Prescribed Fire & Fuel Treatment Effectiveness & Effects

Monitoring Program

Fuels, Vegetation, and Wildlife Habitat

Fire and Aviation Management

USDA Forest Service, Pacific Southwest Region

Volume II: 2003 Detailed Report

Prepared by:

USFS Adaptive Management Services Enterprise Team

Wildland Fire Specialists

Jo Ann Fites-Kaufman

Erin Noonan

Scott Dailey

Marian Kadota

Carol Ewell

Crystal Kolden

Nicole Vaillant

Detailed 2003 Prescribed Fire & Fuel Treatment Effectiveness Monitoring Report

Adaptive Management Services Enterprise Team

CONTENTS

List of Tables

List of Figures

I. INTRODUCTION

In 2001, Fire and Aviation Management of the Pacific Southwest Region of the USDA Forest Service (Forest Service) commenced a fire effects and fuel treatment monitoring program. The primary purposes of the monitoring were to quantify and evaluate the effectiveness of projects in meeting fire effects and fuel objectives to vegetation and wildlife habitat. This is an identified part of the National Fire Plan. A secondary purpose was to coordinate monitoring across other agencies in California already conducting similar monitoring, including the National Park Service (Park Service) and California Department of State Parks and Recreation.

An initial goal was to conduct a several year project to gain information on the feasibility, costs, advantages, and disadvantages of conducting monitoring across the entire Region (discussed in Chapter IV of this document). The project/program was modeled after the National Park Service fire effects monitoring program because this is a well established program and the Forest Service would like to coordinate and share data with other land management agencies (with little need to modify the database). The focus of the program is on vegetation structure and composition for evaluation of changes in dead and live fuels, soil cover and surface organic matter, plant species composition, and wildlife habitat.

This annual report contains a summary of the objectives, design, protocol, results to date (2001-2003), and preliminary adaptive management implications. The design is based upon collection of data before and after prescribed fire or mechanical application treatments.

Objectives

The objectives of the regional fire monitoring program include:

1) commencement of interagency coordination on fire effects and fuel treatment effectiveness monitoring;
2) collection of baseline information on prescribed fire and mechanical fuel treatment effects on fuels, wildlife habitat and vegetation composition and structure, and effectiveness of treatments in achieving fuel objectives for application in future fire use planning;
3) evaluation and comparison of different surface fuel loading sampling methods to ensure applicability to fire behavior modeling;
4) establishment of estimates on the cost and effort to derive results with different levels of statistical confidence; and,
5) evaluation of the feasibility and utility of pooling data across the region.

Products

Information on the prescribed fire and fuel treatment monitoring program is presented in two written volumes and a website (under development). The digital media (website) will contains photographs, individual plot data and interactive maps. Volume I represents an overview of the design and a summary of results. This document represents a detailed report (Volume II) and includes the overall design (Chapter II) and protocol description (Appendix A), preliminary

results and work accomplished in 2001-2003 (Chapter III), and adaptive management implications including statistical results tables (Chapter IV).

At this time, there is not enough post treatment data to come to statistical conclusions to address all the objectives for this annual report. With additional post treatment data being collected this year, next year's report will better address the goals and objectives of this project/program, including more detailed analysis and provide more substantial implications for adaptive management. Due to limited post fuel treatment data and available budget, the focus of this year's report is on fuels. Subsequent reports will include more comprehensive analysis of overall vegetation structure and composition and wildlife habitat. Chapter III, of this report, provides preliminary results of all projects to date. Chapter IV addresses adaptive management implications based on the findings.

II. OVERALL DESIGN: SELECTION OF SITES & RESPONSE VARIABLES

The goal is to conduct monitoring on one prescribed fire or other fuel treatment projects prior to treatment on all National Forests throughout the Region. A long-term goal is to monitor post treatment conditions at 1, 2, 5, 10 and 20-year intervals. The Forests were asked to provide one or several candidate projects that would be treated in the current or following year. The Regional Office requested projects have an initial focus on prescribed burning; vegetation types or locations that are the highest priority for treatment in that bioregion; and, that would be the most consistent for use in sampling statistics calculations. Project area locations included mixed conifer, Douglas-fir and pine dominated forests and chaparral in southern California forests. More recently, there has been an emphasis on evaluation of fuel treatment effectiveness for all types of fuel treatments, including mechanical. Mastication has been a particular recent emphasis since it is an increasingly used method in the wildland urban interface, yet little is known about effects or fire behavior implications. The intent was to track responses by major vegetation types rather than individual projects. This was the most cost effective way to collect enough data to assess effects of treatments in a short time frame.

Initially, a minimum of three plots were randomly placed within each project unit selected. A sample size of three replicates was chosen for the fuels treatment monitoring program because it provides the minimum needed to compute statistics for a project. In 2003, the protocol was modified to collect surface fuels data across six plots, instead of three, to better represent variability within units. Data are summarized by dominant vegetation type. Future analysis will summarize data by dominant vegetation and treatment types (i.e., prescribed fire, mechanical).

Response Variables

All aspects of vegetation, excluding non-vascular plants (e.g., lichens and mosses) were monitored; including, fuel configuration and amount, vegetation density, size, cover, and species composition (Table 1). Based upon key management issues, additional measurements (from the National Park Service protocol) were included (e.g. tree canopy cover).

Table 1 - *Monitoring Response Variables*

		Resource Addressed			
Response Variable	**Measure**	**Fuels**	**Wildlife Habitat**	**Soil Quality Standards**	**Plant Species and Community Response**
ground and surface fuels	tons/acre by size & depth	**x**	**x**	**x**	
herbs and grasses	cover by species	**x**	**x**		**x**
shrubs	cover, height, and % dead by species	**x**	**x**		**x**
	stem density & size (chaparral only)	**x**			**x**
tree density, size and crown bulk density	density by dbh and species	**x**	**x**		**x**
	height to live crown and crown height	**x**	**x**		
	overstory tree cover	**x**	**x**		
	snag density, dbh	**x**	**x**		
predicted fire behavior	flame length	**x**			
	rate of spread	**x**			
	fire type	**x**			

III. PRELIMINARY RESULTS & WORK ACCOMPLISHED IN 2001-2003

Work Accomplished

A total of 36 projects have been sampled, to date, across 17 National Forests, including 129 pre-treatment monitoring plots and 28 post-treatment plots. Table 2 summarizes the projects studied from 2001-2003. Nearly all projects were in vegetation or fuel types that are National Fire Plan priorities. They represent lower elevation vegetation found in wildland urban interfaces. Yellow pine (ponderosa, Jeffrey and Coulter pine), Douglas-fir/white fir, chaparral/mixed forest chaparral, and ponderosa pine/white fir vegetation types have more than one project represented. Figure 1 shows the graphical percentage of projects by each dominant vegetation type addressed in this report. Table 2 further describes the dominant vegetation types and the majority of tree species (vegetation sub-type) that compose each type per project. This means that statistical analysis will be possible representing broad trends in the region by vegetation/fuel type for those vegetation types with enough post fuel treatment data. Projects are not referred to by name because sample design was not developed to assess individual projects.

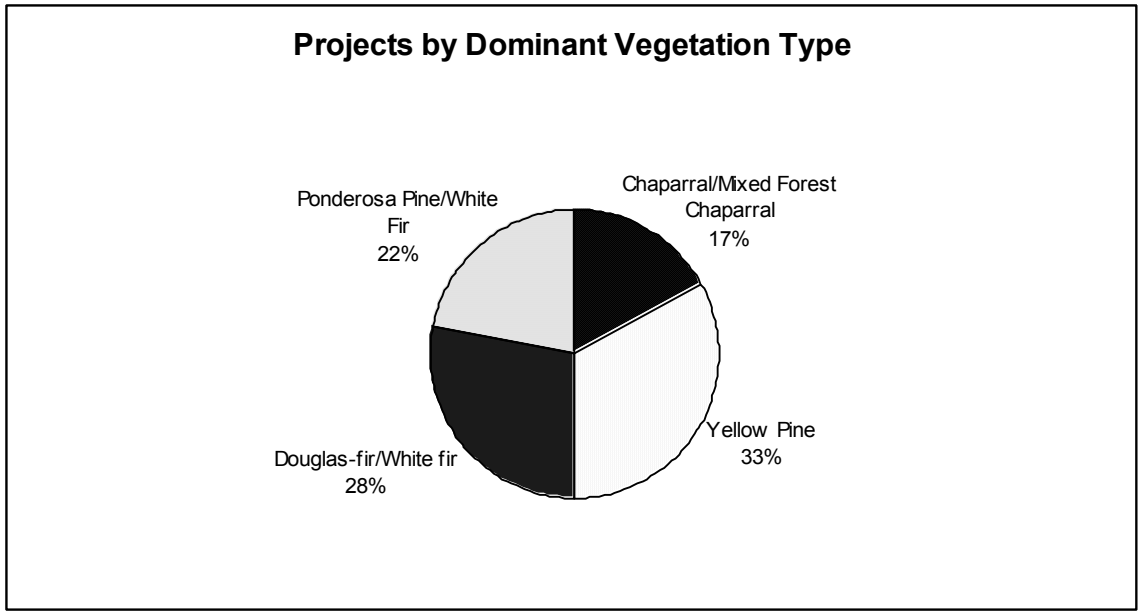


Figure 1 - The percentage of projects (from 2001-2003) by dominant vegetation type addressed in this report.

Table 2 - *Summary and Status of Prescribed Fire Monitoring Projects from 2001-2003.*

Forest	Project Name	Establishment Year	Treatment Type	Dominant Vegetation Type	Vegetation Sub-Type	Status as of 2003
Angeles	Angeles-02 post1	2002	wildfire	chaparral	chaparral	1st year re-measure
Cleveland	Cleveland-01a	2001	prescribed burn	chaparral	chaparral	Pre-treatment
Cleveland	Cleveland-01b*	2001	Prescribed burn	Oak Woodland	Coastal Sage/Riparian Oak	Pre-treatment
Eldorado	Eldorado-02	2002	prescribed burn	Douglas-fir/white fir	Douglas-fir-Black Oak	Pre-treatment
Eldorado	Eldorado-03	2003	mechanical	Ponderosa pine/white fir	Ponderosa Pine - White fir	Pre-treatment
Eldorado	Eldorado-01	2001	prescribed burn	Douglas-fir/white fir	White Fir - Mixed Conifer	Pre-treatment
Inyo	Inyo-02	2002	prescribed burn	Yellow Pine	Jeffrey pine	Pre-treatment
Inyo	Inyo-03*	2003	mechanical	Red fir/Jeffrey Pine	Red fir - Jeffrey Pine	Pre-treatment
Klamath	Klamath-01	2001	prescribed burn	Douglas-fir/white fir	Douglas Fir-Canyon Live Oak	Pre-treatment
Klamath	Klamath-02 post1	2002	prescribed burn	Ponderosa pine/white fir	Ponderosa Pine - White fir	1st year re-measure
Lassen	Lassen-02	2002	prescribed burn	Ponderosa pine/white fir	Ponderosa Pine - White fir	Pre-treatment
Lassen	Lassen-01 post2	2001	prescribed burn	Yellow Pine	Ponderosa Pine-Black Oak	2nd year re-measure
Los Padres	Los Padres-01	2001	prescribed burn	chaparral	Big Pod Ceanothus Chaparral	Pre-treatment
Los Padres	Los Padres-03	2003	prescribed burn	chaparral	chaparral	Pre-treatment
Los Padres	Los Padres-02 post1	2002	prescribed burn	Yellow Pine	Jeffrey pine	1st year re-measure
Mendocino	Mendocino-03	2003	mech & rxburn	Ponderosa pine/white fir	Ponderosa Pine - White fir	Pre-treatment
Mendocino	Mendocino-02 post1	2002	prescribed burn	Yellow Pine	Ponderosa Pine - Black Oak	1st year re-measure
Modoc	Modoc-02 post1	2002	prescribed burn	Yellow Pine	Ponderosa Pine	1st year re-measure
Modoc	Modoc-03	2003	mech & rxburn	Yellow Pine	Ponderosa Pine	Pre-treatment
Plumas	Plumas-03	2003	mech & rxburn	Ponderosa pine/white fir	Ponderosa Pine - White fir	Pre-treatment
Plumas	Plumas-02	2002	prescribed burn	Douglas-fir/white fir	White fir - Douglas-fir	Pre-treatment
Plumas	Plumas-01 post2	2001	prescribed burn	Douglas-fir/white fir	White Fir - Black Oak	2nd year re-measure
San Bernardino	San Bernardino-03	2003	mechanical	Yellow Pine	Coulter Pine	Pre-treatment
San Bernardino	San Bernardino-01	2001	wildfire	Yellow Pine	Coulter Pine-Black Oak	Pre-treatment
Sequoia	Sequoia-02	2002	prescribed burn	chaparral	Chaparral/Oak woodland-grassland	Pre-treatment
Shasta-Trinity	Shasta-Trinity-02 post1	2002	prescribed burn	Ponderosa pine/white fir	Ponderosa Pine - White fir	1st year re-measure
Sierra	Sierra-02 post1	2002	prescribed burn	Yellow Pine	Ponderosa Pine	1st year re-measure
Sierra	Sierra-01	2001	prescribed burn	Yellow Pine	Ponderosa Pine - Black Oak	Pre-treatment
Six Rivers	Six Rivers-02	2002	prescribed burn	Douglas-fir/white fir	Douglas-Fir-Black Oak	Pre-treatment
Six Rivers	SixRivers-01	2001	prescribed burn	Douglas-fir/white fir	Douglas-Fir-Tan Oak	Pre-treatment
Stanislaus	Stanislaus-01	2001	mech & rxburn	Yellow Pine	Ponderosa Pine	Pre-treatment
Stanislaus	Stanislaus-02	2002	prescribed burn	Ponderosa pine/white fir	Ponderosa Pine – Black Oak	Pre-treatment
Tahoe	Tahoe-01a	2001	Mech & rxburn	Douglas-fir/white fir	Douglas-Fir- & Ponderosa Pine Mcn	Pre-treatment
Tahoe	Tahoe-01b post1	2001	mech & rxburn	Douglas-fir/white fir	Douglas-Fir- & Ponderosa Pine Mcn	1st year re-measure
Tahoe	Tahoe-01c post2	2001	mech & rxburn	Yellow Pine	Douglas-Fir- & Ponderosa Pine Mcn	2nd year re-measure
Tahoe	Tahoe-03	2003	mech & rxburn	Douglas-fir/white fir	Douglas-fir	Pre-treatment

***Cleveland-01b and Inyo-03 projects have a unique vegetation type for this report. In several instances, in Chapter III and IV, they have been combined with other vegetation types.**

Results

This report contains results after the third year of the fire effects and fuel treatment monitoring program. Data are presented below by dominant vegetation types and/or specific project for all years of the fire effects and fuels treatment monitoring program, which includes 36 projects (Table 2). Eleven of these projects have been partially or entirely treated. This includes eight forested projects treated with prescribed fire, two forested projects treated with mechanical and prescribed fire, and one chaparral project, burned by wildfire. The eleven projects are composed of a total of 28 pre and post one and/or two-year treatment plots.

In projects that received treatment, not all plots measured during pre-fuel treatment were modified by post fuel treatment. Only those plots that received treatment were re-measured. Some of the results shown in this Chapter represent project data and where possible, there are notations for those projects in which plots re-measured varied from the pre-treatment plots.

The Cleveland-01b (oak woodland) and Inyo-03 (red fir/Jeffrey pine) projects do not fit into the four major vegetation types analyzed in this annual report. Until more projects are included in these two vegetation types, in most cases, Cleveland-01b is included in chaparral and mixed forest/chaparral and Inyo-03 is included in ponderosa pine/white fir vegetation types (when analyzing the data by the 4 dominant vegetation types). In the Dead Surface and Ground Fuels (Fuel Load) section of this chapter, Cleveland-01b is categorized as oak woodland/chaparral (along with Sequoia-02).

Where possible, the major vegetation type results documented in the following pages are divided into forest vegetation types and chaparral vegetation types. However, in two projects (Eldorado-03 and Mendocino-03), the results for both are presented in two vegetation types (i.e., ponderosa pine/white fir and mixed forest/chaparral) to facilitate comparison across all vegetation types.

Some of the data displayed in the graphs below (and in Volume I) provide preliminary trends, but should not be viewed as conclusive. This is due to the small sample size of treatment plots.

Fuels

Dead Surface and Ground Fuels (Fuel Load)

Figures 2-4 are graphical representations of the surface fuel loading by size (0-3 inches and greater than 3 inches diameter) for Douglas-fir/white fir (Figure 2); yellow pine (Figure 3); and, ponderosa pine/white fir (Figure 4).

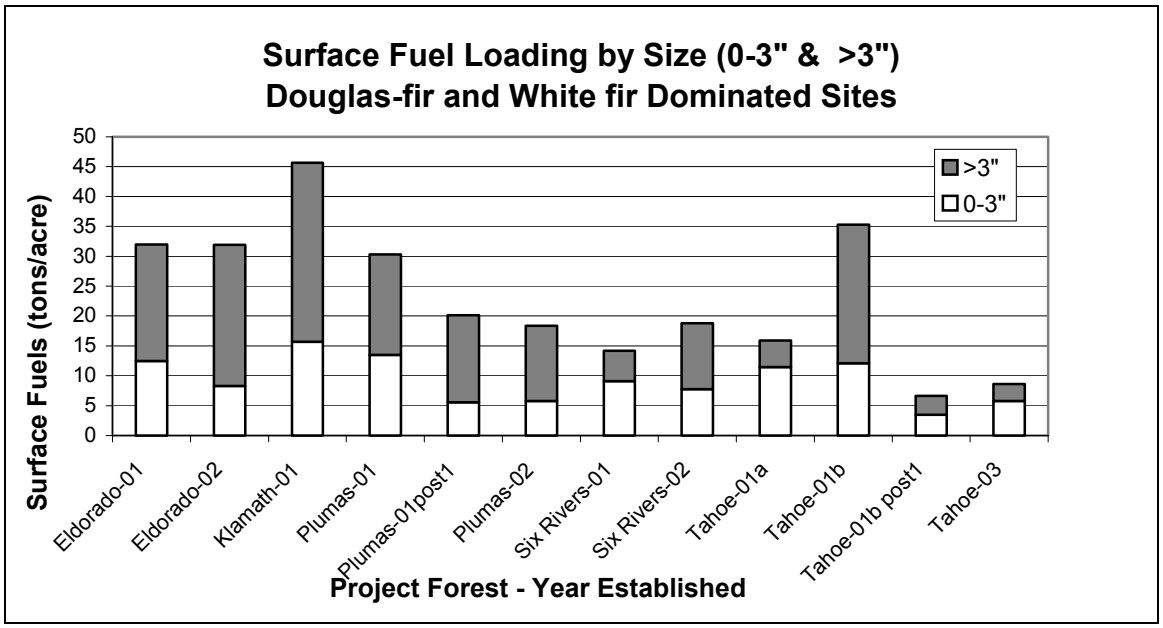


Figure 2 - Surface fuel loading by size (0-3" & >3" diameter) for Douglas-fir and white fir dominated sites. Two projects have pre and post treatment fuels. 0-3" fuels include litter weights predicted from regressions on litter weight.

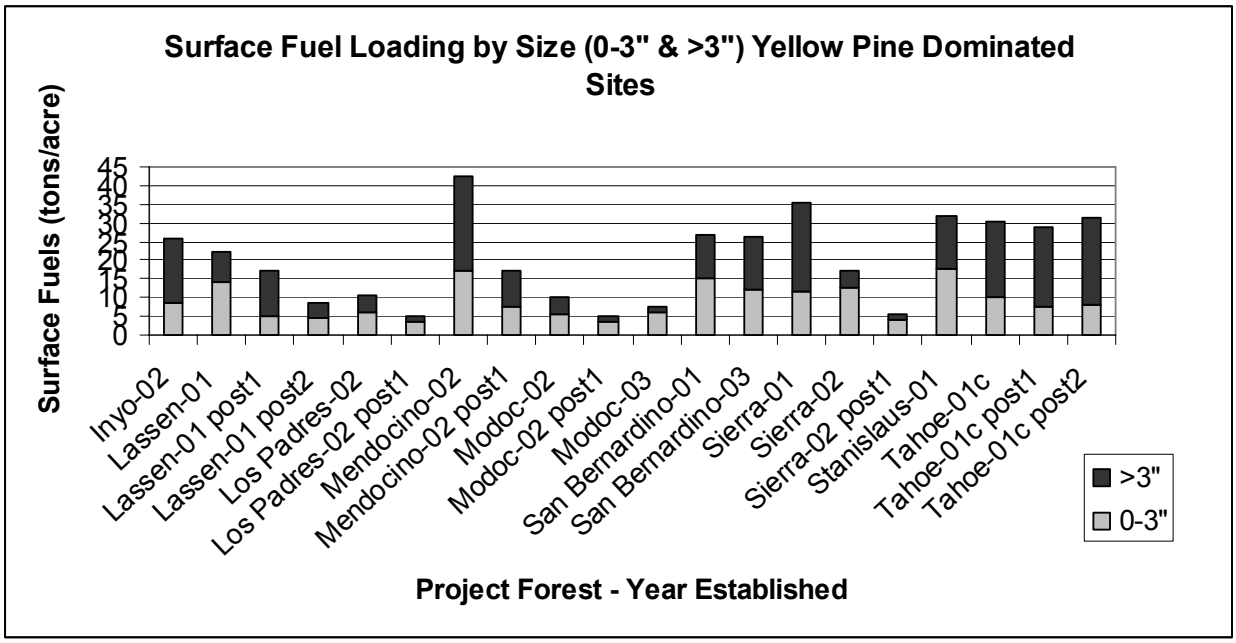


Figure 3 - Surface fuel loading by size (0-3" & >3" diameter) for yellow pine (ponderosa, Jeffrey and coulter) dominated sites, including pre and post treatments. 0-3" fuels include litter weights predicted from regressions on litter weight.

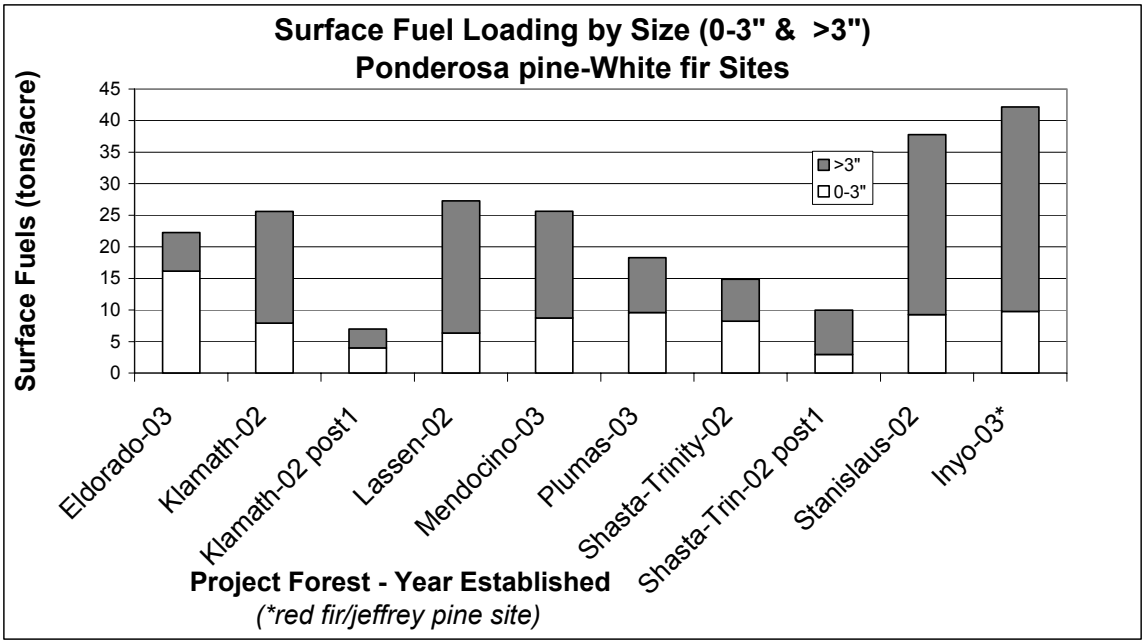


Figure 4 - Surface fuel loading by size (0-3" & >3" diameter) for Ponderosa pine and white fir dominated sites. 0-3" fuels include litter weights predicted from regressions on litter weight.

Tables 3- 6 display the mean and minimum/maximum fuel levels (tons/acre) by fuel size class and type (i.e., 1-hour, 10-hour, 100-hour, 1-100-hour) for Douglas-fir/white fir (Table 3); yellow pine (Table 4); ponderosa pine/white fir (Table 5); and oak woodland/chaparral (Table 6) dominant vegetation types.

Table 3 - *Douglas-fir and/or white fir projects by surface fuels. Summary of both pre and post surface fuel loadings (tons/acre) by fuel size class and type. Litter weights are not included in 1-hour fuel estimates (from planar intercepts only).*

Douglas Fir/White Fir Dominated								
Forest- Year Sampled	**Mean 1-Hour Fuels (tons/ac)**	**Mean 10-Hour Fuels (tons/ac)**	**Mean 100-Hour Fuels (tons/ac)**	**Mean 1- to 100-Hour Fuels (tons/ac)**	**1-Hour Fuels Minimum - Maximum**	**10-Hour Fuels Minimum - Maximum**	**100-Hour Fuels Minimum - Maximum**	**1- to 100-Hour Fuels Minimum - Maximum**
Eldorado-01	0.7	2.1	2.4	5.2	0.1 - 1.6	0.0 - 6.2	0 - 6.3	1.3 - 8.4
Eldorado-02	0.4	2.3	0.6	3.2	0.1 - 0.9	0.0- 15.6	0 - 2.5	0.2 - 15.9
Klamath-01	0.8	3.6	3.4	7.8	0.3 - 1.6	0.3 - 7.7	0 - 9.4	1.4 - 15.5
Plumas-01	0.5	2.4	1.6	4.5	0.1 - 1.3	0.3 - 4.6	0 - 13.3	0.4 - 16.0
Plumas-01 post1	0.2	1.4	0.3	2.0	0.1 - 0.3	0.6 - 1.9	0 - 1.2	1.7 - 2.1
Plumas-02	0.6	1.2	2.3	4.1	0.0 - 3.3	0.0 - 3.4	0 - 7.3	0.0 - 9.4
Six Rivers-01	0.3	2.4	2.3	5.0	0.03 - 1.0	0.0 - 9.8	0 - 6.8	0.03 - 12.0
Six Rivers-02	0.9	2.2	0.7	3.8	0.1 - 2.0	0.3 - 4.9	0 - 2.5	0.4 - 6.9
Tahoe-01a	0.5	1.3	2.2	4.0	0.1 - 1.3	0.0 - 3.1	0 - 7.4	0.3 - 10.2
Tahoe-01b	0.3	1.1	2	3.4	0.1 - 0.5	0.6 - 1.8	0 - 7.3	0.7 - 8.4
Tahoe-01b post1	0.1	0.8	1.5	2.4	0.1 - 0.2	0.3 - 2.1	0 - 4.8	0.4 - 7.1
Tahoe-03	0.9	3.3	1.8	5.8	0.5 - 1.7	0.3 - 8.6	0 - 5.0	2.0 - 13.8

Table 4 - *Yellow pine projects by surface fuels. Summary of both pre and post surface fuel loadings (tons/acre) by fuel size class and type. Litter weights are not included in 1-hour fuel estimates (from planar intercepts only).*

Yellow Pine (Ponderosa, Jeffrey, Coulter) Dominated								
Forest- Year Sampled	**Mean 1-Hour Fuels (tons/ac)**	**Mean 10-Hour Fuels (tons/ac)**	**Mean 100-Hour Fuels (tons/ac)**	**Mean 1- to 100-Hour Fuels (tons/ac)**	**1-Hour Fuels Minimum - Maximum**	**10-Hour Fuels Minimum - Maximum**	**100-Hour Fuels Minimum - Maximum**	**1- to 100-Hour Fuels Minimum - Maximum**
Inyo-02	0.3	2.7	1.3	4.3	0 -0.8	0 - 4.6	0 - 7.3	0.3 - 9.2
Lassen-01	0.9	4.3	2.2	7.4	0 - 2.2	1.0 - 8.5	0 - 6.4	1.2 - 12.5
Lassen-01 post1	0.2	2.1	1.3	3.6	0.1 - 0.7	0.3 - 7.9	0 - 2.7	0.4 - 10.5
Lassen-01 post2	0.5	1.0	1.3	2.7	0.1 - 1.1	0 - 2.7	0 - 4.0	0.4 - 7.9
Los Padres-02	0.2	0.7	1.0	1.9	0 – 1.0	0 - 2.2	0 - 8.5	0 - 9.9
Los Padres-02 post1	0.1	0.5	1.5	2.1	0 - 0.2	0 - 1.9	0 - 9.9	0 - 11.5
Mendocino-02	0.1	1.3	1.5	2.9	0 - 1.2	0 – 7.0	0 - 6.5	0 - 8.9
Mendocino-02 post1	0.2	0.8	2.6	3.6	0 - 1.0	0 - 2.7	0 - 12.1	0 - 12.7
Modoc-02	0.1	0.6	0.6	1.3	0 - 0.3	0 - 1.8	0 - 2.4	0.3 - 3.3
Modoc-02 post1	0.0	0.4	0.9	1.3	0 - 0.1	0 - 0.6	0 - 4.8	0 - 5.5
Modoc-03	0.2	0.8	0.8	1.8	0 - 1.2	0 - 2.7	0 - 3.6	0 - 5.2
San Bernardino-01	0.2	2.9	2.5	5.5	0 - 1.3	0.3 - 7.3	0 - 8.8	1.3 - 14.6
San Bernardino-03	0.1	1.4	1.9	3.4	0 - 0.4	0 - 2.8	0 - 10.0	0.4 - 11.7
Sierra-01	0.1	2.2	2.8	5.1	0 - 0.4	0.3 - 7.1	0 - 12.2	0.3 - 17.1
Sierra-02	0.2	1.3	2.9	4.4	0 - 0.7	0 - 3.4	0 - 9.8	0.1 - 12.1
Sierra-02 post1	0.1	0.4	1.4	1.9	0 - 0.3	0 - 0.9	0 - 3.7	0 - 4.8
Stanislaus-01	0.1	0.8	0.8	1.7	0 - 0.1	0 - 1.8	0 - 3.7	0 - 4.9
Tahoe-01c	0.2	0.7	2.3	3.2	0 - 0.5	0 - 2.6	0 - 7.4	0 - 8.5
Tahoe-01c post1	0.1	0.9	3.7	4.8	0 - 0.2	0 - 2.4	1.2 - 9.7	2.5 - 12.2
Tahoe-01c post2	0.1	1.2	3.9	5.2	0 - 0.2	0.3 - 2.3	0 - 6.5	0.3 - 8.3

Table 5 - *Ponderosa pine-white fir projects by surface fuels. Summary of both pre and post surface fuel loadings (tons/acre) by fuel size class and type. Litter weights are not included in 1-hour fuel estimates (from planar intercepts only).*

Ponderosa Pine-White Fir Dominated								
Forest- Year Sampled	Mean 1-Hour Fuels (tons/ac)	Mean 10-Hour Fuels (tons/ac)	Mean 100-Hour Fuels (tons/ac)	Mean 1- to 100-Hour Fuels (tons/ac)	1-Hour Fuels Minimum - Maximum	10-Hour Fuels Minimum - Maximum	100-Hour Fuels Minimum - Maximum	1- to 100-Hour Fuels Minimum - Maximum
Eldorado-03	0.7	3.5	7.2	11.3	0.0 - 1.6	0.6 - 8.5	1.2 - 25.4	1.8 - 34.3
Inyo-03*	0.5	2.5	2.4	5.3	0.1 - 1.9	0.0 - 9.6	0 - 6.3	0.2 - 12.7
Klamath-02	0.5	1.5	1.2	3.2	0.1 - 1.4	0.3 - 2.7	0 - 8.5	0.7 - 11.3
Klamath-02 post1	0.3	0.7	1.1	2.1	0.0 - 0.6	0.0 - 3.0	0 - 4.8	0 - 6.0
Lassen-02	0.2	1.7	1.8	3.6	0.02 - 0.7	0.0 - 4.9	0 - 6.1	0.1 - 8.9
Mendocino-03	0.3	1.7	2.5	4.4	0.0 - 0.7	0.9 - 2.8	0 - 12.3	1.2 - 15.1
Plumas-03	0.2	1.9	1.8	4.0	0.1 - 0.6	0.0 - 4.9	0 - 3.6	1.0 - 7.9
Shasta-Trinity-02	0.2	1.9	3.0	5.1	0.0 - 0.6	0.6 - 3.4	1.21 - 6.1	2.2 - 9.6
Shasta-Trinity-02 post1	0.1	0.6	1.2	1.8	0.0 - 0.1	0.0 - 1.2	0 - 4.8	0 - 5.2
Stanislaus-02	0.1	1.6	3.4	5.1	0.0 - 0.2	0.3 - 5.0	0 - 9.7	0.6 - 13.8

*Red-fir with Jeffery pine fuel type.

Table 6 - *Oak woodlands/chaparral projects by surface fuels. Summary of pre surface fuel loadings (tons/acre) by fuel size class and type. Litter weights are not included in 1-hour fuel estimates (from planar intercepts only).*

Oak Woodland/Chaparral Dominated								
Forest- Year Sampled	Mean 1-Hour Fuels (tons/ac)	Mean 10-Hour Fuels (tons/ac)	Mean 100-Hour Fuels (tons/ac)	Mean 1- to 100-Hour Fuels (tons/ac)	1-Hour Fuels Minimum - Maximum	10-Hour Fuels Minimum - Maximum	100-Hour Fuels Minimum - Maximum	1- to 100-Hour Fuels Minimum - Maximum
Cleveland-01b	0.6	2.3	0.6	3.5	0.4 - 0.9	0.4 - 4.0	0 - 2.4	1.2 - 5.8
Sequoia-02	0.9	0.5	2.1	3.5	0.6 - 1.2	0.0 - 0.9	0 - 4.8	1.1 - 7.0

Tables 7-10 display the 1000-hour fuels (by tons per acre) for the mean, range, mean-soft, range-soft, mean-hard, and range-hard for Douglas-fir/white fir (Table 7); yellow pine (Table 8); ponderosa pine/white fir (Table 9); and oak woodland/chaparral (Table 10) dominant vegetation types.

Table 7 – *1000-hour fuels stratified by Douglas-fir and/or white fir vegetation type.*

Douglas-Fir/White Fir Dominated						
Forest-year sampled	**Mean 1000 hour fuels (tons/acre)**	**Range 1000 hour fuels (tons/acre)**	**Mean soft 1000 hour fuels (tons/acre)**	**Range soft 1000 hour fuels (tons/acre)**	**Mean hard 1000 hour fuels (tons/acre)**	**Range hard 1000 hour fuels (tons/acre)**
Eldorado-01	20	0 - 101	14	0 - 88	5	0 - 30
Eldorado-02	24	0 - 110	22	0 - 110	2	0 - 8
Klamath-01	30	1 - 200	26	0 - 192	4	0 - 19
Plumas-01	17	0 - 110	15	0 - 110	1	0 - 8
Plumas-01 post1	15	5 - 41	14	4 - 41	1	0 - 2
Plumas-02	13	0 - 43	9	0 - 43	3	0 - 27
Six Rivers-01	5	0 - 13	5	0 - 12	1	0 - 6
Six Rivers-02	11	0 - 36	8	0 - 36	3	0 - 11
Tahoe-01a	5	0 - 24	1	0 - 8	3	0 - 16
Tahoe-01b	23	1 - 65	13	0 - 63	10	0 - 43
Tahoe-01b post1	3	0 - 6	3	0 - 6	0	0 - 0
Tahoe-03	3	0 - 14	2	0 - 6	1	0 - 12

Table 8 – *1000-hour fuels stratified by yellow pine vegetation type.*

Yellow Pine (Ponderosa, Jeffrey, Coulter) Dominated						
Forest-year sampled	**Mean 1000 hour fuels (tons/acre)**	**Range 1000 hour fuels (tons/acre)**	**Mean soft 1000 hour fuels (tons/acre)**	**Range soft 1000 hour fuels (tons/acre)**	**Mean hard 1000 hour fuels (tons/acre)**	**Range hard 1000 hour fuels (tons/acre)**
Inyo-02	17.0	1-98	15.0	0 - 88	2.0	0 - 10
Lassen-01	8.0	1-31	3.0	0 - 10	5.0	0 - 28
Lassen-01post1	12.0	0 - 70	12.0	0 - 70	0.4	0 - 3
Lassen-01 post2	4.1	0.9 - 10.6	2.1	0 - 4.9	2.0	0 - 8.1
Los Padres-02	5.0	0 - 30	5.0	0 - 30	0.0	0 - 0
Los Padres-02 post1	1.7	0 - 19.8	0.0	0 - 0	1.7	0 - 19.8
Mendocino-02	25.0	0 - 146	24.0	0 - 146	1.0	0 - 10
Mendocino-02 post1	9.4	0 - 47.5	7.0	0 - 46.1	2.4	0 - 43.7
Modoc-02	5.0	0 - 42	4.0	0 - 42	1.0	0 - 4
Modoc-02 post1	1.4	0 - 8.6	1.4	0 - 8.6	0.0	0 - 0
Modoc-03	1.2	0 - 5.3	1.2	0 - 5.3	0.0	0 - 0
San Bernardino-01	3.0	0 - 17	2.0	0 - 17	1.0	0 - 3
San Bernardino-03	14.2	0 - 90.2	13.6	0 - 90.2	0.5	0 - 7.8
Sierra-01	24.0	0 - 78	21.0	0 - 75	3.0	0 - 11
Sierra-02	5.0	0 - 17	2.0	0 - 6	3.0	0 - 17
Sierra-02 post1	1.9	0 - 4.5	0.8	0 - 3.2	1.1	0 - 4.5
Stanislaus-01	14.0	0 - 37	10.0	0 - 37	4.0	0 - 17
Tahoe-01c	20.0	0 - 96	8.0	0 - 87	13.0	0 - 52
Tahoe-01c post1	22.0	0 - 54	6.0	0 - 52	15.0	0 - 36
Tahoe-01c post2	23.1	12.2 - 27.9	13.2	0 - 25.7	9.9	0 - 26.5

Table 9 – 1000-hour fuels stratified by ponderosa pine/white fir vegetation type.

Ponderosa Pine-White Fir Dominated						
Forest-year sampled	Mean 1000 hour fuels (tons/acre)	Range 1000 hour fuels (tons/acre)	Mean soft 1000 hour fuels (tons/acre)	Range soft 1000 hour fuels (tons/acre)	Mean hard 1000 hour fuels (tons/acre)	Range hard 1000 hour fuels (tons/acre)
Eldorado-03	6.1	0 - 24.4	1.5	0 - 7.9	4.6	0 - 24.4
Inyo-03*	32.4	0 - 183.7	30.1	0 - 183.7	2.3	0 - 18.3
Klamath-02	18.0	0 - 69	16.0	0 - 69	2.0	0 - 10
Klamath-02 post1	3.0	0 - 15.7	0.5	0 - 2.4	2.5	0 - 15.7
Lassen-02	21.0	0 - 109	21.0	0 - 109	0.4	0 - 3
Mendicino-03	16.9	0 - 90.9	15.7	0 - 90.9	1.2	0 - 4.4
Plumas-03	8.7	0 - 44.0	8.1	0 - 44.0	0.6	0 - 3.6
Shasta-Trinity-02	7.0	0 - 21	6.0	0 - 21	0.2	0 - 2
Shasta-Trinity-02 post1	7.1	0 - 23.2	2.8	0 - 13.3	4.3	0 - 12.8
Stanislaus-02	29.0	0 - 144	28.0	0 - 144	0.7	0 - 7

*Red-fir with Jeffrey pine fuel type.

Table 10 - 1000-hour fuels stratified by oak woodlands/chaparral vegetation type.

Oak Woodland/Chaparral Dominated						
Forest-year sampled	Mean 1000 hour fuels (tons/acre)	Range 1000 hour fuels (tons/acre)	Mean soft 1000 hour fuels (tons/acre)	Range soft 1000 hour fuels (tons/acre)	Mean hard 1000 hour fuels (tons/acre)	Range hard 1000 hour fuels (tons/acre)
Cleveland-01b	0	0 - 0	0	0 - 0	0	0 - 0
Sequoia-02	6	0 -15	6	0 - 15	0	0 - 0

Tables 11-14 display the surface and ground fuel depths by mean duff depth (inches), duff weight (tons/acre), litter depth (inches), litter weight (tons/acre), fuel depth (feet), and range of fuel depth (minimum/maximum in feet) for Douglas-fir/white fir (Table 11); yellow pine (Table 12); and Ponderosa pine/white fir (Table 13) dominant vegetation types. Fuel depth was not collected in mixed forest/chaparral & pure chaparral projects. Litter and duff weights are based on regressions of depth, averaged across species (van Wagtendonk, 1996).

Table 11 – *Surface and ground fuel depths/weight for Douglas-fir/white fir dominated vegetation type.*

Douglas-Fir - White Fir Dominated						
Forest-year sampled	**Mean Duff Depth (inches)**	**Mean Duff Weight (tons/acre)[1]**	**Mean Litter Depth (inches)**	**Mean Litter Weight (tons/acre)[1]**	**Mean Fuel Depth (feet)**	**Range Fuel Depth (min-max)**
Eldorado-01	1.9	60	1.8	7	1.2	0.1-8.5
Eldorado-02	1.0	36	1.2	5	1.0	0-4.9
Klamath-01	2.1	65	1.9	8	0.8	0.1-3.6
Plumas-01	1.5	58	2.2	9	0.7	0.1-4.1
Plumas-01 post1	1.7	44	0.9	3	1.3	0-6.3
Plumas-02	1.2	28	0.4	2	0.5	0.1-2.5
Six Rivers-01	0.7	27	1.0	4	0.8	0-4.2
Six Rivers-02	1.0	31	1.0	4	1.4	0.2-5.0
Tahoe-01a	3.5	91	1.8	8	n/a	n/a
Tahoe-01b	3.7	98	2.1	9	0.3	0-2.3
Tahoe-01b post1	0.3	9	0.3	1	0.3	0 - 1.2
Tahoe-03	2.2	7	0.7	1	0.8	0.1 - 2.7

[1]Litter and duff weights are based on regressions of depth, averaged across species (van Wagtendonk, 1996).

Table 12 – *Surface and ground fuel depths/weight for yellow pine dominated vegetation type.*

Yellow Pine (Ponderosa, Jeffrey, Coulter) Dominated						
Forest-year sampled	**Mean Duff Depth (inches)**	**Mean Duff Weight (tons/acre)[1]**	**Mean Litter Depth (inches)**	**Mean Litter Weight (tons/acre)[1]**	**Mean Fuel Depth (feet)**	**Range Fuel Depth (min-max)**
Inyo-02	0.2	18	1.1	5	0.8	0.1-26.8
Lassen-01	0.8	39	1.7	7	0.6	0-2.2
Lassen-01 post1	0.5	15	0.4	2	0.4	0-1.6
Lassen-01 post2	0.9	22	0.4	2	0.5	0 - 3.0
Los Padres-02	1.0	33	1.0	4	0.3	0-3.0
Los Padres-02 post1	0.5	14	0.4	2	0.1	0 - 3.2
Mendocino-02	0.9	66	3.4	14	2.2	0-4.9
Mendocino-02 post1	0.9	31	1.0	4	0.3	0 - 3.8
Modoc-02	0.7	26	1.0	4	0.3	0-1.7
Modoc-02 post1	0.2	12	0.6	2	0.1	0 - 1.2
Modoc-03	1.2	37	1.1	4	0.3	0 - 2.5
San Bernardino-01	0.1	n/a	2.3	n/a	0.4	0.1-2.0
San Bernardino-03	2.7	79	2.1	9	0.4	0 - 2.9
Sierra-01	1.6	52	1.6	6	n/a	n/a
Sierra-02	0.7	41	2.0	8	2.2	0.1-4.9
Sierra-02 post1	0.5	15	0.5	2	0.3	0 - 1.8
Stanislaus-01	0.5	66	3.9	16	0.3	0-1.8
Tahoe-01c	2.2	64	1.6	7	0.3	0-2.0
Tahoe-01c post1	0.8	24	0.7	4	0.3	0-2.1
Tahoe-01c post2	0.7	22	0.7	3	1.0	0.1 - 5.8

[1]Litter and duff weights are based on regressions of depth, averaged across species (van Wagtendonk, 1996).

Table 13 – *Surface and ground fuel depths/weight for ponderosa pine/white fir dominated vegetation type.*

Ponderosa Pine-White Fir Dominated						
Forest-year sampled	**Mean Duff Depth (inches)**	**Mean Duff Weight (tons/acre)[1]**	**Mean Litter Depth (inches)**	**Mean Litter Weight (tons/acre)[1]**	**Mean Fuel Depth (feet)**	**Range Fuel Depth (min-max)**
Eldorado-03	1.2	39	1.2	5	0.6	0.0 - 3.7
Inyo-03*	1.6	44	1.1	4	0.6	0.0 – 4.0
Klamath-02	1.1	37	1.2	5	0.9	0.1 - 4.9
Klamath-02 post1	0.1	9	0.5	2	0.3	0.0 - 2.5
Lassen-02	0.8	24	0.7	3	0.3	0.0 -3.5
Mendocino-03	1.4	41	1.1	4	0.6	0.0 - 3.3
Plumas-03	1.6	48	1.4	6	0.5	0.1 - 3.6
Shasta-Trinity-02	1.6	39	0.8	3	0.4	0.0 -3.3
Shasta-Trinity-02 post1	0.4	11	0.3	1	0.2	0.0 - 2.8
Stanislaus-02	1.3	39	1.0	4	0.5	0.0 -3.2

[1]Litter and duff weights are based on regressions of depth, averaged across species (van Wagtendonk, 1996).

Crown Fuels

The heights to live canopy results, shown below, were produced using GAMMA, a program used by the Region 5 Planning Analyst, and based upon the Forest Vegetation Simulator, Fire & Fuels Effects Module (FVS FFE source code circa 2001). A key difference between GAMMA and FVS is that GAMMA incorporates crown fuels from hardwoods, such as black or live oak. A recent limitation to the underlying crown fuel calculations for both programs is that they are not always sensitive to changes in crown conditions from fuel treatments that result in increased canopy base height of individual trees. Modifications to improve this sensitivity to changes in crowns from fuel treatments are underway. In the mean-time, these limitations can sometimes result in an estimate of increased crown fuels post-treatment even though trees have been removed or especially crown heights increased from prescribed burning or pruning. Future reports may contain modified estimates of crown fuels due to incorporation of any improved programming.

Height to live canopy is computed by applying a running mean along the length of a tree canopy. The mean must equal or exceed a 75-pound threshold in order to compute a height to live canopy value, similar to the method employed in the Forest Fire Extension of the Forest Vegetation Simulator. If stand data failed to meet the 75–pound minimum threshold, then height to live canopy would not be computed.

<u>Douglas-Fir/White Fir Dominated Sites</u>

Post measurements for crown fuels measured in 2003 show that height to live canopy tends to increase after treatment (Figure 5). Canopy bulk density ranged from 0.09-0.10 kg/m3 for all projects in the Douglas-fir/white fir vegetation types (Figure 6). Post

treatment of Tahoe-01b stand data failed to meet the 75-pound minimum threshold; therefore, no data shows in Figures 5 and 6.

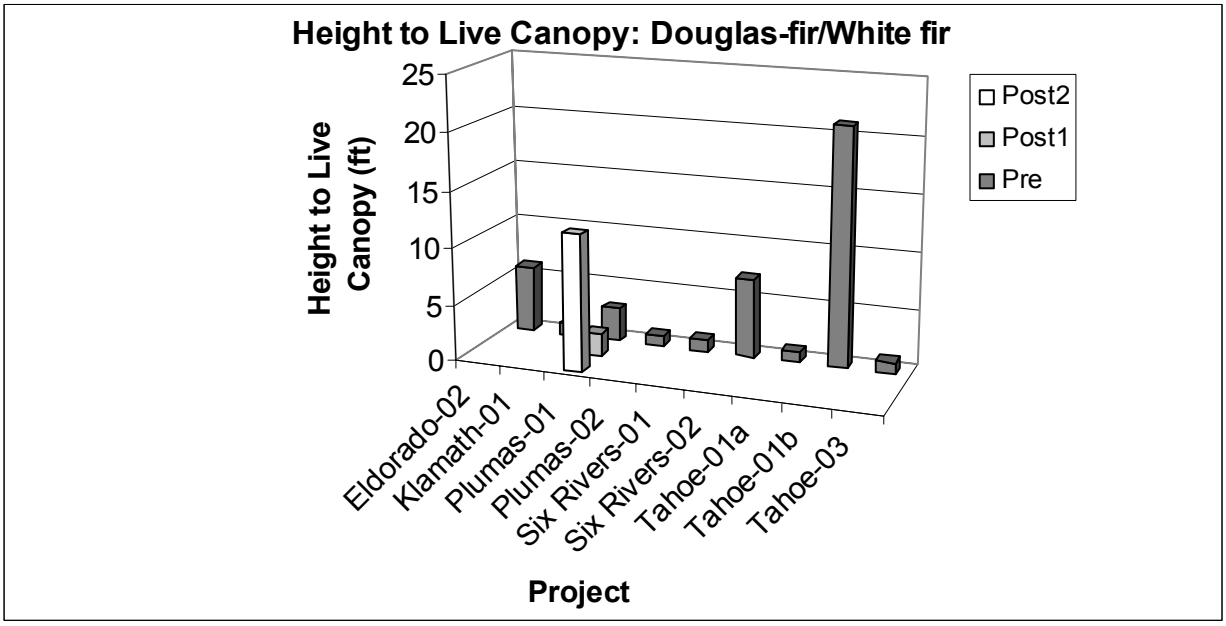


Figure 5 – Years 2001-2003 Douglas-fir/white fir height to live canopy (ft), calculated using the same method as the FFE-FVS extension with a 75-lb. minimum threshold (Scott and Reinhardt, 2001).

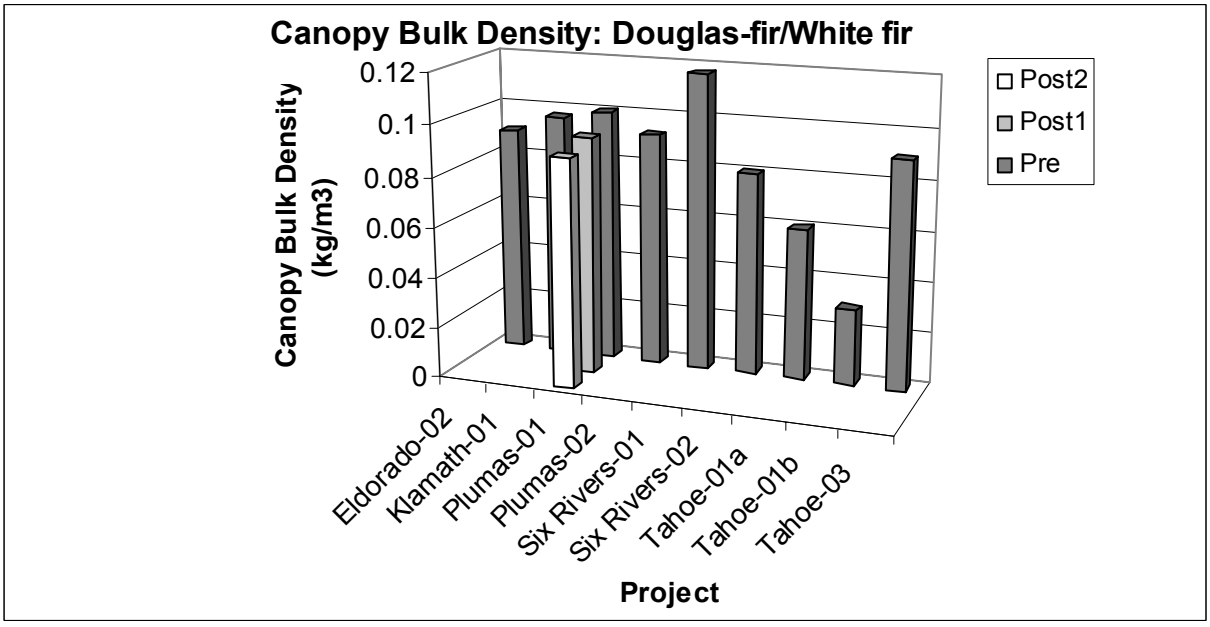


Figure 6 - Douglas-fir/white fir canopy bulk density (kg/m3).

Ponderosa Pine/White Fir Dominated Sites

Figures 7 and 8 provide graphs showing canopy data for Ponderosa pine/white fir dominated sites.

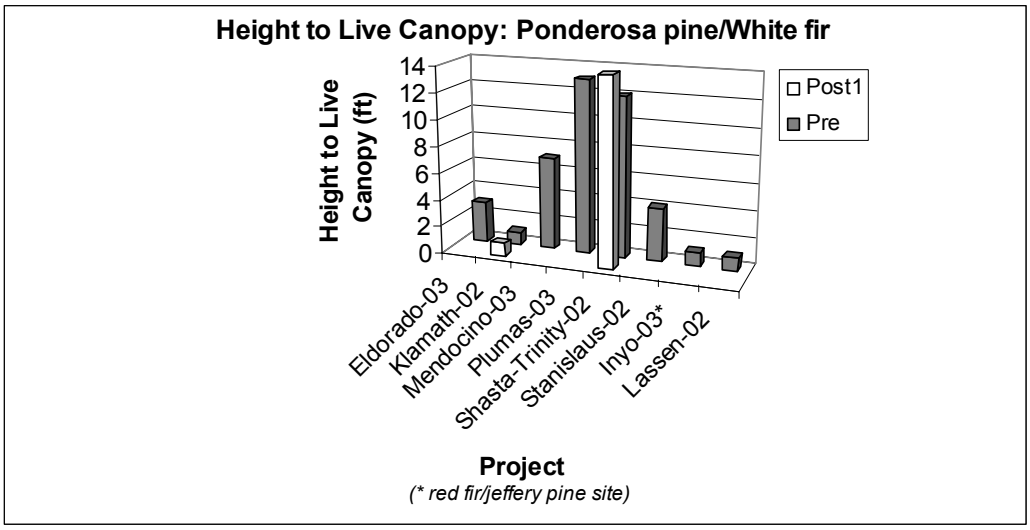


Figure 7 – Years 2001-2003 ponderosa pine/white fir height to live canopy (ft), calculated using the same method as the FFE-FVS extension with a 75-lb minimum threshold (Scott and Reinhardt, 2001).

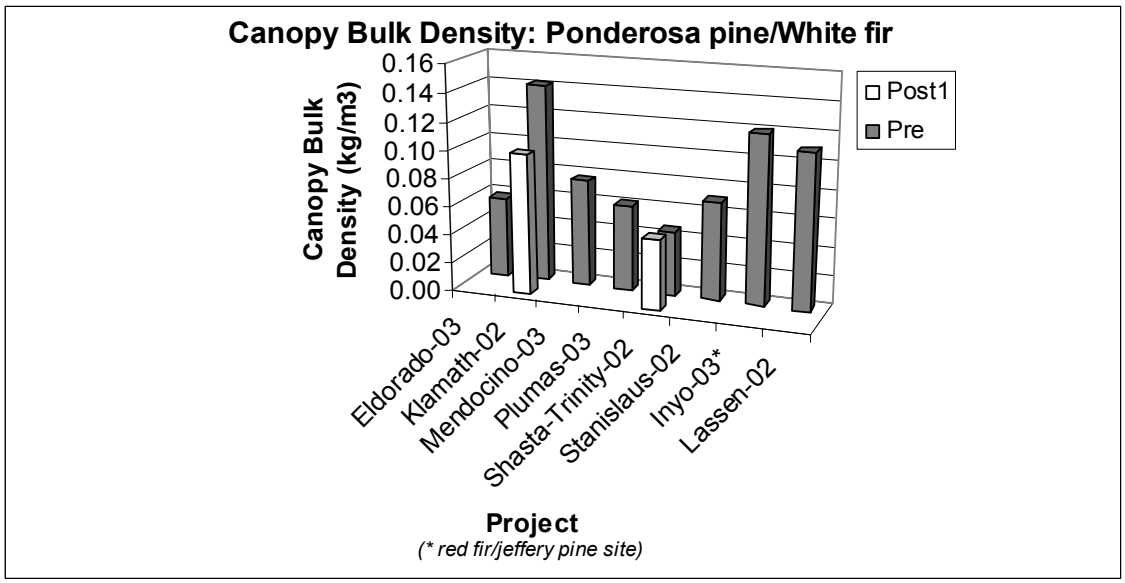


Figure 8 - Ponderosa pine/white fir canopy bulk density (kg/m3).

Yellow Pine Dominated Sites

A summary of canopy fuel measurements for yellow pine vegetation types, such as height to live canopy (feet) and canopy bulk density (kg/m3), are shown in Figures 9 and 10. Similar to the Douglas-fir/white fir canopy graphs, height to live canopy may not be displayed for some projects if the tree data failed to meet the 75-pound threshold necessary for the computation of this value (i.e., Modoc-02).

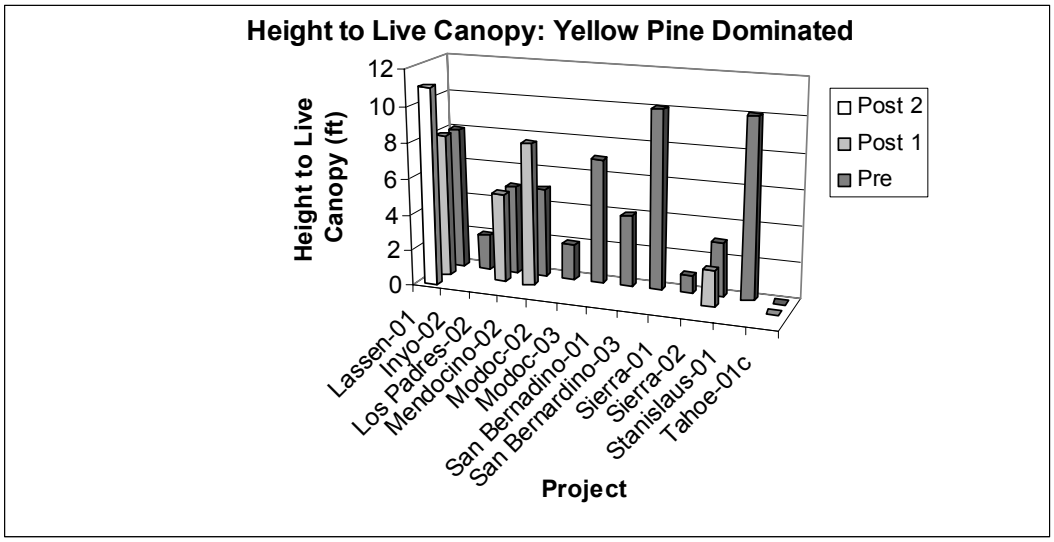


Figure 9 – Years 2001-2003, yellow pine height to live canopy (ft), calculated using the same method as the FFE-FVS extension with a 75-lb. minimum threshold (Scott and Reinhardt, 2001).

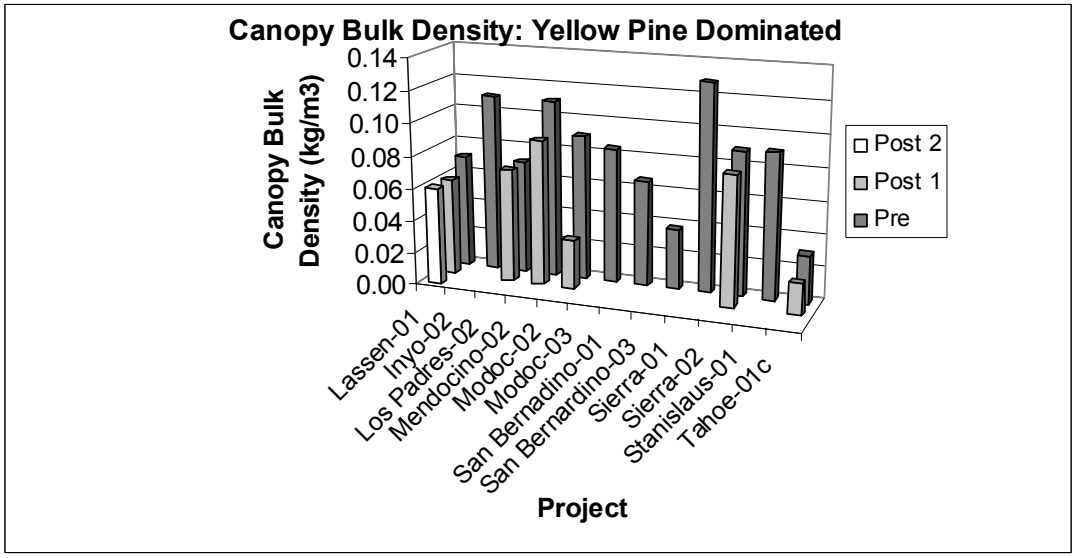


Figure 10 – Yellow pine canopy bulk density (kg/m3).

Chaparral & Mixed Chaparral/Oak Woodlands

Shrub Heights

Shrub heights in feet are expressed as 75th and 90th percentiles (Figure 11). The 75th percentile means that 75% of all the shrubs sampled are below the height that corresponds with the 75th percentile, leaving a remaining 25% that are equal or taller than the specified height. The 90th percentile follows the same ideology. The 75th percentile shrub heights are similar for both the chaparral and mixed forest/chaparral projects with averages of 5.3 feet and 5 feet, respectively. However, the 90th percentile data differs by 1 foot with averages of 6.1 feet for chaparral and 7.2 feet for the mixed chaparral stands.

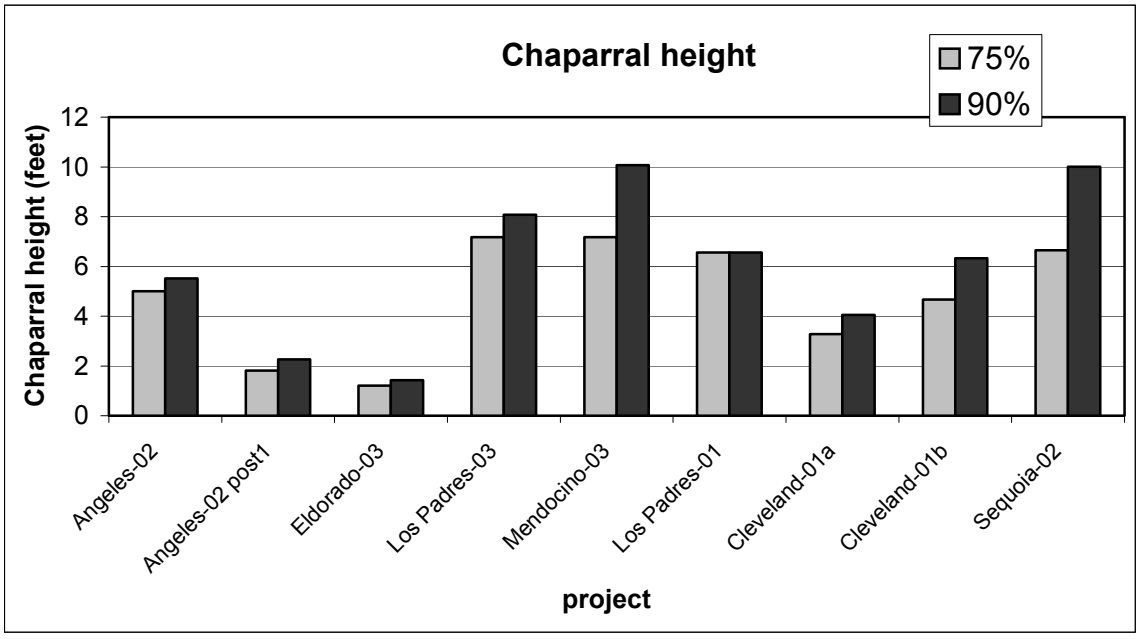


Figure 11 - Shrub heights (feet) expressed as 75th and 90th percentiles for chaparral & mixed forest/ chaparral plots**.**

Shrub Decadence

Chaparral decadence was highest for the Cleveland and Los Padres projects (Figure 12). Average pure chaparral decadence for all projects (Los Padres-01, Cleveland-01a, Angelses-02, Los Padres-03) was 15% (range: 2-31%). The mixed forest/chaparral plots (Eldorado-03 and Sequoia-02) had a lower average value for decadence (4.5%), as shown in Figure 12, compared to the pure stands of chaparral.

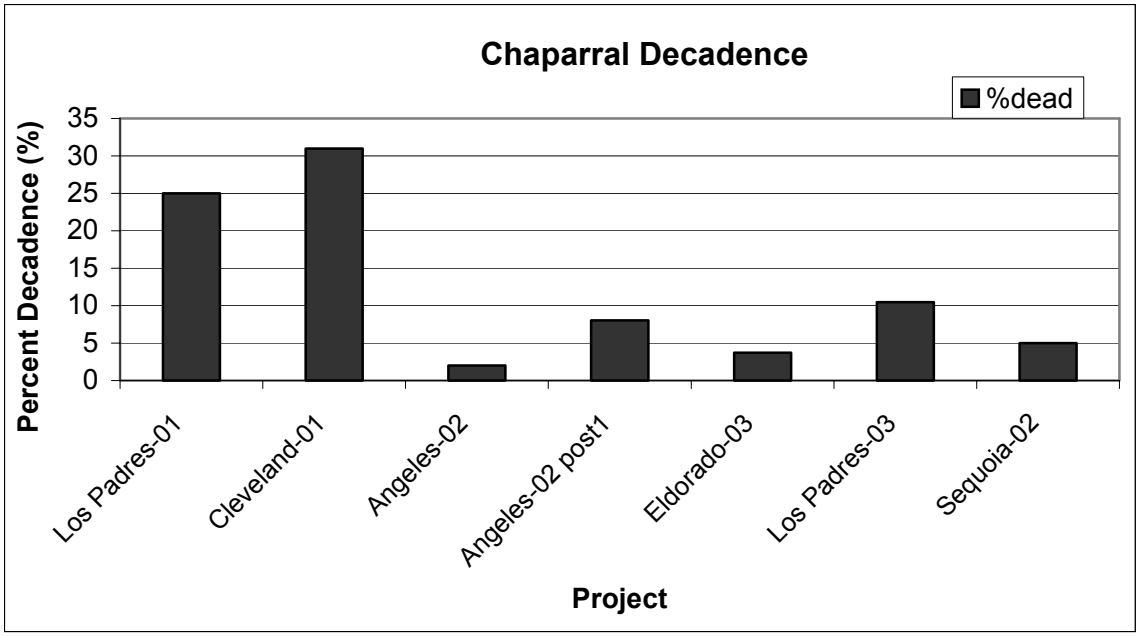


Figure 12 - Shrub decadence (% of stems or cover) for chaparral plots.

Vegetation & Habitat

Vegetation Composition and Structure

Figures 13-16 are graphical representations of total cover per dominant vegetation type: Douglas-fir/white fire (Figure 13), Yellow pine (Figure 14), Ponderosa pine/white fir (Figure 15), and Chaparral/mixed forest (Figure 16). Covers are overlapping; therefore, totals may exceed 100-percent. Tables 14-17 provide the data in which the figures were developed.

Douglas-fir/White Fir Dominated Sites

Figure 13 is a graphic representation of the vegetation cover in the Douglas-fir/white fir dominated projects. The two post-treatment projects are noted (i.e., Plumas-01 post1 and Tahoe-01b post1).

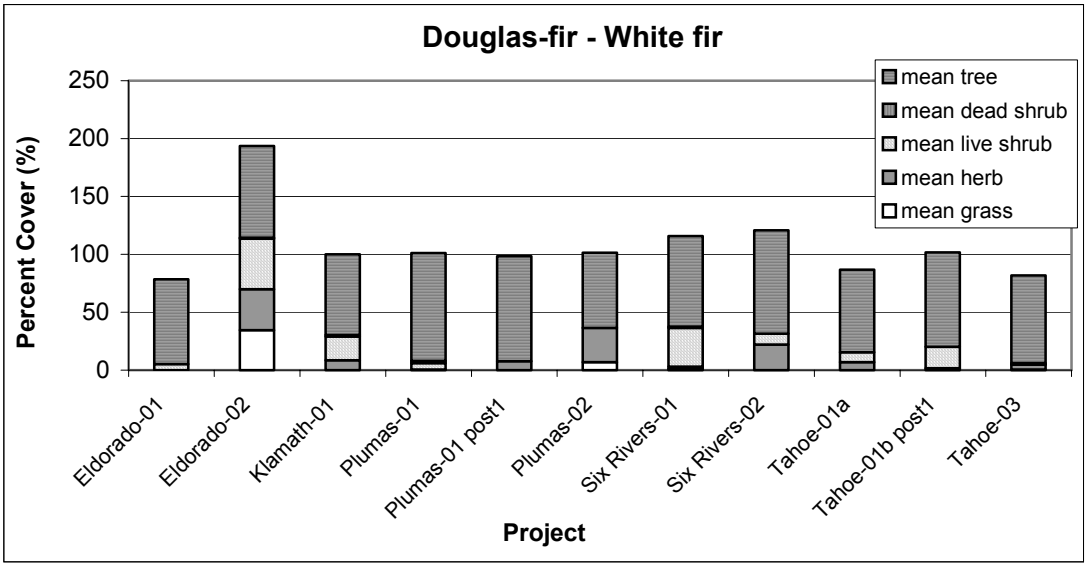


Figure 13 - Vegetation cover (%) by layer for Douglas fir and/or white fir dominated projects.

Table 14 displays the canopy by herb, grass, shrub (live and dead), and tree cover for Douglas-fir/white fir dominated vegetation type (pre and post treatment data is included for Plumas-01 and Tahoe-01b).

Table 14- *Canopy cover per Douglas-fir/white fir dominant vegetation type.*

Douglas fir - white fir dominated											
Forest-Year Sampled	**Burn status**	**Mean Herb Cover**	**Range Min-Max**	**Mean Grass Cover**	**Range Min-Max**	**Mean Live Shrub cover**	**Range Min-Max**	**Mean Dead Shrub Cover**	**Range Min-Max**	**Mean Tree Cover**	**Range Min-Max**
Eldorado-01	**pre**	0.1	0-2	0.03	0 -1	5	0-15	0.1	0-0.15	79	0-100
Eldorado-02	**pre**	36.0	32-43	34	31-38	44	4-75	1.0	0-2	n/a	n/a
Klamath-01	**pre**	9.0	0-80	0.03	0-1	21	11-32	1.0	0-4	70	0-100
Plumas-01	**pre**	0.5	0-3	0.03	0-1	6	0-9	2.0	0-6	n/a	n/a
Plumas-02	**pre**	30.0	28-31	7	2-16	0.1	0-0.3	0.0	0-0	65	0-100
Six Rivers-01	**pre**	2.0	0-6	1	0-20	33	14-63	1.0	0.15-2	78	0-100
Six Rivers-02	**pre**	22.0	3-38	0	0-0	9	1 - 20	0.1	0-0.2	89	0-100
Tahoe-01b post1	**post**	1.5	0-15.5	0	0-0	19	19-19	0.0	0-0	81	0-100
Tahoe-03	**pre**	4.3	0-38	0.43	0 -2.5	0.27	0-0.8	2.1	0-6	76	0-100

Yellow Pine Dominated Sites

Percent cover for grasses, herbs, dead and live shrubs, and trees are shown in Figure 14. Six projects have data for pre and post treatment (Lassen-01, Mendocino-02, Modoc-02, Los Padres-02, Sierra-02, and Tahoe-01c). The Los Padres-02, Mendocino-02, and Modoc-02 projects show a post one-year increase in herbaceous cover. Generally, tree cover did not drastically change compared to pre and post year treatment measurements. Data show a reduction of approximately 18% (range: 0.25–34%) tree cover after prescribed fire or mechanical treatments, which is often contributed to the mortality of poles and small trees (Table 3 in Chapter V, Forest Mortality, in this document).

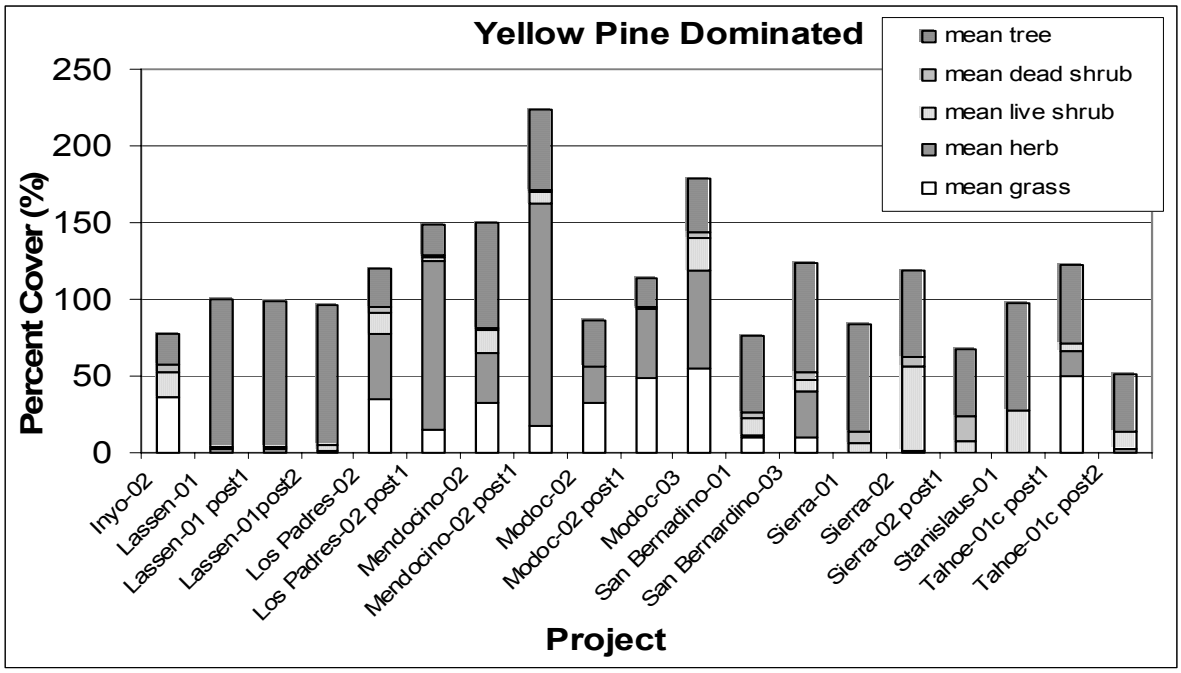


Figure 14 - Vegetation cover (%) by layer for yellow pine (ponderosa pine, Jeffrey pine, Coulter pine) dominated projects

Table 15 - ***Canopy cover per yellow pine dominant vegetation type***

Yellow pine (ponderosa, Jeffrey, coulter) dominated											
Forest-Year Sampled		**Mean Herb Cover**	**Range Min-Max**	**Mean Grass Cover**	**Range Min-Max**	**Mean Live Shrub cover**	**Range Min-Max**	**Mean Dead Shrub Cover**	**Range Min-Max**	**Mean Tree Cover**	**Range Min-Max**
Inyo-02	**pre**	0	0-0	37	30-49	16	9 - 22	5	3-7	20	0-100
Lassen-01	**pre**	2	0-10	0.4	0-1	3	0-3	0	0	95	0-100
Lassen-01 post2	**post**	0	0-0	0	0-0	4	2.1-6.4	0	0	91	0-100
Los Padres-02	**pre**	43	41-48	35	25 -41	14	9-19	4	3-4	24	0-100
Los Padres-02 post1	**post**	110	0-300	15	0-76	2.8	0.2-6.1	1.3	0-2.4	20	0-100
Mendocino-02	**pre**	33	31-38	33	22 -42	15	5-42	1	0-5	69	0-100
Mendocino-02 post1	**post**	145	0-360	17	0-124	7.9	2.4-21.3	1.77	0-5.8	53	0-100
Modoc-02	**pre**	24	21-27	33	26-38	0.3	0-1	0.2	0-0.4	29	0-100
Modoc-02 post1	**post**	45	0-139	49	0-107	0.85	0.6-1.1	2.5	2-3	18	0-100
Modoc-03	**pre**	64	0-202	56	0-139	21	0.8-29	3	0-6.2	36	0-100
San Bernardino-01	**pre**	2	0-10	10	0-60	11	3-23	4	0-7	50	0-100
San Bernardino-03	**pre**	31	0-202	10	0-76	7	0-20	5	0-18	71	0-100
Sierra-01	**pre**	0.3	0-5	0	0-0	7	0-18	7	0-22	69	0-100
Sierra-02	**pre**	1	0-4	0	0-0	55	8-80	5	0-15	57	0-100
Sierra-02 post1	**post**	0	0-0	0	0-0	7	1.2-12.8	35	31-37	44	0-100
Stanislaus-01	**pre**	0.2	0-3	0.1	0-1	27	0-76	0.1	0-0.33	69	0-100
Tahoe-01c post2	**post**	2.5	0-2.5	0	0	11.5	0-11.5	0	0	38	0-100

Ponderosa Pine/White Fir Dominated Sites

Two projects, Klamath-02 post1 and Shasta Trinity-02 post1, represent pre and post one-year treatment data and show changes in percent cover as a result of prescribed fire. Both projects indicate trends where mean grass and herb cover decreased one-year post treatment. The absence of mean tree cover for the Shasta-Trinity-02 post1 project indicates that these data are not available and does not mean that tree cover was 0% for the post measurement (Figure 15).

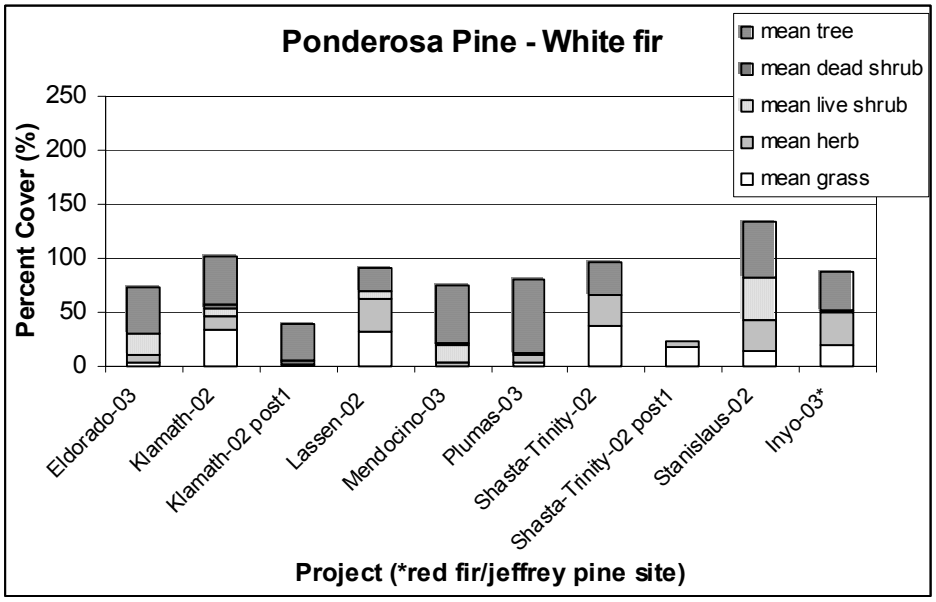


Figure 15 - Vegetation cover (%) by layer for Ponderosa pine-white fir dominated projects.

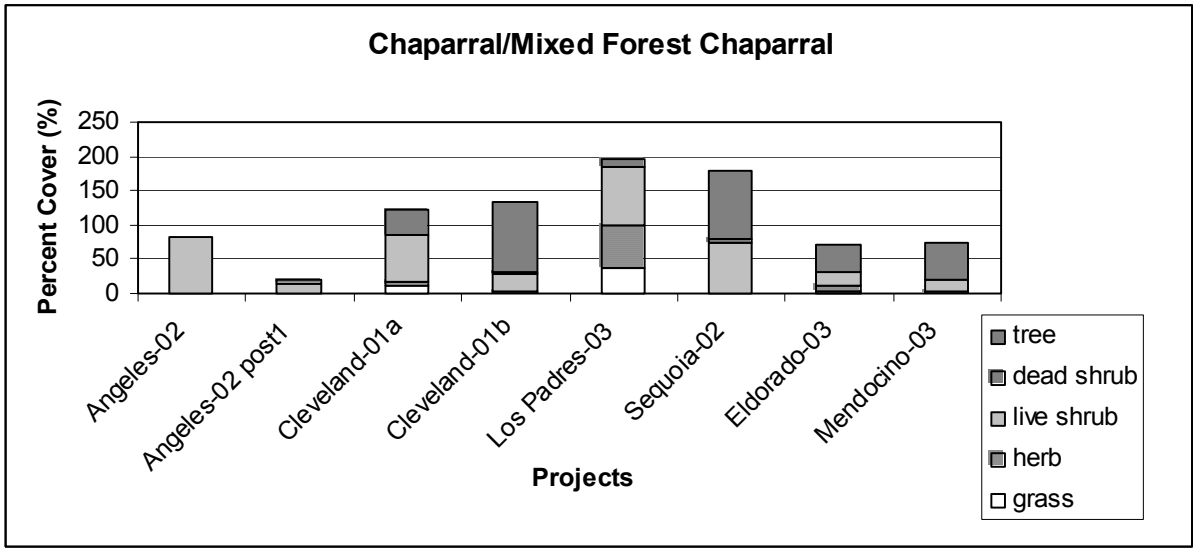
Table 16 - *Canopy cover per Ponderosa pine-white fir dominant vegetation type.*

Ponderosa Pine – White fir Projects											
Forest-Year Sampled	**Burn status**	**Mean Herb Cover**	**Range Min-Max**	**Mean Grass Cover**	**Range Min-Max**	**Mean Live Shrub cover**	**Range Min-Max**	**Mean Dead Shrub Cover**	**Range Min-Max**	**Mean Tree Cover**	**Range Min-Max**
Eldorado-03	**pre**	8	0-162	3	0-54	19	4-52	0	0-0	42	0-100
Klamath-02	**pre**	13	0-23	33	27-38	7	1 -11	3	0-7	45	0-100
Klamath-02 post1	**post**	n/a	n/a	n/a	n/a	1.2	0.8-1.6	3.6	0-7.2	36	0-100
Lassen-02	**pre**	31	27-36	32	24-38	7	2 - 14	1	0-3	22	0-100
Mendocino-03	**pre**	4	0-69	0	0-0	15	0-37	1.5	0-6.6	54	0-100
Plumas-03	**pre**	7	0-18	4	0-23	2	0-3.4	0	0-0	68	0-100
Shasta-Trinity-02	**pre**	28	18-39	38	28-45	0.1	0-0.4	0	0-0	31	0-100
Shasta-Trinity-02 post1	**post**	5	0-94	18	0-78.5	0.8	0-.8	0	0-0	n/a	0-100
Stanislaus-02	**pre**	29	27-31	14	0-27	40	14-69	0.3	0-1	52	0-100
Inyo-03*	**pre**	30	0-154	20	0-126	2	0-8.8	0-8.8	0.2	0-0.8	0-100

*Inyo-03 is a red fir/Jeffrey pine dominated site.

Chaparral/Mixed Forest Dominated Sites

Percent cover for both pure chaparral and mixed forest/chaparral stands are displayed together (Figure 16). Compared to other forest vegetation type projects, percent cover for live shrub is much higher. Angeles-02 post1 cover is approximately 10% the cover before the wildfire (Angeles-02). The Cleveland-01b, Mendocino-02, and Sequoia-02 projects are mixed, resulting in higher tree cover compared to the pure chaparral projects.



*Eldorado-03 and Mendocino-03 are also noted in Ponderosa pine/white fir vegetation type

Figure 16 - Vegetation cover (%) by layer for chaparral and mixed forest/chaparral dominated projects.

Table 17 - *Canopy cover per Oak woodland/chaparral dominant vegetation type. Eldorado-03 and Mendocino-03 are not noted in this table. They are shown in Ponderosa pine/white fir vegetation type (Table 16).*

Oak woodlands/chaparral											
Forest-Year Sampled	**Burn status**	**Mean Herb Cover**	**Range Min-Max**	**Mean Grass Cover**	**Range Min-Max**	**Mean Live Shrub cover**	**Range Min-Max**	**Mean Dead Shrub Cover**	**Range Min-Max**	**Mean Tree Cover**	**Range Min-Max**
Angeles-02 post1	**post**	n/a	n/a	n/a	n/a	13	8-21	7	3-7	n/a	n/a
Cleveland-01a-chap	**pre**	4	n/a	12	n/a	69	n/a	36	n/a	n/a	n/a
Cleveland-01b-oak	**pre**	3	0-32	0.2	0-84	27	16-47	3	0.05-6	96	0-100
Los Padres-03	**pre**	63	0-186	36	0-126	85	85-85	13	13-13	0	0
Sequoia-02	**pre**	n/a	n/a	0	n/a	75	52-97	5	n/a	n/a	n/a

Tree Density by Species

Tree densities by species and diameter class were computed for each project. Diameter distributions of density by species are shown in graphs organized by dominant vegetation type and project. In some cases, projects are represented by pre and post, one and two-year data. The plots for these projects were measured showing a difference in diameter classes. Tree diameters were not re-measured with the assumption that one-year growth

would be negligent, especially with the first year post measurements. Consequently, the diameter distributions change very little, with the exception of measuring fewer numbers of trees in the smaller diameter classes, indicative of their mortality as a result of mechanical and/or prescribed fuel treatments. The scale of the y-axis changes by project and should be noted when comparing projects.

Oak Woodland Dominated Project

Figure 17 is the graphical representation of tree density by diameter class for coast live oak. Cleveland-01b is the only project that is pure oak woodland dominant vegetation type.

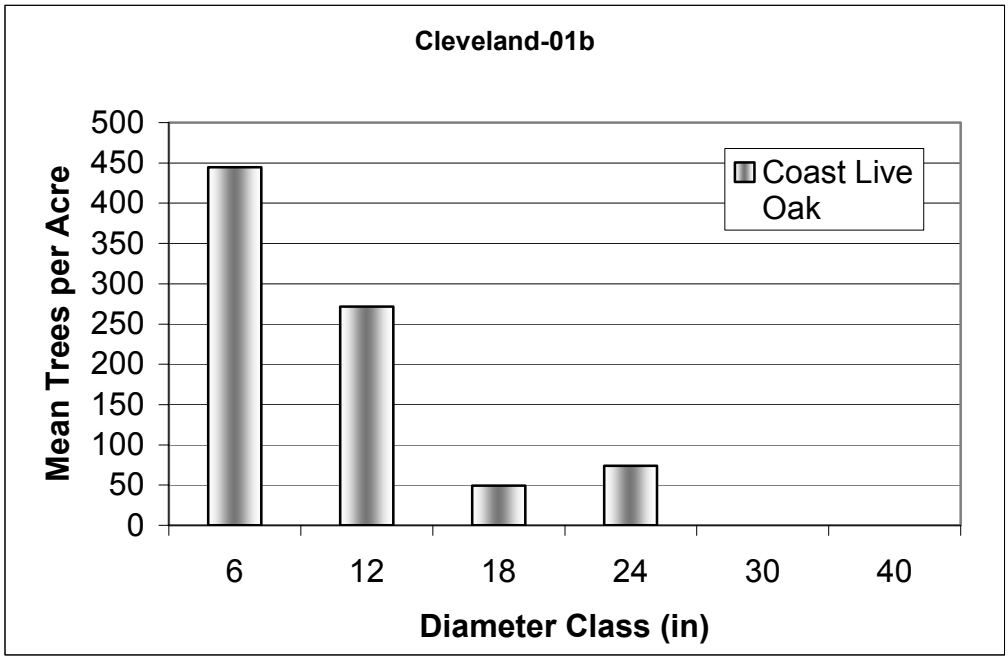


Figure 17 - Cleveland-01b (oak woodland) tree density measured in 2001.

Douglas fir and/or white fir dominated projects

Figures 18a-18l are graphical representations of the tree density by diameter class and tree species for projects that are within the Douglas-fir/white fir dominated vegetation type.

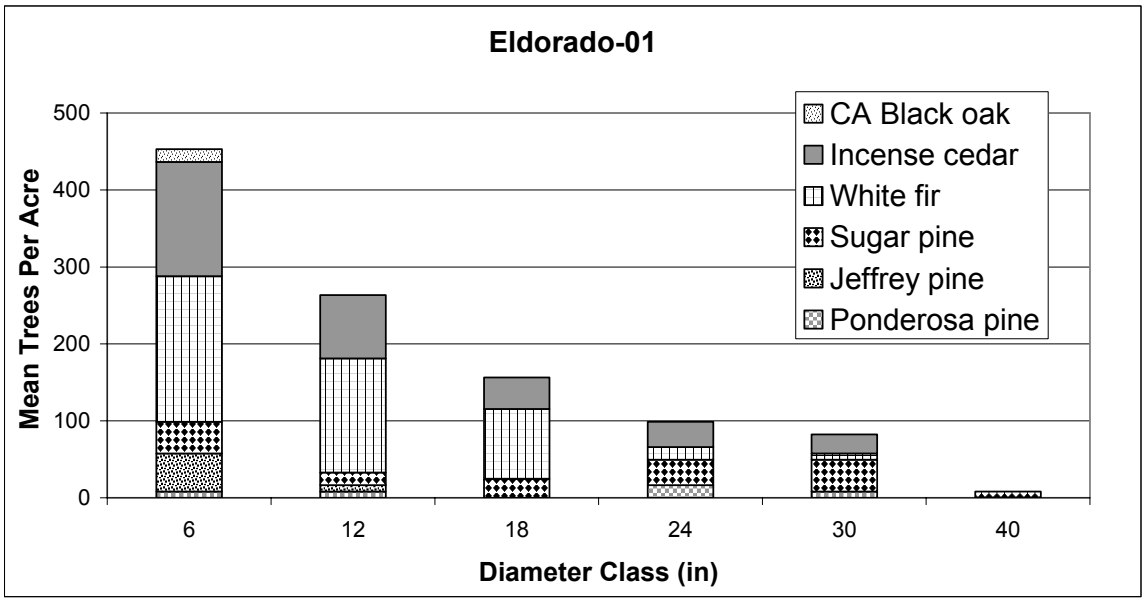


Figure 18a - Eldorado-01 (Douglas-fir/white fir) tree densities measured in 2001.

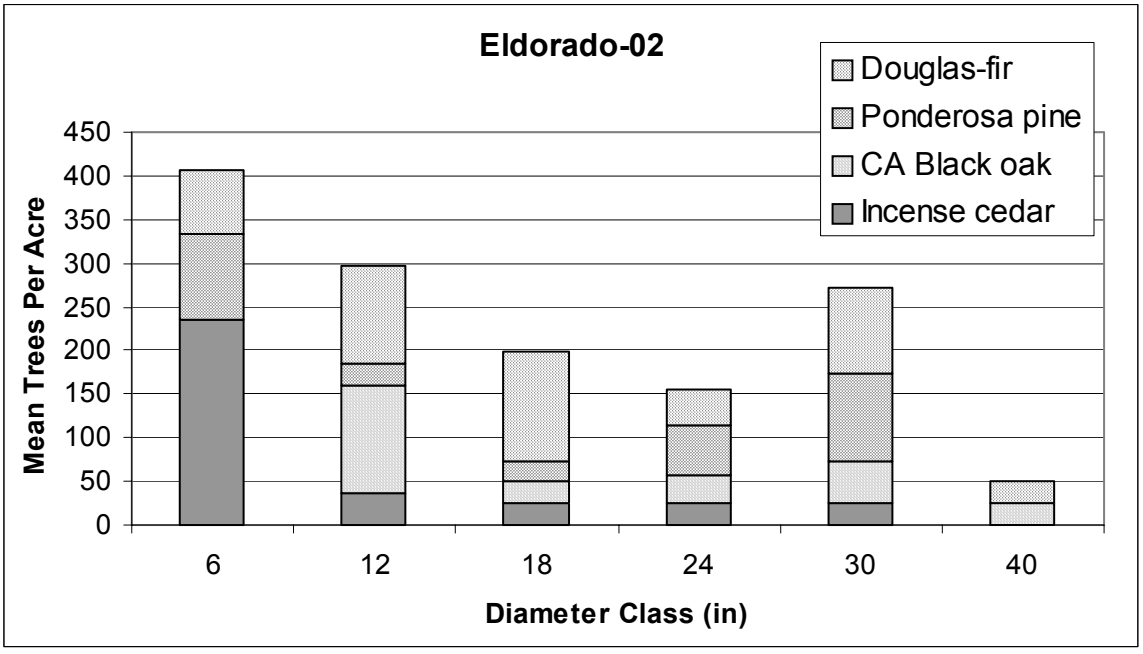


Figure 18b – Eldorado-02 (Douglas-fir/white fir) tree densities measured in 2002.

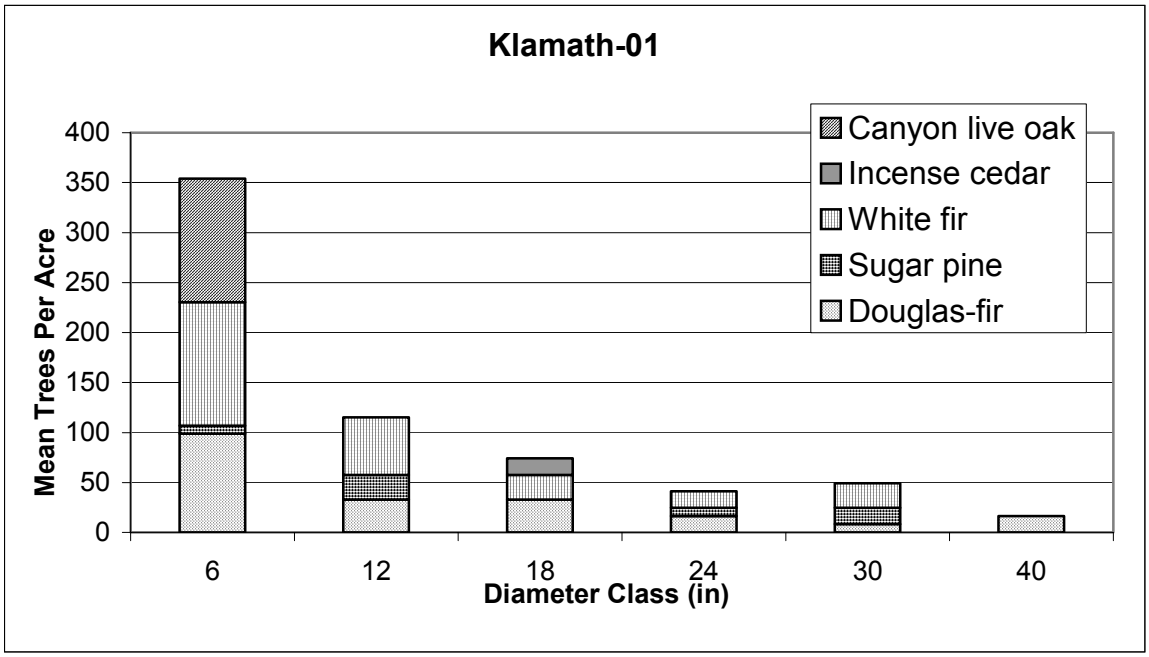


Figure 18c - Klamath-01 (Douglas-fir/white fir) tree densities measured in 2001.

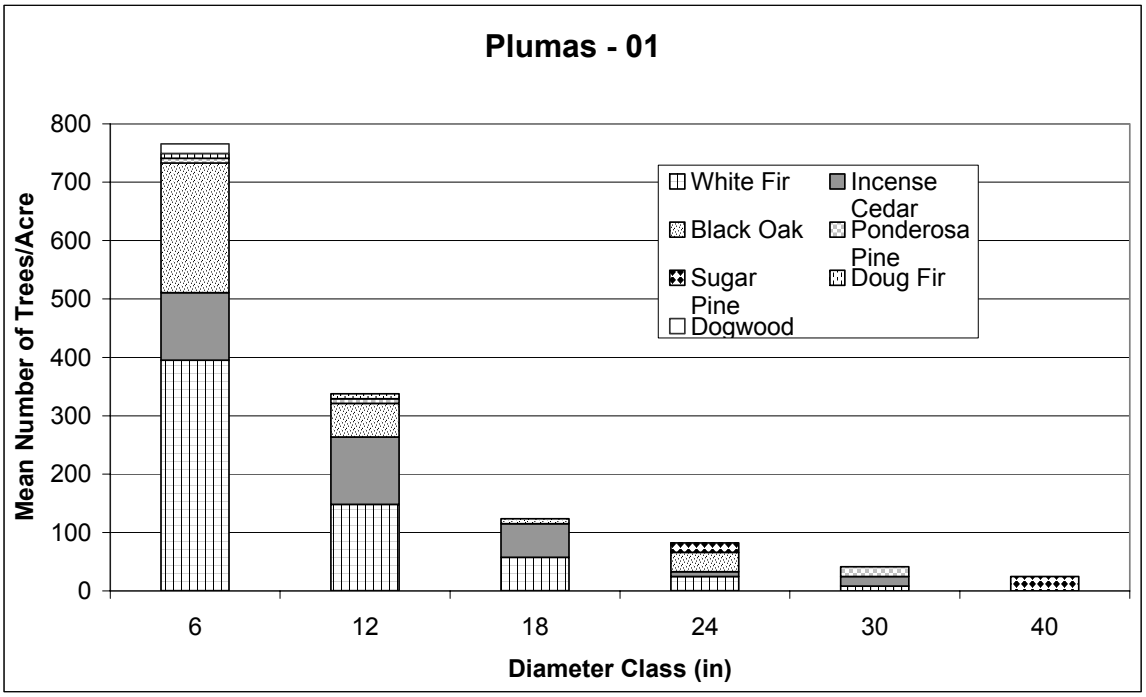


Figure 18d - Plumas-01 (Douglas-fir/white fir) tree densities measured in 2001.

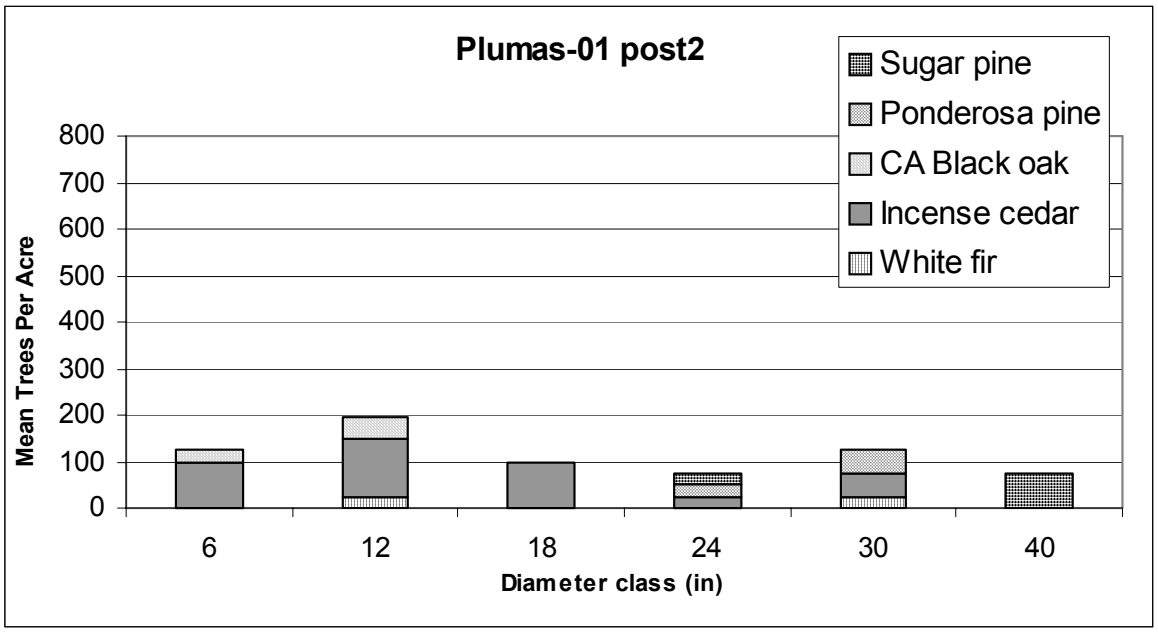


Figure 18e - Plumas-01 post2 (Douglas-fir/white fir) tree densities measurement in 2003, plot 3 only.

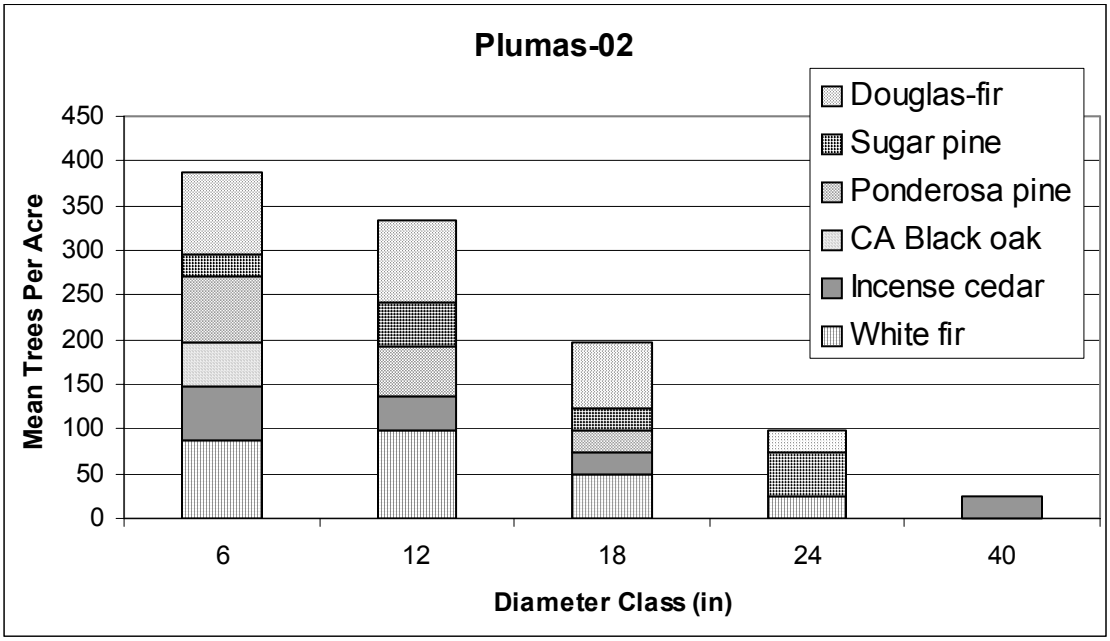


Figure 18f – Plumas-02 (Douglas-fir/white fir) tree densities measured in 2002.

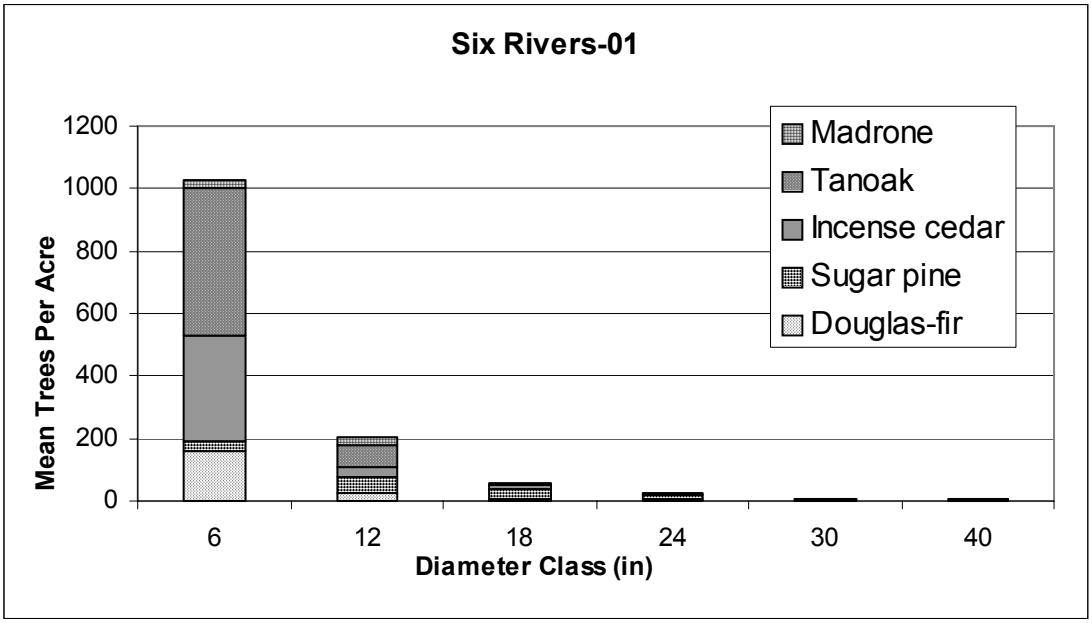


Figure 18g - Six Rivers-01 (Douglas-fir/white fir) tree densities measured in 2001.

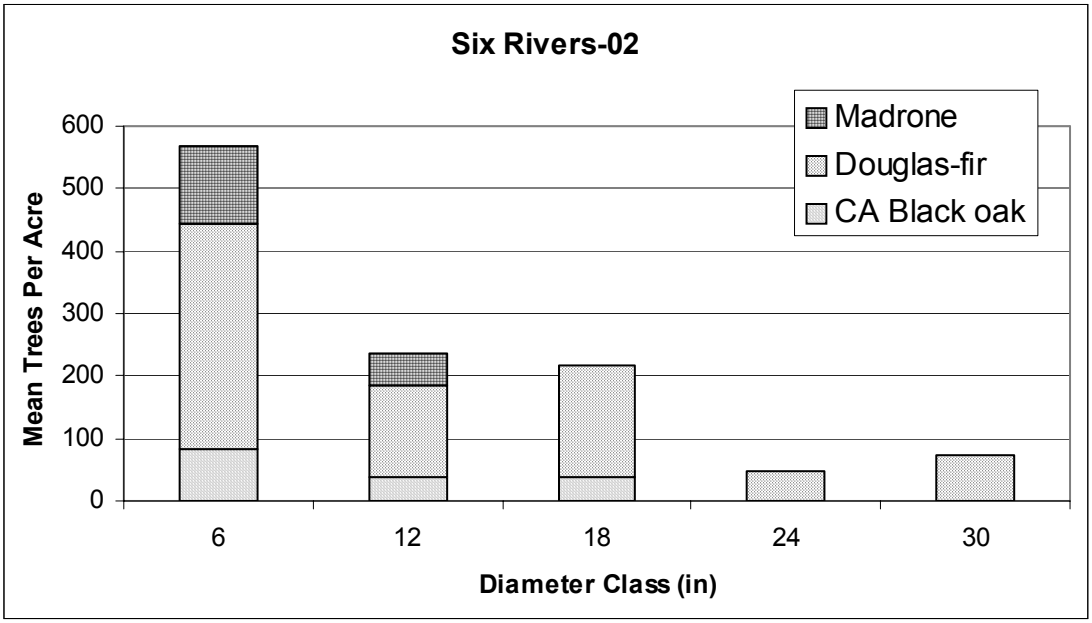


Figure 18h - Six Rivers-02 (Douglas-fir/white fir) tree densities measured in 2002.

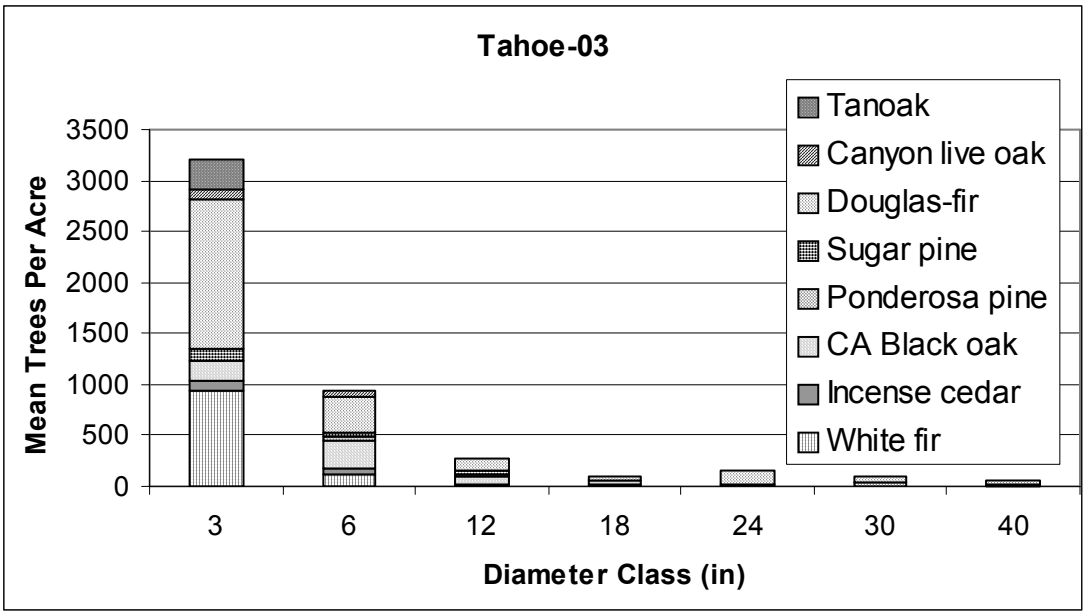


Figure 18i – Tahoe-03 (Douglas-fir/white fir) tree densities measured in 2003.

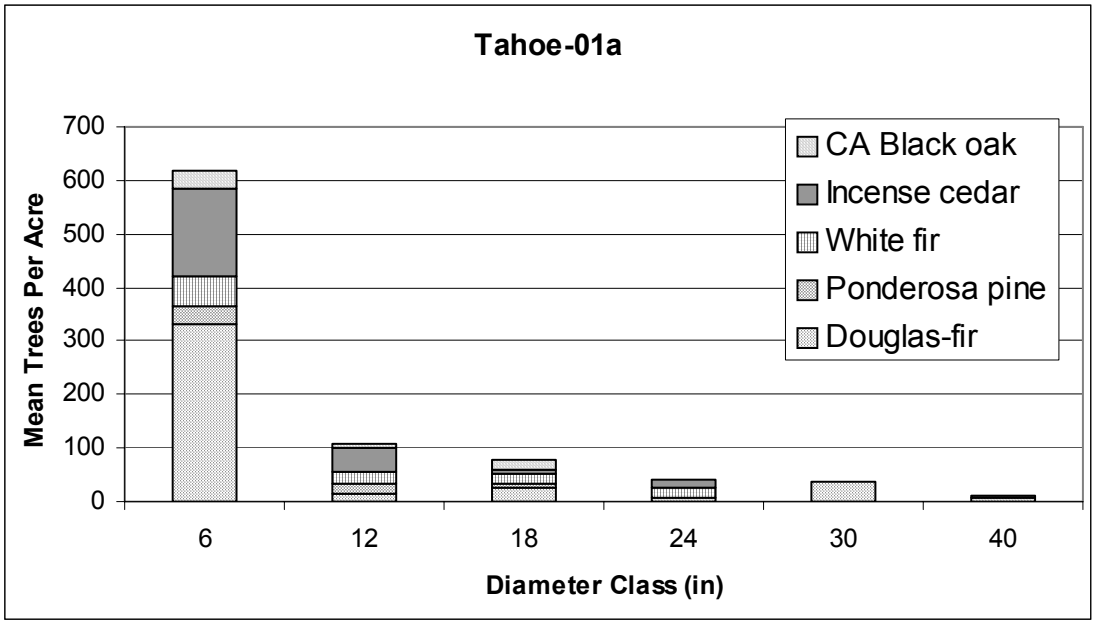


Figure 18j – Tahoe-01a (Douglas-fir/white fir) tree densities measured in 2001.

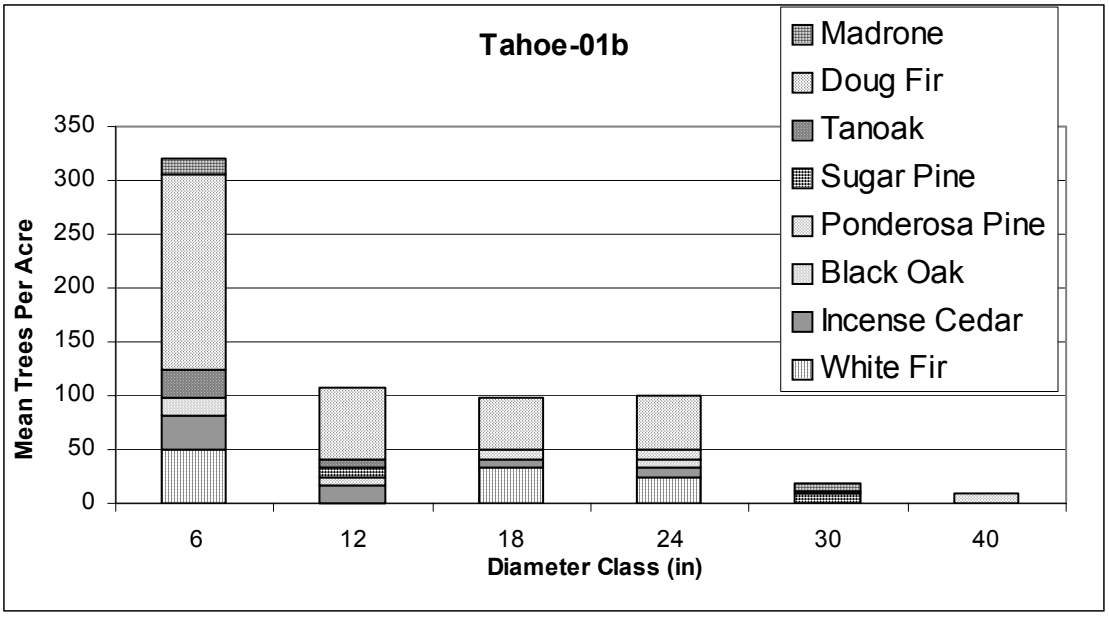


Figure 18k – Tahoe-01b (Douglas-fir/white fir) tree densities measured in 2001, including plots 4-6.

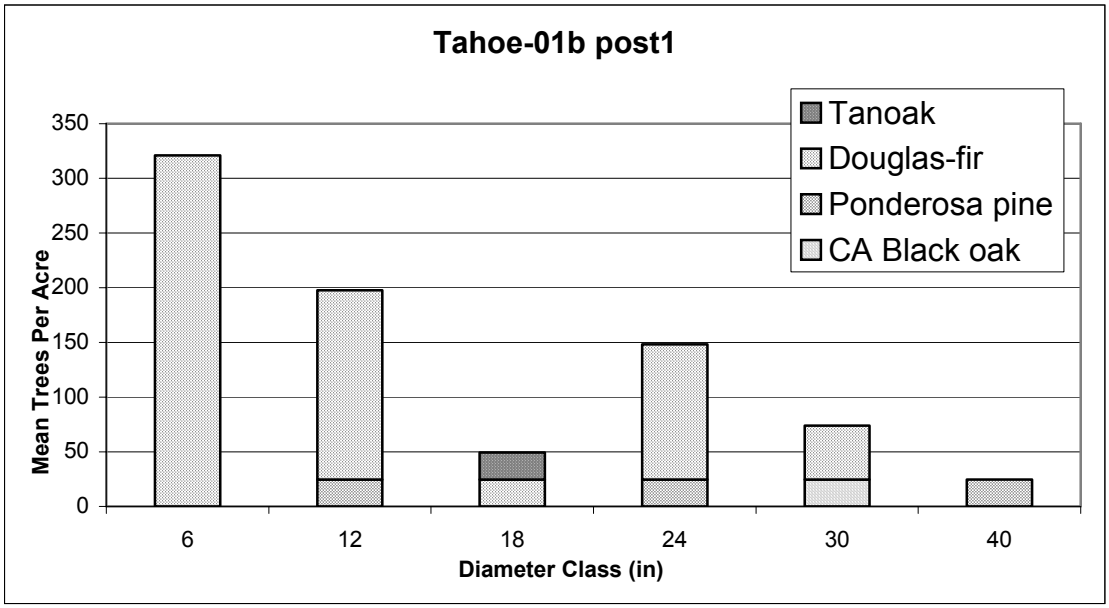


Figure 18l – Tahoe-01b post1 (Douglas-fir/white fir) post treatment tree densities measured in 2003, plot 4 only.

Ponderosa pine-white fir dominated projects

Figures 19a-19g are graphical representations of the tree density by diameter class and tree species for projects that are within the ponderosa pine/white fir dominated vegetation type.

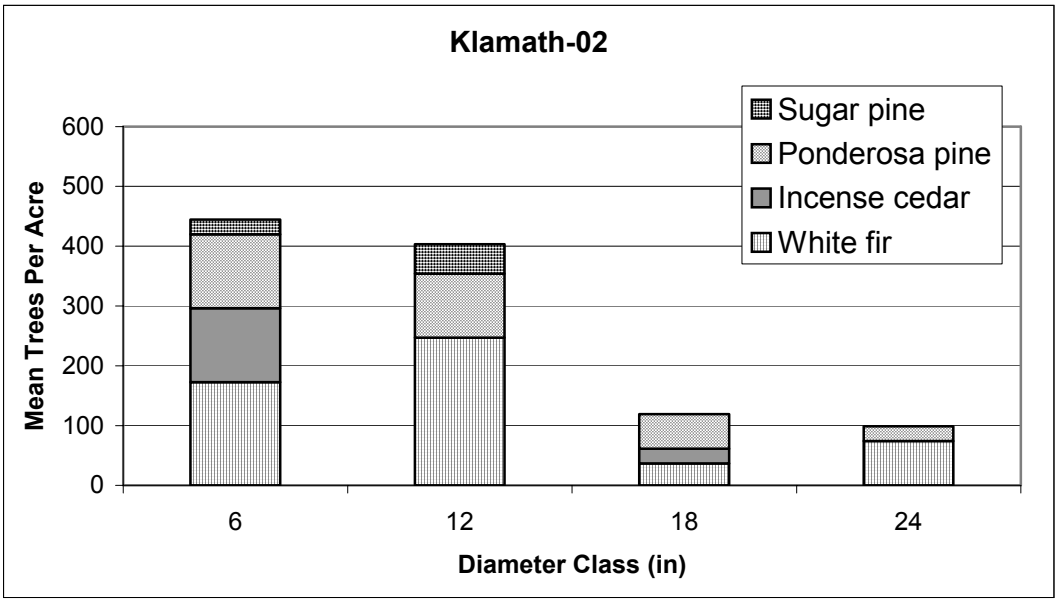


Figure 19a - Klamath-02 (Ponderosa pine/white fir) tree densities measured in 2002, plots 1-3. These plots were re-measured in 2003. The large tree diameter distribution was the same for the 2003 data.

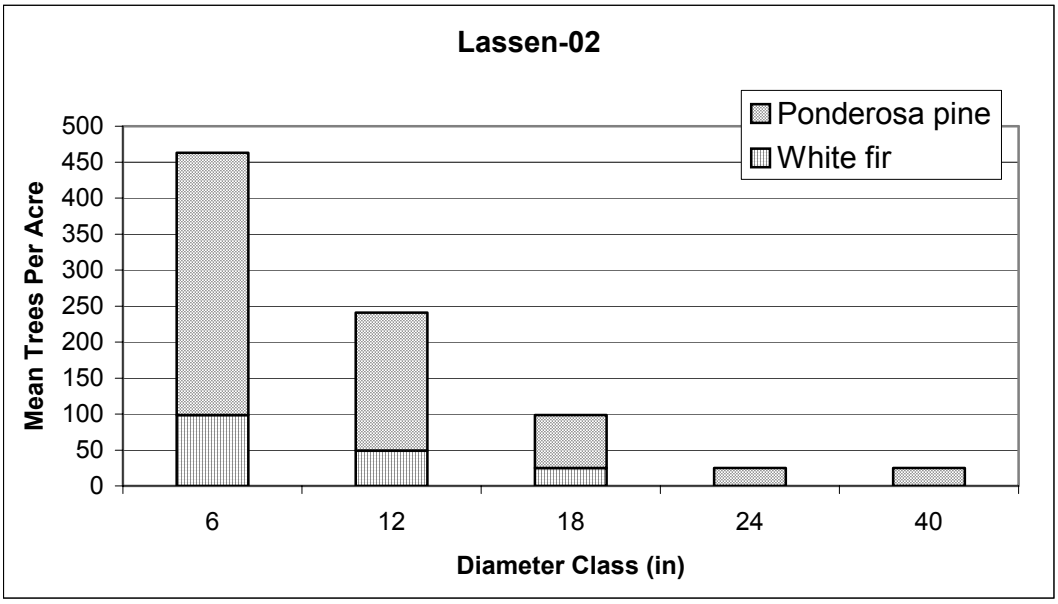


Figure 19b – Lassen-02 (Ponderosa pine/white fir) tree densities measured in 2002.

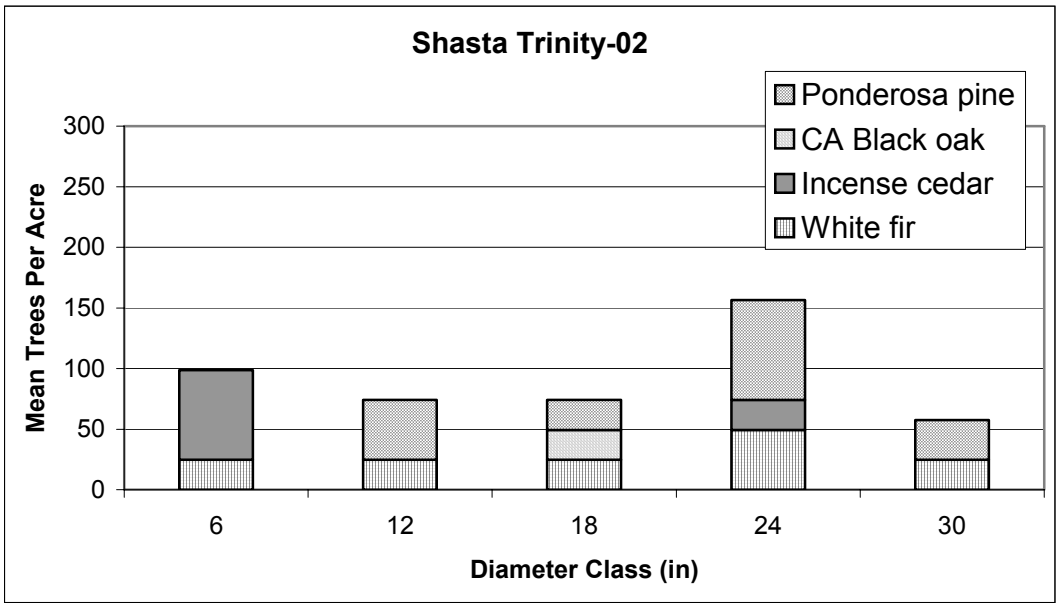


Figure 19c – Shasta Trinity-02 (Ponderosa pine/white fir) tree densities measured in 2002, plots 1-3. Shasta Trinity-02 was re-measured in 2003 and tree diameter distribution was the same.

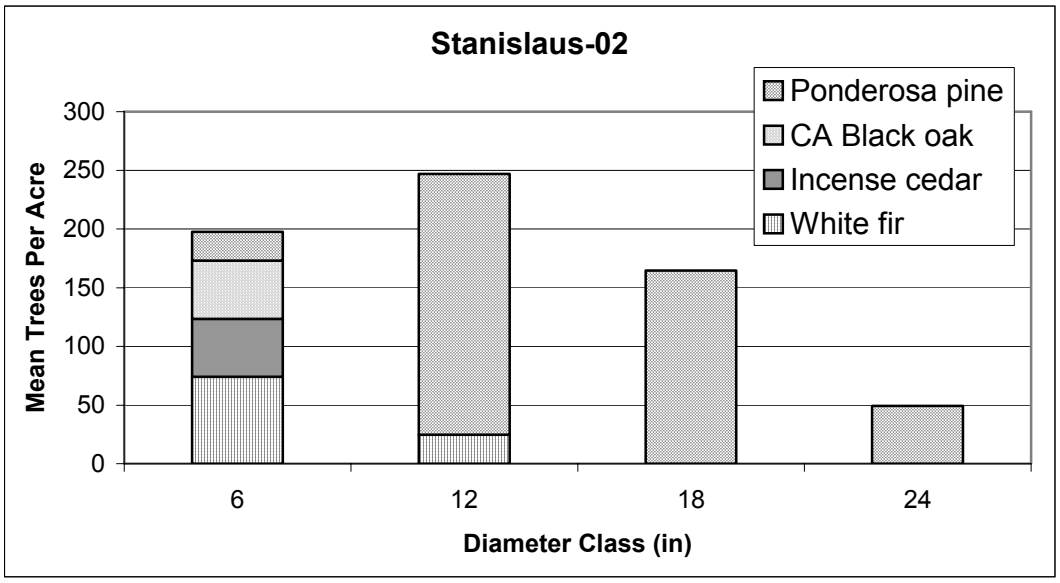


Figure 19d - Stanislaus-02 (Ponderosa pine/white fir) tree densities measured in 2002.

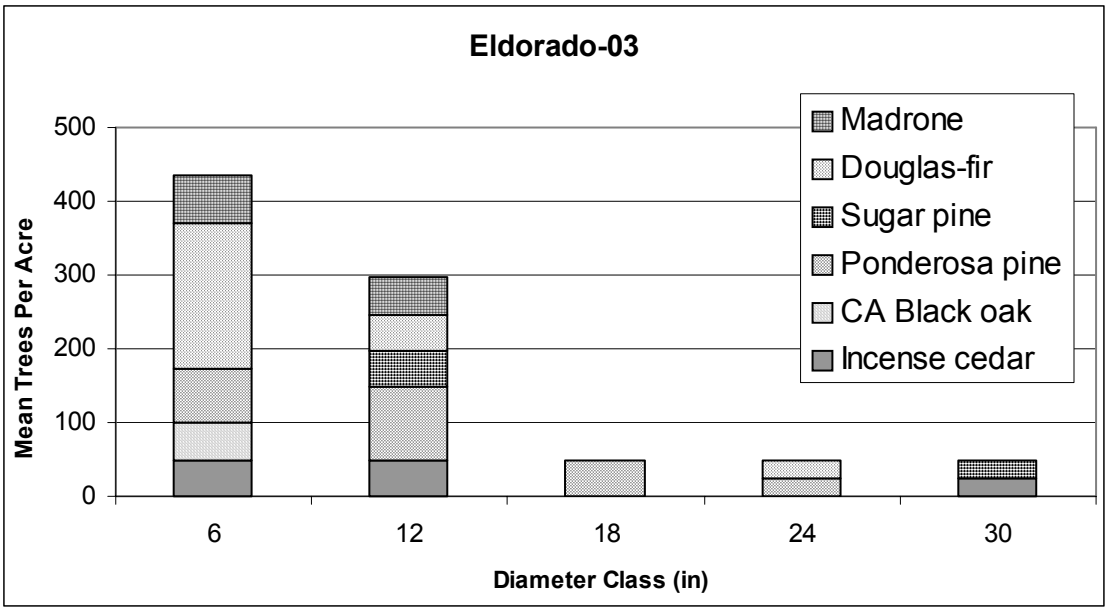


Figure 19e – Eldorado-03 (Ponderosa pine/white fir) tree densities measured in 2003.

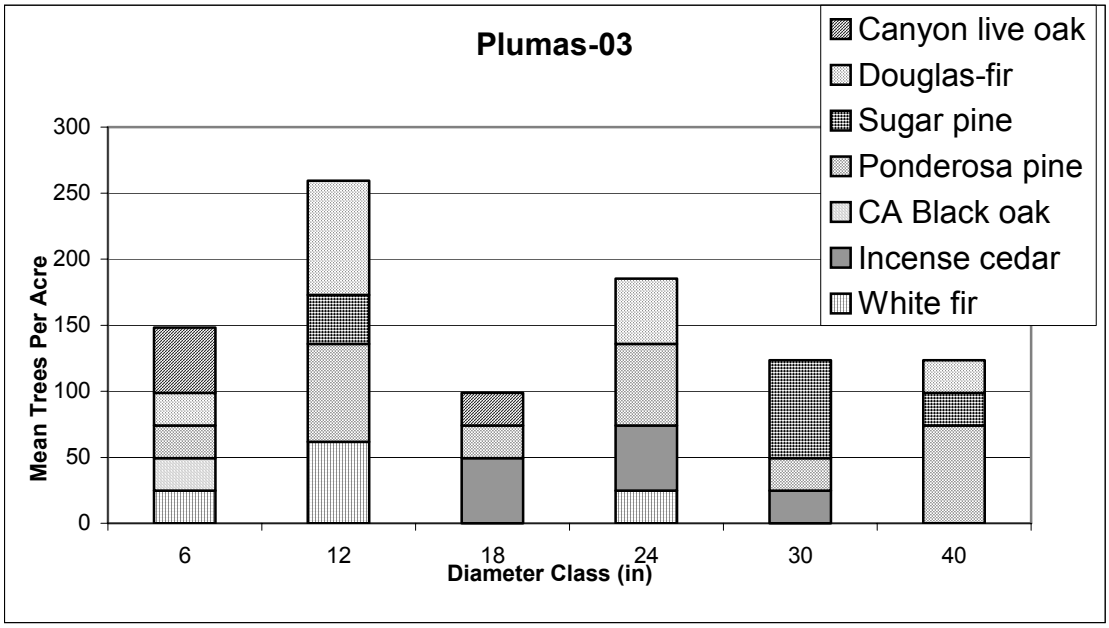


Figure 19f – Plumas-03 (Ponderosa pine/white fir) tree densities measured in 2003.

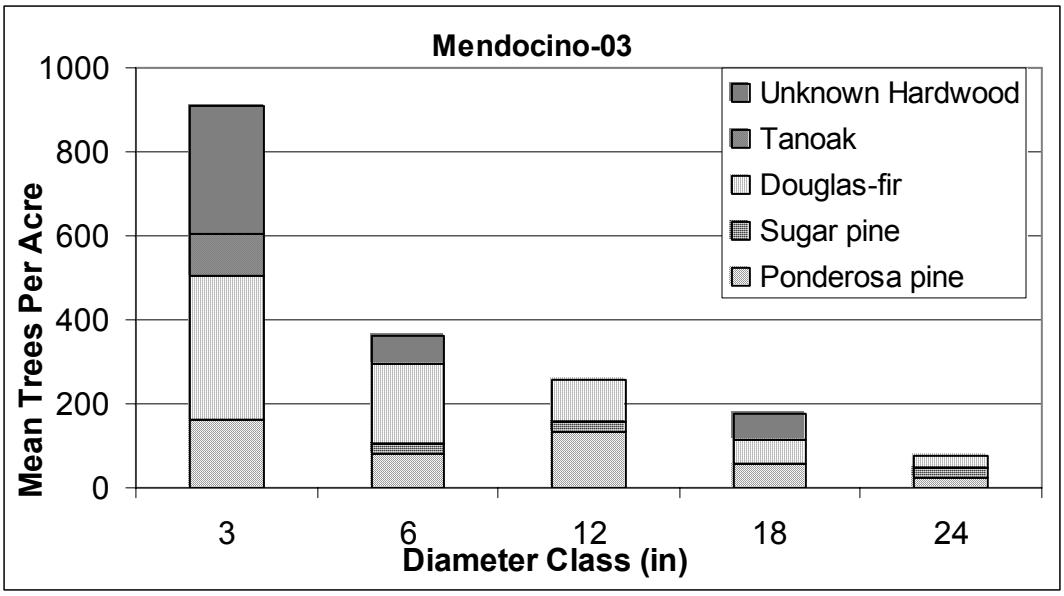


Figure 19g– Medocino-03 (Ponderosa pine/white fir) tree densities measured in 2003.

Yellow pine (Ponderosa pine, Jeffrey pine, Coulter pine) dominated projects

Figures 20a-20q are graphical representations of the tree density by diameter class and tree species for projects that are within the yellow pine dominated vegetation type.

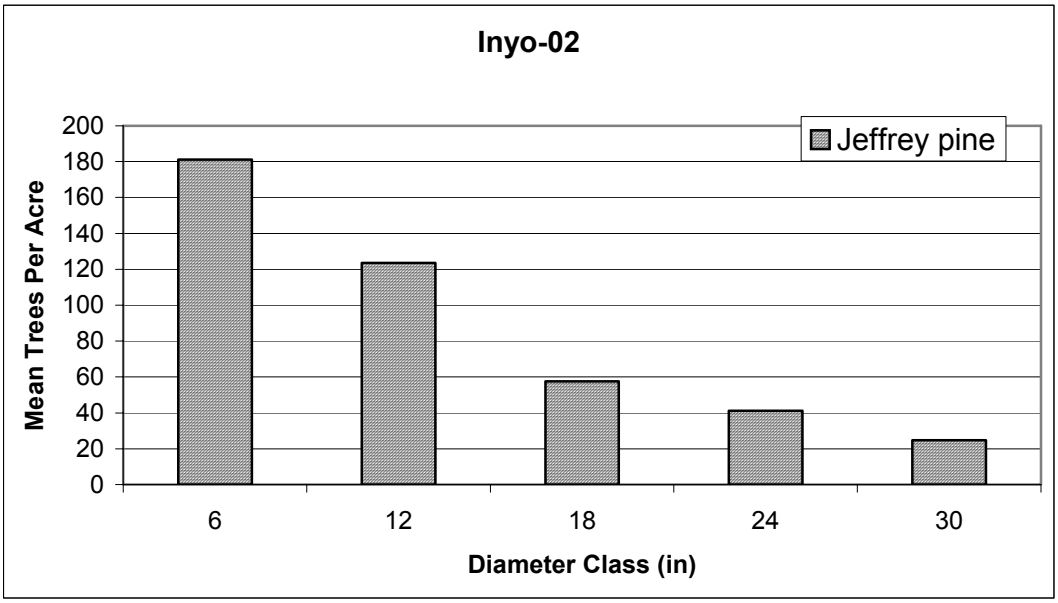


Figure 20a - Inyo-02 (yellow pine) tree density measured in 2002.

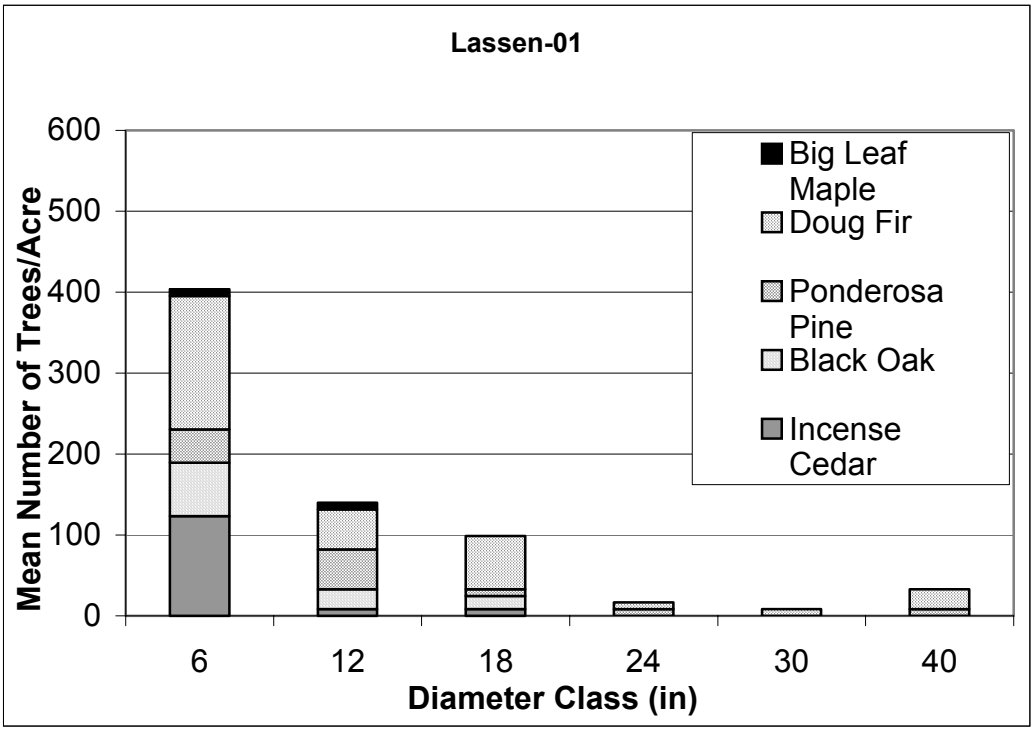


Figure 20b – Lassen-01 (yellow pine) tree density measured in 2001, plots 1-3.

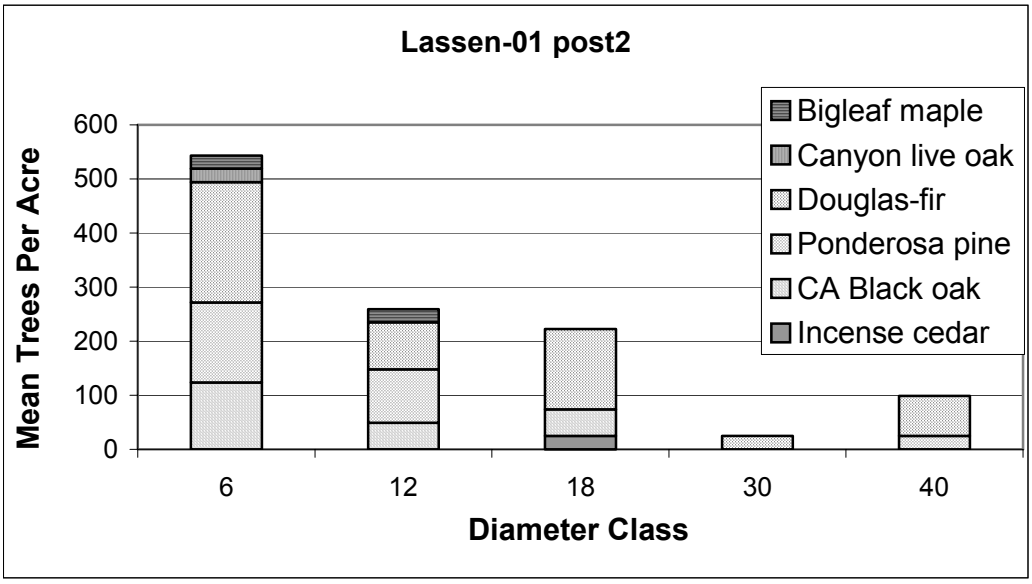


Figure 20c - Lassen-01 post2 (yellow pine) post treatment tree densities in plots 2-3 re-measured.

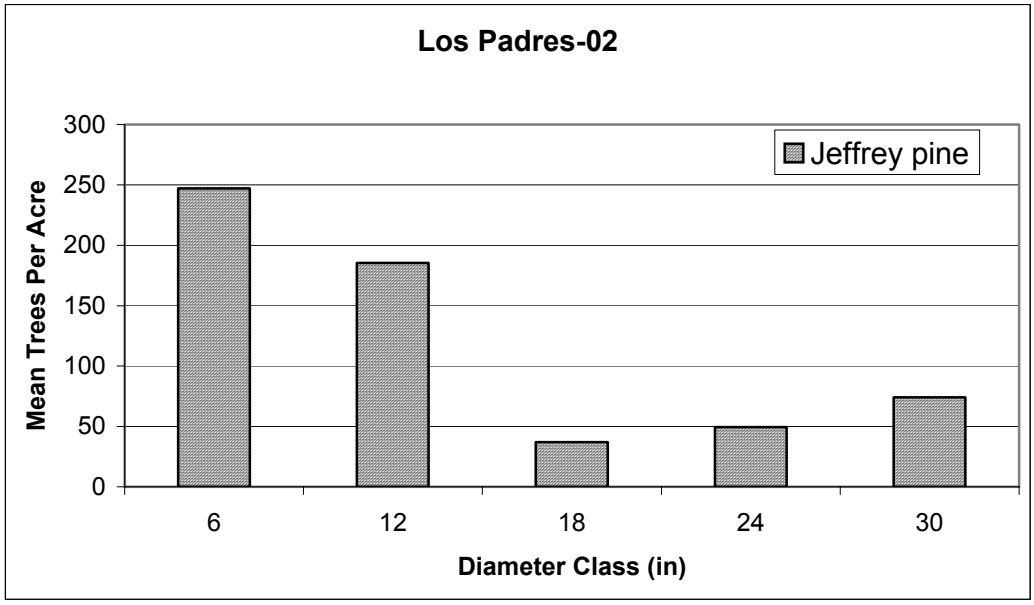


Figure 20d - Los Padres-02 (yellow pine) tree density measured in 2002, plots 1 and 3.

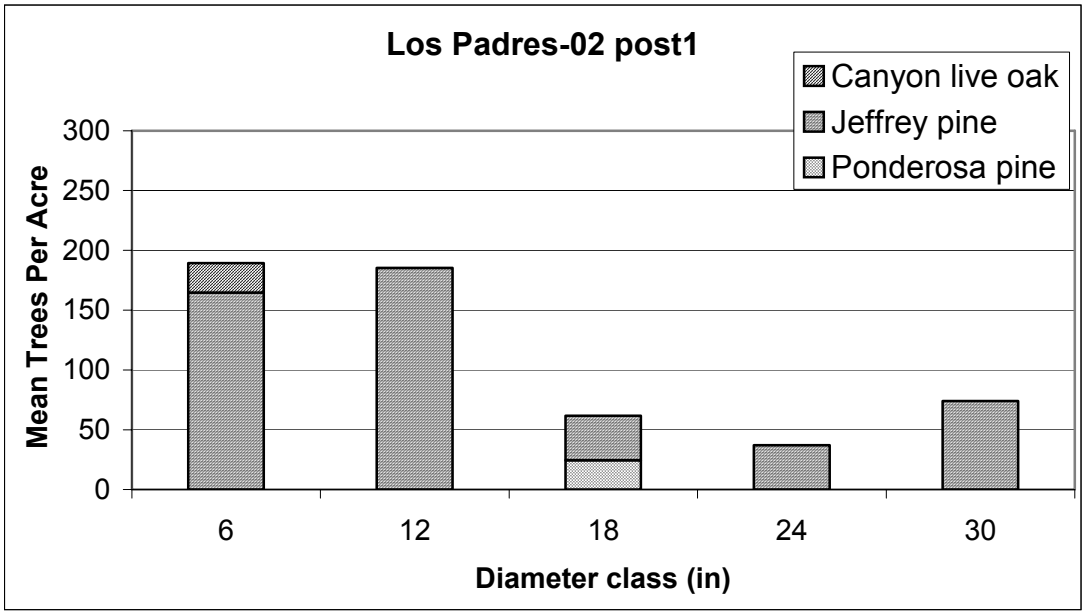


Figure 20e - Los Padres-02 post1 (yellow pine) post treatment tree densities re-measurement for plots 1-3.

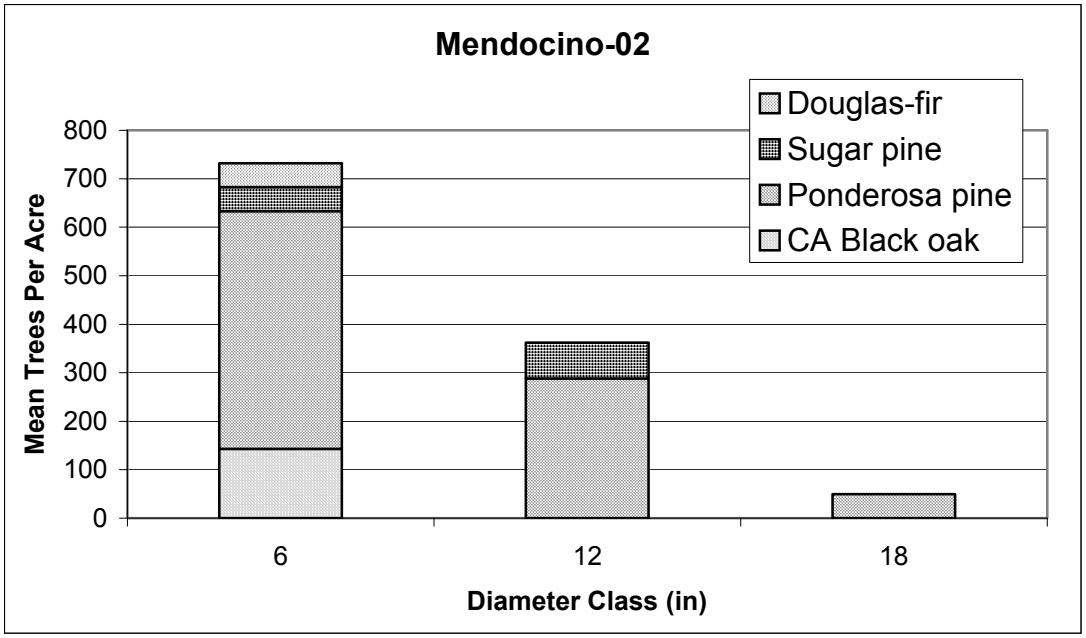


Figure 20f – Mendocino-02 (yellow pine) tree densities measured in 2002, plots 1-6. This project was re-measured in 2003 resulting in the same diameter distribution as 2002.

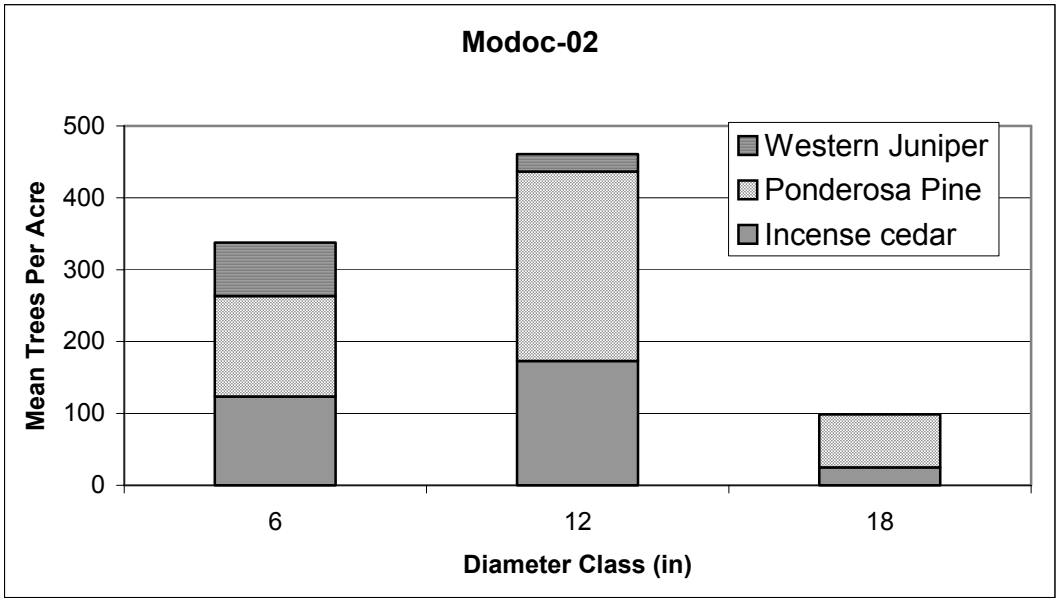


Figure 20g - Modoc-02 (yellow pine) tree densities measured in 2002**,** plots 1-3.

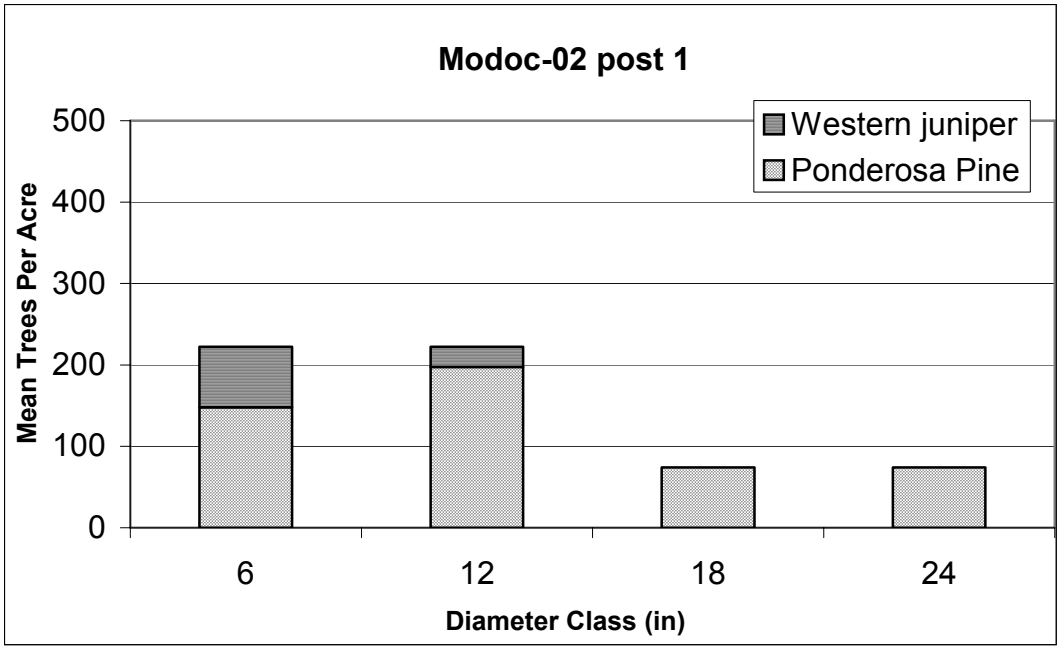


Figure 20h – Modoc-02 post1 (yellow pine) post treatment tree densities re-measured in 2003, including plots 1 and 2.

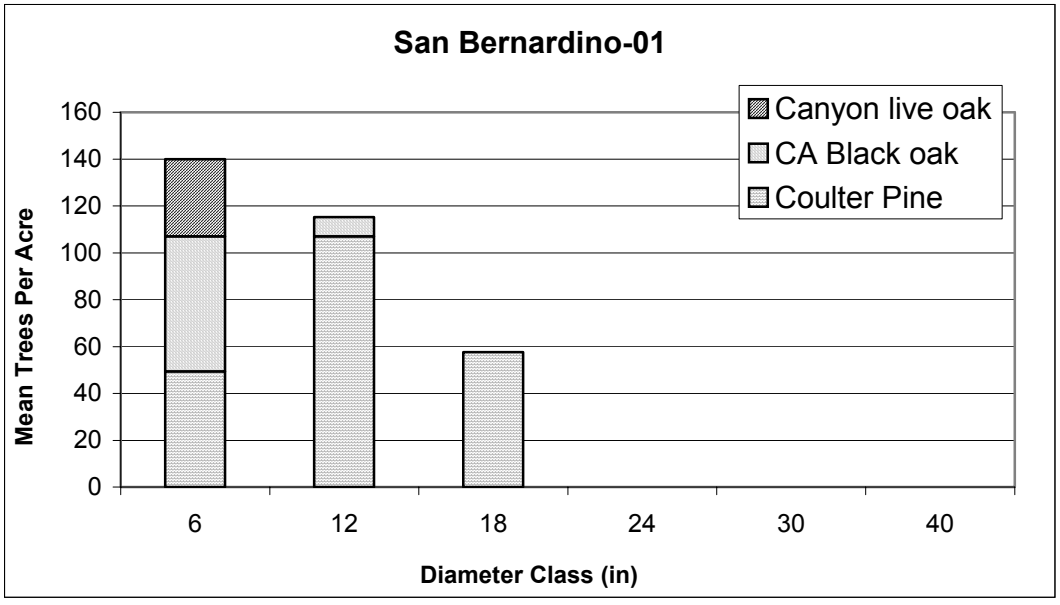


Figure 20i – San Bernardino-01 (yellow pine) tree densities measured in 2001.

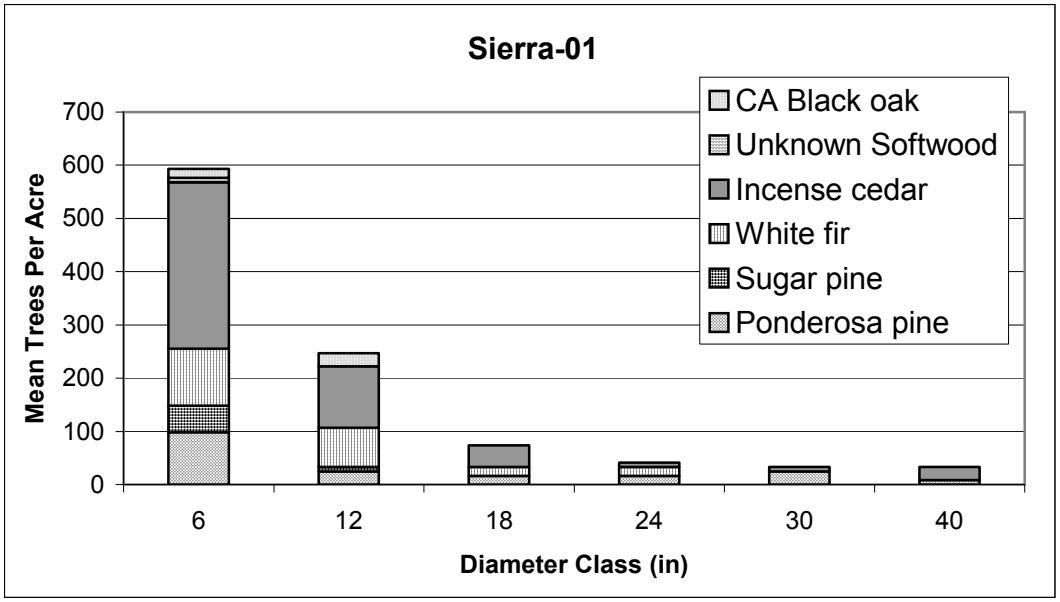


Figure 20j – Sierra-01 (yellow pine) tree densities measured in 2001.

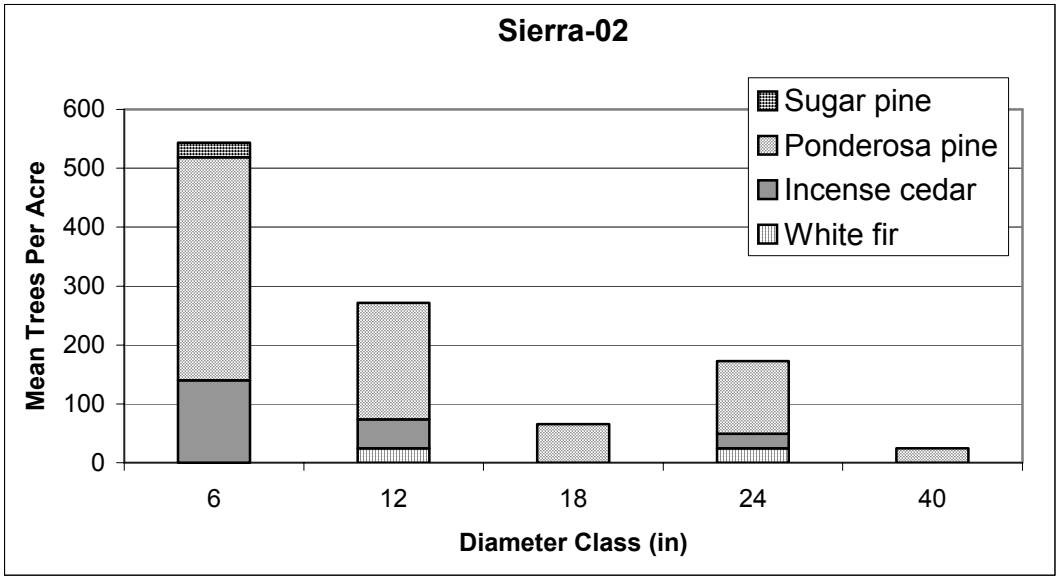


Figure 20k - Sierra-02 (yellow pine) tree densities measured in 2002.

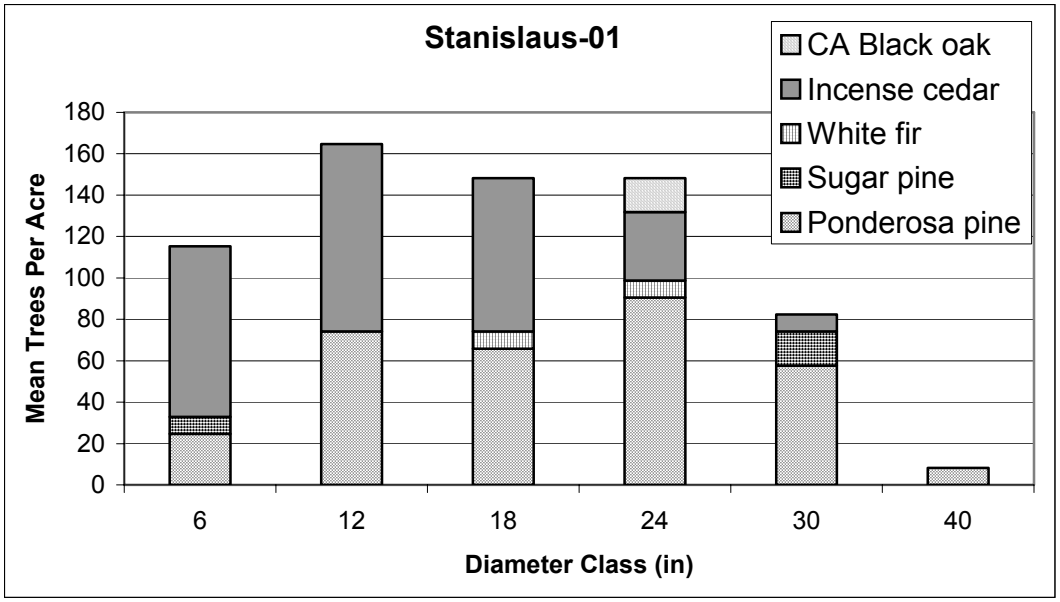


Figure 20l – Stanislaus-01 (yellow pine) tree densities measured in 2001.

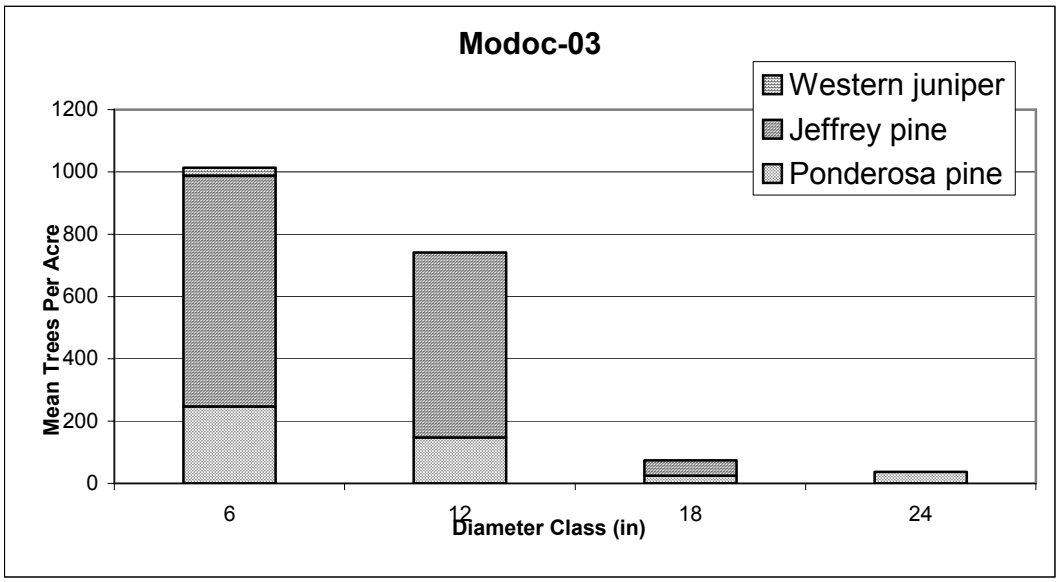


Figure 20m – Modoc-03 (yellow pine) tree densities measured in 2003.

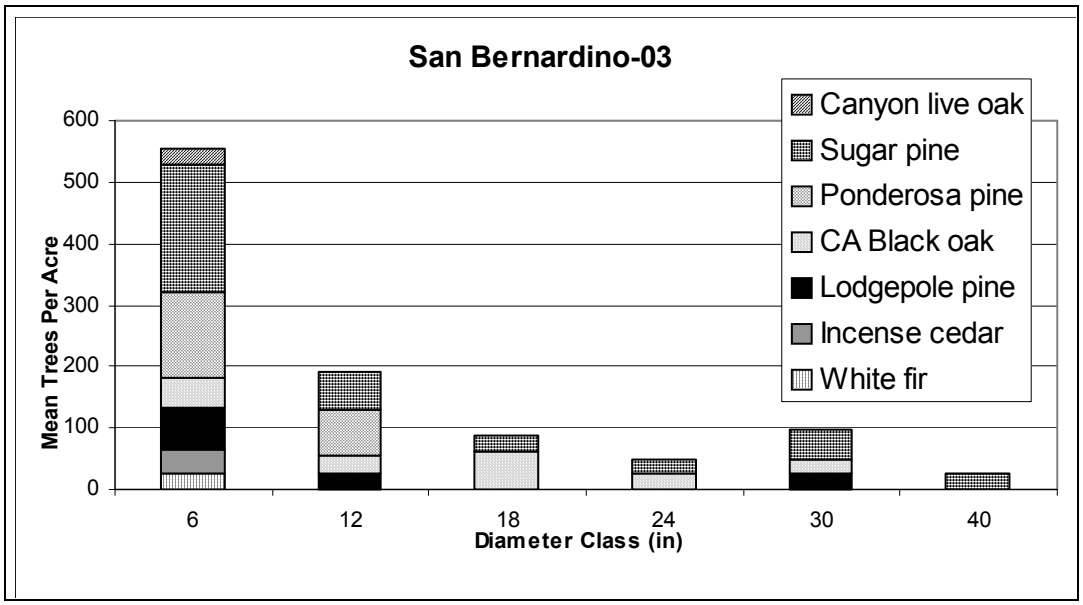


Figure 20n - San Bernardino-03 (yellow pine) tree densities measured in 2003.

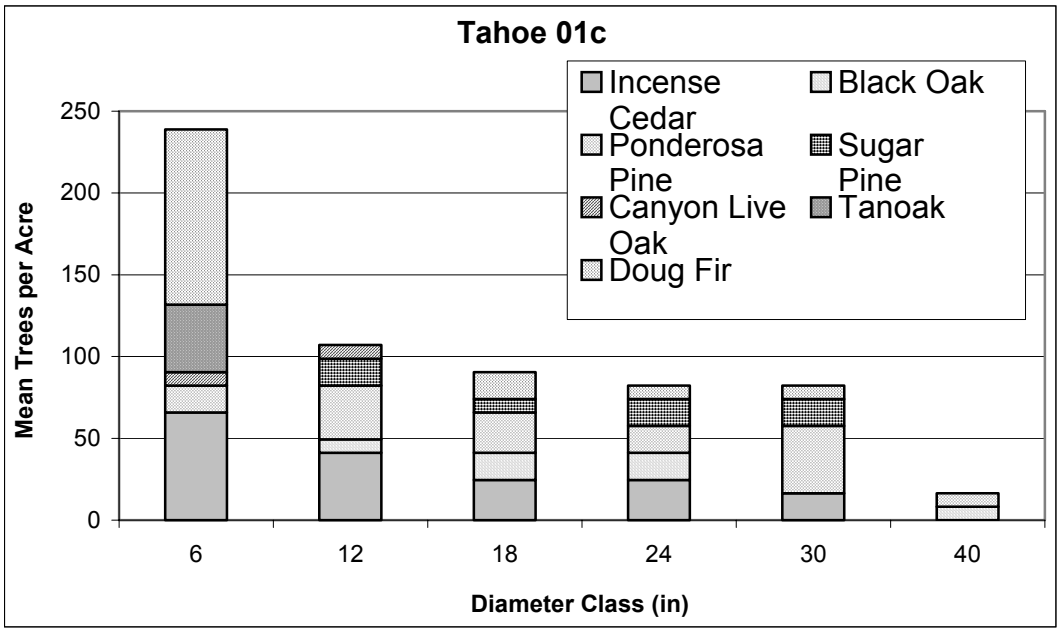


Figure 20o – Tahoe-01c (yellow pine) tree densities measured in 2001.

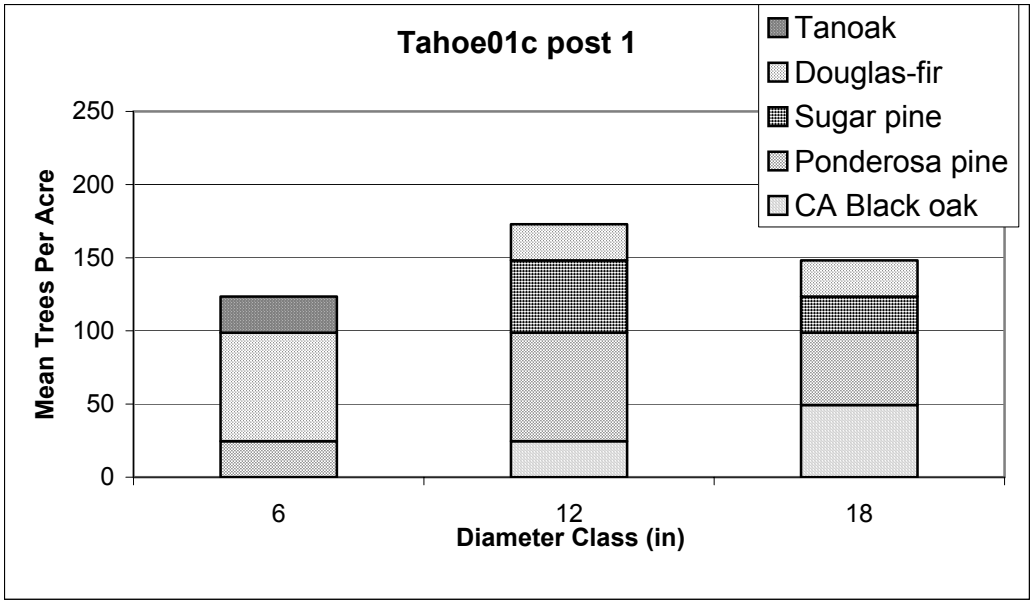


Figure 20p – Tahoe-01c post1, (yellow pine) post treatment tree densities re-measured in 2002 in plots 7-8.

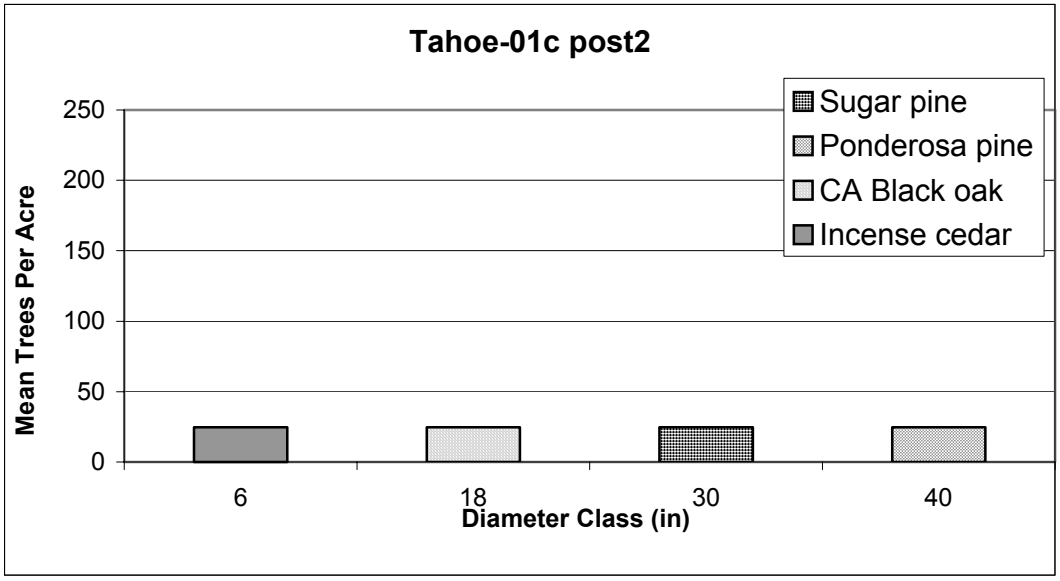


Figure 20q – Tahoe-01c post2, (yellow pine) post treatment tree densities re-measured in 2003 in plot 8.

Red fir-Jeffrey Pine dominated projects

Figure 21 is a graphical representation of the tree density by diameter class and tree species for the one project that is within the red fir/Jeffrey pine dominated vegetation type.

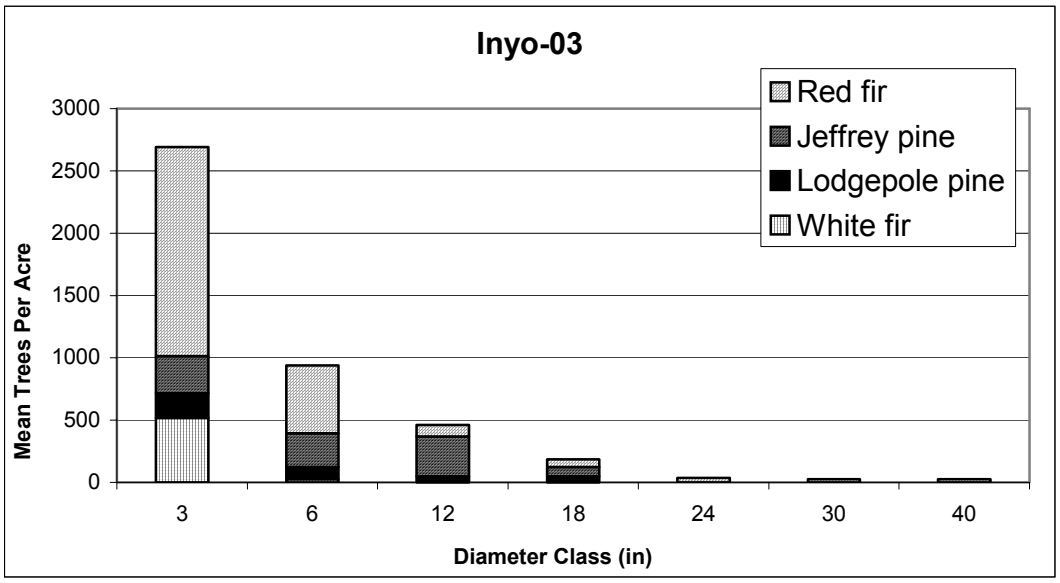


Figure 21 - Inyo-03 (red fir/Jeffrey pine) tree densities measured in 2003.

Understory Species Composition

While we try and conduct monitoring at the best time to identify plants (phenological stage) limited project size makes this not always optimum for each project. In forthcoming sampling, including revisits of these plots post-burn, the sample timing will strive to capture all plant species as logistically possible. Consequently, the list will likely change. The preliminary list of pre-burn herbaceous, grass, grass-like and shrub species are displayed in Appendix B.

IV. ADAPTIVE MANAGEMENT IMPLICATIONS

Pre and Post Treatment Data

The 2003 field season included 10 post treatment projects in the forest vegetation types. Some of these data are displayed in the tables and graphs below (Figure 22, Tables 18 and 19). These data show some preliminary trends, but should not be viewed as conclusive. The variance is high, meaning that it is impossible at this time to conclusively state whether average values are different from one another. More samples averaged over dominant vegetation types will allow for a comparison of means.

Furthermore, tree mortality data are included for some of the post treatment one-year data (Table 20).

For graphs represented below, the data are displayed with box plots. Box plots show the median, interquartile range, outliers, and extreme cases of individual variables. The center horizontal line denotes the median, the upper and lower boundaries of the boxes are the 25^{th} and 75^{th} percentiles and the upper and lower horizontal lines are the maximum and minimum values, except where values exceeded twice the standard deviation. The latter values are shown individually. The whiskers represent the range of outliers for these data.

Table 18 - *Pre and post treatment surface and ground fuels. Minimum and maximum ranges show the variance of the mean. All values are in tons per acre.*

Forest- Year Sampled	1 hour	10 hour	100 hour	Total 1-100 hour	1hr Min-Max	10hr Min-Max	100hr Min-Max	Total Min-Max	Duff Wt.	Litter Wt.	1000hr	1000hr Min-Max
Douglas fir or White fir Dominated												
Plumas-01	0.5	2.4	1.6	4.5	0.1 - 1.3	0.3 - 4.6	0 - 13.3	0.4 - 16.0	58	9	17	0 - 110
Plumas-01 post1	0.2	1.4	0.3	2	0.1 - 0.3	0.6 - 1.9	0 - 1.2	1.7 - 2.1	44	2.7	15	5.0 - 41.0
Plumas-01 post2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	27	4	n/a	n/a
Tahoe-01b	0.3	1.1	2	3.4	0.1 - 0.5	0.6 - 1.8	0 - 7.3	0.7 - 8.4	9	1	23	1.0 - 65
Tahoe-01b post1	0.1	0.8	1.5	2.4	0.1 - 0.2	0.3 - 2.1	0 - 4.8	0.4 - 7.1	7	1	3.2	0 - 5.7
Ponderosa pine-White fir dominated												
Klamath-02	0.5	1.5	1.2	3.2	0.1 - 1.4	0.3 - 2.7	0 - 8.5	0.7 - 11.3	37	5	18	0 - 69
Klamath-02 post1	0.3	0.7	1.1	2.1	0 - 0.6	0 - 3.0	0 - 4.8	0 - 6.0	9	2	3.0	0 - 15.7
Shasta-Trinity-02	0.2	1.9	3	5.1	0 - 0.6	0.6 - 3.4	1.21 - 6.1	2.2 - 9.6	39	3	7	0 - 21
Shasta-Trinity-02 post1	0.1	0.6	1.2	1.8	0 - 0.1	0 - 1.2	0 - 4.8	0 - 5.2	11	1	7.1	0 - 23.2
Yellow pine (Ponderosa, Jeffrey, Coulter) Dominated												
Lassen-01	0.9	4.3	2.2	7.4	0 - 2.2	1.0 - 8.5	0 - 6.4	1.2 - 12.5	39	7	8	1-31
Lassen-01 post1	0.2	2.1	1.3	3.6	0.1 - 0.7	0.3 - 7.9	0 - 2.7	0.4 - 10.5	15.1	.1.6	12	0 - 70
Lassen-01 post2	0.5	1.0	1.3	2.7	0.1 - 1.1	0 - 2.7	0 - 4.0	0.4 - 7.9	22	2	4.1	0.9 - 10.6
Los Padres-02	0.2	0.7	1	1.9	0 – 1.0	0 - 2.2	0 - 8.5	0 - 9.9	33	4 0	5	0 - 30
Los Padres-02 post1	0.1	0.5	1.5	2.1	0 - 0.2	0 - 1.9	0 - 9.9	0 - 11.5	14	2	1.7	0 - 19.8
Mendocino-02	0.1	1.3	1.5	2.9	0 - 1.2	0 – 7.0	0 - 6.5	0 - 8.9	66	14	25	0 - 146
Mendocino-02 post1	0.2	0.8	2.6	3.6	0 - 1.0	0 - 2.7	0 - 12.1	0 - 12.7	31	4	9.4	0 - 47.5
Modoc-02	0.1	0.6	0.6	1.3	0 - 0.3	0 - 1.8	0 - 2.4	0.3 - 3.3	26	4	5	0 - 42
Modoc-02 post1	0.0	0.4	0.9	1.3	0 - 0.1	0 - 0.6	0 - 4.8	0 - 5.5	12	2	1.4	0 - 8.6
Sierra-02	0.2	1.3	2.9	4.4	0 - 0.7	0 - 3.4	0 - 9.8	0.1 - 12.1	41	8	5	0 - 17
Sierra-02 post1	0.1	0.4	1.4	1.9	0 - 0.3	0 - 0.9	0 - 3.7	0 - 4.8	15	2	1.9	0 - 4.5
Tahoe-01c	0.2	0.7	2.3	3.2	0 -0.5	0 - 2.6	0 - 7.4	0 - 8.5	64	7	20	0 - 96
Tahoe-01c post1	0.1	0.9	3.7	4.8	0 - 0.2	0 - 7.4	1.2 - 9.7	2.5 - 12.2	23.6	3.6	22	0 - 54
Tahoe-01c post2	0.1	1.2	3.9	5.2	0 - 0.2	0.3 - 2.3	0 - 6.5	0.3 - 8.3	22	3	23.1	12.2 - 27.9

Table 19 -Pre and post treatment cover data.

Project	Year	Mean Grass Cover	Grass Stand. Dev.	Mean Herb Cover	Herb Stand Dev.	Mean Alive Shrub Cover	Live Shrub Stand Dev.	Mean Dead Shrub Cover	Dead Shrub Stand. Dev.	Mean Tree Cover	Tree Stand. Dev.	Total Cover
Lassen-01	2001	0.4	0.5	2.4	2.9	1.4	1.4	0.0	0.0	95.3	12.6	99.5
Lassen-01 post 1	2002	4.5	6.4	31.1	12.8	2.8	2.9	0.3	0.4	95.1	9.1	133.8
Lassen-01 post2	2003	n/a	n/a	n/a	n/a	4.3	3.0	0.0	0.0	91.1	15.2	95.4
Plumas-01	2001	0.0	0.2	0.5	1.0	5.5	4.7	2.0	3.4	92.8	17.8	100.7
Plumas-01 post1	2002	0.0	0.0	7.6	15.6	0.0	0.0	0.0	0.0	90.8	18.7	98.4
Plumas-01 post2	2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	80.1	22.9	80.1
Klamath-02	2002	33.4	6.0	12.5	11.6	7.2	5.2	3.4	3.7	44.5	43.6	101.0
Klamath-02post1	2003	0.0	0.0	0.0	0.0	1.2	0.6	3.6	5.1	35.4	42.3	40.2
Los Padres-2	2002	34.7	8.4	43.1	4.0	14.0	7.4	3.7	0.9	24.0	39.7	119.5
Los Padres-2 post1	2003	15.3	22.5	109.9	86.5	4.9	6.4	2.6	2.7	19.8	34.9	152.4
Mendocino-02	2002	32.5	7.5	33.0	2.9	14.9	14.1	0.9	2.1	69.0	38.1	150.3
Mendocino-02 post1	2003	17.2	28.3	145.2	28.3	15.8	13.5	1.8	2.2	52.4	37.0	232.4
Shasta-Trinity-02	2002	37.9	8.9	28.0	10.3	0.1	0.2	0.0	0.0	30.5	38.0	96.5
Shasta-Trinity-02 post1	2003	17.6	26.6	5.3	18.3	0.8	0.0	0.0	0.0	n/a	n/a	23.6
Sierra-02	2002	0.0	0.0	1.3	2.2	55.4	40.9	5.2	8.2	57.0	40.3	118.9
Sierra-02 post1	2003	0.0	0.0	0.0	0.0	14.0	16.4	33.8	4.5	44.2	40.7	92.0
Modoc-02	2002	32.6	6.0	23.5	3.3	0.3	0.4	0.2	0.2	29.4	41.8	86.0
Modoc-02 post1	2003	48.4	30.2	45.1	15.6	0.9	0.4	2.5	0.7	17.8	36.4	114.7

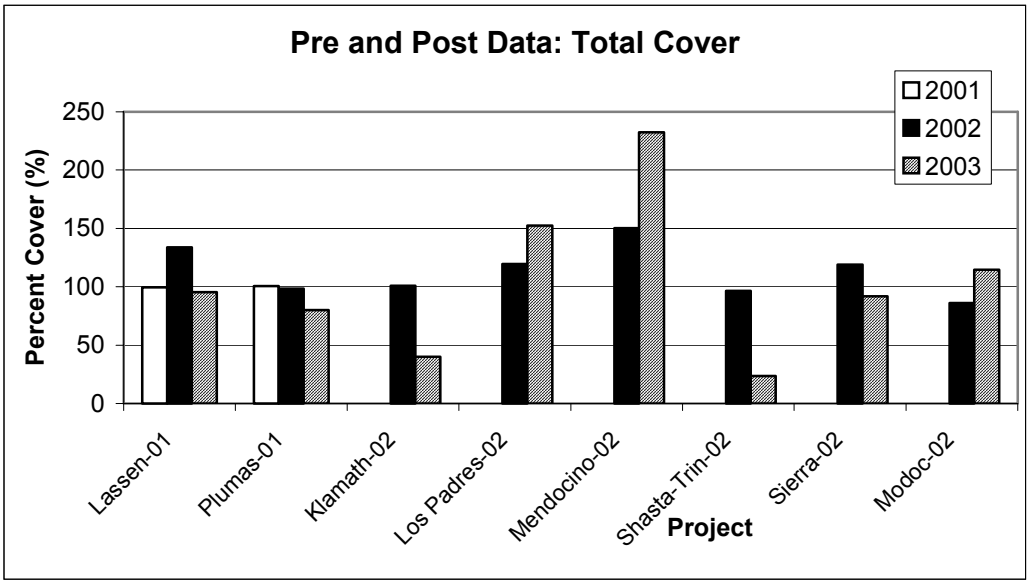


Figure 22 - Pre and post treatment mean total cover data. These data should be viewed in terms of identifying possible trends, due to the variation between the average values. See Table 17, standard deviations for the measure of variation.

Total cover includes understory cover such as grasses, herbs, and shrubs; and overstory cover such as trees. Some projects increased herbaceous and grass cover post fire.

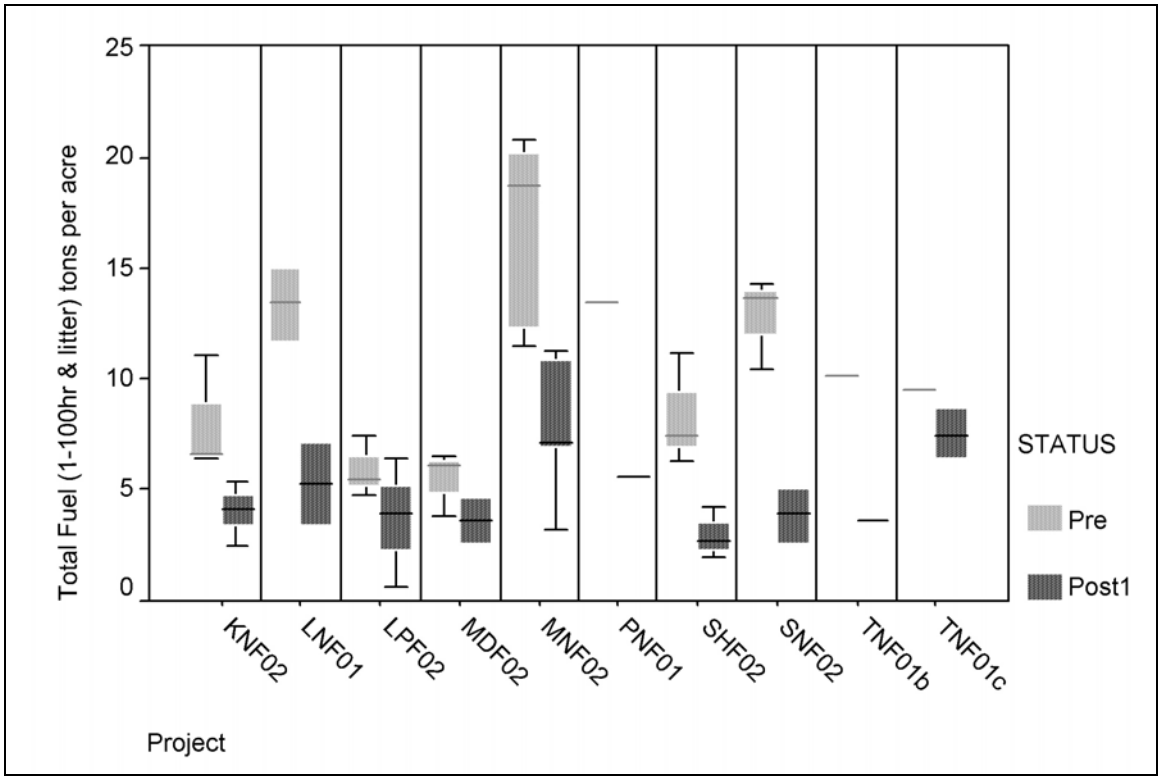


Figure 23 - Pre and one-year post measurements for all fuel treated projects, average surface fuels, including 1-100 hour fuels and litter in tons per acre.

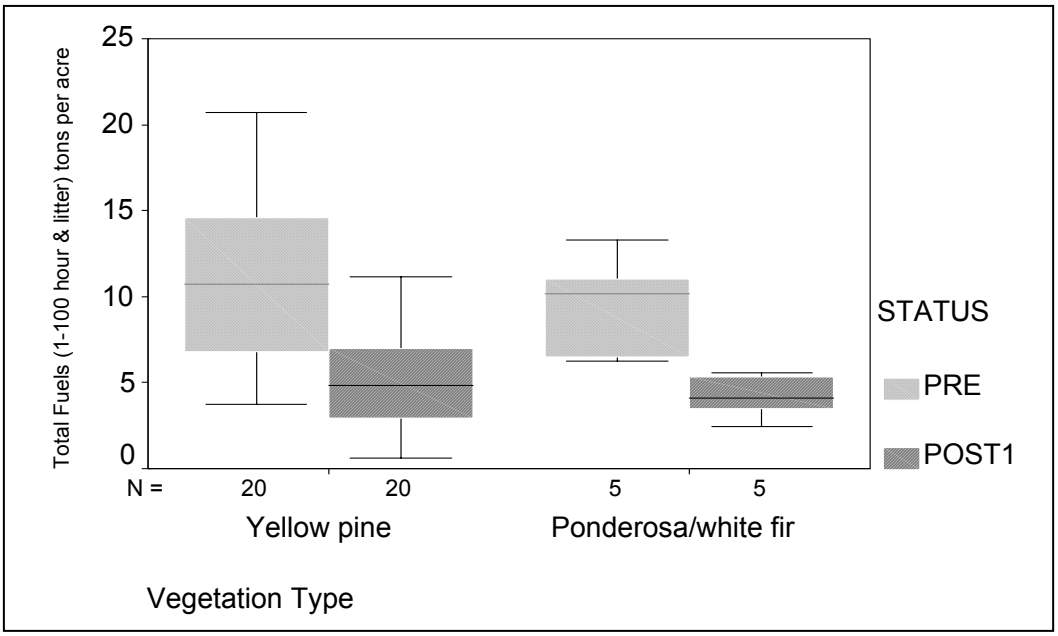


Figure 24 - Pre and one-year post measurements for yellow pine and ponderosa pine/white fir dominant vegetation type. Average surface fuels include 1-100 hour fuels and litter (in tons per acre).

Surface fuel loading was lower for all vegetation types in the post one-year re-measurements. The variability appears to decrease with the post one-year re-measurements. Surface fuel loading includes 1-100 hour fuels and litter weights in tons per acre. The greatest variation was with the yellow pine vegetation types most likely due to a greater sample size (20 plots).

There were several methodological and organizational issues that we tried to address in the first year of the pilot: 1) speed associated with rectangular vs. circular plots shapes; 2) most efficient monitoring crew size; 3) litter weight estimates from depth extrapolations or from actual dry weight samples; 4) tree canopy cover measured by spherical densiometer compared to moosehorn apparatus; and 5) the merits and downfalls of regional compared to province or forest monitoring approaches. Each of these is briefly addressed below. In addition, we summarize the expected production rates for the future years of the program compared to the first.

Plot Shape and Sampling Efficiency

The protocol was initially based upon the Park Service design to facilitate cross-agency data sharing and synthesis. The Park Service protocol is based on a rectangular plot shape. We compared the efficiency (time and cost) of the rectangular with circular shapes on the Tahoe projects and determined that the circular plot was more rapid to layout and required fewer rebars to mark it. We decided that the circular plot shape was more efficient and adopted it. We did not determine the exact increases in efficiency but it is at least 5-10 percent. The protocol for this project is explained in detail in Appendix A of this document.

Sampling Crew Size

We compared various crew sizes for data collection efficiency. At the beginning of the season we started with one four-person crew but later compared three and two-person crews. We determined that three-person crews reduced overall data collection time by approximately 10-30 percent (depending upon the nature of the plot) and decided that a three-person crew was the most efficient. This will increase the efficiency of work this year and enable us to conduct more monitoring for the same amount of money.

Litter Measurements

Since the objectives of most of the projects includes reducing fire hazard and changing fire behavior, it is important that the surface fuel data is collected in a way useful for fire behavior models. The standard Park Service and National Forest Inventory and Analysis approaches use the Brown's planar intercept method (Brown 1974) along with litter and duff depth measurements. The planar intercept method can result in an underestimation of one-hour fuels because of the difficult of tallying the very small diameter litter. Litter depth measurements can be used in conjunction with regressions to estimate litter weights, but a small error in litter depth can result in a large difference in litter weight estimates. Further, the extrapolation of litter weights from depths includes the errors associated with the regression model. Because of these and other issues, Brown et al. (1982) recommended that

litter weights be directly collected when the data was going to be used for fire behavior models and predictions. We collected litter weights for a number of the sites and are currently working on comparing the regression estimates with the actual weight estimates and will report on the difference in future reports.

Tree Canopy Cover Apparatus

The forests included in the Sierra Nevada Framework Environmental Impact Statement (EIS) have standards and guides for vegetation management activities that refer to canopy cover and canopy cover changes. We compared two different apparatus for measuring canopy cover, spherical densiometer and moosehorn apparatus for several of the plots, which were summarized in the 2002 report. Our preliminary findings are that the sampling intensity needed to estimate canopy cover with the moosehorn for a stated level of precision is much greater than for the spherical densiometer. Although there are some practical issues with the spherical densiometer (such as detecting cover from the side), it may be that the sampling intensity needed to produce canopy covers of a desired precision is not practical.

Regional Compared to Province or Forest Approaches

We made a qualitative comparison of the relative merits and downfalls of regional compared to province or forest approaches based upon our experience with this program as well as past monitoring efforts (Forest Health Pilot, Regional Meadow Condition Monitoring, varied other forest or district projects). There are three primary elements of a regional approach that differ in their merits: the cost, data quality, and data comparisons.

The economy of scale of regional monitoring makes them generally the most cost efficient. This is because with a limited monitoring program (not endlessly funded) it is more efficient to have fewer crews that travel the state rather than hire many crews for a short duration of time. The overall time for training separate crews is greater for the project overall (i.e., more crews, more time training) and it is difficult to hire crews for a short period of time (e.g. two months or less). The more experienced a crew, the faster they work. It is possible to overcome these economies of scale issues somewhat by using local crews hired for other purposes to do the fire effects and fuel monitoring as well. However, our experience with other projects is that this rarely works as planned. Other projects or assignments often take priority and sometimes the work does not get completed. Further, there is a greater probability of inconsistency in data collection or application of protocols, which can greatly increase post-sampling analysis costs. Finally, there can be delays in data aggregation which increases data assimilation and analysis costs.

Consistency in data collection and application of protocols can be a large challenge when many crews are involved. A regional approach minimizes these problems because it is easier and cheaper to provide training and quality assurance at one time. Even when protocols are written up in detail, inconsistencies in interpretation of direction can occur. Our experience with this in the past is that to ensure consistency amongst varied crews with different locations and leaders requires greater time in training and inspections, and increased data

processing and analysis costs to handle even minor inconsistencies. All of these added costs, to ensure consistency, result in greater overall costs and time delays.

The downfall of regional crews with a small program is that it is not always possible to optimize sampling for phenological states of plants. That is, it is not always possible to juggle the sampling schedule across the entire region to sample each project at the optimum time for plant identification. This is not a problem if the regional monitoring program is large and there are many crews to schedule. However, this is not likely in the foreseeable future. We seek to minimize these problems with scheduling.

Finally, given the diverse vegetation and fuel conditions in the Region, it has been argued that it will be difficult to synthesize results across the region that is meaningful. While this is likely true to some extent, the projects assembled here seem to have similarities. In part, we constrained the differences by requesting projects with similar vegetation types. This issue cannot be easily addressed until a greater variety of projects are monitored in the next few years. However, what can be said now is that with a limited monitoring budget, a regional approach is the most efficient way to gather data for any scale of summary.

Forest Mortality

Overstory tree mortality (trees greater than 6" diameter) were computed by matching tree tags and evaluating mortality status of live "pre-treatment" trees compared to those same trees post treatment. The mortality of poles and snags, which were not tagged, were first converted to trees per acre (TPA). Next, values were compared between pre and post treated percent live poles and seedlings. The difference between those figures represents percent mortality for poles and seedlings. Table 18 is a summary of these results.

Table 20 - *Tree, pole and seedling mortality for pre and post one-year projects. Data are showed at percent mortality with the number of trees in parentheses.*

Project Name	Dominant Veg Type	Species	Seedlings	DBH 0-6"	DBH 6-12"	DBH 12-18"	DBH 18-24"	DBH 24-30"	DBH > 30"
Lassen-01	Yellow pine	Doug-fir	100 (1)	38 (4)	7 (1)				
Lassen-01	Yellow pine	Ponderosa			17 (1)	17 (1)	100 (1)		
Lassen-01	Yellow pine	Sugar pine	100 (3)						
Lassen-01	Yellow pine	Black Oak	100 (12)						
Plumas-01	Douglas-fir/white fir	Doug-fir	100 (1)						
Plumas-01	Douglas-fir/white fir	Ponderosa				100 (1)			
Plumas-01	Douglas-fir/white fir	Sugar pine	100 (38)						
Plumas-01	Douglas-fir/white fir	Red fir	100 (16)	50 (1)					
Plumas-01	Douglas-fir/white fir	Inc. Cedar	100 (8)		20 (1)	17 (1)			
Plumas-01	Douglas-fir/white fir	Black Oak						100 (1)	
Klamath-02	Ponderosa pine/white fir	Ponderosa	100 (1)	58 (6)	4 (1)				
Klamath-02	Ponderosa pine/white fir	Red fir	99 (400)	54 (6)	7 (1)	2 (1)			
Klamath-02	Ponderosa pine/white fir	Inc. Cedar	99 (15)	13 (1)	17 (1)				
Los Padres-02	Yellow pine	Jeffrey pine	90 (5)	100 (1)	17 (1)			11 (1)	
Los Padres-02	Yellow pine	Sugar pine	100 (1)						
Mendocino-02	Yellow pine	Doug-fir	100 (4)						
Mendocino-02	Yellow pine	Ponderosa	100 (5)						
Mendocino-02	Yellow pine	Black Oak	88 (57)	25 (2)					
Shasta_Trin-02	Ponderosa pine/white fir	Ponderosa	100 (3)						
Shasta_Trin-02	Ponderosa pine/white fir	Red fir	100 (27)	100 (2)		33 (1)			
Shasta_Trin-02	Ponderosa pine/white fir	Inc. Cedar	100 (71)	100 (1)	50 (1)				
Shasta_Trin-02	Ponderosa pine/white fir	Black Oak	64 (9)						
Tahoe-01c	Yellow pine	Doug-fir	100 (21)	50 (7)	70 (3)		50 (1)		
Tahoe-01c	Yellow pine	Ponderosa			50 (1)				25 (1)
Tahoe-01c	Yellow pine	Inc. Cedar		100 (5)	50 (7)	50 (3)	50 (1)		
Tahoe-01c	Yellow pine	Black Oak				50 (1)			50 (1)
Tahoe-01c	Yellow pine	Cany. Liveoak	100 (19)						
Tahoe-01c	Yellow pine	Tan Oak		100 (4)	75 (5)				
Modoc-02	Yellow pine	Ponderosa		100 (3)				17 (1)	
Modoc-02	Yellow pine	W. Juniper				50 (1)			

References

Brown, J.K. 1974. Handbook for Inventorying Downed Woody Material. Gen. Tech. Rep. INT-16. Forest Service, U.S. Department of Agriculture.

Brown, J. K., R. D. Oberheu, and C. M. Johnston. 1982. Handbook for Inventorying Surface Fuels and Biomass in the Interior West. PMS 810/NFES 2125.

Crookston, N.L. and E.D. Reinhardt. 2003. The Fire and Fuels Extension to the Forest Vegetation Simulator. Gen. Tech. Rep. RMRS-GTR-116. Fort Collins, Colorado: Rocky Mountain Research Station, Forest Service, U.S. Department of Agriculture.

National Fire Monitoring Steering Committee. 2000. National Park Service National Fire Monitoring Handbook. Park Service, U.S. Department of Interior.

Sawyer, John and Todd Keeler-Wolf. 1995. A Manual of California Vegetation. Sacramento, CA: California Native Plant Society:

Scott, J. H. and Reinhardt, E. D. 2001. Assessing crown fire potential by linking models of surface and crown fire behavior. Res. Pap. RMRS-RP-29. Fort Collins, CO: Rocky Mountain Research Station, Forest Service, U.S. Department of Agriculture, 59 p.

Van Wagtendonk, J.W., J.M Benedict, and W.M. Sydoriak. 1996. Physical properties of woody fuel particles of Sierra Nevada conifers. Int. J. Wildland Fire. 6(3):117-123.

APPENDIX A: PROTOCOL

This report contains a brief summary of the field protocols. It is partly based upon the National Park Service (Park Service) fire monitoring protocol (NPS 2001) with modifications to include a method of sampling a variety of vegetation structures, i.e. mixed shrub/forest plots, forest only, and chaparral only.

Sample Site Selection

Within the burn/treatment projects, plots were randomly selected with efforts made to avoid roads and stream channels. The random selection process included using a random number table to locate a point on a road within the future burn area. From this location a random compass bearing and distance were followed to the plot center. Occasionally time allowed for the completion of 6 or 9 plots.

Data Collection

Overall, a modified Park Service protocol was applied. The modified Park Service protocol differed in three ways to improve sampling efficiency and address key resource management needs. Circular plot shapes rather than rectangular were used for tree data and alignment of transects to reduce installation time and minimize plot edge and associated sampling errors (Appendix A, Figure 1). Additional data were collected on tree canopy cover, height to live crown for trees (Appendix A, Figure 2), and litter weight. For chaparral vegetation, a modified protocol was applied based upon standard measurements reported in scientific literature (Appendix A, Figure 3). Below is a summary of the measurement procedures for forested and chaparral vegetation.

All Vegetation Types

A Trimble GeoExplorer 3 global positioning system (GPS) was used to mark each plot center and the precise location was digitally recorded for each plot to allow for repeatability.

Forest Vegetation

A series of three nested circular plots form the primary basis of the forest plots. The 1000 square meter ($m^{2)}$ plot area included nested, offset circular plots and six line transects within the 17.85-meter radius outer ring (overstory tree ring). The inner two rings shared a plot center at 8.92 meters from the main plot center with the larger inner ring ($250m^2$) having a radius of 8.92 meters (pole sized tree ring) and the smaller inner ring ($50m^2$) having a radius of 3.99 meters (seedling ring). One line transect (vegetation transect CD) runs 50 meter along the slope contour through plot center. The remaining two line transects (fuels transects 1 and 2) run between the intersections of lines CD within the$1000m^2$ circle. Four pieces of rebar were tagged and permanently placed to allow for relocation of the plot (dark circles in Appendix A, Figure 1.).

Overstory Trees

The radius of the Overstory Tree subplot is 17.85 meters resulting in the measurement of $1000m^2$. On this plot a number of variables were measured: 1) tree species for live trees; 2) tag number (from brass tags placed on all trees); 3) diameter at breast height (dbh, to nearest 0.1 centimeter (cm) measured with a dbh tape) for live trees and snags $\geq$ 15 cm dbh;

4) total tree height (to nearest 0.01 meter measured with an Impulse 2000 laser measuring device); 5) height to partial canopy and height to full canopy (to nearest 0.01 meter measured with an Impulse 2000 laser measuring device); 6) canopy class (distinguished into 5 categories: emergent, dominant, co-dominant, intermediate and suppressed); 7) mortality status (alive or dead); and, 8) damage (following 2000 National Park Service Protocol list).

Pole Size Trees

The radius of the pole plot is 8.72 meters, allowing for a 250m^2 plot area. The variables measured in the pole plot were: 1) tree species for live trees; 2) tag number (from brass tags placed on all trees); 3) dbh (to nearest 0.1 cm measured with a Spencer logging tape) for live trees and snags $\geq$ 15 cm dbh; 4) total tree height (to nearest 0.01 meter measured with an Impulse 2000 laser measuring device); 5) height to full canopy (to nearest 0.01 meter measured with an Impulse 2000 laser measuring device); and, 6) mortality status (alive or dead).

Seedlings

The following variables were measured and recorded from the seedling tree ring with a radius of 3.99 meter and total area of 50m^2: 1) tree species for live trees; 2) height class (as specified in the 2000 National Park Service protocol); and, 3) mortality status (alive or dead).

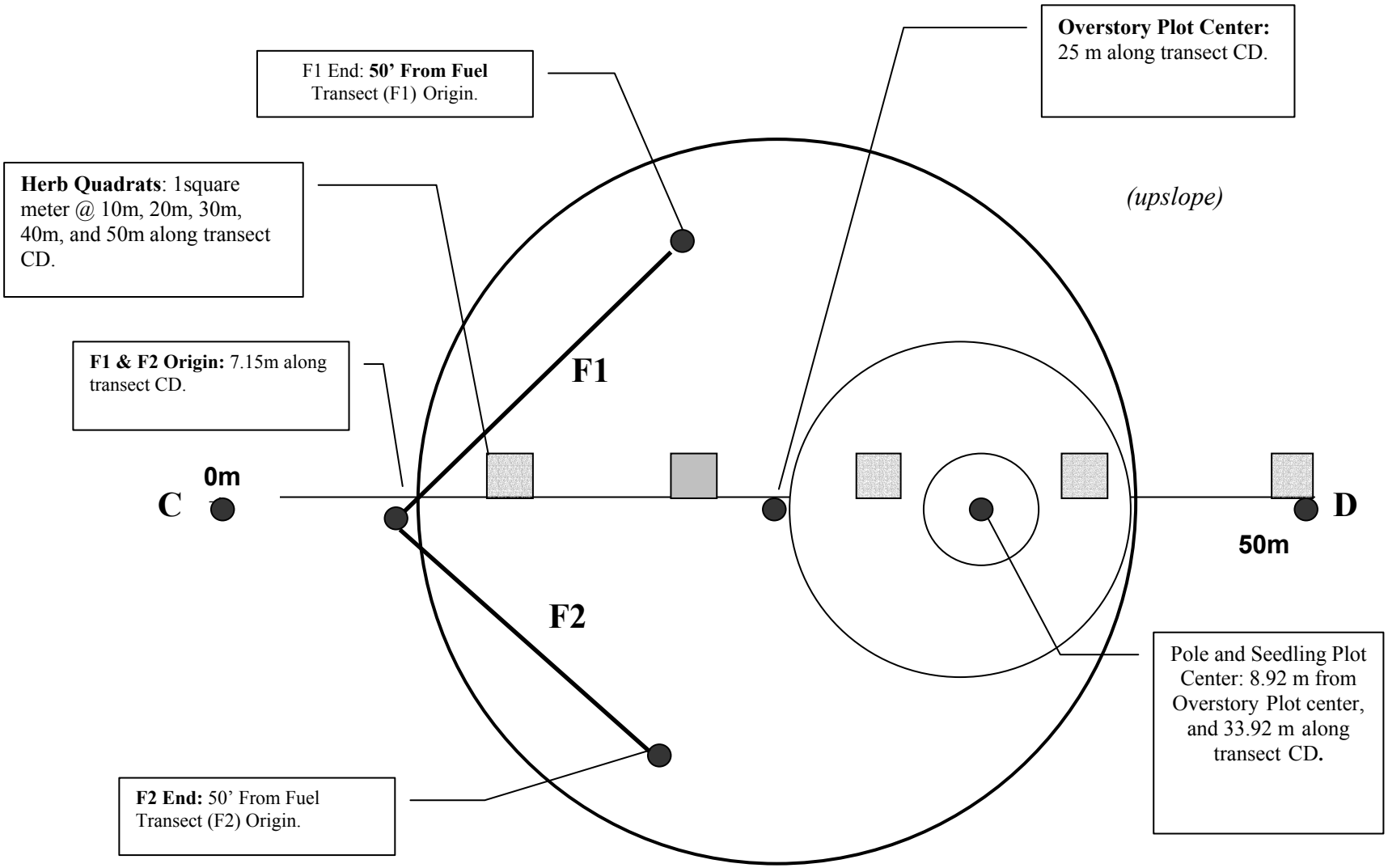
Herbs, Grasses, Shrubs, and Tree Cover

The following variables were measured and recorded along vegetation transect CD: 1) shrub species; 2) shrub height; 3) shrub mortality status; 4) shrub range (where on the transect the shrub occurred, i.e. 0.35-0.90 decimeters); and, 5) overstory canopy cover measured using a moosehorn apparatus at 1 meter intervals. Additionally, 10 1m^2 quadrants (see squares on Appendix A, Figure 1.) were placed along transect CD at 10, 20, 30, 40 and 50-meter and the following data were recorded: 1) herbaceous vegetation species; 2) herbaceous species' cover class; and, 3) herbaceous species' mortality status. Pictures were taken at four locations throughout the plot (Appendix A, Table 1) along transects CD, 1, and 2.

Surface and Ground Fuels

Brown's (Brown 1974) planar intercept technique is the primary basis for the Park Service fuels protocol. The following variables were measured and recorded along fuel transects 1 and 2: 1) compass direction of transect; 2) slope of transect; 3) tally of 1-hour (0-.25"), 10-hour (.25-1") and 100-hour (1-3") fuels; and, 4) number, decay class, diameter, and species of fuels greater than 3 inches. Additionally, 10 point measurements of litter and duff depth were recorded per transect at 5-foot intervals starting at 0 meter of each transect. Nine interval measurements (5-foot intervals starting at 0 meter of each transect) were recorded including: 1) maximum fuel height and 2) maximum litter and duff depth. For many of the sites, we collected litter weight samples based primarily on Brown et al. (1982). Litter samples were collected from a 30 cm X 30 cm (1 ft^2) quadrant at random locations starting along the fuels transect.

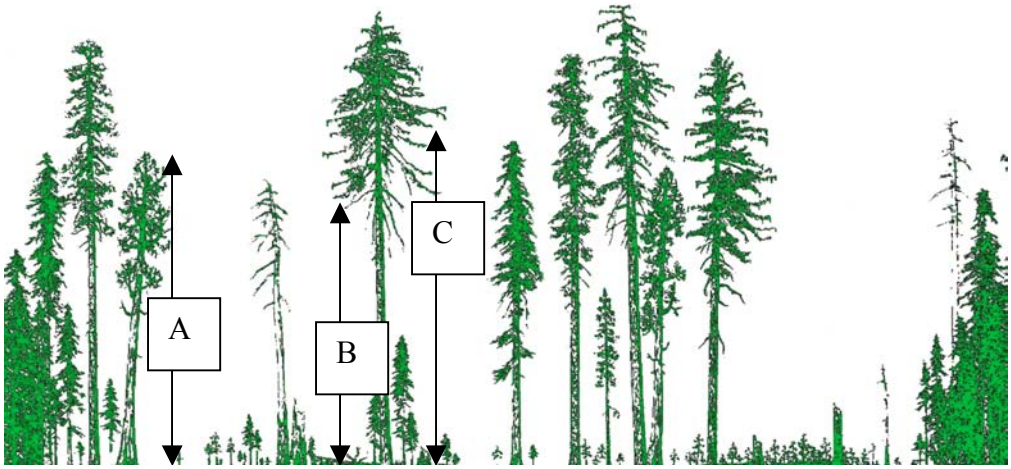
Appendix A, Figure 1. Detailed forest plot.



Appendix A, Table 1. *Photograph Log*

Photo Log	
Field of View	Photo #
A-B	
B-A	
C-D	
D-C	
Fuels 1, 0-50 ft	
Fuels 1, 50-0 ft	
Fuels 2, 0-50 ft	
Fuels 2, 50-0 ft	

Appendix A, Figure 2. *Forest Diagram*

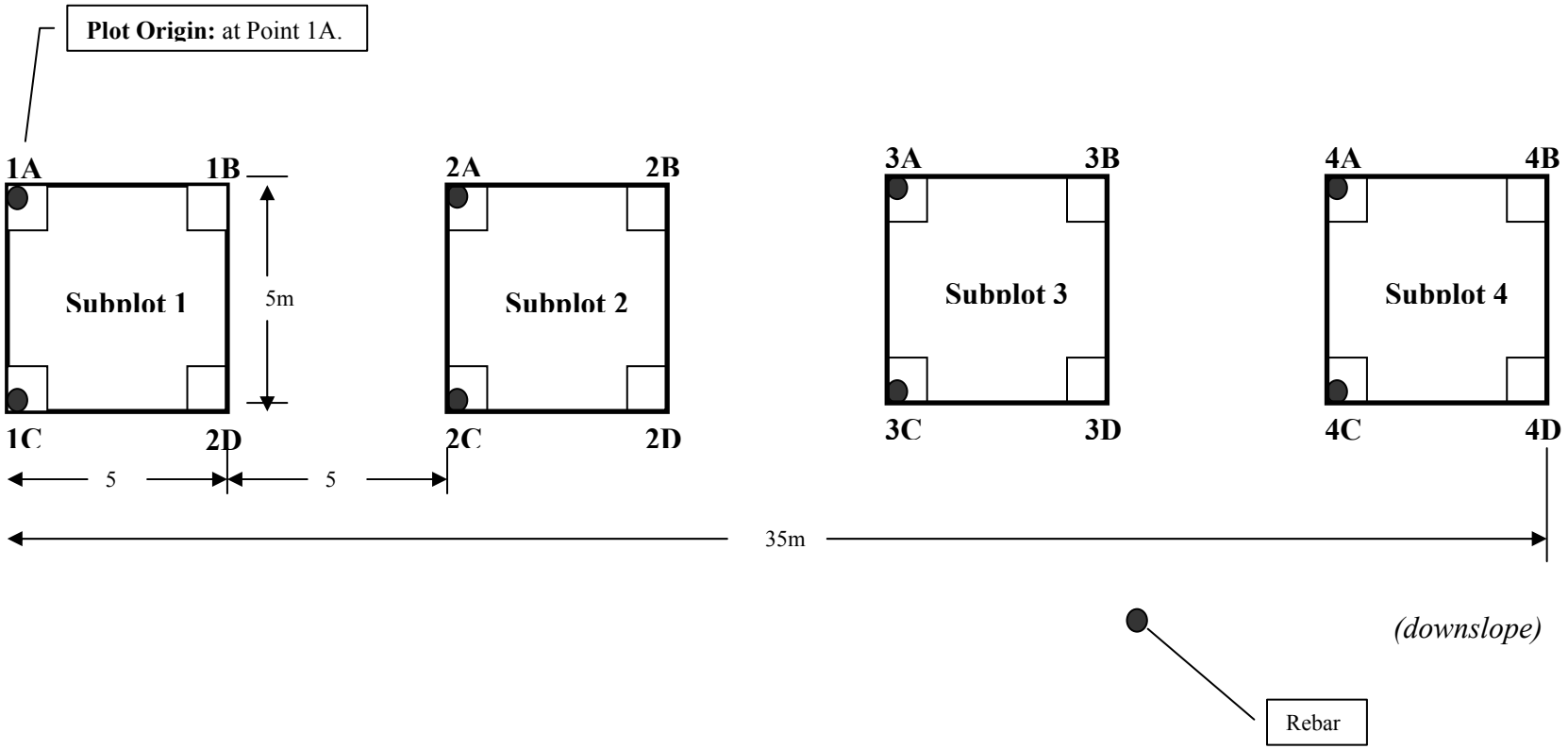


A= Total tree Height
B= Partial Crown Height
C= Full Crown Height to Bottom of Crown

Chaparral Plots

A new methodology was created for the monitoring of chaparral plots in 2003. There are now a total of four subplots per plot that are 5 m^2 in size (Appendix A, Figure 3). Within each subplot are four 1 X 1 meter frames where shrub data such as species, height (cm), mortality, and stem diameter are measured. At the four corners of each frame, duff and litter thickness are measured to the nearest centimeter. Herb species and percent cover are also collected in the 5 X 5 meter frames. Along the 50 meter transect, shrub cover, species, height, and mortality are collected.

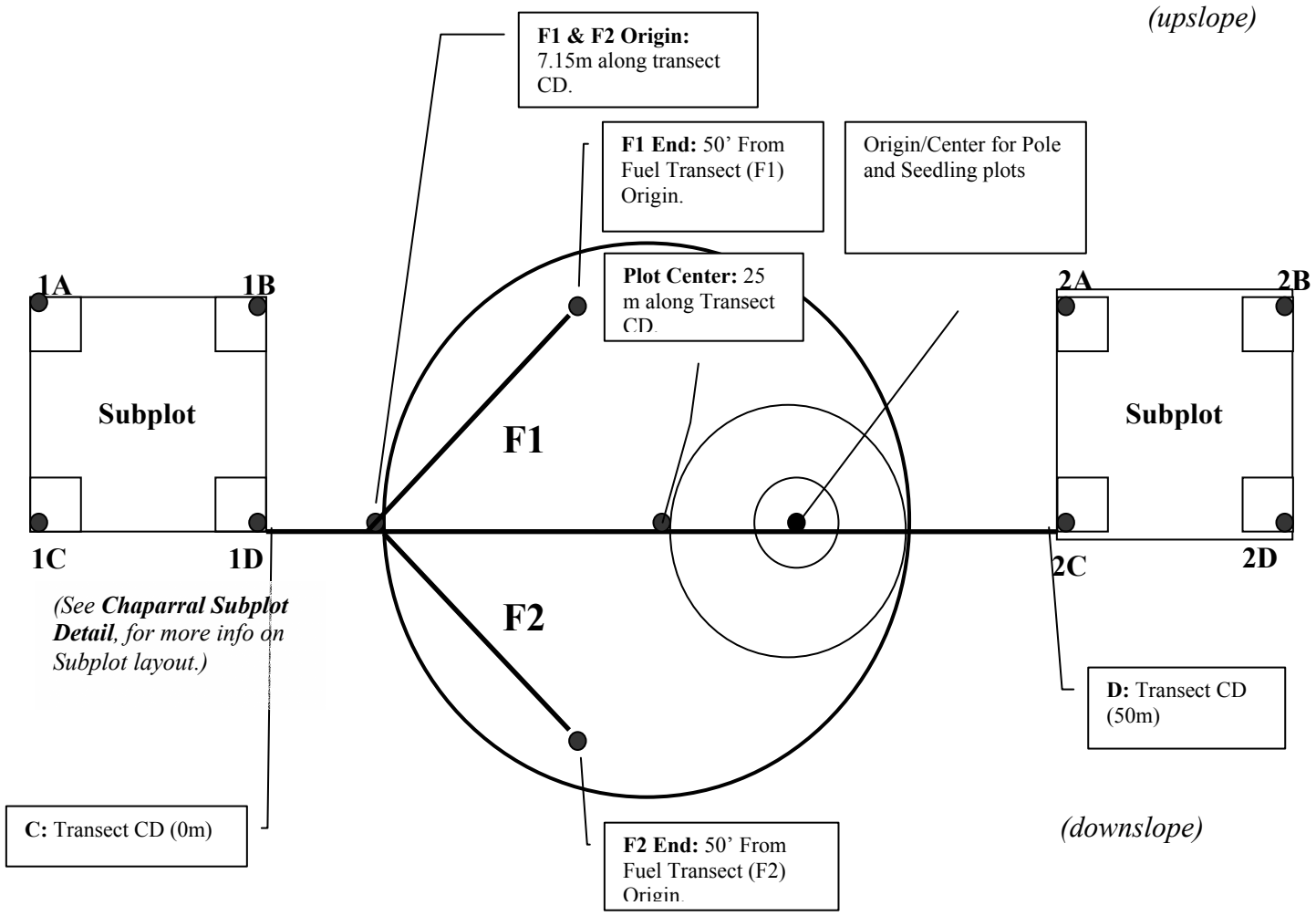
Appendix A, Figure 3. Chaparral plot layout.



Forest/Chaparral Plots

These plots are for areas that have both a coniferous overstory with a substantial understory of chaparral vegetation. This plot layout was created to capture the variability of shrub ecosystems in areas with overstory vegetation. An understory with ten acres or greater of chaparral, or 30 percent chaparral in a plot would follow this methodology. This plot set up is a mixture of the chaparral and forest plots. All the same data is collected for this plot setup as the forest plots. The exception is that two 5 X 5 meter shrub subplots are added to the plot setup to capture more shrub data. Similar to the chaparral subplot set-up, shrub data such as shrub species, height, stem diameter, and mortality are collected in the four 1 X 1 meter corners of the subplot. Within the entire subplot, herbaceous species and cover are recorded. Litter and duff measurements are taken in the four corners of the subplots. Along the 50 meter transect, shrub range, species, and height are also collected. Tree, pole, and seedling data follow the same methodology as the forest plots.

Appendix A, Figure 4. Forest/Chaparral Plot Diagram, "Detailed Plot"
Design established and implemented starting in 2003.



Analysis

Data were compiled into databases in PARADOX and ACCESS and analyzed in SPSS (Norius 1999). Fuel loadings were generally calculated as in Brown et al. (1974) and Brown et al. (1982), using general coefficients and weights for northern region vegetation. Litter and duff weights were estimated using regressions based upon depth for the Sierra Nevada (van Wagtendonk et al., 1996). Later versions will apply more bioregion specific coefficients if available.

The Brown's planar intercept method does not completely inventory 1-hour (0-0.25" diameter) fuels sufficiently for fire behavior input and he recommends including litter weight samples (Brown et al. 1974, 1982) for this purpose. For the pilot, we collected litter weights on a subset of the projects and will be comparing estimates of weights from actual measurements with those estimated by regressions from depth measurements. In the interim, we have estimated litter weights based upon depths and for the total surface fuel loading less than 3 inches (1, 10 and 100-hour fuels combined), we have added the litter weights to the line intercept measurements.

Fire Behavior

Measurement and/or observation of fire behavior at each plot during the prescribed burn is/are important for being able to explain the effects measured and to allow extrapolation of the data to other projects. The Forest Fuel Officers are responsible for the fire behavior monitoring during each burn.

APPENDIX B: PLANT SPECIES LIST BY PROJECT

Pre and post burn herbaceous, grass, and grass-like species list by project. The Jepson Manual was the taxonomic reference used.

Appendix B, Table 1. *2001 Projects*

Herbaceous Species

Forest	Project	Scientific Name	Common Name
Cleveland	**(01) Sutherland**	*Alopecurus L.*	foxtail
		Brassica geniculata (Desf.) J. Ball	
		Bromus L.	brome
		Bromus hordeaceus L.	soft brome
		Ceanothus megacarpus Nutt.	Bigpod ceanothus
		Cuscuta californica Hook. & Arn.	Chaparral dodder
		Festuca L.	fescue
		Juncus L.	rush
		Plagiobothrys Fisch. & C.A. Mey.	Popcornflower
		Polystichum Roth	hollyfern
		Vulpia myuros (L.) K.C. Gmel.	Rat-tail fescue
Eldorado	**(01) Anderson**	*Adenocaulon bicolor Hook.*	American trailplant
		Carex rossii Boott	Ross' sedge
		Kelloggia galioides Torr.	Milk kelloggia
Klamath	**(01) Eddy**	*Adenocaulon bicolor Hook.*	American trailplant
		Apocynum androsaemifolium L.	spreading dogbane
		Arabidopsis Heynh.	Rockcress
		Arabis constancei Rollins	Constance's rockcres
		Festuca L.	fescue
		Galium aparine L.	stickywilly
		Monarda pectinata Nutt.	Pony beebalm
		Pyrola picta Sm.	Whitevein shinleaf
		Vicia L.	vetch
Lassen	**(01) Middle Ridge**	*Adenocaulon bicolor Hook.*	American trailplant
		Asarum hartwegii S. Wats.	Hartweg's wildginger
		Bromus inermis Leyss.	Smooth brome
		Carex multicaulis Bailey	manystem sedge
		Disporum hookeri (Torr.) Nichols.	Drops of gold
		Elymus glaucus Buckl. Ssp. Glaucus	blue wildrye
		Galium L.	bedstraw
		Galium aparine L.	stickywilly
		Goodyera oblongifolia Raf.	Western rattlesnake
		Osmorhiza chilensis Hook. & Arn.	Sweet cicely

		Polygala cornuta Kellogg	Sierra milkwort
		Sanicula graveolens Poepp. Ex DC.	Northern sanicle
		Trichostema lanatum Benth.	Woolly bluecurls
		Trientalis latifolia Hook.	Starflower
		Viola lobata Benth.	Pine violet
Six Rivers	**(01) Gasquet**	*Agrostis hallii Vasey*	Hall's bentgrass
		Bromus L.	brome
		Iris L.	iris
		Melica bulbosa Geyer ex Porter & Coult.	Oniongrass
		Polygala cornuta Kellogg	Sierra milkwort
		Polypodium glycyrrhiza D.C. Eat.	Licorice fern
		Sanicula L.	sanicle
		Trientalis latifolia Hook.	Starflower
		Viola L.	violet
		Viola lobata Benth.	Pine violet
		Whipplea modesta Torr.	Common whipplea
Plumas	**(01) French**	*Pteridium aquilinum (L.) Kuhn*	brackenfern
		Trientalis latifolia Hook.	Starflower
		Viola L.	violet
		Viola lobata Benth.	Pine violet
San Bernardino	**(01) Ash Meadows**	*Agoseris retrorsa (Benth.) Greene*	spearleaf agoseris
		Bloomeria crocea (Torr.) Coville	common goldenstar
		Bromus tectorum L.	cheatgrass
		Clarkia speciosa H.F. & M.E. Lewis	redspot clarkia
		Erigeron foliosus Nutt.	Leafy fleabane
		Kelloggia Torr. Ex Benth.	Kelloggia
		Lessingia filaginifolia (Hook. & Arn.) M.A. Lane	
		Linanthus ciliatus (Benth.) Greene	whiskerbrush
		Melica imperfecta Trin.	Smallflower melicgra
		Stephanomeria virgata Benth.	Rod wirelettuce
Sierra	**(01) Dinkey Mountain**	*Draperia systyla (Gray) Torr. Ex Gray*	violet draperia
		Iris hartwegii Baker	rainbow iris
		Lupinus L.	lupine
Stanislaus	**(01) McKay**	*Bromus L.*	brome
		Bromus orcuttianus Vasey	Orcutt's brome
		Galium L.	bedstraw
		Lathyrus L.	pea
		Pteridium aquilinum (L.) Kuhn	brackenfern

Tahoe	**(01a, b, c)Colombo, Jaybird, Madrone**	*Adenocaulon bicolor Hook.*	American trailplant
		Campanula prenanthoides Dur.	Harebell
		Collomia heterophylla Dougl. Ex Hook.	Variableleaf collomi
		Galium L.	bedstraw
		Galium triflorum Michx.	Fragrant bedstraw
		Goodyera oblongifolia Raf.	Western rattlesnake
		Iris hartwegii Baker	rainbow iris
		Lupinus L.	lupine
		Osmorhiza chilensis Hook. & Arn.	Sweet cicely
		Pyrola picta Sm.	Whitevein shinleaf
		Symphoricarpos acutus (Gray) Dieck	sharpleaf snowberry
		Trientalis latifolia Hook.	Starflower
		Viola lobata Benth.	Pine violet

Shrub Species

Forest	Project	Scientific Name	Common Name
Eldorado	**(01) Anderson**	*Ribes roezlii Regel*	Sierra gooseberry
Klamath	**(01) Eddy**	*Amelanchier alnifolia (Nutt.) Nutt. ex M. Roemer*	Saskatoon serviceberry
		Berberis aquifolium Pursh	
		Corylus cornuta Marsh. var. californica (A. DC.) Sharp	California hazel
		Lonicera L.	honeysuckle
		Quercus vacciniifolia Kellogg	huckleberry oak
		Ribes L.	currant
		Rubus glaucifolius Kellogg	San Diego raspberry
		Symphoricarpos albus (L.) Blake	common snowberry
		Symphoricarpos mollis Nutt.	creeping snowberry
Lassen	**(01) Middle Ridge**	*Keckiella breviflora (Lindl.) Straw ssp. breviflora*	bush beardtongue
		Ribes L.	currant
		Symphoricarpos albus (L.) Blake	common snowberry
		Toxicodendron diversilobum (Torr. & Gray) Greene	Pacific poison oak
Los Padres	**(01) Foothill**	*Ceanothus megacarpus Nutt.*	bigpod ceanothus
		Ceanothus spinosus Nutt.	redheart
		Malacothamnus fasciculatus (Nutt. ex Torr. & Gray) Gree	Mendocino bushmallow
		Malosma laurina (Nutt.) Nutt. ex Abrams	laurel sumac
		Salix melanopsis Nutt.	dusky willow
		Salvia mellifera Greene	black sage

Six Rivers	**(01) Gasquet**	*Arctostaphylos columbiana Piper*	hairy manzanita
		Holodiscus discolor (Pursh) Maxim.	oceanspray
		Prunus L.	plum
		Rhododendron macrophyllum D. Don ex G. Don	Pacific rhododendron
		Toxicodendron diversilobum (Torr. & Gray) Greene	Pacific poison oak
		Vaccinium ovatum Pursh	California huckleber
		Vaccinium parvifolium Sm.	red huckleberry
Plumas	**(01) French**	*Corylus cornuta Marsh. var. californica (A. DC.) Sharp*	California hazel
		Ribes roezlii Regel	Sierra gooseberry
		Rubus parviflorus Nutt.	western thimbleberry
		Symphoricarpos albus (L.) Blake	common snowberry
San Bernardino	**(01) Ash Meadows**	*Amelanchier utahensis Koehne*	western serviceberry
		Ceanothus leucodermis Greene	chaparral whitethorn
		Eriodictyon traskiae Eastw.	Pacific yerba santa
		Lonicera interrupta Benth.	chaparral honeysuckl
		Rhus trilobata Nutt.	skunkbush sumac
Sierra	**(01) Dinkey Mtn**	*Arctomecon Torr. & Frém.*	bearpoppy
		Chamaebatia foliolosa Benth.	mountain misery
Stanislaus	**(01) McKay**	*Ceanothus integerrimus Hook. & Arn.*	deerbrush
		Chamaebatia foliolosa Benth.	mountain misery
Cleveland	**(01) Sutherland**	*Adenostoma fasciculatum Hook. & Arn.*	chamise
		Arctomecon Torr. & Frém.	bearpoppy
		Ceanothus L.	ceanothus
		Haplopappus squarrosus Hook. & Arn.	
		Heteromeles arbutifolia (Lindl.) M. Roemer	toyon
		Keckiella Straw	keckiella
		Lonicera L.	honeysuckle
		Mimulus aurantiacus W. Curtis	
		Polystichum Roth	hollyfern
		Quercus L.	oak
		Ribes L.	currant
		Rubus L.	blackberry
		Symphoricarpos mollis Nutt.	creeping snowberry
		Toxicodendron diversilobum (Torr. & Gray) Greene	Pacific poison oak
		Xylococcus bicolor Nutt.	mission manzanita
		Yucca L.	yucca

Tahoe	**(01a, b, c) Colombo, Jaybird, Madrone**	*Corylus cornuta Marsh. var. californica (A. DC.) Sharp*	California hazel
		Lonicera hispidula (Lindl.) Dougl. ex Torr. & Gray var.	pink honeysuckle
		Rosa californica	
		Ceanothus integerrimus Hook. & Arn.	deerbrush
		Ribes lacustre (Pers.) Poir.	prickly currant
		Rubus leucodermis Dougl. ex Torr. & Gray	western raspberry
		Toxicodendron diversilobum (Torr. & Gray) Greene	Pacific poison oak

Appendix B, Table 2. *2002 Projects.*

Herbaceous Species

Project	Project Name	Scientific Name	Common Name
Lassen	**(02) Middle Ridge**	*Asarum harwegii S. Wats.*	Hartweg's wild ginger
		Galium aparine L.	Stickywilly
		Sanicula L.	Sanicle
		Trientalis latifolia Hook.	Broadleaf starflower
		Viola lobata Benth.	Pine violet

Eldorado	**(02) Free Willy**	*Adenocaulon bicolor Hook.*	American trailplant
		Aster radulinus Gray	Roughleaf aster
		Bromus carinatus Hook. & Arn.	California brome
		Chimaphila umbellata (L.) W. Bart.	pipsissewa
		Cirsium vulgare (Savi) Ten.	Bull thistle
		Cynosurus echinatus L.	bristly dogstail grass
		Disporum hookeri (Torr.) Nichols.	Drops of gold
		Elymus glaucus Buckl.	Blue wildrye
		Festuca occidentalis Hook.	Western fescue
		Galium L.	bedstraw
		Hieracium albiflorum Hook.	White hawkweed
		Homalothecium nuttalii (S)	Nuttall's homalothecium moss
		Iris L.	Iris
		Iris tenuissima Dykes ssp. tenuissima	Longtube iris
		Lupinus L.	Lupine
		Orthotrychum lyellii (Moss, W)	Lyell's orthotrichum moss
		Osmorhiza chilensis Hook. & Arn.	sweetcicely
		Piperia unalascensis (Spreng.) Rydb.	slender-spire orchid
		Polygala cornuta Kellogg	Sierra milkwort
		Trientalis latifolia Hook.	broadleaf starflower
Inyo	**(02) Pilot**	*Bromus carinatus Hook. & Arn.*	California brome
		Carex L.	sedge
		Poa fendleriana (Steud.) Vasey	Mutton grass
Klamath	**(02) Surrogate**	*Elymus elymoides (Raf.) Swezey*	squirreltail
		Epilobium minutum Lindl. ex Lehm.	chaparral willowherb
		Festuca rubra L.	red fescue
		Fomitopsis pinicola	
		Fragaria vesca L.	woodland strawberry
		Hieracium albiflorum Hook.	white hawkweed
		Homalothecium nuttalii (S)	Nuttall's homalothecium moss
		Kelloggia galioides Torr.	milk kelloggia
		Pyrola picta Sm.	whitevein shinleaf
Lassen	**(02) Swain**	*Apocynum androsaemifolium L.*	spreading dogbane
		Astragalus purshii Dougl. ex Hook.	woollypod milkvetch
		Carex rossii Boott	Ross' sedge
		Cirsium P. Mill.	thistle
		Collinsia Nutt.	blue eyed Mary
		Cryptantha Lehm. ex G. Don	cryptantha
		Elymus L.	wildrye
		Eriophyllum lanatum (Pursh) Forbes	common woolly sunflower
		Gayophytum diffusum Torr. & Gray ssp. parviflorum Lewis & Szweykowski	spreading groundsmoke
		Gilia capillaris Kellogg	miniature gilia
		Hieracium albiflorum Hook.	white hawkweed

		Lupinus arbustus Dougl. ex Lindl.	longspur lupine
		Monardella Benth.	(monardella)
		Pedicularis semibarbata Gray	pinewoods lousewort
		Penstemon gracilentus Gray	slender penstemon
		Phacelia hastata Dougl. ex Lehm. var. hastata	silverleaf phacelia
		Phlox diffusa Benth.	spreading phlox
		Poa fendleriana (Steud.) Vasey	muttongrass
		Wyethia mollis Gray	wolly mule-ears
Mendocino	**(02) Howard Mill**	*Achillea millefolium L.*	common yarrow
		Adenocaulon bicolor Hook.	American trailplant
		Agoseris grandiflora (Nutt.) Greene	bigflower agoseris
		Agropyron sp.	(wheatgrass)
		Apocynum androsaemifolium L.	spreading dogbane
		Aster	aster
		Bromus L.	brome
		Calystegia occidentalis (Gray) Brummitt	chaparral false bindweed
		Campanula scouleri Hook. ex A. DC.	pale bellflower
		Carex multicaulis Bailey	manystem sedge
		Cirsium occidentale (Nutt.) Jepson	cobwebby thistle
		Elymus glaucus Buckl.	blue wildrye
		Festuca occidentalis Hook.	western fescue
		Galium californicum Hook. & Arn. ssp. californicum	California bedstraw
		Hieracium albiflorum Hook.	white hawkweed
		Homalothecium nuttalii (S)	(homalothecium moss)
		Iris tenuissima Dykes ssp. tenuissima	(longtube iris)
		Lathyrus L.	pea
		Lathyrus polyphyllus Nutt.	leafy pea
		Lomatium Raf.	Desert parsley
		Lupinus L.	lupine
		Melica geyeri Munro ex Boland.	Geyer's oniongrass
		Orthotrychum lyellii (Moss, W)	(Lyell's orthotrichum moss)
		Osmorhiza chilensis Hook. & Arn.	sweetcicely
		Poa L.	bluegrass
		Pteridium aquilinum (L.) Kuhn	western brackenfern
		Trientalis latifolia Hook.	broadleaf starflower
		Triteleia laxa Benth.	Ithuriel's spear
		Viola lobata Benth.	pine violet
Los Padres	**(02) Alamo**	*Achnatherum Beauv.*	needlegrass
		Agoseris Raf.	agoseris
		Aster L.	aster
		Castilleja Mutis ex L. f.	Indian paintbrush
		Elymus elymoides (Raf.) Swezey	squirreltail
		Eriogonum Michx.	(buckwheat)
		Eriogonum nudum Dougl. ex Benth.	naked buckwheat

		Lupinus L.	lupine
		Poa fendleriana (Steud.) Vasey	muttongrass
Modoc	**(02) Hackamore**	*Achillea millefolium L.*	common yarrow
		Achnatherum Beauv.	needlegrass
		Astragalus purshii Dougl. ex Hook.	woollypod milkvetch
		Bromus tectorum L.	cheatgrass
		Carex rossii Boott	Ross' sedge
		Clarkia sp.	(clarkia)
		Claytonia perfoliata Donn ex Willd.	miner's lettuce
		Collinsia Nutt.	blue eyed Mary
		Cryptantha Lehm. ex G. Don	(cryptantha)
		Elymus elymoides (Raf.) Swezey	squirreltail
		Festuca occidentalis Hook.	western fescue
		Gayophytum diffusum Torr. & Gray ssp. parviflorum Lewis & Szweykowski	spreading groundsmoke
		Koeleria macrantha (Ledeb.) J.A. Schultes	prairie Junegrass
		Lupinus argenteus Pursh	silvery lupine
		Pascopyrum smithii (Rydb.) A. Löve	western wheatgrass
		Poa fendleriana (Steud.) Vasey	muttongrass
		Polygala L.	polygala
		Wyethia mollis Gray	Wolly mule-ears
Plumas	**(02) Spanish Camp**	*Adenocaulon bicolor Hook.*	American trailplant
		Carex multicaulis Bailey	manystem sedge
		Carex rossii Boott	Ross' sedge
		Chimaphila umbellata (L.) W. Bart. var. occidentalis (Rydb.) Blake	pipsissewa
		Clarkia rhomboidea Dougl. ex Hook.	diamond clarkia
		Claytonia perfoliata Donn ex Willd.	miner's lettuce
		Goodyera oblongifolia Raf.	western rattlesnake plantain
		Hieracium albiflorum Hook.	white hawkweed
		Lathyrus sulphureus Brewer ex Gray var. argillaceus Jepson	snub pea
		Pyrola picta Sm.	whiteveined wintergreen
		Smilacina racemosa (L.) Desf. var. amplexicaulis (Nutt.) S. Wats.	feathery false lily of the vally
		Viola sheltonii Torr.	Shelton's violet
Shasta-Trinity	**(02) Elk**	*Achnatherum occidentale (Thurb. ex S. Wats.) Barkworth*	western needlegrass
		Aster L.	aster
		Bromus L.	brome
		Calochortus Pursh	mariposa lily
		Carex L.	sedge
		Carex rossii Boott	Ross' sedge
		Chimaphila umbellata (L.) W. Bart.	pipsissewa
		Collinsia Nutt.	blue eyed Mary

		Collomia grandiflora Dougl. ex Lindl.	grand collomia
		Elymus L.	wildrye
		Erigeron inornatus (Gray) Gray	California rayless fleabane
		Gayophytum diffusum Torr. & Gray ssp. parviflorum Lewis & Szweykowski	spreading groundsmoke
		Kelloggia galioides Torr.	milk kelloggia
		Melica aristata Thurb. ex Boland.	bearded melicgrass
		Stephanomeria lactucina Gray	lettuce wirelettuce
		Viola purpurea Kellogg	goosefoot violet
Six Rivers	**(02) Copper**	*Campanula scouleri Hook. ex A. DC.*	pale bellflower
		Eurhynchium oreganum (Sull.) Jaeg.	Oregon eurhychium moss
		Homalothecium nuttalii (S)	(Nuttall's homalothecium moss)
		Iris L.	iris
		Isothecium stoloniferum (I)	(isothecium moss)
		Orthotrychum lyellii (Moss, W)	(Lyell's orthotrichum moss)
		Porella navicularis (s)	(ahtiana lichen)
		Pteridium aquilinum (L.) Kuhn	western brackenfern
		Stereum hirsutum (W)	
		Trientalis latifolia Hook.	starflower
		Viola glabella Nutt.	pioneer violet
Plumas	**(01 post1) French**	*Pteridium aquilinum (L.) Kuhn*	brackenfern
		Trientalis latifolia Hook.	starflower
		Viola L.	violet
		Viola lobata Benth.	pine violet
		Agoseris retrorsa (Benth.) Greene	spearleaf agoseris
Stanislaus	**(02) Wright**	*Elymus elymoides (Raf.) Swezey*	squirreltail
		Gayophytum diffusum Torr. & Gray ssp. parviflorum Lewis & Szweykowski	spreading groundsmoke
		Kelloggia galioides Torr.	milk kelloggia
		Madia glomerata Hook.	mountain tarweed
		Pteridium aquilinum (L.) Kuhn	western brackenfern
		Pyrola picta Sm.	whiteveined wintergreen
		Viola lobata Benth. ssp. lobata	pine violet
Tahoe	**(01b post1) Columbo**	*Aster L.*	aster
		Carex multicostata	Manyrib sedge
		Iris hartwegii Baker	rainbow iris
		Poa compressa L.	Canada bluegrass

Shrub Species

Forest	Project	Scientific Name	Common Name
Angeles	**(02) Shinn**	*Adenostoma fasciculatum Hook. & Arn.*	chamise
		Yucca whippeie Torr. Var. whipplei	chaparral yucca
		Eriodictyon trichocalyx Heller	hairy yerba santa
Eldorado	**(02) Free Willy**	*Ribes roezlii Regel*	Sierra gooseberry
Klamath	**(02) Surrogate**	*Apocynum androsaemifolium L.*	spreading dogbane
		Ceanothus prostratus Benth.	squaw carpet
		Purshia tridentata (Pursh) DC.	antelope bitterbrush
		Symphoricarpos mollis Nutt.	creeping snowberry
Lassen	**(01 post1) Middle Ridge**	*Ceanothus prostratus Benth.*	squawcarpet
	(02) Swain	*Ceanothus velutinus Dougl. ex Hook.*	snowbrush ceanothus
		Purshia tridentata (Pursh) DC.	antelope bitterbrush
		Quercus chrysolepis Liebm.	canyon live oak
		Rhamnus tomentella Benth.	California buckthorn
		Toxicodendron diversilobum (Torr. & Gray) Greene	Pacific poison oak
Los Padres	**(02) Alamo**	*Arisaema triphyllum (L.) Schott*	jack in the pulpit
		Artemisia tridentata Nutt.	big sagebrush
		Ceanothus crassifolius Torr.	hoaryleaf ceanothus
		Ceanothus greggii Gray var. perplexans (Trel.) Jepson	desert ceanothus
		Quercus berberidifolia Liebm.	scrub oak
		Quercus wislizeni A. DC.	interior live oak
Mendocino	**(02) Howard Mill**	*Arctostaphylos patula Greene*	greenleaf manzanita
		Ceanothus integerrimus Hook. & Arn.	deerbrush
		Quercus chrysolepis Liebm.	canyon live oak
		Rhamnus californica Eschsch.	California buckthorn
		Ribes roezlii Regel	Sierra gooseberry
		Rosa gymnocarpa Nutt.	dwarf rose
		Symphoricarpos mollis Nutt.	creeping snowberry
Plumas	**(01 post1) French**	*Ceanothus integerrimus Hook. & Arn.*	deerbrush
	(02) Spanish Camp	*Symphoricarpos rotundifolius Gray*	roundleaf snowberry
Sequoia	**(02) Coffee**	*Adenostoma fasciculatum Hook. & Arn.*	chamise
		Lonicera interrupta Benth.	chaparral honeysuckle
		Ceanothus cuneatus (Hook.) Nutt.	buckbrush
		Ribes menziesii Pursh	canyon gooseberry
		Rhamnus ilicifolia Kellogg	hollyleaf redberry

		Quercus garryana Dougl. Ex Hook. Var. breweri (Englem.) Jepson	Oregon white oak
		Eriodictyon californicum (Hook. & Arn.) Torr.	California yerba santa
Shasta-Trinity	**(02) Elk**	*Amelanchier Medik.*	serviceberry
		Ceanothus cordulatus Kellogg	whitethorn ceanothus
		Symphoricarpos rotundifolius Gray	roundleaf snowberry
Sierra	**(02) Virginia**	*Arctostaphylos patula Greene*	greenleaf manzanita
		Ceanothus integerrimus Hook. & Arn.	deerbrush
		Chamaebatia foliolosa Benth.	mountain misery
		Quercus chrysolepis Liebm.	canyon live oak
Six Rivers	**(02) Copper**	*Apocynum androsaemifolium L.*	spreading dogbane
		Berberis aquifolium Pursh	hollyleaved barberry
		Corylus cornuta Marsh.	beaked hazelnut
		Holodiscus discolor (Pursh) Maxim.	oceanspray
		Lithocarpus densiflorus (Hook. & Arn.) Rehd.	tanoak
		Lonicera hispidula (Lindl.) Dougl. ex Torr. & Gray	pink honeysuckle
		Polystichum munitum (Kaulfuss) K. Presl	western swordfern
		Quercus chrysolepis Liebm.	canyon live oak
		Rosa gymnocarpa Nutt.	dwarf rose
		Rubus ursinus Cham. & Schlecht.	California blackberry
		Symphoricarpos mollis Nutt.	creeping snowberry
		Toxicodendron diversilobum (Torr. & Gray) Greene	Pacific poison oak
Stanislaus	**(02) Wright**	*Arctostaphylos patula Greene*	greenleaf manzanita
		Ceanothus cordulatus Kellogg	whitethorn ceanothus
		Ceanothus integerrimus Hook. & Arn.	deerbrush
		Chamaebatia foliolosa Benth.	mountain misery
		Frangula rubra (Greene) V. Grub. ssp. rubra	red buckthorn
		Ribes L.	currant
		Rosa pinetorum Heller	pine rose
Tahoe	**(01c post1) Columbo**	*Chamaebatia foliolosa Benth.*	mountain misery
		Rorippacalycina (Englem.) Rydb.	persistent sepal yellowcress
		Symphoricarpos mollis Nutt.	creeping snowberry
		Toxicodendron diversilobum (Torr. & Gray) Greene	Pacific poison oak

Appendix B, Table 3. *2003 Projects*

Herbaceous Species

Forest	Project	Scientific Name	Common Name
Los Padres	**(02 post 1) Alamo**	*Anaphalis margaritacea*	western pearly everlasting
		Avena barbata	slender oatgrass
		Avena species	oatgrass
		Bromus tectorum	cheatgrass
		Calochorus kennedyi	desert mariposa lily
		Calochorus species	mariposa lily
		Cerastium beeringianum	chickweed
		Conyza species	horseweed
		Crepis occidentalis	western hawksbeard
		Elymus elmoides	squirreltail
		Elymus glaucus	blue wildrye
		Epilobium ciliatum	fringed willowherb
		Eriogonum dasyanthemum	chaparral buckwheat
		Eriogonum species	buckwheat
		Gilia brecciarum	Nevada gilia
		Gilia latiflora	hollyleaf gilia
		Gilia splendens	grand gilia
		Lupinus albifrons	silver lupine
		Melica stricta	rock melicgrass
		Mimulus guttatus	seep monkeyflower
		Moluccella laevis	shellflower
		Pedicularis species	lousewort
		Penstemon species	penstemon
		Platanthera species	orchid
		Poa secunda	Sandberg's bluegrass
		tree moss	tree moss
		Viola species	violet
Mendocino	**(02 post1) Howard Mill**	*Achnatherum species*	needlegrass
		Agoseris grandiflora	bigflower agoseris
		Apocynum androsaemifolium	spreading dogbane
		Calamagrostis	reedgrass
		Carex species	sedge
		Cirsium species	thistle
		Clarkia species	clarkia
		Collinsia heterophylla	purple chinese houses
		Crataegus grandis	grand hawthorn
		Elymus elmoides	squirreltail
		Elymus glaucus	blue wildrye
		Festuca idahoensis	Idaho fescue
		Galium bolanderi	Bolander's bedstraw
		Galium californicum	California bedstraw
		Hieracium albiflorum	white hawkweed
		Ipomoea species	morningglory

		Iris species	iris
		Juncus species	rush
		Lathyrus species	pea
		Madia species	tarweed
		Osmorhiza berteroi	sweet cicely
		Pteridium aquilinum	western brackenfern
		Tragopogon species	goatsbeard
		Triteleia laxa	Ithuriel's spear
		Vicia species	vetch
		Viola lanceolata	bog white violet
		Vulpia species	fescue
Modoc	**(02 post 1) Hackamore**	*Achillea millefolium*	yarrow
		Arabis holboelli	Holboell's rockcress
		Bacidia salmonea	dotted lichen
		Bromus carinatus	smooth brome
		Carex rossii	Ross' Sedge
		Elymus elmoides	squirreltail
		Gayophyrum diffusum	spreading groundsmoke
		Lupinus argenteus	silvery lupine
		Poa secunda	Sandberg's bluegrass
		Poa wheeleri	Wheeler's bluegrass
		Rock moss	rock moss
		Senecio integerrimus	ragwort
		tree moss	tree moss
		Viola purpurea	goosefoot violet
		Wyethia mollis	Mule's ear
Shasta-Trinity	**(02 post 1) Elk**	*Agoseris glauca*	pale agoseris
		Bromus inermis	smooth brome
		Carex rossii	Ross' Sedge
		Collomia grandiflora	grand collomia
		Elymus elmoides	squirreltail
		Gayophytum diffusum	spreading groundsmoke
		Kelloggia galioides	milk kelloggia
		Melica aristata	bearded melicgrass
		Poa secunda	Sandberg's bluegrass
		Pseudoroegneria spicata	bluebunch wheatgrass
Tahoe	**(03) Burlington**	*Chimaphila umbellata*	prince's Pine
		Clarkia speciosa	redspot clarkia
		Galium species	galium species
		Goodyera oblongifolia	western rattlesnake plantain
		Iris species	Iris species
		Juncus species	rush
		Pteridium aquilinum	western brackenfern
		Rock moss	rock moss
		tree moss	tree moss
Eldorado	**(03) Bald Boy**	*Anaphalis margaritacea*	western pearly everlasting
		Arctostaphylos manzanita	Konocti manzanita

		Calamagrostis species	reedgrass
		Chenopodium polyspermum	manyseed goosefoot
		Collinsia tinctoria	sticky Chinese houses
		Festuca idahoensis	Idaho fescue
		Galium bolanderi	Bolander's bedstraw
		Hieracium albiflorum	white hawkweed
		Iris species	Iris species
		Juncus species	rush
		Madia species	tarweed
		Melica aristata	bearded melicgrass
		Poa compressa	Canada bluegrass
		Sidalcea glaucescens	waxy checkermallow
Plumas	**(03) Brush Creek**	*Agrostis species*	bentgrass
		Arnica cordifolia	Heartleaf arnica
		Bromus species	brome
		Claytonia perfoliata	miner's lettuce
		Draba species	draba
		Galium bolanderi	Bolander's bedstraw
		Galium trifidum	three petal bedstraw
		Iris hartwegii	Hartweg's Iris
		Juncus species	rush
		Lathyrus sulphureus	snub pea
		Pteridium aquilinum	bracken fern
		Viola species	violet
Modoc	**(03) Sorhog**	*Achillea millefolium*	yarrow
		Arabis holboelli	Holboell's rockcress
		Astragalus coccineus	Scarlet milkvetch
		Bromus orcuttianus	Orcutt's Brome
		Carex rossii	Ross' Sedge
		Clarkia rhomboidea	diamond clarkia
		Claytonia perfoliata	miner's lettuce
		Elymus elmoides	squirreltail
		Poa secunda	Sandberg's bluegrass
		Poa wheeleri	Wheeler's bluegrass
		Senecio integerrimus	ragwort
		Sidalcea glaucescens	waxy checkerbloom
		tree moss	tree moss
		Viola purpurea	goosefoot violet
		Wyethia mollis	Mule's ear
Mendocino	**(03) Trough Ridge Fuel Break**	*Agoseris species*	Agoseris species
		Apocynum androsaemifolium	spreading dogbane
		Chimaphila menziesii	little prince's pine
		Iris Hartwegii	Hartweg's Iris
		Pyrola picta	white veined wintergreen
		tree moss	tree moss
		Viola lanceolata	bog white violet
		Viola lobata	pine violet

Inyo	**(03) Mammoth Fuel Break**	*Carex species*	sedge
		Elymus elmoides	squirreltail
		Eriogonum umbellatum	sulphur flower buckwheat
		Gayophytum diffusum	spreading groundsmoke
		Linanthus nuttaillii	Nuttall's linanthus
		Lupinus argenteus	silvery lupine
		Lupinus polycarpus	small flower lupine
		Penstemon gracilentus	slender penstemon
San Bernardino	**(03) Arrowhead Fuel Break**	*Achillea millefolium*	Yarrow
		Agoseris retrorsa	spearleaf mountain dandelion
		Allium species	Onion
		Arabis holboelli	Holboell's rockcress
		Astragalus coccineus	Scarlet milkvetch
		Bacidia salmonea	dotted lichen
		Bloomeria crocea	common goldstar
		Bromus carinatus	California brome
		Bromus diandrus	ripgut brome
		Bromus species	brome
		Bromus tectorum	cheatgrass
		Carex Rossii	Ross' Sedge
		Clarkia Rhomboidea	diamond clarkia
		Claytonia Perfoliata	Miner's lettuce
		Crepis species	hawksbeard
		Elymus elmoides	squirreltail
		Elymus trachycaulus	slender wheatgrass
		Galium aparine	stickywilly
		Galium trifidum	three petal bedstraw
		Iris hartwegii	Hartweg's Iris
		Lathyrus sulphureus	snub pea
		Linanthus ciliatus	whiskerbrush
		Lupinus argenteus	silvery lupine
		Poa secunda	Sandberg's bluegrass
		Poa wheeleri	Wheeler's bluegrass
		Rock moss	rock moss
		Scutellaria siphocamyploides	grayleaf scullcap
		Senecio Integerrimus	ragwort
		tree moss	tree moss
		Viola purpurea	goosefoot violet
		Vulpia octoflora	sixweeks fescue
		Wyethia mollis	Mule's ear
Angeles	**(02 post 1) Shinn**	*Phacelia sp*	phacelia
		Convolvulus arvensis	field bindweed
		Gilia leptalea	Bridges' gilia
		Yucca whipplei var whipplei	chaparral yucca
		Leptodactylon californicum	Prickly Phlox
		Bloomeria crocea	common goldstar
Lassen	**(01 post2) Middle Ridge**	*Hieracium albiflorum*	white hawkweed

		Viola lobata	pine violet
		Claytonia perfoliata	miner's lettuce
		Carex species	sedge
		Asarum hartwegii	Hartweg's wildginger
		Galium aparine	stickywilly
		Clarkia rhomboidea	diamond clarkia
		Juncus species	grass species
Klamath	**(02 post1) Surrogate**	*Hieracium albiflorum*	white hawkweed
		Claytonia perfoliata	miner's lettuce
		Clarkia rhomboidea	diamond clarkia
		Festuca rubra	red fescue
		Gayophytum diffusum	spreading groundsmoke
		Carex rossii	Ross' Sedge
		Epilobium minutum	chaparral willowherb
		Elymus elmoides	squirreltail
		Poa secunda	Sandberg's bluegrass
		Apocynum androsaemifolium	spreading dogbane
		Pseudoroegneria spicata	bluebunch wheatgrass

Shrub species

Forest	Project	Species Name	Common Name
Lassen	**(01 post 2) Middle Ridge**	*Quercus chrysolepis*	canyon live oak
		Symphoricarpos albus	common snowberry
		Toxicodendron diversilobum	poison oak
		Keckiella species	keckiella
Klamath	**(02 post 1) Surrogate**	*Purshia tridentata*	bitterbrush
		Ribes roezlii	Sierra gooseberry
Tahoe	**(01b post1) Jaybird**	*Corylus cornuta*	California hazelnut
		Symphoricarpos mollis	snowberry
Tahoe	**(01c post2) Colombo**	*Ceanothus integerrimus*	deerbrush
		Ceanothus prostratus	squaw carpet
		Chamabaetia foliolosa	mountain misery
		Chimaphila umbellata	pipsissewa
		Rosa gymnocarpa	dwarf rose
Los Padres	**(01 post 1) Alamo**	*Artemisia tridentata*	sagebrush
		Cercocarpus betuloides	birchleaf mahogany
		Quercus wislizeni	interior live oak
Mendocino	**(02 post1) Howard Mill**	*Arctostaphylos patula*	greenleaf manzanita
		Ceanothus integerrimus	deerbrush
		Quercus chrysolepis	canyon live oak
		Rhamnus californica	California buckthorn
		Ribes species	currant
		Rosa gymnocarpa	dwarf rose
		Symphoricarpos mollis	snowberry
Modoc	**(02 psot1) Hackamore**	*Arctostaphylos patula*	greenleaf manzanita
		Ceanothus prostratus	squaw carpet
		Purshia tridentata	bitterbrush
		Artemisia tridentate spp vaseyana	Mountain big sage brush

Shasta-Trinity	**(02 post 1) Elk**	*Arctostaphylos viscida*	sticky whiteleaf manzanita
		Ceanothus cordulatus	whitethorn ceanothus
		Chrysothamnus viscidiflorus	yellow rabbitbrush
		Rosa woodsii	woodrose
Sierra	**(02 post1) Virginia**	*Arctostaphylos patula*	greenleaf manzanita
		Chamabaetia foliolosa	mountain misery
Tahoe	**(03) Burlington**	*Arctostaphylos patula*	greenleaf manzanita
		Chamabaetia foliolosa	mountain misery
		Ribes roezlii	Sierra gooseberry
Eldorado	**(03) Bald boy**	*Arctostaphylos patula*	greenleaf manzanita
		Ceanothus diversifolius	pinemat
		Chamabaetia foliolosa	mountain misery
		Keckiella breviflora	beardtongue
		Rosa gymnocarpa	dwarf rose
		Toxicodendron diversilobum	poison oak
Plumas	**(03) Brush Creek**	*Ceanothus integerrimus*	deerbrush
		Ribes roezlii	Sierra gooseberry
		Rosa gymnocarpa	dwarf rose
		Rubus species	blackberry
Modoc	**(03) Sorhog**	*Arctostaphylos patula*	greenleaf manzanita
		Ceanothus prostratus	squaw carpet
		Cercocarpus ledifolius	mountain mahogany
		Purshia tridentata	bitterbrush
Mendocino	**(03) Trough Ridge Fuel Break**	*Arctostaphylos*	manzanita
		Arctostaphylos viscida	sticky whiteleaf manzanita
		Ceanothus species	ceanothus
		Quercus chrysolepis	canyon live oak
Inyo	**(03) Mammoth Fuel Break**	*Gutierrezia sarothrae*	broom snakeweed
		Linanthus nuttallii	Nuttall's linanthus
San Bernardino	**(03) Arrowhead Fuel Break**	*Arctostaphylos species*	manzanita
		Ceanothus integerrimus	deerbrush
Angeles	**(02 post1) Shinn**	*Adenostoma fasciculatum*	chamise
		Yucca species	yucca
		Ceanothus species	ceanothus