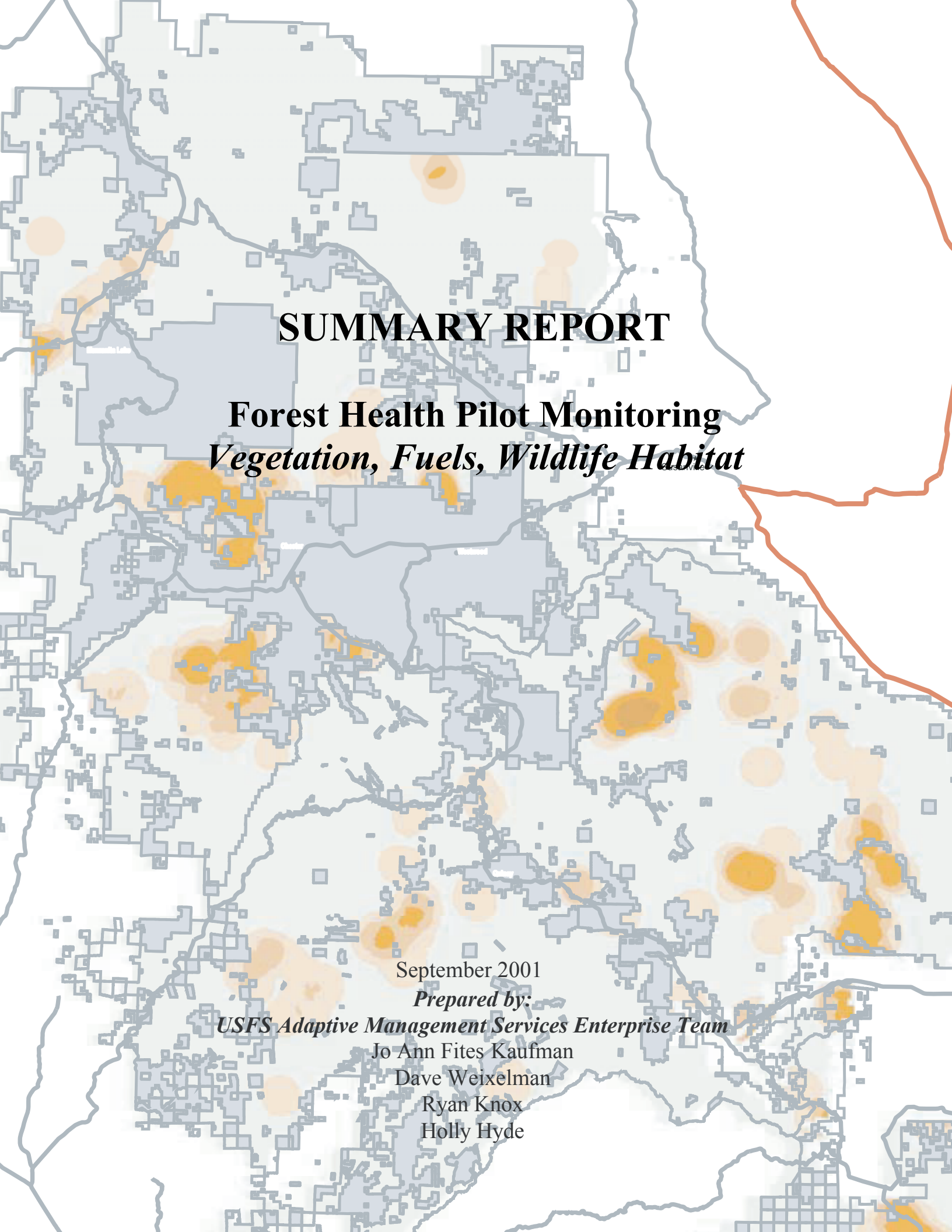


SUMMARY REPORT

Forest Health Pilot Monitoring
Vegetation, Fuels, Wildlife Habitat

September 2001

Prepared by:

USFS Adaptive Management Services Enterprise Team

Jo Ann Fites Kaufman

Dave Weixelman

Ryan Knox

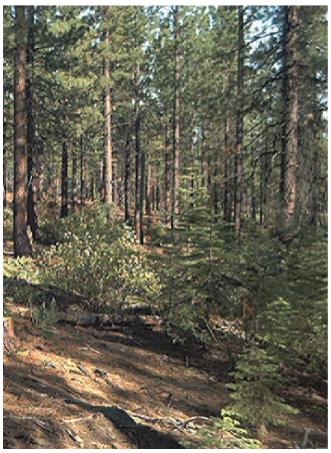
Holly Hyde

Preface

This document is a much abbreviated version of a longer report that is more than 130 pages. Both of these documents, digital photos and digital maps area also available in digital format on CD.

Summary Report

Forest Health Pilot Project Overview



eastside pine in fhp area

In 1997, The Plumas, Lassen, and Tahoe National Forests received funding for a Forest Health Pilot (FHP) project. This project included monitoring of forest health projects across the three forests (Figure 1). This report summarizes the vegetation, wildlife habitat and fuels portion of the Forest Health Pilot (FHP).

FHP projects have been designed to reduce risk of stand replacing fires, improve stand health, and improve riparian and aquatic condition on the Lassen and Plumas National Forests and the Sierraville Ranger District of the Tahoe National Forest. The projects involve a wide variety of treatments including: thinning, prescribed burning, biomass, thinning and burning, and sanitation or salvage. Some of the treatment units were specifically designed and implemented as part of a network of strategically placed defensible fuel profile zones (DFPZ's) (Olson et al. 1995). An important part of the overall project is monitoring the effectiveness and environmental effects of treatments.

Monitoring Approach

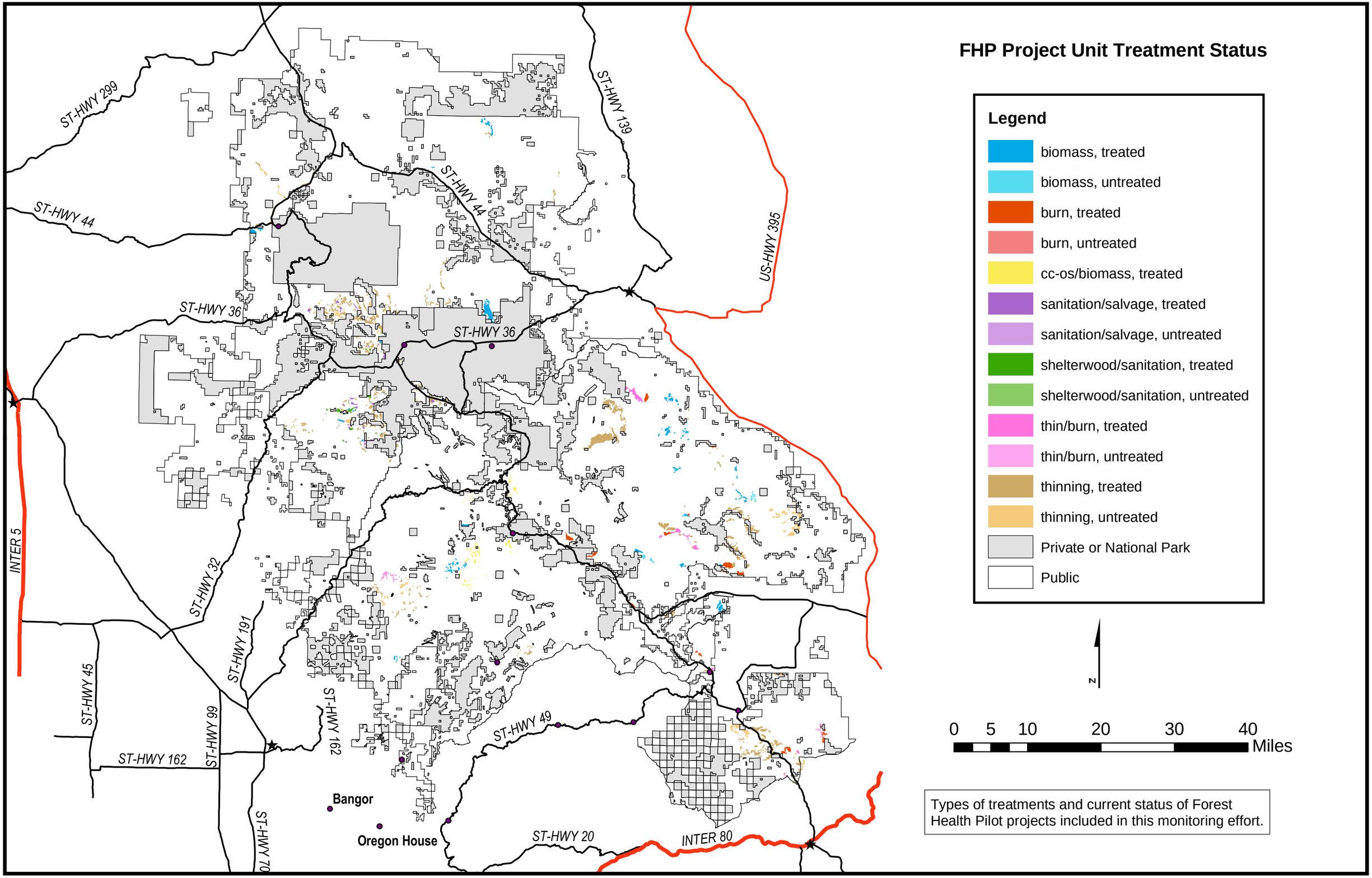
The overall FHP monitoring program was designed to answer three questions:

1) determine if projects were implemented as planned;
2) assess project effects on resources; and
3) assess project effectiveness.

The specific questions that relate to vegetation and fuels are:

1) what are the effect of treatments in modifying fire behavior?; and
2) what are the short-term differences between treated and untreated stands in terms of wildlife habitat, fuels, fire resiliency, and forest composition and structure?

Our approach to addressing these questions was to use a spatially based, statistical design. This allowed us to answer questions at both site and landscape scales. This is important with fire/fuels and wildlife habitat monitoring because ultimately the most important questions apply to the landscape scale. For example, in addressing the potential effects on California spotted owl habitat, the changes in individual treatment units are of less interest and importance than the cumulative effects within an individual homerange or across all homeranges. Similarly, for fuel


FHP Project Unit Treatment Status
Legend
biomass, treated
biomass, untreated
burn, treated
burn, untreated
cc-os/biomass, treated
sanitation/salvage, treated
sanitation/salvage, untreated
shelterwood/sanitation, treated
shelterwood/sanitation, untreated
thin/burn, treated
thin/burn, untreated
thinning, treated
thinning, untreated
Private or National Park
Public
N
0 5 10 20 30 40
Miles
Types of treatments and current status of Forest Health Pilot projects included in this monitoring effort.
ST-HWY 299
ST-HWY 44
ST-HWY 139
US-HWY 395
ST-HWY 36
INTER 5
ST-HWY 32
ST-HWY 191
ST-HWY 45
ST-HWY 99
ST-HWY 162
ST-HWY 70
Bangor
Oregon House
ST-HWY 49
ST-HWY 20
INTER 80

hazard and fire behavior, the effects of treatments on fuels and potential fire behavior in individual treatments is less important than the cumulative effects of those treatments because wildfires affect areas encompassing large areas. In order to do this, we developed a database and GIS map layer of all of the projects and their individual treatment units.

Conceptual Model

The importance of underlying conceptual models in the scientific credibility of monitoring programs has been highlighted recently. In short, the conceptual models are meant to provide a summary of the way we think a particular ecosystem of interest works and how resource management or other changes (such as climate change) might influence the ecosystem components and how they are arranged and operate. This facilitates the selection of meaningful monitoring indicators, most important to ecosystem function, resource management and likely to change. For this monitoring effort, we relied upon two existing conceptual models. The conceptual models from the Tri-Forest Assessment (Fites et al. 1996) and SPAM (Manley et al.2000) as well as the key questions listed above were used to select which indicators to monitor. Forest Health is a broad concept. For purposes of this pilot, we focused on fuels/potential fire behavior and wildlife habitat as two key components of forest health.

Indicators

There is overlap in the measures used for indicators to address fire, wildlife habitat, and forest health questions (Table 1).

Table 1. Specific measures and indicators.

		Process/Question	
Indicator	Measure	Fuels/Fire Behavior	Wildlife Habitat
Fuels	Ground fuel loading	x	
	Surface fuel loading	x	
	Fuelbed depth (feet)	x	
Forest Structure	% cover	x	
	Crown bulk density	x	
	Crown base height (ft)	x	
	Quadratic mean diameter		x
	Tree density by dbh class		x
	Snag density	x	x
	Understory cover	x	x
	Shrub cover	x	x
	California Wildlife Habitat Relations Type		x
Potential Fire Behavior	Predicted Flamelength	x	
	Predicted fire type	x	

eastside pine-unit planned for biomass treatment

This report contains the initial results of monitoring pre- and post-treatment vegetation conditions across the FHP area. The projects have only been implemented in the last several years. Therefore, most of the post-treatment results were obtained 1 to 2 years following treatment. Vegetation is continually changing, and therefore, these results may not reflect the full scope of effects that may occur in a longer time frame. The monitoring plan included plans for repeat measurements at the same site at 5-year intervals.

The vegetation portion of the monitoring pilot focused on a statistical sample design to evaluate differences between various treatments and between treated and untreated sites. Ideally, the design would focus on measurements before and after treatment over time in the same location to reduce variation in responses due to differences between individual sites. However, some of the sites had already been treated prior to instigation of the monitoring pilot. Therefore, in addition to measuring some sites before treatment with plans to follow-up after treatment, we also designed the sample scheme to allow comparisons between treated and untreated sites (referred to hereafter as reference sites). Because we were unable to do a direct comparison of effects of treatments on an individual site, we also tested the assumption that sites selected for different treatments (e.g., thinning vs. burning) may have been different before treatment. This assumption was tested by statistical comparison of untreated sites of different planned treatments.

Projects, Treatments and Current Status

eastside pine-unit treated with thinning and burning

The FHP projects include 45,791 acres of treatment, of which 93% have been completely or partially treated. This includes 85 projects with a total of 993 individual treatment units in them. Most of the units have been mechanically treated to date.

Although most of the treatments are mechanical thinning or biomass (93% of project acres), follow-up surface fuel treatments such as burning or mechanical piling are planned in many of these, but most have not been completed at the date of this report (6% of mechanically treated acres to date). Therefore, many of the thinned units could be considered partially treated thin and burn units but could not readily be analyzed as a third level of treatment status.

Table 5. Summary of forest health pilot projects as of May 2001.

primary treatment	status	all acres	%	2nd treatment (in Acres) unknown	burn	pile & burn	machine pile & burn	roadside pile & burn	wildfire	all second treatments	% 2nd treatment
burn	planned	44	1%	44							
	treated	3068	99%	3068							
	partially treated	0	0%	0							
	total	3112		3112							
biomass	planned	14	0.2%	14							
	treated	7034	93%	4615	230	127	958	1104		2419	34%
	partially treated	516	7%	516							
	total	7564		5145							
cc or overstory removal then biomass	planned	0	0%	0							
	treated	623	100%	317	179	127				306	49%
	partially treated	0	0%	0							
	total	623		317							
thin	planned	813	3%	813							
	treated	27499	84%	18714	2519	938	170	5115	43	8785	32%
	partially treated	4108	13%	4108							
	total	32420		23635							
sanitation/ salvage	planned	250	19%	250							
	treated	1037	81%	392				645		645	62%
	partially treated	0	0%	0							
	total	1287		642							
shelterwood/ sanitation	planned	18	3%	18							
	treated	670	97%	491				179		179	27%
	partially treated	0	0%	0							
	total	688		509							
all mechanical treatments	planned	1095	3%	1095							
	treated	36863	86%	24529	2928	1192	1128	7043	43	12334	33%
	partially treated	4624	11%	4624							
	total	42582		30248							

Vegetation Structure and Habitat

Most sampled sites had mean stand diameters between 12 and 20” dbh, falling into the CWHR size class 4, medium trees. Mixed conifer stands generally had higher mean stand diameters, ranging mostly from 12-22”, but with several sites exceeding 24”. Treated sites either had similar or increased diameters to untreated sites.

Most of the sampled sites fell into the medium tree CWHR habitat types, with the majority of acres (>5,000) in the 4M and 4P types (Figure 2). A little over 1300 acres of sampled stands planned for treatment fell into the denser CHWR habitat types of 4D or 6.

Mixed conifer

Canopy cover was generally higher in mixed conifer sites than eastside pine, exceeding 40% on most sampled sites. Reference sites were mostly greater than 60% canopy cover. Burned sites, sampled either before or after treatment mostly had canopy cover lower than 40%, indicating that sites may be partly selected for burning based upon lower canopy cover.

Eastside Pine

Overstory tree canopy cover mostly ranged from 20 to 60% across all treatments and treatment status, except for reference sites. Reference sites had higher canopy cover, ranging up to 90% cover. Reference sites were selected from those sites with >40% cover, which likely contributed to the higher levels sampled.

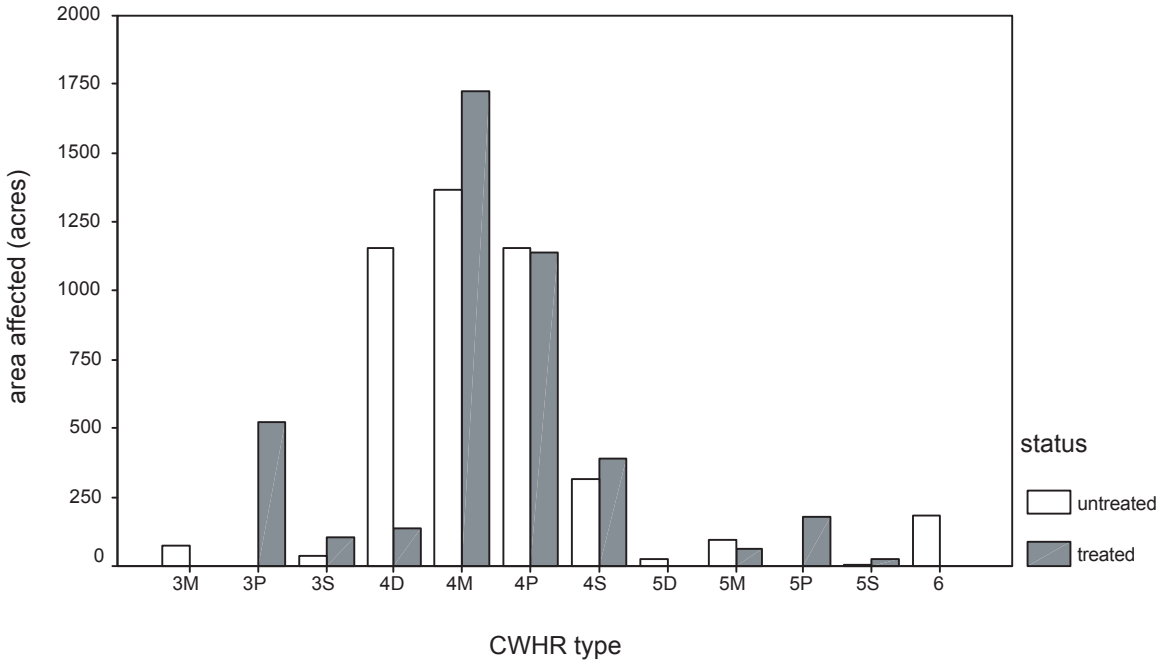


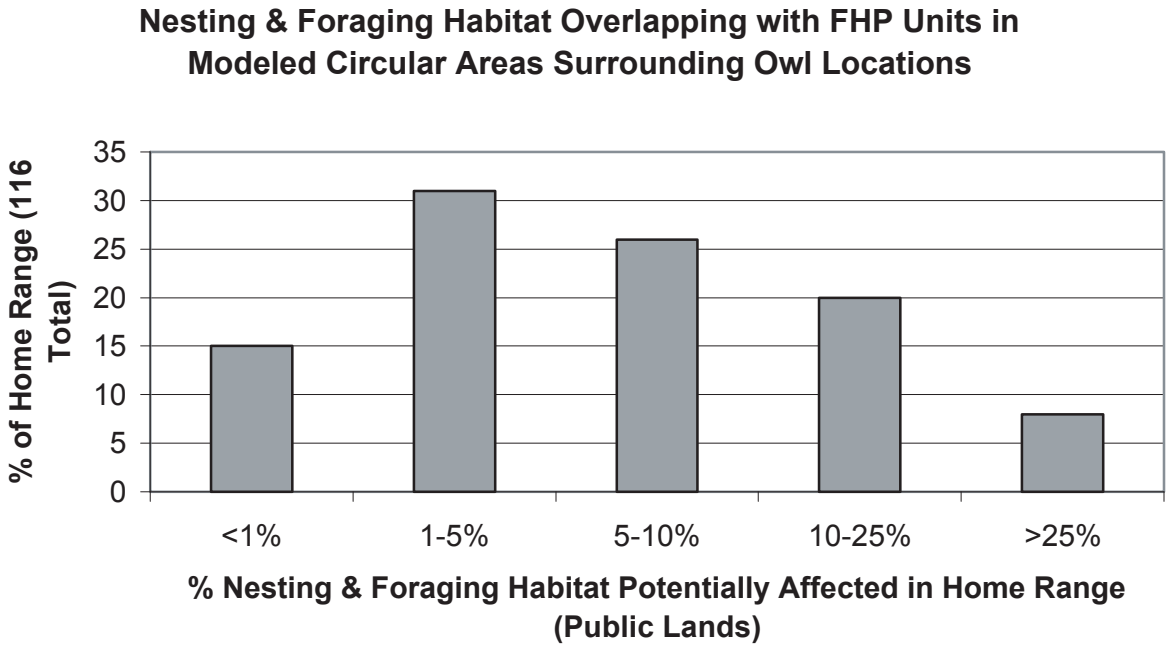
Figure 2. CWHR habitat types **within sampled** FHP treated areas, based upon FHP monitoring plot data.

Spotted Owls

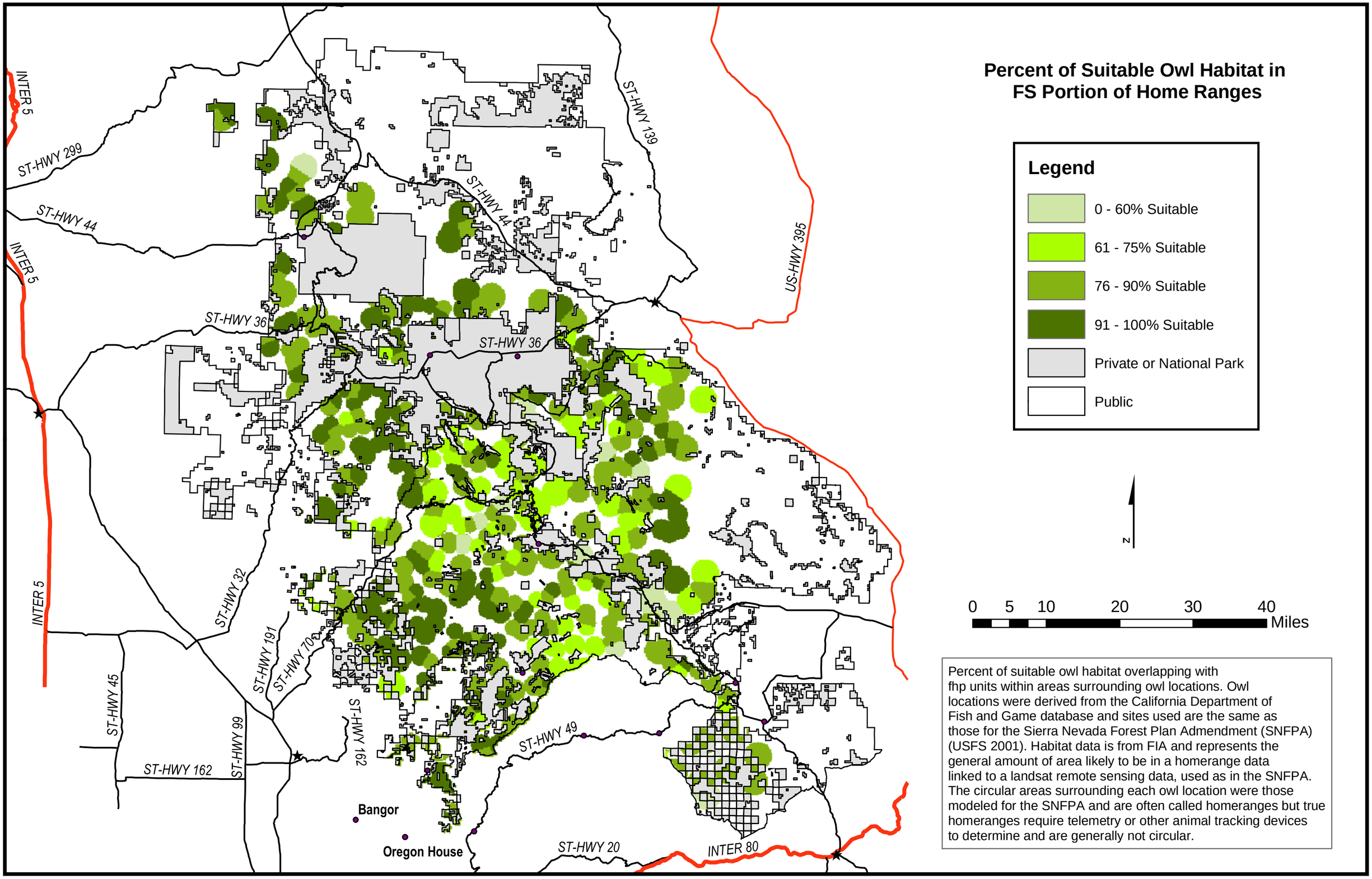
One hundred and ten of the 443 modeled homeranges (25%) in the FHP monitoring area overlapped with at least 1 acre of an FHP treatment unit.

The majority (65%) of homeranges with overlapping nesting habitat and FHP units had 5% or less of the total estimated nesting habitat that occurred within FHP units. Twenty percent of the homeranges had more than 10% of the suitable nesting habitat overlap with the FHP units.

It is unknown how these treatments might affect use or demography of the California spotted owl (USDA FS 2001).



Proportion of nesting habitat in owl homeranges (non-overlapping, variable size from SNCF draft EIS) overlapping with FHP project units. Nesting habitat is based upon vegetation data used in SNCF EIS and HFQLG EIS (forest inventory data [FIA] linked to remotely sensed vegetation polygons [RSL]).



Percent of suitable owl habitat overlapping with fhp units within areas surrounding owl locations. Owl locations were derived from the California Department of Fish and Game database and sites used are the same as those for the Sierra Nevada Forest Plan Admendment (SNFPA) (USFS 2001). Habitat data is from FIA and represents the general amount of area likely to be in a homerange data linked to a landsat remote sensing data, used as in the SNFPA. The circular areas surrounding each owl location were those modeled for the SNFPA and are often called homeranges but true homeranges require telemetry or other animal tracking devices to determine and are generally not circular.

Fuels and Predicted Fire Behavior

Reference site-eastside pint

Reference site-mixed conifer

Sites selected for burning treatments generally had lower canopy covers, tree densities and crown bulk densities than those selected for biomass or thinning treatments. Sites selected for biomass treatments generally had the highest canopy cover, or tree density and crown bulk density of all treatment categories.

Some of the sites selected for thinning had high surface fuel loading and canopy densities prior to the treatment.

Predicted fire type is primarily a function of the predicted flamelengths and the height to live crown. Both passive and active crown fire types will result in high mortality levels. The surface fire type can also result in high mortality levels if there are heavy large fuels (>3”), deep duff accumulations, and/ or younger trees or tree species with less resistance to fire. These two fuel elements are not part of the fire behavior models but can produce high heat or a long duration of heat that can result in high plant tissue death.

Eastside Pine The passive crown fires were the most commonly predicted fire type in the eastside pine sample sites (Figure 3). Treated biomass units and units where burning is planned had the greatest proportion of predicted surface fire. As described previously, the sites selected for prescribed burning alone often have lower fuel levels and less dense vegetation that is more conducive to implementation of prescribed burning with low likelihood of escapes and minimizing levels of mortality.

Mixed Conifer A higher proportion of the sampled sites in mixed conifer were predicted to have active crown fire or either kind of crown fire than in the eastside pine sites (Figure 4). This is due to the overall higher productivity of the mixed conifer zone and the resulting higher fuel loadings and denser vegetation described in previous sections. The sites treated with either burning or a combination of heavy previous overstory removal and recent biomass treatments had the greatest proportion of sites with predicted surface fire types. While there were some lower levels of active crown fire in thin sites sampled after treatment compared to those sampled before treatment, the overall levels of crown fire remained similar. As mentioned several times previously, many of these sites have planned second treatments of burning and this will likely result in more substantial reduction in the proportion predicted to have crown fires.

Figure 3. Predicted fire type in sampled FHP treatment units in the eastside zone. Predictions were developed using FlamMap under high (93rd percentile) weather conditions.

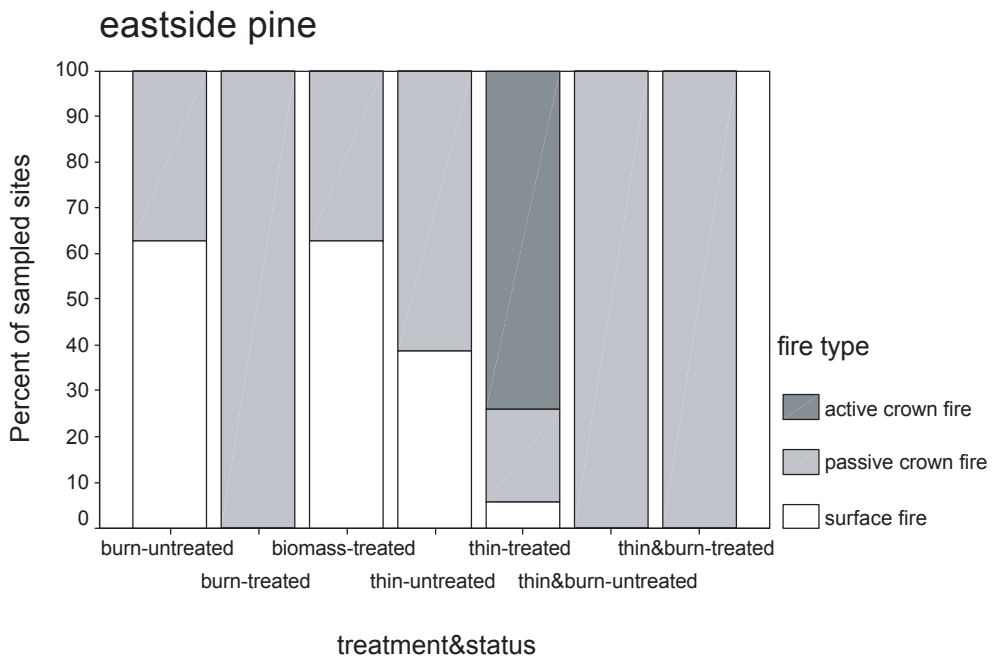
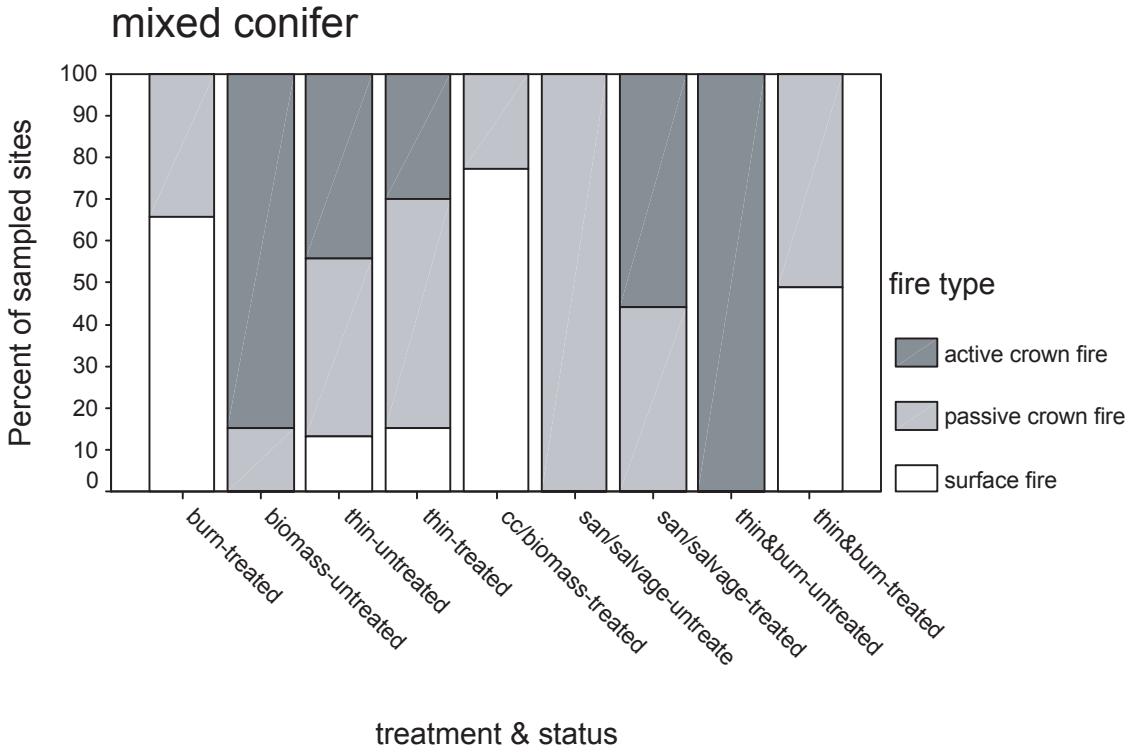


Figure 4. Predicted fire type in sampled FHP treatment units in the mixed conifer zone. Predictions were developed using FlamMap under high (93rd percentile) weather conditions.



Adaptive Management Implications

Achievement of Fuels Objectives

eastside pine, prescribed burn treatment unit

mixed conifer-thin treatment unit, includes heavy fuels prior to treatment

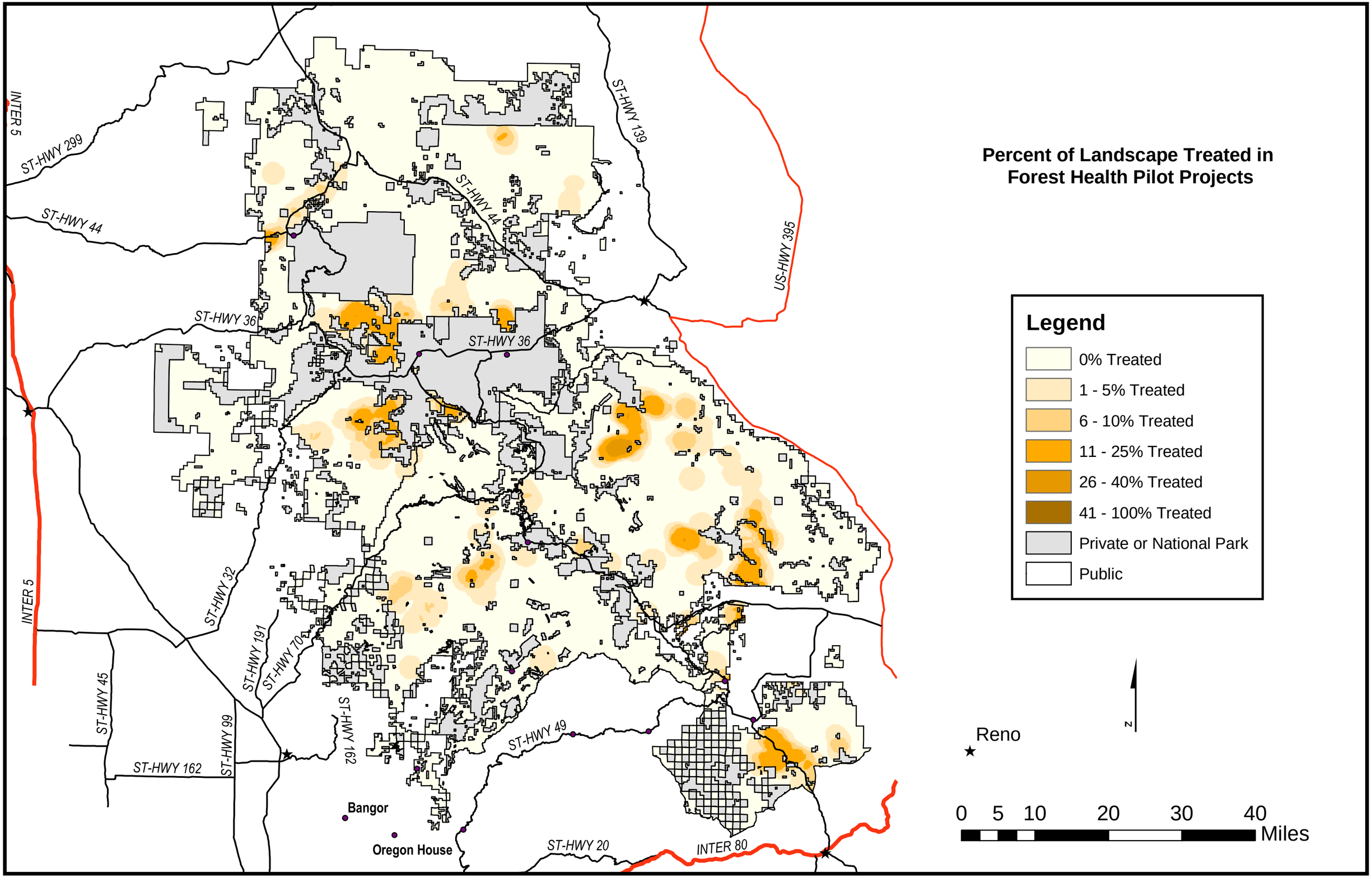
Eastside Pine Many of the treated sites had predicted flamelengths less than 4 feet under high weather conditions, which is the current threshold for HFQLG and SNCF EIS fuel treatment areas. Heights to live crowns were lower than current thresholds and as a result, predicted fire type tended to be crown rather than surface. Flamelengths may be underestimated because we used a constant set of weather and fuel moisture conditions across the entire FHP area to enable consistent and comparable estimates across all forest types. Fuel conditions in the eastside are always drier.

Westside Mixed Conifer Flamelengths generally exceeded current fuel treatment standards and heights to live crowns were much lower, even in most treated stands, than current requirements. As a result, most of the predicted fire types were crown.

Units that had burning as a primary or secondary treatment had the most desirable levels of surface fuel conditions and low flamelengths. Second surface fuel treatments following initial mechanical fuel treatments would best achieve current desired fuel conditions. Many of these sites have planned second treatments of burning and this will likely result in more substantial reduction in the proportion predicted to have crown fires.

Heights to live crowns were consistently highest in units treated with biomass. Some of the thinned units and some of the burned units had higher heights to live crowns but it was inconsistent.

Only a small proportion of the landscape (an estimated 10% or less) has had enough FHP treatments planned or implemented to be effective at the landscape scale (Figure 5). This estimate is most likely an underestimate, since only FHP projects were included. On two districts the FHP units comprised 60% of the total treated acres in a 10-year time frame. However, it is unknown whether these other acres were treated with fuels objectives in mind or not. It is clear that in order for these treatments to be effective at the landscape scale that the second surface fuel treatments are required.


Percent of Landscape Treated in
Forest Health Pilot Projects
Legend
0% Treated
1 - 5% Treated
6 - 10% Treated
11 - 25% Treated
26 - 40% Treated
41 - 100% Treated
Private or National Park
Public
INTER 5
ST-HWY 299
ST-HWY 44
ST-HWY 139
US-HWY 395
ST-HWY 36
ST-HWY 32
ST-HWY 191
ST-HWY 70
ST-HWY 45
ST-HWY 99
ST-HWY 162
ST-HWY 49
ST-HWY 20
INTER 80
Bangor
Oregon House
Reno
N
0 5 10 20 30 40
Miles

Environmental Effects

Few if any conclusions can be drawn about the environmental effects to the California spotted owl or its habitat because there are so many scientific uncertainties regarding habitat relations and effects of treatment activities on habitat or owls directly.

Cost, Effort and Time-Future Monitoring Recommendations

Costs This monitoring pilot cost an estimated $950,000. The majority of the money was spent on the vegetation/fuels/wildlife habitat portions. Less than $250,000 was spent on the actual field sampling for the forest health pilot. At least half of the total amount was spent on tracking the projects, data analysis and compilation of the preliminary and final reports. We estimate that at least 2/3 of the money spent on these latter three tasks was due to difficulty tracking projects accurately and in selecting an appropriate statistical analysis approach.

Value-Improved Monitoring, NEPA Modeling and Assessment While the cost and time undertaken to complete this pilot are high, the value of the results and insight gained for future monitoring are great. This is the most comprehensive set of quantitative fuels treatment condition data that has ever been collected and compiled. It has already been applied to design of fuels monitoring for Region-wide and Sierra Nevada efforts. The data were used for analysis of sampling statistics necessary to determine the sampling intensity necessary to detect changes in fuels from treatments Sierra Nevada-wide. The canopy cover data is currently being analyzed in relation to currently used canopy projections derived from tree inventory data to test applied in the SNCF and HFQLG EIS's and to calibrate these projections for future modeling efforts. We have used this pilot as a key example to WO staff that are involved in design of fuel business tool design and National Fire Plan database improvements.

Value-Public Credibility This monitoring pilot demonstrates the commitment of the Forest Service to support of quantitative and scientifically credible monitoring. Additional public credibility has been gained through this effort that is difficult to put a value on. Late this summer, a presentation was made on the final results of the monitoring pilot to the public. In attendance were representatives of the Quincy Library Group, local and national environmental groups, and the California Timber Association. All of these different groups applauded and were in support of this pilot effort.