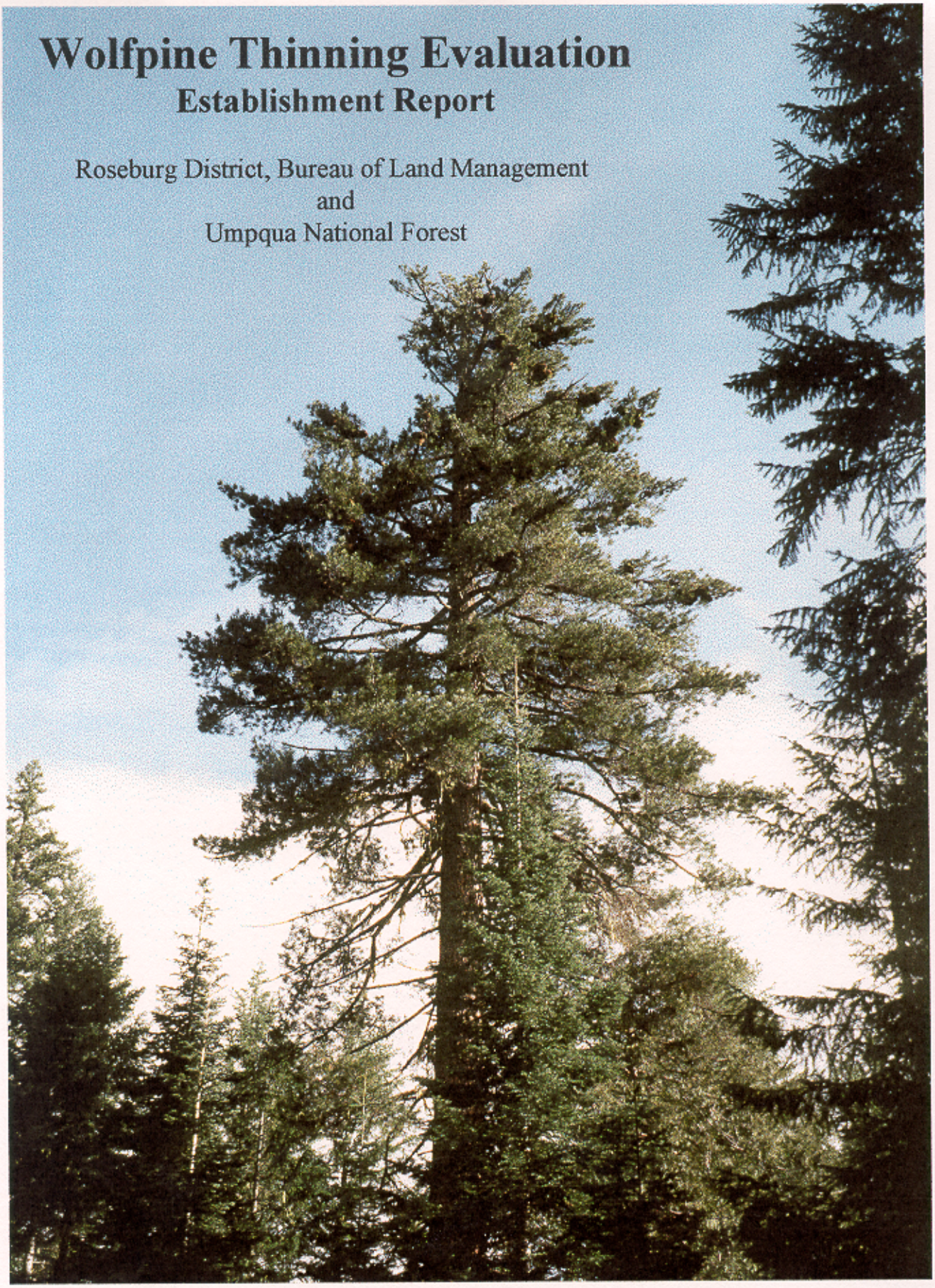
Wolfpine Thinning Evaluation
Establishment Report

Roseburg District, Bureau of Land Management
and
Umpqua National Forest



SWOFIDTC 98-1

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Area and Project Description

The Wolfpine Thinning Evaluation area is located within the Little River Adaptive Management Area in T. 27 S., R. 1 W., Sections 6 and 7 and T. 27 S., R 2 W., Sections 9,12, 15, and 16 (Figs. 1 and 2). Mixed conifer/hardwood stands composed of Douglas-fir, white fir western hemlock, incense cedar, western red cedar, sugar pine, ponderosa pine, Pacific dogwood, bigleaf maple, Pacific madrone, canyon live oak, and golden chinquapin occur in the area. As elsewhere in Southwest Oregon, the sugar pine component of these stands has exhibited increasing amounts of mortality in recent decades (Figs. 3 and 4). Infestation by mountain pine beetle ***(Dendroctonus ponderosae*** Hopkins) is the direct cause of most mortality of mature sugar pines (Fig. 5). Droughty weather, top and branch killing by white pine blister rust, and unfavorable stand conditions are major predisposing factors. Excessive competition between sugar pines and surrounding trees as a result of overstocking appears to be particularly significant (Fig. 6). The Wolfpine thinning study was initiated to test how changes in tree density around large sugar pines might influence their vitality and hence their susceptibility to Future mountain pine beetle infestations.

The study consists of four treatments with individual sugar pines serving as treatment foci. A treatment number was randomly selected for the first tree in each of ten study stands. After that, treatments were assigned to trees in sequence (1,2,3, and 4). Treatments 1 and 3 have 59 study trees in each, Treatments 2 and 4 have 60 study trees in each. Treatments are described as follows:

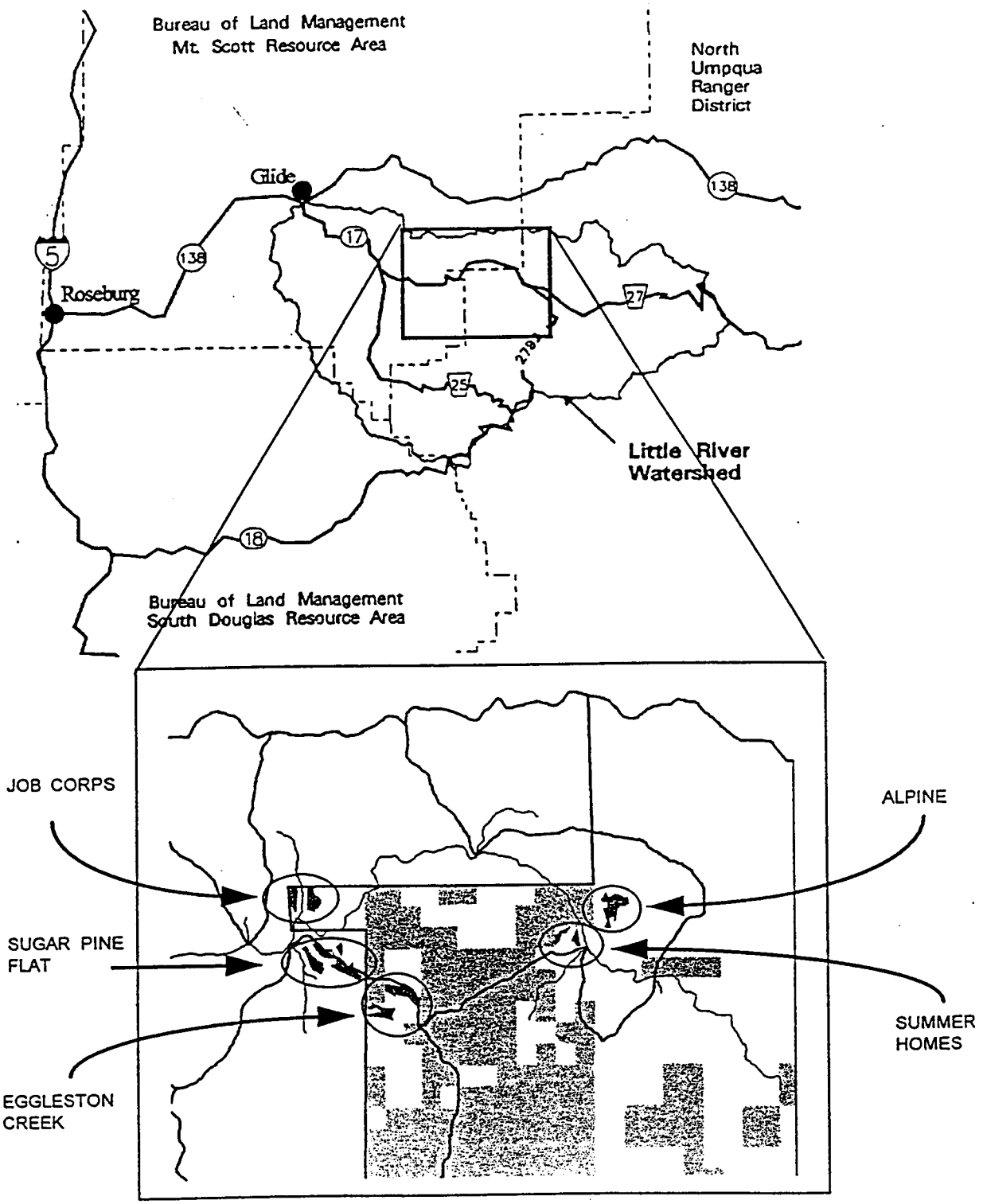
1) Control: no clearing under the sugar pine crown or within 25 feet of the dripline;
2) Extended-Radius Clearing: complete removal of all trees and shrubs under the sugar pine crown and within 25 feet of the dripline;
3) Compressed-Radius Clearing: complete removal of trees and shrubs under the sugar pine crown and within 10 feet of the dripline;
4) Extended-Radius Clearing with Large Trees Retained: as in (2) above but retaining all trees of any species 25 inches or greater DBH within the cleared area around the sugar pine.

The Extended-Radius Clearing is the current management recommendation in Southwest Oregon. A smaller clearing size will be tested in the Compressed-Radius treatment to examine the differences between large vs. small openings. The Large Tree Retention treatment will test

Figure 1.

WOLFPINE PLANNING AREA

VICINITY MAP



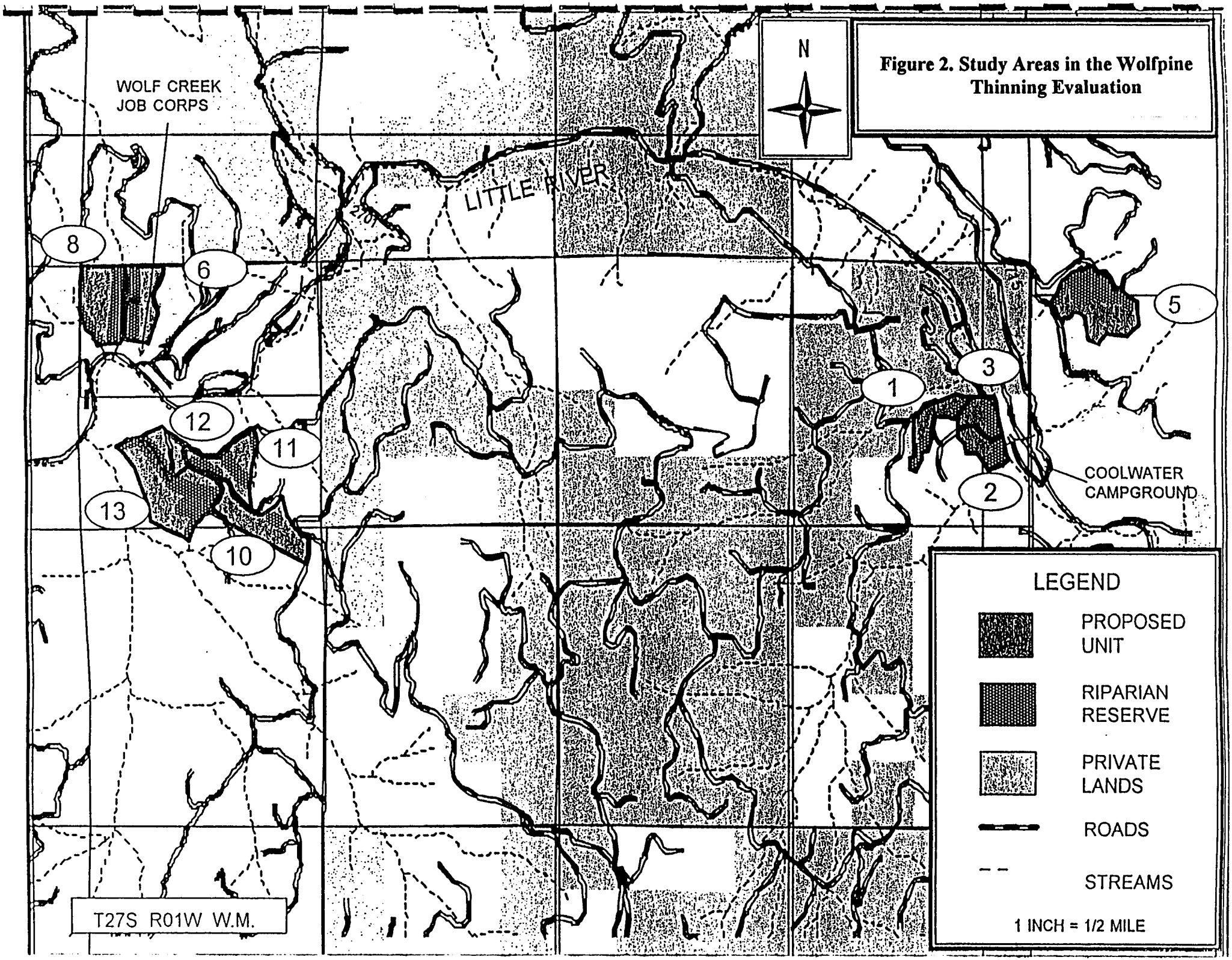


Figure 2. Study Areas in the Wolfpine Thinning Evaluation

the effectiveness of removing small trees and shrubs but retaining one or several large tree competitors adjacent to a sugar pine as a way of maintaining additional large tree structure within prescribed management recommendations. It will contribute to assessing the validity of the notion that small trees and shrubs may be more serious competitors than are large trees.

Pretreatment Data Collection

BLM and Forest Service personnel completed study layout and tree marking in the Wolfpine units in early summer, 1997. Subsequently, Southwest Oregon Forest Insect and Disease Technical Center entomologists and plant pathologists visited study trees and collected the following pretreatment data:

1) Stand number;

2) Tree number;

3) Treatment;

4) DBH of focal tree (ii inches);

5) Average crown radius of focal tree (Average in feet of four measured radii);

6) Last five year's growth of focal tree (expressed in 20ths of inches);

7) Last ten year's growth of focal tree (expressed in 20ths of inches);

8) Live crown ratio of focal tree (expressed as a percentage);

9) Crown fullness rating for focal tree (a subjective rating- possible choices were poor, moderate, or full);

10) Needle retention for focal tree (a subjective rating-possible choices were poor, moderate, or good);

11) Dead top on focal tree (expressed as percentage of top dead);

12) Number of flagging branches on focal tree;

13) Number of stem wounds on focal tree;

14) Number of dead sugar pines within 100 feet of the focal tree;

15) Basal area for trees greater than five inches DBH in square feet/acre around the focal tree;

Fig. 3. Fading crown of a mature sugar pine infested by mountain pine beetles.

Fig. 4. A large dead sugar pine killed by mountain pine beetles three years before. The tree has lost its needles but retains many of its fine branches.

Fig. 5. Galleries of mountain pine beetle under the bark of an infested sugar pine. Adult and larval galleries scour the cambium and are associated with blue staining caused by fungi introduced by the beetles. The tree was killed by the girdling effect of the galleries and occlusion of its water transport system by the fungi.

Fig. 6. A large sugar pine in one of the Wolfpine stands. Note surrounding overstocked stand conditions. Basal area around this tree was 240sq. ft./acre, average for the trees in the study stands.

16) Tree information for a variable radius plot located 16.7 feet NW of the focal tree;

17) Quadratic mean diameter for the plot in (16) above;

18) Relative density for the plot in (16) above (RD= Basal Area/ square root of quadratic mean diameter, expressed as a percentage);

19) Number of small trees (greater than six inches tall but less than five inches DBH) by species in a 50th acre plot centered 16.7 feet NW of focal tree (expressed as trees per acre);

20) Cover of shrubs between a height of six inches and 12 feet by species along a 50 foot transect to NW of focal tree (expressed as a percentage);

21) Cover of trees between a height of six inches and 12 feet by species along a 50 foot transect to NW of focal tree (expressed as a percentage).

Data for items l-l 5,17-19, and cumulative of all species in 20 and 21 were entered into a Paradox database to be shared with all cooperators (disk available from SWOFIDTC). Detailed stand exam data and data on understories by species are on file with the SWOFIDTC.

Pre-Treatment Conditions

Plant associations for the ten study sites are shown in Table 1. Associations varied from relative moist types in the hemlock and white fir series in the creek bottoms and on lower slopes to dry types in the Douglas-fir series on the ridge tops and upper slopes. Most study sites have a site class of three and are moderate to good sites for sugar pine growth.

Table 1. Plant Associations' of the Wolfpine Thinning Evaluation Stands

Stand Number	Plant Association
1	PSME/GASH-BENE2
2	ABCO/GASH-BENE2
3	TSHE/GASH/POMU-SWO
5	ABCO/GASH-BENE2
6	PSME/GASH-BENE2
8	PSME/GASH-BENE2
10	PSME/GASH-BENE2
11	PSME/GASH-BENE2
12	PSME/GASH-BENE2
13	ABCO/GASH-BENE2

' from Atzet, White, McCrimmon, Martinez, Fong and Randall, 1996, Field Guide to the Forested Plant Associations of Southwestern Oregon

An examination of the focal sugar pines for the study treatments shows that they have the following characteristics:

1) Sugar pine focal trees are generally fairly large. Average DBH for all 238 trees is 3 1.6 inches (sd 10.6; range 15.2 to 67.6 inches). Average DBH by treatment is shown in Table 2.

2) Most focal sugar pines exhibit relatively large, full, healthy-appearing crowns. Average live crown ratio for all trees is 39.8 percent (sd 11.2; range 20 to 65 percent), average crown radius is 14.7 feet (sd 3.8; range 7.0 to 27.0 feet), and only 0.8 percent of all focal trees exhibit evidence of noticeably poor crown characteristics (sparse crowns, chlorotic foliage, poor needle retention). Data on live crown ratio, crown radius, and proportion of trees with poor crown characteristics are shown by treatment in Table 2.

3) Many focal sugar pines, in spite of their rather good appearances, can currently be considered at high risk of bark beetle attack because of the excessive level of competition that they are experiencing from surrounding trees and shrubs. Mean basal area of trees greater than 5 inches DBH around focal trees is 240.2 square feet per acre (sd 96.7; range 80 to 520 square feet per acre). Entomologists consider sugar pines to be at high risk of mountain pine beetle attack when surrounding basal areas exceed 180 square feet per acre on moderate to good sites in Southwest Oregon. Average relative density around focal sugar pines is 53.4 percent (sd 21.5; range 15.6 to 142.8 percent). On average, there are 1,065.5 small trees (between 6 inches tall and 5 inches DBH) per acre in the vicinities of the focal trees (sd 1430.8; range 0 to 16,200 small trees per acre). Crown cover of small trees (below 12 feet) averages 21.8 percent around focal sugar pines (sd 24.4; range 0 to 100 percent) and shrub cover in the same zone averages 58.8 percent (sd 28.7; range 0 to 100 percent). Focal sugar pine growth rates reflect the high level of competition that they are experiencing. Average five-year growth for focal trees is 10.7/20 inches (sd 5.4; range l/20 to 28/20 inches) and average ten-year growth is 22.3/20 inches (sd 10.2; range 3/20 to 50/20 inches). Fifty four percent of the focal sugar pines show declining growth rates when their five- and ten-year measurements are compared. Table 2 shows means of the various measurements associated with competition and growth by treatment.

4) There is strong evidence that mountain pine beetles have indeed been active killers of sugar pines in the study stands. Twenty percent of the focal sugar pines have at least one recently killed sugar pine within 100 feet. This mortality is estimated to have occurred within the last ten years. Table 2 shows percentages of focal trees with nearby mountain pine beetle-killed sugar pines by treatment.

In our view, the Wolfpine study provides an excellent opportunity for testing effectiveness of various thinning approaches in reducing likelihood of beetle infestation in sugar pine. It appears that without any density reduction treatments, a large proportion of the sugar pine focal trees in this evaluation have a high probability of suffering mountain pine beetle attack in the not too distant future. If the kinds of thinning that will be tested are indeed effective decreased mortality in treatments vs. untreated controls should be evident within the next 20 years.

Table 2. Attributes by Treatment for the Wolfpine Thinning Evaluation

Attribute	Treatment			
	1	2	3	4
Sample Size	59	60	59	60
Avg. DBH (in.)	37.2 (9.1*)	31.8 (10.2)	26.9 (7.6)	30.6 (12.3)
Avg. crown radius (ft.)	16.8 (3.1)	14.7 (3.8)	12.7 (3.5)	14.5 (3.8)
Avg. 5-yr growth (1/20 in.)	9.5 (4.6)	9.6 (4.5)	11.4 (5.7)	12.4 (6.2)
Avg. 10-yr growth (1/20 in.)	19.2 (8.8)	20.6 (8.8)	23.6 (10.4)	25.7 (11.6)
Avg. live crown ratio (%)	33.6 (8.4)	39.2 (10.0)	40.8 (10.3)	45.7 (12.3)
Avg. surrounding BA (sq. ft/ac)	213.9 (90.6)	258.7 (96.7)	248.1 (102.3)	240.0 (93.4)
Avg. Relative Density (%)	44.7 (19.3)	59.7 (21.1)	55.1 (23.5)	53.9 (19.5)
Avg. # small trees/acre	1756.2 (2414.8)	940.8 (778.7)	590.7 514.3)	969.2 (940.6)
Avg. cumulative shrub cover (%)	57.0 (26.4)	45.6 (25.9)	63.2 (29.8)	69.6 (27.7)
Avg. cumulative tree cover (%)	16.5 (19.5)	21.9 (25.6)	21.5 (24.9)	27.2 (26.3)
% trees with poor crowns	1	2	0	0
% trees with wounds	37	32	27	30
% trees with declining growth	49	52	54	60
% trees with surrounding BA>180 sq. ft	71	60	80	73
% trees near dead Dines	15	25	25	13

* All numbers in parentheses are standard deviations for the presented means

Future Monitoring

Following the thinning treatments (which are expected to be completed in 1998 or shortly thereafter), data will again be collected on all characteristics evaluated in the pre-treatment examinations. Subsequently, the study trees will be monitored every other year for mountain pine beetle-caused mortality or death resulting from other causes. Monitoring will be continued for at least 20 years. Basal area, relative density, and ground cover information will be collected around any study pine that dies as will DBH at time of death. At six-year intervals, all study pines in each treatment will have radial growth (by DBH increase), changes in crown condition changes in surrounding basal area and relative density, and changes in small tree ad shrub cover evaluated.

Over the course of the study, differences in amount of insect infestation/ sugar pine survival between treatments will be tested using Chi-square analyses and contingency tables. Comparisons of growth rates, crown conditions, surrounding basal area, relative density, and surrounding cover of small trees, shrubs, and herbs will be made using regression analysis.

Retreatment of study replicates may be desirable Amount of ingrowth and increases in basal area around focal sugar pines can be used toperiodically evaluate need for such treatments. The study replicates can be maintained by additional clearing or, perhaps, by prescribed fire. Feasibility of testing prescribed fire as a tool to maintain clearings around sugar pines will be determined after thinning treatments are completed.