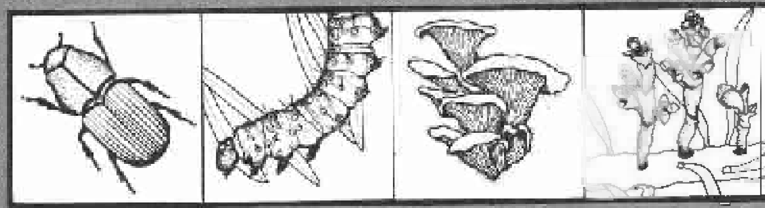
Forest Pest Management



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EVALUATION OF DISEASES WITHIN SELECTED STANDS ON THE PRIEST RIVER EXPERIMENTAL FOREST, IDAHO

by

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ABSTRACT

Three stands along Benton Creek within the Priest River Experimental Forest, Idaho, were surveyed for diseases using previously established timber inventory plots and sample trees. These surveys provided information to aid in formation of silvicultural prescriptions by CEFES (Continuing Education in Forest Ecology and Silviculture) students. Diseases were quantified at the stand level using the Northern Region's Insect and Disease Damage Survey System (INDIDS). The evaluation showed that about 10 percent of the trees examined had some noticeable disease. Mortality associated with root disease was found throughout the stands. Based on previous work in the area, we believe most trees are infected with root pathogens but lacked symptoms. The major pathogenic fungi associated with root diseases were Phaeolus schweinitzii and Armillaria mellea. Butt and stem decays were also prevalent, especially Phellinus pini on western white pine and western larch. Management implications and strategies are discussed.

INTRODUCTION

Three forest stands located along Benton Creek (T33N, R4W, sec. 27) within the Priest River Experimental Forest in northern Idaho were evaluated on March 16-17, 1981, for presence, distribution, and frequency of diseases. These stands had previously been inventoried and will serve as a basis for training students in the program for Continuing Education in Forest Ecology and Silviculture (CEFES). The disease survey was made since such information may influence silvicultural prescriptions for the stands.

METHODS

Stands 43, 44, and 45, covering a total of about 25 acres, were surveyed for diseases using plots previously established by timber inventory. Plot trees more than 5.0" d.b.h. were selected with a relascope calibrated to a basal

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area factor of 40; trees less than 5.0 inches were sampled if within a 1/300-acre fixed plot. Each sample tree measured in the timber inventory was examined for signs and symptoms of diseases. Disease categories used in the survey (table 1) were defined by the Northern Region's Insect and Disease Damage Survey System (INDIDS) (1). A maximum of three insect or disease damage codes could be assigned to each tree. INDIDS computes and displays, at the stand level, insect and disease problems in terms of trees per acre, basal area, and cubic foot volume per acre. It also computes percent of stand affected.

Table 1.--INDIDS 1/ codes used to identify tree diseases 2/ on selected forest stands in the Priest River Experimental Forest.

Code	Description
20	Mistletoe infected
21	Mistletoe mortality
22	Root rot infected
23	Current root rot mortality
24	Older root rot mortality
25	Branch canker and stem rust
26	Stem canker and stem rust
27	Mortality - stem rust
28	Light needle disease infection
29	Moderate needle disease infection
30	Heavy needle disease infection
31	Butt and stem decay

Trees suspected of having root disease (with thin, chlorotic crowns, rounded tops, and stress cone crops) were examined closely at the root collar; lateral roots of suspect trees were also examined. Pathogens associated with root disease were identified in the field on the basis of root crown signs and symptoms; laboratory isolations from wood samples were not routinely made. Proximity of plots to existing root disease centers and evidence of recent windthrow in and around plots were noted.

RESULTS AND DISCUSSION

Diseases were found on 20 (9 percent) of the trees sampled. Incidence ranged from 5 to 16.2 percent of the trees within each stand (table 2). Averages of 12.3 and 6.6 percent of the basal area and cubic foot volumes, respectively, were affected by diseases. Major disease categories included root diseases, stem and butt decays, and stem cankers.

1/ INDIDS - Computer program for the Insect and Disease Damage Survey System of the Northern Region.

2/ Insect and other damage codes are not shown.

Table 2.--Disease damage within selected stands on the Priest River Experimental Forest[1/]

Disease category[2/]	Stand 43 Trees	Stand 43 Basal area	Stand 43 Volume[3/]	Stand 44 Trees	Stand 44 Basal area	Stand 44 Volume[3/]	Stand 45 Trees	Stand 45 Basal area	Stand 45 Volume[3/]
Root disease mortality (code 24)	3.5	2.0	0.6	16.2	6.3	3.5	6.3	6.6	3.8
Stem cankers (code 26)	0	0	0	0	0	0	2.4	0[4/]	0[4/]
Butt and stem decays (code 31)	1.1	4.5	6.1	0	0	0	0.3	3.9	4.1
Other diseases	0.4	1.5	1.9	0	0	0	0	0	0
All diseases	5.0	8.0	8.6	16.2	6.3	3.5	9.0	10.3	7.9

1/ Values in table represent percentages; i.e., percent of trees damaged by disease agents and percent of volume affected.

2/ Categories based on INDIDS codes (table 1).

3/ Cubic foot volume.

4/ Trees with stem cankers were less than 4.5 feet in height; therefore, no basal area or volume was involved.

Survey results (table 3) indicated that over 40 trees per acre had died following attack by root pathogens. This mortality accounted for about 8 square feet per acre basal area and a volume loss of 116 cubic feet per acre. The dead trees fell into damage category 24 (table 1) - older root disease mortality. Root disease was not detected in any living sample trees, although live diseased trees were found between plots. However, based on other work adjacent to sampled stands (2), much greater root disease incidence could be expected. Dubreuil (2) excavated entire root systems of 21 trees and found roots of all (16) Douglas-fir infected with pathogenic fungi. Three of the excavated trees were dead; the others appeared healthy. We concluded that there was substantial root infection in the stand, but detection of some pathogens was difficult without extensive root excavations.

Evidence of substantial past windthrow, probably associated with root diseases, was found throughout sampled stands. Several root disease centers with current mortality were also noted in stands, but no inventory plots fell within such centers. Apparently, root diseases have been active in these stands for many years, with a few trees dying or being windthrown annually.

Most root disease was found on Douglas-fir (Pseudotsuga menziesii Franco); although diseased grand fir (Abies grandis (Dougl.) Lindl.) were not within sample plots, several infected trees were found within the stands. Fewer ponderosa pine (Pinus ponderosa Laws.) and western white pine (Pinus monticola Dougl.) were root diseased (table 3) than other species. Western larch (Larix occidentalis Nutt.), western redcedar (Thuja plicata Donn.), and western hemlock (Tsuga heterophylla (Rafn.) Sarg.) were generally not affected by root disease along Benton Creek (2).

The two major root pathogens in sampled stands were Phaeolus schweinitzii (Fr.) Pat. and Armillaria mellea (Vahl. ex Fr.). Phaeolus caused red-brown cubical decay of the butt and roots of trees. Armillaria caused white-stringy decay and produced characteristic mycelial fans around the base of infected trees. Armillaria and Phaeolus often infected the same trees. Trees infected with P. schweinitzii may appear healthy for many years, even with extensive root decay. Large trees are seldom killed by the fungus before windthrow occurs. However, association with Armillaria hastens tree decline and death.

The other root pathogen detected in sample plots was Verticicladiella sp., cause of black stain root disease. It infected a ponderosa pine which also had Armillaria decay.

Stem decays accounted for substantial volume loss within surveyed stands (table 4). Most decay occurred on western larch and western white pine. The major stem decay organism was Phellinus pini (Thore ex Fr.) Pilat. which caused white pocket rot in the heartwood of mostly mature trees. Although not located on any plot trees, the Indian paint fungus (Echinodontium tinctorium (E. & E.) E. & E.) was common on western hemlock and grand fir within and adjacent to sampled stands. In addition to large old-growth trees, the fungus was found on numerous small-diameter trees. These small trees may have been either young (about 80 years) or old and suppressed.

Table 3.--Root disease mortality within selected stands on the Priest River Experimental Forest[1]

Tree species	Stands											
	43			44			45			Averages		
	Trees[2]	Basal area	Cubic foot volume	Trees[2]	Basal area	Cubic foot volume	Trees[2]	Basal area	Cubic foot volume	Trees[2]	Basal area	Cubic foot volume
Douglas-fir	24.5	4.2	40.8	37.5	2.5	0	26.9	7.5	119.7	29.6	4.7	53.5
Ponderosa pine	0	0	0	16.1	10.0	187.4	0	0	0	5.4	3.3	62.5
Western white pine	0	0	0	0	0	0	16.7	0.1	0	5.6	0.1	0
All species	24.5	4.2	40.8	53.6	12.5	187.4	43.6	7.6	119.7	40.6	8.1	116.0

1/ Values in table on a per acre basis.
2/ Trees which had died following attack by root pathogens.

Table 4.--Incidence of butt and stem decay within selected stands on the Priest River Experimental Forest[1/]

Tree species	Stands: 43 Trees	43 Basal area	43 Cubic foot volume	44 Trees	44 Basal area	44 Cubic foot volume	45 Trees	45 Basal area	45 Cubic foot volume	Averages Trees	Averages Basal area	Averages Cubic foot volume
Ponderosa pine	0	0	0	0	0	0	0.4	2.2	39.2	0.1	0.7	13.1
Western white pine	1.3	3.1	172.2	0	0	0	1.8	2.2	91.8	1.0	1.4	88.0
Western larch	6.4	6.2	218.9	0	0	0	0	0	0	2.1	3.1	73.0
All species	7.7	9.3	391.1	0	0	0	2.2	4.4	131.0	3.3	5.2	174.0

1/ Values in table on a per acre basis.

Stem cankers caused by white pine blister (Cronartium ribicola Fisch.) were found on a few western white pine plot trees (table 2). The disease was especially prominent on young regeneration. Several old-growth white pine were top-killed as a result of girdling by blister rust cankers.

In the original timber survey, conducted by standard inventory methods, the only problems attributed to diseases were weather damage, blister rust, and decays. Several dead trees were recorded on plots; however, cause of tree death was either not known or not indicated. Results of our survey revealed from 3 to 16 percent of the older mortality was due to root disease. Therefore, relying exclusively on timber inventory data as a basis for silvicultural prescriptions may result in overlooking serious problems. More intensive evaluations, such as reported here, may be warranted in stands suspected of being diseased.

MANAGEMENT IMPLICATIONS

The appearance of stands along Bentron Creek did not indicate a major disease problem. Our findings substantiated this; mortality was low in comparison to stands with more agressive pathogens like Phellinus weirii (Murr.) Gilb. (3). However, Dubreuil (2) found such extensive root infection of Douglas-fir by P. schweinitzii in an adjacent stand that management objectives could be affected. The following points should be considered:

1. Although most Douglas-fir were infected with P. schweinitzii and had extensive root decay, mortality rates were moderate. Most of the mortality was scattered; few large root disease centers were found. Therefore, Douglas-fir should probably be kept as an important component of these stands. However, regeneration methods should favor other less susceptible species (larch and pine) when possible. Maintaining a species mix in these stands may help to alleviate some of the low stocking problems resulting from scattered Douglas-fir mortality.

2. Regenerating these stands with a shelterwood or seed tree method will probably lead to extensive windthrow of residual trees; level of stocking of the new stand may be severely limited.

3. Wounding residual trees during stand entries should be kept to a minimum because of potential decay problems. Number of stand entries and thinning operations should be limited. Shortened rotation should also help reduce decay losses.

4. Blister rust will continue to be a problem in white pine regeneration unless resistant stock is used.

ACKNOWLEDGEMENTS

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