



Station Note

No. 34

January 1980

University of Idaho
Forest, Wildlife and Range Experiment Station

Frequency and Damage by Forest-Tree Pests in Southern Idaho

A.D. Partridge and E.R. Canfield

ABSTRACT

Frequencies and volume-loss data derived from ten years of forest insect and disease survey work cover ten important forest-tree species native to the northern Rocky Mountains. All important disease and insect causal agents found during the surveys are listed. The amount of volume lost from each tree species to each damaging agent is given. Budworm, needle diseases, aphids and dwarf mistletoes caused the most frequently found damage. However, carpenter ants, heart rots, and root diseases caused the greatest loss of volume. Spectacular or conspicuous agents such as needle casts and insects account for much less volume loss than do the far less noticeable agents such as heart rots and root diseases.

INTRODUCTION

Of the few comprehensive studies of forest-tree problems published, only one (1) compares impacts by various causes. None is available for the State of Idaho.

The authors are respectively, Professor and Associate Professor, Forest Pathology; Forest, Wildlife and Range Experiment Station, University of Idaho. Contribution No. 162.

This project has been supported by funds from McIntire-Stennis Research Project No. 23 and Forest Insect and Disease Management, State and Private Forestry, Intermountain Region, U.S. Department of Agriculture - Forest Service.

ISSN:0073-4594

The relative damage done by each agent remains ill-defined even though inventories are an essential part of management planning. Recognizing that it is impossible to assign harvesting priorities correctly without estimates of real or potential loss for an area, the University of Idaho assigned forest entomologists and forest pathologists to initiate surveys and studies of survey methods in 1968. Since then, tree data have been gathered each year throughout the state. Additional financial aid from the U.S. Department of Agriculture - Forest Service in 1978 permitted us to gather sufficient information to report occurrences in the central part of Idaho. All lands, regardless of ownership, were included in our studies. The study area encompassed all roaded portions of the Payette, Salmon, Boise, and Challis National Forests and the Northern Division of the Sawtooth National Forest along with included and adjacent lands owned by other agencies and individuals.

METHODS

During the 10 years of study we compared several systems of survey including studies from low-flying aircraft, random and nonrandom map spotting and modified random selections from stratified roadside locations. Repetition of each system and comparisons of data indicated that aerial surveys located the fewest problems and overlooked some of the most damaging ones. Nonrandom selections heavily favored spectacular problems while again overlooking major damage. Modified random selections from maps or from

SD
12
I2
249
No. 34

roadside provided essentially the same results as modified random selections in nonroaded areas except in sparsely wooded areas or exceptionally steep or rocky terrain. Therefore, the data reported here were gathered from randomly-located sample trees not more than 800 meters and not less than 40 meters from a road. Roads along which trees were to be sampled were selected by aerial examination of sample areas. We preferentially selected roads which traversed cover types representing the sampled area. Roads located on or near stream beds, nonforested desert or nonforested alpine sites generally were eliminated or used sparingly. However, we did not exclude recreational areas, grazing lands with sparse tree populations or watersheds. Judgment and experience rather than strict adherence to a statistical design were necessary parts of this survey system. As we drove into each forested area, we selected a number from a container of tags numbered separately from 1 to 10. These numbers then were considered selected mileages at which we would stop to establish plots. This procedure stratified the preselected road network in a practical and unbiased manner. When each plot was finished, we again selected a number for the same road or on a continuing side road. We emphasized unbiased selections and representative sampling rather than precision of location

throughout the selection processes. A toss of a coin at each stop decided whether the plot would be uphill or downhill, or to the left or right of the road. We then chose a series of five markers from a container with numbers 1-25. The first of the 5 numbers was used to locate a plot center from which stand measurements were made. A simple count of trees beginning at least 40 meters from the road edge or beyond obvious road disturbance was used to find the plot-center tree. The other four chosen numbers were used to select four sample trees, one upslope, one downslope, and two along slope in two directions. The four trees were completely measured and described in their standing conditions, then felled, measured, dissected and carefully searched for any and all problems. Any tree, alive or dead, having any remaining foliage and a measurable diameter at breast height (1.37 m) was eligible for selection as a sample tree. The restriction of foliar presence prevented sampling badly decayed, nonrecoverable specimens.

We compared the results of our roadside sampling with results of a similar sampling in nonroaded areas. These tests were located at seven widely separated areas of the Payette and Boise National forests (Table 1), and each included a similar roaded and nonroaded area. In nonroaded

Table 1. Locations of nonroaded and roaded comparison-plot areas on the Payette and Boise national forests.

Comparison no.	Nonroaded area	No. of plots/trees	Roaded area	No. of plots/trees
I.	Trapper-Creek area, Boise N.F. (T17N R8 and 9E)	8/32	Yellowpine-Landmark road (T17N 8E and 16N 7E)	6/24
II.	Scott-Mt. area, Boise N.F. (T15N R5 and 6E)	3/12	Big-Pine-Creek road and Scott-Mt. road (T9 and 10N R6E)	4/16
III.	Sheep-Creek area, Boise, N.F. (T4N R7 and 8E)	6/24	Middle-Fork-Boise River road and Lost-Man-Creek road (T4 and 5N R7 and 8E)	6/24
IV.	Big-Creek, Taylor-Ranch area, Payette N.F. (T20 and 21N R13E)	4/16	Big-Creek and Crooked-Creek roads (T21N R10 and 11E)	4/16
V.	Monumental-Creek trail area, Payette N.F. (T18 and 19N R11E)	2/8	Monumental-Creek road (T18N R10E)	1/4
VI.	French-Creek area, Payette N.F. (T21 - 24N R3E)	5/20	French-Creek-Burgdorf road (T23 and 24N R4E)	7/28
VII.	East-Fork-Weiser River area, Payette N.F. (T16 and 17N R1 and 2E)	2/8	Unnamed roads N and E of nonroaded area (T16 and 17N R1 and 2E)	3/12
VIII.	Kennally-Creek area (T17N R5E)	4/16	Paddy-Flat-Kennally Creek roads (T17N R5E)	4/16
		34 plots/ 136 trees		35 plots/ 140 trees

TO BORROW SEE
OFFICE STAFF
THIS FLOOR

Table 2. Listing of causal organisms and common names of causes of problems each incites.

<i>Acleris gloverana</i> (Walsingham) western blackheaded budworm	<i>Fomitopsis rosea</i> (Alb. et Schw. ex Fr.) Karst. (<i>Fomes roseus</i> (Alb. et Schw. ex Fr.) Cooke light brown cubical rot
<i>Adelges cooleyi</i> (Gillette) cooley spruce gall aphid	<i>Ganoderma applanatum</i> (Pers. ex Wallr.) Pat. (<i>Fomes applanatus</i> (Pers. ex Wallr.) Gill.) white mottled rot
<i>Arceuthobium</i> spp. dwarf mistletoe	<i>Haematostereum sanguinolentum</i> (Alb. et Schw. ex Fr.) Pouz. (<i>Stereum sanguinolentum</i> (Alb. et Schw. ex Fr.) Fr.) red heartrot
<i>Armillariella mellea</i> (Vahl ex Fr.) Karst. (<i>Armillaria mellea</i> (Vahl ex Fr.) shoestring root rot spongy root and butt rot	<i>Haploporus alboluteus</i> (Ell. et Everh.) Bond. et Sing. (<i>Polyporus alboluteus</i> Ell. et Everh.) subalpine brown rot
<i>Camponotus</i> spp. carpenter ants	<i>Inonotus tomentosus</i> (Fr.) Gilbertson (<i>Polyporus tomentosus</i> Fr.) (<i>Polyporus circinatus</i> Fr.) (<i>Polystictus tomentosus</i> Fr. ex Fr.) red-brown root and butt rot honeycomb root rot
<i>Chionaspis</i> (<i>Phenacaspis</i>) <i>pinifoliae</i> (Fitch) pine needle scale	<i>Ips</i> spp. pine engravers
<i>Choristoneura occidentalis</i> (Freeman) western spruce budworm	<i>Laurilia sulcata</i> (Burt.) Pouz. (<i>Stereum sulcatum</i> Burt.) slimy rot
<i>Chrysomyxa</i> sp. <i>Melampsora</i> spp. and <i>Uredinopsis</i> spp. needle rust—in general	<i>Lentinus lepideus</i> Fr. brown cubical rot of conifers
<i>Collybia radicata</i> (Fr.) Quel.	<i>Lophodermium</i> sp. pine needle cast
<i>Coriollus squalens</i> (Karst.) Bond. et Sing. (<i>Dichomitus squalens</i> (P. Karst.) Reid) (<i>Polyporus anceps</i> Pk.) red ray rot	<i>Neodiprion</i> spp. sawflies
<i>Cronartium coleosporioides</i> Arth. f. <i>coleosporioides</i> (<i>Peridermium stalactiforme</i> Arth. et Kern.) stalactiform rust	<i>Perenniporia subacida</i> (Pk.) Donk (<i>Poria subacida</i> (Pk.) Sacc.) stringy root and butt rot feather rot
<i>Cryptoporus volvatus</i> (Pk.) Shear (<i>Polyporus volvatus</i> Pk.) grey-brown saprot	<i>Phaeolus schweinitzii</i> (Fr.) Pat. (<i>Polyporus schweinitzii</i> Fr.) red-brown root and butt rot
<i>Dendroctonus ponderosae</i> Hopkins (= <i>monticolae</i> Hopkins) mountain pine beetle	<i>Phellinus pini</i> (Thore ex Fr.) Pil. (<i>Fomes pini</i> (Thore ex Pers.) Lloyd) (<i>Trametes pini</i> Thore ex Fr.) red ring rot
<i>Dendroctonus pseudotsugae</i> Hopkins Douglas-fir beetle	<i>Phellinus weirii</i> (Murr.) Gilbertson (<i>Poria weirii</i> Murr.) (<i>Inonotus weirii</i> (Murr.) Kotl. et Pouz.) yellow laminated root and butt rot
<i>Dendroctonus valens</i> LeConte red turpentine beetle	<i>Pholiota adiposa</i> (Fr.) Kumm. brown-mottled white rot
<i>Echinodontium tinctorium</i> (Ell. et Everh.) Ell. et Everh. fibrous yellow heartrot	<i>Pucciniastrum</i> spp. fir rust
<i>Elytroderma deformans</i> (Weir) Darker pine needle cast	<i>Tyromyces leucospongia</i> (Cooke et Harkn.) Bond. et Sing. (<i>Polyporus leucospongia</i> Cooke et Harkn.) subalpine brown saprot
<i>Endocronartium harknessii</i> (J.P. Moore) Y. Hirat. (<i>Peridermium harknessii</i> J.P. Moore) western gall rust	<i>Verticillidiella</i> spp. root-stain diseases
<i>Eucosma</i> sp. pine shoot borer	
<i>Fomitopsis annosa</i> (Fr.) Karst. (<i>Fomes annosus</i> (Fr.) Karst.) (<i>Heterobasidion annosum</i> (Fr.) Bref.) Fomes root rot white spongy rot	
<i>Fomitopsis pinicola</i> (Swartz. ex Fr.) Karst. (<i>Fomes pinicola</i> (Swartz. ex Fr.) Cooke) crumbly brown cubical rot	

areas we traveled trails using preselected mileages and a pedometer. When we arrived at the preselected mileages, we moved at right angles to the trail, employing the selection process outlined previously and found four trees for examination. Data were recorded as for roadside selections.

During all parts of this survey we took unknown insects, problems, fungi, stains, or decay to our laboratory facilities for culturing, rearing, and identification.

After 10 years we have accumulated sufficient sample trees to calculate the frequencies at which problems occur and actual or potential volume losses for many problems. Although gaps in information regarding growth loss are evident, we feel that our volume-loss calculations are the best available data for the area of southern Idaho bounded on the north by the Salmon River and on the south by the Snake River. We will update and modify methods to enable sophistication of our data as the project continues.

RESULTS AND DISCUSSION

Although we recognize the interactions and associations of fungi, insects, higher plants, and other agents in causing mortality, growth loss, or decay, we have included only the more obvious ones in this report. This permits simplifying this first presentation and comparing activities or principal causal agents. The primary cause ascertained by each involved scientist is reported as the destructive force. Our roadside sample included 545 trees of 10 species and our off-road comparison-sample included 136 trees of 10 species in eight locations. A list of the scientific and common names of causal organisms and associated problems (Table 2) in the study area provides the names used in our summaries. Common names have been employed whenever practical, but scientific names and their synonyms are included. The first scientific name listed is considered the preferred modern name; others are synonyms.

The distribution of tree species (Table 3) conforms to expected frequencies for this area but includes insufficient information about larch, whitebark pine, or poplars to permit drawing conclusions. We combined data covering grand fir and its hybrid in this area because of problem similarities and because few field foresters can identify differences between these trees.

Data are presented in several forms (Tables 4 and 5) to permit flexible comparisons and interpretations. All volumes are given in cubic meters which can be roughly converted to board feet by multiplying by 200.¹ Unusable or potentially unusable volume is reported as "loss" or "potential loss." Loss includes volumes that are now

¹ A cubic foot contains between 5 and 7 board feet of lumber which we can convert to between 176.5719 and 247.2007 board feet per cubic meter. Our figure of 200 board feet is a rough average of these estimates.

Table 3. Percentage of each tree species in the sampled forest population of 545 trees.

Species	Percent of the total trees sampled
<i>Abies grandis</i> (Dougl.) Lindl.	7.7
<i>Abies lasiocarpa</i> (Hook) Nutt.	9.9
<i>Abies grandis</i> hybrid	0.3
<i>Larix occidentalis</i> Nutt.	0.7
<i>Picea engelmannii</i> Parry	8.1
<i>Pinus albicaulis</i> Engelm.	1.1
<i>Pinus contorta</i> Dougl.	26.6
<i>Pinus ponderosa</i> Laws.	17.6
<i>Populus</i> spp.	0.5
<i>Pseudotsuga menziesii</i> Franco	27.3

unusable such as decayed wood. Potential loss includes both unusable wood and recoverable wood which is dead or dying. This is the loss that will be realized unless recovery occurs. Ordinarily it will be the same as real loss unless extensive salvage is performed. We used the term "recoverable" in the broad sense to include all material that could be utilized if it were accessible and marketable.

All species except Engelmann spruce and lodgepole pine had potential loss values near 50 percent of the standing volume (Table 5). This startling figure is moderated by figures for average recoverable volume. The latter imply that the principal form of volume loss is that which exists as dead or dying standing trees. The relatively high values for average recoverable volume per tree also indicate that this volume exists in large, often decadent, old trees. Keep in mind that a mature tree measuring 18 inches (45.72 cm) diameter breast high (4.5 feet = 1.37 m) and 70 feet (21.34 m) tall contains 1.16760 m³ of wood.

Trees with completely sound wood were relatively small as indicated by the figures for sound tree volumes.

Throughout the samples ponderosa pine contained the largest volumes of sound or recoverable wood, indicating that this large, dry-site species is rarely decadent in the area surveyed. This is supported by the figures for average volumetric damage in this species (Table 4).

The frequencies of problems encountered (Table 4) do not correlate directly with the damage levels caused. The most frequent problems in order were budworm damage, needle diseases, spruce gall aphid, dwarf mistletoe, and decay by *Phellinus pini*. The greatest volume loss was caused by decays in general, followed by loss to carpenter ants which were associated with decays and particularly with decay by *P. pini*, followed by loss to root diseases.

Table 4. Percent frequency and volumetric damage by individual problems in forest trees of southern Idaho.

Problem ^a	Forest tree					
	ABSGRN ^b	ABSLAS	PICENG	PINCON	PINPON	PSUDMN
Bark beetle damage by:						
<i>D. ponderosae</i>					2/ 6.38	
<i>D. pseudotsugae</i>						3/12.82 ^c
<i>D. valens</i>					2/ 0.36	
<i>Ips</i> spp.					3/10.18 ^d	
Brooming (branches)		2	2	1		1
Budworms	23	4	7			3
Canker (stem)						2
Canker (branch)		9				1
Carpenter ants			4/21.13 ^e	2/13.24	2/ 6.80	1/ 7.36
Decay by:						
<i>C. squalens</i>					2/ 8.45	
<i>C. volvatus</i>				1	1	3
<i>E. tinctorium</i>	7/10.6	2/16.37				
<i>F. annosa</i>	2/ 0.17					
<i>F. rosea</i>				1/13.30		
<i>G. applanatum</i>	2/11.36					
<i>H. sanguinolentum</i>		2				
<i>H. alboluteus</i>		2				
<i>I. tomentosus</i>				1/ 0.20		
<i>L. lepideus</i>			2	1		1/ 0.79
<i>L. sulcata</i>		2				
<i>P. subacida</i>		2				
<i>P. schweinitzii</i>				1/ 1.93		
<i>P. pini</i>			14/41.75 ^e	2/ 6.10		4/ 3.49
<i>P. weirii</i>		2				
<i>P. adiposa</i>		2				
<i>T. leucospongia</i>					1	
Dwarf mistletoe		4		12		10/ 0.0006
Gall rust (western)				10	2	
Needle cast	18	2	2	9	19	7
Rodent damage					2	
Root disease by:						
<i>A. mellea</i>			2		3/10.18 ^d	1/ 5.18
<i>C. radicata</i>					1/13.30	
<i>F. annosus</i>					1	
<i>I. tomentosus</i>			2/ 0.40			
<i>P. subacida</i>					1/ 3.32	
<i>P. schweinitzii</i>		2/18.12				4/16.91 ^c
<i>Verticicladiella</i> spp.			2		2/ 0.40	
Sawfly damage				7	2	1
Scale insects					2	
Shoot borers					1	
Spruce gall aphids			16			3
Stalactiform rust				2		
Wetwood	4			1	2	1
Winter (snow) damage		2				1

^a Problems are listed by common name except where inappropriate because of possible error in interpreting a name. Frequency is expressed as a percentage of the sample population of each species and is stated as a whole number. The maximum potential volume loss, when available, is stated as a percentage of the total standing volume of the sampled species and is stated as a decimal number. A slash separates these two numbers when both are available. No number in a space implies no occurrence.

^b Abbreviations: ABSGRN (*Abies grandis*), ABSLAS (*Abies lasiocarpa*), PICENG (*Picea engelmannii*), PINCON (*Pinus contorta*), PINPON (*Pinus ponderosa*), PSUDMN (*Pseudotsuga menziesii*).

^c This insect always occurred with root disease, usually caused by *P. schweinitzii*, therefore these data and those for disease by *P. schweinitzii* should be combined.

^d This insect and root disease by *A. mellea* occurred together.

^e In this tree species carpenter ants and decay by *F. pini* were interrelated.

Table 5. Summarized percentages and volumes for each tree species encountered during the survey.

Summary	Tree species						
	All trees	ABSGRN ^a	ABSLAS	PICENG	PINCON	PINPON	PSUDMN
Number of trees sampled	545	44	45	44	145	96	149
Percent:							
Maximum potential volume loss	43	46	46	80	11	53	45
Average loss per tree	3	4	3	3	1	< 1	1
Live trees with loss	12	11	14	23	8	6	15
Live trees with partly sound (recoverable) wood	76	89	85	70	57	81	85
Recoverable or partly recoverable dead or dying trees	14	5	11	20	9	22	15
Entirely sound trees	52	36	63	39	50	52	57
Average volume ^b of wood:							
Lost in all trees	0.04269	0.21515	0.04499	0.08294	0.01017	0.00283	0.04007
Lost in trees with defect	0.36361	1.89332	0.30365	0.36492	0.13407	0.04537	0.25961
Recoverable in trees with defect	2.34533	2.94379	0.98510	2.17513	0.88608	3.07679	2.76533
Sound in sound trees	0.61117	0.57354	0.25744	0.56000	0.34192	1.00850	0.760169
Sound in all trees	0.51162	0.46962	0.21235	0.18787	0.57403	0.74004	0.64439

^a For abbreviations see Table 4.

^b Volumes are stated in cubic meters.

Table 6. Differences¹ found between records of problems on nonroaded (U) and roaded (R) areas of the Payette and Boise National Forests.

Comparison no. ²	Problem(s) no. name	Frequency ³	Max. pot. loss ⁴	Difference
		U/R	U/R	U/R ⁵
I	1. <i>C. squalens</i> in PINPON stems	2/1	9.80/ 8.25	+1.55
	2. <i>E. tinctorium</i> in ABSGRN stems	10/8	13.36/14.70	-1.34
II	3. <i>P. schweinitzii</i> in roots of PSUDMN	4/2	20.54/15.11	+5.43
III	4. Pine butterfly on PINPON	2/0	—	—
	5. Mountain pine beetle in PINCON	1/0	—	—
IV	No differences			
V	6. <i>F. pini</i> in stems of PINCON	5/2	7.73/ 6.10	+1.63
	7. <i>E. tinctorium</i> in stems of ABSGRN	0/1	0/ 6.30	-6.30
VI	No differences			
VII	8. <i>E. tinctorium</i> in stems of ABSGRN	10/8	13.36/15.15	-1.71
VIII	No differences			

¹ Only those problems (Table 4) which differed in frequency or intensity between nonroaded and roaded areas are listed. Others can be assumed to be the same if they occurred in adjacent areas.

² See Table 1 for coordinates and names.

³ "Frequency" is a percentage of the sample population and is stated as a whole number.

⁴ "Maximum Potential Loss" is stated as a percentage of standing volume of the sampled species and is stated as a decimal number.

⁵ + indicates more loss on the U area than on the R area; - indicates the opposite.

Great care must be exercised in measuring damage and assigning causes because interactions or close associations are common. This fact, obvious with carpenter ants and decays, often is overlooked when pine engravers work in ponderosa pine. The beetle may build up and attack healthy trees but more commonly attacks those with root disease. Western spruce budworm also is responsible for decay entry through dead tops which it creates.

Major causes of volume loss must be evaluated carefully because major loss does not equate with spectacular damage. For example, while mountain pine beetles cause localized, rapid, visible loss in lodgepole and ponderosa pines of this area, many other agents, including various root diseases, cause at least twice as much volume loss in an innocuous way.

When we compared problems on nonroaded and roaded areas (Table 6), few differences in the kinds or amounts of problems were discernible, indicating that

our sampling procedure was adequate to describe conditions in the areas studied. Objections to roadside survey under such circumstances are invalid; however, we recognize that our data permit no comparisons between intensively-managed forests and extensively-managed forests.

Also, summaries are limited in the following areas. First, the data are not stratified by age or size classes, which may drastically influence the impacts of certain problems. The data (Table 5) imply that this is so for dead or dying trees caused by problems like root diseases. Second, we included only trees with a measurable diameter breast high, thus excluding seedling and some sapling problems. Third, we have not developed adequate growth-loss measures or estimates to include in loss estimates and are missing impacts by several agents. Nonetheless, major problems are well outlined by the data presented, and needs for management are implied. It also is obvious that the interrelation and interactions of fungi, insects, and predisposition must become part of the data used to develop management strategies.

LITERATURE CITED

- U.S. Department of Agriculture, Forest Service. 1958. Timber resources for America's future. U.S. Department of Agriculture, Forest Resource Rep. No. 14. 713 pp.

Related Publications

Partridge, A.D., E.R. Canfield, and D.L. Kulhavy. 1978. Keys to major disease, insect and related problems of forests in northern Idaho. Revised Edition. Forest, Wildl. and Range Exp. Sta., Univ. of Idaho, Moscow. 100 pp. Illustrated. (6 x 9") \$2.50.

Partridge, A.D., E.R. Canfield, and R.J. Chacko. 1977. Forest pathology outline. Forest, Wildl. and Range Exp. Sta., Univ. of Idaho, Moscow. 236 pp. Illustrated. \$5.

Partridge, A.D., and D.L. Miller. Major wood decays in the inland northwest. Idaho Research Foundation, Inc. P. O. Box 3368 University Station, Moscow, ID 83843. Illustrated in color. \$4.50.

For these publications, or for a listing of all available experiment station publications and reprints, please write:

Editor
Forest, Wildlife and Range Experiment Station
University of Idaho
Moscow, Idaho 83843

Checks may be made out to COLLEGE OF FORESTRY.

FOREST, WILDLIFE AND RANGE EXPERIMENT STATION

Scientists associated with the Forest, Wildlife and Range Experiment Station conduct wide-ranging research in forest management, wood products and wood technology, range resources, wildland recreation management, wildlife resources and fishery resources. The knowledge gained from research is disseminated nationally, to educational institutions, to federal and state agencies, to private industries, and to private citizens.

The mission of the Forest, Wildlife and Range Experiment Station, like that of the University, is service—to the people of Idaho and the nation. The experiment station scientists fulfill that mission through research directed toward knowledgeable, responsible use, development and management of renewable natural resources for Idaho and the nation.

