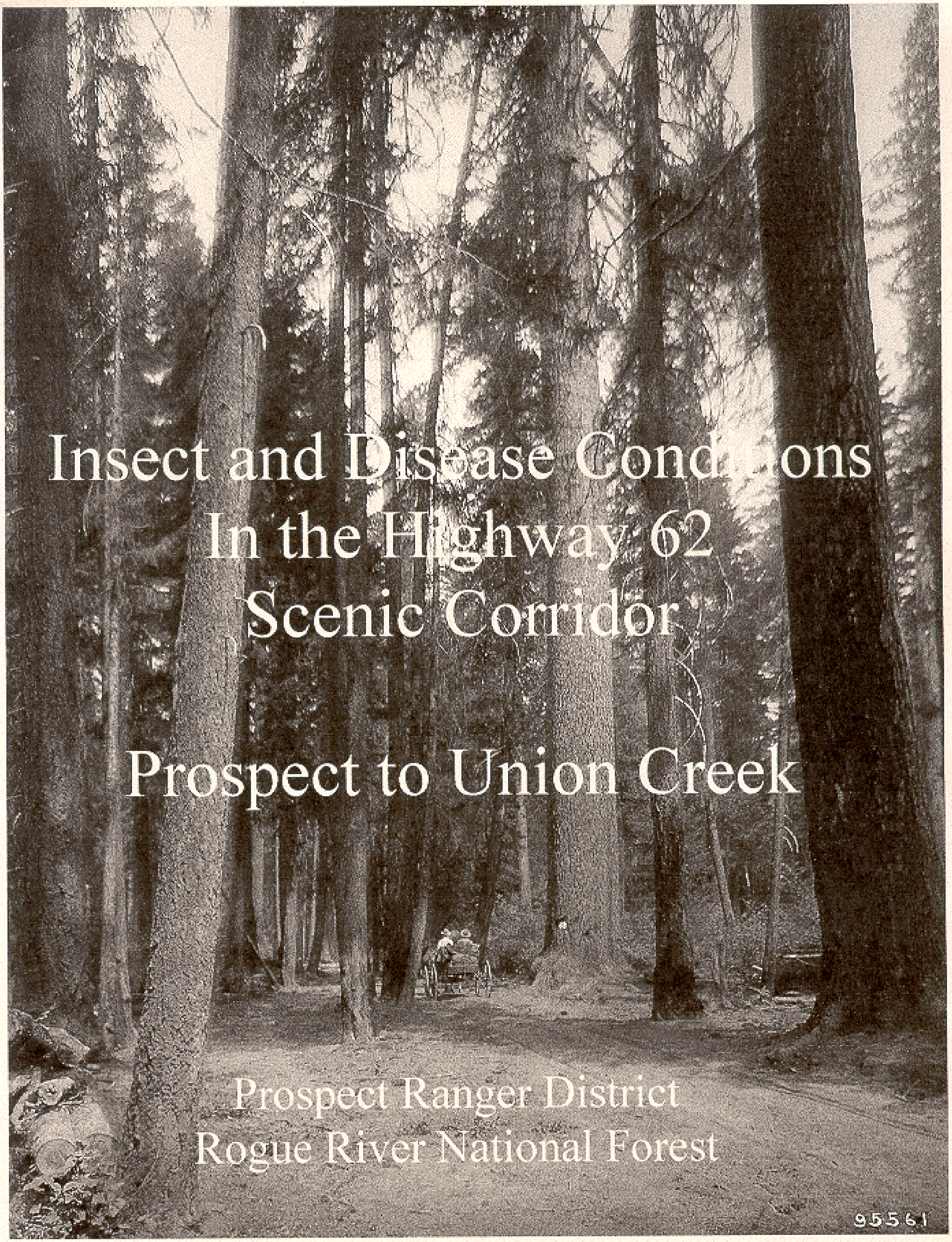

Insect and Disease Conditions In the Highway 62 Scenic Corridor

Prospect to Union Creek

Prospect Ranger District
Rogue River National Forest

Southwest Oregon Forest Insect and Disease Technical Center
SWOFIDTC 97-3

Insect and Disease Conditions in the Highway 62 Scenic Corridor: Prospect to Union Creek

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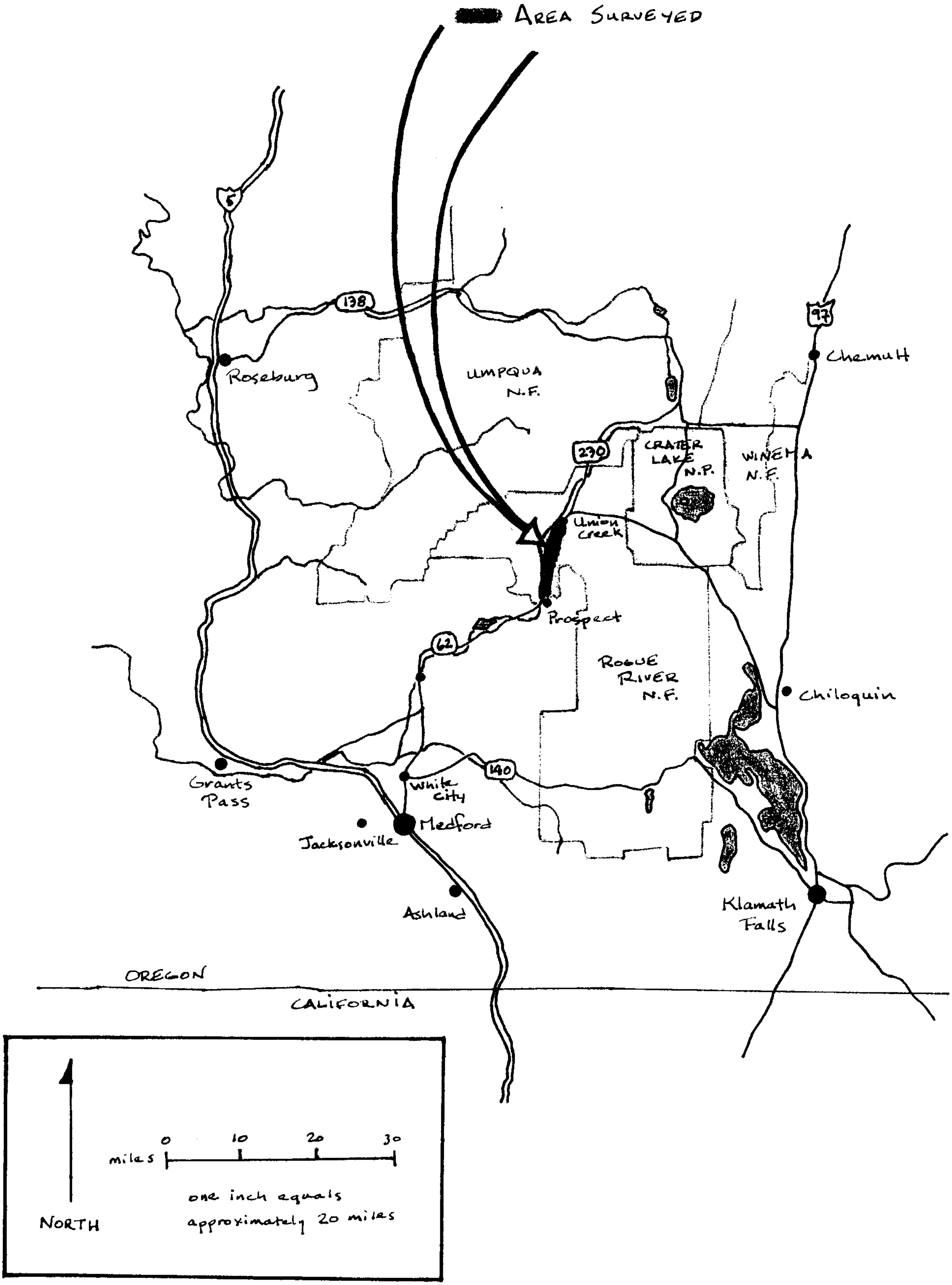
INTRODUCTION

The forested corridor along State Highway 62 between the Prospect Ranger Station and Union Creek (Fig. **1)** provides one of the most attractive forested highway settings in southwestern Oregon. The appearance of the corridor appeals to visiting recreationists as well as residents of the local communities. Important elements of the corridor's attractiveness are the large conifers. Large sugar pines with their purple bark, large cones and long branches are scattered throughout the corridor. The yellow, platy bark and open crowns of large ponderosa pines offer contrast to the dark forest interior. Large Douglas-fir make up a substantial portion of the trees in the corridor.

Due to its exceptional character, and the fact that many visitors to Crater Lake National Park travel through it, the corridor has been designated a Special Interest Area in the Rogue River National Forest Land Management Plan (RRNF, 1990). The management objective for this allocation is to preserve the values of the area in a substantially natural condition. Emphasis is placed on retaining the large trees and the natural-appearing character of stands in the area over the long term.

For a number of decades, mortality of large sugar pines and ponderosa pines within the corridor has been observed, Previous investigations have implicated several species of bark beetles, working alone or in combination, as primary agents of pine mortality. White pine blister rust has been present in the area for many decades, causing branch dieback, topkill, and mortality of sugar pines and western white pines. Investigators have also observed complexes of root diseases and bark beetles killing Douglas-firs and white firs in portions of the corridor.

In 1994 and 1995 the Southwest Oregon Forest Insect and Disease Technical Center conducted an intensive, systematic survey along approximately 10 miles of Highway 62 between the Prospect Ranger Station and Union Creek (Figure 2). The purpose of the survey was to quantify the causes, magnitude, and distribution of conifer mortality in the corridor and to describe the stand conditions associated with the mortality. We were *interested in the area* [illegible]


AREA SURVEYED
5
138
97
Chemult
Roseburg
UMPQUA N.F.
230
CRATER LAKE N.P.
WINEMA N.F.
Union Creek
Prospect
62
ROGUE RIVER N.F.
Chiloquin
Grants Pass
140
White City
Jacksonville
Medford
Ashland
Klamath Falls
OREGON
CALIFORNIA
NORTH
miles
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10
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one inch equals approximately 20 miles

Fig. 1

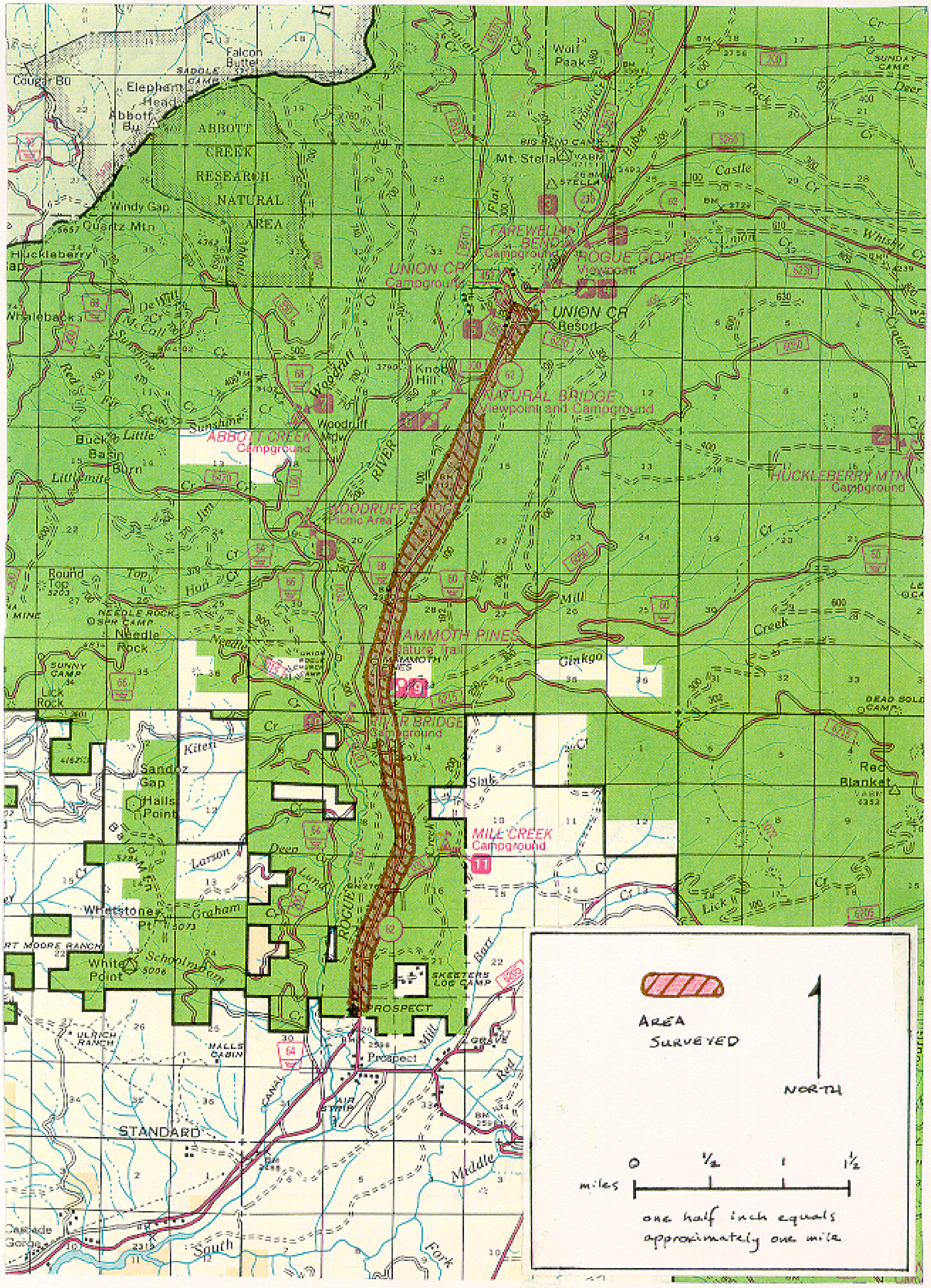
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Fig. 2

motorists, a maximum width of about 400 feet on either side of the highway. Specifically, we surveyed the area extending from Highway 62 to the powerline road or the pine plantations on the west side and from the Highway to the stand boundary or the edges of pine plantations on the east side. This report summarizes the survey results and recommends treatments to maintain the species diversity and large tree components of the scenic corridor.

SURVEY METHODS

Sample points were located at 5-chain (330 ft.) intervals along two transects on each side of the Highway (Figs 3-14). At every grid point, a variable-radius plot (BAF 40) and a fixed-area plot (1/1 00th acre) were established. The breakpoint diameter between variable-radius plots and fixed-area plots was five inches diameter at breast height (dbh). Plot-level basal areas for trees greater than five inches dbh were tallied at every point. Plot-level root disease severity ratings (Table 1) weredetermined for a 1/20th acre circular area surrounding each plot center (Hagle 1985).

Table 1 Root Disease Severity Ratings

Rating	Description
0	No evidence of root disease visible within 50 feet of the nlot.
1	Root disease present within 50 feet of the plot but no evidence of root disease on plot.
2	Minor evidence of root disease on plot, such as a suppressed understory tree killed by root disease or a minor part of the overstory showing signs of infection. Little or no detectable reduction in canopy closure or volume.
3	Canopy reduction evident, up to 20%, usually as a result of the death of 1 codominant tree on an otherwise fully stocked site. In the absence of mortality, numerous trees showing symptoms of root disease.
4	Canopy reduction 20% to 30% as a result of root disease. Snags and downed trees removed from canopy by disease as well as live trees showing symptoms of disease contribute to impact.
5	Canopy reduction 30-50% as a result of root disease. At least half of the ground area of plot considered infested. Plots representing mature stands with half their volume in root disease-tolerant species usually do not go much above a severity rating of 5 due to the ameliorating effect of the root disease-tolerant species.
6	50-75% canopy reduction as a result of root disease with most of the ground area considered infested.
7	At least 75% canopy reduction. Plots which reach this severity level usually are occupied by only the most susceptible species. There are very few of the original overstory trees remaining although infested ground is often densely stocked with regeneration of susceptible species.
8	The entire plot falls within a definite root disease pocket with only 1 or very few overstory trees of susceptible species present.
9	The entire plot falls within a definite root disease pocket with no overstory trees of the susceptible species present.

Table 1. Plot-level Root Disease Severity Rating scale.

At every fifth plot, the following tree-level data were collected to provide information on overall vegetative conditions in the survey area:

All standing trees, living and dead, in variable-radius plots were recorded by dbh (nearest 0.1 inch) and condition, (live or dead). Time since death was estimated for all dead trees. Trees and shrubs in fixed-area plots were tallied by condition and diameter class. If ponderosa pine, western white pines, or sugar pines were present on the plots, the basal area around individual pines and pine crown ratios were also measured.

All plot trees were carefully examined for evidence of disease or insect infestation. Root collars and roots were examined for evidence of root disease fungi. Evidence included decay, stain, fungal mycelia, and fruiting structures. Trees were examined for evidence of recent bark beetle infestation, such as pitch tubes and frass, and for fruiting structures of stem decay fungi. Bark was removed from stems of dead trees to expose bark beetle galleries for identification. Crowns of all trees were examined for signs and symptoms of diseases such as dwarf mistletoes and white pine blister rust.

Plot trees were also examined for evidence of past fires. Fire scars and or charred wood were noted on all plot trees. Evidence of fire in the vicinity of plot trees was also noted.

At all intervening plots the following tree-level data were collected to provide more detailed information on the pine strata present in the Prospect Corridor:

Plots were examined for the presence of pines. If standing pines, either live or dead, were present on variable-radius plots, their species, condition, dbh, live crown ratio, surrounding basal area, estimated time since death, and insect or' disease status was recorded. Small pines (less than five inches dbh) in the fixed-area plots were tallied by species, condition, diameter class, and insect and disease status.

Approximate location and size of root disease centers were mapped over the entire survey area by examining between-plot symptomatic trees (those with chlorotic and/or thin foliage, presence of stress cone crops, basal resinosis, etc.), standing dead, down trees with root balls, and stumps.

Plant Associations for the survey area were determined based on information from Southwest Oregon Ecology plots established within or adjacent to the survey area, from information provided by the Prospect Ranger District (P. Trudeau, pers. communication) and from walk-through examination of the area after survey data were collected.

After the survey, the corridor was stratified into six areas (Areas A-F, Fig. 2-14) based on mapped concentrations of root disease. This was done so that summary data would reflect root disease impacts as well as to increase the efficiency of the analyis procedure. Data for each area were processed through the R6 Forest Insect and Disease Vegetation Resource Survey (R6 FID VRS 1996) to build stand tables, insect and disease tables, and Forest Vegetation Simulator (FVS)-ready treelists. Images of average, current stand conditions were drawn using the Stand Visualization System (SVS) (McGaugheyxxxxx).

Post Blowdown Reconnaissance

During January of 1996, winter storms deposited heavy wet snow in the Cascades over a relatively short time period. Substantial top breakage and blowdown occurred in an elevational band between 3000 and 4000 feet. The northern portion of the Prospect Corridor experienced this storm damage; the Highway was closed for several days due to fallen trees. In late April 1996 we walked through portions of the Corridor to estimate blowdown and breakage-related effects on stocking and to see if blowdown concentrations were related to the presence of root disease centers in the Corridor. A systematic sample of randomly placed plots (variable-radius 40 BAF with l/lOOth acre fixed area plots for trees less than five inches dbh) were established on both sides of the Highway for the length of the Corridor. Information was gathered on standing basal area by species and size class. Recently downed trees were examined for evidence of root disease fungi.

RESULTS

Original PreBlowdown Surveys

576 sample points were established in the Prospect Corridor during the period 1994 to 1995 (Fig. 3-14). Approximately 1011 acres were surveyed, Table 2 provides the post-survey stratification into number of plots and acres surveyed by Area.

Table 2 Post Survey Stratification

Area	Number of Plots	Acres
A	128	225
B	117	205
C	75	132
D	46	81
E	150	263
F	60	105
TOTAL	576	1011

Table 2. Post survey stratification into 6 Areas. Number of plots and corresponding acreage by Area.

Vegetation

White-fir - Douglas-fir / Piper's Oregongrape (ABC0 - PSME / BEPI) was the predominant Plant Association found in the surveyed portion of the Prospect Corridor. We estimated that it occurs on approximately 86 percent of the area. ABC0 - PSME / BEPI is typically found at the lower elevations of the White Fir Series at the warm, dry, end of the environmental grid. (Atzet and McCrimmon 1990). Fire frequency for this Plant Association is about 75 to 100 years; more frequent, lower intensity fires are the norm in contrast to higher elevation White Fir Associations. We estimated that Western hemlock / Dwarf Oregongrape /Western Twinflower (TSHE / BENE / LIBOL) occurs on the remaining 14 percent of the survey area. TSHE / BENE / LIBOL is a common, widely occurring Plant Association that represents the average environment of the Western Hemlock Series. In general, areas of TSHE / BENE / LIBOL represent cooler, more moist conditions where stands are not as frequently burned as in the White Fir Series.

Evidence of low intensity fires was present throughout the Corridor. Fifty three percent of the plots examined had at least one tree with fire scars or presence of charcoal.

Across the surveyed area, Douglas-fir (Pseudotsuga ***menziesii),*** ponderosa pine ***(Pinus ponderosa),*** sugar pine ***(P. lambertiana),*** western white pine ***(P. monticola),*** white fir ***(Abies concolor),*** incense cedar ***(Calocedrus decurrens),*** and western hemlock ***(Tsuga heterophylla)*** were found in the overstory. Additional tree species, more common in the understory, included Pacific ***yew (Taxus brevifolia),*** Pacific madrone ***(Arbutus menziesii),*** golden chinquapin ***(Castanopsis chrysophylla),*** and Pacific dogwood ***(Cornus nuttallii).***

Stocking was very high; average number of trees per acre range from 1557 in Area D to 2861 in Area C (Figure 15, Table 3 and Appendix Tables Al, A3, A5, A7, A9, Al 1). Small trees (five inches dbh or less), particularly white fir, Douglas-fir, western hemlock, incense cedar, golden chinquapin, and Pacific dogwood, contributed significantly to stocking. Small tree stocking ranged from 1509 trees per acre in Area E to 2730 trees per acre in Area C (Appendix Tables Al, A3, AS, A7, A9, Al 1).

Average stand-level basal areas (all size trees) for the six surveyed areas ranged from 232 square feet per acre in Area F to 352 square feet per acre in Area D (Table 4 and Appendix Tables A2, A4, A6, A8, AlO, A12). Individual plot basal areas (for trees greater than or equal to five inches dbh) for the entire corridor ranged from zero to 600 square feet per acre. The average plot-level basal area (for trees greater than or equal to five inches dbh) was 252 square feet per acre (sd = 111).

Table 3 Percentage of Total Trees per Acre by Species and Area

	Area					
Species	**A**	**B**	**C**	**D**	**E**	**F**
PIPO	<1	1	2	6	3	3
PIMO	NA	<1	<1	NA	<1	<1
PILA	4	2	<1	<1	1	<1
ABCO	16	12	12	NA	16	22
PSME	29	27	18	61	34	36
CADE3	14	1	NA	NA	9	24
TSHE	2	18	5	NA	5	NA
TABR	<1	2	3	NA	4	NA
ARME	<1	<1	NA	NA	NA	NA
CACH	19	22	54	32	21	14
SALIX	NA	<1	<1	1	3	NA
CONU	15	13	6	NA	4	NA
Total Number of Trees per Acre	1807	2128	2862	1557	1686	2242

Table 3. The percentage of total trees per acre for each species in all size classes in each surveyed area of the Prospect Corridor.

Table 4 Percentage of Total Basal Area per Acre by Species						
	Area					
Species	**A**	**B**	**C**	**D**	**E**	**F**
PIPO	12	3	20	44	21	32
PIMO	NA	<1	2	NA	<1	<1
PILA	13	14	<1	0	3	<1
ABCO	8	4	9	NA	17	6
PSME	60	74	66	56	66	58
CADE3	6	1	NA	NA	4	2
TSHE	1	3	2	NA	3	NA
TABR	0	<1	<1	NA	0	NA
ARME	0	0	NA	NA	NA	NA
CACH	<1	<1	<1	0	1	<1
SALIX	NA	0	0	0	<1	NA
CONU	<1	<1	<1	0	<1	NA
Total Basal Area per Acre (sq. ft.)	**286**	**282**	**276**	**356**	**287**	**232**

Table 4. The percentage of total square foot basal area per acre for each species in in all size classes in each surveyed area of the Prospect Corridor.

Douglas-fir was the dominant conifer. It comprised 18 to 6 1 percent of the live tree stocking (Table 3) and 56 to 74 percent of the live tree basal area (Table 4) across the six Areas. Large Douglas-fir were present throughout the survey area; a range of four to six Douglas-firs per acre greater than 40 inches dbh occurred in Areas A, C, D, and E (Appendix Tables Al,A3,A5, A7, A9, Al 1).

Ponderosa pine, sugar pine, and/or western white pine were present on 269 of the 576 established sample points (47 percent). Individual pine plot basal areas (for trees greater than or equal to five inches dbh) for the entire corridor ranged from zero to 600 square feet per acre. The average basal area for pine plots (for trees greater than or equal to five inches dbh) was 254 square feet per acre (sd = 113). Plot-level basal areas (for trees greater than or equal to five inches dbh) equaled or exceeded 200 square feet per acre on 206 plots (77 percent). Plot-level basal areas (for trees greater than or equal to five inches dbh) were greater than or equal to 400 square feet per acre on 34 pine plots (13 percent).

Pines contributed a small percentage of the total live tree stocking found in the survey area, ranging from approximately four percent to near seven percent across the six Areas (Table 3). Pines were not well represented in smaller size classes (Appendix Tables Al, A3, A5, A7, A9, Al 1). However, we found that pines contribute significantly to total live tree basal areas. Seventeen to 44 percent of the basal area across the six surveyed Areas was in pines (Table 4). Obviously large pines were present; a range of one to two pines per acre greater than 40 inches dbh occurred in Areas A, C, E and F (Appendix Tables A2, A4, A6, A8, AlO, A12). Seventeen sugar pines greater than 60 inches dbh (representing approximately 0.02 trees per acre for the entire survey area) were measured on established sample points.

Insects and Pathogens

Bark beetles

Bark beetles had killed pines on 50 of the 269 pine plots (19 percent) established in the Prospect Corridor. Most of the mortality that we observed was estimated to have occurred within the period between 1990 and 1995, the five years prior to and including the year of the survey (Table 5). Bark beetle-caused mortality was found across the range of pine size classes.

Table 5 Bark Beetle Related Mortality for All Pines by Species and Size Classes

Host	Condition	Trees per Acre by DBH Diameter Class						
Ponderosa Pine		5-10"	10-20"	20-30"	30-40"	40-50"	>50"	Total
	Green Infested			.18	.24	.08	.02	.51
	Red Needles		.08	.04	.03			.15
	Dead 1 Year	.31	.29	.05		.02		.67
	Dead 2+ Years	.24	1.38		.02	.01	.01	1.66
	Older Dead 5+	.48	.27	.03	.09	.03		.90
Western White Pine								
	Green Infested							
	Red Needles							
	Dead 1 Year							
	Dead 2+ Years	.28	.52	.05				.85
	Older Dead 5+							
Sugar Pine								
	Green Infested						.02	.02
	Red Needles							
	Dead 1 Year	.91		.04	.04		.01	1.00
	Dead 2+ Years		.20	.02	.06	.02	tr	.30
	Older Dead 5+		.18					.18
All Pines		2.22	2.90	.40	.48	.16	.06	6.2

Table 5. Distribution of Live-infested and dead pines killed by bark beetles.

Typical gallery patterns and characteristic pitch tubes of mountain pine beetle ***(Dendroctonus ponderosae)*** and western pine beetle ***(D. brevicomus)*** were commonly found. Western pine beetle primarily attacks large ponderosa pines. Mountain pine beetle attacks all pine species including ponderosa, sugar, western white and lodgepole pines. The red turpentine beetle ***(D. valens),*** pine engravers ***(Ips spp.),*** flat-headed borers (family ***Buprestidae)*** and round-headed borers (family Cerambycidae) were also associated with some of the pine mortality as secondary agents.

Mortality was especially high for ponderosa pine and sugar pine in the larger size classes. Approximately sever and one half percent of all pines greater than 20 inches dbh were infested (successfully attacked) by bark beetles in the five years prior to and including the survey years (Table 6). Twelve and one half percent of all pines greater than 50 inches dbh were infested by bark beetles within this period. Approximately eight and one half percent of all sugar pines greater than 50 inches dbh and ten percent of the sugar pines greater than 60 inches dbh were killed within the five years prior to this survey.

Table 6 Summary of Bark Beetle Related Mortality for Larger Size Classes			
Category	**Total trees per acre (Live and dead)**	**Trees per acre killed by bark beetles (Mortality 1990-1995)**	**Percent**
All pines ≥ 20 in. dbh	12.7	.95	7.5
All pines ≥ 50 in dbh	.48	.06	12.5
Sugar pine ≥ 50 in. dbh	.35	.03	8.5
Sugar pine ≥ 60 in. dbh	.019	.002	10.5

Table 6. Summary of bark beetle-related mortality by size class groupings for the larger size classes.

White Pine Blister Rust

White pine blister rust (caused by the introduced fungus ***Cronartium ribicola)*** was found on one percent of all five needle pines in the Corridor. It caused branch dieback of sugar pines and western white pines in all size classes. Scattered larger trees (greater than 20 inches dbh) of both species had topkill due to blister rust infection. Blister rust was responsible for mortality of two percent of the five needle pines less than five inches dbh.

Root Diseases

Root diseases were commonly encountered in the Prospect Corridor (Figures 3-14). The entire range of plot-level Root Disease Severity Ratings (RDSR) was found (Table 7).

Table 7. Root Disease Severity Ratings									
RDSR	1	2	3	4	5	6	7	8	9
No. of Plots	**89**	**46**	**23**	**18**	**12**	10	8	6	3

Table 7. Summary of plot-level root disease severity ratings by category.

Root diseases were found just outside of 89 plots (RDSR=l). Approximately 22 percent (126 plots) of the established points had root disease-caused mortality in them (RDSR>2). Canopy reduction was minor (RDSR=2-3) on 69 plots (12 percent). More significant canopy impacts, (RDSR=4-5) occurred on 30 plots (five percent). Major root disease-caused canopy openings (RDSR>6) were found on 27 plots (5 percent).

Armillaria root disease (caused by the fungus *Armillaria ostoyae)* was found with the greatest frequency in this survey. It was detected in 23 percent of all plots. White fir was most commonly infected, followed by Douglas-fir. Occasionally, other conifers were killed by Armillaria root disease. Armillaria root disease was most often associated with mortality of scattered smaller diameter understory trees; canopy reduction due to this disease was generally low. This level of impact is reflected in a high proportion of low RDSRs for plots with Armillaria root disease (Fig. 16). Armillaria root disease was also often associated with trees adjacent to or growing on old skid roads. Very little large down wood was associated with Armillaria root disease pockets.

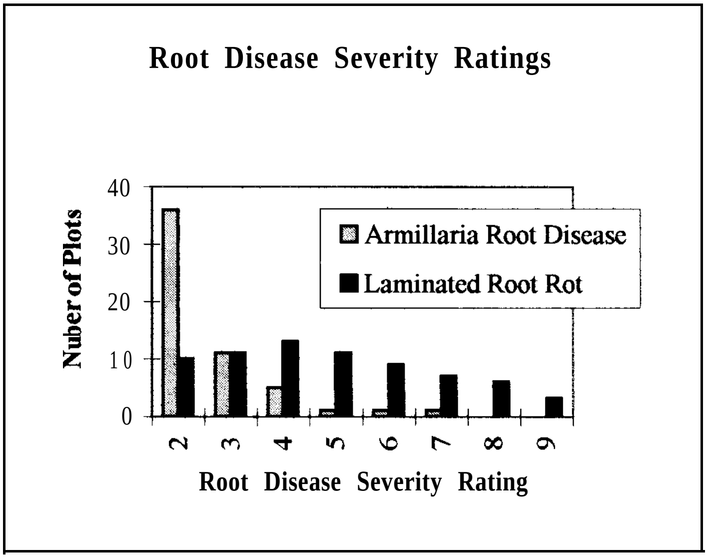

Figure 16. Number of plots and root disease type for different Root Disease Severity Ratings

Laminated root rot (caused by the fungus *Phellinus weirii)* occurred on 15 percent of the plots where it killed white fir and Douglas-fir, primarily, with other conifer species occasionally infected. Laminated root rot infection was mostly found in distinct pockets; boundaries between infected and uninfected areas were usually clear. The canopy openings created by laminated root rot were high relative to Armillaria root disease (Fig. 16). Live tree basal areas of plots with laminated root rot averaged 27 percent lower than plots without laminated root rot. We observed that laminated root rot pockets contained higher quantities of down wood with fewer standing dead trees.

Sixteen plots (3 percent) contained both Armillaria root disease and laminated root rot. In the analysis, these plots were included with those with laminated root rot.

Blackstain root disease (caused by the fungus *Leptographium wageneri)* was found in a single bark beetle-killed ponderosa pine on one plot. Impact was a RDSR of 3.

The "s" strain of *Heterobasidion annosum,* cause of annosus root disease, was not associated with tree mortality; however, the fungus was found in widely scattered white fir stumps across the survey area.

Post survey stratification of the Prospect Corridor based on mapped laminated root rot concentrations resulted in six designated analysis Areas, A-F. Root disease impacts varied from none to 25 percent of the area involved in laminated root rot centers. Impacts of Armillaria root disease are not included because of the scattered nature of the mortality, the size class affected, and the difficulty in estimating area affected.

Table 8 Laminated root rot Acreage by Area

Area	Total Acres	Acres in Root Disease (percent)
A	225	10.5 (5%)
B	205	52.0 (25%)
C	132	32.0 (24%)
D	81	3.5 (4%)
E	263	58 (22%)
F	105	0 (0%)

Table 8. Acres in laminated root rot centers by Area.

Bark Beetles on Hosts Other than Pines

Douglas-fir beetles (D. pseudotsugae), fir engraver beetles ***(Scolytus ventralis),*** flat-headed and round-headed borers were also found associated with tree mortality in the Corridor. These bark beetles killed Douglas-fir and white fir in association with root disease or caused mortality in scattered individual trees presumably weakened by moisture stress.

Stem Decays

Red ring rot (caused by ***Phellinuspini),*** brown cubical butt rot (caused by ***Phaeolus schweinitzii),*** and rust red stringy rot (caused by ***Echinodontium tinctorum)*** were the three most common stem decays found in the corridor. Red ring rot was found in several hosts including Douglas-firs, ponderosa pines, and sugar pines. Brown cubical butt rot was commonly associated with large Douglas-firs. Rust red stringy rot was found in white firs. The average number of trees with stem decay for the entire survey area was 1.6 trees per acre.

Dwarf Mistletoes

Small groups of western hemlock infected by the parasitic plant western hemlock dwarf mistletoe- ***(Arceuthobium tsugense)*** and ponderosa pine infected by western dwarf mistletoe (A. ***campylopodum)*** were observed in scattered locations in the corridor.

Post-Blowdown Reconnaissance

Following the 1996 storm, concentrated pockets of blowdown and breakage were common within two miles of Union Creek. Some blowdown and breakage occurred throughout the remainder of the Corridor but was much more scattered. Douglas-firs and white firs were more frequently downed and/or broken than other tree species. All size classes were affected; however, smaller diameter trees (less than five inches dbh) in dense understory thickets were most commonly affected. In areas of concentrated root disease, trees greater than five inches dbh that were blown down were often found to be infected by root disease fungi and were often located on the edges of root disease centers.

Stocking was not significantly reduced by blowdown and breakage except in a few concentrated areas; stocking levels were very high prior to the winter storms and they generally remained high afterward. In the 40 plots established in the post-blowdown reconnaissance, only four had their basal area (for trees greater than five inches dbh) reduced by the storm. Of these four, basal area was only reduced below 200 square feet per acre in one plot. Basal areas (for trees greater than five inches dbh) after blowdown remained above 200 square feet per acre on average across the Corridor.

DISCUSSION

Historical photographs of areas in or near the Prospect Corridor suggest that in the past these forests were considerably less dense and had smaller components of shade tolerant tree species than they do today. While a rigorous fire ecology study was not included in this survey, our evidence suggests that low intensity fires periodically burned through the area. Fires of this type undoubtedly helped to control stocking. Many large trees of fire resistant species such as ponderosa pine, Douglas-fir and sugar pine would have survived ground fires. Many small diameter pines and Douglas-fir and thin-barked fire intolerant species such as white fir would have died. Patchy ground fires would have had the effect of variable thinning in the stand, leaving patches of trees, creating small openings, and clearing away shrubs and regeneration. Seral species, such as pines, would have been encouraged. Under this regime, established Douglas-firs, sugar pines and ponderosa pines would have grown to great ages and sizes.

Historical records tell us that pines were important components of the forests in the Prospect Corridor and vicinity for many years. In the 187Os, European-Americans first settled in this area to harvest the stand of old-growth sugar pine that was growing in what was known as the Prospect Flats (LaLande 1980). Recreationists in the 188Os, on excursion to Crater Lake via the military road, wrote that "the way leads through the greatest stand of sugar pine in the world". Wagons and early automobiles drove among the giants (Cover photo. 1911. Rogue River NF Archives). When the military route was relocated and paved in the 1920s and 3Os, becoming present day Highway 62, an interpretive site was developed to direct travelers to the 'Mammoth Sugar Pine", a seven foot, eleven inch diameter tree that stood 224 feet tall.

Bark beetle-caused pine mortality has occurred in the Corridor in recent decades. The 'Mammoth Pine" itself was killed by mountain pine beetles in the early 1960s. Data from the Annual Aerial Insect Detection Surveys since 1985 indicate small scattered pockets of bark-beetle-caused pine mortality in the Corridor or its vicinity almost every year (R6 FID Annual Aerial Detection Survey Data). However, the impact of bark beetle-caused mortality has not been readily apparent to the casual observer. The mixed nature of the stands has kept bark beetle populations from building to levels where large numbers of trees die all at once. Pines are scattered through the area. Death of large individual pines is somewhat masked by the occurrence of numerous live large diameter Douglas-firs throughout the Corridor.

Mountain pine beetle and western pine beetle rarely infest healthy, vigorous pines. Rather, they are more successful on low-vigor or stressed trees. Preferred hosts are diseased trees, wounded or injured trees, and trees growing in overstocked stands. Branch dieback and topkill due to white pine blister rust in western white pine and sugar pine increase the risk of bark beetle infestation. Stress induced by competition for water in heavily stocked stands is an especisally important predisposing factor. Bark beetles will kill trees both individually and in small groups. Trees larger than 8 inches dbh are preferred by the beetles. Generally speaking, when stand stocking exceeds 180 square feet per acre on good quality sites, the pine component of the stand is at high risk of bark beetle attack (need reference(s)). On the highest quality sites the threshold may be as high as 220 square feet per acre (need reference(s)). Competition with trees and shrubs of all species contributes to pine susceptibility.

Average stand-level basal areas (for all size classes) for all Areas in the Corridor and average-plot-level basal areas (for trees greater than five inches dbh) exceed the pine bark beetle risk thresholds suggested for even the highest quality sites. More important than the overall survey averages are basal area estimates associated directly with pines. A high percentage of pine plot-level basal areas (for trees greater than five inches dbh) are above these threshold levels without even considering the additional contribution of small tree and shrub competition.

The Pacific Northwest Region's Bark Beetle Specialist suggests that annual bark beetle-related pine mortality rates for large pines (greater than 30 inches dbh) of approximating 0.1 percent per year should be considered average background mortality for stands where density is regulated by fire (D. Bridgwater. 1997. pers. comm.). In the Prospect Corridor, estimated bark beetle-caused mortality levels in several diameter groupings of larger diameter pines for 1990 to 1995 were close to 2 percent per year (Table 6). While these mortality rates may have been exacerbated by recent periods of lower than normal precipitation, bark beetle populations are active in the area and the high risk stand conditions alone are enough to cause high mortality (D. Bridgwater. 1997. pers. comm.). The survey data tells us little about mortality rates prior to 1990 because few of the older dead trees remain. Salvage has occurred in the Corridor for decades; the ground is flat with easy access. We did not attempt to reconstruct bark beetle related mortality from stumps and only looked at stumps in relation to root diseases.

The amount of pine regeneration in the Corridor is very low in comparison to other species. Disturbance that would allow the establishment of pine species is minimal. Golden chinquapins, Pacific dogwoods, white firs, and Douglas-firs dominate the smaller size classes.

The health and successful establishment of five-needle pines is also affected by white pine blister rust. White pine blister rust was introduced into western North America in 1910 and rapidly spread through the western white pine type. It became established in the southern Cascades in the mid 1920s; the first eradication efforts in Oregon were in 1925, just outside of the Prospect Corridor at Woodruff Meadows. It was first described on sugar pine in 1926. ***C. ribicola*** is a rust fungus with a complex life cycle that involves five spore stages and requires an alternate host, a member of the genus ***Ribes.*** Spores from leaves of infected ***Ribes*** plants are blown by the wind for short distances during the late summer and early autumn and infect pine needles. The fungus grows in branch and stem tissue, slowly killing cells. Spore pustules erupt through the bark of pines creating the "blisters" for which the disease is name. Spores are released from these blisters in late spring and early summer and can be windbome for long distances to infect newly formed ***Ribes*** leaves. Smaller infected pine branches are girdled and tree crowns may have a large numbers of red “ branch flags”. Infection can spread into the bole and, depending on where it is, can girdle the stem, killing the top or the entire tree. Larger infected trees become susceptible to bark beetle attack. Bole infections on small trees are usually fatal. In areas where environmental conditions are favorable for this disease, survival of naturally regenerating sugar pine and western white pine is doubtful.

Since 1956 the Pacific Northwest Region has been working actively to develop white pine blister rust-resistant white pine and sugar pine for reforestation. Seed from tested trees with varying resistance levels is available for planting. When combined with culturing techniques such as early pruning, rust-resistant stock has a high probability of surviving and growing in areas where wild stock faces difficulty.

Significant mortality of pines is occurring in the Prospect Corridor. Pines are not reestablishing themselves in sufficient numbers to compensate for these losses. High densities continue to pose a substantial risk of bark beetle attack to pines, particularly to the largest trees. Without measures to reduce stocking in the pine component, ‘above background levels” of mortality are expected to continue. It is entirely possible that in 40 to 50 years, only a very few scattered large diameter sugar pines will remain of what was once “the greatest stand of sugar pine in the world”.

The root diseases that occur in the Prospect Corridor are all native diseases; they have evolved with their hosts over millenia. Laminated root rot, Armillaria root disease, and annosus root disease are considered “diseases of the site”. Fungal inoculum may remain viable in the wood of infected roots and stumps for 20 to 50 years. Root diseases in general operate slowly in stands; average spread rates are one half to two feet per year depending on the causal fungus. Infected roots are killed and or decayed, destroying the trees ability to absorb water and nutrients and seriously compromising anchorage and stability. Trees may be killed outright or can be windthrown with green crowns. Bark beetles often infest root-diseased trees. The result of this slow mortality is the creation of gaps or openings that increase in size over time if susceptible hosts continue to be available at the margins of infection centers. Openings fill in with shrubs, hardwoods, susceptible or resistant conifers, depending upon environmental conditions and seed availability. Snags created by root diseases may not remain upright for long; longevity of snags is highly dependent upon the causal fungus and the amount of root system decayed at the time of tree death. Root disease pockets may be desirable sources of down wood, again depending upon the root disease and other stand conditions.

Laminated root rot infects susceptible tree species regardless of their vigor. In the Prospect Corridor, Douglas-fir and white fir are highly susceptible; they are readily infected and killed. Western hemlock may be infected but is rarely killed. However, this species may perpetuate the disease on the site in the absence of the more susceptible species. Pines and incense cedars are seldom infected and all hardwoods are immune. Laminated root rot pockets are often filled with large quantities of down material in all size classes. Fuel buildups can be high. This situation is particularly visible in the laminated root rot centers in and adjacent to the Mammoth Pines Interpretive Site.

Laminated root rot pockets in the Corridor are probably larger now than historically. Ground fires would have periodically burned through root diseased areas. Consumption of material would have been high where fuel buildups were large. Fires would not have directly destroyed fungal inoculum, but instead would have created openings conducive to the establishment of early seral species, such as pines or hardwoods, that are highly resistant or immune to infection. Without fires, susceptible species are the ones regenerating because of their dominance in surrounding stands. They fill in root disease pockets and perpetuate the fungus or are available in large enough numbers around the perimeters of these centers to encourage additional fungal spread.

Armillaria root disease is usually associated with trees under stress due to environmental or human - induced factors. It can kill trees outright or predispose them to bark beetle or borer attack. All species of conifers are susceptible to this fungus, depending on location and stand conditions. White fir and Douglas-fir are highly susceptible to *A.ostyae* in the Corridor. Small pockets of suppressed trees are most commonly killed, but in several areas larger groups of trees are affected. Ponderosa, sugar, and western white pines, incense cedar and western hemlock are killed in isolated cases but are usually quite resistant. Trees from off-site seed sources and those growing in compacted soil are particularly susceptible to infection and mortality. Mortality is highly correlated with old roads and skid trails. Stumps created by logging infected trees can also be colonized by this fungus. They become food bases in which the fungus can build up and then move to those susceptible trees whose roots contact the stump.

Recent years of drier than normal conditions have increased host susceptibilityand have undoubtedly contributed to a “flare-up” of mortality. However, Armillaria root disease-caused mortality is probably higher in the Corridor now than it was in historic times. Susceptible hosts are more abundant and past salvage activities have created large stumps, roads, and skid trails.

H. annosum occurs in the Corridor in scattered, large, white fir stumps. The fungus enters stands via airborne spores that infect basal wounds in live trees or freshly cut stumps Build-up in stands is directly related to harvest entries. Once the fungus is established in the root system of a host, it spreads via root-to-root contact with adjacent susceptible trees. Generally, ten to twenty years are needed after the initial infection before the effects of annosus root disease become readily observable. Mortality due to this disease is most common in white fir seedlings and saplings that are near infected stumps. While not directly observed in this survey, investigations done in nearby stands indicate that the fungus may be present in live white fir in the area as a butt decay.

Blackstain root disease was found in a single large, dead ponderosa pine in the corridor. This disease is a vascular wilt that kills susceptible trees by colonizing and blocking the water-conducting tissues of the roots and lower stems. In Oregon there are two races of the fungus, one that infects ponderosa pine and another that infects Douglas-fir. Young trees are killed quickly (in one or two years), but older infected trees decline more slowly and are often attacked by bark beetles. The disease is spread to new locations by root-feeding bark beetles and weevils that carry the spores on their bodies. Spores are deposited when the beetles feed on small roots. Once an infection center has been established, the disease spreads by root-to-root contact. Unlike the other root diseases that occur in the Corridor, blackstain does not persist in infected roots after trees die. Blackstain root disease is most common where trees have been damaged or sites disturbed. Thus, it is often found in areas of compacted soil such as sites that have been repeatedly tractor logged, or at the edges of skid trails and landings.

In the Prospect Corridor, root diseases, particularly laminated root rot, are important disturbance agents that are providing significant structural diversity to portions of the Corridor. Areas B, C, and E are currently, or will have in the future, a shift in age and size classes directly related to root disease impacts.

The bark beetles infesting white fir and Douglas-fir are closely tied to root disease pockets. These insects maintain their populations at endemic levels in the root disease centers and build up their numbers when environmental conditions place additional stresses on trees.. Douglas-fir beetles will also breed in large, down trees. When more than 3 trees per acre of Douglas-fir greater than ten inches diameter are downed, beetle population may build up in them, emerge the following spring, and infest surrounding standing trees, especially if they have been weakened by unfavorable environmental conditions. The 1996 winter storms appear to have downed mostly smaller diameter white firs in the Corridor. Some larger Douglas-firs were downed or snapped off. Some mortality of additional trees is likely in the future in scattered pockets.

Stem decay fungi infect the heartwood of susceptible trees, causing decay and eventually, in some cases, snapping of the boles. ***P. pini*** invades the heartwood of Douglas-fir, ponderosa and sugar pines through living and dead branches or branch stubs. ***P. schweinitzii*** infects Douglas-fir (and occasionally pines) through basal wounds or fire scars. Subsequent spread involves both airborne spores and root contacts. Airborne spores of ***E. tinctorium*** invade white fir and hemlock through the small branchlets on suppressed, understory trees. The fungus will then remain dormant for many years until the tree is wounded. Wounding stimulates the fungus to develop in the heartwood. Old, severely decayed trees often become hollow "culverts". White firs growing in the understory below infected overstories are highly susceptible to infection. Stem decays that are present in the corridor are contributing to the production of habitat for cavity nesters.

Dwarf mistletoes are parasitic plants in the genus ***Arceuthobium*** that infect most conifer species. The results of dwarf mistletoe infection include topkill, branch distortion, growth loss, and mortality. Infected trees may be predisposed to attack by other agents such as bark beetles, ***A. ostoyae*** or canker fungi. Dwarf mistletoe spreads by forcibly discharged seeds that are shot outwards up to fifty feet. Infection occurs if the seeds land on suitable sites on susceptible host species. The impact caused by dwarf mistletoe infection is greatest when overstory trees are infected in multi-layered stands. More mistletoe seeds land on sites that are suitable for infection when they come from above, and the rate of spread and effects on the vigor of trees are greatest when the actively growing top is infected. Dwarf mistletoes are present in only a few isolated pockets of the Corridor and are probably not detrimental to stand-level dynamics at this time.

RECOMMENDATIONS

If keeping a living component of large pines in the Prospect Corridor is an important part of meeting long term objectives for the area, treatments to reduce densities around those pines is essential. Not all areas in the Corridor would require treatment. Large continuous sections of the area surveyed have only a limited pine component; treatment areas should be chosen from those locations where the pine concentration is the highest. Treatment objectives must include retaining both scenic and wildlife values. Landscape architecture, wildlife biology, fuels treatment, recreation, vegetation management, pathology, and entomology skills must be involved in treatment planning. Public education and involvement will be necessary for successful project execution.

Recommended treatment options include:

1) Select individual large pines or small groups of large pines for treatment. Remove competing trees of all sizes around these individuals or groups to a distance of at least 20 feet beyond the crown driplines of the pines to be maintained. This treatment will minimize disturbance while reducing the risk of bark beetle attack for individual trees. It will be most appropriate for treating the very largest members of the pine component. It will not, in itself, emulate natural processes.

2) Reduce basal areas to 140 to 170 square feet per acre in areas of the Corridor up to several acres in size. Use variable-spaced thinning, prescribed burning, or some combination. Prescribed fire could also be used in follow-up treatments to keep density at acceptable levels in future decades. This type of treatment would more closely resemble historic disturbance regimes. It could also create openings suitable for pine establishment so that a future component of healthy pine would be ensured.

Consider treating some root disease pockets. Root diseases will continue to kill Douglas-fir and white fir in localized areas and create variable-sized, gradually-expanding stand openings. These openings provide opportunities for enhancing vegetative diversity.

1) Plant root disease-resistant species such as pines and cedars to ensure that adequate stocking exists and that large trees are possible in the future.

2) Use these openings to establish white pine blister rust-resistant western white pine and sugar pine. Both species are root disease-resistant.

3) Consider creating buffers at the margins of some active root disease centers to slow the spread of the root pathogens into uninfected portions of the stands with large susceptible species components.

Develop a comprehensive monitoring plan for the Corridor. Effectiveness monitoring of treatments should receive special emphasis.

Other recommendations:

Develop a public education strategy for the Prospect Corridor. While the public has been sensitized to bark beetle mortality and density management issues in the Siskiyous, their awareness of vegetation and insect and disease-related issues for the southern Cascades is relatively low. Brochures and other information materials that explain the history of the Corridor, vegetation development, fire ecology, etc can be developed for those traveling through the area. Density management treatments being done in the Corridor could be the focus of the information. White pine blister rust control work was begun in Oregon in the vicinity of the Corridor; the disease and its management could be emphasized in educational materials. Roadside signposts explaining treatments could be placed at strategic points, or equivalent signs could be placed in campgrounds or at the Mammoth Pines Interpretive Site. Information for the interpretive trail at the Mammoth Pines Site could be revised to reflect insect and disease-related impacts and treatments. Some density-management treatments could be done at the Mammoth Pines Site for maximum exposure and eduction.

Showcase the situation in the Corridor as an opportunity to expose and educate the public and to practice ecosystem managment.

Additional information from this survey is available for future analysis. Forest Vegetation Simulator input has been gathered; as a result, the survival and growth of trees in the Corridor can be projected into the future. Root disease impacts can also be modeled using the Western Root Disease Model. Current conditions, future stand development, and the effects of stand treatments can be portrayed using the Stand Visualization Simulator.

The Southwest Oregon Forest Insect and Disease Technical Center is willing to work with Rogue River National Forest and Prospect Ranger District personnel and the public on any issues related to insect and disease conditions in the Prospect Corridor. We will be happy to answer any questions related to survey methods and analysis and can provide further assistance with vegetation and insect and disease modeling and developing treatment strategies.

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Plant Pathologist	Plant Pathologist	Entomologist Plant Pathologist

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R6 FID Annual Aerial Detection Survey.

R6 FID VRS. Vegetative Resource Survey analysis procedures. T. Gregg. 1996. USDA Forest Service. Pacific Northwest region. Portland, OR. unpublished procedures.

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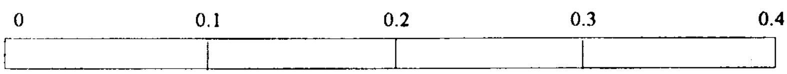
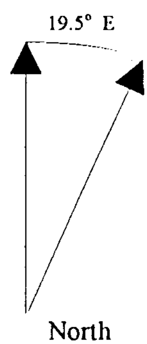
PROSPECT CORRIDOR SURVEY MAPS

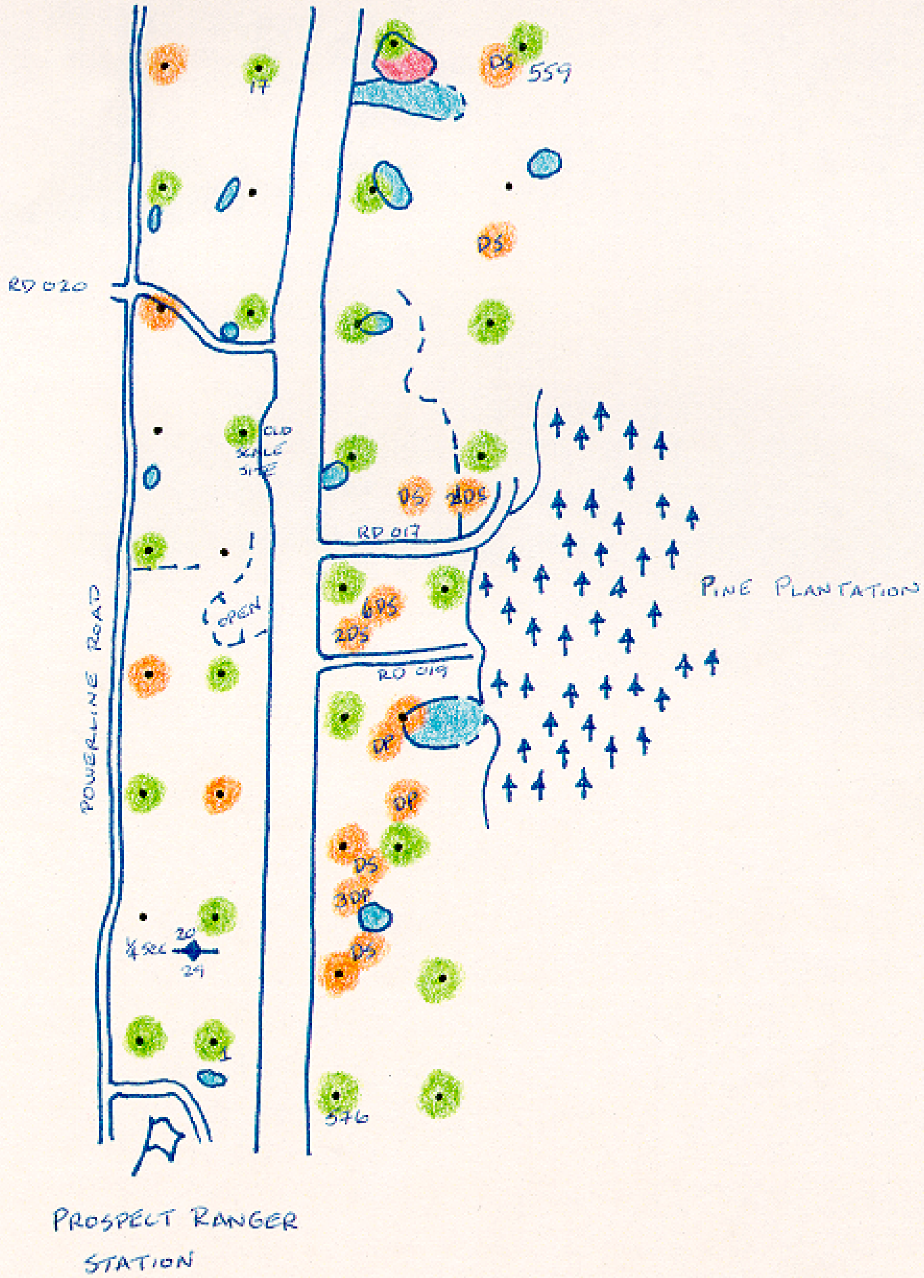
LEGEND

- roads
- skid trails
- Laminated root
- Armillaria root disease
- Blackstain root disease
- Annosus root disease
- plot with no pines
- plot with live pines
- plot with one or more dead pines
- DP dead ponderosa pine outside of plot
- DS dead sugar pine outside of plot
- DW dead western white pine outside of plot



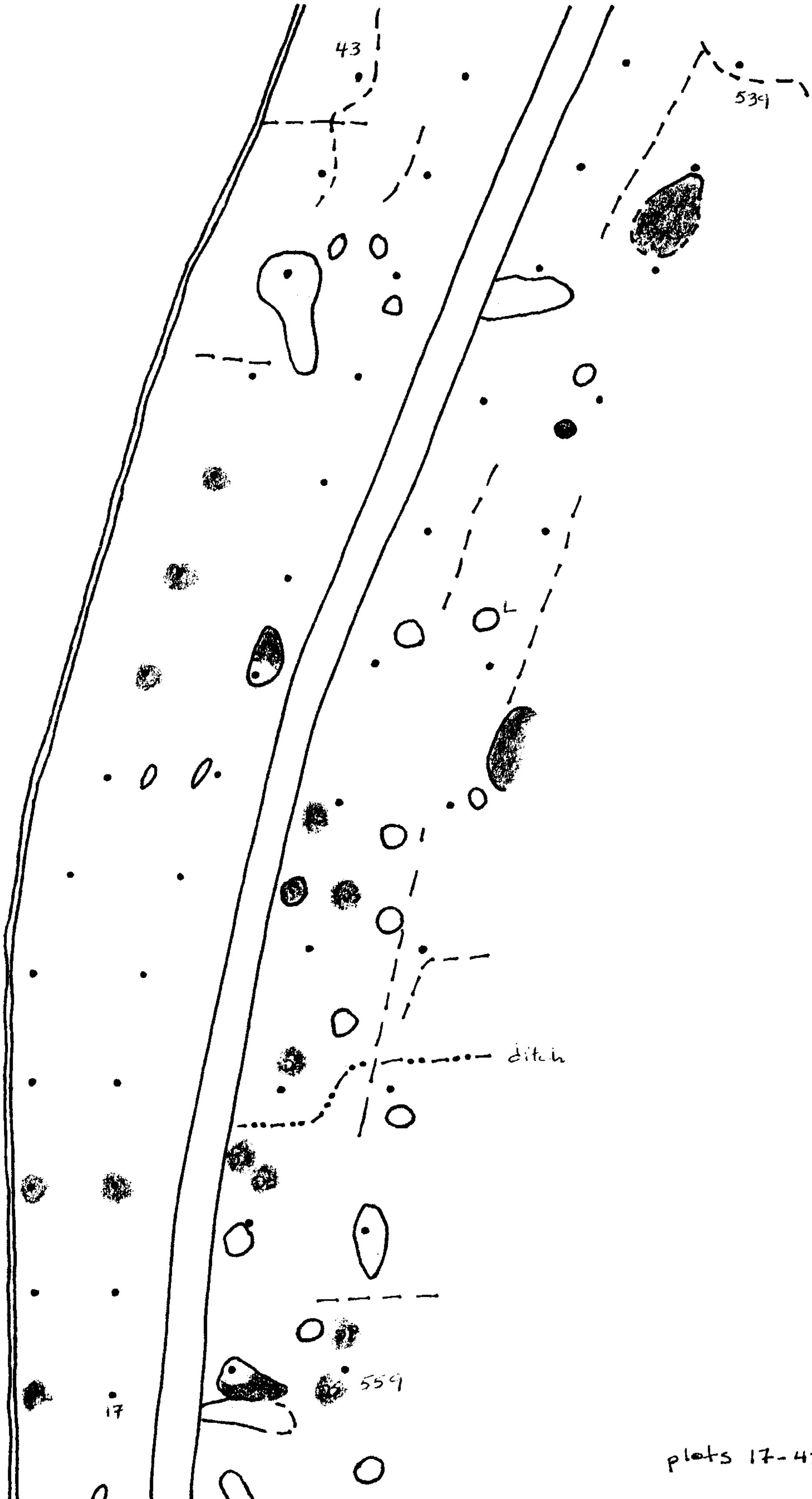
SCALE 1:6336 (1 inch = 0.1 mile)





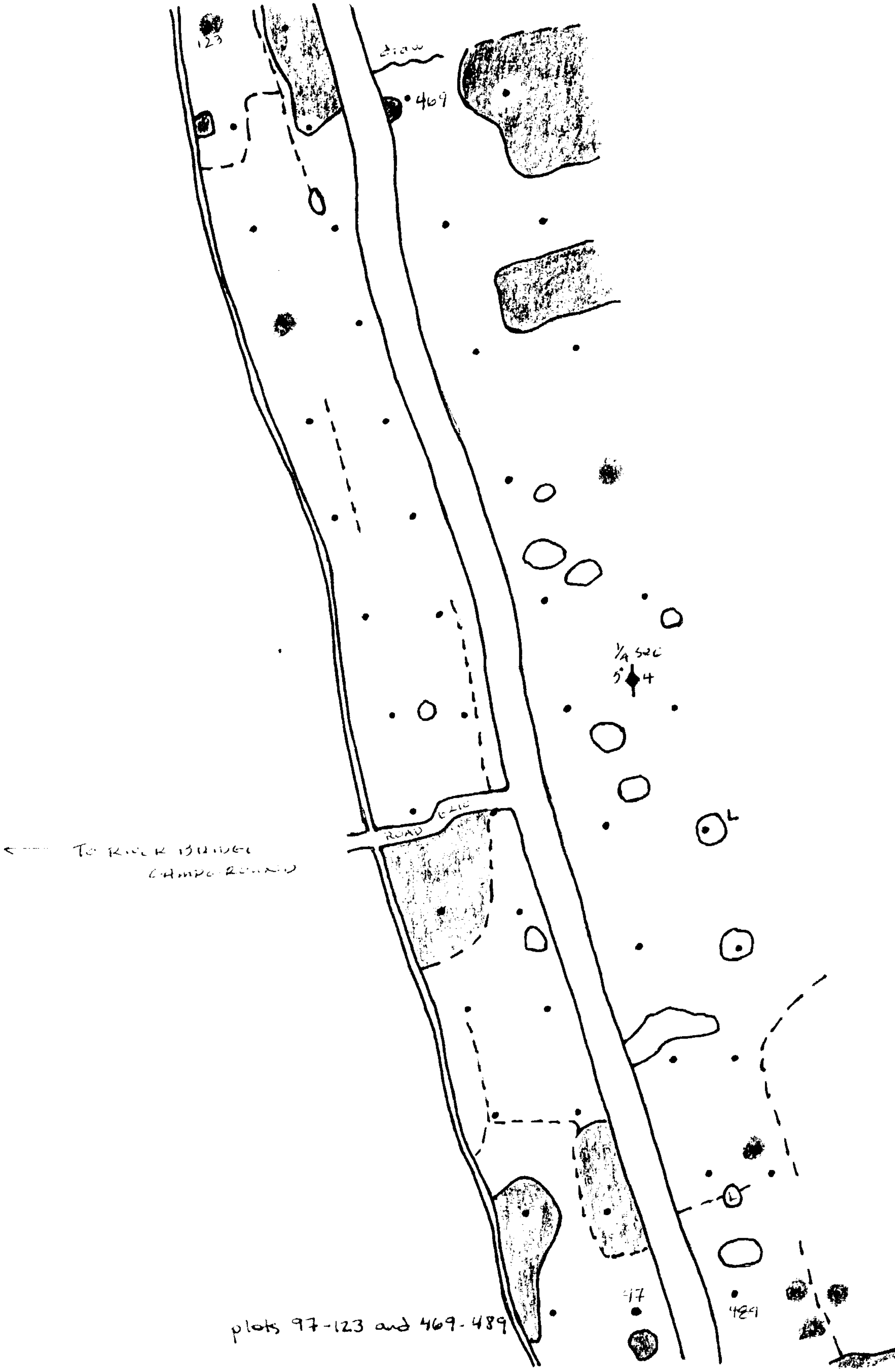
plots 1-17 and 559-576

Fig. 3



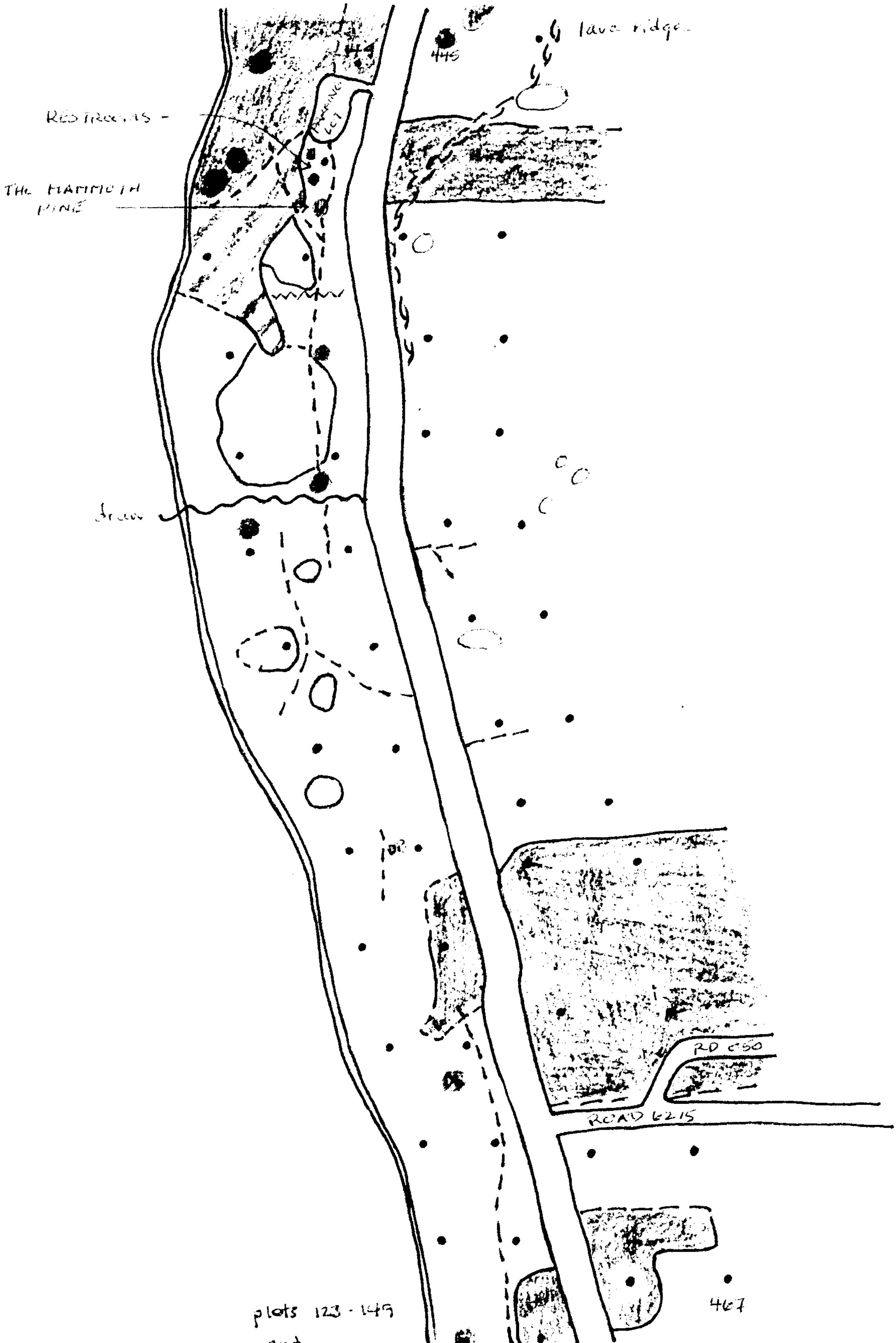
plots 17-43 and 539-559

Fig. 4



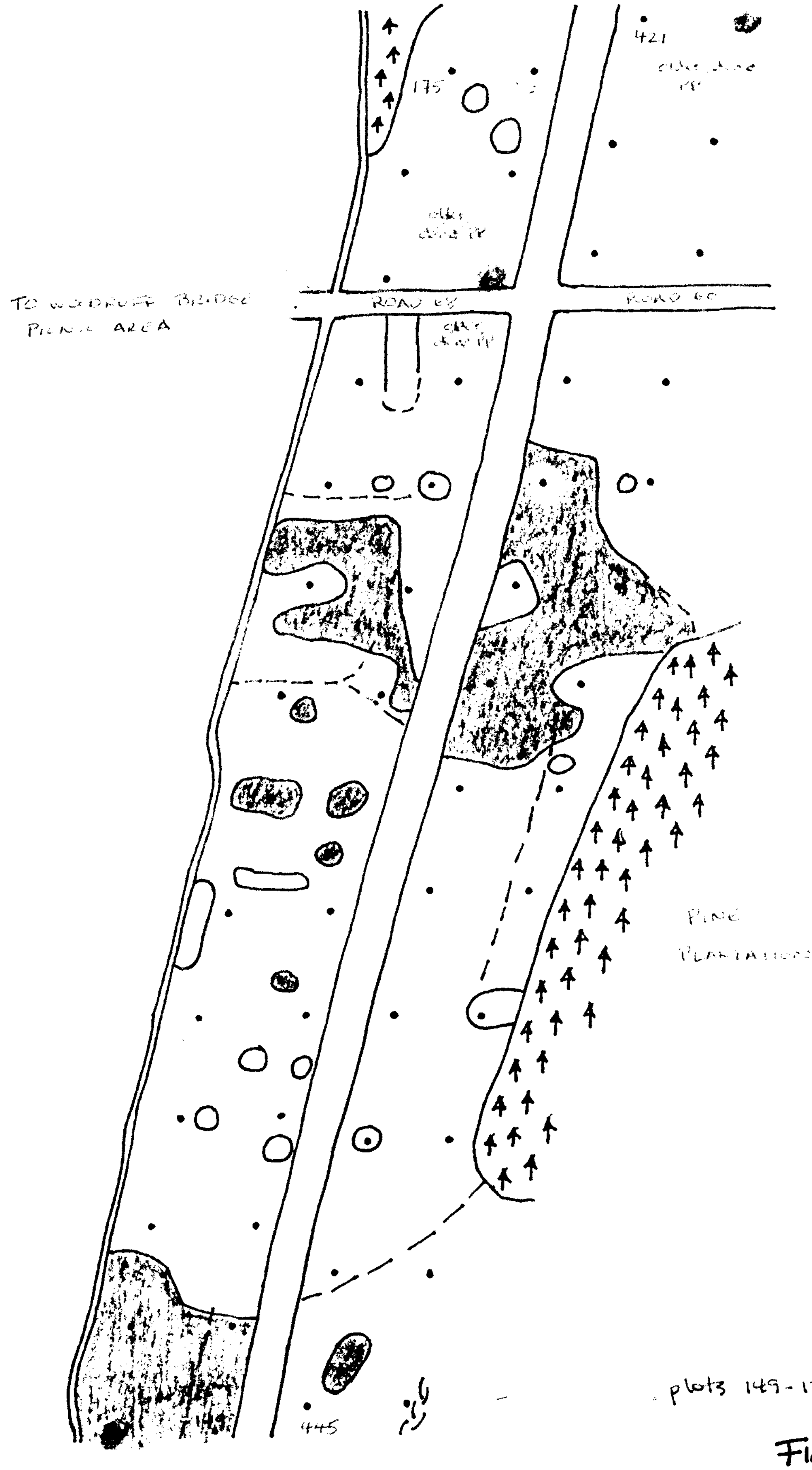
plots 97-123 and 469-489

Fig. 7



plots 123-149
and
445-467

Fig. 8



plots 149-175 and 421-445

Fig. 9

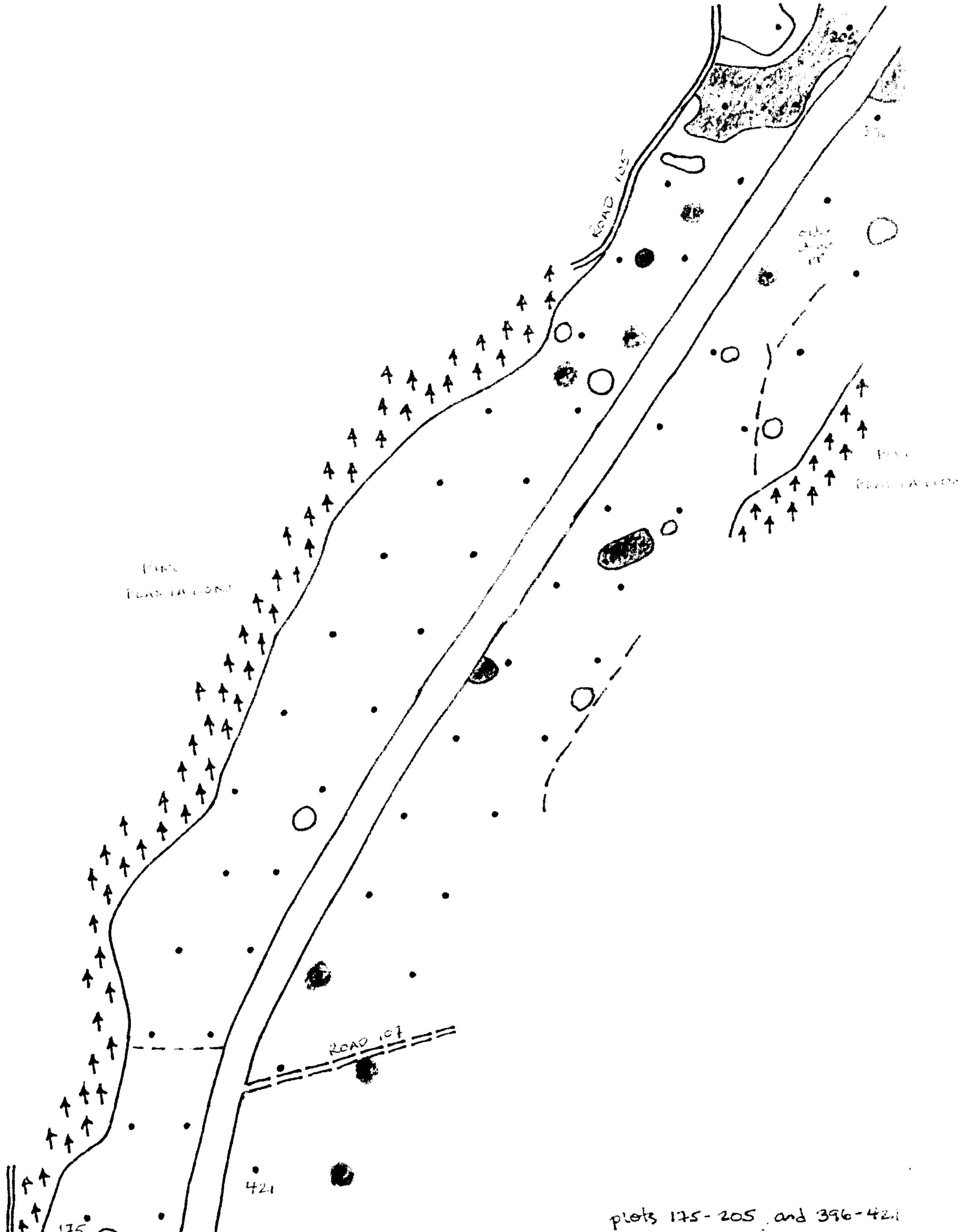
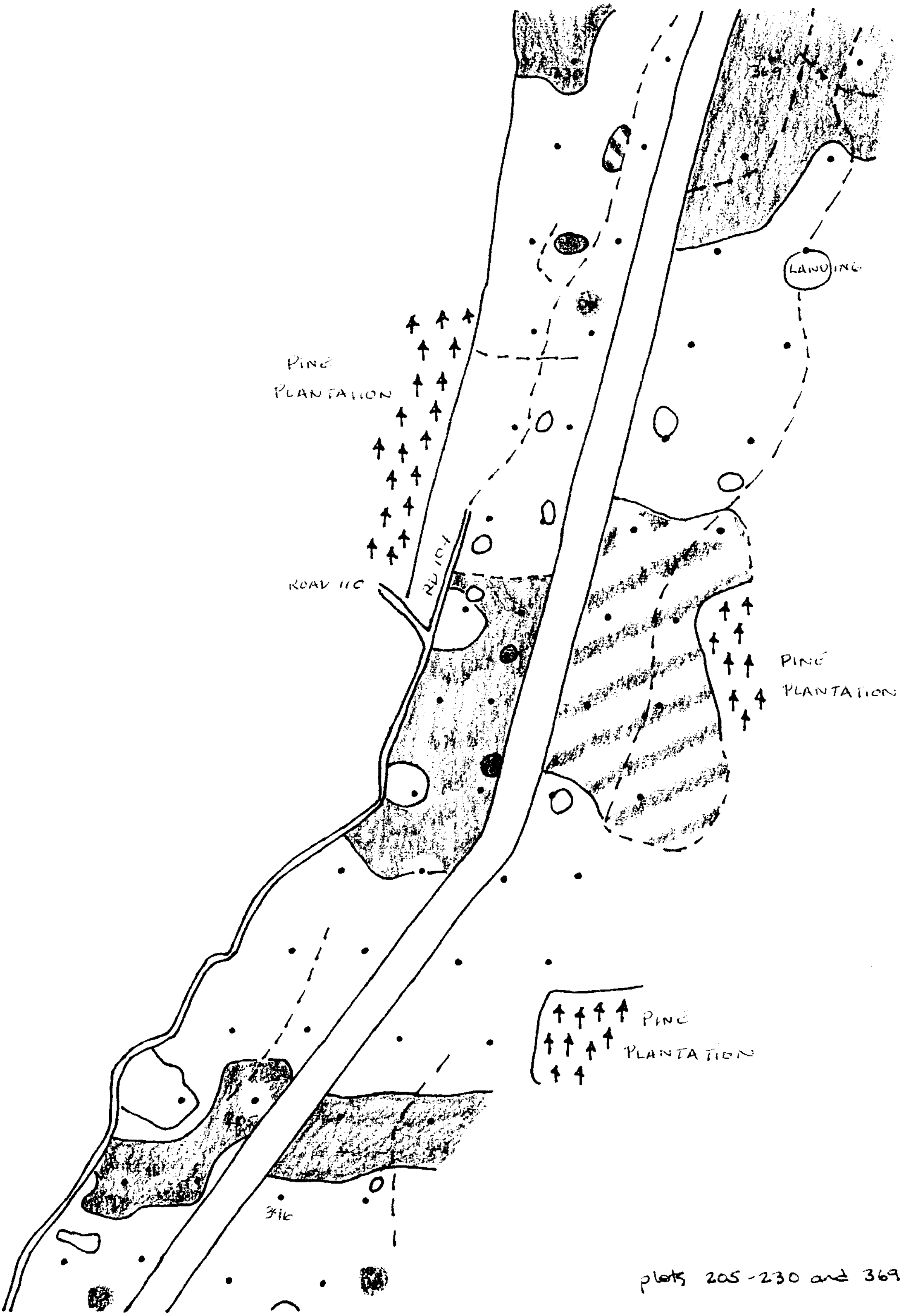
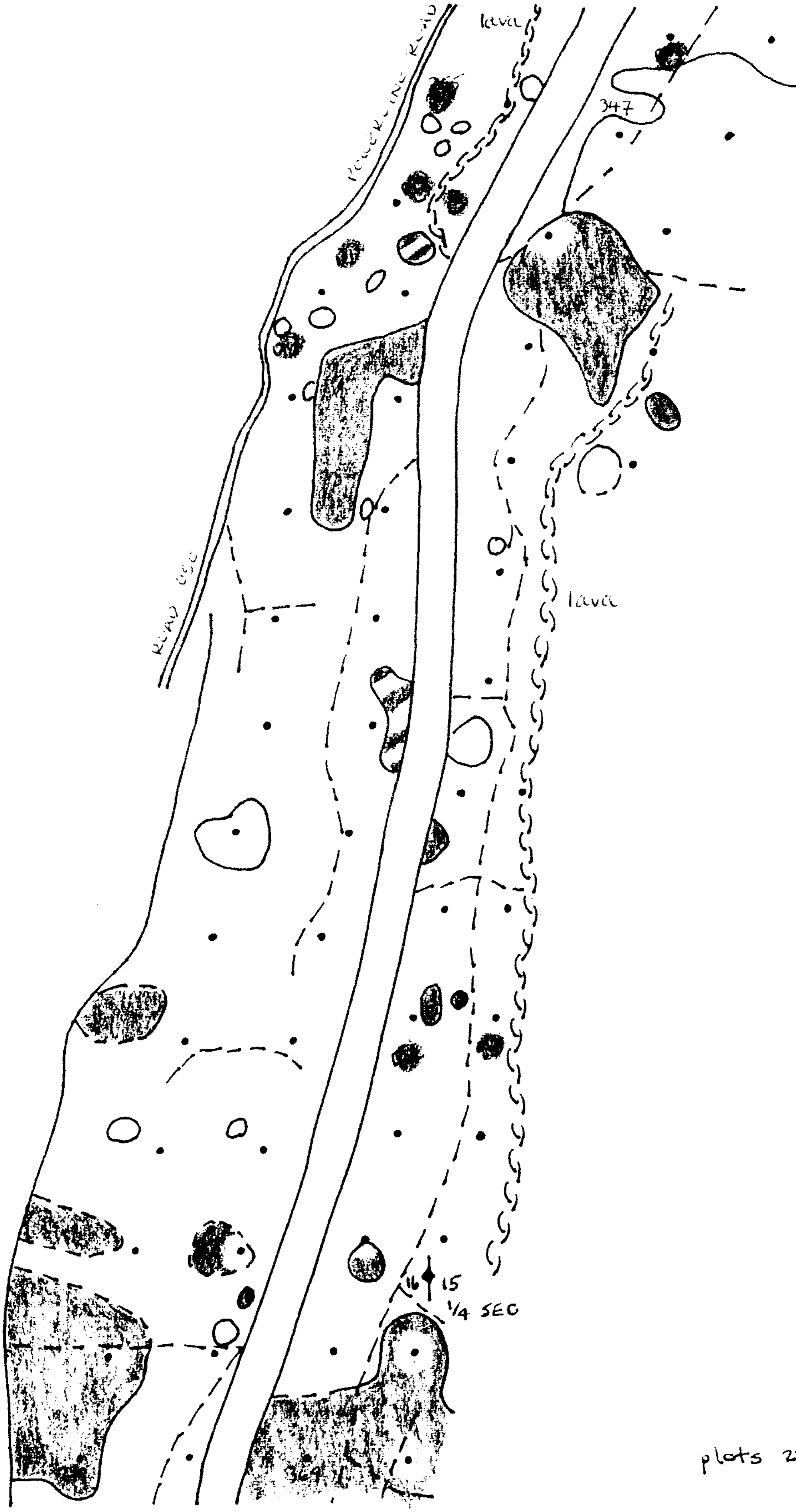


Fig. 10



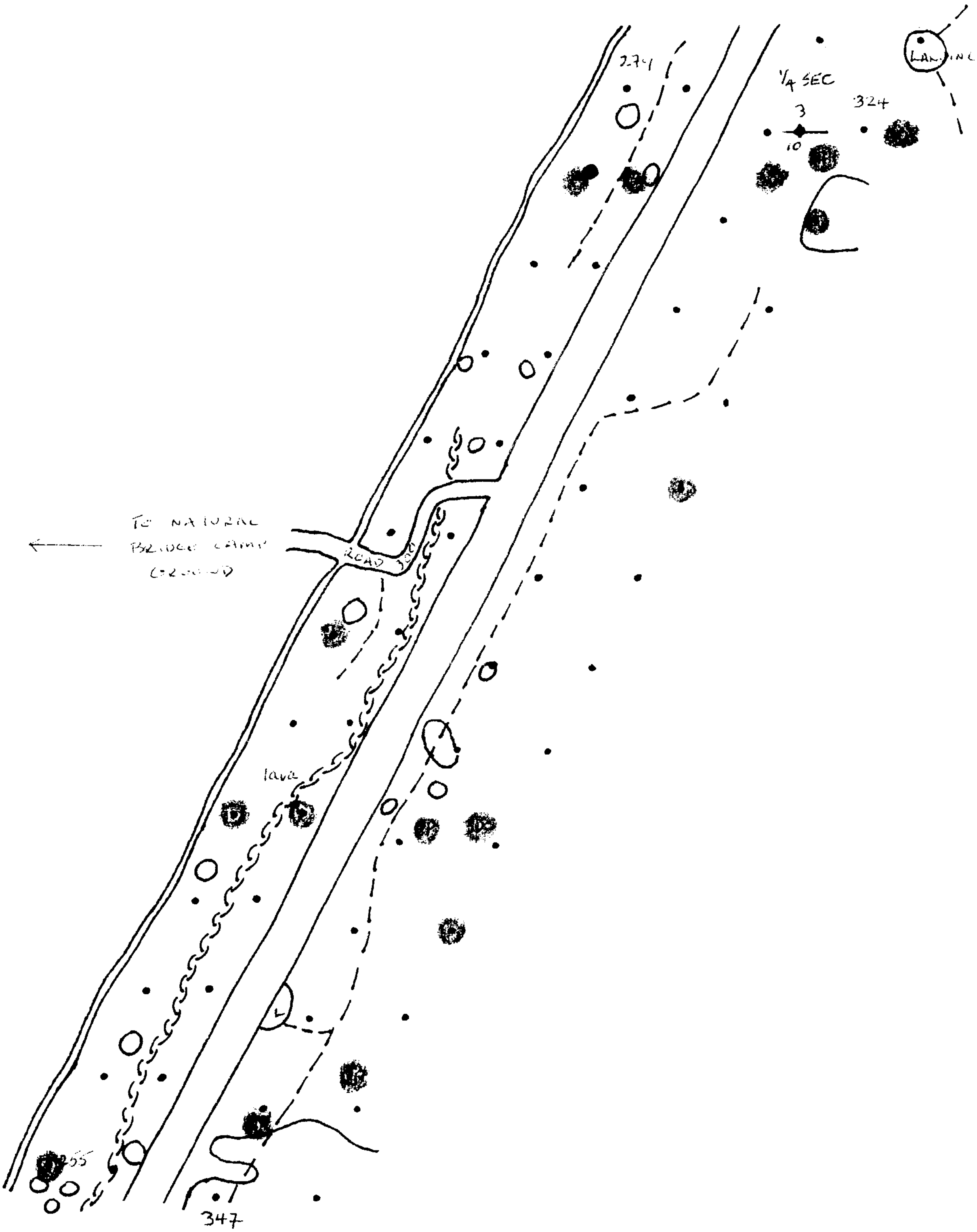
plots 205-230 and 369-396

Fig. 11



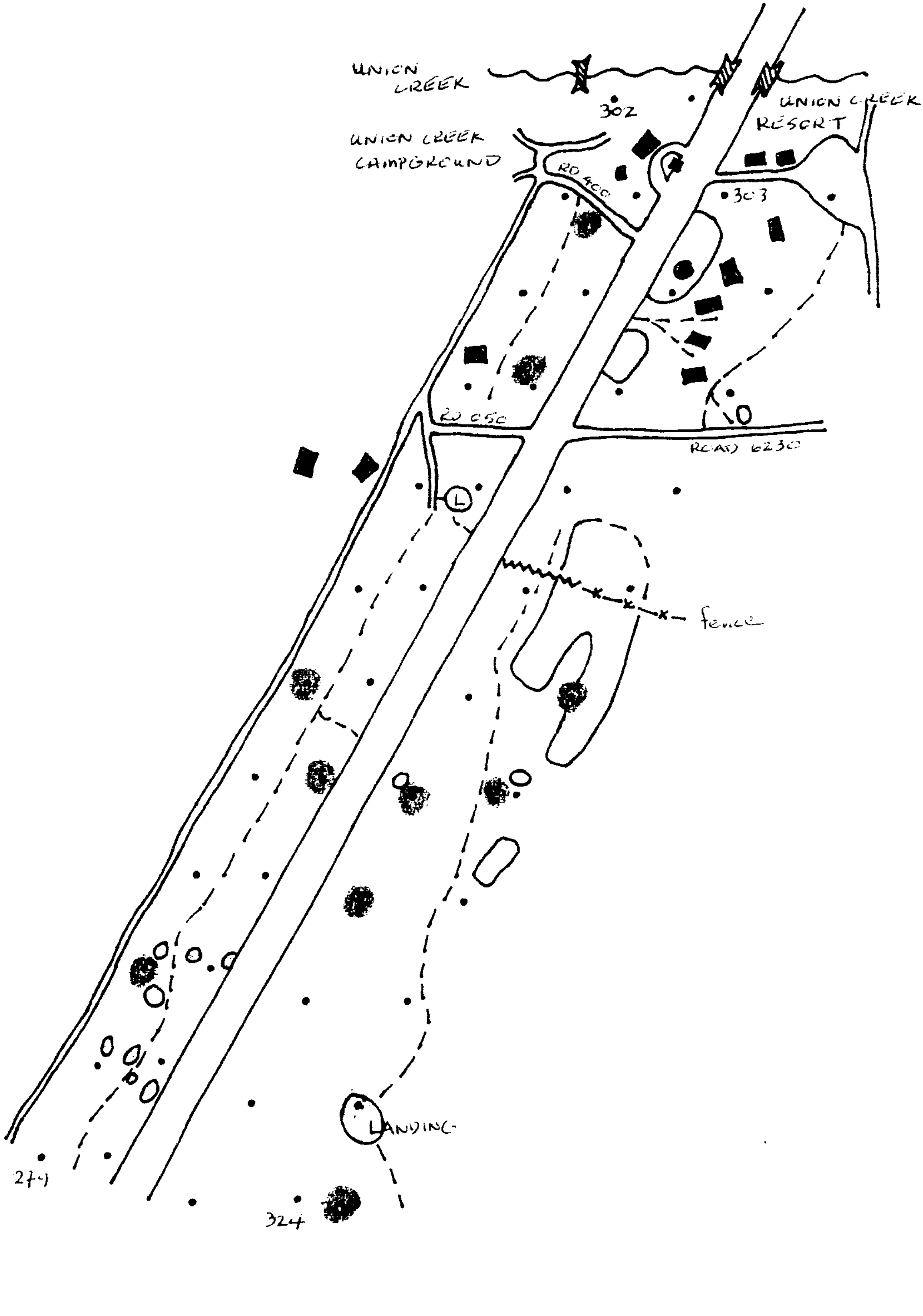
plots 230-255 and 347-369

Fig. 12



plots 255 - 279 and 324 - 347

Fig. 13



plots 279-302 and 303-324

Fig. 14

Fig. 15. Stand Visualization System drawing of average stand conditions in the Prospect Corridor.

TABLE Al LIVE TREES PER ACRE AREA A = PLOTS l-66 and 515-576

DBH	PIP0	PILA	ABC0	PSME	CADE3	TSHE	TABR	ARME	CACH	CONU	TOTAL
<l	.0	65.6	176.9	188.5	88.5	34.6	11.5	3.8	300.0	223.1	1092.5
2	1.1	.0	65.4	207.7	146.2	.0	.0	.0	38.5	42.3	501.2
4	.0	1.1	.0	11.5	7.7	.0	.0	.0	.0	.0	20.3
6	2.3	.0	20.8	17.1	.0	.0	.0	.0	.0	.0	40.2
8	.0	1.1	14.4	21.0	4.6	.0	.0	.0	.0	.0	41.1
10	3.2	.9	5.8	20.3	.0	.0	.0	.0	.0	.0	30.2
12	.5	.0	3.7	10.0	2.2	1.7	.0	.0	.0	.0	18.1
14	.8	.4	.0	11.1	.0	.0	.0	.0	.0	.0	12.3
16	.6	.0	2.3	7.3	1.2	.0	.0	.0	.0	.0	11.4
18	1.0	.7	.0	5.3	.0	.0	.0	.0	.0	.0	7.0
20	.6	.0	.0	2.9	.0	.0	.0	.0	.0	.0	3.5
22	.7	.0	.0	2.4	.6	.0	.0	.0	.0	.0	3.7
24	.8	.4	.9	1.9	.0	.5	.0	.0	.0	.0	4.5
26	.9	.2	.0	2.2	.4	.0	.0	.0	.0	.0	3.7
28	.5	.7	.0	.3	.0	.0	.0	.0	.0	.0	1.5
30	.5	.4	.0	2.2	.0	.0	.0	.0	.0	.0	3.1
32	.3	.2	.0	1.1	.3	.0	.0	.0	.0	.0	1.9
34	.4	.3	.0	1.5	.2	.0	.0	.0	.0	.0	2.4
36	.5	.2	.0	.2	.0	.0	.0	.0	.0	.0	.9
38	.3	.2	.0	.6	.0	.0	.0	.0	.0	.0	1.1
40	.l	.2	.0	.7	.0	.0	.0	.0	.0	.0	1.0
42	.2	.2	.0	.2	.0	.0	.0	.0	.0	.0	.6
44	.0	.2	.0	.9	.0	.0	.0	.0	.0	.0	1.1
46	.0	.3	.0	.4	.0	.0	.0	.0	.0	.0	.7
48	.0	.l	.0	.5	.l	.0	.0	.0		.0	.7
50	.l	.l	.0	.6	.0	.0	.0	.0	.0	.0	.8
52	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.l
54	.0	.l	.0	.2	.0	.0	.0	.0	.0	.0	.3
56	.0	.0	.0	.I	.0	.0	.0	.0	.0	.0	.I
58	.0	.0	.0	.3	.0	.0	.0	.0	.0	.0	.3
60+	.0	.3	.0	.3	.l	.0	.0	.0	.0	.0	.6
TA	15.5	74.5	290.3	519:;	252.1	36.8	11.5	3.8	338.5	265.4	1807
SAMPLES	93	93	26	26	26	26	26	26	26	26	
SE	6	15.6	76.2	100.1	82.3	27.6	6.4	3.8	79.8	60.5	

TABLE A2 LIVE TREE BASAL AREA (SQUARE FEET) PER ACRE AREA A = PLOTS l-66 **and 515-576**

DBH	PIP0	PILA	ABC0	PSME	CADE3	TSHE	TABR	ARME	CACH	CONU	TOTAL
<l	.0	.0	.l	.2	.0	.0	.0	.0	.2	.l	.6
2	.0	.0	.8	2.0	2.0	.0	.0	.0	.2	.3	5.3
4	.0	.l	.0	1.0	.5	.0	.0	.0	.0	.0	1.6
6	.4	.0	4.6	3.1	.0	.0	.0	.0	.0	.0	8.1
8	.0	.4	4.6	7.7	1.5	.0	.0	.0	.0	.0	14.2
10	1.7	.4	3.1	10.8	.0	.0	.0	.0	.0	.0	16.0
12	.4	.0	3.1	7.7	1.5	1.5	.0	.0	.0	.0	14.2
14	.9	.4	.0	10.8	.0	.0	.0	.0	.0	.0	12.1
16	.9	.0	3.1	9.2	1.5	.0	.0	.0	.0	.0	14.7
18	1.7	1.3	.0	9.2	.0	.0	.0	.0	.0	.0	12.2
20	1.3	.0	.0	6.2	.0	.0	.0	.0	.0	.0	7.5
22	1.7	.0	.0	6.2	1.5	.0	.0	.0	.0	.0	9.4
24	2.6	1.3	3.1	6.2	.0	1.5	.0	.0	.0	.0	14.7
26	3.4	.9	.0	7.7	1.5	.0	.0	.0	.0	.0	13.5
28	2.2	3.0	.0	1.5	.0	.0	.0	.0	.0	.0	6.7
30	2.6	2.2	.0	10.8	.0	.0	.0	.0	.0	.0	15.6
32	1.7	1.3	.0	6.2	1.5	.0	.0	.0	.0	.0	10.7
34	2.6	1.7	.0	9.2	1.5	.0	.0	.0	.0	.0	15.0
36	3.4	1.7	.0	1.5	.0	.0	.0	.0	.0	.0	6.6
38	2.6	1.7	.0	4.6	.0	.0	.0	.0	.0	.0	8.9
40	.9	2.2	.0	6.2	.0	.0	.0	.0	.0	.0	9.3
42	2.2	2.2	.0	1.5	.0	.0	.0	.0	.0	.0	5.9
44	.0	2.6	.0	9.2	.0	.0	.0	.0	.0	.0	11.8
46	.0	3.4	.0	4.6	.0	.0	.0	.0	.0	.0	8.0
48	.0	1.3	.0	6.2	1.5	.0	.0	.0	.0	.0	9.0
50	.9	1.7	.0	7.7	.0	.0	.0	.0	.0	.0	10.3
52	.0	.4	.0	.0	.0	.0	.0	.0	.0	.0	.5
54	.4	.9	.0	3.1	.0	.0	.0	.0	.0	.0	4.4
56	.0	.4	.0	1.5	.0	.0	.0	.0	.0	.0	1.9
58	.0	.9	.0	4.6	.0	.0	.0	.0	.0	.0	5.5
60+	.0	6.0	.0	4.6	1.5	.0	.0	.0	.0	.0	12.1
BA	34.5	38.4	22.4	170.9	16.4	3.1	.0	.0	.4	.4	286
SAMPLES	93	93	93	26	26	26	26	26	26	26	
SE	6.3	5.1	8.2	18.8	4.0	2.1	0	0	.2	.2	

TABLE A3 LIVE TREES PER ACRE AREA B = PLOTS 67-133 **and 465-514**

DBH	PIP0	PIMO	PILA	ABC0	PSME	CADE3	TSHE	TABR	ARME	CACH	SALIX	CONU	TOTAL
<1	.0	2.6	17.9	226.1	143.5	17.4	347.8	21.7	.0	408.7	8.7	130.4	1324.8
2	20.5	.0	2.6	21.7	343.5	.0	39.1	17.4	4.3	60.9	.0	147.8	657.8
4	.0	.0	5.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	5.1
6	.0	.0	.0	7.5	16.6	.0	.0	.0	.0	.0	.0	.0	24.1
8	.0	.0	.0	.0	21.4	.0	.0	.0	.0	.0	.0	.0	21.4
10	.0	.0	.0	6.3	9.1	3.9	3.2	.0	.0	.0	.0	.0	22.5
12	.0	.0	.0	2.6	9.1	.0	.0	.0	.0	.0	.0	.0	11.7
14	.0	.0	.0	1.5	3.2	.0	.0	.0	.0	.0	.0	.0	4.7
16	.0	.0	.0	1.1	4.6	.0	1.3	.0	.0	.0	.0	.0	7.0
18	.6	.0	.0	.0	2.9	.0	2.0	.0	.0	.0	.0	.0	5.5
20	.5	.0	.5	.0	4.1	.0	.0	.0	.0	.0	.0	.0	5.1
22	.0	.0	.4	.0	1.4	.0	.0	.0	.0	.0	.0	.0	1.8
24	.0	.0	.3	.0	3.8	.0	.0	.0	.0	.0	.0	.0	4.1
26	.0	.0	.3	.0	2.8	.0	.5	.0	.0	.0	.0	.0	3.6
28	.2	.0	.0	.0	1.7	.4	.0	.0	.0	.0	.0	.0	2.3
30	.6	.2	.2	.0	1.8	.0	.0	.0	.0	.0	.0	.0	2.8
32	.0	.0	.4	.0	3.2	.0	.0	.0	.0	.0	.0	.0	3.6
34	.0	.0	.3	.0	1.1	.0	.0	.0	.0	.0	.0	.0	1.4
36	.2	.0	.0	.0	1.9	.0	.0	.0	.0	.0	.0	.0	2.1
38	.0	.0	.3	.0	1.5	.0	.0	.0	-0	.0	.0	.0	1.8
40	.0	.0	.7	.0	.6	.0	.0	.0	.0	.0	.0	.0	1.3
42	.0	.0	.0	.0	.4	.0	.0	.0	.0	.0	.0	.0	.4
44	.0	.0	.1	.0	1.5	.0	.0	.0	.0	.0	.0	.0	1.6
46	.1	.0	.3	.0	.8	.0	.0	.0	.0	.0	.0	.0	1.2
48	.0	.0	.3	.0	1.0	.0	.0	.0	.0	.0	.0	.0	1.3
50	.0	.0	.2	.0	.4	.0	.0	.0	.0	.0	.0	.0	.6
52	.0	.0	.1	.0	.1	.0	.0	.0	.0	.0	.0	.0	.2
54	.0	.0	.1	.0	.1	.0	.0	.0	.0	.0	.0	.0	.2
56	.0	.0	.1	.0	.2	.0	.0	.0	.0	.0	.0	.0	.3
58	.0	.0	.1	.0	.1	.0	.0	.0	.0	.0	.0	.0	.2
60+			3										
T A	22.7	2.8	37.6	267.0	582.5	21.8	394.0	39.1	4.3	469.6	8.7	278.3	2128
SAMPLES	39	39	39	23	23	23	23	23	23	23	23	23	
SE	18.0	2.6	9.5	70.9	135.0	8.1	208.1	17.5	4.3	64.9	8.7	60.0	

TABLE A4 LIVE TREE BASAL AREA (SQUARE FEET) PER ACRE AREA B = PLOTS 67-133 and 465-514

DBH	PIPO	PIMO	PILA	ABCO	PSME	CADE3	TSHE	TABR	ARME	CACH	SALK	CONU	TOTAL
<1	.0	.0	.0	.0	.1	.0	.0	.0	.0	.2	.0	.0	.4
2	.2	.0	.1	.3	3.2	.0	.3	.2	.0	.3	.0	.9	5.5
4	.0	.0	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5
6	.0	.0	1.0	1.7	3.5	.0	.0	.0	.0	.0	.0	.0	6.2
8	.0	.0	.0	.0	7.0	.0	.0	.0	.0	.0	.0	.0	7.0
10	.0	.0	.0	3.5	5.2	1.7	1.7	.0	.0	.0	.0	.0	12.1
12	.0	.0	.0	1.7	7.0	.0	.0	.0	.0	.0	.0	.0	8.7
14	.0	.0	.0	1.7	3.5	.0	.0	.0	.0	.0	.0	.0	5.2
16	.0	.0	.0	1.7	7.0	.0	1.7	.0	.0	.0	.0	.0	10.4
18	1.0	.0	.0	.0	5.2	.0	3.5	.0	.0	.0	.0	.0	9.7
20	1.0	.0	1.0	.0	8.7	.0	.0	.0	.0	.0	.0	.0	10.7
22	.0	.0	1.0	.0	3.5	.0	.0	.0	.0	.0	.0	.0	4.5
24	.0	.0	1.0	.0	12.2	.0	.0	.0	.0	.0	.0	.0	13.2
26	.0	.0	1.0	.0	10.4	.0	1.7	.0	.0	.0	.0	.0	13.1
28	1.0	.0	.0	.0	7.0	1.7	.0	.0	.0	.0	.0	.0	9.7
30	3.1	1.0	1.0	.0	8.7	.0	.0	.0	.0	.0	.0	.0	13.8
32	.0	.0	2.1	.0	17.4	.0	.0	.0	.0	.0	.0	.0	19.5
34	.0	.0	2.1	.0	7.0	.0	.0	.0	.0	.0	.0	.0	9.1
36	1.0	.0	.0	.0	13.9	.0	.0	.0	.0	.0	.0	.0	14.9
38	.0	.0	2.1	.0	12.2	.0	.0	.0	.0	.0	.0	.0	14.3
40	.0	.0	6.2	.0	5.2	.0	.0	.0	.0	.0	.0	.0	11.4
42	.0	.0	.0	.0	3.5	.0	.0	.0	.0	.0	.0	.0	3.5
44	.0	.0	1.0	.0	15.7	.0	.0	.0	.0	.0	.0	.0	16.7
46	1.0	.0	3.1	.0	8.7	.0	.0	.0	.0	.0	.0	.0	12.8
48	.0	.0	4.1	.0	12.2	.0	.0	.0	.0	.0	.0	.0	16.3
50	.0	.0	1.7	.0	5.2	.0	.0	.0	.0	.0	.0	.0	7.3
52	.0	.0	1.0	.0	1.7	.0	.0	.0	.0	.0	.0	.0	2.7
54	.0	.0	2.1	.0	1.7	.0	.0	.0	.0	.0	.0	.0	3.9
56	.0	.0	1.0	.0	3.5	.0	.0	.0	.0	.0	.0	.0	4.5
58	.0	.0	2.1	.0	1.7	.0	.0	.0	.0	.0	.0	.0	3.9
60+	.0	.0	4.1	.0	7.0	.0	.0	.0	.0	.0	.0	.0	11.1
BA	8.4	1.0	39.6	10.7	208.4	3.5	9.0	.2	.0	.6	.0	.9	282.5
SAMPLES	39	39	39	23	23	23	23	23	23	23	23	23	
SE	3.3	1.0	10.1	4.5	20.3	2.4	5.6	.2	0	.2	0	.3	

TABLE A5 LIVE TREES PER ACRE AREA C = PLOTS 134-170 and 427-464

DBH	PIPO	PIMO	PILA	ABCO	PSME	TSHE	TABR	CACH	SALM	CONU	TOTAL
<l	5.6	5.6	.0	233.3	380.0	113.3	53.3	1386.7	6.7	80.0	2264.5
2	.0	.0	.0	93.3	53.3	13.3	20.0	166.7	.0	93.3	440.0
4	.0	.0	.0	.0	20.0	.0	6.7	.0	.0	.0	26.7
6	24.2	.0	.0	11.6	11.6	.0	.0	.0	.0	.0	47.4
8	.0	6.5	.0	.0	6.6	.0	.0	.0	.0	.0	13.1
10	.0	.0	.0	10.5	.0	.0	.0	.0	.0	.0	10.5
12	.0	.0	.0	4.0	.0	3.3	.0	.0	.0	.0	7.3
14	.0	.0	.0	.0	2.8	.0	.0	.0	.0	.0	2.8
16	1.5	.0	.0	.0	1.9	1.8	.0	.0	.0	.0	5.2
18	2.5	.0	.0	1.5	1.6	.0	.0	.0	.0	.0	5.7
20	2.9	.0	.0	.0	1.2	.0	.0	.0	.0	.0	4.1
22	.0	.0	.0	1.1	1.9	.0	.0	.0	.0	.0	3.0
24	.0	.0	.0	.0	5.1	.0	.0	.0	.0	.0	5.1
26	.0	.7	.0	1.5	3.6	.0	.0	.0	.0	.0	5.8
28	1.0	.0	.0	.0	.7	.0	.0	.0	.0	.0	1.7
30	1.3	.0	.0	.0	1.1	.0	.0	.0	.0	.0	2.4
32	.4	.0	.0	.0	1.0	.0	.0	.0	.0	.0	1.4
34	.4	.0	.0	.0	1.3	.0	.0	.0	.0	.0	1.7
36	.3	.0	.3	.0	3.0	.0	.0	.0	.0	.0	3.6
38	.0	.0	.0	.0	2.4	.0	.0	.0	.0	.0	2.4
40	.3	.0	.0	.0	2.2	.0	.0	.0	.0	.0	2.5
42	.2	.0	.0	.0	.5	.0	.0	.0	.0	.0	.7
44	.4	.0	.0	.0	1.3	.0	.0	.0	.0	.0	1.7
46	.0	.0	.0	.0	.7	.0	.0	.0	.0	.0	.7
48	.0	.0	.0	.0	.6	.0	.0	.0	.0	.0	.6
50	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.2
52	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.2
54	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
56	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.2
58	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
60+	.1	.0	.0	.0	.3	.0	.0	.0	.0	.0	.4
TA	41.1	12.7	.3	356.8	505.4	131.8	80.0	1553.3	6.7	173.3	2861.6
SAMPLES	18	18	18	15	15	15	15	15	15	15	
SE	23.9	8.3	.3	190.0	189.9	75.8	24.3	435.8	6.7	67.2	

TABLE A6 LIVE TREE BASAL AREA (SQUARE FEET) PER ACRE AREA C = PLOTS 134-170 **and 427-464**

DBH	PIP0	PIMO	PILA	ABC0	PSME	TSHE	TABR	CACH	SALIX	CONU	TOTAL
<I	.0	.0	.0	.1	.0	.1	.0	1.0	.0	.I	1.3
2	.0	.0	.0	2.0	.7	.1	.4	.9	.0	.5	4.7
4	.0	.0	.0	.0	I.7	.0	.6	.0	.0	.0	2.3
6	4.4	.0	.0	2.7	2.7	.0	.0	.0	.0	.0	9.7
8	.0	2.2	.0	.0	2.7	.0	.0	.0	.0	.0	4.9
10	.0	.0	.0	5.3	.0	.0	.0	.0	.0	.0	5.3
12	.0	.0	.0	2.7	.0	2.7	.0	.0	.0	.0	5.3
14	.0	.0	.0	.0	2.7	.0	.0	.0	.0	.0	2.7
16	2.2	.0	.0	.0	2.7	2.7	.0	.0	.0	.0	7.5
18	4.4	.0	.0	2.7	2.7	.0	.0	.0	.0	.0	9.7
20	.0	.0	.0	.0	2.7	.0	.0	.0	.0	.0	2.7
22	6.7	.0	.0	2.7	5.3	.0	.0	.0	.0	.0	14.7
24	8.9	.0	.0	.0	16.0	.0	.0	.0	.0	.0	24.9
26	.0	2.2	.0	5.3	13.3	.0	.0	.0	.0	.0	20.9
28	4.4	.0	.0	.0	2.7	.0	.0	.0	.0	.0	7.1
30	6.7	.0	.0	.0	5.3	.0	.0	.0	.0	.0	12.0
32	2.2	.0	.0	.0	5.3	.0	.0	.0	.0	.0	7.5
34	2.2	.0	.0	.0	8.0	.0	.0	.0	.0	.0	10.2
36	2.2	.0	2.2	.0	21.3	.0	.0	.0	.0	.0	25.7
38	.0	.0	.0	.0	18.7	.0	.0	.0	.0	.0	18.7
40	2.2	.0	.0	.0	18.7	.0	.0	.0	.0	.0	20.9
42	2.2	.0	.0	.0	5.3	.0	.0	.0	.0	.0	7.5
44	4.4	.0	.0	.0	13.3	.0	.0	.0	.0	.0	17.7
46	.0	.0	.0	.0	8.0	.0	.0	.0	.0	.0	8.0
48	.0	.0	.0	.0	8.0	.0	.0	.0	.0	.0	8.0
50	.0	.0	.0	.0	2.7	.0	.0	.0	.0	.0	2.7
52	.0	.0	.0	.0	2.7	.0	.0	.0	.0	.0	2.7
54	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
56	.0	.0	.0	.0	2.7	.0	.0	.0	.0	.0	2.7
58	.0	. o	.0	.0	.0	.0	.0	.0	.0	.0	.0
60+	2.2	.0	.0	.0	5.3	.0	.0	.0	.0	.0	7.5
BA	55.6	4.4	2.2	23.5	181.2	5.6	1.0	1.9	.0	.6	276.0
SAMPLES	18	18	18	15	15	15	15	15	15	15	
SE	13.8	3.0	2.2	15.7	27.2	3.7	.7	1.0	0	.4	

TABLE A7 LIVE TREES PER ACRE AREA D = PLOTS 171-194 and 405-426

DBH	PIP0	PILA	PSME	CACH	SALIX	TOTAL
<l	.0	.0	177.8	500.0	11.1	1288.9
2	10.0	.0	.0	.0	11.1	21.1
4	.0	.0	.0	.0	.0	.0
6	.0	.0	21.2	.0	.0	21.2
8	13.8	.0	37.1	.0	.0	50.9
10	.0	.0	50.3	.0	.0	50.3
12	14.6	.0	23.4	.0	.0	38.0
14	15.2	.0	9.1	.0	.0	24.3
16	5.6	.0	.0	.0	.0	5.6
18	4.5	.0	5.1	.0	.0	9.6
20	2.0	.0	2.0	.0	.0	4.0
22	6.3	.0	.0	.0	.0	6.3
24	1.2	.0	.0	.0	.0	1.2
26	7.4	.0	2.4	.0	.0	9.8
28	4.7	.0	2.1	.0	.0	6.8
30	4.2	.0	.9	.0	.0	5.1
32	2.9	.0	2.4	.0	.0	5.3
34	.0	.0	.7	.0	.0	.7
36	.0	.0	1.8	.0	.0	1.8
38	.0	.0	1.7	.0	.0	1.7
40	.0	.0	.5	.0	.0	.5
42	.0	.0	1.8	.0	.0	1.8
44	.0	.0	.4	.0	.0	.4
46	.0	.0	.0	.0	.0	.0
48	.0	.0	.4	.0	.0	.4
50	.0	.0	.3	.0	.0	.3
52	.0	.3	.0	.0	.0	.0
54	.0	.0	.0	.0	.0	.0
56	.0	.0	.3	.0	.0	.3
58	.0	.0	.0	.0	.0	.0
60	.0	.0	.2	.0	.0	.2
TA	92.3	.3	941.9	500.0	22.2	1556.7
SAMPLES	10	10	9	9	9	
SE	23.1		371.4	121.3	14.7	

TABLE A8 LIVE TREE BASAL AREA (SQUARE FEET) PER ACRE AREA D = PLOTS 171-194 and 405-426

DBH	PIPO	PILA	PSME	CACH	SALIX	TOTAL
>1	.0	.0	.5	.0	.0	.5
2	.2	.0	.0	.0	.1	.3
4	.0	.0	.0	.0	.0	.0
6	.0	.0	4.4	.0	.0	4.4
8	4.0	.0	13.3	.0	.0	17.3
10	.0	.0	26.7	.0	.0	26.7
12	12.0	.0	17.8	.0	.0	29.8
14	16.0	.0	8.9	.0	.0	24.9
16	8.0	.0	.0	.0	.0	8.0
18	8.0	.0	8.9	.0	.0	16.9
20	4.0	.0	4.4	.0	.0	4.4
22	16.0	.0	.0	.0	.0	16.0
24	4.0	.0	.0	.0	.0	4.0
26	28.0	.0	8.9	.0	.0	36.9
28	20.0	.0	8.9	.0	.0	28.9
30	20.0	.0	4.4	.0	.0	24.4
32	16.0	.0	13.3	.0	.0	29.3
34	.0	.0	4.4	.0	.0	4.4
36	.0	.0	13.3	.0	.0	13.3
38	.0	.0	13.3	.0	.0	13.3
40	.0	.0	4.4	.0	.0	4.4
42	.0	.0	17.8	.0	.0	17.8
44	.0	.0	4.4	.0	.0	4.4
46	.0	.0	.0	.0	.0	.0
48	.0	.0	4.4	.0	.0	4.4
50	.0	.0	4.4	.0	.0	4.4
52	.0	4.0	.0	.0	.0	.0
54	.0	.0	.0	.0	.0	.0
56	.0	.0	4.4	.0	.0	4.4
58	.0	.0	.0	.0	.0	.0
60	.0	.0	4.4	.0	.0	4.4
BA	156.2	4.0	196.1	.0	.1	356.4
SAMPLES	10	10	9	9	9	
SE	37.3	4.0	39.6	0	.1	

TABLE A9 LIVE TREES PER ACRE AREA E =PLOTS 195-270 and 331-404

DBH	PIP0	PIMO	PILA	ABC0	PSME	CADE3	TSHE	TABR	CACH	SALM	CONU	TOTAL
<l	29.6	9.3	3.7	136.7	330.0	46.7	16.7	70.0	253.3	23.3	26.7	946.0
2	5.6	1.9	5.6	90.0	170.0	86.7	50.0	.0	86.7	23.3	33.3	553.3
4	.0	.0	.0	3.3	6.7	.0	.0	.0	.0	.0	.0	10.0
6	3.1	.0	7.1	.0	5.3	7.5	9.8	.0	7.5	.0	.0	40.3
8	.0	.0	2.3	13.7	18.1	.0	7.0	.0	.0	.0	.0	41.1
10	.0	.0	.0	9.9	6.8	.0	2.5	.0	.0	.0	.0	19.2
12	1.1	.0	.0	3.3	10.0	.0	.0	.0	.0	.0	.0	14.4
14	2.0	.0	.0	3.7	1.1	1.2	2.7	.0	.0	.0	.0	10.7
16	.0	.0	.0	.9	3.9	.0	.0	.0	.0	.0	.0	4.9
18	.8	.0	.0	3.1	4.7	.8	.0	.0	.0	.0	.0	9.4
20	.3	.0	.0	2.4	1.3	.0	.0	.0	.0	.0	.0	4.0
22	2.0	.0	.0	.5	3.1	.0	.0	.0	.0	.0	.0	5.6
24	1.4	.0	.0	.8	1.7	.0	.0	.0	.0	.0	.0	3.9
26	.6	.0	.0	1.5	1.1	.0	.0	.0	.0	.0	.0	3.1
28	.7	.0	.0	.3	1.5	.6	.0	.0	.0	.0	.0	3.2
30	.5	.0	.0	.0	1.9	.3	.0	.0	.0	.0	.0	2.6
32	1.2	.0	.2	.0	1.7	.0	.0	.0	.0	.0	.0	3.1
34	.8	.0	.0	.0	1.5	.0	.0	.0	.0	.0	.0	2.3
36	.1	.0	.0	.0	1.1	.0	.0	.0	.0	.0	.0	1.2
38	.7	.0	.0	.0	.3	.0	.0	.0	.0	.0	.0	1.1
40	.3	.0	.0	.0	.9	.0	.0	.0	.0	.0	.0	1.2
42	.1	.1	.0	.0	1.0	.0	.0	.0	.0	.0	.0	1.2
44	.3	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.5
46	.1	.0	.0	.0	.6	.0	.0	.0	.0	.0	.0	.7
48	.1	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.3
50	.2	.0	.0	.0	.4	.0	.0	.0	.0	.0	.0	.6
52	.1	.0	.1	.0	.7	.0	.0	.0	.0	.0	.0	.9
54	.0	.0	.0	.0	.5	.0	.0	.0	.0	.0	.0	.5
56	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.1
58	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.1
60+	.0	.0	.1	.0	.3	.0	.0	.0	.0	.0	.0	
TA	51.6	11.5	19.0	270.1	576.8	143.7	88.7	70.0	347.5	46.7	60.0	1685.6
SAMPLES	54	54	54	30	30	30	30	30	30	30	30	
SE	8.3	1.0	2.9	65.5	169.3	84.8	43.9	28.4	66.3	25.7	27.4	

TABLE A10 LIVE TREE BASAL AREA (SQUARE FEET) PER ACRE AREA E =PLOTS 195-270 and 331-404

DBH	PIP0	PIMO	PILA	ABC0	PSME	CADE3	TSHE	TABR	CACH	SALM	CONU	TOTAL
<I	.0	.0	.0	.I	.l	.0	.0	.0	.2	.0	.0	.5
2	.0	.0	.l	1.1	2.0	.6	.3	.0	.8	.l	.2	5.2
4	.0	.0	.0	.3	.3	.0	.0	.0	.0	.0	.0	.6
6	.7	.0	1.5	.0	1.3	1.3	1.3	.0	1.3	.0	.0	7.4
8	.0	.0	.7	5.3	6.7	.0	2.7	.0	.0	.0	.0	14.7
10	.0	.0	.0	5.3	4.0	.0	1.3	.0	.0	.0	.0	10.7
12	.7	.0	.0	2.7	8.0	.0	.0	.0	.0	.0	.0	11.4
14	2.2	.0	.0	4.0	1.3	1.3	2.7	.0	.0	.0	.0	11.5
16	.0	.0	.0	1.3	5.3	.0	.0	.0	.0	.0	.0	6.7
18	1.5	.0	.0	5.3	8.0	1.3	.0	.0	.0	.0	.0	16.2
20	.7	.7	.0	5.3	2.7	.0	.0	.0	.0	.0	.0	9.4
22	5.2	.0	.0	1.3	8.0	.0	.0	.0	.0	.0	.0	14.5
24	4.4	.0	.0	2.7	5.3	.0	.0	.0	.0	.0	.0	12.4
26	2.2	.0	.0	5.3	4.0	.0	.0	.0	.0	.0	.0	11.5
28	3.0	.0	.0	1.3	6.7	2.7	.0	.0	.0	.0	.0	13.7
30	2.2	.0	.0	.0	9.3	1.3	.0	.0	.0	.0	.0	12.9
32	6.7	.0	.7	.0	9.3	.0	.0	.0	.0	.0	.0	17.3
34	5.2	.0	.0	.0	9.3	.0	.0	.0	.0	.0	.0	14.5
36	.7	.0	.0	.0	8.0	.0	.0	.0	.0	.0	.0	8.7
38	5.2	.0	.0	.0	2.7	.0	.0	.0	.0	.0	.0	7.9
40	3.0	.0	.0	.0	8.0	.0	.0	.0	.0	.0	.0	11.0
42	.7	1.3	.0	.0	9.3	.0	.0	.0	.0	.0	.0	11.3
44	3.0	.0	.0	.0	2.7	.0	.0	.0	.0	.0	.0	5.7
46	.7	.0	.0	.0	6.7	.0	.0	.0	.0	.0	.0	7.4
48	.7	.0	.0	.0	2.7	.0	.0	.0	.0	.0	.0	3.4
50	2.2	.0	.0	.0	5.3	.0	.0	.0	.0	.0	.0	7.6
52	.7	.0	1.5	.0	10.7	.0	.0	.0	.0	.0	.0	12.9
54	.0	.0	.0	.0	8.0	.0	.0	.0	.0	.0	.0	8.0
56	.0	.0	.7	.0	1.3	.0	.0	.0	.0	.0	.0	2.0
58	.0	.0	.0	.0	2.7	.0	.0	.0	.0	.0	.0	2.7
60+	.0	.0	2.8	.0	5.3	.0	.0	.0	.0	.0	.0	8.1
BA	51.9	1.5	8.2	41.5	165.1	8.6	8.3	.0	2.4	.l	.3	287.5
SAMPLES	54	54	54	30	30	30	30	30	30	30	30	
SE	8.3	1.0	2.9	13.6	17.5	4.0	3.6	0	1.4	.l	.l	

X

TABLE All LIVE TREES PER ACRE AREA F = PLOTS 271-302 ***and 303330***

DBH	PIP0	PIMO	PILA	ABC0	PSME	CADE3	CACH	TOTAL
<1	17.0	.o	7.5	441.7	583.3	241.7	325.0	1616.2
2	22.6	.0	41.7	83.3	283.3	.0	.0	430.9
4	1.9	.0	.0	8.3	8.3	.0	.0	18.5
6	7.0	.0	24.4	.0	.0	.0	.0	31.4
8	.0	.0	8.7	20.5	.0	.0	.0	29.2
10	4.5	.0	.0	12.5	.0	.0	.0	17.0
12	.0	.0	4.9	17.5	.0	.0	.0	22.4
14	.8	.0	2.8	19.1	.0	.0	.0	22.9
16	.0	.0	2.2	12.4	.0	.0	.0	14.6
18	.8	.0	.0	13.5	.0	.0	.0	14.3
20	1.4	.0	.0	5.9	.0	.0	.0	7.3
22	.5	.0	.0	.0	2.6	.0	.0	3.1
24	.2	.0	.0	.0	.0	.0	.0	.2
26	.8	.0	.0	.0	.9	.0	.o	1.7
28	.9	.0	.0	.0	.8	.0	.0	1.7
30	1.2	.2	.0	.0	.0	.0	.0	1.4
32	1.5	.0	.1	.0	.6	.0	.0	2.2
34	1.5	.0	.0	.0	.5	.5	.0	2.5
36	.9	.0	.0	.0	.5	.0	.0	1.4
38	.2	.0	.0	.0	.4	.0	.0	.6
40	1.0	.0	.0	.0	.0	.0	.0	1.0
42	.4	.0	.0	.0	.0	.0	.0	.4
44	.4	.0	.0	.0	.0	.0	.0	.4
46	.1	.0	.0	.0	.0	.0	.0	.I
48	.1	.0	.0	.0	.0	.0	.0	.I
50	.1	.0	.0	.0	.0	.0	.0	.1
52	.0	.0	.0	.0	.0	.0	.0	.0
54	.0	.0	.0	.0	.0	.0	.0	.0
56	.0	.0	.0	.0	.0	.0	.0	.0
58	.0	.0	.0	.0	.0	.0	.0	.0
60+	.0	.0	.0	.0	.2	.0	.0	.2
TA	66.2	.2	7.7	501.9	807.5	533.9	325.0	**2242.4**
SAMF'LES	53	53	53	12	12	12	12	
SE	19.2	.2	5.9	170.6	458.9	272.3	124.4	

TABLE Al2 LIVE TREE BASAL AREA (SQUARE FEET) PER ACRE AREA F = PLOTS 271-302 and 303-330

DBH	PIP0	PIMO	PILA	ABC0	PSME	CADE3	CACH	TOTAL
<l	.0	.0	.0	.2	.0	.0	.l	.4
2	.4	.0	.0	.2	1.0	1.5	.0	3.1
4	.I	.0	.0	.0	.7	.7	.0	1.5
6	1.5	.0	.0	.0	3.3	.0	.0	4.8
8	.0	.0	.0	3.3	6.7	.0	.0	10.0
10	2.3	.0	.0	.0	6.7	.0	.0	9.0
12	.0	.0	.0	3.3	13.3	.0	.0	16.7
14	.8	.0	.0	3.3	20.0	.0	.0	24.1
16	.0	.0	.0	3.3	16.7	.0	.0	20.0
18	1.5	.0	1.5	.0	23.3	.0	.0	26.3
20	3.0	.0	.0	.0	13.3	.0	.0	16.3
22	1.5	.0	.0	.0	6.7	.0	.0	8.2
24	.9	.0	.0	.0	.0	.0	.0	.9
26	3.0	.0	.0	.0	3.3	.0	.0	6.3
28	3.8	.0	.0	.0	3.3	.0	.0	7.1
30	6.0	.8	.0	.0	.0	.0	.0	6.8
32	8.3	.0	.8	.0	3.3	.0	.0	12.4
34	9.1	.0	.0	.0	3.3	3.3	.0	15.7
36	6.0	.0	.0	.0	3.3	.0	.0	9.3
38	1.5	.0	.0	.0	3.3	.0	.0	4.8
40	9.1	.0	.0	.0	.0	.0	.0	9.1
42	3.8	.0	.0	.0	.0	.0	.0	3.8
44	3.8	.0	.0	.0	.0	.0	.0	3.8
46	3.0	.0	.0	.0	.0	.0	.0	3.0
48	1.5	.0	.0	.0	.0	.0	.0	1.5
50	1.5	.0	.0	.0	.0	.0	.0	1.5
52	1.5	.0	.0	.0	.0	.0	.0	1.5
54	.8	.0	.0	.0	.0	.0	.0	.8
56	.0	.0	.0	.0	.0	.0	.0	.0
58	.0	.0	.0	.0	.0	.0	.0	.0
60+	.0	.0	.0	.o	3.3	.0	.0	3.3
B A	74.4	.8	.8	13.8	135.1	5.6	.I	231.5
SAMPLES	53	53	53	12	12	12	12	
SE	6.8	.8	.8	10.4	24.8	4.2		