 project area, cottonwoods are only known from Manzanita Creek just outside the project boundary. While this species has been observed within the perennial portion of the creek, the intermittent portion, adjacent to the project area does not contain this species. In addition, Hwy 89/44 is located between the creek and the project area. As a result, there will be no direct or indirect effects from the implementation of the North 49 project to cottonwoods.

The MIS whose habitat would be either directly or indirectly affected by the North 49 Project, identified as Category 3 in Table 90, are carried forward in this analysis, which will evaluate the direct, indirect, and cumulative effects of the proposed action and alternatives on the habitat of these MIS. The MIS plant species selected for Project-Level MIS analysis for the North 49 Project are: Riparian hardwoods; Alder (*Alnus incana ssp. tenuifolia*), Aspen (*Populus tremuloides*) and Willow (*Salix* spp.), and Antelope bitterbrush (*Purshia tridentata*).

LRMP Monitoring Requirements for MIS Selected for Project-Level Analysis

The Lassen National Forest LRMP (1993) required no specific requirements to monitor or assess habitat status and trend or population status and trend at the forest or project scale for MIS plant species including antelope bitterbrush, and riparian hardwoods alder, aspen and willow (Response to Comments, pages 13-17).

Antelope Bitterbrush: Management Indicator species for Eastside Pine Habitats:

Antelope bitterbrush was added as a Management Indicator Species for eastside pine stands, due to the recognition that this species is an important forage species for deer and antelope. In order to maintain or enhance its value as forage, the LRMP recognized that "Bitterbrush stands can be improved by prescribed burning and livestock management to rejuvenate decadent stands and by thinning the conifer overstory in some stands"(LRMP 1993, Response to Comments, page 13).

Key Habitat Factors for Antelope Bitterbrush:

As stated in the LRMP (1993), Appendix O-1, "Wherever Management Area Direction emphasizes a species, species group, or special habitat, management will provide for High or Medium habitat capability for that species or species group. It is assumed that by providing these habitat characteristics, viability of populations dependent on these characteristics will be guaranteed." For bitterbrush, the "Desirable" habitat characteristics represent "High" habitat capability and "Adequate" habitat characteristics described for bitterbrush represent "Medium" habitat capability. Desirable habitat characteristics for bitterbrush include a mix of age classes, with the highest numbers in the seedling and young age classes, and where the relative cover of the species consists primarily of young and mature age classes.

Within the North 49 Project there are approximately 865 acres of eastside pine stands found primarily within California Wildlife Habitat Relationship (CWHR), size class 3 and 4, and canopy closure classes M and D (2005) (Table 90). For bitterbrush, "Adequate" habitat characteristics from Figure 1 would be represented by eastside pine CWHR structural classes with "M" (40-59 percent) canopy closure designation, while "Desirable" habitat characteristics would be found in structural classes with "S" (10-24 percent) or "P" (25-39 percent) canopy closure designations (Table 90). As a result, it can be assumed that higher canopy closure classes with > 60 percent (D) would most likely result in habitats unable to support bitterbrush, due to a decrease light availability.

Project-level Effects Analysis for Antelope Bitterbrush Based on Habitat

Analysis Area for Project-level Effects Analysis: The North 49 Project area was chosen as the analysis-area for project level effects since eastside pine is one of the dominant vegetation types within the project area and effects within the project area do not go beyond the project area boundaries.

Current Condition of the Key Habitat Factor(s) in the Analysis Area: The Lassen National Forest contains approximately 460,853 acres of high potential suitable habitat for bitterbrush (US Forest Service 2006). In addition, there are approximately 224,066 acres of eastside pine habitat on the Lassen National Forest (US Forest Service 1993), of which 865 acres (0.3 percent) are found within the North 49 Project area.

Direct and Indirect Effects to Habitat for Alternatives 1, 3, and 7

The Action Alternatives proposed to treat approximately 865 acres or 100 percent of the 865 acres of eastside pine stands within the North 49 project area with thin from below, modified thin from below and group selection prescriptions. Direct effects to eastside pine stands will primarily involve thinning the canopy and removing smaller sized ladder fuels within treated acres, as well as treating the understory vegetation through the use of prescribed fire. Treatments will be accomplished across a range of eastside pine CWHR structural classes (Table 91).

Table 91. Action Alternatives: Pre- and post-project acres per CWHR forest structural classes[6] within the North 49 project area. Only those structural class changed by the project are shown

Strata	Pre-project acres w/in project area	Post-project acres w/in project area	Acre Change
ESP3D	433	0	-433
ESP4P	0	411	+ 411
ESP4M	381	384	+3
ESP4D	51	0	- 51
ESP5P	0	70	+70
Total	**865**	**865**	

Source: GIS and CalVeg data files prepared for the North 49 project

Thinning and group selection treatments will change the distribution of CWHR size classes. There will be an increase in the pole and small size class stands, and a corresponding decrease in the medium/large size class stands (Table 91). Some of these changes occur because treatments will move some size class 3 stands to size class 4, because CWHR size classes are based on the Quadratic Mean Diameter (QMD) of trees 5 inches dbh and greater within a stand. QMD is the diameter of a tree of average basal area in a stand. Using QMD to calculate mean tree diameter is typically favored over a simple mean because larger diameter trees are given greater weight in the calculation of QMD. Most fire-suppressed stands are dominated by great numbers of trees in the smaller size classes, which reduces the overall average diameter for the stand. Thinning from below removes many of these smaller stems while retaining the larger stems, thus raising the QMD. Therefore, thinning existing size class 3 in many cases resulted in a size class 4 stands.

Treatment of eastside pine stands for all action alternatives will also decrease canopy cover as a result of treatments. The North 49 project will benefit bitterbrush habitat in eastside pine stands by treating high canopy cover stands with D (> 60 percent) canopy closure classes, and moving these stands into the lower P (25-39 percent) canopy closure classes (Table 90). Overall, since P canopy cover classes are considered "Desirable" habitat characteristics for bitterbrush, the proposed treatment of these stands will benefit bitterbrush habitat by opening up the canopy, which will allow more light and potentially increase the vigor of existing shrubs in the understory. In addition, group selection treatment areas will create small openings

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*Codes used:	Forest type:	Size Class:	Canopy:
	ESP = eastside pine	1 = seedlings	S = 10-24%
		2 = saplings (1-5.9")	P = 25-39%
		3 = poles (6-10.9" dbh)	M = 40-59%
		4 = small (11-23.9" dbh)	D = ≥60%
		5 = medium/large (≥24")	

within the project area, thereby lowering the canopy cover even more and potentially creating additional desirable habitat for bitterbrush establishment.

The North 49 project also proposes to treat the understory, if warranted, with prescribed fire. Ponderosa and Jeffery pine are adapted to fire, however underburning would result in some mortality of ponderosa and Jeffrey pine seedlings and some limited mortality would also be expected in saplings of these species. Prescribed fire would also result in creating areas of bare mineral soil. In addition, since proposed treatment areas contain variable amounts of duff and woody fuels and since season of burning and specific weather conditions at the time of burning are also likely to vary between treatment areas, underburning in these stands is likely to be patchy. The resulting mosaic of burn intensities in treatment areas would create areas of both low and high bitterbrush mortality, as well as areas of bare soil where new bitterbrush seedlings can establish.

Cumulative Effects to Habitat

The North 49 project area was chosen as the cumulative effects analysis area for bitterbrush and its associated eastside pine habitat, because the historic distribution and condition of bitterbrush in the project area and vicinity are unknown, and activities to eastside pine stands outside the North 49 project will have no effect on those stands within the project area. Past activities over the last 20 years within the project area are considered in the analyses, but historical assessment of eastside pine within the project area will be discussed as it relates to the current condition.

The existing vegetative conditions within the North 49 project area are the result of past management and treatments that include various logging and biomass removal, fuelwood harvest, grazing, fire suppression, prescribed fire and tree planting (Appendix A, North 49 EIS). Stand structure has drastically changed since settlement of the project area. Eastside pine stands today are much more dense, likely due in a large part to grazing by sheep and cattle, which reduced grasses and other fine fuels, and served to inhibit the spread of fire (Norman 2002). Prior to livestock grazing, it was common for ponderosa pine types in high frequency, low intensity fire regimes to be kept at low tree densities due to, 1) competitive exclusion of tree seedlings by dense understory grasses, and, 2) frequent thinning of understory trees by low-intensity surface fires (Belsky and Blumenthal 1997; Rummell 1951; Madany and West 1983).

There are three past activities, the Ashpan (1977-1982), Mud (1992-1994), and Hwy 44 Fuelbreak (1997-2000) TS projects, that may have impacted eastside pine stands within the project area (Appendix A, North 49 EIS). These past vegetation management activities may have benefited eastside pine stands and therefore bitterbrush habitat by reducing forest canopy cover (McConnell and Smith 1970) and creating more openings for bitterbrush establishment. In addition, historic fire suppression over the past century may have initially favored eastside pine stands and increased bitterbrush abundance by preventing fire damage to established shrubs. However, prolonged fire suppression has likely caused established shrubs to become less vigorous and decadent, while also preventing creation of post-fire conditions that are favorable for bitterbrush seedling establishment (Zlatnik 1999).

Future activities such as DFPZ maintenance also have the potential to add cumulatively to those effects from the proposed action. The bulk of these treatments would occur in the next 10 years and would remove small trees and brush through hand treatment, mechanical treatment, or underburning (Appendix A, North 49

EIS). These maintenance treatments would maintain relatively open understories with small amounts of regeneration. As a result, it is likely that some bitterbrush habitat in eastside pine stands within DFPZ corridors will decrease in density due primarily to repeated underburn treatments within these areas. While some bitterbrush ecotypes will sprout after a fire, those ecotypes that do not sprout may be killed with future DFPZ maintenance activities. However, any future underburning activities within these areas likely to be patchy and of different intensities, which will help maintain a mix of age classes within the project.

> **Cumulative Effects Conclusion:** It is anticipated that the implementation of Alternatives 1, 3 or 7 in combination with past, ongoing and reasonably foreseeable future actions will result in a short-term impact to 865 acres of bitterbrush habitat in eastside pine through thinning and underburning activities. In the long term, this will benefit eastside pine bitterbrush habitat by opening up the stands, and creating areas of bare mineral soil for bitterbrush regeneration. Therefore, while the action Alternatives are treating 100% of eastside pine habitat within the project area, treatments will help to move this habitat toward conditions needed to maintain the long-term viability of bitterbrush within the project area.

Direct and Indirect Effects to Habitat of Alternative 2 (No Action)

There would be no direct effects to eastside pine stands from the no action Alternative other than those associated with ongoing activities. The implementation of Alternative 2 could indirectly affect eastside pine stands by allowing conifer density and canopy cover to increase in the project area over the next 20 years. With no treatment tree stocking levels in the unthinned areas would continue to be excessive, resulting in continued growth stagnation, continuing intertree competition for limited resources, an overall decrease in stand vigor, and an ever-increasing susceptibility to insects and disease (Silviculture Report, North 49 Project Record). Throughout the project area the average stand density would slowly decline until a large-scale disturbance caused by a combination of drought, tree mortality, and or wildfire. Some CWHR density M stands would slowly shift into canopy density D where site resources can support these densities. However, the more likely scenario is that density class D stands would eventually become M stands as tree mortality continues to reduce canopy cover and the more open stands (CWHR canopy density P and S) would generally grow at faster rates due to less inter-tree competition (Silviculture Report, North 49 Project Record). Overall, stands with “Desirable” CWHR canopy cover classes S and P will shift to higher CWHR canopy cover class classes over the next 20 years. While 3M and 4M structural classes are within the “adequate” range for bitterbrush, with no treatment, these stands either shift to the “Undesirable” canopy cover D classes, or will remain in the M canopy cover classes, due to tree mortality.

The absence of fuels treatments and prescribed fire would allow continued increases in fuel loading across the project area. Under the No Action Alternative, both surface and ladder fuels would continue to increase, which would increase the risk of a high intensity fire, should a fire get established (Fuels Report, North 49 Project Record). The potential effects of a future wildfire on eastside pine stands in the project area would vary widely, depending on factors such as location of fire start, burn pattern, season of burning, and fire intensity (Zlatnik 1999). However, unless a widespread, high intensity fire affected a majority of eastside pine habitat in the project area, wildfire would be expected to create areas of both high and low bitterbrush

mortality, as well as bare soil where new bitterbrush seedlings could establish. This would contribute to a mix of bitterbrush age classes in the project area.

Cumulative Effects to Habitat

As with Alternative 1, the project area was chosen as the cumulative effects analysis area bitterbrush and its associated eastside pine habitat for the No Action Alternative. Cumulative effects for past, ongoing and foreseeable future actions for the No Action Alternative will be identical to those previously discussed within Alternative 1. Unlike Alternative 1 though, there will be no direct effects and only indirect effects from the continued increase in canopy cover and the increase threat of s high intensity wildfire from by the implementation of the No Action Alternative. As a result, these additions effects to eastside pine habitat will add cumulatively to past, ongoing, and future actions by the selection of the No Action Alternative.

Cumulative Effects Conclusion: It is anticipated that the implementation of the no action Alternative in combination with past, ongoing and reasonably foreseeable future actions will result in no short-term impacts to eastside pine habitat within the project area. Future impacts from the selection of this alternative could include the continued increased canopy within eastside pine stands and the movement away from the “Desirable” habitat characteristics required for long-term viability of bitterbrush within the project area. In addition, if a high intensity wildfire event occurred within the project area, some or all of the 865 acres of eastside pine stands within the project area could be lost, along with those bitterbrush ecotypes that are not adapted to high intensity fire.

Alternative 1, 3 and 7: Relationship of Project-Level Impacts to Forest-Scale Habitat for Antelope Bitterbrush

Currently there is approximately 224,066 acres of eastside pine habitat on the Lassen National Forest (US Forest Service 1993). In addition, there is approximately 460,853 acres of high potential suitable habitat for bitterbrush on the Lassen National Forest, within and outside of eastside pine habitats (US Forest Service 2006). The North 49 Project will result in a treatment of approximately 865 acres of eastside pine habitat within the project area regardless of which Action Alternative is chosen.. This is equivalent to 0.3 percent of the total eastside pine habitat, and is equivalent to less than 0.2 percent of the total potential bitterbrush habitat on the forest. However, while there may be short-term impacts to bitterbrush and its associated eastside pine habitat with the implementation of the North 49 Project, the proposed project will move treated eastside pine stands back closer to their historical condition and will benefit bitterbrush by opening up the stands and providing the bare mineral soil conditions needed for regeneration.

Conclusion: In summary, project-level habitat impacts will alter existing forest-wide trends to eastside pine within the North 49 Project, but will provide a long-term benefit to bitterbrush by moving these stands toward their historical condition which have been lost due to past disturbances on the landscape.

Riparian Area: Management Indicator Species:

Aspen (*Populus tremuloides*) along with willow (*Salix* spp.), alder (*Alnus* spp.), and cottonwood (*Populus trichocarpa*), were chosen as management indicator species for riparian areas, due to the recognition that these species "…can be important components of riparian systems and function to provide streambank stability, stream shade, and wildlife cover and habitat" (LRMP 1993, Response to Comments, page 13).

On the Lassen National Forest, riparian areas occur around stream corridors, along lakeshores, and around springs, wetlands and wet meadows. Riparian vegetation is critical for maintaining water quality and fisheries. It is also important for many wildlife populations because it provides food, nesting sites, shade and cover. In the past, grazing by domestic livestock has reduced the productivity of some riparian areas, particularly along streams in the more arid portions of the Forest. Timber harvesting, skidding of logs, and leaving thinning slash in and around streams was historically common place and has resulted in riparian degradation. Vegetative condition and diversity can be improved in existing riparian areas, by maintaining or enhancing riparian dependant resources and can be managed to improve bank stability, shade patterns, canopy heights, crown density, and cover (USDA 1993).

Key Habitat Factors for Riparian Area MIS species:

Within the North 49 Project area, there is approximately 2,296 acres of riparian habitat scattered throughout the project area along Bunchgrass Creek and the North Fork of Battle Creek and it tributaries, as well as Mud, Red, and Big lakes. All of these areas have potential habitat for one or more riparian MIS species. The effects from the North 49 Project to all riparian species will be analyzed together, since it is impossible to know exactly where potential habitat exists for each species in the project area, and all species are considered MIS species for riparian areas. Riparian habitat within this analysis will equate to designated Riparian Habitat Conservation Areas (RHCA's) within the project area.

Alder, aspen and willow were added as a Management Indicator Species for riparian areas on the Lassen National Forest. As stated in the LRMP (1993), Appendix O-1, "Wherever Management Area Direction emphasizes a species, species group, or special habitat, management will provide for High or Medium habitat capability for that species or species group. It is assumed that by providing these habitat characteristics, viability of populations dependent on these characteristics will be guaranteed." For alder, aspen and willow, it is assumed that the "Desirable" habitat characteristics are "High" and that the "Adequate" characteristics described for these species represent a "Medium" habitat capability. Desirable habitat characteristics for alder, aspen and willow include a mix of age classes, with the highest numbers in the seedling and young age classes, and where the relative cover of the species consists primarily of young and mature age classes. Since the North 49 project will not be directly impacting the canopy within any of the riparian areas in the Project area, only potential impacts to riparian areas will be considered in the project area.

Project-level Effects Analysis based on Habitat

Analysis Area for Project-level Effects Analysis: The North 49 Project area was chosen as the analysis-area for project level effects since riparian impacts are will be minimal and effects to this habitat within the project area do not go beyond the project area boundaries.

Current Condition of the Key Habitat Factor(s) in the Analysis Area: The Lassen National Forest contains approximately 80,200 acres of riparian habitat scattered throughout the forest, of which 2,296 acres (3 percent) is found within the North 49 project area (USDA 2008).

Direct and Indirect Effects to Habitat of All Action Alternatives

The North 49 Project is not proposing to actively treat any riparian area within the project boundary, but fire will be allowed to back down into approximately 547 acres for Alternative 1 and 3 and 552 acres in Alternative 7. No ignitions would occur in RHCAs, but broadcast burns would be allowed to creep back into this zone. If riparian areas do burn, the fire is likely to be patchy and of low intensity, due to the wetness of these habitats. Direct effects to riparian areas will be few, since they would not be directly ignited, but there may be short-term effects from the removal and/or scorching of above ground foliage during burning activities. However, riparian hardwood species are known to indirectly benefit by low intensity fires, since all three species can sprout back from underground rhizomes, shoots and suckers (Dwire and Kauffman 2003; Sheppard 2001). Overall, assuming the fire is of low intensity, treatment in these areas should help to revitalize these species, reduce competition, and potentially allow each to spread within treated riparian areas, which will contribute to the long-term health of this habitat and its associated species. In addition, removal of conifers within adjacent stands will reduce competition and increase sunlight availability to adjacent riparian areas.

Since the “Desirable” habitat characteristic for all species is described as an open canopy type, with a mix of age classes dominated by younger individuals, the proposed activity of allowing fire to back into riparian areas and treating conifer in adjacent stands will benefit riparian habitats and their associated alder, aspen and willow species. Overall, a low intensity fire within riparian habitat has the potential in the long-term to open up the stands, remove decadent vegetation, and stimulate sprouting of these species, which will increase the vigor of existing riparian hardwood species within underburned areas.

Cumulative Effects to Habitat

The North 49 Project area was chosen as the cumulative effects analysis area for riparian species alder, aspen and willow and its associated riparian habitat, because the historic distribution and condition of riparian areas in the project area and vicinity are unknown, and activities in riparian areas outside the North 49 Project will have no effect on those within the project area. Past activities within the project area are considered in the analysis.

The existing vegetative conditions within the North 49 Project area are the result of past management that include various timber harvest treatments, fuelwood, grazing, recreation, and fire suppression activities (Appendix A, North 49 EIS). This has resulted in a range of riparian vegetative conditions throughout the project area. However, there have been very few past treatment activities within RHCAs in the project area, most likely due to riparian protection measures required for these projects. The only project with riparian habitat was the Latour Timber Sale (1985-1987), which was implemented adjacent to a tributary of the North Fork of Battle Creek. Impacts from this sale are unknown, but it is most likely that the riparian corridor was

protected during project implementation activities. As a result, there are very few impacts to riparian areas from past projects that would add cumulatively to any impacts from the proposed action.

Past and ongoing livestock grazing, as well as fuelwood cutting within and adjacent to these areas has caused and is continuing to cause impacts within riparian habitat within the project area. This is especially true in those areas adjacent to lodgepole stands such as Big, Red and Mud lakes. Along the shores of these lakes impacts from woodcutters have been observed, and will most likely continue while these areas remain open to fuelwood cutting activities. In addition, ongoing as well as past livestock use in these areas has also caused additional impacts to riparian habitat scattered throughout the project area.

Future activities such as DFPZ maintenance may also have the potential to add cumulatively to those effects from the proposed action. The bulk of these treatments would most likely remove small trees and brush through hand treatment, mechanical treatment, or underburning, and may or may not occur within riparian habitat. However, these treatments would open the canopy, necessary to maintain active regeneration of hardwood species and healthy riparian habitats within the North 49 project area and would most likely provide similar protection measures for riparian areas during project implementation.

Cumulative Effects Conclusion: It is anticipated that the implementation of the North 49 Project in combination with past, ongoing and reasonably foreseeable future actions will result in a short-term impact of 547 acres of riparian habitat for Alternative 1 and 3 and 552 acres for Alternative 7. In the long-term this will benefit riparian habitat by removing decadent vegetation, reduce competition, and stimulate sprouting of hardwood species, which will aid in creating riparian habitats with a mix of age classes. Overall, the North 49 Project has the potential to impact approximately 24% of the riparian habitat within the project area. However, proposed treatments will help to move this habitat toward conditions needed to maintain the long-term viability of alder, aspen, and willow species within the project area.

Direct and Indirect Effects to Habitat of Alternative 2 (No Action)

There would be no direct effects to riparian areas from the No Action Alternative other than those associated with ongoing activities. The implementation of Alternative 2 could indirectly affect riparian habitat by allowing conifer density and canopy cover to increase in the project area over the next 20 years. With no treatment, adjacent stands would become increasingly susceptible to mortality as stand densities increase and stands would continue to shift to an increasing composition of shade tolerant species that are more adapted to persist at high densities (Silviculture Report, North 49 Project Record). This will cause a shift in the canopy cover in untreated areas to high, more dense types, which will most likely shift age classes of riparian hardwoods to mature age groups, leading to “Undesirable” habitat characteristics.

In the absence of fuel treatment and prescribed fire activities there would be an increase in fuel loading across the project area. As stands become denser with understory in-growth and surface fuel loads increase, anticipated fire behavior and effects would become more severe. These factors would cause an increase in the probability of stand replacement in the event of a wildland fire (Fuels Report, North 49 Project Record), which if sever enough could kill some hardwood species in these areas (Uchytil 1989; Howard 1996). The potential effect of a future wildfire in riparian habitat would vary widely, depending on factors such as

location of fire start, burn pattern, season of burning, and fire intensity. However, unless a widespread, high intensity fire affected the majority of riparian areas in the project area, wildfire would be expected to create areas of both high and low riparian hardwood mortality, but may also create areas of bare mineral soil, which can be a benefit to alder seedling establishment (Dwire and Kauffman 2003; Uchytil 1989).

Cumulative Effects to Habitat

As with the Action Alternatives, the project area was chosen as the cumulative effects analysis area for alder, aspen, and willow species and their associated riparian habitat for the No Action Alternative. Cumulative effects for past, ongoing and foreseeable future actions for the No Action Alternative will be identical to those previously discussed for the Action Alternatives. Unlike the discussion of the Action Alternatives though, there will be no direct effects and only indirect effects from the continued increase in canopy cover and threat of wildfire from by the implementation of the No Action Alternative. These additional effects to riparian habitat will add cumulatively to past, ongoing, and future actions by the selection of the No Action Alternative.

> **Cumulative Effects Conclusion:** It is anticipated that the implementation of the No Action Alternative in combination with past, ongoing and reasonably foreseeable future actions will result in no short-term impacts to riparian habitat within the project area. Future impacts from the selection of this alternative could include a continued increase in canopy cover in these areas and the increase in mature age classes of hardwood species, which could lead to the movement away from “Desirable” habitat characteristics required for long-term viability of alder, aspen and willow species within the project area. In addition, if a large-scale wildfire event occurred within the project area, some or all of the 2,296 acres of riparian habitat and their associated riparian hardwood species could be lost.

Alternatives 1, 3 and 7: Relationship of Project-Level Impacts to Forest-Scale Habitat for Riparian Hardwood Species, Alder, Aspen, and Willow

In the past, grazing by domestic livestock has reduced the productivity of some riparian areas, particularly along streams in the more arid portions of the Forest. Timber harvesting, skidding of logs, and leaving thinning slash in and around streams was historically common place and has resulted in riparian degradation. Past trends are most evident in aspen communities throughout the forest and the state, which are steadily being replaced by conifers due to changes in historic fire regimes and grazing pressure (USDA 2006b).

Currently, there are approximately 80,200 acres of riparian habitat on the Lassen National Forest (USDA 2008). In addition, there are approximately 2,296 acres of riparian areas within the North 49 project area. The North 49 Project will result in a treatment of approximately 547 acres of the riparian habitat for Alternative 1 and 3 and approximately 552 acres for Alternative 7. This is equivalent to approximately 0.7 percent of the total riparian habitat on the forest. In addition, while there may be short-term impacts to riparian hardwood species and their associated riparian habitats with the implementation of the North 49 Project, the proposed project will move treated stands back closer to their desired condition consisting of a mix of age classes along the riparian corridors they are found.

Conclusion: In summary, project-level habitat impacts may alter existing forest-wide trends to riparian habitat within the North 49 Project, but will provide a long-term benefit to riparian hardwood species alder, aspen, and willow by moving these stands toward their historical conditions which have been lost, due to past disturbances on the landscape.

Range

A comprehensive report on range and grazing in the North 49 project area was prepared and is incorporated into the project administrative record. The information contained here and used for comparative analysis is derived from that report.

Alternative 1, Alternative 3, and Alternative 7 Direct Effects

Effects to the grazing allotments will be the same under all three alternatives. Under these alternatives, grazing on the active allotment (North Battle Creek) is expected to continue at current levels. Impacts from the alternatives would be minimal to the vacant allotment.

Most fences and range improvements within the allotments are not located within areas proposed for treatment. Five improvements including two fences, one cattleguard and two water developments are located near proposed project activity. Four miles of fence is in very poor condition and no longer serves a purpose for livestock management. This fence should be removed. The other four improvements would need to be avoided or repaired if damaged during project activities.

Advance notification of project activities and coordination with the permittees would reduce any unexpected distribution of cattle caused by project noise and activity. If cattle needed to be removed from activity areas, they would be gathered or herded in small groups following roads and trails. The proposed new roads and decommissioned roads should not affect the cattle operation. Reductions in grazing use are not anticipated, and costs associated for any additional moving of cattle away or out of the project area are unknown.

There could be a risk of vehicle collisions or other incidents with livestock during project activities. Contract safety specifications would reduce the risk of incidents, and the quality of the roads would also reduce a vehicle’s travel speed, thus minimizing the risk of livestock collision. Coordination with the permittee in advance and signing along Forest system roads to alert the public to potential hazards would also help reduce incidents.

Most range study areas and transects occur within riparian areas within the allotments, and would not be affected by slash piling. If project activities did come close to a study area, transects would be marked with items such as T-posts, cages, rebar with yellow caps, painted PVC posts etc., and these areas would be avoided.

The livestock on the North Battle Creek Allotment tend to stay in the higher elevations where there are some open areas and forage is greater. The proposed activities (logging and underburning) will open the canopy, allowing understory to establish and in turn attracting livestock to graze. In past years, there has not been a problem with livestock drifting onto Highway 44 at the south boundary of the North Battle Creek

Allotment, although after the proposed activities are completed, there could be an increase in livestock drift onto the highway. There has always been a problem of livestock drift from the Hat Creek Allotment onto the highway and if this vacant allotment were to be stocked, these activities would cause the drift to increase.

Livestock browsing on terminal buds of plantation trees should not be a concern on the North Battle Creek Allotment. It has been found on the Hat Creek Ranger District, that if grazing is delayed until after July 1 when the terminal buds tend to harden off, livestock refrain from browsing the buds. Under this permit, livestock are not allowed to graze until after July 1.

Aspen treatments often require fencing to eliminate livestock browsing of new sprouts and annual leader growth on saplings. The proposed aspen treatments are located in the vacant Hat Creek Allotment where no livestock grazing is authorized. There would be no effect to livestock management on the North Battle Creek Allotment.

Indirect Effects

Natural and artificial regeneration efforts within group selection units would be monitored and an assessment of any livestock impacts could be completed. Regeneration efforts within group selection areas could be affected by.

If needed, the standard and guideline to defer livestock grazing may be required for two growing seasons after burning to allow desirable plants to establish. Hardship could result to the permittee if they were required to find other areas to graze cattle or reduce numbers during this deferment period.

Currently, the risk of non-native invasive species spread due to livestock would be within North Battle Creek Allotment.

At this time, it is unknown whether treatments in areas not previously used by cattle would result in additional forage. Utilization monitoring would continue in current use areas. Additional monitoring may be added if new key use areas become established with the addition of transitory range or improved cattle distribution from thinning activities.

The proposed project could have a positive effect on rangeland availability and health by creating additional forage within the treated areas. Forage production and accessibility could be increased on a large portion of the North Battle Creek Allotment, and new areas of transitory range could be created which could improve livestock distribution and use patterns.

Cumulative Effects

The area considered for cumulative effects is the North Battle Creek and Hat Creek Allotments because these allotments overlap the North 49 Project area.

The description of the allotment’s background discusses past grazing activities in the analysis area. Livestock grazing on the two allotments has occurred in a variety of forms since the early 1900’s and numerous grazing systems have been implemented along with accompanying range improvements.

Previous vegetation management projects have provided, or are providing, transitory grazing opportunities for livestock, since more open forest habitat results in additional forage for livestock as more

sunlight and moisture reach the forest floor. These particular allotments have not been reliant on transitory rangelands and no major changes in grazing use are known to have occurred on these allotments due to past projects.

Overstory removal would result in a thinner canopy with intermittent openings in areas that may have been previously inaccessible to livestock. The cumulative effect of openings within the allotments is a temporary increase in foraging areas for livestock as well as improved access between grazing use areas.

Group selections would create open areas and uniform stands that extend over substantial areas, and some areas would have established with grasses or brush, which may be utilized as transitory range. Low and/or discontinued use of the vacant grazing allotments may result in a relatively minor accumulation of fine fuels in the form of cured grasses and forbs in the planning area.

Heritage Resources

Heritage resources include prehistoric and historic resources. This section provides comparative analysis of the potential effects on physical remnants of those resources and the contributing settings associated with the heritage resources under the proposed action and alternatives.

Methods of Analysis

As discussed in more detail in the compliance section, heritage work completed for the North 49 project was designed to conform to the regulations of the National Historic Preservation Act, the National Environmental Policy Act, and other application legislation, and to comply with management direction in the Forest Plan. The 2001 Programmatic Agreement (see the reference section for its lengthy full name) and its annex the 2004 Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects provided the basis for the protection measures identified in Chapter 2.

Heritage work for the project included pre-field research, field survey, site monitoring, site documentation, and analysis of site protection needs, as well as tribal consultation. Pre-field research included a review of Forest Service files to determine whether known sites were present, and review of historic maps to locate historic features still potentially in existence.

Multiple field surveys to locate archaeological sites have been completed to cover the project area to modern standards. They include a 9,780-acre survey reported upon in 2003 (Waechter et al. 2003). In keeping with standard archaeological practices, some portions of the treatment area were eliminated from survey because they are outside treatment areas and thus outside the Area of Potential Effect for the project. Others were eliminated from survey or surveyed less than intensively due to the steepness of the slopes (some were too dangerous to walk; others fall within the provisions of the Interim Protocol). Locations with brush too dense to allow for adequate survey will require post-implementation survey as provided for in the Interim Protocol. Site monitoring activities included documenting the current conditions of previously known sites, and newly identified sites were recorded in detail.

To identify potential areas of tribal concern, Forest Service personnel conducted tribal consultation with the Pit River Tribe. Initial consultation for the project occurred on April 15, 2004. This consultation included

the Atsuge band representative. Ongoing consultation has included updates on the project provided to the tribe at quarterly consultation meetings, with the last such update given on January 9, 2008. In the sense that tribal input will continue to be welcomed, the consultation process is ongoing.

Direct Effects of the No Action Alternative

Under the No Action Alternative, no project activities would take place, thereby eliminating the risk of direct impacts to heritage sites as a result of project activities. Other sources of impacts (such as recreational activities) would continue to affect sites.

Indirect Effects of the No Action Alternative

If no action occurs, fuel loads within the vicinity of archaeological sites would be expected to increase, increasing the risk of high-intensity wildfires that could impact site components. (Depending upon the types of site components present, high-intensity fires could have a greater potential for impacts than would lower-intensity prescribed burns.) If sites currently concealed by vegetation are present, leaving the vegetation in place would help conceal them and could reduce the chance of looting, at least until wildfire burns through the area. However, it would also reduce the chance that these sites would be found and documented, adding to our knowledge of the area.

Cumulative Effects of the No Action Alternative

Under the No Action Alternative, project activities would not contribute to cumulative effects. Other types of ongoing impacts would continue.

Direct Effects Common to Action Alternatives 1, 3 and 7

All three action alternatives require project activities having potential to affect heritage resources. Each alternative includes some combination of group and individual tree harvesting, machine mastication, machine and hand piling, prescribed burning, and road construction. Ground-disturbing activities such as road and landing construction can damage or destroy historic and prehistoric archaeological sites and features. Tree felling, skidding, and slash disposal can alter or destroy surface or shallow sites and other physical features. All of these activities can displace artifacts, which can subtract from their ability to provide scientific information in cases in which patterned distribution of artifacts within a site can provide useful information. Mechanical equipment driven within a site can crush artifacts and features.

Prescribed burning presents complexities, since it can result in relatively low-intensity burns potentially less damaging to sites than higher-intensity wildfires, but can also itself cause damage. DeBano et al. note (1998:269) that the direct effects of fire on artifacts include combustion, structural change, breaking off of a piece of the artifact (often termed spalling), chemical changes, and rearrangement of site components. They add “artifact materials affected by burning include ceramics, grinding stone, lithic artifacts and glass, architectural material, rock art panels, and wood and other organics. Heating can also destroy the usefulness of research dating techniques, including those involving carbon-14 ratio analysis, obsidian hydration, archaeomagnetism, and dendrochronology.”

Historic wooden structures and features incur the greatest risk from fire including prescribed burns, but many other types of artifacts can be affected. Prehistoric site components that might provide information on dietary practices, such as shell, bone, and plant residues including pollen, can be affected. Surface pollen can be affected at temperatures above 300 degrees C. Bone chars at 400 degrees C and can be severely altered at higher temperatures. Shell and bone can become calcined and fragile with moderate heating (for example, bone can become calcined starting at about 525 degrees C (DeBano et al. 1998:273-274).

Fire's effects on groundstone range from smudging (starting at about 375 degrees C) to disintegration. Effects on flaked stone range from discoloration and patination; to structural changes resulting from water loss, which can cause the stone to become brittle. Some types of flaked stone are more susceptible to fire damage than others (DeBano et al. 1998:271).

Given these effects, prescribed burns are sometimes appropriate within sites (such as historic trails) that lack elements expected to be damaged as a result of fire. (These can, under certain circumstances, include sites that have already been completely burned over by higher-intensity burns).

Not all management activities would adversely affect heritage properties. Timber harvesting outside site boundaries could restore more open conditions of the type that would have been encountered by Euro-American emigrants, and reduce the chances of high-intensity fires that could enter sites. Burning and other silvicultural practices often promote the growth and spread of important plant resources traditionally collected by Native Americans.

Indirect Effects Common to Action Alternatives 1, 3 and 7

In addition to directly affecting the location and physical features of heritage resources, ground-disturbance and vegetation removal outside the site boundaries can indirectly affect a site by altering its setting. Setting is often an important value for historic sites and Traditional Cultural Places.

Management activities that indirectly increase access to heritage resources or improve ground visibility can adversely affect archaeological sites. Increased pedestrian or off-road vehicle traffic facilitated through brush removal, burning, or other management activities can destroy sites through inadvertent damage such as soil compaction. Looters and vandals could severely damage or destroy cultural heritage values if sites become more accessible or if site components become more readily visible.

Brush removal is expected to open up new areas for survey. If new sites are identified and recorded as a result, their recording could add to our knowledge of area history or prehistory.

Cumulative Effects Common to Alternatives 1, 3, and 7

Geographical Scope

For heritage resources, the effective geographical area is most straightforwardly defined in terms of the physical boundaries of the project area, and specifically the sites within it, since these are the locations that could be physically impacted and that contain specific values to be protected during a proposed project. In considering the importance of cultural resources, however, one should also keep in mind that the consequences of managing cultural resources might extend beyond the site/project boundaries.

For example, scientific information lost from a site in one area may subtract from the overall archaeological record for a geographic or cultural region. Values lost from a segment of a linear historic site that extends beyond the project area may subtract from the values of the entire site. Damage to Traditional Cultural Properties affects, at a minimum, the group that identifies with that location. The heritage resource protection measures specified in Chapter 2 are designed to preserve the physical resources in a manner that preserves their specific values both for their own sake and for their potential to contribute to our cultural heritage at larger scales.

Time Frame

The effective time frame for cumulative effects to heritage resources differs in some ways from that used for renewable resources, since site values, once lost, are gone forever. The list of actions considered for cumulative effects analysis in Appendix A of the EIS thus tells a portion of the story, but not all. (In fact, in terms of human actions, both prehistoric and historic activities sometimes have disturbed earlier site components.) Prior to mid-1970s legislation such as the Forest and Rangeland Renewable Resources Planning Act (1974) and the Archaeological and Historical Data Preservation Act (also 1974), effects to heritage resources were not considered during most project planning and implementation. Within the treatment area, observed damage to sites from past actions may predate the mid-1970s. Such damage provides examples of how various activities can impact sites and suggests ways to avoid further effects.

One way to examine past sources of impacts to sites is to review the site records. Review of the site records for the treatment area indicates that the most common sources of disturbance include past logging activities, road construction and maintenance, and bulldozing for various purposes.

The effects, if any, of road use need clarification (to be obtained through monitoring). Additional sources of site disturbance include looting (digging and unauthorized surface collection), recreational activities such as hunting, possibly plantation planting, possibly construction and maintenance of a telephone line or lines, fence maintenance, and recent occupation.

As identified in Appendix A of the EIS, past, present, and reasonably foreseeable actions include numerous timber harvests, with some brush mastication. Ongoing actions include recreational uses, a small amount of grazing, road maintenance, plantation maintenance, special uses, and timber harvest on private and state lands. Reasonably foreseeable future actions include special uses, timber harvest, broadcast burning, DFPZ maintenance, aspen release, and group selection.

Conclusions

Past damage to sites cannot be undone, but cumulative effects added from the current treatments can be avoided. Now that effects to sites are fully taken into consideration in project planning, clear communication between the project manager and/or harvest inspector and archaeologist, and the project manager and those implementing the project on the ground, is needed to avoid further damage. Areas that need avoidance must be clearly marked, and buffer zones should be used where necessary to help prevent accidental damage. Ways to avoid impacts must be examined in terms of both the proposed activity and the site’s components. This would be achieved by applying the mitigation measures for protecting heritage resources described in Chapter 2.

Recreation

This section provides a comparative analysis of effects on recreational resources and opportunities that would occur from implementation of the proposed action or alternatives.

Alternative 1 – Proposed Action

Direct Effects to Recreation

Alternative 1 meets the Recreation Opportunity Spectrum and Visual Quality Objectives of the 1993 Lassen LRMP as amended. In general, recreation and special use sites would be protected by avoidance or implementation of the Limited Operating Period. Since timber sale activity would be restricted between December 1 and April 1 because of snowmobile trails, the Lassen LRMP standard would be met.

Dispersed recreation – Impacts to visitors that are camping, hunting, hiking, horseback riding, snowmobiling, driving for pleasure, sight seeing, and OHV riding are likely to be minimal due to the current level of visitor use, the size of the project area, and the fact that treatment activities would be staged over time. It is unlikely that a visitor who has been temporarily displaced would be unable to find another suitable campsite within a reasonable distance. No known, well-used dispersed sites are located within the proposed DFPZs. More isolated dispersed hunter camps could require temporary closure during operations, but treatment would result in reduced fire hazard in and around these sites, and provide a buffer of protection from campfires and other visitor activities.

The largest impact to most recreational visitors during spring, summer, and fall seasons would be an intermittent and temporary increase in operations noise, including timber felling (chainsaw and mechanical), heavy equipment use, and large truck traffic. This is a historical, temporal, occurrence throughout much of the project area.

Effects to Thousand Lakes Wilderness could include operating noise that may be audible in the southern portion of this area. However, the majority of visitor use is concentrated in the north half of this wilderness, and is unlikely to be affected. The long-term benefit to the wilderness would be the creation of a DFPZ along the southern boundary. This would serve to protect it from the threat of wildfire as was shown in the Farsite model run. Under the assumptions used in the model, if a fire were to ignite to the north/northwest portion of the project area, it would likely move into the wilderness, where high fuel loading could result in severe impacts.

Standard operating procedures for timber sale administration require the posting of log truck traffic on haul routes, and providing adequate safety caution to recreationists driving and riding OHVs. If OHV use in the Red Lake/Battle Creek area continues to increase as has occurred in recent years, visitor education efforts and Law Enforcement patrols could be increased to further ensure public safety when log trucks are operating.

During the fall, the project area could be temporarily impacted by smoke from prescribed burning operations. However, with the exception of hunters, forest visitor use is minimal during these times, and prescribed burning activities are typically limited in duration.

A temporary impact to seasonal recreation activity would be the reduction of small red fir and white fir sought by Christmas tree cutters. Where DFPZs are created, this would eliminate the public's access to desirable trees near the road. Group selections, on the other hand, could provide more regeneration of the desired species in 10 or 20 years, although it is uncertain whether the public would be able to access these. In the interim, the public is likely to seek Christmas trees in other nearby, high-elevation areas, such as West Prospect, Burney Mountain, and Butte Creek Rim.

Group selections have been placed to avoid the developed recreation site at Eskimo Hill, and the adjacent permitted area for the Boy Scouts winter campout. This would ensure protection of the necessary aesthetic and recreational values supporting existing public uses, as well as the potential for future expansion of uses in the future. The creation of a DFPZ around these areas would maintain forest health and provide protection from wildfire for this location at the gateway of LVNP.

The unclassified roads in Sections 1 and 2 proposed for decommissioning serve as (ungroomed) cross-country ski routes from Eskimo Hill Snowplay area to higher elevations near Red Mountain. These roads would be decommissioned by means of a barrier method, rather than obliteration, so that the current dispersed recreational use would not be affected.

Developed recreation – Few treatments are proposed in the immediate vicinity of PG&E's North Battle Creek Reservoir Campground, so disturbance (such as operating noise) to this developed site would be limited in intensity and duration. If thinning and mastication operations were conducted before Memorial Day or after Labor Day, when visitor use is minimal, it would further reduce any effects to the recreation experience of campers.

Winter recreation at Ashpan Snowmobile Park and Eskimo Hill would be unaffected unless winter logging was proposed near either location. This could require temporary closure of these sites, to ensure public safety of winter recreationists. The winter LOP in effect for snowmobile trails makes it unlikely that this would occur.

Trails – The Lassen Backcountry Byway would have a short term impact due to the intermittent and temporary increase in large truck and heavy equipment traffic.

There would be no effect to the Ashpan snowmobile trail system so long as vehicular traffic on these roads would be prohibited between December 26 and April 1.

Access – Under the proposed modifications to the existing transportation system in the project area, a total of 33.1 miles would be decommissioned. In addition, 18.9 miles of road would be added to the system as Level 1 roads, which are closed to public (motorized) use. 2.2 miles of existing non-system roads would be added to the system as Level 2 roads, which are open to the public. Other than 0.3 miles of road proposed for full rehabilitation, the decommissioned roads would remain available for public, non-motorized uses.

Although the net result represents a decrease in the number of miles of road available for public motorized use, the actual effect on desirable driving and OHV riding opportunities should be minimal. Most of the road segments proposed for closure are short, dead end spurs, which were once used for timber management activities, but which do not provide access to dispersed campsites or other recreational features, or offer loop riding opportunities. Thus, the overall effect to motorized users would be limited in terms of

quality driving and riding opportunities. The effect to non-motorized users would be a reduction in road noise, and an increase in opportunities for wildlife viewing or hunting. Restoring 0.3 miles of road in the RHCA to natural conditions may also enhance opportunities for cross-country hikers to enjoy birdwatching and wildlife viewing as a result of overall habitat improvement.

Indirect Effects to Recreation

Long-term effects of the project would be an improvement to the over all health of the forest and safety from wildfire thereby improving recreation opportunities in the future. DFPZ construction would provide increased wildfire protection for Thousand Lakes Wilderness. People familiar with the area, especially those who return each year such as campers, hunters, and motorized users would be most aware of any limitations to recreation activities during project implementation. New or occasional visitors would be less aware of changes. Design features would lessen the short-term effects to recreation.

Cumulative Effects to Recreation

The Cumulative Effects analysis boundary for Recreation extends beyond the project area to encompass the larger subwatershed area in order to provide context for recreational uses in this portion of the forest. Although the actual project area does not typically receive heavy recreation use, the watershed boundaries include portions of Thousand Lakes Wilderness to the north, Lassen Volcanic National Park to the southeast, and the designated Hat Creek Recreation Area to the east/northeast (see and Appendix A). The recreation features of these areas; including developed campgrounds, interpretive trails, information centers, day use areas, hiking and equestrian trails, and popular fishing lakes and streams; draw thousands of visitors each year to these destinations adjacent to the project area. A look at the broader, subwatershed area is important in assessing how project activities may affect this area of concentrated recreational use. Activities proposed under North 49 are not expected to pose any long-term negative effects to recreation in these areas, and should provide the benefit of protection from catastrophic wildfire.

The North 49 Project area has a long history of vegetation management projects. Impacts to visitors have been well mitigated and complaints are few. The recreating public appears to be satisfied with their recreational experiences as they enjoy the project area. The only public complaints or suggested changes in management have been concerning our roadside fuel reduction projects that have eliminated an abundance of desirable Christmas trees. They have returned from family outings frustrated at being unable to find a tree, or may resort to cutting illegally. Over time, cutting pressure may increase in other parts of the forest, or the program may decline, as the accessible supply of desirable trees diminishes.

New authorizations for Special Use Permits are evaluated, analyzed, and approved if they are feasible and in compliance with the 1993 LNF LRMP as amended. Existing permits are inspected for compliance with requirements, and uses are protected during operations, or an appropriate solution is negotiated to meet mutual needs. The continued elimination of brushfields under future fuels reduction projects could potentially affect foraging for permitted apiary sites in the future. The affected sites would need to be dealt with on a case-by-case basis.

With regard to most recreational or permitted activities, once treatments have been completed, the recreating public would be able to enjoy these uses as before. It is expected that cumulative effects to recreation activities would remain limited in scope and duration.

Alternative 2 – No Action

Direct and Indirect Effects to Recreation

The No Action Alternative would result in no immediate or foreseeable change to existing developed or dispersed recreation activities, and visitors' use of roads and wilderness.. Over time, the extensive brushfields and plantations that are currently unusable by recreationists would continue to increase in density and decadence. With no reduction in the fuel hazard, the occurrence of high intensity wildfire could have a devastating effect on the recreational opportunities within, and adjacent to, the project area, which are largely based on scenic values and dispersed opportunities for camping, hunting, motorized use, and gathering forest products.

Cumulative Effects to Recreation

With no reduction in the risk of wildfire to this forest area, effects to all types of recreation activities would take place if a large scale wildfire were to occur due to continued buildup of debris, brush and ladder fuels. Depending on the scale of a wildfire, it could cause some temporary or long term closures and inconvenience to the recreation user, or in the worst case, fire damage to the forest could be extreme and take several decades to recover. In this scenario, many visitors would be displaced.

Alternative 3 – Modified Proposed Action

Direct and Indirect Effects to Recreation

Although there are some differences between alternatives 1 and 3 in the intensity of treatment and the dropping of some group selection treatments, differences in the potential effects to recreational resources are minimal. Alternative 3 also meets the Recreation Opportunity Spectrum and Visual Quality Objects of the 1993 Lassen LRMP as amended. The analysis of effects described under Alternative 1 also applies to Alternative 3, with the following exceptions:

Under this alternative, treatments in Sections 1 and 2 would retain a more natural appearance in the forested areas adjacent to the southern boundary of Thousand Lakes Wilderness due to fewer group selections, as well as a result of such features as retention islands, increased retention of larger diameter trees, and less intensive treatment of ground fuels. This effect is desirable as a visual buffer and improved wildlife habitat adjacent to the wilderness, and along the access road to Bunchgrass Trailhead.

The less intensive thinning treatment may also result in greater retention of smaller red and white fir trees sought by the public for Christmas trees.

However, increased retention of trees susceptible to mortality and reduction of the intensity of ground fuels treatment may also increase the risk of high intensity fire and the potential for spread into the wilderness.

Cumulative Effects to Recreation

The cumulative effects under Alternative 3 would be comparable to those described under Alternative 1, with the exception that fewer group selections would reduce the number of openings created in addition to treatments on both public and private lands in the vicinity, providing more continuous forest cover for dispersed recreational activities.

Alternative 7 – Preferred Alternative

Direct and Indirect Effects to Recreation

Under Alternative 7, potential effects to recreation resources would be similar to the other action alternatives, and would meet the Standards and Guidelines Recreation Opportunity Spectrum as designated under the Lassen LRMP. The analysis of effects described under Alternative 1 also applies to Alternative 7, although specific modifications to silvicultural treatments and operational methods in the new alternative appear to provide greater benefits to recreation resources.

The direct effect of eliminating helicopter units would be the absence of aircraft noise audible to campers, hunters, and wilderness users while these operations are in progress. The addition of structural diversity thinnings and brushfield treatments would result in improved wildlife habitat, with the indirect effect of more robust populations of game species, as well as wildlife viewing opportunities.

Also, treatments designed to enhance the diversity of stand structure and species' composition (including aspen release) would increase and improve settings desirable for dispersed camping and hiking, where current stand conditions are too dense to allow these uses. Radial thinnings and pine restoration treatments adjacent to the boundary of Thousand Lakes Wilderness and Bunchgrass trailhead would encourage, and continue to provide, over time, a mature forest character as the approach to the southern end of wilderness.

The direct effect to motorized vehicle access of administrative decommissioning of 30.8 miles of unclassified routes and 1.5 miles of system roads appears to be negligible, as the designated closures are short spurs that are not associated with specific dispersed recreational uses. No new road construction would occur than under any alternative.

Cumulative Effects to Recreation

Cumulative effects to recreation resources under Alternative 7 would be generally comparable to those discussed under Alternative 1 (and 3), and would remain limited in scope and duration. However, the site-specific treatments proposed under this alternative would provide a long-term benefit to forest stand diversity and sustainability, wildlife habitat, and wilderness protection, and consequently, better support the expected increase in future recreation uses.

Visual Resources

This section provides a comparative analysis of effects on visual resources that would occur from implementation of the proposed action or alternatives.

Alternatives 1 and 3

Direct and Indirect Effects to Visual Resources

Although there are some differences among alternatives 1 and 3 in the intensity of treatment and dropping of some group selection treatments, no real distinction between the alternatives can be made to the visual resource. Both action alternatives meet the Visual Quality Objects of the 1993 Lassen LRMP as amended, therefore the effects analyses are discussed together.

Retention - Those areas identified as retention would be managed in the foreground to maintain diversity of tree, shrub, forb and other grass species common to the area in irregular shaped patterns to retain the appearance of unmanaged timber and to achieve a range of age and size classes up to 48 inch dbh in multi-storied stands. Most treatments would consist of thinning, machine piling and underburning. Highway 44 is recognized as a scenic byway through this area, Approximately ten years ago, under the Highway 44 project, a strip along the road was lightly treated to create a fuelbreak/community protection zone Treatments under the action alternatives would retain the same general appearance of size class and species diversity. Those areas identified as retention would be managed in the middleground to retain the appearance of continuous forest cover in timber stands, which would again meet the retention objective.

Partial Retention and Modification - Given that the DFPZ and area thinning treatments occur along Forest Road 16 and Highway 44, this would create a visual effect where management activities would remain visually subordinate to the surrounding landscape. Because there are currently varying degrees of canopy closure along these roads, the basic parameters within which meeting this VQO would be possible. Alternatives 1 and 3 would maintain a dominance of mature forest character. Alterations proposed would be made in such a way as to minimize their negative contrast with the landscape and move the stand toward its desired long-range goal. Slash and other logging debris would be eliminated so as not to be visually evident. Some stumps may be visible in the foreground. However, as vegetation regrows, the negative effect would lessen.

Vegetative patterns of the thinned stands within the DFPZs and the area thinnings include a mosaic of differing forest types, and moderately uneven terrain. Some areas have a continuous canopy with some patterns of openings. Small openings from the group selections would be created which would repeat the existing forms, colors and texture of the openings. Uncut segments, giving a more natural landscape appearance, would also break up cutting along the roadside frontage. Establishing vegetation after treatment both by natural regeneration and understory growth, as well as reforestation would reduce exposed soil.

Some groups would be established within the DFPZs. Most cutting units should be located behind vegetative screens. For those that would be visible to the vehicle-oriented observer, the irregular edges used to define the groups would be softened and blend with natural openings and landforms in the middle and fore ground. In addition, after slash disposal, the groups would be planted to assure prompt regeneration. This would begin the transition zone to soften the coarse edge of the residual trunks.

A few groups could be visible from the Thousand Lakes Wilderness or Highway 44. However, they would be on the slope below or above the observer eye level. In this case, most cutting units would have vegetative screens in the foreground as they are looking down upon them. They would appear as natural

openings, but in some instances appear clustered together. The irregular edges used to define the groups would soften and blend with natural openings and landforms in the middle and fore ground as noted above. In addition, after slash disposal, the groups would be planted to assure prompt regeneration.

Those areas identified as partial retention would be managed in the foreground to maintain diversity of tree, shrub, forb and other grass species common to the area in irregular shaped patterns to retain the appearance of unmanaged timber and to achieve a range of age and size classes up to 36 inch dbh in multi-storied stands. Those areas identified as partial retention would be managed in the middleground where the effects of management activities may be noticeable, but should not attract attention.

Alternative 7

Direct and Indirect Effects to Visual Resources

Alternative 7, like the other action alternatives, meets the Visual Quality Objectives (VQOs) as designated under the Lassen LRMP. The analysis of the direct and indirect effects of Alternatives 1 and 3 that describes how the vegetative treatments are designed to meet or improve visual resources within the project area is applicable to Alternative 7, as well.

However, additional thinning treatments proposed under Alternative 7 are especially designed to enhance the diversity of species' composition and age classes. The direct effect of this approach would be a more natural, as opposed to managed, appearing forest composition that the recreating public frequently states a preference for. Indirectly, these treatments also result in a varied stand composition that is healthier, and more sustainable, over time, as these stands are more resistant to large-scale mortality due to insect infestation, disease, and fire. This long-range sustainability serves to protect and perpetuate visual resources for the future.

Also, specialized, site-specific treatments such as radial thinning and pine restoration located adjacent to Thousand Lakes Wilderness and the roadless area are intended to encourage the growth of large trees, and move the stand toward late seral characteristics.

In the future, the visual resource would move toward a less-managed, more varied landscape, in contrast to much of the adjacent private timber lands. These would also maintain desirable aesthetics along the Lassen Backcountry Byway, and the boundary of the wilderness and roadless area, and protect visual resources throughout the project area from the potential effects of catastrophic wildfire.

Cumulative Effects to Visual Resources

The cumulative effects analysis boundary goes outside the project area to the extent of the subwatersheds where the visual aspect may be noticed. These watershed boundaries take in small portions of the Thousand Lakes Wilderness to the north and the Lassen Volcanic National Park to the southeast. Figure A-10 displays this area (Appendix A). Neither of these entities is within the North 49 boundary. However, from a visuals perspective some view points along their boundaries are visible. The North 49 Project area has a long history of vegetation management projects. Visual impacts to visitors have been well mitigated and complaints are rare. The recreating public appears to be satisfied with their experiences as they enjoy the project area. No public complaints or suggested changes in visual management have been requested to date. Once the new

treatments have been completed, the recreating public would be able to enjoy their uses as before. Therefore, there is little cumulative effect to the visual quality of the North 49 project areas.

Alternative 2 – No Action

Direct, Indirect and Cumulative Effects to Visual Resources

The No action alternative would result in no immediate, discernable change to the visual resource and little perceived change for years. If no disturbance events occur over the next 20 to 30 years, the forest stands would continue to dominate the landscape and increase in density further reducing scenic variety and diversity. With no reduction in the risk of wildfire to this forest area, effects to the scenery would take place if a large-scale wildfire (beyond expected disturbance levels in this ecological unit) were to occur. Depending on the scale, wildfire could permanently change the vegetative composition of the forest resulting in scenery with very negative appearance for 3 to 10 years and a different type of scenic expression thereafter, as was shown in the Farsite model run.

Economics

A comprehensive report on socio-economics was prepared for the North 49 Project and is incorporated into the project record. The information contained here is derived from that report.

Methodology

According to FSM 1970.62, the analysis should implement “techniques to develop the most efficient combination of activities for each decision unit within each alternative.” Given the information provided, financial efficiency measures are calculated in this analysis to provide a means of comparing the economic feasibility across alternatives.

Table 92. Project activities across alternatives

Fiscal Year	Timber Harvest	Mech. Group Site Prep.	Hand Group Site Prep.	Tree Planting	Temp Aspen Fencing	Plantation Thin/ Masticate	Under-burn/ Machine Pile	Group Release
2008	Alt 1, 3 & 7							
2009	Alt 1, 3 & 7	Alt 1, 3 & 7	Alt 1 & 3	Alt 1, 3 & 7	Alt 1, 3 & 7	Alt 1, 3 & 7	Alt 1, 3 & 7	
2010	Alt 1, 3 & 7	Alt 1, 3 & 7		Alt 1, 3 & 7		Alt 1, 3 & 7	Alt 1, 3 & 7	
2011		Alt 1, 3 & 7	Alt 7	Alt 1, 3 & 7		Alt 1, 3 & 7	Alt 1, 3 & 7	
2012								Alt 1, 3 & 7
2013								Alt 1, 3 & 7
2014								Alt 1, 3 & 7
2015								Alt 1, 3 & 7
2016								Alt 1, 3 & 7
2017								Alt 1, 3 & 7

The alternatives are analyzed and compared using the Quicksilver program to estimate the Benefit-Cost ratios and the Net Present Values (NPVs) of project alternatives. Quicksilver is a financial analysis tool developed by the USDA Forest Service to generate measures of financial efficiency. A 10 year planning horizon is used in this analysis; activities would begin in fiscal year 2008 and end in fiscal year 2017. Table 92 summarizes the activities expected to take place each year for each alternative, a blank cell in the table means that the activity would not take place during that year for any alternative. Information regarding the vegetation management activities as well as the timeline for project implementation was collected from local sources. Since potential implementation scenarios are still under investigation (i.e. firms harvesting salvageable timber, developing/maintaining roads, etc. are TBA), the estimated costs and benefits across alternatives are reported together and are not allocated across potential partners. Thus, the NPVs calculated are simply the discounted benefits associated with the North 49 Forest Health Restoration Project activities minus the discounted costs in aggregate. All monetized values in this analysis are reported in 2008 dollars.

This analysis is based on the likely development scenarios outlined in the alternatives. During the course of the analysis, it was determined that Alternatives 4, 5 and 6 did not meet the objectives of the North 49 Forest Health Recovery Project and were therefore eliminated from further consideration. Alternative 7 was developed later on in the process in response to public comments received on the Draft Environmental Impact Statement. The elimination of Alternatives 4, 5 and 6, as well as the development of Alternative 7, are discussed in Chapter 2. Thus, the remaining alternatives addressed in this analysis are the proposed action (Alternative 1), the no action (Alternative 2), modified proposed action (Alternative 3), and the preferred action (Alternative 7). To remain consistent with the terminology and labeling throughout the analysis, financial efficiency measures are reported for Alternatives 1, 2, 3 and 7; however, to eliminate confusion, Alternative 2 is the No Action alternative. The quantities utilized throughout the analysis, as well as the values of costs and benefits, were obtained from sources on the Lassen National Forest. The data utilized in this analysis represents the best available estimate of the quantities, costs, and benefits associated with each development scenario. Table 93 reports the costs and benefits associated with proposed activities in the North 49 Forest Health Recovery Project, while Table 94 reports the proportion of saw timber harvested by species.

Table 93. Costs and benefits associated with the North 49 project

Activity	Cost/Benefit	Unit of Measurement
Value of Saw Timber*	Benefit	CCF
Value of Biomass	Benefit	CCF
Logging Cost	Cost	CCF
Haul Costs	Cost	CCF
Administration Costs	Cost	US Dollar
Mechanical Group Site Preparation	Cost	Acre
Hand Group Site Preparation	Cost	Acre
Tree Planting	Cost	Acre
Temporary Aspen Fence	Cost	US Dollar
Plantation Thin/Masticate	Cost	Acre
Underburn/Machine Pile	Cost	Acre
Group Release	Cost	Acre

* Value per unit varies by species. Values used for this analysis are those reported by the Oregon Department of Forestry for the Klamath Unit (Region 5).
http://oregon.gov/ODF/STATE_FORESTS/TIMBER_SALES/logpage.shtml

Table 94. Proportion of saw timber harvested by species

White Fir	75%
Ponderosa Pine	15%
Lodgepole Pine	9%
Incense Cedar	1%

Under all alternative development scenarios, the harvest of saw timber and biomass is proposed. Biomass consists of all trees harvested between 3 inches and 9.9 inches dbh. Saw timber consists of trees harvested between 10 inches and 29.9 inches dbh; however, only 0.5 percent of the trees harvested will be greater than 24 inches dbh. Given the vast differences in the revenue streams associated with the commercial harvesting of saw timber and biomass, economic measures are estimated separately for biomass harvesting. Saw timber and biomass harvesting and sales are planned for fiscal years 2008, 2009 and 2010. Table 95 reports the revenues associated with sale of timber and biomass during the life of the project for each alternative. Alternative 2 is not included in Table 95 because there is no prescribed sale, and thus no revenues associated with the sale, of saw timber or biomass under the No Action Alternative. These revenue streams represent the only monetary returns associated with the North 49 Forest Health Recovery Project. Thus, the discounted sums of these revenues are the only measurable benefits accounted for in the benefit-cost ratios and NPVs reported below. Under Alternative 1, the prescribed harvest of saw timber and biomass are greatest in fiscal year 2008, thus revenues are greatest for that alternative during that year; revenues in subsequent years are considerably less. Alternative 7 has largest sustained level of harvesting during fiscal years 2008 thru 2010, and has the greatest monetary return in terms of saw timber and biomass sale revenues.

Table 95. Revenues Associated with the North 49 Project by Alternative

		Alt 1	**Alt 3**	**Alt 7**
FY2008	Saw Timber	$6,045,833.10	$2,844,410.60	$5,744,086.20
	Biomass	$9,274.00	$3,717.25	$4,780.50
	Total	**$6,055,107.10**	**$2,848,127.85**	**$5,748,866.70**
FY2009	Saw Timber	$2,355,868.00	$2,844,410.60	$5,744,086.20
	Biomass	$3,625.00	$3,717.25	$4,780.50
	Total	**$2,359,493.00**	**$2,848,127.85**	**$5,748,866.70**
FY2010	Saw Timber	$2,131,650.00	$2,844,410.60	$5,744,086.20
	Biomass	$3,750.00	$3,717.25	$4,780.50
	Total	**$2,135,400.00**	**$2,848,127.85**	**$5,748,866.70**
Entire Project	**Total**	**$10,550,000.10**	**$8,544,383.55**	**$17,246,600.10**

According to OMB Circular A-94, NPV is the standard criterion for deciding whether a project is economically justifiable. NPV is a way of comparing all monetarily valued costs and benefits, and is calculated by subtracting the discounted sum of total costs from the discounted sum of total benefits. Economic principles associated with the time value of money suggest that money now is worth more than money in the future. Thus, benefits and costs occurring in the future must be discounted back to represent their current value. A Federally prescribed discount rate of 4 percent is used in this analysis (FSM 1971.21). A positive NPV means that the discounted sum of benefits is greater than the discounted sum of costs, and vice versa. Inflation is also a variable that can affect the NPVs associated with each alternative. However, due

to the uncertainty of future inflation, OMB Circular A-94 recommends the avoidance of making assumptions about the inflation rate whenever possible. Thus, for the purposes of this project, inflation will be left at zero.

The relationship between benefits and costs is further assessed with the computation of Benefit-Cost ratios. The Benefit-Cost ratio is simply the discounted sum of benefits divided by the discounted sum of costs. A ratio greater than one suggests that the benefits associated with a project are greater than the costs. One caveat of Benefit-Cost ratios is that they do not allow the analyst to assess the aggregate value of benefits associated with an alternative. The alternative with the highest Benefit-Cost ratio has the highest value of benefits compared to the associated costs, but does not necessarily have the greatest value of benefits at the aggregate level. Benefit-Cost ratios are often utilized as a decision criterion in situations when a budget constraint is present, i.e. chose the alternative with the highest ratio up to a certain level of total costs. NPV provides a better measure of the overall level of benefits and costs as it reports the difference between benefits and costs at the aggregate level, rather than being a ratio of the two.

Economic Impact Analysis investigates the effects of the alternative development scenarios on employment and income in the North 49 Economic Analysis Area. The relative size of the local communities plays an important role in the assessment of job and income impacts to the economy. Broader, more diverse, economies will likely be more resilient to changes in jobs and income than smaller, more rural, communities. For example, a loss of ten jobs in a large metropolitan area will likely have very little impact on the overall health of the economy. However, the same loss in jobs in a small rural community may severely affect local economic conditions. Thus, when assessing the magnitude of impacts to employment and income across alternatives, it is important to keep in mind the relative importance of those economic factors to the specified analysis area.

Models of the local economy were built using IMPLAN Professional 2.0 software and 2006 data. IMPLAN models were then imported into the Forest Economic Analysis Spreadsheet Tool (FEAST) which is a Microsoft Excel based workbook designed to describe the impacts to employment and income by resource program, major industry and planning alternative (http://fsweb_col.ewz.r6.fs.fed.us/epm/imisupplement/PEIA.htm). The North 49 Economic Analysis Area consists of Shasta County, Lassen County, and Plumas County as defined by local sources.

A change in economic stimulus to a region, e.g. increased production of a natural resource, will likely change the total level of jobs and income in the region. For example, and increase in the level of timber harvesting allowed in a county will likely require logging companies to hire more labor to perform the additional work associated with the increased extraction levels. In some cases, increased extraction may result in the migration of new logging companies to the area. Such increases in employment will also increase the total wages paid by the companies, which will raise total income in the county. Thus, firms within the logging industry are reacting directly to the increased extraction of the timber resource in that county. Similarly, now that there is more timber on the market, local sawmills will have to compensate by increasing employment to handle the new extraction levels. Thus, both the logging and sawmill industries must react to the increase in local timber harvesting. Such impacts to industries occurring from a change in local production are referred to as the direct effects of policy implementation. In other words, these are the impacts (i.e. change in

employment) resulting from the changes in expenditures and/or production values caused by a policy to increase the timber harvested in the county.

In addition to hiring more labor, industries must meet the technical requirements associated with increased timber harvest by purchasing more equipment, supplies, and other inputs to production. Some of these purchases will be made from other local industries; for example, additional fuel purchased by the logging companies at local gas stations increases the output in the oil and gas industry. Thus, the local gas stations must respond to the increased demand for fuel by hiring additional labor, which also affects total income in the area; such impacts are called the indirect effects of the policy. Thus, the indirect effects, are the changes in inter-industry purchases as they respond to the new demands of the directly affected industries. Another type of indirect effect is referred to as induced effects. The induced effects reflect changes in spending habits from individual households as income increases or decreases due to changes in production. For example, an increase in employment in the Agriculture, Forestry, Fishing and Hunting sector will be filled by unemployed individuals in the region and/or the in-migration of new households; and the increased income to those individuals will stimulate an increase in their demand for goods and services in the local area, which will in turn cause firms to respond by increasing employment and output.

Similar to the employment impacts, the total income in the study area will be affected according to the activities associated with each alternative. Total income is the sum of employee compensation, proprietors' income and other property income. Total income changes along with local employment levels. As reported in the case of employment impacts, income is generated through direct, indirect, and induced effects. Definitions for these effects remain the same as was stated in the employment impacts section above.

Alternative 1-Proposed Action

Direct and Indirect Effects

The proposed action of the North 49 Forest Health Recovery Project includes activities designed to improve the overall health of the forest. Activities include the commercial and non-commercial harvest of saw timber and biomass, mechanical and hand group site preparation, tree planting, temporary fencing, plantation thinning/mastication, and underburing/machine piling. Implementation of such activities would impose a variety of monetary costs upon the agency. Table 93 identifies the costs and units of measurement associated with the restoration project. The only revenues associated with project are those generated from the sale of saw timber and biomass. As mentioned above, a 10 year planning horizon is used for this project, with costs and benefits allocated across years according to the specific activities with which they are associated. Table 92 above reports the timeline for those activities occurring by alternative. Given the high cost of harvesting, and the low-level of revenue generated by the sale of biomass, activities associated with the harvesting of biomass appear as a large cost associated with the project. Thus, the financial efficiency measures were estimated for the harvesting of biomass separately. The NPV is the discounted sum of all monetarily valued benefits and costs associated with Alternative 1 activities. A second financial efficiency measure estimated for the proposed action is a benefit cost ratio, which is the discounted sum of benefits divided by the discounted sum of costs. The NPV and Benefit-Cost ratio for all activities, except for the harvesting of biomass, associated with Alternative 1 is negative $10,383,381 and 0.50 respectively. The NPV and Benefit-Cost ratio

for just the harvesting of biomass associated with Alternative 1 is negative $12,001,226 and 0 respectively. Thus, the NPV for all activities associated with Alternative 1 is negative $24,216,047.

Since both Benefit-Cost ratios are less than one, and all NPV's are negative, the monetary costs associated with Alternative 1 outweigh the monetarily valued benefits. However, such values do not imply that Alternative 1 is economically inefficient. In determining economic efficiency, all costs and benefits associated with the management activities should be taken into account. This includes those that may not directly be monetized; those of which are outside the scope of this analysis. Non-market benefits may include improved ecosystem health, increase in wildlife, reduced threat of fire, and a variety other effects not accounted for in the market place. Thus, the financial measures reported in this document should be considered along with any other social and ecological impacts associated with the management activities.

The activities associated with Alternative 1 would require human power in the North 49 Economic Analysis Area. This would occur in the form of employment in the area. A detailed description of the direct and indirect impacts to employment and income is provided in the methodology section above. Overall, it is estimated that the activities associated with Alternative 1 would support 649 jobs in Shasta, Lassen and Plumas Counties, and $28,419,896 in income. The Agriculture industry would be impacted the most with 122 direct jobs, and 146 indirect and induced jobs. Thus, of the 649 jobs created under Alternative 1, 268 of them would occur to the Agriculture industry. The manufacturing industry would also experience a significant employment impact under Alternative 1 with 55 direct and 68 indirect and induced jobs. The remaining jobs supported would be distributed across the other sectors in the economy; however, there would be no change in employment to the mining industry.

Cumulative Effects

Management activities on the Lassen National Forest have impacts on the economic conditions of local communities through changes in employment and income. Such modifications to local employment and income may be stimulated directly by the labor required to accomplish the management activities, as well as indirectly through changes in inter-industry and household purchases in response to any direct change in the composition on an industry. In the case of Alternative 1 of the North 49 Forest Health Recovery Project, timber supplies would be affected due to the timber harvesting under that alternative. The change in timber production associated with the proposed alternative stimulates both employment and income in the local area through the direct, indirect, and induced effects as described above. The impacts to employment and income associated with Alternative 1 of the North 49 project would be in addition to those impacts created by other Forest Service projects occurring in the same region. Current projects in the area include the Old Station Wildland Urban Interface Project and the Lost Rock/Shotput SC. The Old Station Project is adjacent to the North 49 treatment area to the east and south of Highway 44, and treatments for the project include mastication, thinning, and prescribed burning on up to 1300 acres. The Lost Rock/Shotput Project is approximately 1 mile south of the North 49 treatment area, and treatment consists of a pre-commercial thinning harvest on 975 acres. Projects planned to begin in the near future include the South Bunch Forest Health Recovery Project and the Whittington Forest Health Recovery Project. Both projects are still in the design phase and treatments include DFPZ thinning, group selection and area thinning. Although estimates of the total impacts to employment and income associated with these projects are not readily available, it is

assumed that they will likely generate increases to jobs and income in addition to those reported for Alternative 1 of the North 49 Forest Health Recovery Project.

As reported in the Economic Environment section above, the North 49 Economic Analysis Area has low population density, and a high proportion of residents in the working age group. Lassen and Plumas Counties have very low populations in relation to other counties in the state of California. All three counties in the North 49 Economic Analysis Area are experiencing unemployment rates higher than the state and national averages. Thus, the potential increase in employment opportunities associated with this alternative would likely be filled by unemployed residents in the local area. This should contribute to reduced local unemployment rates and increased resident incomes.

As indicated by local sources (i.e. County Chambers of Commerce), the relative importance of the travel and tourism industries is increasing. Thus, potential adverse effects of the alternatives on tourism activities should be taken into account. However, given the scale of the vegetation management activities, it is not likely that Alternative 1 would have serious effects on the local economy outside the jobs and income supported as reported above. Also, given the high unemployment rates in Shasta, Lassen and Plumas Counties, it is not likely that the development scenarios under this alternative would affect household migration in and out of the local area.

Alternative 2-No Action

Direct and Indirect Effects

There would be no direct effects on the economy in the North 49 Economic Analysis Area if no action were to take place.

In terms of indirect effects on the local economy under the no action alternative, no estimate exists that allows for determination of changes in the local economic conditions. There would be no direct, indirect and induced effects to local employment and income as measured by IMPLAN and FEAST. However, any change in environmental conditions as a consequence on the no action alternative that alters the use patterns of the area, may potentially affect total employment and income in the area. For example, changes in recreational expenditures occurring from a change in environmental conditions may affect the jobs and income. However, given the scale of the North 49 Forest Health Recovery Project, it is unlikely that the no action alternative would have any affect on the local economy.

Cumulative Effects

Given that there are no measurable direct and indirect effects that would occur under the no action alternative, there would also be no measurable cumulative effects.

Alternative 3-Modified Proposed Action

Direct and Indirect Effects

The modified proposed action, Alternative 3, of the North 49 Forest Health Recovery Project includes activities designed to improve the overall health of the forest. Activities include the commercial and non-commercial harvest of saw timber and biomass, mechanical and hand group site preparation, tree planting,

temporary fencing, plantation thinning/mastication, and underburing/machine piling. Implementation of such activities would impose a variety of monetary costs upon the agency. Table 93 identifies the costs and units of measurement associated with the restoration project. The only revenues associated with project are those generated from the sale of saw timber and biomass. As mentioned above, a 10 year planning horizon is used for this project, with costs and benefits allocated across years according to the specific activities with which they are associated. Table 92 above reports the timeline for those activities occurring by alternative. Given the high cost of harvesting, and the low-level of revenue generated by the sale of biomass, activities associated with the harvesting of biomass appear as a large cost associated with the project. Thus, the financial efficiency measures were estimated for the harvesting of biomass separately. The NPV is the discounted sum of all monetarily valued benefits and costs associated with Alternative 3 activities. A second financial efficiency measure estimated for the modified proposed action is a benefit cost ratio, which is the discounted sum of benefits divided by the discounted sum of costs. The NPV and Benefit-Cost ratio for all activities, except for the harvesting of biomass, associated with Alternative 3 is negative $11,559,828 and 0.42 respectively. The NPV and Benefit-Cost ratio for just the harvesting of biomass associated with Alternative 3 is negative $9,615,788 and 0 respectively. Thus, the NPV for all activities associated with Alternative 3 is negative $22,883,734.

Since both Benefit-Cost ratios are less than one, and all NPVs are negative, the monetary costs associated with Alternative 3 outweigh the monetarily valued benefits. However, such values do not imply that Alternative 3 is economically inefficient. In determining economic efficiency, all costs and benefits associated with the management activities should be taken into account. This includes those that may not directly be monetized; those of which are outside the scope of this analysis. Non-market benefits may include improved ecosystem health, increase in wildlife, reduced threat of fire, and a variety other effects not accounted for in the market place. Thus, the financial measures reported in this document should be considered along with any other social and ecological impacts associated with the management activities.

The activities associated with Alternative 3 would require human power in the North 49 Economic Analysis Area. This would occur in the form of employment in the area. A detailed description of the direct and indirect impacts to employment and income is provided in the methodology section above. Overall, it is estimated that the activities associated with Alternative 3 would support 529 jobs in Shasta, Lassen and Plumas Counties, and total income of $23,023,396. The Agriculture industry is impacted the most with 99 direct jobs, and 118 indirect and induced jobs. Thus, of the 529 jobs supported under Alternative 3, 217 of them would occur to the Agriculture industry. Employment would also be supported in the manufacturing industry under Alternative 3 with 44 direct and 56 indirect and induced jobs. The remaining jobs created would be distributed across the other sectors in the economy; however, there would be no change in employment to the mining industry.

Cumulative Effects

The cumulative effects under Alternative 3 would be similar to those described under Alternative 1. The only dissimilarity would be the difference in impacts to jobs and income between the two alternatives, as changes to the local economic conditions as a consequence from other projects in the area would remain the same. Alternative 3 generates 120 less jobs and $5,396,500 less total income than Alternative 1.

Alternative 7-Preferred Action

Direct and Indirect Effects

The preferred action, Alternative 7, of the North 49 Forest Health Recovery Project includes activities designed to improve the overall health of the forest. Activities include the commercial and non-commercial harvest of saw timber and biomass, mechanical and hand group site preparation, tree planting, temporary fencing, plantation thinning/mastication, and underburing/machine piling. Implementation of such activities would impose a variety of monetary costs upon the agency. Table 93 identifies the costs and units of measurement associated with the restoration project. The only revenues associated with project are those generated from the sale of saw timber and biomass. As mentioned above, a 10 year planning horizon is used for this project, with costs and benefits allocated across years according to the specific activities with which they are associated. Table 92 above reports the timeline for those activities occurring by alternative. Given the high cost of harvesting, and the low-level of revenue generated by the sale of biomass, activities associated with the harvesting of biomass appear as a large cost associated with the project. Thus, the financial efficiency measures were estimated for the harvesting of biomass separately. The NPV is the discounted sum of all monetarily valued benefits and costs associated with Alternative 7 activities. A second financial efficiency measure estimated for the preferred action is a benefit cost ratio, which is the discounted sum of benefits divided by the discounted sum of costs. The NPV and Benefit-Cost ratio for all activities, except for the harvesting of biomass, associated with Alternative 7 is negative $7,765,232 and 0.68 respectively. The NPV and Benefit-Cost ratio for just the harvesting of biomass associated with Alternative 7 is negative $8,540,246 and 0 respectively. Thus, the NPV for all activities associated with Alternative 7 is negative $18,125,144.

Since both Benefit-Cost ratios are less than one, and all NPV's are negative, the monetary costs associated with Alternative 7 outweigh the monetarily valued benefits. However, such values do not imply that Alternative 7 is economically inefficient. In determining economic efficiency, all costs and benefits associated with the management activities should be taken into account. This includes those that may not directly be monetized; those of which are outside the scope of this analysis. Non-market benefits may include improved ecosystem health, increase in wildlife, reduced threat of fire, and a variety other effects not accounted for in the market place. Thus, the financial measures reported in this document should be considered along with any other social and ecological impacts associated with the management activities.

The activities associated with Alternative 7 would require human power in the North 49 Economic Analysis Area. This would occur in the form of employment in the area. A detailed description of the direct and indirect impacts to employment and income is provided in the methodology section above. Overall, it is estimated that the activities associated with Alternative 7 would support 1,065 jobs in Shasta, Lassen and Plumas Counties, and total income of $46,494,126. The Agriculture industry is impacted the most with 199 direct jobs, and 239 indirect and induced jobs. Thus, of the 1,065 jobs supported under Alternative 7, 438 of them would occur to the Agriculture industry. The manufacturing industry would also benefit under Alternative 7 with 89 direct and 112 indirect and induced jobs. The remaining jobs supported would be distributed across the other sectors in the economy.

Cumulative Effects

The cumulative effects under Alternative 7 would be similar to those described under Alternative 1. The only dissimilarity would be the difference in impacts to jobs and income between the two alternatives, as changes to the local economic conditions as a consequence from other projects in the area would remain the same. Alternative 7 generates 416 more jobs and $23,470,730 more total income than Alternative 1.

Summary

The financial efficiency measures and impacts to jobs and income reported above are summarized across alternatives in Table 96 thru Table 98. This allows for an easy comparison of effects across alternatives.

Financial Efficiency

The financial efficiency measures reported in the description of effects for each alternative include NPVs and Benefit-Cost ratios. The following tables report the results for each alternative side by side for easy comparison. Table 96 reports the NPVs and Benefit-Cost ratios across alternatives for all vegetation management activities except the harvesting of biomass, while Table 97 reports the NPVs and Benefit-Cost ratios strictly for the harvesting levels of biomass associated with each alternative. Table 98 summarizes the discounted value of all activities associated with the North 49 Forest Health Recovery Project by reporting the NPV for all measurable benefits and costs associated with the activities across alternatives. Simply stated, the NPVs reported for each alternative in Table 98 are the sum of those reported in Table 96 and Table 97.

Table 96. Comparable economic measures across alternatives, without biomass

Economic Measure	No Action	Alt. 1	Alt. 3	Alt. 7
Benefit Cost Ratio	0	0.50	0.42	0.68
Net Present Value ($)	0	-10,383,381	-11,559,828	-7,765,232

Source: USDA Forest Service, Quicksilver

Table 97. Comparable economic measures across alternatives, biomass only

Economic Measure	No Action	Alt. 1	Alt. 3	Alt. 7
Benefit Cost Ratio	0	0	0	0
Net Present Value ($)	0	-12,001,226	-9,615,788	-8,540,246

Source: USDA Forest Service, Quicksilver

Table 98. NPVs Across Alternatives, All Activities

Economic Measure	No Action	Alt. 1	Alt. 3	Alt. 7
Net Present Value ($)	0	-24,216,047	-22,883,734	-18,125,144

The figures provided in Table 96 thru Table 98 serve as measures of the financial efficiency of the proposed alternatives. Specific welfare criteria may affect the determination of the preferred alternative. The decision maker should assess the results of each alternative separately and take into account any secondary ecological and social impacts associated with the alternatives. The Benefit-Cost ratios and NPVs presented above are based solely on the financial information provided by local sources on the Lassen National Forest. The data provided does not allow for the quantitative valuing of secondary impacts. Thus, the financial

measures provided here should be balanced with a qualitative assessment of any expected ecological and social impacts associated with the alternatives.

In regard to financial efficiency, cumulative effects are measured in terms of the costs and revenues associated with the vegetation management activities. A variety of costs are associated with the North 49 Forest Health Recovery Project; those costs include harvesting, administration, site preparation, planting, fencing, etc. The benefits associated with the project are in the form of revenues from the sale of saw timber and biomass. In terms of the financial efficiency of alternatives, Alternatives 1, 3 and 7 report negative NPVs. Although all NPVs associated with the alternatives are negative, this does not imply that they are economically inefficient. In determining economic efficiency, all costs and benefits associated with the management activities should be taken into account. This includes those that may not directly be monetized; those of which are outside the scope of this analysis. Non-market benefits may include improved ecosystem health, increase in wildlife, reduced threat of fire, and a variety other effects not accounted for in the market place. Thus, the financial measures reported in this document should be considered along with any other social and ecological impacts associated with the management activities.

Employment and Income

The following analysis summarizes the effects of the alternative development scenarios on employment and income in the North 49 Economic Analysis Area. Impacts to employment and income are reported as direct, indirect and induced effects as defined above. The total impact to employment or income is the sum of the direct, indirect and induced effects. Table 99 reports the total employment impacts by alternative.

Table 99 reports the direct and indirect employment in the North 49 Economic Analysis Area that would be stimulated by implementation of the proposed alternatives. Although the primary activities associated with the vegetation management activities lie within the Agriculture and Manufacturing sectors, they also stimulate employment in a variety of other sectors. For example, activities associated with Alternative 1 directly increase employment in the Accommodation and Food Services industry by 14 jobs. Those jobs are supported in response to the increased economic activity generated by the additional production of wood products associated with the North 49 vegetation management activities for that alternative. In addition to those 14 jobs, another 16 jobs are generated in the Accommodation and Food Services sector in response to the increased inter-industry purchasing resulting from the increased demand for the output of the directly effected industries, as well as the increased expenditures from households due to the increase in local income (i.e. the indirect and induced effects). Thus, the estimated total employment supported in the Accommodation and Food Services industry as a result of the activities proposed under Alternative 1 is the sum of the direct, indirect and induced effects, or 30 jobs.

Table 99. Impact to Total Employment by Alternative

No Action	Alt. 1	Alt. 3	Alt. 7
0	649	529	1,065

Source: USDA Forest Service, FEAST

Table 100. Direct and Indirect Employment Impacts Across Alternatives

Employment Category	Alt. 1		Alt. 3		Alt. 7	
	Direct	Indirect & Induced	Direct	Indirect & Induced	Direct	Indirect & Induced
Agriculture, Forest, Fish and Hunt	122	146	99	118	199	239
Mining	0	0	0	0	0	1
Utilities	1	0	1	0	1	1
Construction	1	1	1	1	1	2
Manufacturing	55	68	44	56	89	112
Wholesale Trade	8	10	7	8	13	17
Transportation & Warehousing	6	7	5	6	10	11
Retail Trade	20	24	16	19	32	39
Information	2	2	1	2	3	3
Finance & Insurance	8	10	7	8	13	17
Real Estate & Rental & Leasing	6	7	5	6	10	12
Prof, Scientific, & Tech Services	7	9	6	7	12	14
Management of Companies	2	1	1	2	3	3
Admin, Waste Mgmt & Removal Svc	5	7	4	6	9	11
Educational Services	3	3	2	3	4	6
Health Care & Social Assistance	19	22	15	19	31	37
Arts, Entertain & Recreation	2	3	2	2	4	5
Accommodation & Food Services	14	16	11	13	22	27
Other Services	13	16	10	13	21	26
Government	1	2	1	2	2	3
Total	**295**	**354**	**238**	**291**	**479**	**586**

Source: USDA Forest Service, FEAST

Table 101 summarizes the estimated change in total income in the analysis area across alternatives and resource program. An increase in income occurs under all alternatives; however, Alternative 7 yields the greatest estimated increase in local income with $46,494,126. The lowest estimated change in total income is $23,023,396 associated with Alternative 3.

Table 101. Impact to average annual income by alternative ($'s)

No Action	Alt. 1	Alt. 3	Alt. 7
0	28,419,896	23,023,396	46,494,126

Source: USDA Forest Service, FEAST

Table 102 reports the direct and indirect effects to industry income in the North 49 Economic Analysis Area that would be stimulated by implementation of the proposed alternatives. The greatest change in income across alternatives is experienced by the manufacturing sector, followed by the agricultural sector. Increases in local income are typically viewed as an economic benefit; however, such benefits must be weighed in accordance with the other social and ecological impacts associated with policy implementation.

Table 102. Direct and indirect income impacts across alternatives ($'s)

Employment Category	Alt. 1		Alt. 3		Alt. 7	
	Direct	Indirect & Induced	Direct	Indirect & Induced	Direct	Indirect & Induced
Agriculture, Forest, Fish and Hunt	6,706,236	4,689,183	5,432,826	3,798,780	10,971,209	7,671,368
Mining	42,987	32,023	34,825	25,942	70,326	52,389
Utilities	163,101	123,787	132,131	100,282	266,829	202,512
Construction	45,875	34,701	37,164	28,112	75,049	56,771
Manufacturing	4,720,007	3,825,052	3,823,751	3,098,734	7,721,795	6,257,674
Wholesale Trade	404,978	306,243	328,079	248,092	662,532	501,004
Transportation & Warehousing	323,984	254,475	262,465	206,153	530,029	416,313
Retail Trade	477,445	354,375	386,786	287,084	781,086	579,747
Information	89,645	66,854	72,622	54,160	146,656	109,371
Finance & Insurance	467,128	346,969	378,428	281,084	764,209	567,629
Real Estate & Rental & Leasing	374,386	276,740	303,296	224,191	612,484	452,740
Prof, Scientific, & Tech Services	288,282	218,823	233,542	177,271	471,621	357,988
Management of Companies	91,432	68,252	74,070	55,292	149,580	111,658
Admin, Waste Mngt & Rem Serv	116,223	88,000	94,154	71,290	190,137	143,965
Educational Services	31,956	23,694	25,888	19,195	52,279	38,762
Health Care & Social Assistance	718,377	532,263	581,968	431,195	1,175,244	870,768
Arts, Entertain & Recreation	43,595	32,454	35,317	26,291	71,320	53,094
Accommodation & Food Services	199,146	149,480	161,332	121,096	325,798	244,545
Other Services	260,032	194,193	210,656	157,318	425,404	317,694
Government	709,918	527,602	575,116	427,418	1,161,406	863,141
Total	**16,274,733**	**12,145,163**	**13,184,416**	**9,838,980**	**26,624,993**	**19,869,133**

Source: USDA Forest Service, FEAST

Overall the proposed activities associated with the North 49 Forest Health Recovery Project are not likely to have major economic implications for local communities. Even relative to the small, rural, communities in Shasta, Lassen and Plumas Counties, the estimated changes in employment and income are not enough to significantly affect the economic environment of the analysis area. Given the high unemployment rates in the region, new jobs created from the vegetation management activities would likely be filled by local residents;

thus, household migration patterns should not experience significant changes. Any impacts to local communities should be positive in the form of lower unemployment and greater local income. However, the direct and indirect effects on employment and income, as well as the financial efficiency measures estimated in this analysis should be carefully considered along with any social and ecological impacts and the overall objectives of the policy.

Environmental Justice

As stated in Executive Order 12898, it is required that all federal actions consider the potential of disproportionate effects on minority and low-income populations in the local region. The principals of Environmental Justice require agencies to address the equity and fairness implications associated with Federal land management actions. The Council on Environmental Quality (CEQ) (1997) provides the following definition in order to provide guidance with the compliance of Environmental Justice requirements:

> "Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis..."

According to US Census data, it is suggested that none of the counties in the North 49 Economic Analysis Area have minority populations that meet the Environmental Justice criterion.

Table 103 reports the proportion of families below the poverty level by county in the North 49 Economic Analysis Area.

Table 103. Poverty levels by county

Location	Percent Below Poverty Level
Shasta County	11.3%
Lassen County	11.1%
Plumas County	9.0%
California	10.6%

US Census 2000

The Environmental Justice principles set forth in Executive Order 12898 and CEQ (1997) were considered in regards to the North 49 Forest Health Recovery Project. Alternatives were reviewed to determine whether or not the proposed actions adversely impact minority and low-income populations. The alternatives do not differ from one another, and it is has been determined that there should not be any disproportionate impacts to minority or low income groups as a result of the North 49 Forest Health Recovery Project decision. Impacts to local communities are expected to be negligible, and there is no reason to suspect that any impacts will disproportionately affect minority and low income populations. The actions associated with the alternatives may support additional employment and income to the region; from which, minority and low-income populations may benefit.

Required Disclosures

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Unavoidable Adverse Effects

Any adverse effects that are unavoidable for each alternative as described in the environmental consequences discussion for different resources.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

Silvicultural Resources

Short-term Uses and Long-term Productivity

DFPZ and area thinning would reduce competition for resources, which would improve overall stand growth and vigor and reduce individual tree mortality; stand densities would decrease as a result of treatments. Thinning would target the removal of damaged and diseased trees and favor retention of trees free of damage and defect. These treatments would increase the species composition of fire resistant trees such as sugar, ponderosa, and Jeffrey pine. Proposed treatments would retain or promote a higher component of pine within mixed conifer and white fir stands. Lower stand densities in the thinned stands would also promote the health of pine, since pine do not grow at the higher stocking densities that white and red fir can persist at. Open stands dominated be larger trees with relatively few scattered understory trees and regeneration are conditions that support low to moderate intensity ground fires. Treated stands would be more resistant to insect attack due to decreased stocking. Group selections would promote the regeneration of pine species and provide stand structure diversity. Forest composition and structure would move closer to desired conditions.

Unavoidable Adverse Effects and Irreversible and Irretrievable Commitment of Resources

There are no unavoidable adverse effects or irreversible commitments of resources expected for silvicultural resources.

Fire, Fuels and Air Quality

Short-term Uses and Long-term Productivity

The fuels treatments of the north 49 project areas (underburning, broadcast burning, handpiling and machine piling) would not impact any short term use or the long term productivity of the project area.

Unavoidable Adverse Effects

There are no unavoidable adverse effects from the fuels treatments in the north 49 project.

Irreversible and Irretrievable Commitment of Resources

There is no irreversible or irretrievable commitment of resources in the north 49 project area for fuels management.

Terrestrial Wildlife

Short-term Uses and Long-term Productivity

Alternative 1 DFPZ construction would reduce suitability for fisher, California spotted owl, northern goshawk and marten by removing timber products from 7,505 acres. These timber products would provide goods to the local economy. Impacts to wildlife from these removals would last for 30 years (the estimated lifespan of the DFPZs with maintenance) plus the 2-5 decades after maintenance ends for conditions to return to current suitability levels. Alternative 1 would also generate products from group selections within habitats for these species. The 1,180 acres of group selections would require 5-10+ decades to return to current suitability levels. Although fisher, California spotted owl, northern goshawk and marten would be affected by this alternative, their viability would be assured due to maintenance and protection of reserve areas such as spotted owl protected activity centers, goshawk protected activity centers, and off-base/deferred areas per guidelines established in the Sierra Nevada Forest Plan Amendment Record of Decision and the Herger-Feinstein Quincy Library Group Record of Decision. However, reproduction and recruitment of new individuals into the population is expected to be reduced until habitat recovers.

Alternative 3 would reduce suitability for fisher, California spotted owl, northern goshawk and marten by removing timber products from 7,754 acres from DFPZ construction and another 686 acres of group selections. The period of effect is similar to Alternative 1 but the intensity of impact is less. These differences are discussed in more detail in the Wildlife section of Chapter 3.

Unavoidable Adverse Effects

Alternative 1 would reduce suitability for fishers on 9,955 acres. Alternative 1 would remove 8,190 acres of currently suitable habitat for the California spotted owl, 1,085 acres of habitat for the northern goshawk, and 9,410 acres of suitable marten habitat. Alternative 3 would reduce suitability for fishers on 5,885 acres. Alternative 3 would remove 5,295 acres of suitable habitat for the California spotted owl, 600 acres of habitat for the northern goshawk, and 5,595 acres of suitable marten habitat.

Irreversible and Irretrievable Commitments of Resources

There would be no irreversible commitments of wildlife resources in any of the alternatives. Irretrievable commitments of wildlife resources are loss of habitat for California spotted owls, goshawks, and marten during the 30-year period during which DFPZs are expected to be built and maintained.

Soils and Watersheds

Short-term Uses and Long-term Productivity

The risk of negatively affecting soil productivity is low for the proposed project activities. The project would be implemented with integrated design features designed to avoid or reduce the potential negative effects of the proposed activities on soil resources (Integrated Design Features, Chapter 2). By limiting and designating the number of skid trails, soil compaction would not exceed 10 percent of any activity area. Existing compaction would be reduced by decommissioning all temporary roads (many are existing nonsystem roads) utilized during timber harvest following project activities as well as decommissioning 3.9 miles of system and nonsystem roads.

Bridges Creek is the only subwatershed with potential to go over threshold and this possibility depends on the timing of private harvest. The N49 project treats few acres in this subwatershed and is unlikely to negatively affect soil or water resources. Based on a combination of field surveys and estimates of cumulative disturbance using equivalent roaded acres (ERA), soil quality guidelines would be met in all project subwatersheds as would soil productivity standards.

Removal of road crossings would result in a short-term increase in sediment in stream reaches below these crossings. Removal of the crossings would result in long-term reduction in sediment delivery at the sites and would benefit water quality. Therefore, our expectation is a long-term decrease in sediment delivery as a result of the proposed action. In the short term, the time during which roads are used for haul, it is expected sediment reductions from road surface and road surface treatments at crossings would be balanced by increases due to road maintenance. In the long term the removal of crossings known to be chronic sediment sources, as well as the reduction in road density would lead to long term improvement in water quality. Based on the results of the CWE analysis, the risk of adverse cumulative effects to water resources within the project area are low and beneficial uses of would be maintained.

Unavoidable Adverse Effects

There are no unavoidable adverse effects to soil and watershed resources.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources expected for soil and watershed resources.

Fisheries and Aquatic Resources

Short-term Uses and Long-term Productivity

The risk of negatively affecting Fisheries resource productivity is low for the proposed project activities. There is some risk of increases in short-term sediment delivery. Most sediment delivered to streams comes from a source zone along the streams, often a road or trail. However, because of the lack of stream channels within the project area, connectivity between roads and streams is confined to a few sub-watersheds. This risk would be largely offset by treatment of existing erosion sources. Therefore, the expectation is for a slight decrease or no change in sediment delivery in the short term, with a decrease in sediment delivery in the longer term. Any short term delivery would be expected to be minor, and of short duration and not expected to adversely impact the long-term habitat for aquatic species in the project area. Overall, effects of the project would not be expected to result in a reduction in population or distribution of aquatic species.

The proposed actions were designed to minimize potential adverse impacts to aquatic habitat within the project area in recognition of existing watershed conditions due to lasting impacts of stand replacing fires, high road densities and high number of road crossings. Based on the results of the CWE analysis, implementation of BMPs and integrated design features (including RHCA designations and treatments), the risk of adverse cumulative effects to aquatic resources within the project area is low and beneficial uses would be maintained. The analysis concluded that there is no loss of aquatic/riparian habitat and therefore no cumulative contribution to the loss of suitable habitat for aquatic and riparian dependent species within the project area.

Unavoidable Adverse Effects, Irreversible and Irretrievable Commitment of Resources

There are no unavoidable adverse effects, irreversible, or irretrievable commitments of resources expected for Fisheries/Aquatic resources.

Botanical Resources

Short-term Uses and Long-term Productivity

Activities occurring adjacent to *Astragalus pulsiferae var. suksdorfii* occurrences will have short-term impacts to this species and its potential habitat, such as timber harvest, road maintenance and hauling within the occurrence. These activities could kill or damage plants and their habitat. Integrated Design Features for this species were created specifically for this species within the project area to ensure that the viability of these species within the project area is maintained. Long-term impacts to this species and its habitat are expected to be beneficial by the opening of the canopy in adjacent overstocked stands. Another potential indirect effect is an increase in noxious weeds or other undesirable non-native species as a result of project activities. The standard practice of equipment cleaning and Integrated Design Features of avoiding or treating noxious weed infestations within the project area would reduce potential effects.

Unavoidable Adverse Effects, Irreversible and Irretrievable Commitments of Resources

There are no unavoidable adverse effects, irreversible, or irretrievable commitments of resources expected for botany resources.

Economics

Short-term Uses and Long-term Productivity

The implementation of the Proposed Action provides public benefits such as local jobs, income generated from the forest products industry, and energy from local cogeneration plants.

Unavoidable Adverse Effects, Irreversible or Irretrievable Commitments of Resources

There are no unavoidable adverse effects, irreversible, or irretrievable commitments of resources expected for economics resources.

Heritage Resources

Short-term Uses and Long-term Productivity

There is the potential that sites (unanticipated discoveries) do exist that are currently obscured by vegetation cover. Unanticipated discoveries are to be mitigated using the stipulations and modules outlined in the Programmatic Agreement (PA). Sites with a high probability to be adversely affected by projects would be evaluated for National Register eligibility.

Unavoidable Adverse Effects

Heritage sites have been lost to wildfires. Sites within the current project area would be adversely affected by high-intensity wildfire. Under the Proposed Action alternative, fewer sites would be adversely affected by wildfire due to the removal of hazardous fuels. Known sites would receive protection from project activities. Therefore, there would likely be beneficial cumulative effects from the proposed project on heritage resources. Under the No Action alternative, heritage resources remain subject to adverse affects by potential high-intensity wildfire.

Irreversible and Irretrievable Commitment of Resources

Irreversible commitments could consist of irreparable disturbance to heritage resources such that values are permanently lost.

Irretrievable commitments could consist of cultural heritage resource disturbances that would preclude further study and documentation.

Recreation and Visual Resources

Short-term Uses and Long-term Productivity

Effects of both action alternatives to recreational uses in the short-term would be limited in scope and duration. The North 49 Project area has a long history of vegetation management projects. Impacts to visitors have been well mitigated and complaints are few. People familiar with the area, especially those who return each year such as campers, hunters, and motorized users would be most aware of any limitations to recreation activities during project implementation. New or occasional visitors would be less aware of changes. Project design features would lessen short-term effects to recreation. Once treatments have been completed, the recreating public would be able to enjoy their recreational uses as before. In the long-term, project activities under Alternatives 1 and 3 would improve overall forest health and reduce the risk of catastrophic wildfire, notably with respect to Thousand Lakes Wilderness, and assure a landscape suitable for recreation activities.

The proposed creation of DFPZs and group selection harvest would result in a short-term visual effect to the recreating public, whereby management activities would be visible across the landscape. To minimize this effect, group selections have been placed to avoid visually sensitive areas such as trailheads and the wilderness boundary. Slash and other logging debris would be eliminated so as not to be visually evident. Initially, stumps may be visible in the foreground; however, as vegetation is re-established, this visual effect would diminish. Over time, the proposed treatments would move timber stands toward their desired long-rage goal. Under both action alternatives, thinning treatments are designed to maintain a dominance of mature forest character, and group selections would create a mosaic of uneven-aged timber stands. In the long-term, the visual resource for recreational users should benefit from the proposed actions.

Unavoidable Adverse Effects, and Irreversible and Irretrievable Commitment of Resources

There are no unavoidable adverse effects, irreversible, or irretrievable commitments of resources expected for recreation or visual resources.

Chapter 5 – Lists

This chapter lists the Interdisciplinary Team members, Federal State and Local agencies that responded to the Draft EIS,

Preparers and Contributors

Interdisciplinary Team

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23 years in Timber Sale Preparation. Currently responsible for layout, mark and cruise, volume determination, contract preparation, first line supervisor to the timber marking crew, marking contract preparation and COR inspections and processed payments for marking and cruising contracts.

Susan Chappell -
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Education: B.S. Natural Resources Management (emphasis in Fisheries Management), California Polytechnic State University, San Luis Obispo

Career: Two years as Wildlife Biologist, California Department of Fish and Game; two years as Wildlife Biologist, Plumas National Forest; 2 years as Fisheries Biologist, Eagle Lake Resource Area, Bureau of Land Management; and Fisheries Biologist on the Lassen National Forest since 1990.

Experience: Habitat management for inland and anadromous fisheries, amphibian, and aquatic mollusk species; aquatic program planning/implementation; aquatic and terrestrial species surveys; environmental education; watershed restoration; management of aquatic survey data and geospatial applications; preparation of aquatic species/habitat analyses for NEPA documents; consultation with regulatory agencies for federally-listed aquatic species.

Theresa M. Frolli –
Eagle Lake District Ranger, Lassen National Forest

Theresa holds a Master of Arts degree in Geography (Geographic Information System) from California State University – Fresno and a Bachelor of Science degree in Rangeland Management from the University of

Wyoming. Theresa is currently the District Ranger on the Eagle Lake RD, Lassen National Forest, and previously was the Forest Planner for the Lassen National Forest, and served as the NEPA Coordinator for the Herger-Feinstein Quincy Library Group Pilot Project Implementation Team. She has worked for the USDA Forest service for 27 years, with the last 19 years in resource planning and has worked at eight National Forests within four regions.

Kimberly Ganz – Forester

Kym has a Bachelor of Science degree in Forestry in addition to a Bachelor of Science degree in Wood and Fiber Utilization from Michigan Technological University in Houghton, Michigan. She has 20 years experience in forest management working on six National Forests in Regions 9, 2, 6, and 5. She has been a Forester on the Lassen National Forest since 1990. Kym also worked for private industry as a Technical Service Representative for a wood adhesives company.

Stephanie L. Gripne – Economics and Social Analyst TEAMS Enterprise

Stephanie is a Boone and Crockett Fellow at the University of Montana working on a PhD in Forestry with an emphasis in sociology and economics. She holds a Bachelor of Science degree in Wildlife Management and Biology from the University Wisconsin-Stevens Point. She also has a Master of Science degree in Ecology from Utah State University.

Patrick Hickey – Soil Biologist, Supervisor’s Office, Lassen National Forest

Patrick received his Bachelors of Science Degree in Natural Resources (Soil and Water Systems) from North Carolina State University and his Masters Degree in Soil and Land Resources from the University of Idaho. He is a member of both the Soil Science Society of America and Sigma Xi research society.

John Jesenko – Logging Systems/Transportation TEAMS Enterprise

John has worked for the Forest Service for over 17 years performing timber sale layout, logging systems and transportation analysis, and preparing timber sale contracts and appraisals. He has worked on the Tongass, the Mendocino, and the Black Hills National Forests, as well as with the Washington State Department of Natural Resources. John currently works for the U.S. Forest Service Enterprise TEAMS as a Logging Systems Specialist, and lives in Baker City, Oregon.

Deborah Mayer – District Fire Management Officer

Debbie has a Bachelor of Science degree in Forestry Management from Humboldt State University, Arcata California. Debbie has 25 years experience in fire and fuels management working for the US Forest Service in both California and Oregon on the San Bernardino, Winema, Plumas and Lassen National Forests.

Allison B. Mead - GIS Coordinator

Allison has a Bachelor of Science degree in Forest Resources and Conservation, with a minor in Wildlife Management, from University of Florida. Allison has 2 years of experience as a GIS Specialist with the State of Florida, and 4 years with the Forest Service. She has been the GIS Coordinator for the Hat Creek Ranger District since 2005. Currently, Allison is working as the GIS Coordinator for the BLM in Redmond, Oregon.

Kit Mullen – Hat Creek District Ranger, Lassen National Forest

Kit holds a Bachelor of Science degree in Wildlife Biology from Colorado State University. She worked six seasons as a Wildlife Biologist followed by six years as an Environmental Specialist at Wrangell-St. Elias National Park and Preserve, Alaska. From 1992 to 1995 she worked at the National Park Service, Denver Service Center as the Senior Compliance Specialist for the Central Team guiding large planning and NEPA projects. In 1995, Kit went to Grand Teton National Park, Wyoming as the Management Assistant. From 1998 to 2006 she was the Superintendent of Timpanogos Cave National Monument, Utah. Kit has been the Hat Creek District Ranger on the Lassen National Forest since December 2006.

Russell Nickerson – Wildlife Biologist, Plumas National Forest, Beckwourth Ranger District

Russell holds a B.S. degree in Wildlife Biology from the University of Montana, Missoula. He has seven years of experience working for the Forest Service. He has worked for the Pacific Southwest Research Station-Redwood Sciences Lab and on other field research projects. He’s been the Assistant District Wildlife Biologist on the Beckwourth Ranger District, Plumas National Forest since 2001. He served as the District Wildlife Biologist on the Hat Creek Ranger District, Lassen National Forest for approximately four months on a detail assignment.

Christopher O'Brien - Heritage Program Manager

Chris has a Bachelor of Science Degree in Anthropology from University of California, Davis and M.A. and Ph.D. degrees in Anthropology from the University of Wisconsin, Madison. He has been conducting archaeological research in North America and Africa for 25 years. He has been with the Lassen National Forest as an archaeologist since 1995. He has been the Heritage Program Manager for the Lassen since 2002.

Anthony Olegario - Fisheries Biologist TEAMS Enterprise

Anthony has worked for the Forest Service since 1999. Prior to TEAMS, Anthony worked as a Fisheries Biologist for the Gifford Pinchot National Forest in southwest Washington. He specializes in planning, implementing, and monitoring stream and watershed restoration projects. Anthony holds a Bachelor of Science degree in Mechanical Engineering from Binghamton University and is currently completing his Masters of Science degree in Fisheries Science from Oregon State University, Corvallis.

Kirsten C. Pasaro –
Zone Range Management

M.S. Range Management – 1989,University of Idaho, Moscow

B.S. Range Science – 1986,Montana State University, Bozeman

2006 – present: Rangeland Management Specialist, Lassen National Forest, Eagle Lake and Hat Creek Ranger Districts

2003 – 2006: Wild Horse and Burro Program Coordinator, Northeastern California,Bureau of Land Management, Eagle Lake Field Office

2000 – 2003: Rangeland Management SpecialistBureau of Land Management, Eagle Lake Field Office

1989 – 2000: Rangeland Management Specialist Modoc National Forest, Warner Mountain Ranger District

Lauren Payne -
VMS Team Co-Leader & Silviculturist

Lauren has twenty two years experience with the Forest Service. She has worked in fire suppression, forestry/silviculture and contract administration. Lauren is a Certified Silviculturist. Lauren's education includes a B.S. in Natural Resource Management from California State University, Humboldt, graduate work in hydrology at California State University Chico and completion of the Pacific Southwest Region's Natural Resource Institute.

Brenda Reed –
District Archeologist, Lassen National Forest, Hat Creek Ranger District

Brenda is an archaeologist with diverse experience within the western United States, including the Central Coast of California and eastern Nevada. Her recent experience includes work on the Los Padres National Forest, and for the Bureau of Land Management. She has a B.A. and an M.A. in her field from the University of Montana, and completed additional study (emphasizing particular types of artifacts, such as plant remains in archaeological sites and flaked stone) at the University of Washington.

Allison L. Sanger –
Forest Botanist

Allison has a Bachelor of Science degree in Environmental and Systematic Biology, with an emphasis in Fisheries and Wildlife Management from California Polytechnic State University, San Luis Obispo, California. She also has two years of Botany graduate coursework from California State University, Chico. Allison has 15 years experience in botany and weed ecology working for the Bureau of Land Management as well as the Modoc and Lassen National Forests in California.

Janice Sorochtey –
Lands and Recreation Specialist

Jan earned a Bachelor of Arts degree in English Literature from Mount Holyoke College, and subsequently completed extensive coursework in Forestry and Natural Sciences at Humboldt State University. Since 1974 she has worked for several National Forests and private industry in forestry, engineering, logging, lands,

special uses, recreation, and fire suppression. During the past five years she has served as Lands and Recreation Officer on the Hat Creek Ranger District.

Matt Staudacher –
District Silviculturist, Lassen National Forest Hat Creek Ranger District

Matt received his Bachelor of Science degree in Forest Resource Management from Humboldt State University, Arcata, California. He has worked for the Forest Service for 13 years in Vegetation and Wildlife Management on three forests in California and Utah.

Scott Stawiarski -
District Silviculturist, Lassen National Forest Hat Creek Ranger District

Scott currently serves as District Silviculturist and Timber Management Officer on the Eagle Lake Ranger District of the Lassen National Forest. He previously served for 10 years as Silviculturist and Interdisciplinary Team Leader on the Hat Creek Ranger District. He held positions in silviculture, planning, and timber sale preparation on the Tahoe National Forest from 1984-1995. Scott also serves as leader of Burned Area Emergency Response (BAER) Teams. He has 18 years experience as an ID Team Leader and has completed numerous environmental planning and landscape analysis projects. He received his Associates degree in Forestry Technology from Alpena College in 1984. Scott completed the Natural Resource Institute (NRI) in 1998, which included graduate coursework in silviculture and forest ecology at the University of Washington, Oregon State University, and Washington State University. He has been a Certified Silviculturist since 1999.

Alissa Tanner –
ID Team Leader, Assistant Silviculturist

Alissa has a Bachelor of Science degree in Forest Management with a concentration in Fire Management from Colorado State University. She worked for the Forest Service in fire management and silviculture for 5 years before returning to school to earn her Master of Arts in Lay Ministry from Trinity Lutheran Seminary. Upon returning to the Forest Service in 2005, she worked as a Fuels Technician and is currently pursuing her Silviculture Certification.

Carol Thornton –
Hydrologist TEAMS Enterprise

Carol has a Bachelor of Science degree in Geology from the University of Oregon and a Masters degree in Hydrology and Hydrogeology from the University of Nevada. She worked as a Geomorphologist at the Desert Research Institute for 3 years. Carol has worked for the Bureau of Land Management and the Forest Service for the past 11 years.

Boyd R. Turner -
Wildlife Biologist

Boyd has a Bachelor of Science degree in Wildlife Management, with an emphasis in Resource Planning and Interpretation from Humboldt State University, Arcata, California. He completed additional coursework in Forestry at Oregon State University after obtaining his BS. Boyd has worked on the Mt. Hood and Cleveland National Forests in addition to working the last 18 years as a wildlife biologist on the Lassen National Forest.

He has been the team leader for late-successional reserve assessment and landscape analysis teams. Boyd is also highly experienced in wildland fire management with 32 seasons of experience in fire and fuels management where he continues to be active as an air tactical group supervisor for a National incident management team. Currently, Boyd is a wildlife biologist on the Modoc National Forest.

Tiffany Vanosdall - Fisheries Biologist TEAMS Enterprise

Tiffany has a Bachelors degree in Biology and Chemistry from Wayne State College and a Masters degree in Aquatic Ecology from the University of Nebraska. She has worked as a Fisheries Biologist with TEAMS since 2001 and has experience in several regions across the nation. Prior to working for TEAMS she was a Regulatory Specialist with the Corps of Engineers.

Kristin Whisennand - Writer/Editor

Kristin has a Bachelor of Arts in Anthropology from Dartmouth College, a Bachelor of Science in Resource Conservation Management from the University of Montana, and extensive graduate work in archeology and paleontology. She has worked as a writer/editor with TEAMS since 2002. Prior to TEAMS, she worked for five years as a team leader with the USDA FS Content Analysis Team, and for nine years as an archeologist with the Lolo National Forest.

Joshua Wilson - Economics and Social Analyst TEAMS Enterprise

Josh graduated from the University of California, Davis in 2003 with a B.S. in Managerial Economics. Upon graduation, he began work as a credit analyst for Farm Credit in Woodland, CA until moving to Fort Collins, CO to attend graduate school at Colorado State University (CSU). During his graduate program, Josh worked as a research assistant and instructor at CSU; he earned his M.S. degree in Agriculture and Resource Economics in December of 2005. Josh began a STEP position as an Economist with the USDA Forest Service’s Ecosystems Management Coordination group in March of 2006. In October 2007, he began working as contractor for TEAMS Enterprise Unit. Josh continues to conduct social and economic analysis for the agency while working towards his Ph.D. in Forestry Economics at CSU.

Federal State and Local Agencies

Howard Brown, NOAA Marine Fisheries Service, July 12, 2004

Tribes Consulted

Bill George and Sharon Elmore, Pit River Tribe, April 15, 2004

Distribution of the Final Environmental Impact Statement

Individuals and Groups

Bruce Olsen, Franklin Logging

Robert Hoover, Sierra Pacific Industries

David B. Edelson, Craig Thomas – Sierra Nevada Forest Protection Campaign

Patrick Gallagher – Sierra Club

Frank Stewart – QLG Forester

Patricia Puterbaugh – Lassen Forest Protection Group, Sierra Club

Pete Harrison – Californians for Alternatives to Toxics

Linda Blum - individual

California Department of Fish and Game

Barbara Camacho – Shasta County Fire Safe Council

Chad Hanson – John Muir Project

Tribes

Pit River Tribal Council
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Federal Agencies

U.S. Army Engineer Division
South Pacific CESPD-CMP
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Environmental Protection Agency
Office of Federal Activities
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Advisory Council on Historic Preservation
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Glossary

Action Alternative - An alternative that proposes some management action, as contrasted to the No Action Alternative.

Active Crown Fire – A fire that advances from top-to-top of trees or shrubs more or less independently of the surface fire.

Administrative Appeal - A request to a higher authority for review of a decision related to an Environmental Impact Statement, Environmental Analysis, or Categorical Exclusion.

Affected Environment - The biological and physical environment that will or may be changed by actions proposed and the relationship of people to that environment.

Age or Size Class - A distinct group of trees, or portion of growing stock recognized on the basis of age (or size).

Airshed - Basic geographic units in which air quality is managed.

Alternative - A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis. One of the several policies, plans or projects, proposed for decision-making.

Anadromous – Refers to fish that migrate from salt water to spawn in fresh water, such as salmon.

Area Thin - The area outside of the Defensible Fuels Profile Zone or Wildland Urban Interface.

Bank Cover - Living streamside vegetation overhanging the water for up to one meter above the water surface.

Basal Area - The cross-sectional total area of all tree stems at breast height over a given area, usually an acre.

Best Management Practices (BMPs) - Methods, measures or practices to prevent or reduce water pollution, including but not limited to, structural and non-structural controls, operation and maintenance procedures, other requirements, and scheduling and distribution of activities. Usually BMPs are applied as a system of practices rather than a single practice. Best management practices are taken from Water Quality Management for Forest System Lands in California and are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

Biological Assessment (BA) - A document prepared by a federal agency for the purpose of identifying any endangered species or threatened species, which is likely to be affected by an agency action. This document facilitates compliance with the Endangered Species Act. The federal agency, in consultation with the Secretary of Interior, must insure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of its habitat.

Biological Evaluation (BE) - A document prepared by the Forest Service to review programs or activities to determine how an action might affect any threatened, endangered, proposed, or sensitive species. This document often focuses only on sensitive species if the Threatened, Endangered, and Proposed Species will be covered in a Biological Assessment.

Biomass (Fuels) - Live and dead accumulations of organic material.

Board Foot - A unit of measurement represented by a board one foot square and one inch thick.

Browse - Twigs, leaves, and young shoots of trees and shrubs on which animal feed; in particular, those shrubs which are utilized by big game animals for food.

Buffer – A land area designated to block or absorb unwanted effects to the area beyond the buffer and to preserve other qualities along or adjacent to roads, trails, watercourses, and recreation sites.

Burn Severity– A relative measure of the degree of change in a watershed that related to the intensity of the fire on soil hydrological function. Burn severity is delineated on topographic maps of polygons. Classes of burn severity are high, moderate, low, and unburned.

California Wildlife Habitat Relationships (CWHR) - A system developed jointly by the California Department of Fish and Game that classifies forest stands by dominant species types, tree sizes and tree densities and rates the resulting classes in regard to habitat value for various wildlife species or guilds.

Canopy - The forest cover of branches and foliage formed by tree crowns.

Canopy Base Height – The lowest height above the ground where there are sufficient fuels that could spread a fire vertically into the canopy. Canopy base height incorporates ladder fuels including brush, shrubs and understory trees. An increase in canopy base height results in decreased crown fire potential.

Canopy Cover or Crown Closure - The percentage of ground surface that is shaded by the live foliage of plants as seen from above. Used to describe how open or dense a stand of trees is.

Capability - The potential of an area of land and/or water to produce resources, supply goods and services, and allow resource uses under a specified set of management practices and at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology; as well as the application of management practices, such as silviculture or protection from fires, insects, and disease.

Cavity - A hollow in a tree that is used by birds or mammals for nesting, denning, roosting, etc.

Closed Canopy - The description given to a stand when the crowns of the main level of trees forming the canopy are touching and intermingled so that light cannot reach the forest floor directly.

Coarse Woody Debris - Any piece(s) of dead woody material, e.g., dead boles, limbs, and large root masses on the ground or in streams.

Cohort – An Age class of trees that is distinctively different from other age classes in a particular forest stand.

Commercial Thinning - A silviculture treatment that “thins” out an overstocked stand by removing trees, which are large enough to be sold as products such as poles or fence posts. It is carried out to improve the health and growth rate of the remaining crop trees.

Composition (Species) - The mix of different species that make up a plant or animal community, and their relative abundance.

Condition Class – A function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components, such as species composition, structural stage, stand age, and canopy closure. Categorized by three classes as follows: Condition Class 1 – Fire regimes are within or near an historical range; Condition Class 2 – Fire regimes have been moderately altered from their historical range; Condition Class 3 – Fire regimes have been significantly altered from their historical range.

Consultation - A process required by Section 7 of the Endangered Species Act whereby Federal agencies proposing activities in a listed species habitat confer with the U.S. Fish and Wildlife Service about the impacts of the activity on the species. Consultation may be informal, and thus advisory, or formal, and thus binding.

Corridor - A band of vegetation, usually older forest, which serves to connect distinct patches on the landscape. By providing connectivity, corridors permit the movement of plant and animal species between what would otherwise be isolated patches.

Council on Environmental Quality (CEQ) - An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover/Forage Ratio - The ratio of tree cover (usually conifer types) to foraging areas (natural openings, clearcuts, etc.).

Cover Type - The present vegetation composition of an area, described by the dominant plant species.

Critical Flame Length – Is a threshold for transitioning from a surface fire to a crown fire. It is determined by the flame length needed to spread fire from the surface into the canopy.

Crown - The part of a tree or other woody plant bearing live branches and foliage.

Crown Base Height - The height of the lowermost branches of the forest canopy above the ground.

Crown Bulk Density – The measurement of tree canopy foliage in lbs/ft^3 which is used to determine the vertical propagation of fire. A bulk density of 100 lbs/acre-foot or 0.0023 lbs/ft^3 is the threshold for spreading fire into the canopy.

Crown Closure - (see Canopy Cover)

Cultural Resources - The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events; as a sacred area of native peoples, etc.) of an area of prehistoric or historic occupation. Cumulative Effect- The impact on the environment, which results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor but collectively significant actions taking place over a period of time.

Defensible Fuel Profile Zone (DFPZ) – Zones approximately ¼-mile wide where fuel has been reduced. They usually are constructed along roads or ridgetops. They are intended to break up fuel continuity across the landscape and provide a defensible space for suppression forces.

Defensible Space - A buffer zone within the wildland-urban interface generally ¼-mile wide around human habitation (residences, commercial buildings, administrative sites) in adjacent areas of flammable wildland vegetation. The desired condition for these zones is vegetation that makes ignition of crown fire highly unlikely and allows staging of fire suppression equipment and personnel to directly attack an approaching wildland fire. Stands should be fairly open and dominated primarily by larger, fire-tolerant trees

Density (Stand) - The number of trees growing in a given area, usually expressed in terms of trees per acre.

Diameter Best Height (dbh) - The diameter of a tree measured four and one-half feet above the ground.

Direct Effect - Effects on the environment that occur at the same time and place as the initial cause or action.

Dispersal - The movement of organisms away from the place of birth or from centers of population density.

Disturbance (Ecosystem) - Refers to events that alter the structure, composition, or function of terrestrial or aquatic habitats. Natural disturbances include, among others, drought, floods, wind, fires, wildlife grazing, and insects and pathogens. Human-caused disturbances include actions such as timber harvest, livestock grazing, roads, and the introduction of exotic species.

Disturbance Regime - Natural pattern of periodic disturbances, such as fire or flooding.

Diversity - The distribution and abundance of different plant and animal communities and species.

Diversity Thin – A silvicultural treatment made up of three treatment elements: a) structural thinning of the general matrix, b) radial release of large diameter overstory trees, and c) retention islands which is used to develop multi-aged, multi-structured stands.

Duff - The partially decayed organic matter on the forest floor.

Early Seral/Structural Stage - A stage of development of an ecosystem from a disturbed, relatively unvegetated state to a plant community that is up to 30 years old. Stand structure is seedling and sapling sized.

Ecosystem - A functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size--a log, pond, field, forest, or the earth's biosphere--but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation, for example, forest ecosystem, old-growth ecosystem, or range ecosystem.

Endangered Species - Any species, plant, or animal that is in danger of extinction throughout all or a significant portion of its range. In accordance with the 1973 Endangered Species Act, the Secretary of the Interior identifies endangered species.

Endemic - A species whose natural occurrence is confined to a certain region and whose distribution is relatively limited (vertebrate biology). A population that is at equilibrium or low density (invertebrate biology or pathology).

Escape Route – A means to access a safety zone.

Fire Exclusion - The disruption of a characteristic pattern of fire intensity and occurrence (primarily through fire suppression).

Fire Event (Fire Occurrence, Fire Incidence) - A single fire or series of fires within an area at a particular time.

Fire Frequency – A general term referring to the recurrence of fire in a given area over time.

Fire Hazard - The potential fire behavior for a fuel type, regardless of the fuel type's weather-influenced fuel moisture content or its resistance to fire line construction. Assessment is based on physical fuel characteristics, such as fuel arrangement, fuel load, condition of herbaceous vegetation, and presence of elevated fuels

Fire Intensity – Based on temperature, flame length, rate of spread, heat of combustion, and total amount and size of fuel consumed. Accounts for convective heat rising into the atmosphere and fire effects to the overstory.

Fire Intolerant (or “intolerant”) - Species of plants that do not grow well or die from the effects of fire. Generally these species are shade-tolerant as well.

Fire Regimes - The ecological effects of frequency, intensity, extent, season, and synergistic interactions with other disturbances, such as insects and disease, classified into generalized levels of fire severity.

Fire Resilient – The ability to survive low to moderate fire intensity due to a biological adaptation such as self-pruning or thick, flakey bark.

Fire Return Interval (Fire Interval) - The number of years between successive fire events in a given area.

Fire Risk - The probability or chance of fire starting determined by the presence and activities of causative agents.

Fire Rotation – The length of time necessary for an area equal in size to the study area to burn.

Fire Severity – A relative measure of the post-fire appearance of vegetation (residual fuels/mortality) as it related to the intensity of the fire and its consumptive effects on vegetation.

Fire Suppression (Fire Control) - All of the work and activities connected with fire extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Fire Tolerant (or “tolerant”) - Species of plants that can withstand certain frequency and intensity of fire. Generally these species are shade-intolerant as well.

Fish Habitat - The place where a population of fish species lives and its surroundings; includes the provision of life requirements such food and cover.

Fish Passage - Clear access for migrating fish through a potential barrier.

Fishery - The total population of fish in a stream or body of water and the physical, chemical, and biological factors affecting that population.

Flame Length - The distance measured from the tip of the flame to the middle of the flaming zone at the base of the fire. It is measured on a slant when the flames are tilted due to effects of wind and slope.

Forage - All browse and non-woody plants available to livestock or wildlife for feed.

Forb – Any herbaceous (herb-like) plant other than grass or grass-like plants that has little or no wood on it. For example, wildflowers are forbs.

Forest Development Road (FDR) - A road wholly or partly within or adjacent to and serving the National Forest System and which is necessary for the protection, administration, and use of the National Forest System and the use and development of its resources.

Forest Diversity – The mix and distribution of vegetation species and ages within a forest.

Forest Health - (also called forested landscape or forestland) is defined as: the conditions under which the integrity of the soil and ecological processes are sustained resulting in systems that maintain their diversity, resiliency, and productivity with associated sustainable human resource issues.

Forest Structure - The mix and distribution of tree sizes, layers, and ages in a forest. Some stands are mostly one size (single-story), some are two-story, and some are a mix of trees of different ages and sizes (multi-story).

Forest Type - Relates to the tree species (and to generalized understory plant) composition.

Fuels - Includes living plants, dead, woody vegetative materials; and other vegetative materials capable of burning.

Fuel Break – A constructed discontinuity in a fuelbed utilized to segregate, stop, and control the spread of fire or to provide a control line from which to suppress a fire.

Fuel Loading - The oven dry weight of fuels in a given area, usually expressed in tons per acre. Fuel loadings may be referenced to fuel size or time-lag categories; and may include surface fuels or total fuels.

Fuel Management - Manipulation or reduction of flammable matter for the purpose of reducing the intensity or rate of spread of a fire, while preserving and enhancing environmental quality.

Fuel Treatment - The rearrangement or disposal of natural or activity fuels.

Geographic Information System (GIS) - Computer software that provides database and spatial analytic capabilities.

Goal – A concise statement that describes a desired condition to be achieved. It is normally expressed in broad, general terms and is timeless in that it has no specific date that it is to be completed. Goal statements form the principal basis upon which objectives are developed.

Group Selection – An uneven-aged management system that harvests small areas of trees (generally less than two acres). Implementation results in uneven-aged stands consisting of small even-aged groups. The opening created in the stands must remove enough trees to allow for sufficient sunlight and soil moisture for regeneration tree seedlings to survive and grow.

Guideline - An indication or outline of policy or conduct dealing with the basic management of the Forest. Forest-wide management standards and guidelines apply to all areas of the Forest regardless of the other management prescriptions applied.

Habitat Type - An aggregation of all land areas potentially capable of producing similar plant communities at climax.

Hazard - A real or potential condition that may result in an undesired event, the cause of risk. Hazard can apply to the probability of tree mortality or damage by an insect or disease and also represents material or fuel that will ignite and burn.

Heterogeneity – The state of a forest consisting of diverse components including vertical and horizontal structure

Hiding Cover - Vegetation used by an animal for hiding. The amount and quality of vegetation needed depends on the animal's size, mobility, and reluctance to venture into relatively open areas. For an elk, hiding cover conceals 90 percent of a standing adult elk from the view of a human at a distance equal to or less than 200 feet. Hiding cover allows elk to use areas for bedding, foraging, thermal relief, wallowing, or other functions, but it does not necessarily provide security during the hunting season.

Historic Range of Variability (HRV) - Conditions which be expected to occur under natural disturbance and succession regimes.

Home Range - An area, from which intruders may or may not be excluded, to which an individual restricts most of its usual activities.

Home Range Core Area (HRCA) - An area established surrounding each territorial spotted owl activity center detected after 1986. The core area amounts to 20 percent of the area described by the sum of the average breeding pair home range plus on standard error. Home range core area size for the Hat Creek Ranger District is 2,400 acres.

Homogeneity - The state of a forest consisting of similar components including vertical and horizontal structure

Indirect Effects - Secondary effects which occur in locations other than the initial action or significantly later in time.

Individual Tree Selection – Also referred to as single tree selection. This is an uneven-aged management system where the objective is to maintain all age groups across the stand. Harvests are made frequently and the appearance of the stand remains relatively unchanged. Trees are harvested such that the desired number of trees in each age group is maintained.

Instream Cover - Anything in the water that provides protection to fish from predators (including turbulence, debris, logs, and rocks).

Intensity - Energy release rates; these are physical descriptors of the fire, not its ecological effects. Generally referred to as High, Moderate, or Low intensity.

Intermittent Stream - A stream which flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow.

Invasive Plant – All State and County listed “noxious weeds” are considered invasive plants. Also, other exotic species (not listed by State or Counties as noxious weeds) that can successfully out compete and displace native plant communities.

Inventoried Roadless Area - An area identified and classified as roadless. These areas were identified during the second Roadless Area Review and Evaluation (RARE II).

Issue - A subject or question of widespread public interest identified through public participation relating to management of National Forest System lands.

Ladder Fuels - Fuels which provide vertical continuity between the surface fuels and crown fuels in a forest stand, thus contributing to the ease of torching and crowning.

Land and Resource Management Plan (Forest Plan) - A strategic integrated resource plan based on the principles of enhanced public involvement, consideration of all resource values, and resource sustainability.

Landscape - The landforms of a region in the aggregate; the land surface and its associated habitats at scales of many acres to many square miles; a spatially heterogeneous area.

Large Woody Debris – Dead woody material including boles (stems), limbs, and large root masses. Type and size of material designated as large or coarse woody debris varies among classification systems.

Late Seral Habitat – A heterogeneous forests capable of sustaining late seral wildlife species such as California spotted owl and American martin. Identified components of this habitat are multi-layered forest canopy, multi-aged trees, diverse vegetation (including grasses, forbs and brush), and a canopy closure of 40 percent or greater.

Legacy Tree – A healthy tree greater than 24 inches in dbh of a desirable species around which radial thinning would be conducted.

Lethal Fire/Lethal Fire Regime - Fire that consumes the entire vegetative community (grasses, shrubs, trees. Also see Stand Replacement Fire.

Linkage (Habitat) - Linkage zones are combinations of landscape structural factors that allow wildlife to move through, and live within, areas influenced by human actions. A linear habitat patch through which a species must travel to reach habitat more suitable for reproduction and other life-sustaining needs.

Low Severity Ground Fire - A fire with low intensity that primarily scorches tree boles, allowing fire tolerant species to survive.

Management Indicator Species (MIS) - Species identified in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish including those that are socially or economically important.

Maximum Stand Density Index (SDImax) – The maximum trees per unit area with a given average diameter. The SDImax varies with species; values can be calculated for combinations of numbers of trees and sizes. This a biological limit controlled by the resources available on a site to support live, respiring tissues.

MBF and MMBF - Thousand board feet and million board feet, respectively.

Mean Fire Return Interval (Mean Fire Interval) – The average of all fire intervals in a given area over a given time period.

Mechanical Treatment – The use of mechanized equipment to treat an area.

Mid-Seral/Structural Stage - A stage of development of an ecosystem from approximately 30 to 80 years old. Forested stands are generally 5 to 12 inches average dbh. Stand structure is pole- and small sawlog-sized trees.

Mixed-Severity Fire/Mixed Severity Fire Regime - Mixed-severity fire regime areas can experience the full range of fire severities during either a single event or consecutive events. In other words, in a single fire event both low severity (killing few trees) and high severity (killing all trees) in patches of variable sizes. This tends to create complex fine-grained spatial patterns of vegetation conditions across a landscape.

Monitoring and Evaluation - The periodic evaluation on a sample basis of Forest Plan management practices to determine how well objectives have been met and how closely management standards have been applied.

National Environmental Policy Act (NEPA) - An act which encourages productive and enjoyable harmony between man and his environment; promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; enriches the understanding of the ecological systems and natural resources important to the Nation; and establishes a Council on Environmental Quality

National Forest Management Act (NFMA) - A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of Regional and Forest plans and the preparation of regulations to guide that development.

National Forest System (NFS) - All national forest lands reserved or withdrawn from the public domain of the United States, all national forests lands acquired through purchase, exchange, donation, or other means, the national grasslands and land utilization projects administered under Title III.

Native Species - Species that are indigenous to a region, as opposed to introduced or exotic species.

Native (Natural) Succession and Disturbance Regimes - The historic patterns (frequency and extent) of fire, insects, wind, landslides and other natural processes in an area.

Natural Regeneration - Renewal of a tree crop by natural seeding, sprouting, suckering, or layering.

Nesting Core – An identified area approximately 500 acres surrounding a California spotted owl nest.

Net Present Value – A means of comparing the benefits and costs of any particular silvicultural system by discounting all future benefits and costs to today's dollars throughout the rotation until the activities begin to cycle.

No Action Alternative - The management direction, activities, outputs, and effects most likely to exist in the future if the current plan would continue unchanged.

Non-Lethal Fire/Non-Lethal Fire Regime – Fire that primarily consumes surface fuels causing little mortality to overstory trees. See also Low Severity Fire.

Northern Goshawk Protected Activity Center (gPAC) – An area of known or suspected nest stands which encompass the best available 200 acres of forested habitat in the largest contiguous patches possible, based on aerial photography.

Noxious Weed - Any exotic plant species established or that may be introduced in the area which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses.

Old-Forest - Old forests are forested areas with a physical structure and ecological processes similar to what would have been common before the year 1850 and before the implementation of current forest management activities. Old forests are characterized by: 1) a significant number of trees that approach their biological maximum age; 2) a complex horizontal and vertical structure, including live and dead vegetation, that has been shaped or maintained by natural disturbances or their functional equivalents; 3) an array of plant and animal species endemic to the region and location; and 4) continuity in the above characteristics over large geographic areas (hundreds of thousands of acres).

Old-Growth – Encompass two broad types of forests that reflect different roles for fire. "Forests in the coastal Pacific Northwest and other areas where climates are wet are typical examples of forests driven largely by natural plant succession and small-scale disturbances. . . . In drier regions, forest types have evolved more in response to disturbance by fire than in response to successional processes in the absence of fire. Old trees become a part of such forests because of adaptations that allow them to survive all but the most severe fires….Old-growth forests or landscapes contain sufficient numbers of patches and stands of old-growth to be reasonably representative of the forest type in historical times. However, portions of the landscape may be in various stages of development (even temporary openings or patches of very young trees) to provide future old-growth patches in the landscape. Landscapes vary in size, but are generally considered to be at least as large as major natural disturbances, such as fire." (Kaufmann et. al., 2007)

Open Road – A road with no restrictions on motorized vehicle use.

Overstory - The portion of the trees that form the uppermost canopy layer in a forest of more than one story.

Passive Crown Fire – Also referred to as torching. Fire burns principally as a surface fire that intermittently ignites the crowns of trees or shrubs as it advances.

Perennial Streams - Streams that flow continuously throughout most years and whose upper surface generally stands lower than the water table in the region adjoining the stream.

Pine Restoration Area – A silvicultural treatment meant to restore existing pine stands or aggregates by removing all trees except pine that are less than 30 inches in diameter.

Pole - A tree between a sapling and small timber size at least five inches in diameter at breast height but smaller than 8" dbh.

Pool - A portion of the stream with reduced current velocity, often with water deeper than the surrounding areas, and which is usable by fish for resting and cover.

Population - A group of coexisting (nonspecific) individuals that interbreed if they are sexually reproductive.

Potential Habitat (Wildlife) - Habitat that is likely to be occupied by a wildlife species or group of species, currently or in the near future.

Pre-Commercial Thinning - The selective felling, deadening, or removal of trees in a young stand primarily to accelerate diameter increment on the remaining stems, maintain a specific stocking or stand density range, and improve the vigor and quality of the trees that remain.

Predominate Tree – A tree which was part of the pre-settlement forest.

Preferred Alternative - The agency's preferred alternative is the alternative that the agency believes would best fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors, and which meets the purpose and need of the NEPA document.

Prescribed Burning- The controlled use of fire to reduce or eliminate the unincorporated organic matter of the forest floor, or low, undesirable vegetation. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Proposed Action - The proposed action or proposal exists at that stage in the development of an action when an agency subject to the Act (NEPA) has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal and the effects can be meaningfully evaluated.

Public Involvement - A process designed to broaden the information base upon which agency decisions are made by informing the public about Forest Service activities, plans, and decisions, and participation in the planning processes which lead to final decision making.

Radial Thin – The removal of all trees less than 30 inch dbh within 50 feet or less of an identified legacy tree.

Ranger District– Administrative subdivision of the Forest supervised by a District Ranger.

Rate of Spread – The relative activity of a fire in extending its horizontal dimensions. The forward rate of spread at the fire front or head is usually what is meant by this term.

Reach - A length of stream channel, lake, or inlet exhibiting, on average, uniform hydraulic properties and morphology.

Recovery Plan - A plan that details actions or conditions necessary to promote species recovery, that is, improvement in the status of species listed under the Endangered Species Act to the point at which listing is no longer appropriate. Plans are required for virtually all listed species.

Reforestation - The renewal of forest cover by seeding, planting, and natural means.

Regeneration - The renewal of a forest, whether by natural or artificial means. This term may also refer to a tree crop itself.

Rehabilitation (Road) - The act of maintaining a road and improving drainage features, usually to meet Best Management Practices standards.

Release - Freeing a tree or group of trees from more immediate competition by cutting or otherwise eliminating growth that is overtopping or closely surrounding them.

Residence Time – The time required for the flaming zone of a fire to pass a stationary point; the width of the flaming zone divided by the rate of spread of the fire.

Resident Fish - Non-migratory fish species.

Resilient, Resiliency - The ability of a system to respond to disturbances. Resiliency is one of the properties that enable the system to persist in many different states or successional stages.

Responsible Official - The Forest Service employee who has the authority to select and/or carry out a specific planning action.

Restore, Restoration - The re-creation of a natural or self-sustaining, resilient community or ecosystem, or a movement in that direction.

Restricted Road - A road on which motorized vehicle use is restricted during the entire non-denning period. The road requires physical obstruction and motorized vehicle use in the non-denning period is legally restricted by order.

Riparian Areas - Areas with distinctive resource values and characteristics that are comprised of an aquatic ecosystem and adjacent upland areas that have direct relationships with the aquatic system. This is considered the horizontal distance of approximately 100 feet from the normal high water line of a stream channel, or from the shoreline of a standing body of water.

Riparian Ecosystem - A transition between the aquatic ecosystem and the adjacent upland terrestrial ecosystem. It is identified by soil characteristics and by distinctive vegetative communities that require free or unbounded water.

Riparian Habitat Conservation Area (RHCA) - Portions of watersheds where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and guidelines. RHCAs were established as INFISH guidelines.

Riparian Land Type - Integrated map units of the types of riparian habitats based on topography, substrate materials (i.e. clays or boulders), and associated vegetation.

Riparian Wildlife Habitat - Vegetation growing close to a watercourse, lake, swamp, or spring that is generally critical for wildlife cover, fish food organisms, stream nutrients and large organic debris, and for streambank stability.

Risk - The probability of a hazard and/or the consequences of that hazard (hazards are undesirable events).

Road Density – Number of miles in a given area.

Road Management - The combination of both traffic management and maintenance management operations. Traffic management is the continuous process of analyzing, controlling, and regulating uses to accomplish National Forest objectives. Maintenance management is the perpetuation of the transportation facility to serve intended management objectives.

Roadless Area – A National Forest area which (1) is larger than 5,000 acres, or if smaller than 5,000 acres, contiguous to a designated wilderness or primitive area; (2) contains no roads; and (3) has been inventoried by the Forest System for possible inclusion in the Wilderness Preservation System.

Sawlog – A log that meets minimum regional standards of diameter, length, and defect, intended for sawing into end products.

Salvage – Harvest of trees that are dead, dying, or deteriorating due to fire, wind, insect or other damage, or disease.

Sapling - A young tree that is larger than a seedling but smaller than a pole, typically 5 to 25 feet tall.

Scoping Process - An early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action. Identifying the significant environmental issues deserving of study and deemphasizing insignificant issues, narrowing the scope of the environmental impact statement accordingly (CEQ regulations, 40 CFR 1501.7).

Security - The protection inherent in any situation that allows a wildlife species to remain in a defined area despite an increase in stress or disturbance, such as that associated with hunting season. The components of security include vegetation, topography, the size of the blocks of vegetation, road density, distance from roads, intensity of the disturbance, and seasonal timing.

Sediment - Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from its site of origin by air, water, gravity, or ice.

Seedling - A young tree that has just germinated but has not yet reached sapling size, typically 1 to 5 feet tall.

Seedling/Sapling - A size category for forest stands in which trees less 5 inches in diameter are the predominant vegetation.

Sensitive Species - Those wildlife and plant species identified by the Regional Forester for which population viability is a concern because of significant current or predicted downward trends in (a) population numbers or density, or (b) habitat capability that would reduce a species' existing distribution.

Seral - A biotic community that is developmental; a transitory stage in an ecologic succession.

Seral Stage - (also called successional or structural stage) refers to vegetation structural development; and describes the mix and distribution of tree species, sizes, canopy layers, ages, and general conditions in a forest.

Severity - Refers to the ecological effects of fires, usually on the dominant organisms of the ecosystem, for example a stand dominated by lodgepole pine.

Shade Intolerant - Species of plants that do not grow well or die from the effects of too much shade. Generally these are fire-tolerant species.

Shade Tolerant - Species of plants that can develop and grow in the shade of other plants. Generally these are fire-intolerant species.

Silviculture - The theory and practice of controlling the establishment, composition, growth, and quality of forest stands in order to achieve the objectives of management.

Silvicultural Prescription - A written document that describes management activities needed to implement silvicultural treatment or treatment sequence. The prescription documents the results of the analysis during the diagnosis phase.

Silvicultural Systems - A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. It includes all cultural management practices performed during the life of the stand, such as regeneration cutting, thinning, and use of genetically improved tree seeds and seedlings to achieve multiple resource benefits.

Site Preparation - A general term for a variety of activities that remove competing vegetation, slash, and other debris that may inhibit the reforestation effort.

Site Productivity - Production capability of a specific area of land.

Slash - The residue left on the ground after felling and other silvicultural operations and/or accumulating there as a result of storms, fire, or poisoning trees.

Snag - A standing dead tree usually greater than five feet in height and six inches in diameter at beast height.

Soil Productivity - The capacity of a soil to produce a specific crop such as fiber and forage, under defined levels of management. It is generally dependent on available soil moisture and nutrients and length of growing season.

Spatial – Of, relating to, involving, or having the nature of space.

Spawning Gravel - Small gravels (1/4" - 1.0" diameter) in streams grouped in areas of about one square foot or larger with good water circulation through them.

Spawning Habitat - Areas of substrate that provide well-oxygenated and suitable sized gravels for fish spawning.

Species - A group of actually or potentially interbreeding populations that are reproductively isolated from all other kinds of organisms.

Specified Road - See Forest Development Road, above.

Spotted Owl Habitat Area (SOHA) – Areas delineated in Land and Resource Management Plans for the purpose of providing nesting and foraging habitat for spotted owls.

Spotted Owl Protected Activity Center – The best available 300 acres of habitat surrounding each territorial owl activity center detected on National Forest System lands since 1986. Owl activity centers are designated for all territorial owls based on : 1) the most recent document nest site, 2) the most recent known roost site when a nest location remains unknown, and 3) a central point based on repeated daytime detections when neither nest or roost locations are known.

Stand - A community of trees or other vegetative growth occupying a specific area and sufficiently uniform in composition (species), age, spatial arrangement, and conditions as to be distinguishable from the other growth on adjoined lands, so forming a silvicultural or management entity.

Stand Density Index – Developed in 1933 by L.H. Reineke to determine the relative density measure of even-aged stands and is also applied to uneven-aged stands. It is based on the relationship between mean tree size (dbh) and the number of trees per unit area in a forest stand.

Stand Maintenance Fire (Non-Lethal) - Fire that emphasizes the survival of the living overstory vegetation.

Stand Replacement Fire- Fire that emphasizes the destruction of the living overstory vegetation. See also Lethal fire.

Stand Replacement Fire Regime - Stand-replacement fire regimes typically occur on lands that experience predominantly lethal fires, with less than 10% of the forested canopy cover remaining after the fire.

Stand-Replacing Disturbance - An agent such as fire, blowdown, insect or disease epidemic, or timber harvest that kills or removes enough trees to result in an early-seral/structural stage condition.

Standards and Guidelines - An indication or outline of policy or conduct dealing with the basic management of the Forest. Forest-wide management standards and guidelines apply to all areas of the Forest regardless of the other management prescriptions applied.

Stocking - A measure of timber stand density as it relates to the optimum or desired density to achieve a given management objective.

Streamside Management Zone (SMZ) - An area adjacent to the bank of a stream or body of open water where extra precaution is necessary to carry out forest practices in order to protect bank edges and water quality.

Structure - The various horizontal and vertical physical elements of the forest, including tree size, canopy composition, quantity and quality of deadwood, ephemeral herbaceous species, density of wildlife trees, fungi, age structure, forest height, etc.

Structural Thin - Structural thinning places an emphasis in retaining healthy desirable trees within all size classes. Thinning would be conducted through all size classes less than 30” dbh.

Subspecies - Subpopulations or races within a species that are distinguishable by morphological characteristics and, sometimes, by physiological or behavioral characteristics.

Substrate - Mineral and/or organic material that forms the stream bed (stream bottom).

Summer Range - Land used by wildlife species (specifically big game and/or grizzly bear) during the summer months.

Succession - A predictable process of changes in structure and composition of plant and animal communities over time. Conditions of the prior plant community or successional stage create conditions that are favorable for the establishment of the next stage. The different stages in succession are often referred to as "seral stages."

Surface Fire – Fire that burns surface litter, other loose debris of the forest floor, and small vegetation.

Sustainability - The capacity of forests, ranging from stands to eco-regions, to maintain their health, productivity, diversity, and overall integrity, in the long run, in the context of human activity and use.

System Road - See also Forest Development Road, above. A road wholly or partly within or adjacent to and serving the National Forest System and which is necessary for the protection, administration, and use of the National Forest System and the use and development of its resources.

Temporary Road - A road constructed to facilitate forest management activities but is reclaimed soon after the activity is completed.

Territory - Any area defended by one or more individuals against intrusion by others of the same or different species.

Thermal Cover- Cover used by animals to ameliorate the chilling effects of winter weather or the heating effects of summer weather.

Thin From Below – An even-aged silvicultural system. Thinning from below involves the removal of most of the smaller trees in the stand so the remaining large trees have more growing space and are better able to maintain vigor.

Threatened Species - Any species, plant or animal, which is likely to become an endangered species within the foreseeable future throughout all, or a significant portion, of its range. In accordance with the 1973 Endangered Species Act, the Secretary of the Interior identifies endangered species.

Tiering - Refers to the elimination of repetitive discussions of the same issue by incorporating by reference the general discussion in an environmental impact statement of broader scope. For example, a project environmental assessment could be tiered to the Forest Plan EIS.

Travel Habitat - Habitat used by a wildlife species for daily or periodic movements between areas of higher-quality habitat. For example, for a lynx this would be the forested cover used while traveling between areas used for denning and that used for hunting.

Underburning - A fire that consumes surface fuels but not trees and large shrubs. See also Low Severity Fire and Stand Maintenance Fire.

Understory - The trees and other woody species which grow under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

Vegetative Screening - Vegetation (trees, shrubs, etc.) that ameliorates the visual effect of management activities adjacent to viewing areas (i.e. main roads).

Vegetative Succession - A phase in the gradual supplanting of one community of plants by another. Viability - A viable animal or plant species is defined as consisting of self-sustaining populations that are well distributed throughout the species' range. Self-sustaining populations are those that are sufficiently large, and have sufficient genetic diversity to display the array of life history strategies and forms that will provide for their persistence and adaptability in the planning area over time.

Visual Resource - The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

Water Quality- The physical, chemical, and biological properties of water.

Water Yield - The runoff from a watershed, including groundwater outflow.

Watershed - The land area drained by a river system.

Wetland - Areas that under normal circumstances have hydrophytic vegetation, hydric soils, and wetland hydrology.

Wildfire - An unwanted wildland fire that requires a suppression response.

Wildland Fire - A non-structure fire, other than prescribed fire, that occurs in the wildland. Any fire originating from an unplanned ignition.

Wildland Urban Interface (WUI) - That line, area, or zone where structures and other human development meet or intermingles with undeveloped wildland or vegetative fuels.

Wildlife Analysis Area – Area utilized for the analysis of wildlife which encompasses the entire project area and adjacent California spotted owl PACs and HRCAs within close proximity to the project area.

Wind Dominated Fire - The power of the wind is greater than the power of the fire in influencing its behavior.

Windfirm - A tree (live or dead) or species of tree that is relatively resistant to being blown over by the wind.

Winter Range - The areas available to and used by big game during the winter season. Must contain forage or browse to feed big game. Winter range areas tend to have a relatively low amount of snow cover which enables the animals to reach the forage.

Zone of Imminent Mortality – Usually expressed as 55 to 60 percent of the SDImax and identifies the density at which trees begin to die due to competition.

Appendix A – Cumulative Effects

Past, Present and Reasonably Foreseeable Future Actions - List of Cumulative Actions

This section summarizes the analysis area and the temporal scale (time) considered for the cumulative effects analysis. Each resource analysis has disclosed the specific cumulative effects for that particular resource area. Refer to the applicable FEIS sections for a specific discussion of cumulative effects.

Scope of the Cumulative Effects Area (CEA)

The cumulative effects area would be at a minimum the project area. In addition, some resources would use a larger CEA such as subwatersheds. Each resource specialist has defined what they have used for their geographical analysis area for cumulative effects in Chapter 4 of the DEIS, along with rationale for the CEA chosen. The cumulative effects analysis area applies to Alternatives 1, 2, 3 and 7.

The geographical analysis area boundary used for the past, ongoing and future vegetative management actions is the area of the thirteen subwatersheds for this project. The subwatershed boundaries were chosen as the cumulative effects analysis area for the management actions displayed in this appendix in conjunction with, and because they are the same boundaries the Project Hydrologist used in determining cumulative effects of the watersheds.

The time period used for including past actions is 20 years before present (1986-2006), and 30 years for cumulative watershed effects analysis.

Past, Present and Reasonably Foreseeable Future Actions

The following list of cumulative effects actions is considered for this project. Maps showing these activities in relationship to the CRMP follow the tables. Tables A-1 through A-8 summarize those past, ongoing and foreseeable future actions within the subwatershed boundaries of the project, with a description of the activity and the acres affected. Guidance on cumulative effects, in particular, past actions, was considered, based on Connaughton (2005), hereby incorporated by reference.

Table A- 1 List of Past Vegetative Management Actions

Activity Name	Year	Activity Description
Battle TS	1975-1979	Timber harvest on 152 acres using the following silvicultural prescription: Intermediate Thinning (thin from above) on 152 acres.
Mud Lake Lodgepole TS	1976	Timber harvest on 130 acres using the following silvicultural prescriptions: Regeneration Clearcut on 15 acres; Seed Step Shelterwood on 15 acres; and Intermediate Sanitation on 100 acres.
Ashpan TS	1977-1982	Timber harvest on 3,551 acres using the following silvicultural prescriptions: Intermediate Sanitation on 3,091 acres; Overstory Removal on 335 acres; Intermediate Thinning (thin from above) on 70 acres; and Regeneration Clearcut on 55 acres.
Bad Salvage TS	1978	Timber harvest on 980 acres of standing dead timber.
Thirty-Five Salvage TS	1979	Timber harvest on 540 acres of standing dead timber.
Snowmobile Park TS	1979-1980	Timber harvest using the following silvicultural prescription: Overstory Removal on 4 acres.
Badger/Prospect Insect Salvage TS	1980	Timber harvest on 1,000 acres of standing dead timber.
Fiddle Thinning TS	1980-1981	Timber harvest using the following silvicultural prescription: Multi-product Thinning (thin from below) on 59 acres.
Campground Salvage TS	1981	Timber harvest on 1,260 acres of standing dead timber.
Ash TS	1981-1991	Timber harvest on 1,720 acres using the following silvicultural prescriptions: Intermediate Sanitation on 545 acres; Overstory Removal on 575 acres; Seed Step Shelterwood on 530 acres; and Regeneration Clearcut on 132 acres.
Bash TS	1982-1986	Timber harvest on 2,272 acres using the following silvicultural prescriptions: Intermediate Sanitation on 949 acres; Overstory Removal on 1,200 acres; and Regeneration Clearcut on 123 acres.
Hot Shot TS	1982	Timber harvest on 1,330 acres using the following silvicultural prescriptions: Overstory Removal on 800 acres and Intermediate Sanitation on 530 acres.
Jenny TS	1983	Timber harvest on 180 acres using the following silvicultural prescriptions: Overstory Removal on 100 acres and Seed Step Shelterwood on 80 acres.
Hot Rock TS	1984	Timber harvest on 925 acres using the following silvicultural prescriptions: Intermediate Sanitation on 230 acres; Seed Step Shelterwood on 557 acres; Multi-product Thinning (thin from below) on 220 acres; and Regeneration Clearcut on 5 acres.
Latour TS	1985-1987	Timber harvest on 597 acres using the following silvicultural prescriptions: Intermediate Sanitation on 400 acres; Intermediate Thinning (thin from above) on 173 acres; and Regeneration Clearcut on 24 acres.
Devil's Garden Buyout TS	1986-1990	Timber harvest on 1,949 acres using the following silvicultural prescriptions: Overstory Removal on 1,063 acres, Seed Step Shelterwood on 8 acres; and Intermediate Sanitation on 878 acres.
Onion TS	1988	Timber harvest on 585 acres using a thin from below prescription (multi-product thinning).
Superbowl TS	1988-1991	Timber harvest on 942 acres using the following silvicultural prescriptions: Overstory Removal on 535 acres; and Regeneration Clearcut on 407 acres.
Manzanita TS	1989-1990	Timber harvest using the following silvicultural prescription: Overstory Removal on 415 acres.
Grayback TS	1990-1991	Timber harvest using the following silvicultural prescription: Regeneration Clearcut on 348 acres.

Activity Name	Year	Activity Description
Flea TS	1991-1992	Timber harvest using the following silvicultural prescription: Overstory Removal on 140 acres.
Steamboat Insect Salvage TS	1992-1993	Timber harvest on 900 acres of standing dead timber.
Mud TS	1992-1994	Timber harvest on 570 acres using the following silvicultural prescriptions: Overstory Removal on 235 acres; Seed Step Shelterwood on 20 acres; Intermediate Thinning on 270 acres; and Regeneration Clearcut on 45 acres.
Dusty Biomass TS	1992-1996	Timber harvest on 400 acres using the following silvicultural prescription: Multi-product Thinning (thin from below).
Soy Insect Salvage TS	1993	Timber harvest on 335 acres of standing dead timber.
Plantation Biomass TS	1993-1994	Timber harvest on 889 acres using a thin from below prescription (multi-product thinning).
Potatohead Biomass Thinning TS	1993-1996	Timber harvest on 315 acres using the following silvicultural prescription: Multi-product Thinning (thin from below).
Lost Rock/Shotput TS	1994-1996	Timber harvest on 200 acres using the following silvicultural prescription: Group Selection (followed by planting of each individual group).
Fiddlehead Windthrow SSTS	1996	Timber harvest on 200 acres of windthrown timber.
17 Road Windthrow Salvage TS	1996	Timber harvest on 200 acres of windthrown timber.
Eskimo Windthrow Salvage TS	1996-1997	Timber harvest on 600 acres of windthrown timber.
Bellow Insect Salvage TS	1996-1997	Timber harvest on 1,000 acres of standing dead timber.
Chuckle TS	1996-1998	Timber harvest on 291 acres using the following silvicultural prescriptions: Seed Step Shelterwood on 23 acres; Intermediate Sanitation on 199 acres; Multi-product Thinning (thin from below-fuelbreak) on 53 acres; and Regeneration Clearcut on 16 acres.
Twin Windthrow SSTS	1997-1998	Timber harvest on 350 acres of windthrown timber.
Wheel TS	1997-2000	Timber harvest on 680 acres using the following silvicultural prescription: Multi-product Thinning (thin from below).
Highway 44 Fuelbreak TS	1997-2000	Timber harvest on 888 acres using the following silvicultural prescription: Multi-product Thinning (thin from below).
Ashpan Parking SSTS	1998	Timber harvest on 4 acres using a clearcut prescription for developed recreation site.
Redlock Thinning TS	1999-2004	Timber harvest on 1,000 acres using a thin from below prescription (multi-product thinning).
Ashpan Realignment TS	2000	Timber harvest on 4 acres using a clearcut prescription for a state highway road realignment project for safety reasons. SUP issued to Cal-Trans.
Deep Red Reoffer TS	2002-2005	Timber harvest on 1,512 acres using the following silvicultural prescriptions: Multi-product Thinning (thin from below) on 1,478 acres and Group Selection on 34 acres.
Camp Hazard Salvage TS	2003	Timber harvest on 194 acres of standing dead timber.
Hawkeye Sanitation/Salvage TS	1990	Timber harvest on 1628 acres.

Activity Name	Year	Activity Description
Igloo Salvage TS	1988-1991	Timber harvest 399 acres.
Wilcox Blowdown	1999	Timber harvest on 1 acre.
Wilcox Thinning/Salvage	1998	Timber harvest on 407 acres using the following silvicultural prescriptions: Multi-product thinning/salvage harvest on 277 acres and Salvage harvest on 130 acres
Cabin TS	2004-2007	Timber harvest on 120 acres using a thin from below prescription.
Chutes Service Contract	2004	Timber harvest on 501 acres using a thin from below prescription.
Cabin Plantation TS	2005	Timber harvest on 232 acre using a thinning prescription.
Red Shoe SC	2005	Timber harvest on 59 acres using a thinning prescription.
Red West SC	2003	Timber harvest on 233 acres using a thinning prescription.
Chuckle Plantation Mastication	2007	Brush mastication on 50 acres of a plantation.
Eskimo Mastication	2007`	Brush mastication on 300 acres.
Snowmobile Hazard TS	1992	Timber harvest on 108 acres using a sanitation/salvage prescription.
Backbone Sanitation TS	Early 1990s	Timber harvest on 456 using a sanitation prescription.
Jack's Back Windthrow		Timber harvest on 4 acres using a salvage prescription.
Red Fuel	2007	Timber harvest – individual tree selection
Private Land Use (Fruit Growers Supply Company)	1996-2005	Within the past ten years, the following harvest treatments have been applied to Fruit Growers lands: Shelterwood & Commercial Thinning – 53% Shelterwood & Sanitation – 27% Selection (single tree) – 13% Clearcutting – 4% Sanitation – 2% Commercial Thinning – 1%
Private Land Use (Sierra Pacific Industries)	1996-2005	Within the past ten years, the following harvest treatments have been applied to SPI lands: Clearcutting – 39% Shelterwood – 33% Commercial Thinning – 19% Shaded Fuelbreak – 9%
State Land Use	1996-2005	Within the past ten years, the following harvest treatments have been used on Latour Demonstration State Forest lands: Group Selection – 88% Shelterwood – 10% Commercial Thinning – 2%

Sources: Hat Creek Ranger District Records and State of California Timber Harvesting Plans
Note: Records of Timber Harvesting Plans (THPs) for the California Department of Forestry and Fire Protection are only kept for the past ten years.

Table A- 2. Summary of Table A-1. Acres of Past Vegetative Management Actions by Treatment Type on NFSL*

Treatment Type	Acres Treated
Intermediate Thinning (thin from above)	665
Regeneration Clearcut	1,170
Clearcut (no regeneration)	8
Group Selection	234
Windthrown Fuels Reduction	1,350
Seed Step Shelterwood	1,233
Multiproduct Thinning (thin from below)	6,567
Intermediate Sanitation	6,922
Overstory Removal	5,402
Insect Salvage Removal	8,058

*NFSL – National Forest System Lands

Table A- 3. List of Ongoing Actions

Activity Name	Year	Activity Description
Sandy Hazard	2007-ongoing	Hazard tree removal on a total of 2 acres.
Road Maintenance	ongoing	Annual road maintenance, grading of roads and ditches, culvert cleanout, hazard tree removal.
Plantation Maintenance	ongoing	Hat Creek Ranger District; North 49 Planning File
Special Uses	ongoing	Annually waterlines are replaced as needed, weather stations are maintained for access and fire protection, hazard trees and sub-merchantable material removed, and fire clearance is maintained.
Mining operations	ongoing	Not Applicable.
Grazing Allotments and Range Permits	ongoing	North Battle Creek and Hat Creek Allotments. Active permit in use for North Battle Creek allotment with 240 cattle AUMs from July 1-Sept. 30 annually.
Post Poles; Christmas Tree; Fuel Wood Use	ongoing	Use is very common in project area.
Timber harvest on private lands (Fruit Growers Supply Company)	ongoing	Several large parcels of privately held commercial timber lands. Most recent THP, 2005, (Lost Creek) covers 2,669 acres to be logged. Shelterwood & Sanitation – 1,303 acres, Shelterwood & Commercial Thinning – 499 acres, Single tree selection – 612 acres, Clearcutting – 167 acres, and Sanitation – 88 acres.
Timber harvest on private lands (Sierra Pacific Industries)	ongoing	Several large parcels of privately held commercial timber lands. Most recent THP, 2005, (Cherry) covers 1,073 acres to be logged. Clearcutting – 820 acres and Shaded Fuelbreak – 253 acres. Another 2005 THP (Manzanita Flat) includes 703 acres of clearcutting.

Activity Name	Year	Activity Description
Timber harvest on State lands (Latour Demonstration State Forest)	ongoing	Several parcels of State timber lands adjacent to the project but within the subwatershed boundaries. Most recent THP, 2002 (South Cow) covers 1,632 acres of logging. Group Selection – 1,332 acres and Shelterwood – 300 acres.
Recreation Maintenance	ongoing	Hazard tree removal, fire rings removed, signs installed, and sites closed to use within 100' of water sources.
OHV, Bikes, Hikes, Fishing, Dispersed Camping, Camping Use, Trail Rides, Snowmobile use.	ongoing	Recreation use by the public is common.

Sources: Hat Creek Ranger District Records and State of California Timber Harvesting Plans

Table A- 4. Summary of Table A-3. Acres of Ongoing Vegetative Management Actions by Treatment Type

Treatment Type	Acres Treated
Commercial Thinning (thin from below) – Individual Tree Selection	933
DFPZ Thinning	933
Aspen Release (remove all competing conifers)	15

Table A- 5. Detailed List of Ongoing Range Allotments

Allotment Name	Livestock Class	Livestock Kind	Livestock Number	Season of Use	AUMs	Status
NorthBattle Creek	Cattle	Cow/Calf	80	7/1-9/30	240	Active
Hat Creek	Cattle	Cow/Calf				Vacant

Source: Hat Creek Ranger District 2230 Permit Files

Table A- 6. List of Reasonably Foreseeable Future Actions - (2006+)

Activity Name	Year	Activity Description
Special Uses:	2006+	Eskimo Project. This is a CalTrans proposal scheduled for Fall 2006 to widen Hwy 44/89 for safety reasons. In Section 31 of Township 32 North, Range 4 East, approximately 0.2 mile will be affected. CalTrans plans to shave rock points and remove some trees for road daylighting purposes.
Timber harvest on private lands (Fruit Growers Supply Company)	2006+	There are no plans for additional Timber Harvesting Plans in the next five years.
Timber harvest on private lands (SPI)	2006+	SPI's future plans are to continue long-term forest management activities. Under the 2005 Cherry THP, the logging of the clearcuts and shaded fuelbreaks are scheduled to occur during 2007-2010. Under the 2005 Manzanita Flat THP, the clearcuts are to be logged during the same time period of 2007-2010. They anticipate returning to harvest in forest stands adjacent to the proposed harvest units in the 2005 Cherry THP after 10 years.

<table>
<tr><th>Activity Name</th><th>Year</th><th>Activity Description</th></tr>
<tr><td>Old Station WUI</td><td>2008+</td><td>Implementation of Wildland Urban Interface project around the community of Old Station, California. Treatments could include mastication, thinning, and prescribed burning on up to 1300 acres.</td></tr>
<tr><td>Lost Rock/Shotput SC</td><td>2008+</td><td>Treatments would consists of precommercial thinning harvest on 975 acres.</td></tr>
<tr><td>Stonehenge</td><td>Ongoing</td><td>Broadcast burning project on 61 acres. This project will be conducted in conjunction with the Lassen Volcanic National Park.</td></tr>
<tr><td>South Bunch Forest Health Recovery Project</td><td>2008+ (est.)</td><td>Implementation of HFQLG – unknown amount of acres of DFPZ thinning, unknown amount of acres of group selection, and unknown amount of acres of area thinning. This project is still in the design phase.</td></tr>
<tr><td>Timber harvest on private lands (PG&E)</td><td>2008+</td><td>Most recent THP, 2004, (Grace Lake) has been approved for the North Battle Creek watershed. In 2008, under this THP, Pacific Gas & Electric (PG&E) plans to harvest approximately 1,135 acres of timber around North Battle Creek Reservoir using sanitation, salvage, and single tree selection as their silvicultural harvest treatments.</td></tr>
<tr><td>North 49 DFPZ Maintenance</td><td>2010-2040</td><td>Expected DFPZ maintenance treatments are tiered to the Herger-Feinstein Quincy Library Group Final Supplemental Environmental Impact Statement (HFQLG FSEIS, 2003) (USDA FS, 2003). The proposed DFPZ treatment units were analyzed using GIS to identify predicted post-treatment vegetation conditions and maintenance regimes identified under the SEIS.

Approximately 12 acres of DFPZ maintenance using herbicides was identified thru analysis using the 2003 HFQLG FSEIS. Upon review, the strata of these acres were deemed incorrect based on local vegetation data. It was not considered cost efficient or reasonable to treat these acres using herbicides because of the small area. This area was joined to adjacent larger areas of proposed prescribed fire treatments.

Additionally, 21 acres of DFPZ maintenance using hand treatments every 3 years was identified according to the 2003 HFQLG FSEIS.

Hand treatment is cost prohibitive. It costs approximately $500 per acre to hand treat fuels versus approximately $150 per acre to underburn fuels. In addition to lower costs, the other reason why underburning is the preferred treatment for maintaining DFPZs on the Hat Creek District is that it returns fire to the ecosystem.

Potential maintenance treatments are summarized and described below:

Potential Maintenance Treatments - District
<table>
<tr><th>Maintenance Treatment</th><th>Time of Initial Maintenance</th><th>Time of Secondary Maintenance</th><th>Acres</th></tr>
<tr><td>Hand Treatment</td><td>5 Year</td><td>10 Year</td><td></td></tr>
<tr><td>Hand Treatment</td><td>10 Year</td><td>10 Year</td><td></td></tr>
<tr><td>Mechanical Treatment</td><td>5 Year</td><td>5 Year (3 times)</td><td></td></tr>
<tr><td>Mechanical Treatment</td><td>10 Year</td><td>10 Year</td><td></td></tr>
<tr><td>Mechanical Treatment</td><td>30 Year</td><td>30 Year</td><td></td></tr>
<tr><td>Prescribe Burn</td><td>5 Year</td><td>10 Year</td><td></td></tr>
<tr><td>Prescribe Burn</td><td>10 Year</td><td>10 Year</td><td>11,836</td></tr>
<tr><td>Prescribe Burn</td><td>30 Year</td><td>30 Year</td><td>26</td></tr>
<tr><td>No Treatment</td><td>--</td><td></td><td></td></tr>
<tr><td colspan="2">Total</td><td></td><td>11,862</td></tr>
</table></td></tr>
</table>

Activity Name	Year	Activity Description
		Hand Treatment: Hand treatments would entail the use of hand tools such as hoes, or mechanized brush cutters to cut brush and young trees. Small brush may be grubbed out, removing their root systems. Sprouting brush species and hardwoods are expected to re-sprout after hand cutting, but their growth rates would be reduced due to overstory shading and competition. This material would then be hand piled and burned according to a prescribed burn plan. Hand treatment would be performed in sensitive areas such as the inner zone of RHCAs. Hand treatments could damage seedlings and small trees by accidental cutting or scraping away cambium. Hand treatments could cause minor soil disturbance but should not create any off-site soil movement. The burning of hand piles could pose a risk of scorching to smaller residual trees. Potential damage to the stand from the hand treatments and pile burning are expected to be very minor and most likely immeasurable. **Mechanical Treatment:** Mechanical treatments would vary depending on the type of establishing vegetation and ground conditions such as amount of surface rock. Most likely, mastication or tractor crushing would be used to treat small trees and woody shrubs. Stands containing predominantly herbaceous or young, non-sprouting vegetation may be treated by discing. Discing would only be used where soil and watershed Best Management Practices (BMPs) could be applied, so that the effects of soil disturbance would be minimized. Concentrations of dead fuels may be machine piled and burned according to a prescribed burn plan. Dozer-type equipment may cause minor soil compaction or soil disturbance, particularly where track equipment makes turns. Equipment would only operate when soils are dry such that the risk of compaction is minimized. Discing could cause damage to tree roots. Extensive discing on the adjacent Eagle Lake Ranger District indicates root damage from discing is generally minimal and produces little to no observable affects. Residual trees could be damaged by equipment accidentally rubbing up against them, or by accidentally crushing or running over smaller “leave’ trees. Damage to the overstory is expected to be rare because of the relatively wide tree spacing. Areas of desirable regeneration would be avoided by equipment to provide protection. **Prescribe Burn:** Prescribed underburning would be used to remove small trees as well as brush and accumulated surface fuels such as needle caste. Underburning would reduce duff layer thickness but not remove it entirely. Occasional “torching” could occur causing small group (4 - 8 trees) or individual tree mortality in trees upwards of 24 inches dbh. At the extreme, prescribed burning could kill up to 10% of stand basal area, predominantly in smaller trees less than 12 inches dbh. Stand growth between prescribed burning treatments would exceed burn mortality, such that stand density and average dbh would continue to increase over time. Burning would be conducted according to a prescribed fire plan developed for the maintenance project. Fire prescriptions would be developed to meet resource objectives including retention levels of desirable small and midstory trees. Prescribed burning would not be expected to measurably alter stand overstory structure or canopy closure, but would remove most understory vegetation including most seedlings and young trees less than 4 inches dbh.

Sources: Hat Creek Ranger District Planning Files, State of California Timber Harvesting Plans, and phone conversations with California RPFs (Registered Professional Foresters)

Table A- 7. Summary of Table A-6. Acres of Reasonably Foreseeable Future Actions by Treatment Type

Treatment Type	Acres Treated
Group Selection	690
Area Thinning (Individual tree selection)	830
DFPZ Thinning	8,540
Aspen Release	30

Table A- 8. Summary of Table A-6. Acres of Potential Maintenance Treatments

Treatment Type	Acres Treated
Hand Treatment	0
Mechanical Treatment	0
Prescribe Burn	11,862
No Treatment	69

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Appendix B:
North 49 Comments and Response to Comments

List of Respondents to DEIS	
Letter Number	**Agency, Organization, Business, or Individual**
1	Bruce Olsen, Franklin Logging
2	Robert Hoover, Sierra Pacific Industries
3	David B. Edelson, Craig Thomas – Sierra Nevada Forest Protection Campaign Patrick Gallagher – Sierra Club
4	Frank Stewart – QLG Forester
5	Patricia Puterbaugh – Lassen Forest Protection Group, Sierra Club
6	Pete Harrison – Californians for Alternatives to Toxics
7	Linda Blum
8	Environmental Protection Agency[7]
9	CDFG
List of Respondents to Scoping of Purpose and Need, and Proposed Action	
10	Barbara Camacho – Shasta County Fire Safe Council
11	Chad Hanson – John Muir Project

Some rationale for determining comment or issue status are:

- The issue has been addressed with existing project design features to eliminate or reduce effects on a resource.
- The issue is just a comment, opinion, or position statement with no specific concerns noted about adverse effects of the Proposed Action on a resource.
- The issue is already decided by law, regulation, Forest Plan, or other higher-level decision.
- The issue is outside the scope of the proposed action.
- The issue is irrelevant to the decision to be made.
- The issue is conjectural and not supported by scientific evidence.

[7] The EPA comments were postmarked after the stated deadline and are therefore are officially categorized as scoping comments. Because of the DEIS-specific nature of the comments they are being incorporated into this response to comment and the FEIS.

Response # 1: Bruce Olsen, Franklin Logging

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
1.1	Reduction of shade tolerant species/ openings for shade intolerant species has been lost as an objective. The preferred alternative does not meet forest health objectives.	…. Without too much discussion of classical silviculture, eliminating 494 acres of group selections and changing 3,673 acres to lower intensity thinning is absolutely contrary to the statement of page 47, ". . . disturbances that create large openings, generally one acre or larger, would promote the successful regeneration and growth of shade intolerant pine species." …. The new preferred alternative flies in the face of forest health. It has absolutely nothing to do with forest health or scientifically based resource management, but rather is a shameless attempt to avoid controversy by placating a small group of vocal obstructionists. Reducing the acres of group selection by 42% and lowering the intensity of thinning on approximately 3,900 acres has nothing to do with a healthy forest, but everything to do with reducing the volume and value of the timber harvested in order to jeopardize the economic viability of the projects.	Alternative 3 would meet the objectives of reducing the amount of shade tolerant species and increasing opportunities to establish shade intolerant pine species through created openings but to a lesser extent than alternative 1. Alternative 7 (preferred alternative) would also meet the objectives of reducing the amount of shade tolerant species and increasing opportunities to establish shade intolerant pine species through the creation of openings by group selections and radial thinning around legacy. In alternative 7, the thinning intensity would be similar to alternative 1, and in the Area Thin, thinning would be throughout the tree sizes leaving some of each size instead of thinning all of the trees in the smaller size classes. By leaving some of the smaller trees and yet still thinning to the same intensity as is prescribed in alternative 1, the ratio of biomass to sawlog would improve increasing the economic viability of the sale.
1.2	Proposed thinning would compromise forest health.	Lets take a look at page 85, which states "The risk for high levels of tree mortality would remain high under the modified thinning prescription . . . increasing the risk for mechanical tree damage . . . would also leave more acres with higher levels of potential ladder and canopy fuels." Or how about the statement on page 89 which states, "Approximately 61 percent of the forested stands in the project area would not be thinned at this time. Virtually all of these stands are expected to have densities above 60 percent of maximum SDI and most likely above 70 percent of maximum SDI. ***These stands are at risk of widespread mortality from insect attack or drought."*** (emphasis added)	The modified thinning prescription would be less effective at stocking control over time as compared to the standard thinning prescription. Forest health conditions would be improved in the short term (generally 10 years) using the modified thinning prescription as opposed to no-action. Approximately 61 percent of the forested stands in the project area would not be thinned as part of the North 49 project under all action alternatives. Dense, untreated stands would remain at risk of widespread mortality from insect attack or drought. Alternative 7 (preferred alternative) reduces the acres of group selections by 17% due to economic viability (helicopter groups), planting suitability, or area meets the Purpose and Need. In alternative 7, the thinning intensity would be similar to alternative 1, and in the Area Thin, thinning would be throughout the tree sizes leaving some of each size instead of thinning all of the trees in the smaller size classes. By leaving some of

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
			the smaller trees and yet still thinning to the same intensity as is prescribed in alternative 1, the ratio of biomass to sawlog would improve increasing the economic viability of the sale.
1.3	Proposed stand structure treatments would be inconsequential. Treatments would not be effective for 20 years.	Page ii states, "Treatments of stand structures are designed to be effective for a minimum of 10 years, with a desire target efficacy of approximately 20 years". Twenty years is acceptable as a target but with the basal area standards discussed on pages 16 and 17 (170-220 square feet) and the tree spacing discussed on page 67 (12 to 25 feet) it is easy to believe the crown canopy closure will be 60% plus at the completion of harvest. ….	Post thinning canopy cover estimates are based on modeling of stand exam data using Forest Vegetation Simulator (FVS) software developed by the Forest Service. A range of alternatives provides for a variety of results. Although a goal of re-entry for treatment on a 20 year cycle was presented, the effectiveness of alternatives is measured against the Purpose and Need. In the FEIS, Alternatives 7 does achieve a 20 year re-entry cycle, while the modified thin treatments in Alternatives 1 and 3 does not. See also response to comment 1.2.
1.4	Critical of economic feasibility of helicopter or cable yarding.	Page 28 references cable and helicopter yarding. This may be economically feasible with high volumes per acre, high value timber, and no biomass. I believe the changes in the new Preferred Alternative will substantially reduce the volume and value making exotic yarding systems questionable.	The thinning and group selection prescriptions in areas where cable and helicopter yarding systems are proposed are the same under action alternatives 1 and 3. Alternative 7 (preferred alternative) removes all helicopter groups and most cable groups due to economic concerns.
1.5	Questions the commonality of cumulative effects for Alts 1 and 3.	Pages 104 and 105 indicate that the cumulative effects common to both alternatives 1 and 3 are identical. How is this possible when alternative 3 harvests 494 less acres of group selection and 3,873 acres at significantly less intensity?	See fuels section. Fire behavior modeling is based on the surface fuels (needles, branches, logs, brush etc). In order for a fire to transition to the canopy you have to have sufficient fireline intensities (flame lengths) and ladder fuels to move the fire up. All the action alternatives treat the surface fuels (reduce the fire line intensities) and reduce the ladder fuels, so the fire has a difficult time transitioning into a crown fire under 90th percentile weather. In both alternatives the surface (due to surface fuel treatments) is assumed to be the same fuel model, therefore the same fire behavior.

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1.6	Concerns with road construction and reconstruction costs.	Page 18 indicates the need for constructing 1.4 miles of new road, upgrading 26.6 miles of unclassified road, and miscellaneous reconstruction on up to 138.7 miles of road! This certainly seems excessive, especially since so much of the value has been removed by the new Preferred Alternative. Only absolutely essential road work should be done under these projects.	The road improvements referenced in the DEIS are designed to bring the existing transportation system in the project area up to current standards. These improvements would be completed using a variety of funding sources not just timber sales. In the FEIS, road use for the project was re-analyzed and the recommendations for transportation system activities were adjusted. See Chapter 2 FEIS.
1.7	Concerned that Preferred Alternative abandons sound science.	The discussion on page 19 looks like someone used an environmental buzz word generator. In reality the Preferred Alternative abandons sound silviculture, forest health, fuel reduction, and community safety in order to meet the obstructionists “perception” of what needs to be done. There are no data supporting the statement that thinning at lower intensity does anything positive for “mature and late-successional forest wildlife habitat distribution, connectivity, prey base, and habitat fragmentation”. In fact, a case can be made that lower intensity thinning can have deleterious impacts on forest health through insects, disease and stand replacing fires.	The analysis of alternative 3 (commenter references page 19 and the description of alternative 3) is extensive and is well supported by the scientific literature cited in the analysis of the alternative in Chapter 3.
1.8	Contests inference that standard thinning and group selection negatively affect owl foraging habitat.	Also on page 19, the inference is made that “standard” thinning and group selection units are somehow bad for existing spotted owl foraging habitat. Where are the data to support the statement that increasing cover and reducing the number of openings is somehow good for foraging habitat? There are numerous studies showing a positive relationship between “edge effect” and prey base.	The impacts of the standard thinning prescription and the group selection treatment are extensively addressed in Chapter 3 and in the biological evaluation. Although in some cases increased edge may increase species diversity in general terms, it does not necessarily correlate to increased prey base for all predatory species. The discussion in chapter 3 and within the biological evaluation detail why group selections do not provide increased prey base for some predators.

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1.9	Challenges validity of conclusions regarding degradation of foraging habitat by standard thinning prescription.	Page 129 categorically states "(T)he standard thinning prescription for DFPZ construction and ITS, would remove or degrade approximately 7,715 acres of foraging habitat . . . " Where are the data to support this contention? I do not believe data exist to prove that foraging habitat is either removed or degraded after a standard mixed-conifer thinning (44.3% average canopy cover) as compared to a modified thinning average of 52.4% (see page 128). Does logic dictate that decreasing the basal area from 187.3 square feet (modified) to 173 square feet in the standard mixed-conifer thinning would "remove" foraging habitat?	The rationale and logic for the summary statement on page 129 of the DEIS are found in the preceding pages and include scientific literature citations.

Response # 2: Robert Hoover, Sierra Pacific Industries

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2.1	Alternative 3 does not follow the stated Purpose and Need.	This alternative is a drastic change from the Proposed Action, and does not follow the stated Purpose and Need for the project.	Alternative 3 would meet the purpose and need for the project but to a lesser extent than alternative 1. For example, group selections would be implemented but fewer acres than alternative 1.
2.2	Proposed age-class diversity treatments in Alt. 3 do not meet Purposed and Need or LRMP.	Age-Class Diversity Treatments: The Purpose and Need calls for Group Selection silviculture in order to develop and improve age-class diversity within the project area. Justification for group selection is provided on pg. 7 of the DEIS, and specifically references the Lassen National Forest LRMP which states: *Provide at least five percent of the acreage of each vegetation type that occurs in the management area in each seral stage. Where five percent of each type is not available, plan to correct for the deficit.* The purpose and need clearly identify within this project that, the "*Mixed conifer California Wildlife Habitat Relationships (CWHR) size class 1 (seedling stage) is below the 5 percent minimum.*" Group selection has been chosen to correct for this deficit. Alternative 3 calls for reduction in group-selection acres …., This acreage estimate (4%) falls short of the minimum 5% target and is therefore inconsistent with the Purpose and Need.	There are fewer acres of group selection proposed under alternative 3. Group selection would increase seedling size class 1 stands from 1% to 4% in the project area. Although the 5% minimum would not be attained this entry, the acreage of CWHR size class 1 would increase considerably from existing. This alternative would meet the purpose and need because it would be a major step in correcting the deficit.
2.3	Proposed thinning treatments in alt 3 do not meet the crown base height objectives in the Purpose and Need.	The Purpose and Need call for thinning treatments aimed at reducing surface fuel loading in WUIs, DFPZs and GPACs in order to reduce the potential for catastrophic wildfires and protect the Thousand Lakes Wilderness Area. Page 5 of the DEIS Purpose and Need identify Crown Base Height as an indicator of ladder fuel conditions, and propose that post treatment CBH should average 15 to 25 feet. Alternative 3 will only increase CBH to 13.75 ft (*weighted average of standard and modified thinning acres*), which is less than the 15ft minimum. The Modified Thinning Prescription in each alternative will generally not provide the level of treatment necessary to achieve the Purpose and Need target of 15-25ft	Thinning treatments treat the ladder fuels, not the surface fuels. Machine piling and underburning treat the surface fuels. As the comment states the alternative three thinning prescriptions does not meet the desired CDH of 15 to 25 feet. As shown in the fuel section, a combination of thinning (even with lesser intensities and a lower CBH) and surface fuel treatment will reduce the threat of a crown fire.

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		CBH. Alternative 1, however, on the average, proposes treatments that will meet the purpose and need for achieving CBH within the desired range (15.3ft weighted average. See table 18, pg.59).	
2.4	Alternative 3 fails to meet SDI objectives from the Purpose and Need.	Alternative 3 also falls short of the Purpose and Need direction with concern to Stand Density Index (SDI). …. According to the Purpose and Need, a timber stand that exceeds 70% of maximum is "*considered to be in the zone of imminent mortality."* …. Page 81 states: *"Some mixed conifer and all lodgepole pine stands would remain above 70% of SDI max post-treatment."* The DEIS (pg81) recognizes that the Modified Thinning Prescription, which comprises 47% of the thinning acres, will be less effective (than Alternative 1) in improving forest health *". . . because it is expected that most of these stands would grow back into the zone of imminent mortality (greater than 70 percent of SDImax) in a shorter time period than under the standard thinning prescription."* …. According to tables 18 and 27(pgs. 59 & 82), Alternative 1 proposed an SDImax that is approximately 6% lower on the average than Alternative 3. Alternative 1 will more effectively reduce SDI and promote forest health than Alternative 3.	Part of the purpose and need is also "to provide habitat for dense forest species such as spotted owls and goshawks." The action alternatives display a range of options to provide a balance between minimizing tree mortality and providing sufficient density for species such as goshawks and spotted owls.
2.5	Questions conclusions regarding relative effects of thinning on CWHR stand structure between alts 1 and 3.	The development of Alternative 3 was in response to an issue of ". . . protection of mature late successional forest characteristics . . ." that was identified during public scoping (DEIS pg. ii). Alternative 3 proposes to drop 494 acres of group selection and convert 3,873 acres of standard thinning to modified thinning (DEIS pg. 78) in order to reduce the impacts of Alternative 1 and provide more protection to late successional stage habitat than Alternative 1 (DEIS pg. 116). According to the DEIS page 82, treatments under Alternative 3 will yield the same CWHR class structure as Alternative 1. Table 53, page 117, indicates that stand density between the two alternatives is almost identical. How is this possible if Alternative 3 proposes to thin at a much lower intensity than Alternative 1? (DEIS pg. 35).	Although the CWHR class structure will be the same in both Alternative 1 and 3 (and 7), the stand densities and structure will be different. The importance of these differences are discussed in Chapter 3.

Response # 3: David B. Edelson, Craig Thomas – Sierra Nevada Forest Protection Campaign Patrick Gallagher – Sierra Club

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3.1	Request to modify proposed action to: reduce diameter limit, increase canopy cover retention, reduce effects of group selection.	In addition to considering the earlier proposed action (Alternative 1) and no action (Alternative 2), the DEIS includes a new preferred alternative (Alternative 3). Compared to the earlier proposed action, Alternative 3 would reduce the project's adverse impacts to old forest habitat and wildlife by applying a lower intensity thinning prescription to 4,946 acres of proposed DFPZs and by reducing the acreage of group selection logging. Although this is an important step in the right direction, we continue to have significant concerns about the project's environmental impacts. The preferred alternative would involve 5,621 acres of "standard thinning," which will degrade habitat for old forest wildlife. In addition, even within the 4,946 acres of modified thinning, trees up to 30" diameter can be logged, which will also degrade habitat. Finally, the remaining 686 acres of group selection will also be rendered unsuitable for old forest wildlife. We therefore urge the Forest Service to modify the proposed action to reduce the logging diameter limit, increase canopy cover retention in the "standard thinning" prescription, and reduce the adverse impacts of group selection logging.	This is a comment, opinion, or position statement, not a comment on the DEIS. Also not supported by scientific evidence. Environmental effects are addressed in the DEIS. In consideration of public comments and discussions with substantive commentors on the DEIS, alternative 7 was developed and analyzed in the FEIS rather than modify the proposed action.
3.2	N49 project is contrary to law.	The North 49 project implements the 2004 Sierra Nevada Framework ROD (USDA Forest Service 2004a), and tiers to the accompanying FSEIS (USDA Forest Service 2004b). As demonstrated in our appeal of the 2004 ROD and FSEIS (SNFPC et al. 2004), both the 2004 plan and the FSEIS fail to comply with the National Forest Management Act, the National Environmental Policy Act, and other environmental laws. A lawsuit challenging the 2004 Framework is currently pending in federal court. Therefore, for the programmatic reasons set forth in our appeal of the 2004 ROD and FSEIS, the North 49 project is also contrary to law.	To date, the lawsuit challenging the 2004 Sierra Nevada Framework Record of Decision (2004 Framework) is still pending in federal court. Current direction is to go forward with implementing projects under the 2004 Framework, pending a decision on the challenge.

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3.3	Insufficient information and analysis for adequate disclosure of effects.	The DEIS fails to include sufficient information and analysis to adequately disclose the project's likely environmental impacts and to allow a reasoned choice about whether or not to implement the proposed action or one of the alternatives.	Chapter 3 of the DEIS describes the effects, by resource, for implementation all the alternatives considered in detail. Changes to effects will be made in the FEIS when warranted, based on comments received from the public. Please refer to Chapter 3 of the FEIS for analysis and disclosure of effects.
3.4	Request for information to be included in EIS.	The EIS should provide a clear and detailed description of the project, including the nature, intensity, and extent of planned logging by unit.	The DEIS provides a clear description of existing and post treatment stand attributes by vegetation type for each alternative. Described attributes include, but are not limited to, average tree diameter, trees per acre, basal area per acre, canopy cover, crown to base heights, and CWHR typing. Average attributes of all stands within a vegetation type are provided as well as the range representing stand level averages. The DEIS also provides a description of logging systems, methods, design features, and requirements.
3.5	FS should disclose 30% basal area retention and relationship to maximum diameter limit by unit.	The 2004 Framework requires that projects must retain 30 percent of existing basal area, "generally comprised of the largest trees." (USDA Forest Service 2004b, p. 68). The EIS should disclose, for each unit, how this basal area standard translates into a maximum diameter limit of trees that will be removed. The EIS should provide the underlying data and modeling assumptions and methodology that supports the diameter limit. In addition, the Forest Service should provide information on the number of medium and large (20" dbh or greater) trees that will be retained within the treated units, the number of such trees that will be logged, and the size of those trees. Although the DEIS (p. 51) asserts that the number of trees logged greater than 20" diameter will "generally" be less than 4 per acre, it fails to disclose the underlying data or methodology used to make this estimate. In addition, by only providing an average, the DEIS fails to disclose the number of trees greater than 20" diameter per unit that will be logged and that will remain. This information is important to an adequate assessment of the project's likely impacts, including impacts to the California spotted owl and other old forest wildlife.	The maximum diameter limit of trees to be removed is 29.9 inches dbh as required by the 2004 Framework. However, modeling using site specific data collected at the stand level with field verification indicate that the majority of trees removed during thinning would be less than 20 inches dbh. The largest trees cut by stand ranges 16-24 inches dbh. In stands where modeling indicates that trees greater than 20 inches may be removed, the numbers are small (generally < 4 per acre). Thinning from below would remove trees in the smaller diameter classes until the desired stocking level is achieved. The objective is to retain and protect the largest trees in each stand. Modeling assumptions for thinning are provided on page 51 of the DEIS. Field estimates indicate that in 56 percent of the group selections proposed under alternative 1, the largest trees to be removed would average between 16-24 inches dbh. In the remaining groups, only 16 percent would remove trees between 24-29.9 inches dbh. Maximum tree sizes removed during thinning and group selection under the North 49 project would generally be well below the maximum upper diameter limit for tree removal required by the 2004 Framework.

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3.6	FS should ID acreage and type of logging by land allocations: particularly old forest, WUI, owl, and carnivore.	The Forest Service should identify the acreage and type of logging by land allocation, including (where applicable) old forest emphasis area, threat zone of the wildland urban intermix ("WUI"), defense zone of the WUI, and owl home range core areas ("HRCAs"). The EIS should also disclose and analyze the extent to which the project will log within other relevant land designations, such as areas of concern ("AOCs") for the California spotted owl as identified by Verner et al. (1992) and habitat management areas for forest carnivores in the Lassen LRMP. …..	Impacts to HRCAs and AOCs are discussed in the spotted owl section of Chapter 3. The network of forest carnivore territories and corridors established in the LNF LRMP (1993) are no longer recognized land allocations as per the 2004 SNFPA ROD. Although the DEIS does not analyze effects to these abandoned land allocations the document does disclose effects to marten, fisher, wolverine and their habitats.
3.7	Need for additional maps showing comment 3.6 land allocations.	The EIS should also include maps that overlay the project boundaries with these land allocations and other ecologically significant land designations.	WUI threat zone boundaries are displayed in Figures 4 and 5. Figure 21 displays the location of spotted owl areas of concern. Home Range Core Areas and a forest carnivore network are NOT land allocations implemented within the HFQLG project area under the 2004 SNFPA ROD and therefore are not displayed.
3.8	Snag information confusing.	The information in the DEIS about snags within the project area is confusing and contradictory. The DEIS states that stands on average contain "up to 3 snags per acre greater than 16 inches dbh" (DEIS, p. 49), but elsewhere states that "snag densities are estimated to be low to moderate (0-3 snags/acre > 16 inches dbh" (DEIS, p. 112). Please clarify this information, being as specific as possible with respect to stand density in different stands or parts of the project area, and provide the underlying data and methodology that support your estimates.	Snag retention guidelines are presented in chapter 2 of the FEIS.
3.9	FS should disclose acreage and location of OG stands 1 acre or larger to be logged.	The Forest Service should disclose the acreage and location of old growth stands 1 acre or larger that will be logged. Research indicates that these small inclusions of habitat are important for the California spotted owl (Blakesley 2003; Moen and Gutierrez 1997) and other species. …..	The definition of old growth is varied and indistinct. The FEIS considers and analyzes CWHR 4M, 4D, 5M, and 5D in consideration of late seral habitat dependent species.
3.10	Logging in accordance with 2004 ROD threatens owl's viability by degrading nesting and foraging habitat.	There is strong evidence that logging pursuant to the 2004 ROD, particularly logging of medium and large trees, reduction in canopy cover, removal of large snags and down wood, and logging within owl HRCAs, owl home ranges, and areas of concern, will degrade owl nesting and foraging habitat and threaten the owl's	We agree that logging has the potential to affect individuals. The DEIS discusses these impacts on pages 117-137. However on the larger issue of effects to the population, the 2004 SNFPA ROD addressed the viability of the spotted owl. The North 49 project follows the direction of the 2004 SNFPA ROD that determined

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		viability. (SNFPC et al. 2004, pp. 14-20). Based on her review of the proposed action (Alternative 1), Bond concluded that "the North 49 project is likely to threaten the distribution and viability of the California spotted owl within the project area and beyond, contributing to the present trend towards federal listing." (Bond 2004, p. 4).	implementation would not affect the viability of the owl within the Sierra Nevada. The FEIS provides in-depth analysis of effects on California spotted owl HRCAs. Alternative 7, the FEIS preferred alternative, demonstrates that proposed treatments maintain sufficient habitat.
3.11	DEIS lacks information on impacts to home ranges and HRCAs.	Because the DEIS lacks important information about the impacts of Alternative 3 on owl home ranges and HRCAs, it is not possible to assess carefully the extent to which Alternative 3 may reduce these impacts on the owl.	The FEIS provides comparative analysis and information on habitat for CSO and other species and clarifies the effects under all alternatives.
3.12	Disclose owl status in the region and project area.	Given the risks to the owl of implementing the 2004 ROD and the QLG pilot project, it is essential that the Forest Service take a detailed and careful look at the likely impacts on the owl and its habitat of implementing the North 49 project. An adequate analysis should address, at a minimum, the following issues. (See SNFPC et al. 2004, pp. 9-28, 77-80). • The EIS should frankly disclose the owl's status in the northern Sierra Nevada and within the project area, as discussed above.	The status of the owl and its habitat is discussed on pages 117-126 in the DEIS.
3.13	EIS should analyze project effect on owl habitat at multiple scales for both action alternatives.	…. The EIS should analyze the project's impacts to owl habitat at multiple scales, including HRCAs and home ranges. The EIS indicates that, under Alternative 1, a large percentage of HRCAs will be rendered unsuitable or degraded as owl habitat within the project area. (DEIS, p. 132). However, it fails to provide similar information for Alternative 3, and fails to disclose more specific information about impacts to individual HRCAs and home ranges for either alternative.	The FEIS provides comparative analysis and information on habitat for CSO and other species and clarifies the effects under all alternatives.
3.14	EIS should ID current and post-project owl nesting and foraging habitat for each alternative.	…. With respect to each HRCA, the EIS should identify the current amount of owl nesting and foraging habitat and the amount that will be degraded and rendered unsuitable under the various alternatives. …. The analysis should assess the percentage of suitable nesting and foraging habitat within each HRCA both before and after project implementation. …. The DEIS discloses the current amount of	Home Range Core Areas (HRCAs) are not current land allocations within the HFQLG project area but may be a land allocation after the end of the HFQLG pilot project. The potential impacts to HRCAs are considered as part of the cumulative effects discussion. Effects at the home range scale (4500 acre) are discussed in the FEIS.

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		nesting and foraging habitat within owl home ranges (DEIS, p. 125; Table 59), but fails to analyze or disclose the amount of such habitat that will remain under the various alternatives. ….	
3.15	EIS should include analysis of spotted owl habitat fragmentation.	…. The Forest Service should carefully analyze the impacts of logging within the AOC, particularly the extent to which logging may exacerbate habitat fragmentation and affect the owl's distribution and dispersal in the planning area. The EIS concedes that Alternative 1 will "exacerbate habitat fragmentation" and "could isolate the existing breeding territories." (DEIS, p. 132). Although the EIS asserts that Alternative 3 "would maintain connectivity" (DEIS, p. 136), it lacks the information and analysis to support this claim. In particular, the DEIS fails to disclose how Alternative 3 will affect habitat within and between owl home ranges and HRCAs.	The FEIS provides analysis results on the effects of treatments for 3 action alternatives. Alternative 7, the FEIS preferred alternative, minimizes habitat fragmentation and maintains a high level of late seral habitat.
3.16	EIS needs to include analysis other than vegetation mapping to estimate spotted owl foraging habitat.	…. The EIS acknowledges that owl foraging habitat "may be overestimated" in the EIS, because the vegetation mapping only addresses tree size and density and does not address other required habitat characteristics, such as snags and down logs. (DEIS, p. 125). Yet, despite this disclaimer, the EIS makes no effort to correct this overestimate, …. Over-reliance on lower quality CWHR 4M strata, simply because this strata label qualifies as suitable within the CASPO definitions, places spotted owls in the N49 project at increased risk. The EIS should accurately estimate (by surveying) the utility of the foraging habitat to owls. ….	The commenter is asking the Forest Service to obtain data not currently available by validating existing mapping data. The available data are just that: and the EIS discloses the flaws within that data. Additional data collection is not warranted or required, as the analyses utilizes the data set (GIS data) that is the most accurate for spatial analysis and combines it with the data (silvicultural stand exams) that is most accurate for portraying the intensity of impact. The analysis does not rely on strata labels such as CWHR 4M because of the broad nature of such labels. The analysis utilizes specific definitions instead of strata labels to measure existing habitat and model impacts. These definitions are found at the beginning of the discussion for each species and are tailored to each species requirements. For example, spotted owl habitat is defined on page 124 of the DEIS.

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3.17	EIS should include additional indirect effects of the project on owl survival re: reestablishment of hypogeous fungi.	…. The DEIS p. 129 discloses longer term impacts to owls stating that it would take "several decades" to re-establish the abundance of hypogenous fungi necessary to support the flying squirrels, the primary prey. Since "several decades" is well beyond the life expectancy of the existing owl population, the EIS should to more clearly address the indirect effects of the N49 project on owl survival in the project area.	The DEIS displays indirect effects as precisely as possible. Indirect effects occur at a later time than direct effects and may be affected by unknowable factors such as stochastic events or changing weather and climate. The estimate of "several decades" is based on the time to attain pre-treatment canopy and woody debris conditions. The analysis on page 129 also states that food availability would begin to slowly increase several years after project completion.
3.18	EIS should include more rigorous habitat analysis to support conclusions regarding owl population viability. Create an additional alternative reducing long-term risk to owls.	The EIS should include an improved assessment of the project's cumulative effects, which take into account present and planned logging on private lands. The DEIS p. 133; 137, relies on the 2004 Framework ROD to support conclusions regarding owl population viability on the Lassen National Forest yet the trend on the Lassen is anything but secure (see above). The EIS response to this issue should be to increase the rigor of the habitat analysis (actually assess the quality and utility of the 4M strata and improve the disclosure of cumulative impacts) and to create an additional alternative to address (reduce) the long-term risks to owls in this project.	The draft EIS did take into account present and planned logging on private lands. The cumulative effects of fully implementing HFQLG pilot project was modeled analyzed and displayed in the 2004 SNFPA FSEIS. This documented cumulative effects to habitat across the entire Sierra Nevada range including the HFQLG pilot project area. The SNFPA analysis formed the basis for the determination on owl viability across the entire Sierra Nevada range. The Fish and Wildlife Service also analyzed viability for the subspecies and did not find concerns that warranted the recovery or protection actions that would be initiated via listing under the Endangered Species Act.
3.19	Cumulative effects analysis ignores cumulative impacts to owls and their offspring.	…. The Council on Environmental Quality Cumulative Effects Handbook (1997) identifies strategies to properly assess the cumulative effects on past, current and reasonable foreseeable future actions. …. "cumulative effects analysis should be conducted on the scale of human communities, landscapes, watersheds, or airsheds." …. The "wildlife analysis area" identified in the North 49 DEIS fails to adequately address potential cumulative impacts to the California spotted owl. …. There is no meaningful discussion of the actual effects of these past projects and current activities on a wide-ranging species such as the spotted owl. Breeding dispersal, juvenile dispersal, and seasonal (elevational) migration behavior are all impacted by fragmentation and habitat loss which in turn impact long-term adult survival. …. Impacts from past activities including logging, fires, urbanization, grazing and roads all generate	The commenter appears to confuse the 55,722-acre Terrestrial Wildlife Analysis Area (TWAA) with the cumulative effects analysis area. The cumulative effects analysis area for spotted owls is displayed in Figure A-6 in Appendix A, and effects are discussed in the text for each alternative's effects to spotted owls. The text also briefly discusses how the impacts foreseen within the cumulative effects area relate to the population of spotted owls on the District and the Forest. Past activities are described in appendix A and have led to the current landscape that is described in the affected environment sections of the EIS. This EIS provides specific local cumulative effects. These effects are part of what was anticipated to occur under the 2004 SNFPA that included full implementation of the HFQLG pilot project. Thus, the analysis in the North 49 EIS when combined with the 2004 SNFPA analysis provide details of impacts from the sub-territory level to the level of the entire Sierra Nevada range.

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		cumulative impacts that effect spotted owls in the surrounding landscape within and outside the current wildlife analysis area. Scientifically valid cumulative effects analysis must be conducted on the potential impacts to at-risk species in terms of all their behavioral life cycle functions such as foraging, nesting, dispersal, migration, not limiting the analysis to an arbitrary line on a map but rather addressing the actual movements of, and stressors on, the local and regional owl population. …..	
3.20	EIS fails to adequately consider marten and fisher status in N Sierra Nevada, and importance in ensuring viability and distribution.	The DEIS fails adequately to consider and disclose the marten's imperiled status in the northern Sierra Nevada and the importance of the project area to ensuring the marten's viability and distribution in the region.	The FEIS provides more detailed discussion on the effects of the project on marten.
3.21	FS should disclose impact of group selection on marten and fisher.	There is strong evidence that logging pursuant to the 2004 ROD, particularly logging of medium and large trees, reduction in canopy cover, removal of large snags and down wood, and logging within the QLG pilot project area, will degrade marten denning, resting, and foraging habitat. (SNFPC et al. 2004, pp. 45-48). Given the risks to the marten of implementing the 2004 ROD, it is essential that the Forest Service take a detailed and careful look at the likely impacts on the marten and its habitat of implementing the project. An adequate analysis should address, at a minimum, the following issues. (See SNFPC et al. 2004, pp. 41-48, 83-85). The Forest Service should disclose the impact of group selection openings on the marten. …. As summarized by the U.S. Fish and Wildlife Service, "marten are … sensitive to forest openings, tolerating a landscape that has no greater than 20-25 percent openings." (USDI Fish and Wildlife Service 1999). Kucera demonstrated in his earlier critique that the percentage of forest openings in the project area is currently approximately 20 percent. (Kucera 2004, p. 4). "Given that group selection treatments are concentrated in portions of the project area, and that barren areas and other existing openings may be similarly concentrated, there is a good possibility that	Although Dr. Kucera is a respected forest carnivore researcher, we disagree with his analysis. GIS mapping of existing vegetation indicates that existing openings within the project area make up about 14 percent and about 11 percent within the TWAA. These impacts are disclosed on page 154 of the DEIS.

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		the percentage of openings will exceed 25 percent in portions of the project area." (Ibid.). ….	
3.22	FS should address impacts of proposed logging on marten and fisher habitat connectivity and fragmentation.	…. The Forest Service should carefully address the impacts of proposed logging on marten habitat connectivity and on the fragmentation of existing habitat. (SNFPC et al. 2004, pp. 38-39). Special attention should be paid to impacts of proposed DFPZs or road construction on habitat connectivity and fragmentation within the QLG pilot project area, which has been identified by the Forest Service and others as a significant concern. …. The DEIS acknowledges that Alternative 1 may adversely affect marten habitat connectivity and dispersal (DEIS, p. 157). The DEIS further asserts that Alternative 3 would address this problem, but lacks adequate analysis and information to support this conclusion. (DEIS, p. 158).	Impacts to connectivity for marten are discussed on pages 155-158. As discussed on page 159, fishers do not appear to occur within the project area or on the Lassen National forest. Fisher connectivity is discussed on page 164 as a cumulative effect to other fisher populations.
3.23	EIS should include disclosure of amount and intensity of proposed logging within the forest carnivore network.	…. The EIS should disclose the amount and intensity of proposed logging within the forest carnivore network previously identified by the Lassen National Forest and how such logging may affect the ecological values within these areas. ….	The habitat network promulgated by the 1992 Lassen LRMP has been superceded by the forest carnivore conservation plan in the 2004 SNFPA ROD. Discussion of previous management strategies were thus rendered moot.
3.24	Threats to marten and fisher viability and distribution need to be better assessed because it appears likely that den sites lie within proposed treatment areas.	…. There is considerable overlap between marten sitings and planned group selection units under both Alternatives 1 and 3. (DEIS, p. 153; Figure 23). As a result, it appears likely that marten den sites are "within treatment areas in this project." (DEIS, p. 151). Given that the marten's status in the northern Sierra Nevada is imperiled, and that the project area appears to be critical for marten connectivity, adverse impacts to potential marten den sites, together with the project's other impacts, are likely to threaten the marten's viability and distribution in the planning area. These issues need to be assessed more carefully in the EIS.	When marten dens are discovered they would be protected pursuant to the forest carnivore strategy in the 2004 SNFPA ROD. The potential for direct impacts to marten are disclosed in the discussion of the direct effects to marten beginning on page 154 of the DEIS.
3.25	N49 may adversely affect east-west habitat connectivity for fisher.	…. The foregoing concerns also apply to the Pacific fisher and its habitat. In addition, we are concerned that the North 49 project may adversely affect east-west habitat connectivity for the fisher, which the DEIS acknowledges "may be important." (DEIS, p. 165).	As noted on page 165 east-west connectivity would not be improved by one alternative over another because "of the extensive treatments on PRIVATE land to the west" (emphasis added).

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3.26	EIS should discuss all available population monitoring data for each MIS or SAR.	…. For each MIS or SAR within the analysis area, the EIS should discuss all available population monitoring data, including the dates the monitoring occurred, the areas that were monitored, and the results of such monitoring. The EIS should specifically disclose any available local information regarding species distribution, trends in distribution over time, and population trends for such species, based on the monitoring data.	The 2004 SNFPA ROD did not amend the Lassen NF list of MIS species. There is no direction to analyze the effects of actions to species identified as SAR. The MIS species are addressed in the FEIS. A new MIS report is included in the FEIS in the appendices.
3.27	FS has failed to obtain and analyze monitoring data for pileated and hairy woodpeckers habitat.	…. Based on the information in the DEIS, the Forest Service has failed to obtain and analyze required monitoring data for numerous MIS, including the pileated woodpecker and hairy woodpecker. The FEIS should carefully address the project's impacts on the pileated woodpecker and its habitat. The Lassen National Forest has designated the pileated woodpecker as an MIS or "emphasis species" whose population is "declining." ….	The impacts to pileated woodpecker are discussed on pages 192-194.
3.28	MIS information on back bear needs to disclose impacts to bears within the project area, including site-specific habitat and population information.	…. The MIS information on Black bears DEIS p. 181, includes a statewide population trend graph which fails to disclose impacts to black bears in the project area and therefore fails to meet NEPA's requirement for taking a "hard look" at specific impacts to MIS. Also, the Black bear data displayed in the DEIS at www.dfg.ca.gov/hunting/bear/index.htm 4/29/04 is based upon bear hunting tag numbers and for the Sierra Nevada addresses the Sierra floristic province which includes Plumas county to the north, not Lassen county or the Lassen National Forest. The North 49 DIES should be revised to include site-specific habitat and population information as required by NFMA and the existing Lassen forest plan.	***The correct link should have been:*** ***http://www.dfg.ca.gov/hunting/bear/popgraph.html*** The table in the DEIS was clearly labeled as "estimated California black bear population". Additional information on Black Bear is in the MIS report as appended in the FEIS.
3.29	EIS should include alternatives with lower logging diameter limits and higher canopy cover retention.	NEPA and the CEQ regulations require that the Forest Service "[r]igorously explore and objectively evaluate all reasonable alternatives." 40 C.F.R. § 1502.14(a). The requirement that agencies consider all reasonable alternatives "is at the heart of the environmental impact statement." 40 C.F.R. § 1502.14. The purpose of this requirement is to "sharply defin[e] the issues and provid[e] a clear basis for choice among options by the	See Chapter 2, Alternative Considered but Eliminated from Detailed Study, Alternative 4.

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		decisionmaker and the public." Ibid. The North 49 DEIS fails to consider all reasonable alternatives. The EIS should include alternatives with lower logging diameter limits (e.g., 20" diameter) and higher canopy cover retention standards (e.g., 50 percent). These are reasonable alternatives as defined by NEPA because they will reduce the project's adverse impacts to old forest wildlife while meeting the project's purpose and need. For this reason, owl scientists have urged the Forest Service in similar contexts to consider alternatives that would achieve fuels objectives while maintaining owl habitat: The Forest Service asserts that owl habitat is "at a greater risk of being lost to wildfire than the proposed treatments" … but the FEIS fails to consider whether the Forest Service's fuels objectives can be attained with fewer adverse impacts to owl habitat. ….	
3.30	Alternative: higher canopy cover retention. Don't need 40% to reduce the risk of fire.	As the court recognized in Sierra Club v. Bosworth, 2005 WL 2204986 (N.D. Cal. 2005), the failure to consider logging alternatives involving fewer impacts to old growth wildlife is unreasonable: There can be little dispute that fire poses a threat to the [old forest wildlife] and must be considered in an environmental analysis. However, the proper question given all the available science is not only whether a project protects the Forest from catastrophic fire, but also whether it does so in a manner that has the least impact on sensitive species. For example, a reasoned analysis likely would revisit the original canopy cover and tree diameter restrictions to determine … whether restrictions set at other levels would still protect the forest from fire while better protecting important habitat features. There is substantial evidence indicating that it is not necessary to reduce canopy cover to 40 percent, as proposed in the North 49 project, to reduce the risk of catastrophic wildfire. The analysis in the DEIS reveals very little difference on fire behavior between Alternative 3, which utilizes a 50 percent canopy cover standard in many stands, and Alternative 1, which utilizes a 40	Although fire modeling programs may indicate that a UDL of 20" and 50% canopy cover is sufficient to meet fuel reduction objectives often, there are trees larger than 20" that may compromise the effectiveness of the DFPZ. In addition to fuels reduction, a 30" UDL allows larger trees to be selected during thinning for forest health reasons. Previous analyses has shown that there is little difference in the quality of the residual habitat between a 20" and 30" UDL, but that a 30" UDL allows greater flexibility in removing dead and dying trees, reducing economic cost retaining trees with better phenotypes and fire resilient. It is rather difficult to model the differences in decreased fire risk between 40% and 50% canopy cover. Fire fighter experience has shown that a lower canopy cover increased crown separation which helps slow or stop the progress of crown fires. This is a positive effect of a lower canopy cover that fire modeling may not capture.

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		percent canopy cover limit. (DEIS, pp. 99-103). This provides further site-specific evidence that the Forest Service's fuels reduction goals can be met with a 50 percent canopy cover standard.	
3.31	Alternative: lower logging diameter limits.	With respect to the size of trees to be logged, there is overwhelming evidence that it is not necessary to remove medium and large trees to achieve fuels objectives. "Most of the trees that need to be removed to reduce accumulated fuels are small in diameter and have little or no commercial value." (U.S. General Accounting Office 1999, p. 44). "When thinning is used for restoration purposes in dry forest types, removal of small diameter material is most likely to have a net remedial effect. Brush, small trees, along with fine dead fuels lying on top of the forest floor, constitutes the most rapidly ignited component of dry forest." (Christensen et al. 2002, p. 2). Similarly, Perry et al. (2004) and Omi and Martinson (2002) both found that severe fire could be prevented with an 8-10" dbh limit, followed by prescribed burning or mastication. The DEIS should address this research and incorporate lower diameter limits into specific alternatives, or explain in detail why these studies do not apply to the North 49 project area.	Perry et al also noted that in some stands the largest cohort was greater than 16" and the thinning treatments needed to be flexible to reflect multidisciplinary planning with shared objectives and "what sorts of stand and landscape structures best meet those objectives." Omi and Martinson noted that thinning from below raising the Quadratic Mean Diameter (QMD) of a stand would also raise the crown base height of a stand, thus making it less likely that a fire would move from the ground into the tree crowns. There is also the density of the stands to consider when determining thinning treatments. If all stand were thinned to 10", the Stand Density Index (SDI) would initial decrease to 51% of the SDImax and 55% of SDImax is when trees begin to self-thin; dying because there is not enough resources to support all the trees. As the trees continue to grow the SDI will rise and stay above the SDImax causing more and more trees to die do to lack of resources until an average of 57 trees per acre remain. Additionally, there is the matter of economics. A merchantable tree is 10" DBH by 10' tall and need to have a 6" diameter inside the bark at the top. None of the trees thinning the recommendation would be merchantable and the project would not pay its way out of the woods.

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3.32	EIS should include and alternative based on the 2001 Framework.	In particular, the EIS should include an alternative based upon the 2001 Framework. An alternative based on the 2001 ROD is a "reasonable alternative" as that term is used in NEPA, for several reasons. First, there is strong support for the 2001 ROD within the scientific community, federal and state agencies, and the public. As demonstrated in the Campaign's administrative appeal of the 2004 ROD, leading researchers on the California spotted owl, Pacific fisher, and American marten have criticized the 2004 ROD and urged the Forest Service to implement the 2001 ROD instead. (SNFPC et al. 2004 with attachments). The overwhelming opinion of leading wildlife experts in support of the 2001 ROD demonstrates that an alternative consistent with the 2001 ROD requires consideration in the EA or EIS for this project. Second, the U.S. Environmental Protection Agency, in its scoping comments on this project, specifically requested that the Forest Service evaluate an alternative that would implement the 2001 Framework and "include a description of the various environmental, social and economic issues, and the pros and cons of each management approach." (U.S. EPA 2004). As noted by EPA, "public debate continues regarding the scientific basis for; the fuel management, environmental and social benefits of; and the adverse effect associated with the 2004 SNFPA ROD versus the Sierra Nevada Framework." Therefore, EPA urged the Forest Service to "reconsider whether to evaluate an alternative which would implement the 2001" Framework. Third, there is enormous public support for the 2001 ROD, including over 6,000 administrative appeals of the 2004 ROD. Fourth, a 2001 ROD alternative needs to be considered to "sharply defin[e] the issues and provid[e] a clear basis for choice among options by the decisionmaker and the public." 40 C.F.R. § 1502.14.	See Chapter 2, Alternative Considered but Eliminated from Detailed Study, Alternative 4.

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3.33	Cumulative effects discussion is inadequate.	EISs are required to consider cumulative impacts…., The Ninth Circuit has recently clarified NEPA's cumulative impacts requirement in two decisions, both of which overturned Forest Service timber sales for failing adequately to consider cumulative impacts. …. the Ninth Circuit has recently confirmed that timber sale EISs must analyze the cumulative impacts of logging on private lands within the project analysis area. …. …. "[T]he general rule under NEPA is that, in assessing cumulative effects, the EIS must give a sufficiently detailed catalogue of past, present, and future projects, and provide adequate analysis about how these projects, and differences between the projects, are thought to have impacted the environment." …. The discussion of cumulative impacts in the North 49 DEIS falls far short of these requirements. Thus, for example, the DEIS discloses the acreages and prescriptions of other projects, but fails to assess the cumulative amount of old forest habitat that will be degraded or rendered unsuitable by these projects, the impacts of such habitat degradation on a spatial scale, or how such impacts are likely to affect the viability and distribution of species. ….	As stated in Appendix A of the DEIS, page 301, "This section summarizes the analysis area and the temporal scale (time) considered for the cumulative effects analysis. Each resource analysis has disclosed the specific cumulative effects for that particular resource area. Refer to the applicable FEIS section for a specific discussion of cumulative effects." Appendix A is the accumulation of the information each resource specialist used in considering cumulative effects. Please refer to Chapter 4 for the resource specific discussions under the heading called cumulative effects.
3.34	DEIS should be revised and re-released.	In sum, the North 49 fails to include the information, analysis and alternatives necessary for a careful assessment of the project's likely impacts. The DEIS should be revised, and a revised DEIS should be circulated for additional public comment.	Comments on the DEIS allow us to make the necessary changes to our analysis in an FEIS. Comments received do not normally warrant a revised DEIS and another comment period. For the North 49 FEIS public comment has been considered and a new alternative has been developed.

Response # 4: Frank Stewart – QLG Forester

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
4.1		Thank you for the opportunity to provide written supporting comments for the North 49 Forest Health Recovery Project that is being developed and implemented under the Herger-Feinstein Quincy Library Group Forest Recovery Act – Pilot Project. Although this NEPA evaluation process has been taking place for over two years, I request that my earlier comment letters of March 24, 2004, May 14, 2004 and November 8, 2005 be incorporated with these comments in the final development of the Final Environmental Impact Statement (FEIS) for the North 49 project.	General Comment
4.2	Support for Alternative 1	Please accept these comments in support of Alternative-1 (Proposed Action) because it treats the most acres of fuel reduction and forest restoration activities while generating the highest level of social and economic benefits for the citizens, businesses and local governments in Shasta County:	General Comment
4.3	Appendix A maps do not show any proposed DFPZs connecting to future DFPZs.	Page 5, 1st paragraph: You mention that the proposed DFPZ's would connect to future DFPZ's but yet the 14 maps in Appendix-A do not show this connection. Since one of the primary purposes of this project is to provide fire protection to the citizens and communities in northeastern Shasta County, it is imperative that you present a clear and concise map of the DFPZ strategy and how it ties into other fuel reduction and fire protection activities in the area. ….	See the annual report to Congress (incorporated by reference) that shows where the DFPZ's are that have been completed. The Hat Creek fire Safe Council has identified high priority areas to treat, but specific treatments for those areas are still in the planning stages.
4.4	Justification of 50% canopy closure in light of FWS 5/23/06 findings re CASPO listing.	Page 6, ITS Treatment 2: Your justification for the modified 50% canopy closure is "These species are dependent on canopy cover greater than 50% in order to survive and reproduce successfully." How does this option hold up under the May 23, 2006 findings of the Fish and Wildlife Service for not listing the California spotted owl? The F&WS found that the standards and guidelines of the 2004 Sierra Nevada Framework are adequate for the protection of owls and other old growth dependent species, so why are you proposing more restrictive standards?	The Fish and Wildlife Service determined that listing was not warranted for the California spotted owl in May of 2006. However, just meeting the minimum habitat standards is not the purpose of the North 49 project. As stated on page 3 of the DEIS, the desired condition for the project area includes "stands with more dense, multi-storied canopies that provide habitat for dense forest species such as spotted owls."

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4.5	2004 Sierra Nevada Framework standards and guidelines establish a 30" diameter limit. Why are you using 20"?	Page 16, 1st sentence: Why are you continuing with the 20" diameter limit for removal of trees in the DFPZ when the standards and guidelines (page 68 and 69) of the 2004 SN Framework establishes a diameter limit of 30" dbh? This has a direct economic impact on the costs of the operation and the revenues that are returned to the Treasury and shared with Shasta County.	Commenter may be confused with a different project. There is no 20-inch upper diameter limit proposed under the North 49 project. See comment 3.5.
4.6	Mixing silvicultural group selection with seed tree is inappropriate.	Page 17, 1. Group Selection Treatments: Since all trees over 30" dbh are left in group selection units, why are you requiring additional seed trees that fall under 30"'s dbh be left for regeneration and "structural diversity"? 30"+ trees provide adequate "structural diversity" and trees out side of the group provide the regeneration seed source as needed. The primary forest management decision on establishing the size, location and shape of a group selection unit is the existence of the surrounding seed source trees. These are the trees that are used for natural regeneration and not the leaving of seed trees within the unit. You are mixing the silvicultural practices of group selection with seed tree and it is an inappropriate interpretation. ….	Trees greater than 30 inches dbh are not present in all group selection units. They would be retained where they exist. Where trees greater than 30 inches do not exist, up to 2 of the largest trees per acre would be retained. The priority for seed trees in these groups would be Jeffrey, ponderosa, and/or sugar pine. One objective for this project is to create conditions conducive to the regeneration of shade intolerant pine species that are disappearing from the project area. Leaving pine seed trees would be consistent with this objective.
4.7	Difference in acres between alternatives based on owl observations moot given FWS findings.	Page 20, 1st paragraph: A major difference between Alternative-1 and Alternative-3 is the reduction of 494 acres of group selection because of the perceived impacts to the "area of higher densities of spotted owl observations". This is s false argument when the recent F&WS findings clearly state that" the greatest continuing threat to spotted owls is the loss of habitat and subsequent population losses of spotted owls due to stand-replacing fire in unnaturally dense forest stands". The report further confirms that "Group Selection harvests are .5-2 acres in size, so these small patches may not be large enough gaps in the canopy to adversely affect spotted owls. To the contrary, such small breaks in the forest could provide good quality habitat for wood rats, the preferred prey for spotted owls..".	As discussed in Chapter 3 page 129 of the DEIS, flying squirrels, not woodrats are the primary prey of spotted owls within the project area. Chapter 3 pages 131-133 specifically address the impacts of group selections on spotted owls.

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4.8	Questions 10% retention when 2004 Framework standards and guidelines require only 5%.	Page 28, Thinning 3: Why are you leaving 10% of the area inside of thinning units untreated when the standards and guidelines of the 2004 Sierra Nevada Framework (page 68) requires only 5% retention? This again diminishes the fire protection for communities and reduces the social and economic benefits of the citizens, businesses and local governments in Shasta County. What is the total acreage left untreated in the 10% category and what is the standing sawlog and biomass volume contained on the total retained acres?	The 10% retention is an element of the project design intended to meet the desired condition of "stands with more dense, multi-storied canopies that provide habitat for dense forest species such as spotted owls." The three action alternatives would leave different total amounts within the islands. Alternative 1 would leave 107 acres, Alternative 3 would leave 494 acres, and Alternative 7 would leave 204 acres untreated.
4.9	Allowable % mortality in prescribed fire? Questions differences in standards and guidelines between prescribed fire and mechanical treatment.	Page 29, Fuel Reduction-Prescribed Fire: What is the % of damage or mortality that is allowed under the use of prescribed fire and why aren't the standards the same for prescribe fire and mechanical treatments?	On page 29 of the DEIS in the fuels section does not mention standards and guidelines for prescribed fire or machine piles. District standards and guidelines used in prescribed burn plans for mortality guidelines in underburning is 10% of the existing basal area. The majority of the districts underburning when averaged across the treated acres is about 1% of the existing basal area is lost to mortality.
4.10	Justification for increasing buffer around PAC?	Page 30, Wildlife, 4: What is the justification for adding an additional 200 acres of buffer protection around the existing 300 acres PAC? The H-FQLG Act and 2004 SNFramework only require the protection of the 300 acre PAC.	The commenter apparently mistakes 500-foot buffer for a 500-acre buffer. The guideline calls for a 500-foot buffer which is approximately 18 acres within the 200 acre PAC for northern goshawks.
4.11	Table 9 should include canopy closure or sawlog and biomass volumes.	Although Table 9 on pages 35 and 36 is informative, it is missing the most important information: 1) Canopy closure is not mentioned as a measuring standard and 2) the sawlog and biomass volumes are not shown. Although crown base heights and crown bulk density can be used for measuring thinning treatments, the most important measure is crown closure % which is specified in the standards and guidelines of the 2004 Sierra Nevada Framework. ….	Table 9 includes acres and road miles to display how each alternative would meet the purpose and need. Table 10 includes indicators and measures to display intensity of effects for the significant issue by alternative and includes canopy closure as a measure of stand density. Timber volumes for each alternative are displayed in the economics section of the DEIS.

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4.12	Requests the FEIS give equal space to social and economic impacts; and wildlife.	Page 37, Chapter 3, 1st line: "This chapter summarizes the physical, biological, social and economic environment of the project …". The chapter is 254 pages long and only 2.5 pages (1%) are dedicated to the social and economic aspects of this project. The Hairy Woodpecker got more analysis than the social and economic impacts on people. Since the citizens, businesses, communities and local governments in Shasta County are a critical component of the environment, I request that in the FEIS, they get equal footing and analysis with the spotted owl and all his flying, hopping and swimming buddies.	The North 49 project is being planned in response to the HFQLG Forest Recovery Act and the associated QLG Community Stability Proposal. All analyzed action alternatives provide economic and social benefits to local communities in the form of forest products and employment (see the economics section of the DEIS).
4.13	Table 13 needs numbers fixed.	Page 43, Table 13: Total acres for 5S and 5P need to be corrected. The current totals are wrong.	Thank you.
4.14	Should use % crown closure as measuring target in thinning.	Page 50, 1st paragraph: Again, the critical measuring target for thinning operations inside of DFPZ's is missing % crown closure. This is a critical descriptive guide that is established in the 2004 SNFramework and it must be used.	Existing and post treatment percent canopy closure is displayed for each alternative by vegetation type in numerous locations throughout chapters 2 and 3 of the DEIS.
4.15	Should review standard thinning prescription.	Page 51, Standard Thinning Prescription: I encourage you folks to review the thinning prescriptions that are presented in the Phoenix EIS on the Sierraville Ranger District of the Tahoe National Forest. Page 2-21 of the DEIS " The 40% canopy cover objective for DFPZ's is a good balance between the need to reduce the intensity of predicted fire behavior to provide for a safer and more effective fire suppression environment, and maintenance of a minimum level of wildlife habitat quality for old forest dependent species. The 40% canopy cover is estimated to be the lowest canopy cover level where marginal suitable spotted owl foraging habitat could be maintained …"	Thank you for the information on the Phoenix EIS. See fuels section for a discussion of the fire behavior with a 40% canopy closure and a 50% canopy closure. As shown in the fire modeling treating the surface fuels and ladder fuels reduces fire behavior (flame lengths and rate of spread). It will be the line officer who makes the decision about which alternative and thinning prescriptions to use.

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4.16	Disputes limitations of DFPZs where fires spot across.	Page 90, Fire and Fuels: Although "Hood" may have had an experience where the oncoming fire spotted over the constructed DFPZ, we have several examples of where the DFPZ worked as intended. DFPZ's constructed on the Eagle Lake Ranger District, Mt Hough Ranger District, Feather River Ranger District and the Sierraville Ranger District have been tested by forest fires and they worked as intended. ….	The paper from Hood was used as a part of a justification to make the DFPZ's wider so they would be more effective.
4.17	Need to reduce surface, ladder and canopy fuel to prevent crown fire from developing in DFPZs.	• Page 97, Ponderosa Pine, last sentence: Although successfully constructed DFPZ's can prevent the initiation of crown fires from developing within the DFPZ there major safety factor is brining "oncoming crown fires" to the ground. Unless surface, ladder and canopy fuels are reduced to specified levels, an oncoming crown fire can burn right through a DFPZ if it has the right wind conditions.	On page 97 under ponderosa pine that section discussed the effects of fire on ponderosa pine and how ponderosa pine reacts to fire. The rest of the section discusses the effects of fire to other vegetation types in the project area. The discussion about how surface fuel reduction, ladder fuel reduction, and crown reduction affects fire behavior starts on page 99.
4.18	Should be using 2004 not 2001 SNFP standards and guidelines.	Page 124, Habitat: Why are you quoting the standards and guidelines of the 2001 SNFramework when they have been replaced with the 2004 SNFramework, "This ROD replaces, in its entirety, the SNFPA ROD of January 2001." The combination of the 2004 SNFramework and the recent F&WS Findings provide the current thinking relative to spotted owl habitat and I urge your support in the FEIS.	The FEIS provides new analysis of effects from alternatives on wildlife and wildlife habitat in Chapter 4. This should sufficiently address the comment.
4.19	Requests a variety of measures be displayed for economics.	Page 255, Economics: It would help to have the actual sawlog volume in million board feet and biomass volume in bone dry tons. It doesn't help much to show the harvest volumes in CCF for combined sawlog and biomass volume. What is the volume by species and harvesting system (bd ft for sawlogs and bdt's for biomass)? What is the average selling price for each species and what is the operational costs for each of the phases of the project? What portions, acres and treatments will be covered by Timber Sale Contracts, Service Contracts and SSTS Contracts? What is the volume, value, revenues and costs for each? What is the cost of all the road work? What is the Forest Reserve Revenues for each alternative and contract method?	The FEIS provides a new economic analysis that includes harvest volumes and ratios of sawlogs to biomass. See FEIS, Chapter 4.

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4.20	Recommends selecting alternative 1.	Again, thank you for the opportunity to comment on this important project. I hope you will take the time to read the F&WS ruling and adjust your ROD to select Alternative-1 instead of Alternative-3. There are two sawmills, several power plants and a whole bunch of contractors that are in need or work and fiber in this area and you must select the alternative that maximizes the benefits to the people as well as the wildlife.	Recommends selecting alternative 1.
4.21	Request to be kept informed. REQUEST FOR COPIES OF ANY APPEALS TO THE PROJECT, AND REQUEST TO ATTEND 'NEGOTIATIONS.'	Please keep me informed on further developments of this and other QLG projects on the district. When the obstructionists file their appeals on this project, I request a copy of their appeals and an opportunity to sit in on any negotiations that may take place with them.	Request to be kept informed.

Response # 5: Patricia Puterbaugh – Lassen Forest Protection Group, Sierra Club

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
5.1	Identifies commentors and incorporations by reference.	The following observations on the North 49 Draft Environmental Impact Statement (DEIS) are submitted on behalf of the Lassen Forest Preservation Group (LFPG) and the Yahi Group of the Sierra Club, Mother Lode Chapter. We incorporate by reference our appeal of the original North 49 Environmental Assessment, October 2004 including the comments by wildlife scientists Bond, Britting and Kucera.	Thank you.
5.2	Support alternative 3	First, although we continue to have significant concerns about the project, we commend the Hat Creek Ranger District and the US Forest Service for the proposed changes in the preferred alternative, (Alternative 3). We see this as a sound step in the right direction to design a timber sale that will both protect old forest ecosystems and start the process toward a more fire resilient forest.	Thank you.
5.3	Recommend modifications to proposed activities in section 19.	The first significant modification to analyze in the EIS is to leave an uncut corridor, possibly made up of “habitat islands” between the adjacent SOHAs and PACs in section 19 in the middle of the project area. This section was once entirely included in the Furbearer Management area for carnivores. (HCRD archived map 9/24/04) You have decreased the thinning Rx here to 50% and eliminated the groups, but an uncut section is critical to decrease fragmentation along this corridor. In doing so, you would significantly cut down the effects to marten, Northern goshawk, and CSO, as exhibited by the sighting maps ….	Alternative 7, the FEIS preferred alternative, addresses this issue.

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5.4	Recommend modifications to proposed activities in sections 8,10,17,3,4 and 9.	Another critical change would be to drop the group selections in Sections 8, 10 and 17 and between sections 3 & 4 in the NW corner of the project. These are in the vicinity of Huckleberry mountain and Big Lake. These sections are mostly roadless, the erosion hazard here is high or medium high, (DEIS, pg. 202) and expensive helicopter operations are planned. These sections had many stands "suitable for CSO nesting" in the Redlock project and included aggregations of large trees. This corner is also a headwaters locale for tributaries to Battle Creek. Replanting and maintaining the group selections will be difficult or impossible with the steep, roadless terrain and may INCREASE fire danger in this region. …. The relatively frequent observations of marten near Huckleberry Mountain and the concentrated use shown by the radio-telemetry work are suggestive of den sites within a relatively short distance. Home range sizes of 200-3700 acres would potentially place den sites within treatment areas of this project." (DEIS, pg. 151).	Alternative 7, the FEIS preferred alternative, addresses this issue.
5.5	Recommend grouping and increasing uncut islands for furbearers in sections 24, 1, and 12.	We would further suggest the final EIS group and increase the "islands" of uncut habitat where the marten have been sighted or where the historical furbearer management area was. Specifically in section 24 mid project, SW of the deferred region and also in the North midsections 1 & 12 leading to Thousand Lakes Wilderness to create a SW/NE corridor of uncut forest between the PACs and SOHAs. …. USING THE REGIONAL OFFICE'S LITERATURE REVIEW AS A GUIDE, 33 PERCENT OF OUR FURBEARER AREAS ARE DEFICIT IN SUITABLE HABITAT AND DO NOT MEET THE MEDIUM HABITAT CAPABILITY MODEL DEFINED BY THIS REVIEW.	Alternative 7, the FEIS preferred alternative, addresses this issue.

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5.6	Request analysis of commenter's specific suggestions in comments 5.6-5.8.	Alternative 3 with a modified thinning Rx will provide improved connectivity between the SOHAs and PACS that would have been completely disconnected under alternative 1. However the canopy cover will be only "marginally suitable" and there will continue to be a gap in suitability between Bunchgrass SOHA and the North Battle Creek complex. We would like you to analyze in the EIS the suggestions presented earlier, considering dropping specific groups that are impediments to marten, this will also decrease the degradation and removal of CSO and goshawk habitat. ….	Alternative 7, the FEIS preferred alternative, addresses this issue.
5.7	Request for alternative (2001 Framework) that preserves old-forest ecosystems with thinning to restore fire-adapted forest.	"Qualitatively this prescription (modified) would have all the impacts to spotted owls discussed above for alternative 1" (DEIS, pg. 134) This includes removing or degrading almost 10,000 acres of CSO habitat and the degradation will last 15-20 years. All this degradation and "potential higher adult mortality of CSO" within an area where the owls are already struggling to survive is purported "to restore fire adapted forest ecosystems by creating an all-age, multistory, fire-resistant forest approximating pre-settlement conditions." (DEIS, pg. 3, purpose and need) The North 49 region is rated "low to moderate for ignition risk in the HFQLG FEIS. Suppression has been effective with no large fires (>100ac.) in the last 30 years within the TWAA. These factors make it difficult to gauge the value of the beneficial effect of less habitat loss to wildfire." (DEIS, pg.130) We would like to see the EIS examine an alternative, based on the 2001 Framework that will preserve old forest ecosystems while thinning to restore fire-adapted forest.	See Chapter 2, Alternative Considered but Eliminated from Detailed Study, Alternative 4.

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5.8	EIS should disclose data supporting diameter limit.	The Environmental Impact Statement should disclose the data and assumptions that support the diameter limit (UDL) for the project. I am very familiar with the North 49 area and there are very few trees greater than 30" in much of the region. The DEIS is somewhat confusing and unclear on the planned UDL. On page 15 of the DEIS, "Thinning would primarily consist of removing suppressed and intermediate trees less than 20" dbh, with limited exceptions including removal of trees heavily infected with dwarf mistletoe adjacent to group selections." Then on page 28 the thinning is described twice as, "All trees greater than or equal to 30" will be retained". Then on page 51 "…where modeling indicates that trees greater than 20" may be removed, the numbers are small (generally<4/ac.)"	The maximum diameter limit of trees to be removed is 29.9 inches dbh as required by the 2004 Framework. However, modeling using site specific data collected at the stand level with field verification indicate that the majority of trees removed during thinning would be less than 20 inches dbh. The largest trees cut by stand ranges 16-24 inches dbh. In stands where modeling indicates that trees greater than 20 inches may be removed, the numbers are small (generally < 4 per acre). Thinning from below would remove trees in the smaller diameter classes until the desired stocking level is achieved. The objective is to retain and protect the largest trees in each stand. Modeling assumptions for thinning are provided on page 51 of the DEIS.
5.9	EIS should provide stand and unit data showing large tree groups.	The DEIS on page 192 says, "Trees larger than 20 inches dbh would be removed by this project." We know there are aggregations of large trees and stands suitable for nesting throughout the thinning areas. Many stands were deferred in the Redlock project due to these aggregations and wildlife presence. Many sections were classified in the L or B prescription under the LRMP. "The purpose of the B rx was to provide forage for livestock and wildlife and to improve soil and vegetative conditions. No timber harvest will be scheduled under this prescription." (LRMP, pg. 4-42) "The purpose of the L rx was to provide for vegetative diversity through maintenance of old growth ecosystems and to maintain or improve habitat to provide high habitat capability for species that are at least partially dependent on old timber stands…." (LRMP, pg. 4-58) How have we gotten so far away from the vision for the Lassen National Forest that was laid out in 1992? The EIS should provide stand and unit data showing exactly where these large tree groups are. The 2004 Framework requires that projects must retain 30% of existing basal area, "generally comprised of the largest trees". (USDA FS 2004b, p.68) How can we be assured this is being followed? The EIS needs to be very specific to allow a	The treatments proposed under alternatives 1 and 3 are consistent with the 1993 LNF Land and Resource Management Plan (LRMP), as amended by the Northwest Forest Plan Final Environmental Impact Statement (FEIS), Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) (1994, 2001, 2004), Herger-Feinstein Quincy Library Group Forest Recovery Act FEIS, FSEIS and RODs (1999, 2003) and the Sierra Nevada Forest Plan Amendment FEIS, FSEIS and RODs (2001, 2004). The original LRMP prescription areas have been superceded by the above LRMP amendments. Thinning from below would remove trees in the smaller diameter classes until the desired stocking level is achieved. The objective is to retain and protect the largest trees in every proposed treatment stand.

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		clear assessment of the impacts to old forest wildlife in the North 49 area.	
5.10	EIS should examine possibility of leaving all standing and down cull logs as LWD.	We ask that the EIS consider and examine the possibility of leaving all cull logs standing or on the ground in the forest. Maintaining more large woody debris and snags could reduce impacts to all prey species for CSO, Northern goshawk and marten. Downed hollow logs and snags are also used as hiding, resting and nesting cover for these creatures. …. Recent studies show that it is the fine fuels that carry fire in the forest, therefore retaining a higher percentage of large woody debris would not decrease the fire resiliency of the DFPZs. …. Please model an alternative that will increase the large woody debris and snags to decrease the degradation of habitat for sensitive and management indicator species on the LNF.	See table 35 for desired tons per acre of material greater than 3 inches. Cull logs while not contributing to the spread of a fire do contribute to the intensity of the fire and will slow fire line construction rates. A high surface fuel loading in down logs could lead to a high intensity surface fire that kills the remaining stand after thinning.
5.11	EIS should include specifics of when underburning and non-logging fuel treatments would occur.	LFPG would also like the EIS to specify exactly WHEN the underburning and non-logging fuel treatments would take place. We have been disappointed in the past to see underburning and thinning of very hazardous stands NOT done along with the logging. Underburning for both Redlock and the Highway 44/16 road DFPZ has still not been completed long after the logs have been taken. (DEIS, pg. 104) The critical thinning of lodgepole around Big Lake was also never done, increasing the fire danger in this area substantially.	Underburning and machine piling will follow the logging. Depending on the size of the project and length of contract some logging projects can take five or more years to complete. On both the Wheel and Redlock projects the post sale machine piling has been accomplished. The underburning that was supposed to happen on both of these projects has been postponed due to the N49 project. The N49 project overlaps parts of both Redlock and Wheel. Also, the timing of treatments is often weather dependent. Underburning usually occurs during the months of April and May in the spring, and late October into December in the fall.

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5.12	Would like to see reduction in group selections.	We would also like to see, as suggested above, a reduction in the numbers of group selections in the project area. Especially those where helicopters will be used on steep slopes in non-roaded areas. “The group selections result in a microclimate change that would encourage the growth of grasses and forbs. Within 5 to 10 years brush would replace the grass and forbs. If the release of the brush in the groups does not take place, the combination of brush and increased drying due to sunlight could result in a moderate to high severity fire within the group”. (DEIS, pg. 104) These groups will be inaccessible for reforestation or maintenance and therefore will INCREASE the risk of fire in these regions. It would be unfortunate to create higher fire danger right in the middle of these areas used heavily by marten, NGO and CSO.	Thanks you for your concern. It is a line officer decision to reduce the groups in the project area.
5.13	Avoid all trees over 30”dbh.	The DEIS states on page 51 “some trees greater than 30 inches dbh may need to be removed for operability when constructing temporary roads or landings but not to facilitate proposed thinning”. You could probably count the trees over 30 inches in this project area. There is no reason they should be cut. The EIS can design the project to completely avoid any large trees.	Facilitating the safe and efficient harvesting, processing, and removal of all of these products requires that the skid patterns and landings be properly located. It would be unrealistic, if not impossible, to expect to design a harvesting operation without the benefit of a contractor or timber purchaser's equipment operators, their expertise, skills, and needs during the layout for harvesting, and their personal knowledge of their specific equipment's capability. Sale administrators make every attempt to utilize existing skid trails and landings to minimize ground disturbance and more damage to residual timber. Occasionally this requires the cutting of a larger tree rather than re-locating the landing by constructing a new opening elsewhere. And regardless of size, roadside trees that pose an obvious hazard to contractors, purchasers, and the public, also must be cut for the safe use of the transportation system.

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5.14	EIS should include more detailed discussion of the 26.6 miles of unclassified roads proposed for use in N49.	Another modification the EIS needs to make is to change the plan for 26.6 miles of existing unclassified roads to be used by this project and added to the Forest transportation system. This is a HUGE addition to the impacts of this project, especially as you are planning to decommission only 3.9 miles of roads. We have consistently seen, throughout the Lassen National Forest that "unclassified roads" are often completely overgrown, terribly eroded, within the riparian zone and often non-existent. "Roads can contribute more erosion than any other management activity. There would be a decrease in road miles under this alternative leading to an overall beneficial effect." (DEIS, pg. 207) I cannot understand how you can state this when you are increasing the classified/permanent road system by 26.6 miles! The ERA threshold will be breached in 3 watersheds in the next 4 years. …. The discussion and analysis in the DEIS is insufficient to determine what the effect of all this road building will be.	In the FEIS, road use for the project was re-analyzed and the recommendations for transportation system activities were adjusted. See Chapter 2 FEIS.
5.15	Should include detailed maps of unclassified roads proposed for addition to system.	The EIS should contain detailed maps of the exact "unclassified roads" that will be added to the FS permanent system so we can check them.	Unclassifed roads to be added to the system are listed in the Roads Analysis along with a map showing roads to be decommissioned new construction.
5.16	Cumulative effects analysis insufficient.	The cumulative impacts discussion in the DEIS is not sufficient for the public to determine the effects to the North 49 region, or the greater LNF from this project and others. You have tables and maps listing and showing the cumulative effects in Appendix A, but there is no discussion at all. Chapter 3 details the affected environment and environmental consequences, but it would be helpful to summarize and detail the cumulative effects along with the cumulative effects analysis in the EIS. The discussion needs to be more concise and focused in one place.	As stated in Appendix A of the DEIS, page 301, "This section summarizes the analysis area and the temporal scale (time) considered for the cumulative effects analysis. Each resource analysis has disclosed the specific cumulative effects for that particular resource area. Refer to the applicable FEIS section for a specific discussion of cumulative effects." Appendix A is the accumulation of the information each resource specialist used in considering cumulative effects. Please refer to Chapter 3 for the resource specific discussions under the heading called cumulative effects.

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5.17	Cumulative effects acreages need to be more clearly defined for ease of analysis.	The geographical analysis area boundary used for the past, ongoing and future vegetative management actions is the area of the thirteen subwatersheds for this project in the DEIS on page 301. The project area is approx. 42,335 acres but how many acres are in these subwatersheds? Do the ERAs use this same analysis area? What percentage of this analysis area has been logged or will be logged in the future? I see numbers of acres treated in various tables, but I can't find the total acreage of the geographical analysis area. These acres treated do not include the acres of private land that have been heavily logged with thousands of acres of clear cuts in the analysis area. (Table A-2, pg. 304) Latour state forest, adjacent to the project area has used Group Selection harvests almost exclusively in the last 10 years. Many of the tables do not relate to the others in terms of measurable effects. How do we use percentages and acres together; or to know effects when we don't have a total? As requested above, the EIS cumulative effects statement needs to be easier for the public to use. Considering the planned logging to commence in the coming years on the Hat Creek Ranger District, as well as Almanor Ranger District, a forest wide analysis should be included.	Acreages for each subwatershed used for cumulative watershed effects (CWE) are listed in Chapter 3 of the N49 FEIS in the first table (table 77) of the Soil and Water section. Table 80 in Chapter 3 lists the present Equivalent Roaded Acres (ERA), the addition from alternatives associated with this project, and proposed addition from private before 2008. Details of past activities and proposed activities on both private and public land are listed in Appendix A. Analysis was completed at the subwatershed level for this project. Cumulative effects analysis at the Forest scale is beyond the scope of this project.

Response # 6: Pete Harrison – Californians for Alternatives to Toxics

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
6.1	Establishing their interest in N49.	Californians for Alternatives to Toxics (CATs) is a public interest, non-profit organization that is concerned about the use of pesticides and promotes alternatives to pesticide use in California. CATs is also concerned about activities that create conditions in which the use of pesticides is likely. Many CATs members live in the vicinity of or otherwise use and enjoy the Lassen National Forest and the Hat Creek Ranger District. The activities that are planned for the North 49 Forest Health Recovery Project DEIS are of particular concern to our members.	We appreciate your interest.
6.2	Concern over lack of monitoring and maintenance plan, and opposition to Sporax.	…. CATs applauds the Forest's history of commitment to non-herbicide vegetation management strategies, and we strongly support the noxious weed mitigation measures included in the proposed actions. We are, however, concerned over the Forests failure to include any plans for monitoring and maintenance of the proposed DFPZ, GS, and fuel reduction/thinning areas. CATs is also opposed to unnecessary and excessive use of "an EPA registered borate compound," the pesticide borax (product Sporax).	See Chapter 2, Alternative Considered but Eliminated from Detailed Study, Alternatives 5 and 6.
6.3	Failure to include monitoring plan.	The Forest has failed to include in the DEIS an established monitoring plan for the project area. Monitoring of fuel levels and noxious weeds in the project area post project completion are essential for determining the success of the project and determining when maintenance activities will need to occur. Responsible land management dictates that a DFPZ monitoring plan be included as part of the North 49 Project FEIS.	Monitoring is done as part of the HFQLG EIS and is conducted across the pilot project area. See Appendix A for the maintenance of the DFPZ's.

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6.4	Recommendations for fuels monitoring.	Below we will outline what we suggest as a minimum for fuels monitoring. This information was sent to the Forest twice, during scoping comments for this project, yet has so far been ignored. …. The object being to maintain surface fuels (fuels 0 – 3 inches diameter, including fallen vegetation from brush and trees) at levels below fives tons per acre and prevent dense ladder fuel accumulations. ….	See Appendix A for the maintenance of the DFPZ's. Prescribed fire is the preferred method for maintaining the DFPZ's. Monitoring is done as part of the HFQLG EIS and is conducted across the pilot project area.
6.5	Preferred DFPZ maintenance method.	Prescribed fire will be the preferred and priority treatment method to retain DFPZ effectiveness and reduce noxious weed invasion and surface fuel levels. The intention is to avoid herbicide use in DFPZ maintenance activities. DFPZ maintenance activities will be scheduled to insure fuel conditions are at desired levels and herbicides would not be needed. The intent is to take action with prescribed fire when surface fuel conditions reach levels of 5 to 7 tons per acre, and reduce accumulated fuels to levels less than 5 tons per acre.	Thank you for this information, we are planning on using prescribed fire to maintain the DFPZ's.
6.6	Believe thinning is excessive.	We also feel the thinning design is excessive and does not reflect site community characteristics.	The standard and modified thinning prescriptions are both conservative thinning approaches based on site-specific conditions including vegetation type, stand age, site quality and associated carrying capacity.
6.7	Maintenance must be accounted for in project designs.	The courts have ruled with CATs that maintenance is inherently part of DFPZ projects and must be accounted for within project designs. Monitoring is how the Forest will determine when maintenance is needed. By failing to include DFPZ fuels monitoring and maintenance plans as part of the proposed actions the Forest is exploiting its responsibility as stewards of public lands and setting up a situation with potentially dramatic ecological implications in the near future.	See appendix A of the N49 EIS. Monitoring is done as part of the HFQLG EIS and is conducted across the pilot project area. See appendix A (p. 306) for a discussion on maintenance of the N49 DFPZ's.

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6.8	Concern that DFPZ maintenance not part of this decision.	In Appendix A, under Past, Present and Reasonably Foreseeable Future Actions, the Forest mentions maintenance of the North 49 DFPZ project area. CATs is concerned that the Forest has, as this point, stated that DFPZ maintenance "would not be part of the decision." (p. 34). ….	See appendix A (p. 306) for a discussion on maintenance of the N49 DFPZ's.
6.9	Foreseeable future actions associated with DFPZ construction need to be addressed in this analysis.	The proposed DFPZ construction will create a situation where vegetation will vigorously respond to disturbance and the increased light availability creating a future fire hazard and fuel condition similar or greater than the one that currently exists. The proposed actions will establish a precedent for future actions. Those future actions, specifically fuels maintenance, need to be addressed and determined during NEPA analyses.	See chapter 3 for a description of the project area. The affected environment discusses slope, aspect, elevation, soils, and vegetation. The foreseeable future actions are dealt with in appendix A and under cumulative effects.
6.10	Concern that analysis predicts maintenance only after 10 years.	The implementation of the proposed DFPZs, fuel reductions and group selection cut efforts will inherently increase light availability and disturb the soil surface. Both of these create optimal conditions for the invasion of noxious and invasive plant species as well as undesired natives. In such an instance, undesired vegetation, or early seral species, are typically represented by annual grasses and weeds, and woody shrubs. The successful establishment of such a stratum could result in high fuel levels in as little as three to five years, depending on vegetation types. CATs fears such an outcome will prompt the Forest to adopt a chemical dependent maintenance strategy. CATs is opposed to and will not support any forest management actions that will result in the potential for future herbicide use.	Based on district experience of machine piling and underburning, and fire regimes of the area, 10 years will be the earliest that these stands will need maintenance.
6.11	Need monitoring plan to identify maintenance needs.	However, we are concerned about the prediction of no maintenance for 10 years. Monitoring is the only way to know when maintenance should be done, and as stated earlier, we want the Forest to start conducting monitoring in no latter than 4 years post project completion, and every 2 years thereafter.	There is a project wide monitoring plan that is part of the HFQLG EIS that monitors fuels, large fire occurrence, and other non-fire related issues.

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6.12	Legal basis for veg maintenance plans.	Also, predicting foreseeable maintenance and committing to DFPZ, GS, and ITS maintenance are two different things. The courts have established legal precedence that the Forest has a responsibility to establish vegetation maintenance plans for HFQLG FRA projects. Thus CATs expects the Forest to do so.	The N. 49 DEIS has addressed DFPZ maintenance as a reasonably foreseeable action as is shown on pages 306-308 of the DEIS. The decision framework clearly states that a decision on DFPZ maintenance would not be made at this time, thus defining the scope of the decision to be made, and stating the analysis is to follow. There is no proposal, or reasonably foreseeable action, to maintain group selection or individual tree selection treatments, making maintenance plans beyond the scope of this analysis for these actions.
6.13	EIS should include language committing to a maintenance plan.	Preferably, the Forest should include specific language in North 49 Project NEPA documentation committing to maintenance of DFPZ, GS, and ITS project areas, as deemed necessary by monitoring results, for both fuels and noxious weeds, without the use of herbicides, and by prescribed fire, hand and mechanical treatments. Or, at the very least, the Forest must commit, in writing, that when in the future the Forest determines it necessary to conduct project areas maintenance, and treat unwanted vegetation (both fuels and noxious weeds), that the Forest will provide publicly reviewable analysis and evaluation of those actions within new and additional NEPA documentation.	Page 9 of the DEIS states: … “A decision on DFPZ maintenance would not be made at this time. Treatments of stand structures are designed to be effective for a minimum of 10 years, with a desired target efficacy of approximately 20 years. Some stands or portions of stands may require maintenance within ten years of the initial treatment. Maintenance treatments of surface fuels are not expected to be necessary for the first five years following the initial treatment. Therefore, DFPZ maintenance would be analyzed as a reasonably foreseeable action in cumulative effects, during the analysis of this project. Future maintenance actions would be analyzed separately and site-specifically, in compliance with NEPA.”
6.14	The Forest cannot rely on programmatic documents to support site-specific impacts.	The Herger-Feinstein Quincy Library Group Forest Recovery Act Environmental Impact Statement (HFQLG FRA EIS) is programmatic and not site-specific. While, the proposed actions must adhere to the limits and guidelines set forth by the HFQLG EIS, the Forest must provide the site-specific evaluation and cannot rely on generalist design protocol as recommended in programmatic documents. ….	Limits that were set forth in the programmatic HFQLG FRA EIS helped to describe the proposed action for North 49 in terms of design criteria for implementation. For the discussion of the site-specific environmental effects for implementation of the proposed action, the no action and alternatives to the proposed action, please refer to Chapter 3 of the North 49 DEIS.

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6.15	EIS should include criteria for use of maintenance tools.	Although the Forest has made no references to using herbicides in this project, CATs is still wary of its potential use in the project area in the future, especially since the use of herbicides for maintenance is outlined in the HFQLG FEIS. CATs would like the Forest to include within the EIS the criteria that determine which maintenance tools will be used. Maintenance is a foreseeable connected action, and as such must be covered in full detail within the North 49 Project EIS.	The N. 49 DEIS has addressed DFPZ maintenance as a reasonably foreseeable action as is shown on pages 306-308 of the DEIS. A discussion of what the HFQLG SEIS/ROD direction is outlined in those pages as well as why herbicides would not be used.
6.16	Urges Forest to include long-term maintenance plans, with criteria.	We urge the Forest to include long-term plans for maintenance of fuel levels. Maintenance estimates must include justification and specific data that back up time intervals and maintenance strategies. The Forest cannot just describe the environmental effects of the proposed treatments as being discussed in the programmatic HFQLG Forest Recovery Act.	Please refer to pages 306-308 of the North 49 DEIS where DFPZ maintenance as a reasonably foreseeable action is addressed. This discussion refers to time intervals and the rationale for those intervals as they relate to fuels buildup.
6.17	Fears lack of maintenance plan now will lead to dependence on herbicides.	CATs feels that by not considering and proposing maintenance strategies specific to this project, the proposed action would establish a precedent for future actions, specifically, the likelihood of the Forest becoming dependent on an herbicide-based vegetation management strategy. CATs is opposed to any management activities that could lead the Forest onto the herbicide treadmill.	Herbicides are not considerd a reasonably foreseeable action for DFPZ maintenance from implementation of the North 49 project and therefore are not discussed in the analysis. Consideration of DFPZ maintenance as a reasonably foreseeable action has already been completed on most HFQLG projects on the Lassen National Forest. Therefore, this action does not establish a precedent for future actions, or represent a decision about future management considerations. Future actions would require project analysis in compliance with NEPA.
6.18	Concern over excessive group selection (dbh), thinning, and DFPZ design; as generalized strategies.	CATs is concerned over the excessive group selection, thinnings, and DFPZ design characteristics. The DBH limits (30") are too high and desired canopy cover percentages (30%) are too low. CATs would support alternatives that reduce DBH limits to 12" and hopes the Forest can see beyond the 'timber dollars' and use lower and more responsible DBH limits. Adequate support for this silvicultural prescription is not provided in the DEIS. This generalized strategy for fuels reduction does not consider historical stand densities that are influenced by stand age, site productivity, vegetative communities, and site characteristics such as soils, elevation, aspect, and	The post treatment canopy cover percentages referenced by the commenter (30%) is incorrect. See the discussion in the silviculture section of the DEIS concerning existing and projected post treatment canopy cover. Adequate support for this silvicultural prescription is provided in the DEIS. Thinning prescriptions were developed using site specific forest inventory information and considered historical stand densities, stand age, site productivity, vegetative communities, and site characteristics such as soils, elevation, aspect, and slope. See the discussion in the silviculture section of the DEIS concerning historical

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		slope. The Forest needs to determine their desired stand density, for each specific site, each treatment unit within the project areas, based on historical stand densities that reflect the aforementioned forest dynamics.	project area cover types, comparison of existing and historical conditions, modeling assumptions, and post treatment stand attributes.
6.19	Critique effects of thinning.	Thinning can have both positive and negative effects depending on the forest type and its existing structure and age. …. "Selection thinning and crown thinning that maintain multiple crown layers, along with individual tree selection systems, will not reduce the risk of crown fires except in the driest ponderosa pine forests (Graham et al 1999)." Only a very small percentage of the project area is reported in the DEIS to be ponderosa pine forests.	The DEIS analyzes "thinning from below" not selection or crown thinning as mentioned by the commenter. Thinning from below would raise crown base heights (CBH) and reduce ladder fuels that carry a surface fire from the ground up into the crowns. Please read the silviculture section of the DEIS.
6.20	Critique use of generalized dbh limits.	By using predetermined, generalized DBH limits, the Forest risks either under harvesting, resulting in a static state characterized by excessive fuels, or, as in this case, over harvesting, allowing increased light availability thus providing a suitable medium for the establishment and proliferation of undesired vegetation. Both of which, will likely result in the quick return of hazardous fuel levels. This excessive thinning is the primary contributor to the actual and necessary maintenance interval likely to be needed in the next 3-5 years.	As described in the response to comment 6.6, the North 49 thinning prescriptions are conservative and would retain 40-54% canopy cover post treatment in the mixed conifer type. See the discussion about the effects to understory microclimate in thinned stands on page 60 of the DEIS.
6.21	Must analyze hotter, drier, windier.	In addition to the proliferation of vegetation, the project area will experience reduced surface fuel moisture and increased flammability (Countryman 1955 as cited in Weatherspoon 1996). The greater the stand opening, the more pronounced the change in microclimate is likely to be. Increased ladder fuels and decreased surface fuel moisture can be a catastrophic combination. These effects must be analyzed within the EIS.	Sierra Nevada Framework ROD standards and guidelines for fire behavior modeling is to use 90th percentile weather. While many papers state that opening the canopy will create a hotter and drier environment, there are no studies that have been completed that state exactly how much hotter and drier the environment will be. See fire behavior section under fire and fuels for a discussion in the differences in fire behavior between 40 and 50 percent canopy closure.
6.22	Cite studies regarding use of mechanical treatment and prescribed fire.	There is no questioning that the existing conditions and fuel levels of the project area need to be mechanically treated prior to the implementation of any fire and/or fire surrogate maintenance strategies. Abundant surface and ladder fuels, and dense stands pose a high risk for any prescribed burning efforts.	Please refer to the N49 FEIS (Appendix A) for a discussion of DFPZ maintenance. No herbicide use is planned for maintenance in the project area, only prescribed fire.

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		However, studies have shown that following the mechanical treatment, underburning every 5-8 years is required to stabilize the system in order to reintroduce any type of natural fire regime (Stephens 1998).	
6.23	Contend proposed prescriptions will lead to failed DFPZs unless prescribed fire used extensively as well.	Studies have shown that fuel breaks alone will not halt the spread of wildfire. Consistent prescribed burning has shown to be the most effective treatment for reducing a fire's rate of spread, fireline intensity, flame length, and heat per unit of area (van Wagtendonk 1996). The implementation of the currently designed DFPZs will ultimately fail due to their excessive harvesting prescription promoting the proliferation of surface and ladder fuels, the reduction in surface fuel moisture resulting from increased insolation, and the lack of landscape scale prescribed burning, or alternative fire surrogate strategies, used in combination with the fuel breaks. ….	A DFPZ by itself will slow a wildfire but as stated the best way to reduce the damage from a wildfire is through treating large areas with thinning and surface fuels reduction (mechanical and prescribed fire). For the above stated reason is why there is large areas of ITS in the N49 project. The Hat Creek RD has an existing program of treating areas using prescribed fire to reduce the surface fuels and reduce the intensity of a wildfire. Some of the areas we have treated are second entry areas from past projects in the 1980's and 1990's. If and when the N49 project is completed it will become part of the districts prescribed fire target. The DFPZ's will be maintained as part of area wide underburning.
6.24	Contend need for monitoring plan to determine maintenance needs.	The proposed actions will, without doubt, establish a precedent for future actions. The Forest has demonstrated their awareness for these future actions by predicting a maintenance interval (pg. 307) but have failed to include a monitoring plan.	There is a project wide monitoring plan that is part of the HFQLG EIS that monitors fuels, large fire occurrence, and other non-fire related issues.
6.25	Concern only mechanical treatments will be used for maintenance.	In addition, without a firm proposal of a maintenance strategy, we are to assume the same mechanical thinning, utilized as a natural fire surrogate, may again be implemented. These mechanical strategies have shown to have a cumulative effect by increasing surface fuels and actually increasing the potential fire risk over time (Graham et al 1999, Weatherspoon 1996, Wagtendonk 1996, Stephens 1998).	See appendix A. Prescribed fire is the treatment planned on being used for maintenance of the DFPZ's. Mechanical thinning will not significantly increase the surface fuel loadings because all thinning operation will require the purchaser to remove the tree to a landing for chipping (tops included).
6.26	Contend plans needed for consistent, proactive management using prescribed fire in order to eliminate need for herbicide use.	Although the proposed actions are rehabilitative and preventative in nature, plans for consistent long-term maintenance need to be implemented for proactive management. The proposed actions intend to return the forest to pre-historical natural conditions. But without changes in future management, the existing conditions will likely return with more severity. Specifically, the Forest should include consistent prescribed burning as an element of their typical forest	See appendix A for maintenance of the DFPZ's.

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		management practices. We commend the Forest's prediction that prescribed fire will be used as a maintenance tool. However, we insist that the Forest evaluate and incorporate a maintenance strategy, founded on prescribed burning, into the proposed action plan. …. the proliferation of noxious weeds lends itself to the inferred state of the landscape; one of increased light availability, disturbed soil surface, devoid of native vegetation, and moving towards a system dominated by annual invasive species, likely contributing to surface and ladder fuels. ….	
6.27	Forest need to commit to reintroducing fire.	While the Forest has made vague reference to reintroducing a natural fire regime, a demonstrated commitment to that goal needs to be discussed and proposed within this project. The courts have ruled that maintenance is an inherent part of DFPZ and QLG projects. The Forest needs to discuss, outline, and commit to specific steps towards reintroducing fire, utilizing goats, hand pruning and/or plans for future non-intrusive, non-herbicide management of fuels within the DFPZ that mimic historic natural cycles and conditions. ….	The DFPZ's and ITS units would be either unberburned or machine piled and then underburned following thinning of the stands. As discussed in appendix A the DFPZ's would be maintained using prescribed fire.
6.28	Summary of Radosevich analysis of Forest data used to determine DFPZ maintenance timeframes. CATS conclusions based on Radesovich.	Dr. Steven Radosevich, a professor at the College of Forestry at Oregon State University and a federal court-recognized vegetation management specialist provided expert declaration in support of our DFPZ maintenance arguments during litigation over the HFQLG FRA. In response to the Forest's reluctance to include DFPZ maintenance strategies, Dr. Radosevich has reviewed papers used by the Forest to determine and ultimately lengthen the timeframe for DFPZ maintenance. He has provided CATs a report outlining his expert interpretation of these papers. Three papers by Alan Taylor …. fuel maintenance should be implemented every 2-5 years in order to maintain the efficacy of DFPZs. In addition, Taylor and his associates demonstrate a strong correlation between fire return frequency and elevation. …. The proposed action makes no mention of using elevation as a determiner of DFPZ design or maintenance despite the Forest's use and reference	Thank you for the information. Please refer to the N49 FEIS (Appendix A) for a discussion of DFPZ maintenance. Forbs and grasses that come in following the treatment are part of the ponderosa pine and mixed conifer ecosystems. These plants do cure and die off every year, resulting in a fuel bed made up of fine fuels. The fuel beds can burn with a rapid rate of spread, but do not burn with a high intensity that will damage the resulting stand. Due to the low flame lengths (under 4 feet) engine crews are able to directly attack these kinds of fires, unlike many brush fires that burn with a higher intensity resulting in indirect firelines, larger fires and larger fire costs.

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		of these very same papers by Taylor for the purpose of DFPZ design and maintenance. The Forest should base DFPZ design on site-specific characteristics, as opposed to programmatic recommendations. ….	
6.29	Expect sporax risk analysis for health and human safety.	Application of any pesticide is controversial and comes with inherent hazards and risks. These potential effects and impacts must be accounted for, analyzed, and alternatives evaluated for potential environmental effects as part of the NEPA process. The use of a fungicide, like borax, is no different. CATs expects the Forest to provide a project specific risk analysis and evaluation of human health safety and environmental impacts within project NEPA documentation if Sporax is to remain part of the proposed actions.	There is no requirement within NEPA or any FSH/FSM that would require a project-specific human health and safety or environmental pesticide-use risk assessment when using Sporax. The Forest Service has prepared a human health and ecological risk assessment for Sporax (SERA TR 04-43-21/06-30-02b, February 24, 2006) that addresses these issues. Sporax applications would follow all State and Federal rules and regulations as they apply to pesticides. Sporax would be applied according to label directions, which have been determined to be safe.
6.30	Contend inadequate information regarding sporax use in EIS.	While we support the prevention and control of Heterobasidion annosum and annosus root disease, CATs questions the wisdom and necessity of the Forest's inclusion of Sporax as part of the proposed actions. The Forest provides inadequate information regarding the proposed use of this toxic chemical. For starters, the Forest states that "no specific locations [of annosus] have recently been identified in the project area" (pg. 49). Annosus in other areas is no reason to apply tons of pesticides into the project area. Before applying Sporax, the Forest needs to document both annosus actually in the project area and determine which strains exist and what tree species are at risk for the root rot (only certain species are susceptible to certain strains of the disease, see later comments). Also the Forest must disclose how much total Sporax will be applied within the forest for this project? Over what total acreage will pesticides be applied? ….	Sporax use is needed as a preventative measure to reduce the potential for annosus infection and spread. Annosus root disease occurs on fir and pine on the Lassen National Forest. Proposed treatment acres are provided in the DEIS. True firs are especially susceptible to annosus root disease. The proposed thinning and group selection treatments would favor the retention of pine over white fir. This would help reduce the spread of root disease by reducing root-to-root contact between host tree species (true fir) as well as reducing host populations. Cut stumps of live true fir and pine trees 14 inches in diameter and greater would be treated with the borate compound. Sporax would be applied to all conifer stumps within 1 hour of creation. Sporax would not be applied when rain is falling. Also, Sporax would not be applied near water because RHCAs and riparian areas would be buffered (see DEIS for RHCA and riparian buffer widths).

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6.31	Requests minimal sporax use.	CATs would prefer that no pesticides are applied in our National Forests. We prefer alternative non-pesticide pest control …. The Forest is under direction to protect forest health and prevent the spread of annosus and new infection centers, yet there is a deficiency of studies regarding alternative, non borax treatment options from California …. if the Forest can determine no other way to prevent the spread of annosus, then CATs wants the Forest to apply as little Sporax as possible ….	Commenter requests minimal Sporax use. R5 USFS recently increased recommended stump treatment diameters to 14" from 12" (chainsaw) and 8" (mechanical felling). This effectively reduced the amount of borax being applied. Borax does naturally occur. Boron is an essential micronutrient in plants. Some farmlands with soil deficient in boron need supplemental borax for growing crops.
6.32	Offer of CATS annosus prevention data.	If the Forest desires, CATs would be happy to provide it with information on non-Sporax annosus prevention alternatives, Sporax toxicological concerns, and so fourth. We have sent this information before regarding previous projects in the Lassen National Forest.	See response to comment 6.29
6.33	Summary of CATS research on non-sporax annosus prevention.	As we will demonstrate below, scientific literature, and USFS R5 surveys demonstrate that Sporax need not be applied to stumps less than 18” for control of annosus root disease. The Forest must analyze and evaluate the potential of reducing borax applications to only stumps of a diameter equal to or greater than 18 inches. Several scientific expert sources indicate that there is no need to apply borax on stumps less than 18” to protect them from annosus. Dekker-Robertson (2005) states that “stumps smaller than 18” in diameter need not be treated with borax as they rarely become sources of inoculum” for new infection centers. Schmitt et al. (2000) agree stating “annosus root disease has mostly been associated with occurrence of large stumps – usually 18” and larger in diameter”. Goheen and Otrosina (1998) go with a larger stumps, stating “new disease foci are usually associated with large host stumps 0.5 meter or greater in diameter.” Half a meter is equal to nineteen point seven inches. Since the scientific experts on annosus state that the key to preventing it spread is preventing the occurrence of new infection centers, then that should be the Forest’s goal in for this project. If the Forest is truly only applying borax to control the	See Chapter 2, Alternative Considered but Eliminated from Detailed Study, Alternative 5.

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		spread of annosus root disease then there is no need to apply it to stumps <18" in diameter. Several survey results indicate that annosus infections only occur on the larger stumps, and thus no borax is needed on the smaller ones. Kliejunas (1986) found in the Modoc NF that stumps less than 18 inches were not infected with annosus. In the Plumas and Tahoe NFs only 2 of 173 pine stumps less than 18 inches had annosus conks (infection) present (Kliejunas 1989b). Surveys of 5 timber sale areas in the Inyo NF found that the smallest pine stump with annosus infection (visual conks) was 23 inches in diameter. Obviously there is adequate evidence that borax need not be considered for stumps <18" in diameter.	
6.34	Justification of borax use in EIS is inadequate.	Just stating that borax applications have been shown to be effective at preventing the spread of annosus does not constitute adequate justification or information disclosure as required by NEPA. The most recent available literature must support application criteria and rates. The Forest must disclose all relevant scientific views within NEPA documentation for decision analysis and evaluation of options.	Application rate is dependent upon the number and size of stumps treated per acre. The Sporax label rate of one pound per fifty square feet of stump surface is the rate at which Sporax is being applied within Region 5.
6.35	Recommend particular spatial and species consideration in borax applications with specific examples from EIS.	The annosus disease travels very slowly from root to root spread …. Hence the primary concern in most cases where annosus root disease is a concern is spore travel and new infection centers, not root to root contact. While the spores can travel far, Dekker-Robertson (2005) reports that "pine stumps should only be treated if they are within one mile of an infected pine stand. The Forest should only be considering applying Sporax on stumps in the project area if the stands are within one mile of annosus infection centers. Are there infection centers within the project area? The Forest should be restricting borax applications only to stumps of certain tree species, …. The Forest has a responsibility to the public to determine what strains of annosus (S or P) are present in the project area and include this information within the EIS. ….	Sporax use is needed as a preventative measure to reduce the potential for annosus infection and spread. Annosus root disease occurs on fir and pine on the Lassen National Forest.

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6.36	Recommend letting annosus change species composition where desirable.	Often the Forest Service wants to change stand species composition from shade tolerant species (like firs) to shade intolerant species (like pines) with forest health projects such as this one. In fact the Forest mentions favorably retaining shade intolerant species over shade tolerant ones. Then why not just let the annosus help do this, skip borax treatments for some species, like shade tolerant fir species, and let the annosus change stand species structures for you? It is as simple as only applying borax to the large stumps of the most desired tree species that are in danger of the particular strain that infects them.	As noted by the commenter, one component of the purpose and need is to create conditions conducive to the establishment and growth of shade intolerant pine species. Reducing surface fuel loading is also part of the purpose and need. Not treating shade tolerant white fir stumps would increases the risk for infection of live residual trees. This would increase the potential for unacceptable surface fuel loading which would not be consistent with the purpose and need.
6.37	Forest has a responsibility to develop and implement management strategies that consider sound and accepted ecological ideals in combination with public interests.	These comments should be familiar. As an organization, despite successful litigations in court, CATs continues to be burdened by the need to pressure the Forest to consider the issue of DFPZ monitoring and maintenance. Yet, the Forest continues to ignore the responsibility. CATs has established in federal court (CATs vs. Dombeck, Case No. S-00-2106 LKK) that the implementation of fuel reduction thinnings, specific to the HFQLG FRA, is directly correlated with the inherent vegetative recovery and the long-term maintenance of those project areas. …. By ignoring the issues of monitoring and maintenance, the Forest is exploiting its scientific and public accountability.	See Chapter 2, Alternative Considered but Eliminated from Detailed Study, Alternative 6.
6.38	Make sure that the absolute minimum amount of borax is applied in our public forests.	While we'd prefer that the Forest studied and evaluated alternative non-pesticide methods to prevent the spread of annosus, our main objective is to make sure that the absolute minimum amount of borax is applied in our public forests. Less pesticides are always better than more, and borax does not naturally occur in forests.	See Chapter 2, Alternative Considered but Eliminated from Detailed Study, Alternative 5.

Response # 7: Linda Blum

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
7.1	Notes internal inconsistencies among resource areas: Silviculture, fire and fuels, wildlife.	Pardon my blunt characterization, but it seems the DEIS has multiple personalities within the same document, and they do not agree on basic facts about environmental conditions and trends in the project area. This set of internal inconsistencies in the EIS must be resolved in order to produce a Final EIS with internal consistency, and scientific and professional integrity.	The FEIS addresses this comment.
7.2	Notes internal inconsistencies among resource areas: Silviculture, fire and fuels, wildlife.	The DEIS's fire and fuels analysis essentially concludes that either Alternative 1 or 3 will effectively ameliorate the hazard of crown fires, but Alternative 2 will ultimately lead to a high-intensity wildfire. The fire and fuels analyses are well documented with model results and discussions. Interestingly, the fire guys don't seem to think there's any functional difference, fire-wise, between the Alternative 1 and Alternative 3 treatment combinations, nor even between the standard and modified thinning prescriptions. (DEIS, p.99) I do not understand why the two alternatives are identical in their effects on fire behavior.	See fuels section. Fire behavior modeling is based on the surface fuels (needles, branches, logs, brush etc). In order for a fire to transition to the canopy you have to have sufficient fireline intensities (flame lengths) and ladder fuels to move the fire up. All the action alternatives treat the surface fuels (reduce the fire line intensities) and reduce the ladder fuels, so the fire has a difficult time transitioning into a crown fire under 90th percentile weather. In both alternatives the surface (due to surface fuel treatments) is assumed to be the same fuel model, therefore the same fire behavior.
7.3	Notes internal inconsistencies among resource areas: Silviculture, fire and fuels, wildlife.	The views of the wildlife biologist appear to be directly opposite to both the other viewpoints, however: fire is not considered to be a serious threat to the continued existence of wildlife habitat (DEIS, p.130), and taking no action (Alternative 2) is seen as continuing the current trend of improving habitat for California spotted owls (DEIS, p.134), goshawks, and martens. The effects analyses for California spotted owls rely entirely on the findings and recommendations of Forest Service owl researchers Verner, Blakesley, and Rotta concerning habitat management; but the DEIS fails to disclose a large body of responsible opposing scientific points of view, notably those laid out in publications by Alan Franklin, Lee and Irwin, the Review Team for the Sierra Nevada Forest Plan Amendment, and most recently by the U.S. Fish and Wildlife Service in its finding on the latest petition to list the California spotted owl. In each of these studies	The commenter mischaracterizes the inability to quantify future reductions in acres affected by stand-replacing fire as a personal viewpoint. The commenter than utilizes references to large-scale studies by Franklin, the review team, and the Fish and Wildlife Service finding on listing to find fault with the much more narrowly focused findings of the publications by Verner, Blakesley et al, and Rotta. The commenter interprets the larger scale review comments as having the view that "edges and mixes of habitat types are actually good for spotted owls up to a point". The specific studies cited in the DEIS analysis discloses the specific changes in habitat between current conditions and the resulting habitat conditions for each of the alternatives. The Fish and Wildlife Service's listing finding is specific to determining if listing of the California subspecies is warranted. That listing was found to be

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		that reach conclusions different than those of Verner/Blakesley/Rotta, spotted owl data sets and habitat data sets were analysed by attemtpting to correlate habitat qualities at varying owl territorial scales with owl occupancy and reproductive success. Instead of the "only 50 percent or greater is suitable" and "more is always better" approach to stand density, canopy cover, and downed woody material advocated by the DEIS biological section (invoking Verner, Blakesley, and Rotta), these other experts' views are that edges and mixes of habitat types are actually good for spotted owls, up to a point. In fact, the U.S. Fish and Wildlife Service stated in their May 24, 2006, Federal Register notice that at least 44% of a 430-ha (1,063-ac) area around a spotted owl territory center seems to be the minimum amount of forest with 40% or more canopy cover necessary to support California spotted owls. Once this minimum was met, the relative amount of forests with intermediate (40-70 percent) and dense (greater than 70 percent) canopy cover had little measurable effect on reproduction of spotted owls. ….	unwarranted does not change the purpose of this project to meet the desired condition of "stands with more dense, multi-storied canopies that provide habitat for dense forest species such as spotted owls." The analysis of the Fish and Wildlife Service is at a different scale, with a different purview, and a different legal objective than the NEPA analysis contained in the DEIS. While the Fish and wildlife service was looking at the survivability of a subspecies across its range, the DEIS takes a hard look at impacts as proposed for a specific action in a specific location. It is to be expected that there would be differences between the broad stroke approach of the Fish and wildlife Service and the focused look required by NEPA.
7.4	Questions goshawk reliance on closed-canopy.	page 6: The DEIS has overestimated the goshawk's reliance on closed-canopy forest, especially for foraging. Goshawks frequently forage in open stands and along forest edges.	The DEIS relies on the cited scientific literature for its analysis and conclusions. The commenter does not provide conflicting scientific data.
7.5	Questions utility of units of measure for habitat suitability.	page 10, Table 1: the units of measure for habitat suitability --especially miles of edge -- are not nearly as relevant as the amount of owl home range core areas having 40 percent or greater canopy cover. See the USFWS statement above.	The miles of edge measure is one metric out of seven. It does not apply only to spotted owls but does provide a measure of change due to the project's proposed actions.
7.6	Questions amount of owl habitat.	page 41: Wow, what a lot of owl habitat! The DEIS says that 67% of the forest stands are CWHR size class 4 and 85% of the forest stands have 40 percent or more canopy. Page 125, Table 58 shows that 71% of all forest acres in the project analysis area are spotted owl foraging habitat with greater than 50 percent canopy cover. How then can it be true that the standard thinning prescription "would isolate each	As described on pages 133, 114, and 127-130 of the DEIS, the proposed standard thinning would alter existing vegetation conditions to a condition that would not meet the parameters of habitat that spotted owls select for foraging as defined by the spotted owl specific studies cited in the DEIS. We agree that the data raises intriguing questions. However it primarily points out that there are

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		of the owl reserve areas by placing unsuitable habitat between each area," as is stated on page 129? Those same landscape-scale habitat and habitat-proxy percentages on pages 41 and 125 also raise some intriguing questions and challenges to the spotted owl orthodoxy. If so much of the landscape is suitable habitat, why are the owls in this area not regularly paired up and breeding? The owl occupancy and reproductive history for this area is the worst of any of the HFQLG project areas, but it has the most amount of closed-canopy maturing forest and the least amount of edge of any of the project areas.	multiple parameters involved in defining what makes up suitable foraging habitat in addition to canopy cover and tree size. The CWHR strata (utilized on page 41) do not account for differences in climate, coarse woody debris, snags, or other factors that can affect owl use and fecundity. We are unaware of data that does, in fact, show that the North 49 project area "has the most amount of closed-canopy maturing forest and the least amount of edge of any of the project areas."
7.7	Recommends explaining SDI earlier in the document.	page 114: I love Footnote 14! This information explaining and referencing the term Stand Density index should also appear at the FEIS's first mention of the term, and/or in the silvicultural section of Chapter 3.	Page 42 in the Silvicultural Resources section of the DEIS includes a detailed explanation of the term Stand Density Index.
7.8	Recommends updating information based on 5/24/06 FWS findings.	page 124: FEIS should update with information from the May 24, 2006, finding of the U.S. Fish and Wildlife Service regarding listing the California spotted owl. On pages 124 and 128 and elsewhere, the DEIS defines owl foraging habitat as "generally more than 50 percent" canopy cover even though, as discussed above, that more exclusive definition is unwarranted and unaccepted by other owl authorities.	The FEIS addresses this comment.
7.9	Editorial comment on wildlife.	page 126: The third sentence on the page has a typographical error, I believe. I suspect there are at least one noun and one connecting phrase missing.	The error is noted and will be corrected in the FEIS.
7.10	Questions owl analysis and canopy threshold.	page 128: What 50 percent canopy threshold for owl occurrence and productivity? The area's owl records belie that notion. Analysis fails particularly to account for what natural fire effects would be on downed wood, snags, tree growth, and stand structures; for fire effects on extent of openings across the landscape (DEIS p. 39) and canopy cover (p. 40).	The questioned phrase: "the canopy cover would be below the 50 percent threshold that contributes to occurrence and productivity" refers to the previous statement that "50 percent canopy closure is generally considered below what spotted owls preferentially select for foraging (Verner et al., USDA FS 2001). The analysis on page 129 does not address the historical conditions listed on pages 39 and 40 because those historical conditions do not currently exist. The analysis takes the required hard look at the impacts of the proposed actions and the cumulative effects of those actions.

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7.11	Disagrees with evaluation of hypogeous fungi.	page 129: I disagree with the DEIS's evaluation of effects on hypogeous fungi. At least some fungi species on the east side of the Cascade Range require forest crown separations, and the dew driplines created by tree crowns, for the right conditions to survive.	It is undisputed that different fungi species have different requirements. This analysis is based on what the effects would be to hypogeous fungi that are a key food item for the flying squirrel based, in part, on the scientific studies of the peer-reviewed articles of Smith et al 2003 and Meyer et al 2005.
7.12	Questions threat barred owl poses.	page 130: The Fish and Wildlife Service did not find barred owls to be serious threat to the California spotted owl in the May 24, 2006, Federal Register notice.	The Fish and Wildlife Service found that there was "no indication that barred owls are significantly affecting spotted owls in the Sierras due to their low relative densities" (71 FR 29907). Page 130 of the DEIS discloses the potential for the project to provide conditions more favorable for barred owls.
7.13	Believes EIS should analyze project potential to support other small mammal populations.	page 130+: The FEIS should analyze the project's potential to support and stimulate other small mammal populations within owl foraging habitats. Spotted owls are known to take other food items than just flying squirrels and woodrats; indeed, in restored forests with greater vegetative diversity, it is likely that owls would have a more varied and therefore also more reliable diet than in homogeneous, young-fir-dominated stands.	Although spotted owls do take a variety of other species, they appear dependent on just two species: flying squirrels and woodrats (Verner et al 1992). Woodrats appear to be exceedingly rare or absent from the North 49 project. Thus spotted owls are dependent on the availability of flying squirrels within the project area. The proposed actions would reduce coarse woody debris and shrub cover thus concomitantly reducing other species populations as well as flying squirrel populations (see pages 113-114).
7.14	Disputes measurement of post-project foraging habitat and resulting conclusions.	page 132: Whether the project's alternatives "remove or degrade" 30% of the foraging habitat in the project area is less important than whether the known owl sites would have sufficient habitat amounts to support owls post-project. By all the data in Tables 59 and 60 on pages 125 and 126, it appears that each of the owl territories in the North 49 area has more than enough habitat in the home ranges and activity centers, by all owl researchers' and Forest Service standards.... which merely begs the question of owl reproductive history, since the habitat is supposedly more than adequate!	The FEIS addresses this comment.

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7.15	Disputes implications of cumulative effects to owls.	page 133: Given the tone of the rest of the wildlife section, it seems inaccurate and unfair to state in the cumulative effects analysis, "The recently approved Creeks project would impact 19 [spotted owl] territories." By loose use of terminology, this statement implies adverse impacts are expected on 19 owl sites, when in fact the Creeks FEIS does not expect any significant effects to owls.	Per Table 3-34 of the Creeks FEIS, 19 territories would have acres treated within the home range. The percent reduction in suitable acres within the home range in the affected territories is projected to be .5-30 percent. Page 133 is accurate.
7.16	Editorial comment on wildlife.	page 180: The first paragraph under Management Indicator Species refers to an appendix that does not exist in my copy of the DEIS.	The Biological Evaluation and assessment will be an appendix to the final EIS.

Response # 8: EPA

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
8.1	Contend preferred alternative fails to address many of the environmental concerns in the area.	This project is designed to implement and be consistent with the Northwest Forest Plan, Herger-Feinstein Quincy Library Group Forest Recovery Act, and the Sierra Nevada Forest Plan Amendment 9SNFPS). EPA has commented extensively on these preceding management documents and many of our concerns expressed with the management actions are carried over into this project. This project was initially documented in an environmental assessment in March 2004. Due to comments received during the comment period, the Lassen National Forest Supervisor decided to prepare an EIS and develop a new alternative (Alternative 3) to the proposed action (Alternative 1). While we appreciate the decision to prepare an EIS and the addition of a modified alternative, the preferred alternative does not address many of the environmental concerns in the area. Therefore, we have rated the Proposed Action as Environmental Concerns – Insufficient Information (EC-2). Please see the enclosed Rating Factors for a description of EPA's rating system.	The FEIS reformats and clarifies the Purpose of and Need for the Proposed Action and alternatives.
8.2	Recommends re-analyzing Alternative 4 – the 2001 ROD.	EPA recommends that the Forest Service reconsider analyzing the implementation of Alternative 4, which would incorporate the more protective measures of the SNFPA 2001 Record of Decision (ROD), rather than those in the 2004 ROD.	Thinning to a 20"UDL would not meet the purpose and need nor would it provide adequate protection for late seral species. Thinning trees less than 20" would not provide the forest with the multistoried structure identified in the purpose and need. A multistory structure provides a higher quality of owl habitat and prey species habitat than a thin from below to 20". Alternative 7 has been developed to provide this structural diversity. Additionally, to develop forests that are healthy, structurally diverse, and fire resilient, flexibility in tree removal will be needed. A 20" UDL does not provide flexibility in choosing smaller trees with better phenotypes over larger inferior and/or decadent trees. Typically pines are more fire resilient than white fire and over time provide better branching to provide large birds nesting opportunities. However, white fir grows faster and reaches 20" quicker than pine. Thus the more fire resilient pine will be removed over the fire intolerant, bigger white fir.

8.3	Need to identify and include WUIs in analysis.	This project is intended, in part, to provide feedback regarding the success of fire protection methods in the Wildland Urban Interface (WUI). However, these areas have not been identified or included in the development of the alternatives.	The WUIs identified within the North 49 project area are all within DFPZs and were analyzed for treatment as part of the overall fuels treatment strategy for both action alternatives.
8.4	Concerned about water and air quality effects.	We are also concerned about potential water quality and air quality impacts in the project area for which mitigation has not been proposed as part of the project.	See air quality discussion in the EIS. All burning will be conducted on permissive burn days, with good smoke dispersion conditions (unstable air). Burning will be coordinated through the Shasta County Air Quality Control District to ensure good smoke dispersion. Water quality concerns were addressed through integrated design features, best management practices (BMP's) and adherence to LRMP (as amended) standards and guidelines (Chapter 3, Soil, Water, Fisheries). For anadromous watersheds this includes long-term strategy for anadromous fish-producing watersheds as contained in the SNFPA FEIS (USDA FS 2001a), for the nonanadromous watersheds this includes SAT guidelines as defined in the HFQLG ROD (USDA FS 1999b).
8.5	FEIS should include monitoring information.	Monitoring measures and their funding mechanisms and implementation schedules should be included in the Final Environmental Impact Statement (FEIS).	Implementation and effectiveness monitoring is conducted by the US Forest Service, HFQLG. A report to Congress is provided annually.
8.6	Recommends Alternative 4, with justifications re: water quality, grazing, owl mitigations, and roads.	The DEIS states that Alternative 4, an alternative that implements the Sierra Nevada Forest Plan Amendment (SNFPA) 2001 Record of Decision (ROD), was not considered in detail due to the fact that the 2004 SNFPA ROS supercedes it. However, EPA has expressed objections to the implementation of the 2004 ROD because it eliminates many of the protective measures under the 2001 SNFPA ROD.	The SNFPA SEIS describes the differences between the S1 and S2 or the differences between the 2001 and 2004 RODs. Our site-specific analysis describes the effects the proposed action has on the environment as required by NEPA.
8.7	Need to discuss WUIs and monitoring.	A major objective of this project is to test methods that will provide additional fire protection for wildland urban interfaces (WUIs). Portions of three WUIs are within the analysis area. However, there is no discussion of the WUIs or monitoring that will be used to determine if the proposed methods are effective. …. The FEIS should include a description of the WUIs in the project area and if these areas are given priority for fuels management activities. The FEIS should include a description of the applicable CWP Plans, if any, and should document how the proposed	There are three WUI's (threat zones) within the project area. The threat zone is defined as 1.25 miles from the defense zone boundary. The fuels treatments inside a threat zone are to reduce wildfire spread and intensity. In the three portions of the threat zones within the N49 project we are reducing the surface, ladder and crown fuels, which will reduce the wildfire spread and intensity, meeting the desired condition for the treat zone. See fire behavior modeling in the fuels section.

		project implements the recommendations of these CWP Plans.	
8.8	Mitigations and monitoring: Roads and water quality.	We note that the 2001 SNFPA ROD included a commitment to develop a multi-agency body to collaboratively address and resolve management issues (p. 16, SNFPA ROD). EPA is concerned that this commitment has not been implemented. One particular issue of concern with these forest plans is the need to reduce the size of the transportation system and the need to protect roadless resources. …. However, the road-related impacts from Alternative 3 are very similar to those from Alternative 1 (p. 209) and monitoring plans are not established in the document to determine the effectiveness of BMPs in responding to soil, water, or watershed impacts (p. 331).	See Chapter 2, Alternative Considered but Eliminated from Detailed Study, Alternative 4.
8.9	There are no Best Management Practices for air quality.	The North 49 project area is located between two Class I airsheds, the Thousand Lakes Wilderness and Lassen Volcanic National Park (p. 107). The area's air quality is affected by pollutants from downwind population centers, adjacent forest activities, traffic, and agriculture (p. 108). Therefore, it is important to reduce air impacts from the project to the greatest extent possible. The DEIS does not include any specific air BMPs or other mitigation measures to reduce this impact. ….	The project area currently meets all the standards for air quality standards. The burning that is conducted will be done under permissive burn days that allow for good smoke dispersion and with wind flows that will keep smoke from impacting the two class one airsheds. The normal air flow through the project area is from the southwest to the north east. Lassen NP is to the south of the project area and 1,000 Lakes wilderness is to the north of the project area and a higher elevation.

Response # 9: California Department of Fish and Game (CDFG)

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
9.1	Request additional information on anadramous watershed management objectives.	On Page 214, reference is made to "anadramous watershed management objectives" and then on page 224 is Table 83 summarizes these objectives. Please provide a description of the objectives and how they were derived. Is this part of the Lassen National Forest Management Plan?	Watershed Management Objectives (WMOs) were developed by the LNF using the watershed analysis process and are found in Appendix I, Part 4 of the SNFPA. WMOs are a part of the Long-Term Strategy for Management of Anadromous Fishes on the Lassen National Forest. The strategy replaced PACFISH, which provided interim management direction.
9.2	Request additional information on future timber harvest on private lands.	On page 214, reference is made to future timber harvest on private timberlands in the Bridges Creek watershed between 2007 and 2010. What do the proposed plans consist of and what information do you have about past private timber harvest activities in the area?	Additional information regarding past, present and future private timber harvest activities can be obtain from: California Department of Forestry Northern Operations Center 6105 Airport Rd. Redding, CA 96002
9.3	Request info on indirect effects to extended anadramous waters (Battle Creek Salmon and Steelhead Restoration Project).	On page 221, under the Anadramous Fish Habitat Account, reference is made to Eagle Canyon Dam and the Coleman National Fish Hatchery as being barriers to anadromy. According to the Battle Creek Salmon and Steelhead Restoration Project, North Fork Battle Creek is a stream restorable to anadramous fish. This project is funded and in the implementation stage. The project will remove 5 diversion dams and construct 3 fish ladders at diversion dams as well as increase flows for anadramous fish. While the proposed timber plan will not likely cause a direct impact to anadramous streams, please explain how the increased extent of anadramous waters will be indirectly impacted by the project.	As stated in the Anadromous Fish Habitat Account section of the EIS, there is a natural barrier approximately 13 miles downstream of the Lassen National Forest boundary, which is the natural limit of habitat accessible to listed anadromous fish. The analysis for this project considered the effects to the upper extent of the available habitat at the natural barrier which would not change after implementation of the restoration project.
9.4	Request additional information on culvert replacement.	On page 222, Table 82, two culverts are proposed for replacement in the road maintenance column. What are the diameters and lengths of the new culverts? How were the culverts sized? Are these on fish bearing reaches of streams?	Roads needing upgrading are identified as part of the Roads Analysis process. Sizing of culvert will be decided in the field during implementation. The new culverts will be sized for a 100 year flood.
9.5	Note potentially conflicting information on road densities and objectives in the Noble Creek Subwatershed.	On page 224, it is stated the Noble Creek Subwatershed will not meet the road density objectives of less than 2.5 miles/square mile. On page 8, it states that 1.6 of 3 road miles in Noble Creek	Under the Lassen Forest Plan Watershed Management Objectives (WMO) for anadromous fish producing watersheds, the goal is to reduce road densities to 2.5 miles per square mile. Under the

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
		need to be decommissioned in order to meet objectives. This implies that 1.6 miles will be decommissioned and the objective will be met. Please revise the statement on page 8 to reflect the road closure that will be done. Please provide an explanation as to why the objective will not be met.	action alternatives, road density in Nobles subwatershed would go from 3 miles/sq. mile to 2.6 miles/sq. mile. This approaches, but does not meet the WMO of 2.5 miles/sq. mile. These numbers were generated in GIS and may be slightly different on the ground.
9.6	Note stray plant species.	*Silene occidentalis* spp. *Longistipitata* is mentioned in the last paragraph on page 224 and in the middle of page 250. However, it isn't mentioned earlier as a species considered.	The Biological Evaluation for Sensitive Plants (Appendix A), for the North 49 project determined that the project area lacks potential habitat for this species. As a result, the inclusion of this species within the DEIS was unintentional, and all references have been removed.
9.7	Question meeting target rate for snag retention.	The document states that all snags within 125 feet of roads will be removed and other snags that pose an operational safety hazard further than 125 feet may be removed also. Yet the target rate for snag retention within the Terrestrial Wildlife Assessment Area, 4 snags per acre, will most likely not be met. How will the target rate for snag retention be met with the given criteria? Have other criteria or alternatives been proposed that may achieve the given target rate? For example, removing snags only if they pose a safety hazard rather than removal of all snags at a set distance?	Snags within one tree length of roads would be removed as discussed on page 113 of the DEIS. In areas with shorter trees this would be less, in areas with taller trees this may be farther. It is assumed that the snag retention rates will be met post-project thru a combination of natural mortality, accretion from prescribed fire, and thru the inclusion of adjacent non-harvest areas.
9.8	Questions regarding distance between group selection units and fragmentation.	Is there a set distance between each group selection unit? How were the locations of the group selection units chosen? The map on page 118 shows a clumped distribution of group selection units in a relatively small area. Will fragmentation be an issue given the clumped distribution of the group selection units? Is there a way to space the units apart to decrease fragmentation and still meet stand objectives?	There is no minimum distance between groups. They were located to leave at least 2 acres between each group and to utilize existing skid trails whenever possible. Some group selections on the map appear closer than they actually are because of the size of the point feature.
9.9	Questions regarding recruitment of decay class 4 and 5 downed wood.	On page 145, it is stated that the number of downed logs in decay class 4 and 5 will decrease overall. How will future downed logs be recruited? ….	Future down logs will be recruited as snags fall, tops snap out of green trees and as green trees are blown over.
9.10	Suggest table of acronyms.	A table of acronyms used in the document would be useful.	Acronyms are defined when first used in the document.

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
9.11	Note citations missing from bibliography.	Several of the citations are not in the bibliography, including: Kier 1999, USDI 1997, McEwan & Jackson 1996, Harvey 1995 &1996, among others. Please make sure all citations are included in the bibliography.	Thank you, we will do so.
9.12	Suggest additional maps.	The maps provided in the draft EIS cover a large expanse of land. Several maps covering smaller extents would be more suitable to get a detailed picture of the project area. A map(s) of the watercourses would be useful for reference and orientation. Other maps that would be useful are: a. The extent of anadromy in North Fork Battle Creek. b. Roads and crossings that are to be constructed or decommissioned.	A map with intermittent and perennial streams is provided on page 205 of the DEIS. On the North Fork of Battle Creek, a barrier, located approximately 13 miles downstream of the Lassen National Forest boundary is the natural limit of habitat accessible to listed anadromous fish (presently, habitat is limited further downstream at Eagle Canyon Dam). Based on the maximum restored habitat potential for fall-run Chinook salmon (Forest Service Sensitive species), their upstream limit would be below Eagle Canyon Dam (Kier 1999), and approximately 23+ miles below the LNF boundary. Presently, however, their upper range in the North Fork of Battle Creek is limited even further downstream due to management operations at the Colemen National Fish Hatchery near the confluence with the Sacramento River. A map with proposed transportation system changes is provided on page 21 of the DEIS.

The following comments were received during the initial scoping of this project in November of 2005. The combination of commentors on the scoping document for the EIS and the Draft EIS include all the commentors on the North 49 EA. To capture all concerns, substantive comments on the 2005 scoping document are considered and responded to below.

Response # 10: Barbara Camacho - Shasta County Fire Safe Council

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
10.1	Shasta County Fire Safe Council supports the project.	Thank you for the opportunity to provide our support for the North 49 Forest Health Recovery Project that is being planned…, This is the largest forest health and fuel reduction project in Shasta County…, In addition to the short term fuel reduction activities, we fully support the long term forest and watershed restoration activities scheduled under this project because they advance the goals and objectives of the Shasta County Fire Safe Council while meeting the social and economic needs of the citizens, businesses and local governments in Shasta County.	Thank you very much for your support.
10.2	Shasta County Fire Safe Council would like their scoping comments carried forward to the DEIS opportunity to comment period.	We ask that this letter be placed in the current scoping file and that we be included in the review process of the forthcoming draft of the EIS for this project. This project is critically important for the protection of citizens in eastern Shasta County from catastrophic forest fires and we want to work with you and your staff to make sure that our concerns are incorporated into this project and that it is implemented on the ground without further delays from frivolous appeals and lawsuits.	Thank you. Your comments will be considered throughout the planning process until a final decision is made on this project.

Response # 11: Chad Hanson – John Muir Project

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
11.1		1) The scoping notice states that group selection would be used to increase tree species diversity and to create a more fire-resistant (and fire-resilient, as required by the QLG Act) forest. Scoping Notice, pp. 9-10, 13. In particular, the Notice states that group selection would be used to increase the proportion of shade intolerant (pine) species. a) Given that the post-fire conifer mortality data being gathered by USFS staffer Sheri Smith (ssmith@fs.fed.us) shows that the shade tolerant species (e.g., incense-cedar, red fir, and white fir) are MORE fire-resistant at equal levels of crown kill (from fire) than yellow pine or sugar pine, how do you intend to create a more fire-resilient forest by increasing the proportion of conifer species that are less fire-resistant? See, Hood, S.M., S.L. Smith, and D.R. Cluck. 2005. Delayed conifer tree mortality following fire in California. USDA Forest Service, PSW-GTR-xxx (Draft). Or are you suggesting that the Hood et al. (2005) data is unreliable for some methodological reason (that data does show far higher mortality levels for ponderosa pine than the published, peer-reviewed research shows for wildland fires, see, e.g., McHugh, C.W., and T.E. Kolb. 2003. Ponderosa pine mortality following fire in northern Arizona. International Journal of Wildland Fire 12: 7-22).	Group selection is required by the Act. Programmatic environmental consequences are documented in the associated EIS. This project initiates the restoration of species composition and stand structure to approximate pre-settlement conditions. Effective fire exclusion and other historical management practices in this project area have resulted in increased understory tree density and altered forest composition that includes more white fir. Restoring species composition to include more drought tolerant species such as ponderosa and sugar pine will result in less drought-related tree mortality and facilitate the development of mature stands. Attempting to manage for high levels of shade tolerant, and drought intolerant, species in this project area (>50% of the species composition) will lead to a more dramatic increase in fuel loading during protracted drought periods which can alter fire severity and reduce the ability to effectively return fire to this system. When comparing the results of the Hood et al. 2007 models it is important to consider that the intent of the study was to collect data on a wide range of tree species, size classes and fire injuries for developing models to predict the probability of mortality for individual trees. The Hood et al. 2007 model for yellow pine did show a slightly higher predicted probability of mortality than the white fir and incense cedar models for similar size classes given the same level of crown kill. Accurate comparisons between the yellow pine and red fir models are not possible due to the limited sample size of red fir. True firs tend to receive more severe fire injuries from equal amounts of basal heating and crown scorching than yellow pines because of their thinner bark and shorter needles (Hood et al. submitted 2008, Wagener 1961). Crown scorch typically results in the killing of buds and branches on true firs and a permanent reduction in live crown ratio (except for some limited post-fire epicormic branching), whereas crown scorch in ponderosa pine often leaves the branches and buds intact and partial crown recovery occurs the following growing season. Both Hood et al. 2007 and Stephens and Finney 2002 report lower predicted probabilities of mortality for ponderosa pine and incense cedar than white fir with equal levels of crown scorch. The Hood et al. 2007 study is part of the published peer-reviewed scientific literature regarding fire injured

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
			conifers in CA (http://treesearch.fs.fed.us/pubs/25906). All three ponderosa pine models in the publication predict increasing probabilities of mortality with increasing dbh. This is similar to results in McHugh and Kolb (2003) for ponderosa pine models developed using wildfire alone and prescribed and wildfire combined data sets, but contrary to the prescribed fire models reported in Stephen and Finney (2002) and McHugh and Kolb (2003). Most often, the objective of a prescribed fire is to limit mortality of the overstory while reducing fuel loadings and in growth of smaller trees. Therefore, a data set from a prescribed burn likely does not contain many larger, overstory trees with high levels of crown and cambium kill. The differences in tree size and fire type could account for the different effects of dbh when predicting mortality. Hood, S. M., Cluck, D. R., Smith, S. L. and K. C. Ryan. 2008. Using bark char codes to predict cambium mortality after fire. Submitted to Fire Ecology for publication. McHugh, C. and Kolb, T. E. 2003. Ponderosa pine mortality following fire in northern Arizona. International Journal of Wildland Fire. 12: 7-22. Stephens, S. L. and Finney, M. A. 2002. Prescribed fire mortality of Sierra Nevada mixed conifer tree species: effects of crown damage and forest floor combustion. Forest Ecology and Management. 162: 261-271. Wagener, W. W. 1961. Guidelines for estimating the survival of fire-damaged trees in California. Miscellaneous paper-60, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA. 11 p.
11.2		b) The Notice (p. 13) states that shade intolerant (pine) species are in substantially lower proportion now relative to historic times, due to fire suppression and other management, concluding that "Based on historical records, existing species composition is outside the range of natural variability." Such a statement cannot be accepted without significant empirical evidence being provided, which the scoping notice fails to do. The Notice does not even cite which "historical records" it relies upon. In the Draft EIS, please provide hard data and citations to fully answer the following questions relevant to the stated purpose and need regarding group selection:	See response to 11.1

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
11.3		* What historical documents, and particular passages of those documents, does the Notice refer to regarding its conclusion that pines are far less prevalent now than in historic times? Please do not cite recent articles which speculate about historic structure. You claimed to rely upon actual "historical records", so please provide these citations to what are presumably 19th century documents (or very early 20th century). * What was the composition (proportion of each conifer species) of overstory trees in the project area and/or analysis area in historic times, and from which sources is this information derived? * What is the current composition (proportion of each conifer species) in the project area for trees less than or equal to 16 inches dbh? * What is the current composition (proportion of each conifer species) in the project area for trees greater than 16 inches dbh? * What is the current composition of conifer species (by proportion) <16" dbh and >16" dbh WITHIN PROPOSED GROUP SELECTION UNITS? * Upon what data are you relying for your conclusion that pine species are more fire-resistant than fir and cedar, and will thus facilitate a more fire-resilient forest?	See response to 11.1
11.4		2) If you maintain that pine species are more fire-resistant than fir and cedar, and mature fire-resistant pines should be increased, please fully explain why you are proposing to remove large, mature pine trees up to 30" dbh in group selection units? This is contrary to the stated purpose and need.	See response to 11.1
11.5		3) Please also divulge the proportion of the timber volume from group selection units that would come from pine species (ponderosa, Jeffrey, and sugar pine).	A majority of the species removed in the Group Selection would be white fir. The exact proportion of pine to other conifers would be determined implementation.

Comment Number	Comment Summary/Topic	Comment Text	Response to Comment
11.6		4) I suspect that shade-intolerants may have increased in the understory for trees <16" dbh since historic times in a number of areas, but that this is not true for canopy trees >16" dbh, or >20" dbh. If you have data that contradicts this, please cite and analyze it.	The information analyzed from GLO surveys in 1881 - 1883 indicates that shade-intolerant species have declined in both the overstory and understory.
11.7		5) Please explain why you propose to locate group selection units in natural red fir forest. Red fir forest naturally had a longer fire return interval, and naturally had more moderate and high severity fire historically. Nor would pine species ever have been dominant in the red fir zones. Group selection in red fir forests does not meet appear to meet the stated purpose and need. If you believe it does, this requires some significant explanation because it makes no sense as proposed.	The FEIS clarifies the need for improved diversity within the project area. The limited area of red fir in the project area demonstrates homogenous stands lacking in vertical and horizontal structure and compositional diversity.
11.8		6) Please divulge the average amount of timber sales receipts that you anticipate per acre for group selection units, as well as the average anticipated cost per acre of slash piling/burning, subsequent precommercial thinning of dense young regenerated stands in group selection units (some years after logging occurs), and administrative outlays (including analysis, sale administration, etc.).	The FEIS provides a thorough economic analysis that addresses anticipated revenues.
11.9		7) Please send us the DEIS, Fire/Fuels Report, and Silvicultural Report, as well as copies of the historic data relied upon for conclusions made in the Scoping Notice.	Thank you for your request.

Appendix C - Mitigation

Best Management Practices

Timber

BMP 1.1 Timber Sale Planning Process

Objective: To incorporate water quality and hydrologic considerations into the timber sale planning process.

Implementation: Maintenance of SAT and Lassen LRMP buffers and protection of water quality.

BMP 1.2 Timber Harvest Unit Design

Objective: To ensure that timber harvest unit design will secure favorable conditions of water quality and quantity while maintaining desirable stream channel characteristics and watershed conditions. The design should consider the size and distribution of natural structures (snag and down logs) as a means of preventing erosion and sedimentation.

Implementation: No entry into SAT and Lassen LRMP buffers by equipment unless specified for RHCA improvement. Group thinning/timber units to minimize landings.

BMP 1.3 Determination of Surface Erosion Hazard for Timber Harvest Unit Design

Objective: to identify high erosion hazard areas in order to adjust treatment measures to prevent downstream water quality degradation.

Implementation: Review of soil input has identified areas to be of moderate erosion hazard.

BMP 1.4 Use of Sale Area Maps (SAM) and/or Project Maps for Designation of Water Quality Protection Needs

Objective: To ensure recognition and protection of areas related to water quality protection delineated on a SAM or Project Map.

Implementation: The sale area map contract map will show designated RHCAs within proposed harvest boundaries.

BMP 1.6 Protection of Unstable Areas

Objective: To provide special treatment of unstable areas to avoid triggering mass slope failure with resultant erosion and sedimentation.

Implementation: There are highly erosive soils in the Battle Creek watershed. There are no documented areas of mass movement but the areas with erosive soils will be identified on sale area maps and will be treated in such a way to avoid triggering mass movement.

BMP 1.8 Streamside Management Zone Designation

Objective: To designate a zone along riparian areas, streams and wetlands that will minimize potential for adverse effects from adjacent management activities. Management activities within these zones are designed to improve riparian values.

Implementation: Identification of buffers (BMP 1.4) and identification of RHCAs for the project area with the interdisciplinary team.

BMP 1.9 Determining Tractor Loggable Ground

Objective: To minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems.

Implementation: Forest LRMP standards apply and areas over 35% slope should not be tractor logged. In the Logan Management Area, cinder cones will only be tractor logged on slopes of less than 20%.

BMP 1.10 Tractor Skidding Design

Objective: By designing skidding patterns to best fit the terrain, the volume, velocity concentration and direction of runoff, water can be controlled in a manner that will minimize erosion and sedimentation.

Implementation: Sale Administrators may work with the operator to minimize skid trail density and use low ground pressure equipment. If 15% or more of the activity area is compacted, major skid trails will be tilled to stay within the LRMP direction. No skidding will take place in the RHCA unless authorized for RHCA improvement. All skid trails in the RHCA are to be tilled.

BMP 1.12 Log Landing Location

Objective: To locate new landings or reuse old landings in such a way as to avoid watershed impacts and associated water quality degradation.

Implementation: Landings within RHCAs will be tilled after use. Sale administrators will utilize existing landings where possible. Grouping harvest areas where feasible will minimize new landings development. In addition the following criteria may be applied: (1) Cleared or excavated size shall be no larger than that needed for safety; due to the silvicultural prescriptions this may be up to 1 acre in size. (2) New sites selected for the least amount of excavation and erosion potential; utilize existing landings were feasible. (3) Landings will be located outside of RHCAs and where sidecast will not enter drainages or damage other sensitive areas; (4) In group selection harvests these areas will be placed to minimize landing construction.

BMP 1.13 Erosion Prevention and Control Measures During Timber Sale Operations

Objectives: To ensure that the purchasers' operations will be conducted reasonably to minimize soil erosion.

Implementation: Equipment will not be operated when ground conditions are such that excessive damage will result. Soil should be dry to avoid compaction. Purchaser may have to adjust work to ground and weather conditions. Erosion control work required by the contract will be kept current.

BMP 1.16 Log Landing Erosion Control

Objective: To reduce the impacts of erosion and subsequent sedimentation associated with log landings by use of mitigating measures.

Implementation: Include proper drainage on landings and avoid use of poorly located landings. Any landing within an RHCA will be tilled after use. Any landings not needed for the next 20 years should be considered for subsoiling to improve infiltration and foster vegetative recovery.

BMP 1.17 Erosion Control on Skid Trails

Objective: To protect water quality by minimizing erosion and sediment derived from skid trails.

Implementation: The sale administrator(s) will use their best judgment in determining needed erosion control measures on skid trails. They will ensure that no more than 15% of the activity area (unit) has compacted skid trails. Units with over 15% skid trails should be tilled to improve infiltration.

BMP 1.18 Meadow Protection during Timber Harvesting

Objective: To avoid damage to the ground cover, soil and the hydrologic function of meadows.

Implementation: Maintain RHCA buffer widths as identified under SAT and Lassen LRMP guidelines. Consult with Forest Soil Scientist/Hydrologist for any areas that appear ambiguous. Ensure that Riparian Conservation Objectives are followed.

BMP 1.19 Streamcourse and Aquatic Protection

Objective:

1) To conduct management actions within these areas in a manner that maintains or improves riparian and aquatic values.
2) To provide unobstructed passage of storm flows
3) To control sediment and other pollutants from entering stream courses.
4) To restore the natural course of any stream as soon as practicable, where diversion of the stream has resulted from timber management activities.

Implementation: RHCA buffer widths are to be established and equipment/operations are to be excluded from the area unless authorized for RHCA improvement. In unforeseen areas where skid trails, landings, or roads intersect and/or divert any natural drainage feature, the natural course of that drainage should be restored.

BMP 1.20 Erosion Control Structure Maintenance

Objective: To ensure that constructed erosion control structures are stabilized and working.

Implementation: Field review of necessary erosion control structures immediately after construction. Follow-up visits are to occur to ensure that the structures are functional over time.

BMP 1.21 Acceptance of Timber Sale Erosion Control Measures Before Sale Closure

Objective: To ensure the adequacy of required erosion control work on timber sale.

Implementation: The SA will inspect erosion control measures prior to accepting the unit. Coordination for routine inspections should be carried out in association with the Forest Soil Scientist.

BMP 1.25 Modification of the Timber Sale Contract

Objective: Modify the Timber Sale Contract if new circumstances or conditions indicate that the timber sale will damage soil, water, or watershed values.

Implementation: Once timber sales are sold, they are harvested as planned via the Timber Sale Contract. At times, however, it may be necessary to modify a Timber Sale Contract because of new concerns about the potential effects of land disturbance on the water resource. If new evidence raises serious concerns to the Forest Service Representative, an interdisciplinary team will be assigned to assess the evidence and implications. The team will report to the appropriate Line Officer on whether the timber sale as currently planned will (1) damage soil, water, or watershed conditions or (2) inadequately protect stream courses, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water quality, and/or blockages of watercourses. The interdisciplinary team will also make recommendations of mitigation and corrective actions. The environmental document prepared for the timber sale will then be amended to reflect the findings of the interdisciplinary team.

Road Building and Site Construction

BMP 2.1 General Guidelines for the Location and Design of Roads

Objective: To locate and design roads with minimal resource damage.

Implementation: Review by interdisciplinary team of proposed new road location and decommissioning of old road prism. Road design emphasizes drainage features that reduces maintenance cost and is in keeping with the crossing. Roads meet standards and guidelines for RHCAs and have been evaluated in the field.

BMP 2.2 Erosion Control Plan

Objective: To limit and mitigate erosion and sedimentation through effective planning prior to initiation of construction activities and through effective contract administration during construction.

Implementation: Work with Engineering on erosion control plan for site-specific work.

BMP 2.3 Timing of Construction Activities

Objective: Minimize erosion by conducting operations during minimal runoff periods.

Implementation: Minimize the erosive effects of water concentrated by road drainage features; disperse runoff from disturbances within the road clearing limits; lessen the sediment yield from roaded areas; minimize erosion of the road prism by runoff from road surfaces and from uphill areas.

BMP 2.7 Control of Road Drainage

Objective: Is to minimize the erosive effects of water concentrated by road drainage features; to disperse runoff from disturbances within the road clearing limits; to lessen the sediment yield from roaded areas; to minimize erosion of the road prism by runoff from road surfaces and from uphill areas.

Implementation: As a component of maintenance to avoid excessive erosion of the road surface, and subsequent delivery of sediment to drainage features.

BMP 2.9 Timely Erosion Control Measures on Incomplete Roads and stream Crossing Projects

If needed, apply this BMP to minimize erosion and sedimentation from disturbed ground if the project is not completed by the end of the normal operating season. Preventative measures include temporary culvert removal, removal of debris or obstructions from channel and floodplains, or planting vegetation or applying mulch.

BMP 2.12 Servicing and Refueling of Equipment

Objective: To prevent pollutants such as fuels, lubricants, bitumens and other harmful materials from being discharged into or near rivers, streams and impoundments, or into natural or man-made channels.

Implementation: Operators are required to remove all service residues, waste oil and other materials from National Forest land.

BMP 2.13 Control of Construction and Maintenance Activities Adjacent to SMZs

Objective: To protect water quality by controlling construction and maintenance actions within and adjacent to any streamside management zone so that RHCA functions are not impaired.

Implementation: Appropriate mitigation measures are incorporated into the project design and contract to ensure water quality objectives are achieved.

BMP 2.15 Diversion of Flows around Construction Sites

Objective: To ensure that all stream diversions are carefully planned, to minimize downstream sedimentation, and to restore stream channels to their natural grade, condition, and alignments as soon as possible.

Implementation: Project location, bypass design, and detailed mitigation will be developed in the design and planning process.

BMP 2.17 Bridge and Culvert Installation

Objective: To minimize sedimentation and turbidity resulting from excavation for in-channel structures.

Implementation: When improving drainage or upgrading roads as part of the proposed action follow guidelines for diversion of water and excavation of material and ensure that project design achieves RMOs.

BMP 2.19 Disposal of Right of Way and Roadside Debris

Objective: To ensure that organic debris generated during road construction is kept out of streams so that channels and downstream facilities are not obstructed. To ensure that debris dams are not formed which obstruct fish passage, or which could result in downstream damage from high water flow surges after dam failure.

Implementation: During construction of new roads ensure that material disposal sites are identified that meets other resource objectives including RMOs.

BMP 2.20 Specifying Riprap Composition

Objective: To minimize sediment production associated with the installation and utilization of riprap material.

Implementation: Riprap will be utilized in many of the road improvement projects. Ensure that it is appropriately sized and installed to resist erosive water velocities. Consult with Forest soil scientist/hydrologist.

BMP 2.21 Water Source Development Consistent with Water Quality Protection

Objective: To ensure that water source development does not lead to degradation of water quality.

Implementation: Two water sources have been identified to be updated for this project. Updating these water sources may include, but is not limited to sloping the approach ramp away from the stream and adding a sump to prevent hydrocarbon contamination of the stream.

BMP 2.22 Maintenance of Roads

Objective: To maintain roads in a manner which provides for water quality protection by minimizing rutting, failures, side casting, and blockage of drainage facilities all of which can cause erosion and sedimentation, and deteriorating watershed conditions.

Implementation: Work with the Transportation Planner to ensure roadwork is done in a manner that is consistent with RCOs.

BMP 2.24 Traffic Control during Wet Periods

Objective: To reduce road surface disturbance and rutting of roads. To minimize sediment washing from disturbed road surfaces.

Implementation: Control hauling activities when conditions exist that could create adverse effects to the road and local resources.

BMP 2.26 Obliteration or Decommissioning of Roads

Objective: To reduce sediment generated from temporary roads or unneeded system roads by obliterating or decommissioning them at the completion of the intended use.

Implementation: All temporary roads used in the project will be tilled and allowed to revegetate. Sideslopes will be reshaped and stabilized. Sale administrators will work with Forest hydrologist or soil scientist and transportation planner to ensure that roads are fully restored.

Vegetative Manipulation

BMP 5.1 Soil Disturbing Treatments on the Contour

Objective: To decrease sediment production and stream turbidity while mechanically treating slopes.

Implementation: During site preparation ensure that factors such as slope, infiltration rate, and water-holding capacity of the soil are evaluated prior to tilling skid trails or landings.

BMP 5.2 Slope Limitations for Mechanical Equipment Operation

Objective: To reduce gully and sheet erosion and associated sediment production by limiting tractor use.

Implementation: In higher slope areas, the project planner should ensure that tilling is done on the contour and that soil cover is approximately 50%. Include the soil scientist for questions and soil cover requirements on a site-specific basis.

BMP 5.3 Tractor Operation Limitation in Wetlands and Meadows

Objective: To limit turbidity and sediment production resulting from compaction, rutting, runoff concentration, and subsequent erosion by excluding the use of mechanical equipment in wetland and meadows except for the purpose of restoring wetland and meadow function.

Implementation: The application of this BMP will be mandatory on all vegetation manipulation projects as prescribed in the environmental document. Mitigation includes maintaining RHCA buffers and restricting mechanized equipment in these areas.

BMP 5.6 Soil Moisture Limitations for Mechanical Equipment Operations

Objective: The objective of this measure is to prevent compaction, rutting, and gullying, with resultant sediment production and turbidity.

Implementation: Ensure soil conditions are evaluated and soil moisture is low prior to the implementation of management activities.

BMP 5.7 Pesticide Use Planning Process

Objective: To introduce water quality and hydrologic considerations into the pesticide use planning process.

Implementation: The IDT will evaluate the project in terms of site response, social and environmental impacts and the intensity of monitoring needed.

The responsible line officer will prepare environmental documentation, Project Plan, and the Safety Plan. Project plans and safety plans will specify management direction.

Approval or for proposed pesticide projects will proceed according to direction established in region 5 supplement No. 2100-95-1 to 2150.

BMP 5.8 Pesticide Application According to Label Directions and Applicable Legal Requirements

Objective: To avoid water contamination by complying with all label instructions and restrictions for use.

Implementation: Constraints identified on the label and other legal requirements of application must be incorporated into project plans and contracts.

For force account projects, responsibility for ensuring that label directions and other applicable legal requirements are followed will be the responsibility of the Forest Service project supervisor who will have a Qualified Applicator Certificate.

For contracted projects, it will be the responsibility of the contracting officer, or the COR to ensure that label directions and other applicable legal requirements are followed.

BMP 5.9 Pesticide Application Monitoring and Evaluation

Objective: To determine whether pesticides have been applied safely, restricted to intended target areas, and have not resulted in unexpected non-target effects.

Implementation: The need for a monitoring plan will be identified during the pesticide use planning process as part of the project environmental evaluation and documentation.

The water quality monitoring plan will specify:

1) Who will be involved and their roles and responsibilities;

2) What parameters will be monitored and analyzed;

3) When and where monitoring will take place;

4) What methodologies will be used for sampling and analysis, and the rationale behind each of the preceding specifications.

A water quality specialist and the project leader will evaluate and interpret the water quality monitoring results in terms of compliance with and adequacy of project specifications.

BMP 5.10 Pesticide Spill Contingency Planning

Objective: To reduce contamination of water by accidental pesticide spills.

Implementation: Pesticide spill contingency planning will be incorporated into the Project Safety Plan.

The site-specific environmental evaluation and resulting documentation will include public and other agency involvement in plan preparation. The plan will list the responsible authorities.

BMP 5.11 Cleaning and Disposal of Pesticide Containers and Equipment

Objective: To prevent water contamination resulting from cleaning, or disposal of pesticide containers.

Implementation: The Forest, or district Pesticide Use Coordinator (Qualified Applicator) will approve proper rinsing procedures in accordance with State and local laws and regulations, and arrange for disposal of pesticide containers when the pesticide is applied by Forest Service personnel.

When the pesticide is applied by a contractor, the contractor will be responsible for proper container disposal in accordance with label directions and Federal, State, and local laws.

BMP 5.12 Streamside Wet Area Protection during Pesticide Spraying

Objective: To minimize the risk of pesticide inadvertently entering waters, or unintentionally altering the riparian area, SMZ, of wetland.

Implementation: The IDT will identify the perennial and intermittent surface waters, wetlands, riparian areas, and SMZ from onsite observation, and map them during project planning.

When included as part of the environmental evaluation and documentation, the Project Work Plan, the protection of surface waters, wetlands, riparian areas, or the SMZ will be the responsibility of the project supervisor for force account projects, and the COR will be responsible on contracted projects.

The certified applicators must be briefed about the location of surface waters, wetlands, riparian areas, or SMZ. Buffer strip boundaries will be flagged, or otherwise marked when necessary to aid identification from the air.

BMP 5.13 Controlling Pesticide Drift During Spray Application (practice 5.13)

Objective: To minimize the risk of pesticide falling directly into water, or non-target areas.

Implementation: The prescription will be prepared by an IDT working with the Forest or District Pesticide Use Coordinator during project planning.

For force account projects, the Forest Service project supervisor will be responsible for ensuring that the prescription is followed during application and for closing down application when specifications are exceeded.

These will also be the responsibility of the Contracting Officer, of the COR, on contracted projects.

Fire Suppression and Fuels Management

BMP 6.1 Fire and Fuel Management Activities

Objective: To reduce public and private losses and environmental impacts which result from wildfires and/or subsequent flooding and erosion by reducing or managing the frequency, intensity and extent of wildfire.

Implementation: Fuel treatments will be implemented on a project wide basis to reduce public and private losses and environmental impacts.

BMP 6.2 Consideration of Water Quality in Formulating Fire Prescriptions

Objective: To provide for water quality protection while achieving the management objectives through the use of prescribed fire.

Implementation: The fire prescription will include elements such as fire weather, slope, aspect, soil moisture, and fuel conditions. These elements influence the fire intensity and have a direct effect on whether or not a desired ground cover remains after burning, and a water-repellent layer is formed.

BMP 6.3 Protection of Water Quality from Prescribed Burning Effects

Objective: To maintain soil productivity, minimize erosion, and minimize ash, sediment, nutrients, and debris from entering water bodies.

Implementation: Fuel treatments will meet Riparian Conservation Objectives and minimize disturbance or riparian ground cover and vegetation. No ignition would occur within RHCAs unless otherwise prescribed for RHCA improvement. Fire would be allowed to back into the RHCAs to achieve low intensity burning. Fire lines would be roads, skid trails, natural barriers, hand lines or machine lines (ATV or tractor).

Watershed Management

BMP 7.1 Watershed Restoration

Objective: To repair degraded watershed condition and improve water quality and soil stability.

Implementation: Riparian improvement projects associated with road decommissioning and landing restoration. These activities will be monitored for effectiveness of treatment.

BMP 7.8 Cumulative Off-Site Watershed Effects

Objective: Protect the identified beneficial uses of water from the combined effects of multiple management activities, which individually may not create unacceptable effects but collectively may result in degraded water quality conditions.

Implementation: A site-specific cumulative watershed effects analysis was performed, including an assessment of the project area using the Equivalent Roaded Area (ERA) method. Conclusions based on this assessment are located in the Hydrologist’s specialist report as well as in the cumulative watershed effects section of the EIS.

Appendix D - Noxious Weed Risk Assessment

Introduction

A general Noxious Weed Risk Assessment (NWRA) has been completed for the three-Forest Herger-Feinstein Quincy Library Group (HFQLG) pilot project area. The North 49 NWRA for the Proposed Action (Alternative 1) was developed from the General Outline of a Risk Assessment contained in the HFQLG Final Environmental Impact Statement (FEIS), Appendix G, Table G-1, and is tiered to the general NWRA, Appendix G (1999). The general NWRA contains background information which applies to this North 49 NWRA. The General Outline of a Risk Assessment provided in the HFQLG FEIS, is a guide for evaluating risks and explains the components, variations and risks (high, moderate, and low), which make up this risk assessment.

Non-proposed Action Dependent Factors

1. Inventory:

The North 49 Project Area consists of over 42,000 acres. Noxious weed surveys were conducted in conjunction with rare plant surveys for this project in 2002, 2003, 2004, and 2007. In addition, all roads within the project area were surveyed by the forest weed crews for noxious weed species in 2003. The area has also been surveyed in the past during the course of other projects (Table 104).

Table 104. Previous project surveys conducted in the North 49 analysis area within the last 10 years

Project	Survey Date
North Battle	August-September 1998
Garden Thin TS	June & August 1998
North 49	July 2002, July 2003, July-August 2004, July 2007
Southbunch	July 2005

Although adequate surveys have been conducted in the analysis area, a complete inventory of the project area for noxious weeds has not been done. Time and personnel constraints have not allowed surveys of this intensity.

2. Known Noxious Weeds:

The California Department of Food and Agriculture's noxious weed list (http://pi.cdfa.gov/weedinfo/) divides noxious weeds into categories A, B, and C. A-listed weeds are those for which eradication or containment is required at the state or county level. With B-listed weeds eradication or containment is at the discretion of the County Agricultural Commissioner. C-listed weeds require eradication or containment only when found in a nursery or at the discretion of the County Agricultural Commissioner.

Table 105. Noxious weed occurrences within the North 49 DFPZ Project

Occ #	Species	Location	Size	Year Found	Treatment	Comments
2	Squarrose knapweed	Hwy 44/89 at LVNP boundary	1	1997	Pulled 1997; none seen in 2003/2005	Outside project
4	Squarrose knapweed	Hwy 44/89 near scenic overlook	25	1998	Pulled 1998 & 2000; none seen in 2003	Outside project
3	Scotch broom	Hwy 44/89 near Old Station P.O.	100	1997	Pulled in 2004; none seen 2005	Outside project, on private land
4	Scotch broom	Hwy 44/89 at LVNP boundary	Big patch	1998	None seen 2003 or 2005	Outside project
13	Scotch broom	Ashpan Snowmobile Park	1	2005	Dug in 2005	
11	Klamathweed	7 patches along Rd. 32N31	Many	1998	Most sites pulled 2004, 2005, 2006; 2007	
34	Klamathweed	Hwy 44/89 at LVNP boundary	655	2002	Most sites pulled in 2003 & 2007	At edge of project area
50	Klamathweed	E of Eskimo Hill snowmobile park	500+	2003	Pulled 2003, 2005, 2006, 2007	At edge of project area
51	Klamathweed	Snowpark	156	2003	Pulled 2003 & 2007	At edge of project area
53	Klamathweed	2 patches on Hwy 44 E of rd 32N17	42	2003	Pulled 2005, 2006, 2007	At edge of project area
54	Klamathweed	N. Battle Ck. Res.	35	2003	Pulled 2003, 2005, 2007	
79	Klamathweed	Road 32N18Y	1000s	2006	Pulled 2006 & 2007	
80	Klamathweed	Road 32N18Y	~200	2006	Pulled 2006 & 2007	
84	Klamathweed	E of junction Road 17 & Hwy 44	100	2006	Pulled 2006; none seen in 2007	At edge of project area

Three species of California Department of Food and Agriculture (CDFA) listed noxious weeds occur in or adjacent to the project area (Table 105). Among those three, squarrose knapweed (*Centaurea squarrosa*) is the only CDFA A-listed species and so is considered a high-priority weed for treatment, but it has been found only outside the project area and has not been seen in recent years. Two species from the CDFA C-list can also be found within or adjacent to the project area: Scotch broom (*Cytisus scoparius*) and Klamathweed (*Hypericum perforatum*). These weeds are lower priority for treatment on the Forest. Most of the known weed locations are currently undergoing treatment or are thought to be eradicated.

3. Habitat Vulnerability:

The North 49 Project is located within high elevation, westside vegetation types, which include manzanita/mountain mahogany brushfields, as well as dense mixed conifer stands with scattered fir and lodgepole stands. Due to the high canopy cover and precipitation associated with these vegetation types, habitats within the project area are not as susceptible to weed invasion as those habitats found within the dryer and/or lower elevation areas of the Forest. Disturbance from roads and past logging activity can dramatically increase the risk of weed invasion within the project area. Past and current disturbance can be found scattered throughout the analysis area, and several large plantations are present as well. Many of the known infestations are found along the southern boundary of the project area along Highway 44, either outside or on the edge to the project boundary. Currently the only species within the project area itself are of Klamathweed and Scotch broom, both low priority species for treatment. However, nearly all occurrences are restricted to roads within the project area. Thus, even with past and continuing impacts within the analysis area, the North 49 Project is relatively free of the many weed species and problems found in other areas of the forest, giving it a low risk for habitat vulnerability.

4. Non-project-dependent Vectors:

Livestock, vehicles, and road maintenance equipment are the most important non-project-dependent vectors for noxious weeds in the analysis area. There is currently only one active allotment within the project area consisting of 80 head of cattle (Range Report for the North 49 Project). Cattle could be potential vectors for noxious weed spread in the project area, though they are most likely not a large factor. In addition, traffic is typically light on the many roads, with the exception of the four main roads that traverse the project area, which include the 16 (33N16) and 32N24 roads, which run north-south, and the Bear Wallow (32N16) and North Battle Creek (32N31) roads, which run east-west. Road density in the project area is currently high and on all roads there is a potential for road maintenance to quickly spread noxious weeds along roadsides within the project boundary. Wildlife are also present in the analysis area and can serve as potential non-project vectors, posing an additional small risk for spreading of noxious weed infestations. Nearly all infestations within the project area are along Hwy 44 and other roads, so vehicles would pose the greatest risk for spread to other areas of the project. Thus, the potential risk of noxious weed invasion from non-project-dependent vectors appears moderate to high, due to the high volume of roads within the project area.

Proposed Action Dependent Factors

5. Habitat Alteration Expected as a Result of Project:

The North 49 Project analysis area consists of over 42,000 acres of public and private lands. The proposed action is to treat approximately 16,900 acres with a variety of activities which includes approximately 10,954 acres of thinning, 3,452 acres of plantation thinning and brush mastication followed by underburning treatments, 1,168 acres of group selection treatments, 38 acres of aspen enhancement and 1,288 acres of underburn only treatment activities. Road management activities for North 49 include approximately 21.1 miles of new system road construction, 0.5 miles of temporary road construction, and approximately 40.1 miles of system and non-system roads that would be decommissioned administratively or through

rehabilitation activities. All these activities will cause soil disturbance and the removal shade and duff during project implementation. Such actions provide the conditions for a high risk of noxious weed invasion.

DFPZ construction poses the highest risk, since work is done in the narrow corridor most likely to contain noxious weeds. Group selection and area treatment units will also receive moderate to high levels of disturbance, however, these treatment areas are not located along roads with known infestations of noxious weed species. Outside of treatment units within the project area, little habitat alteration would take place, and the potential risk of noxious weed invasion appears to be low. The large amount of road use and construction within the project area also adds to potential weed spread during project implementation activities. Overall, the potential risk of noxious weed invasion from project level habitat alteration appears to be high, due to the vast acreages that will be impacted by proposed activities and the large amount of road work which is needed to implement the proposed action.

6. Increased Vectors as a Result of Project Implementation:

The North 49 project proposes to add approximately 21.1 miles of existing non-system roads to the permanent road system, but only 2.2 miles will be open for public use following treatment activities. The remaining 18.9 miles will be open for administrative use only. However, approximately 0.5 miles of temporary roads would be constructed and then decommissioned after use. In addition, another 40.1 miles of existing system and non-system roads would be decommissioned after project activities, but of these only .8 miles will be removed from the landscape. The remaining 32.2 miles would be closed using other means and would not be open for use by the public or Forest Service personnel.

For the project, road maintenance activities will be needed on all roads required for use during implementation activities, prior to any decommissioning work, this activity can quickly spread noxious weeds along disturbed road corridors. Construction of temporary roads and increased traffic from workers during the project could potentially pose a moderate risk of noxious weed introduction, transport, and establishment, since such a large area is being affected and so many miles of roads will be impacted by the project. Overall, the potential risk posed by increased vectors appears high during project implementation, but decommissioning and road closure efforts required after project implementation should mitigate this in the long-term.

7. Integrated Design Features:

The following Integrated Design features (IDFs), implemented as part of the proposed action, will greatly reduce the risk factors described in this document.

a. All off-road equipment would be weed-free prior to entering the forest. Equipment would be staged in weed-free areas. Mulch or fill required for the project would be certified weed-free.

b. Known noxious weed infestations would be identified, flagged where possible, and mapped for this project. Identified sites within or adjacent to the project area containing isolated patches with small plant numbers would be treated (hand pulled or dug) prior to project implementation. This includes all known occurrences of Klamathweed and Scotch broom located within the project area. Occurrences of Scotch broom and squarrose knapweed found adjacent to the project area would be

surveyed prior to project implementation and treated if needed. Any larger or unpullable infestations would be avoided by harvesting equipment to prevent spreading weeds within the project.

c. New small infestations identified during project implementation would be evaluated and treated according to the species present and project constraints and avoided by project activities. If larger infestations are identified after implementation, they would be isolated and avoided by equipment, or equipment used would be washed after leaving the infested area and before entering an uninfested area.

d. Post-project monitoring for implementation and effectiveness of weed treatments and control of new infestations would be conducted as soon as possible and for a period of multiple years after completion of the project.

8. Anticipated Weed Response to Proposed Action:

Currently the North 49 Project has only one high-priority noxious weed species adjacent to the project area and only low priority species within the project area. The project involves the following moderate and high risk factors for noxious weed invasion: moderate to high risk from non-project-dependent vectors, high risk from habitat alteration, and moderate to high risk from increased vectors as a result of project implementation. However, the IDFs implementation as part of the Proposed Action, including ongoing treatment efforts, will greatly reduce the potential risk of noxious weed spread and invasion within the project area (Table B-3). Project-related vectors are addressed through the development and use of Integrated Design Features, while potential non-project-related vectors are not. Non-project vectors operate independently of the proposed action, and they pose a low to moderate potential risk of spreading weeds in the absence of the Proposed Action. With all the risk factors taken into consideration, including the incorporation of the Integrated Design Features into the Proposed Action, there is an overall low to moderate risk for increased noxious weed spread from the implementation of the North 49 Project (Table 106).

Table 106. Summary of risk factors for the North 49 Project

Factors	Risk
Non-proposed Action Dependent Factors	
Inventory	Adequate
Known noxious weeds	Low priority species present in the project area: prevention high priority
Habitat vulnerability	Low current vulnerability
Non-project-dependent vectors	Moderate to high current vulnerability
Proposed Action Dependent Factors	
Habitat alteration expected as a result of the project	High risk
Increased vectors as a result of project implementation	Moderate to High risk
Integrated Design Features	Reduced risk
Anticipated weed response to the Proposed Action	**Low to Moderate potential for weed spread**

9. Costs:

Noxious weeds significantly reduce the value of public lands. Timber production, grazing, wildlife habitat, and recreational opportunities are all negatively impacted by noxious weeds. Furthermore, noxious weed control is expensive and time consuming. Prevention and control of small infestations can reduce these impacts and reduce expenditures in the long run. Thus, noxious weed surveys, control of small infestations, and post-project monitoring are vital in reducing overall impacts and costs from noxious weeds.

Appendix E: Treatment Acres by Alternative

Alternative 1 - Treatment Acres

Feature	Treatments	Total
Area Thin	Broadcast Burn, Brushfields	91.16
	Release Thin, Plantations, Masticate, Machine Pile, Underburn	1,773.83
	Thin from Below, Machine Pile, Underburn	1,950.25
	Thin from Below, Modified Prescription, Machine Pile, Underburn	916.90
	Underburn	125.04
Total		**4,857.18**
DFPZ	Aspen Release	36.33
	Release Thin, Plantations, Masticate, Machine Pile, Underburn	1,208.82
	Thin from Below, Machine Pile, Underburn	7,368.73
	Thin from Below, Modified Prescription, Machine Pile, Underburn	204.18
	Underburn	724.47
Total		**9,542.53**
DFPZ/WUI	Broadcast Burn, Brushfields	133.42
	Release Thin, Plantations, Masticate, Machine Pile, Underburn	469.11
	Thin from Below, Machine Pile, Underburn	423.67
	Underburn	147.67
Total		**1,173.87**
WUI	Thin from Below, Machine Pile, Underburn	90.18
	Underburn	66.72
Total		**156.91**
Grand Total		**15,730.48**

Alt. 1 - Group Totals

Location	Type	Total
Area Thin	Cable	7
	Tractor	103
Total		**110**
DFPZ	Aspen	1
	Cable	4
	Helicopter	2
	Tractor	273
Total		**280**
DFPZ/WUI	Helicopter	1
	Tractor	25
Total		**26**
Matrix	Helicopter	41
	Tractor	124
Total		**165**
WUI	Cable	1
	Tractor	3
Total		**4**
Grand Total		**585**

Alt. 3 - Treatment Acres

Feature	Treatments	Total
Area Thin	Broadcast Burn, Brushfields	91.16
	Release Thin, Plantations, Masticate, Machine Pile, Underburn	1,773.83
	Thin from Below, Machine Pile, Underburn	989.85
	Thin from Below, Modified Prescription, Machine Pile, Underburn	1,877.25
	Underburn	125.06
Total		**4,857.14**
DFPZ	Aspen Release	36.33
	Release Thin, Plantations, Masticate, Machine Pile, Underburn	1,208.82
	Thin from Below, Machine Pile, Underburn	4,461.50
	Thin from Below, Modified Prescription, Machine Pile, Underburn	3,111.44
	Underburn	724.41
Total		**9,542.51**
DFPZ/WUI	Broadcast Burn, Brushfields	133.42
	Release Thin, Plantations, Masticate, Machine Pile, Underburn	469.11
	Thin from Below, Machine Pile, Underburn	423.72
	Underburn	147.73
Total		**1,173.97**
WUI	Thin from Below, Machine Pile, Underburn	90.18
	Underburn	66.71
Total		**156.89**
Grand Total		**15,730.52**

Alt. 3 - Group Totals

Location	type	Total
Area Thin	Cable	6
	Tractor	62
Total		**68**
DFPZ	Aspen	1
	Cable	4
	Helicopter	2
	Tractor	141
Total		**148**
DFPZ/WUI	Helicopter	1
	Tractor	25
Total		**26**
Matrix	Helicopter	41
	Tractor	54
Total		**95**
WUI	Cable	1
	Tractor	3
Total		**4**
Grand Total		**341**

Alt. 7 - Treatment Acres

Feature	Treatments	Total
Area Thin	Aspen Release	50.06
	Release Thin, Plantations, Masticate, Machine Pile, Underburn	1,826.45
	Structural Thin, Radial Thin, Machine Pile, Underburn	5,605.00
Total		**7,481.51**
DFPZ	Aspen Release	5.13
	Release Thin, Plantations, Masticate, Machine Pile, Underburn	1,274.17
	Thin from Below, Machine Pile, Underburn	4,091.36
	Underburn	956.58
Total		**6,327.23**
DFPZ/WUI	Broadcast Burn, Brushfields	130.49
	Release Thin, Plantations, Masticate, Machine Pile, Underburn	271.49
	Thin from Below, Machine Pile, Underburn	420.39
	Underburn	174.03
Total		**996.39**
WUI	Release Thin, Plantations, Masticate, Machine Pile, Underburn	219.31
	Thin from Below, Machine Pile, Underburn	90.20
Total		**309.52**
Grand Total		**15,114.65**

Alt. 7 - Group Totals

Location	type	Total
Area Thin	Cable	5
	Pine Restore	25
	Tractor	180
Total		**210**
DFPZ	Pine Restore	10
	Tractor	174
Total		**184**
DFPZ/WUI	Tractor	20
Total		**20**
Matrix	Tractor	72
Total		**72**
WUI	Tractor	3
Total		**3**
Grand Total		**489**

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