

Lodgepole Pine Dwarf Mistletoe in the Intermountain Region

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ABSTRACT

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During 1978 and 1979, a survey of lodgepole pine dwarf mistletoe (*Arceuthobium americanum*) was conducted in 11 national forests in Utah, Nevada, southern Idaho, and western Wyoming. Incidence of the parasite by national forest ranged from 17 to 79% with a weighted mean of 60% of surveyed plots. Computer-simulated yield information derived from survey data indicated that annual volume reduction of lodgepole pine by dwarf mistletoe varies among national forests from 16,040 to 100,420 m³. The total timber volume yield reduction caused by lodgepole pine dwarf mistletoe in the Intermountain Region is estimated at 488,120 m³ a year.

Dwarf mistletoes (*Arceuthobium* spp.) are host-specific, obligate parasites of conifers that are important to forest managers because they suppress growth, diminish wood quality, and reduce seed crop production. Infected trees are often predisposed to insect attacks or are killed directly by these parasites (7).

Dwarf mistletoes are frequently observed in conifer stands in the 18 national forests administered by the USDA Forest Service, Intermountain Region (Fig. 1). The general distribution of these pests has been documented (8), but no information quantifying effects of dwarf mistletoes on timber yields in the Intermountain Region has been available.

Stands of lodgepole pine (*Pinus contorta* Dougl.) in the Intermountain Region constitute about 25% of the commercial forestland in southern Idaho, western Wyoming, northeastern Utah, and parts of western Nevada (R. Hamilton, *unpublished*). Lodgepole pine dwarf mistletoe (*Arceuthobium americanum* Nutt. ex Engelm.) is distributed throughout the range of the host species in the region (8).

The objectives of this survey were to obtain estimates of dwarf mistletoe incidence and volume yield reductions in infected lodgepole pine stands. Pest impact data are needed by forest managers to develop plans and stand prescriptions with the best possible projections of timber volume yields. Additionally, the survey was part of a USDA Forest Service national assessment of dwarf mistletoes (2).

MATERIALS AND METHODS

Eleven national forests within the range of lodgepole pine in the Intermountain Region (11) were surveyed (Table 1, Fig. 1). The survey was similar in design to those conducted by Hawksworth (5), Andrews and Daniels (1), and more recently, Johnson et al (10). A two-person crew drove along passable roads in each surveyed forest and established variable-radius (basal area factor of 10) plots 40 m perpendicular from the road at 4.8-km intervals. Plots were arbitrarily established first to the right side of the road and, if lodgepole pine was absent, to the left side. If lodgepole pine was absent along both sides of the road, the plot was dropped from further investigation.

Within each variable-radius plot, the height, diameter at breast height (dbh), and dwarf mistletoe rating (DMR) (6) were recorded for all lodgepole pine greater than 13 cm dbh. An increment core was extracted from one tree representative of those within the plot to establish stand age and determine site index, a measure of stand capability necessary for modeling yield tables.

Data analyses. Dwarf mistletoe incidence was calculated by dividing the number of plots with infected lodgepole pine in each forest by the total number of plots. This quotient was multiplied by 1979 forest inventory estimates (obtained from timber management plans) of hectares of commercial lodgepole pine to approximate the area infested by dwarf mistletoe in each forest.

Volume yield reductions caused by lodgepole pine dwarf mistletoe were estimated by computer simulation after summarizing the tree data from each infected plot into stand information. Volume yields were projected by entering stand information in a computer program, RMYLD (4), that simulates growth of lodgepole pine stands either with or without dwarf mistletoe infections.

The model, developed for use in Colorado and southern Wyoming, has not been adequately tested for applicability in the Intermountain Region but was used because it was the only yield program available for lodgepole pine infested with dwarf mistletoe. Volume estimates representing the actual stand DMR were compared with the same stand volume estimates with a hypothetical DMR value of 0 (uninfected) over the next decade. The difference in cubic meters per hectare divided by 10 approximated annual volume yield reduction caused by dwarf mistletoe. Finally, the yield reduction estimates were averaged by forest and multiplied by the incidence estimates of dwarf mistletoe-infested area, resulting in a forest estimate of annual volume yield reduction caused by dwarf mistletoe. This method gives a conservative estimate of the impact of dwarf mistletoe because it neglects the cumulative effects of parasitism that occurred before the 10-yr simulation period.

RESULTS AND DISCUSSION

Estimates of the incidence of *A. americanum* and effects of the parasite on volume yields in lodgepole pine stands in the Intermountain Region are presented by national forest in Table 1. Regionwide, 60% of the lodgepole pine area was infested with dwarf mistletoe. Incidence was greatest in the Targhee National Forest, Idaho (79%), and least in the Toiyabe National Forest, Nevada (17%).

Estimated annual reductions in total volume yield caused by dwarf mistletoe were highest in the Targhee National Forest, Idaho (100,420 m³/yr), and lowest in the Sawtooth National Forest, Idaho (16,040 m³/yr). The positions of these two forests were reversed when comparing estimates of volume yield reduction per hectare of infested lodgepole pine; the Sawtooth National Forest had the greatest annual volume yield reduction per hectare (2.11 m³/ha), whereas the Targhee National Forest had the lowest (0.64 m³/ha). Stand data indicated that although fewer hectares of lodgepole pine were infested on the Sawtooth National Forest than the Targhee National Forest, the infestations were more intense (higher DMR).

The total volume yield reduction caused by *A. americanum* in lodgepole pine stands in the Intermountain Region was estimated at 488,120 m³/yr, an average of 0.86 m³/ha. Since the average

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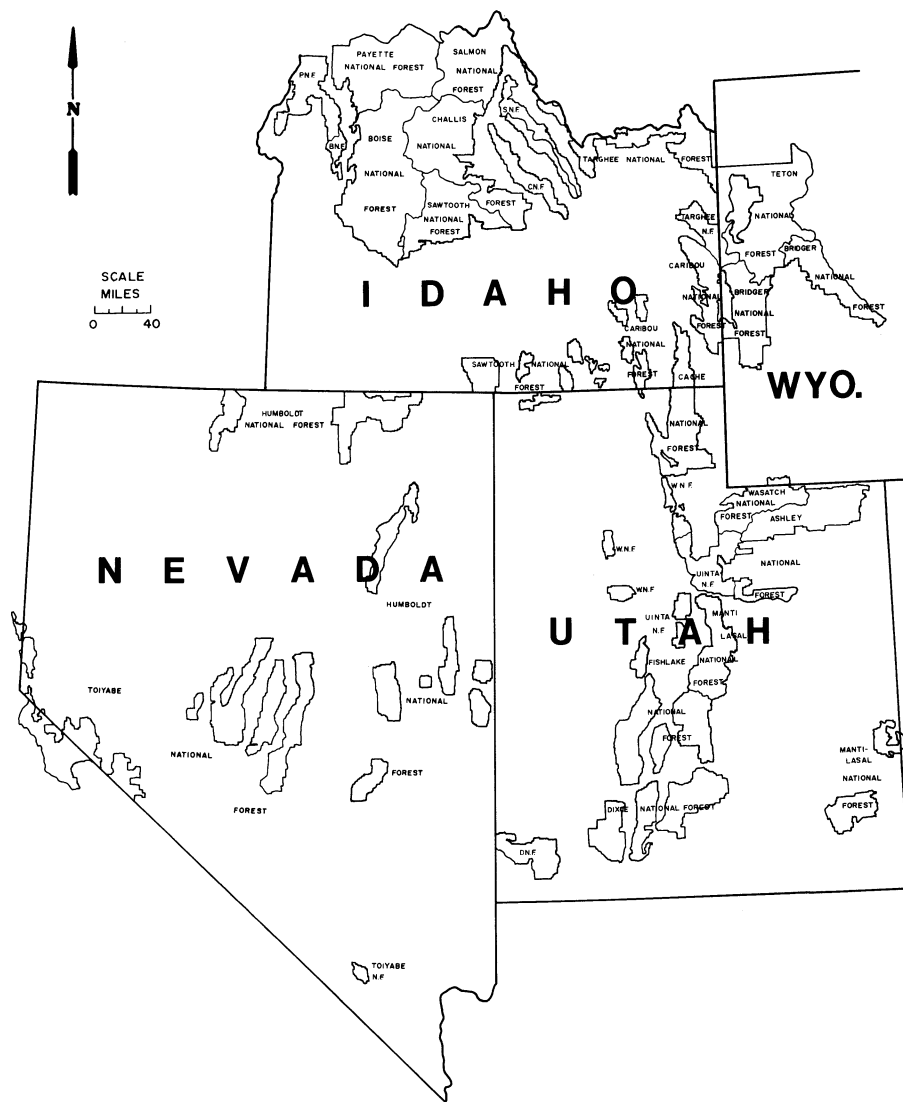


Fig. 1. National forests of the Intermountain Region, USDA Forest Service, Region 4.

Table 1. Incidence of *Arceuthobium americanum* in lodgepole pine stands in the Intermountain Region and estimates of annual reduction of timber volume yields by dwarf mistletoe

National forest	Area of host type × 1,000 ha	Area of host type infested		Annual volume yield reduction	
		× 1,000 ha	%	m ³ /ha	Total × 1,000 m ³
Idaho					
Boise	71.1	33.4	47	1.00	33.40
Caribou ^a	63.7	43.3	68	0.73	31.61
Challis	87.8	39.7	45	0.74	29.38
Payette	69.4	34.8	50	1.07	37.24
Salmon	114.5	67.5	59	1.28	86.40
Sawtooth ^b	10.7	7.6	71	2.11	16.04
Targhee	198.2	156.9	79	0.64	100.42
Subtotal	615.4	383.2	62	0.87	334.49
Nevada					
Toiyabe	15.0	2.5	17	... ^c	... ^c
Utah					
Ashley	100.1	58.2	58	0.91	52.96
Wasatch ^a	75.1	25.3	34	0.79	19.99
Subtotal	175.2	83.5	48	0.87	72.95
Wyoming					
Bridger and Teton ^a	146.1	97.2	67	0.83	80.68
Total	951.7	566.4	60	0.86	488.12

^aBecause of administrative jurisdiction, data from the Cache National Forest are divided between the Caribou and Wasatch national forests, and data from the Bridger and Teton national forests are combined.

^bExcludes Sawtooth National Recreation Area.

^cInsufficient data for calculation.

lodgepole pine volume harvested during both survey years was 592,556 m³, the estimated annual volume yield reduction caused by dwarf mistletoe exceeded 80% of the region's annual lodgepole pine harvest.

Dwarf mistletoe incidence and volume yield estimates presented in Table 1 are comparable to results of other large-scale surveys in surrounding areas. Dooling and Eder (3) reported 35% of all surveyed lodgepole pine stands in Montana infested with dwarf mistletoe. Johnson et al (10) found that in Colorado and Wyoming, 47 and 55%, respectively, of the surveyed lodgepole pine stands were infested. Annual volume yield reduction estimates in Montana forests averaged 0.70 m³/ha and ranged from 0.43 to 1.30 m³/ha (3). For six national forests in Colorado, Johnson et al (9) reported that annual lodgepole pine volume yield reductions averaged 0.62 m³/ha and ranged from 0 to 0.82 m³/ha.

Comparisons of dwarf mistletoe survey results are not intended to emphasize the problems of specific national forests but rather to focus on the damage dwarf mistletoe inflicts on lodgepole pine stands throughout the Rocky Mountains. This survey demonstrates the importance of these pests in present and future land management decisions.

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