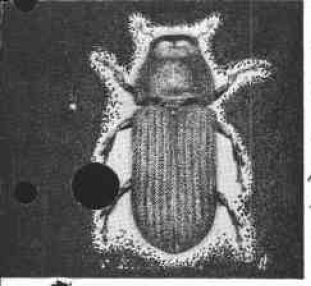

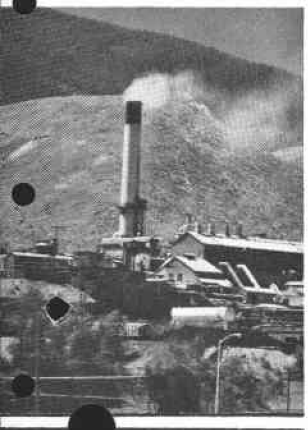

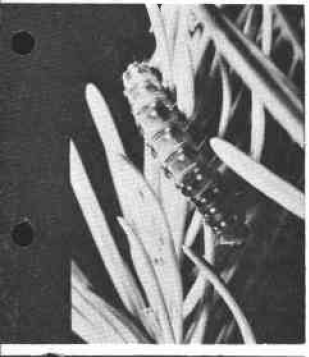
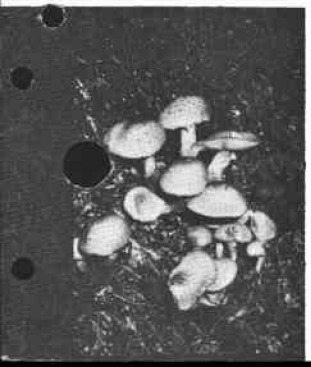

PRONG BINDER

FOREST INSECT & DISEASE MANAGEMENT

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EVALUATION OF A MOUNTAIN PINE BEETLE INFESTATION, SHOOK MOUNTAIN, SULA DISTRICT, BITTERROOT NATIONAL FOREST, 1977

by

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ABSTRACT

A mountain pine beetle outbreak developed on the north face of Shook Mountain in 1972. Beetle populations increased, and have continued at an epidemic level since 1973. Surveys show 404,798 ponderosa pine containing 12,173,940 bd. ft. volume of merchantable timber; and 20,875 lodgepole pine containing 730,625 bd. ft. volume of merchantable timber were killed from 1974 through 1976. Losses will continue as long as stands remain overstocked and stagnated. Reducing basal area below 120 ft.^{2}/acre by thinning and removing infested trees will manage the infestation. Suggestions are given to prevent buildup of secondary bark beetles.

INTRODUCTION

A mountain pine beetle (Dendroctonus ponderosae Hopk.) outbreak developed in second-growth ponderosa pine (Pinus ponderosa Laws) stands on the northeast side of Shook Mountain, Sula District, Bitterroot National Forest in 1972 (Hamel et al. 1974). Number of infested trees increased from 350 on 173 acres in 1972 to an estimated 1,200 trees on 624 acres in 1974, and over 100,000 infested trees on 1,150 acres yearly through 1976. To obtain data on infestation intensity and determine stand factors contributing to the infestation, a 1,150-acre area was surveyed in 1977 for bark beetle damage.

SURVEY METHODS

Green, infested, dead tree, and volume loss estimates were obtained using a variable plot cruise (BAF=20). Plots were located at 5-chain intervals on cruise lines 5 chains apart within the infested area. All trees within plots were recorded by species, diameter at breast height (d.b.h.), total height, and placed into the following classes:

1 = green, uninfested

2 = 1977 attack; green or partially faded, brood and blue stain present

3 = 1976 attack; yellow foliage, brood emerged

4 = 1975 or prior attack; majority of needles dropped

5 = unsuccessful attack or pitchout; green foliage and pitchtubes; blue stain absent.

Data were analyzed using the computer program INDIDS (Bousfield 1977).

RESULTS

Summaries of infested tree data are provided in table 1. Killed lodgepole pine averaged 7.6 inches d.b.h.; killed ponderosa pine averaged 8 inches d.b.h. Remaining green trees averaged 8 inches d.b.h. for lodgepole pine and 9 inches d.b.h. for ponderosa pine.

Table 1.--Estimated tree mortality and volume losses to mountain pine beetle in second-growth ponderosa pine, Shook Mountain, Bitterroot National Forest, MT, 1974-1977

Year	Average d.b.h. (inches)		Trees killed per acre		Total trees killed		Volume killed/acre (bd. ft.)		Total volume killed (bd. ft.)	
	LPP	PP	LPP	PP	LPP	PP	LPP	PP	LPP	PP
1974	0	7	0	90.2	0	103,740	0	2,706	0	3,142,200
1975	9	8	2.2	89.6	2,549	103,040	77	2,688	89,215	3,091,200
1976	7	7	2.5	92.3	2,822	105,222	87	2,769	98,770	3,156,660
1977	7	10	13.6	81.4	15,504	92,796	476	2,442	542,640	2,783,880
Total or Average	7.6	8.0	6.1	88.3	20,875	404,798	213	2,651	730,625	12,173,940

LPP = Lodgepole pine
PP = Ponderosa pine

Since 1972, the mountain pine beetle has killed 404,798 ponderosa pine amounting to a volume of 12,173,940 bd. ft. Since 1975, 20,875 lodgepole pine containing 730,625 bd. ft. have been killed.

Of the ponderosa pine killed, 26% were killed in 1974, 25% in 1975, 26% in 1976, and 23% in 1977. Tree mortality occurred in 3- to 22-inch d.b.h. size classes.

Of trees killed, 71% were 0 - 4.9 inches d.b.h.; 43% were 5 - 11.9 inches d.b.h.; and 27% were $\geq$ 12 inches d.b.h. Approximately 63% of the stand from 0 - 4.9 inches d.b.h.; 33% from 5 - 11.9 inches d.b.h.; and 12% of the trees $\geq$ 12 inches d.b.h. has been killed.

Percent mortality by diameter groups is shown in table 2.

Table 2.--Percent mortality/diameter classes, Shook Mountain, Sula District, Bitterroot National Forest, MT, 1975 - 1977

	Mortality (in percent) d.b.h. Size Classes (inches)		
Year	0 - 4.9	5 - 11.9	12+
1975	32	66	1
1976	32	66	1
1977	16	78	5

Basal area (BA) ranged from 20 to 500 $ft.^2$/acre, averaging 184 $ft.^2$/acre. Greatest BA was in the 5 - 11.9 inch d.b.h. classes, followed by the 0 - 4.9 inch d.b.h. classes, with the least amount of BA in diameters $\geq$ 12 inches d.b.h.

DISCUSSION

Outbreaks of mountain pine beetle in second-growth ponderosa pine stands are related to the following stand conditions (Sartwell and Stevens 1975):

1. Species composition: pure or nearly pure ponderosa pine

2. Stand structure: essentially even aged

3. Stand age: 50 to 100 years

4. Tree size: 8 to 12 inches d.b.h.

5. Stand density: stem basal area generally in excess of 150 ft.^{2}/acre.

In second-growth ponderosa pine, outbreaks develop almost exclusively in stands which have been undisturbed for many years, and may develop during years of both normal and deficient precipitation (Beal 1943; Blackman 1931). Outbreaks occur earlier in stands on good sites than those on poor sites. For example, in central Oregon where much ponderosa pine rates as site class III or IV (site index 71-98), stands usually sustain their first serious infestation between ages 50 and 75. In the Black Hills where site quality is poor, generally class V or VI (site index 43-70) stands are usually 75 to 100 years old when first infested (Meyer 1961).

Overstocked ponderosa pine stands (BA > 150 ft.^{2}/acre) are generally more susceptible to beetle attack (Sartwell 1971). The relationship of beetle-caused mortality to stand density is believed to be due to tree competition which reduces vigor and allows beetles to kill a larger proportion of trees in a dense stand than in a sparse one. Since the greatest amount of BA is contained in the 5 - 11.9 inch d.b.h. classes, thinning of trees with these diameters would open stands and reduce competition. Griffin (1975) found that second-growth stands thinned below BA 120 ft.^{2}/acre sustained less tree mortality up to 4 years after thinning than stands thinned only to a BA of 150 ft.^{2}/acre.

Surveys in the Nine Mile drainage (McGregor et al. 1974) and data analyzed by Griffin (1975) show thinning affects stands in several ways: (1) beetle caused tree mortality is significantly reduced; (2) spacing conditions are improved with lower stand densities; and (3) uninfested portions of thinned stands are unlikely to become infested in the future. Similar results have been reported for other stands in Oregon and Montana (Sartwell 1971; Sartwell and Stevens 1975; Stage 1958).

RECOMMENDATIONS

Silvicultural treatments deserve major emphasis in action programs against mountain pine beetle in second-growth ponderosa pine stands. Direct control and most other insect-oriented approaches to pest management, although sometimes useful, are costly, difficult to apply over large areas, and often ineffective.

Sales that remove infested trees, open stands, and leave mixed species composition are encouraged. Basal area should be reduced below 120 ft.^{2}/acre, with at least a 16-ft. spacing between residual trees. Meyer (1961) visualized a site index 70 stand thinned at age 30 from 119 ft.^{2} BA to 79 ft.^{2} BA. Subsequent intermediate cuts to 100 ft.^{2} BA, at 20-year intervals, will minimize or prevent mountain pine beetle outbreaks. Such a stand will reach a maximum of 134 ft.^{2} BA, at age 90, still below the 150 ft.^{2} BA usually considered hazardous.

Stands managed for other than maximum timber production may be repeatedly cut to lower densities; for example, 80-ft.^{2} BA/acre. Under these conditions, a stand greater than site index 70 will never exceed 98 ft.^{2} BA, well below hazard level.

Infested trees should be either salvage logged or skidded to a central landing and burned prior to beetle emergence. This will improve stand vigor and reduce and/or prevent future beetle infestation.

Although there was a decline in number of infested ponderosa pine/acre from 1976 to 1977, there was over a 6-fold increase in number of lodgepole pine killed from 1976 to 1977. Management of mountain pine beetle in lodgepole stands has been described by Amman et al. (1977).

Drought conditions during 1977 may weaken trees and make the ponderosa pine more susceptible to attack by primary and secondary bark beetles in 1978. Ips plastographus (LeC.) and Ips pini (Say) were found infesting trees in the Shook Mountain area. Both beetles can build to epidemic levels and cause significant tree mortality.

Pine engraver beetles (Ips spp.) are frequently associated with logging slash and thinning operations and prefer slash to standing green trees. If sufficient slash is not available to absorb emerging adult populations from April-September, beetles will attack groups of moisture-stressed trees.

Damage to trees caused by Ips spp. can be minimized by: (1) providing a constant supply of green slash from April through September, (2) thinning large areas by progressively thinning blocks of $\pm$ 10 acres during summer months, and (3) piling and burning slash as it becomes infested or when thinning is completed. Avoid scorching standing trees when burning slash. Scorched trees are weakened and susceptible to attack by the red turpentine beetle (Dendroctonus valens Lec.), as well as Ips spp. If weather prevents slash burning, chippers can be used to destroy beetle broods.

Slash < 3 inches in diameter dries rapidly and produces few beetles. Slash exposed to direct sunlight dries rapidly and causes brood mortality.

In logging and thinning areas, log decks can be left until they become infested with Ips, then transported to the mill. These logs should be processed and the slash burned prior to beetle emergence to prevent infestation of adjacent forests.

These practices will improve stand conditions and should reduce bark beetle populations to tolerable levels.

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