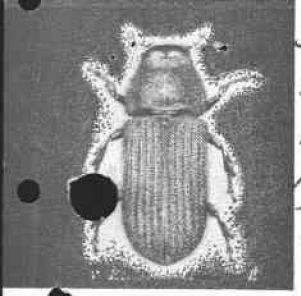
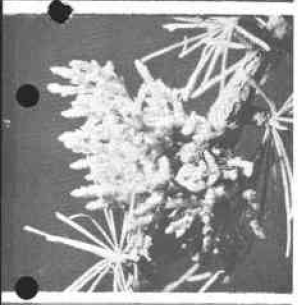

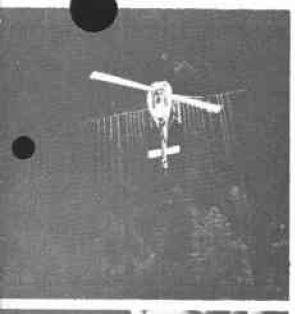

FOREST INSECT & DISEASE MANAGEMENT

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EVALUATION OF MOUNTAIN PINE BEETLE IN HIGH USE AREAS AND OTHER INFESTED STANDS ON THE HEBGEN LAKE RANGER DISTRICT, GALLATIN NATIONAL FOREST 1977

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ABSTRACT

Mountain pine beetle populations reached epidemic level on the Hebgen Lake Ranger District in 1970. Infested area increased from 6,680 acres in 1970 to 78,000 acres in 1977. Buildup ratio of trees killed in 1976 to trees killed in 1977 is 1:8. Approximately 1,700,000 trees, containing 175 MMBF of merchantable timber, are currently infested. An accelerated program of logging infested trees and silvicultural treatment to reduce the inventory of large diameter trees is recommended. In high use areas (campgrounds and administrative sites), 3,027 trees are currently infested. Buildup ratio is expected to exceed 1:1 in 1978. In high use areas all green lodgepole pine 7 inches d.b.h. and larger, which are to be retained, should be sprayed with the protective spray Sevimol 4®. Infested trees should be removed prior to July 1, 1978. Trees that have been dead for several years may be a hazard and should be removed.

INTRODUCTION

The present mountain pine beetle (Dendroctonus ponderosae Hopkins) infestation was first detected in uneven-aged lodgepole pine (Pinus contorta var. latifolia Engelm.) stands on the Hebgen Lake Ranger District in 1970 (Ciesla 1971; McGregor and Tunnock 1971). Since that time extensive infestation has occurred on the Moose Creek Plateau on the south end of the District, spread north yearly along the western edge of Yellowstone National Park to Johnson Lake, and along the west-southwest side of Hebgen Lake to Beaver Creek Campground. The infestation has recently spread to the Targhee Pass area.

Infested area increased from 6,680 acres in 1970 to 12,000 in 1974; 41,000 in 1975; 59,000 in 1976; and 78,000 in 1977 (figure 1).

District personnel need data to provide direction for logging in areas experiencing severe mortality and in areas of potential high mortality, and for planning protection of high use areas. This evaluation reports the number of newly infested trees per acre, buildup ratios, and predicted infestation trend.

METHODS

Tree and volume loss estimates and buildup ratios were based on eighty 1/10-acre plots located on lines at 5-chain intervals in six drainages. A hypsometer was used to determine trees to be tallied within plots. All green and infested trees 5 inches diameter breast height (d.b.h.) and larger were placed into one of these classes:

0 = Healthy trees
1 = Unknown or natural mortality
2 = Current beetle attack
3 = 1-year-old attack
4 = 2 years and older beetle attack
5 = Unsuccessful attack

Heights were recorded on two trees of each species that occurred per plot for estimating volume loss. Data were analyzed using the computer program INDIDS (Bousfield 1977). High use sites were 100 percent cruised for 1977 successfully attacked trees. Data were used to predict additional tree mortality and acreage that could become infested in 1978.

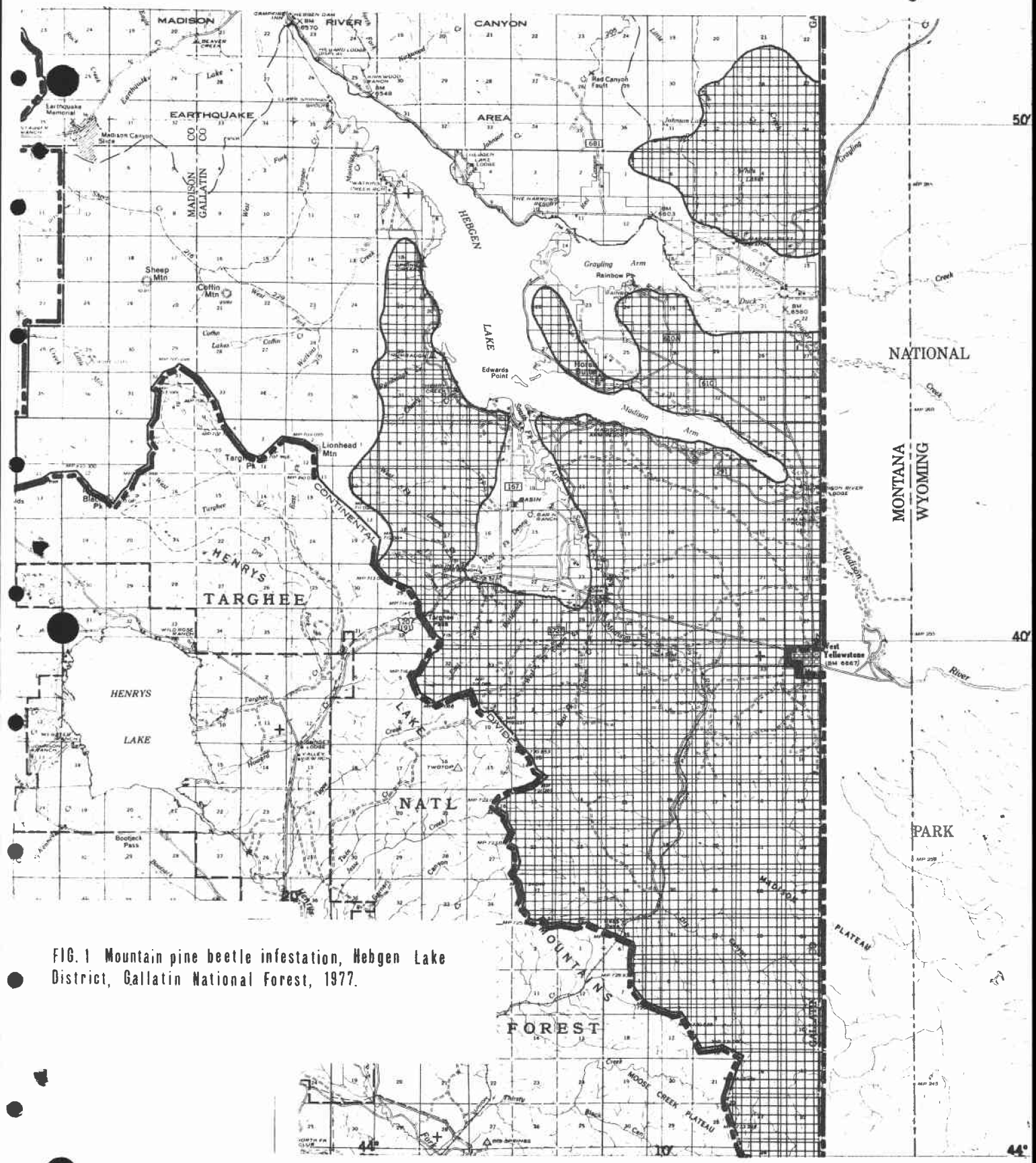

FIG. 1 Mountain pine beetle infestation, Hebgen Lake District, Gallatin National Forest, 1977.

RESULTS

Many coniferous stands on the Hebgen Lake Ranger District are mixed, uneven-aged species, with lodgepole pine the major component. Habitat type ranges from Pinus contorta/Purshia tridentata at lower elevations (6,667 ft.) to Abies lasiocarpa/Vaccinium scoparium at higher elevations (8,000 ft.) (Pfister et al. 1974).

Infestation intensity.--Intensity of infestation by year is presented in table 1. In 1977 an average of 22 trees per acre (range 0-44) were infested. Based on this, approximately 1,700,000 trees are currently infested. Buildup ratio from 1976 to 1977 averaged 1:8.

Trees $\geq$ 12 inches d.b.h. in pure lodgepole pine stands suffered greatest amount of mortality. Twenty-three percent of the tree mortality occurred in trees 5 to 11.9 inches d.b.h., and 77 percent in trees $\geq$ 12 inches d.b.h. Of the total stand killed, 33 percent of the mortality occurred in trees from 5 to 11.9 inches d.b.h., and 67 percent in trees $\geq$ 12 inches d.b.h. Lodgepole pine mortality increased from 5 percent in 1975, to 20 percent in 1976, and to 77 percent in 1977.

Volume loss ranged from 95 to 450 bd. ft./acre in 1975; 66 to 2,063 bd. ft./acre in 1976; and 468 to 3,376 bd. ft./acre in 1977. Of the volume killed to date, 7 percent occurred in 1975, 29 percent in 1976, and 64 percent in 1977.

Summary of insect losses in high use areas is shown in table 2.

SUMMARY AND DISCUSSION

Mountain pine beetle populations increased yearly with an increase in tree mortality, volume loss, and acreage infested. Our 1977 aerial survey identified visible faders (beetle-killed trees) on 78,000 acres. Using an average of 22 infested trees/acre, as determined from our evaluation, over 1,716,000 trees containing 175 MMBF of merchantable timber were killed in 1977.

Table 1.--Summary of mountain pine beetle infested stands surveyed, Hebgen Lake Ranger District, Gallatin National Forest, 1977

Area	D.b.h.	Trees/acre infested			Volume/acre infested (bd. ft.)			Percent lodgepole pine killed			Percent stand killed		
		1975	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Black Bear Canyon 1	0- 4.9			43			--1/			20			20
	5-11.9			30			--			6			6
	> 12.0			1			--			50			50
	Total			74			--			10			10
Black Bear Canyon 2	0- 4.9	--	--	--	--	--	--	--	--	--	--	--	--
	5-11.9	--	5	13	--	--	--	--	3	7	--	3	7
	> 12.0	--	5	12	--	--	--	--	10	6	--	10	26
	Total	--	10	25	--	--	--	--	3	8	--	3	7
Black Bear Canyon 3	0- 4.9	--	--	--	--	--	--	--	--	--	--	--	--
	5-11.9	--	--	23	--	--	--	--	--	4	--	--	4
	> 12.0	--	--	--	--	--	--	--	--	--	--	--	--
	Total	--	--	23	--	--	--	--	--	4	--	--	4
Spring Cr.	0- 4.9	--	--	--	--	--	--	--	--	--	--	--	--
	5-11.9	2	3	9	113	160	662	2	4	13	2	3	10
	> 12.0	1	6	11	256	1,574	2,689	4	15	35	3	13	31
	Total	3	9	20	369	1,734	3,351	3	8	20	2	5	12
Cream Cr.	0- 4.9	--	--	--	--	--	--	--	--	--	--	--	--
	5-11.9	--	6	25	--	235	994	--	4	17	--	4	17
	> 12.0	1	11	18	95	1,828	2,382	3	28	64	3	28	64
	Total	1	17	43	95	2,063	3,376	< 1	7	19	< 1	7	19
Madison Arm 1	0- 4.9	--	--	--	--	--	--	--	--	--	--	--	--
	5-11.9	1	5	33	76	253	842	< 1	2	16	< 1	2	16
	> 12.0	1	2	11	374	228	1,397	4	8	50	4	8	50
	Total	2	7	44	450	481	2,239	< 1	2	16	< 1	2	11
Madison Arm 2	0- 4.9	--	--	--	--	--	--	--	--	--	--	--	--
	5-11.9	1	3	6	45	66	198	1	2	4	1	2	4
	> 12.0	1	--	3	110	--	270	17	--	60	17	--	60
	Total	2	3	9	155	66	468	1	1	3	1	1	3

1/ Tree heights not recorded.

Table 2.--Summary of insect loss in high use areas, Hebgen Lake Ranger District, Gallatin National Forest, 1977

Location	Acres	No. 1977 attacked trees	No. attacked trees/acre	Avg. diameter of attacked trees (inches)
High Use Areas				
Cherry Creek Campground	5.0	120	24.0	16.0
Rimbaugh Ridge Campground	2.0	40	20.0	13.2
Spring Creek Campground	3.0	18	6.0	16.8
Lonesomehurst Campground	3.0	138	44.7	10.3
South Fork Campground	6.0	591	98.5	12.0
Bakers Hole Campground	25.0	858	34.3	8.8
Rainbow Point Campground	12.0	528	44.0	11.4
Beaver Creek Campground	15.0	126	8.4	13.8
Administrative Sites				
Hebgen Lake Ranger Station	7.0	570	81.4	9.5
Hebgen Lake Work Center	.5	38	76.0	10.0
Total or average	78.5	3,027	38.5	10.7

Based on buildup ratios from 1975 to 1977, and on the formula $Y' = y+bx$ (Baker 1968) where:

Y' = the potential cumulative number of trees killed predicted through 1978
y = cumulative number of trees killed through 1977
x = number of trees killed in 1977
x_1 = number of trees killed in 1976
$b = \frac{x}{x_1}$

we predict that 8,313,372 trees will be killed on 183,217 acres in 1978, bringing the cumulative total since 1975 to 10,635,680 trees. If the buildup ratio is only 1:1 from 1977 to 1978, over 1.5 million trees will be killed in 1978. However, we expect the buildup ratio to exceed 1:1 because the infestation does not appear to have reached its peak.

In addition to tree mortality, other negative effects occur where an infestation has persisted. Falling trees pose a hazard to road passage, trails, fences, powerlines, and to campers and hikers using the forest. Downfall may limit domestic animal use. Increased fuel loads result in hotter, more destructive fires (Amman et al. 1977). Excessive tree mortality hampers movement of big game, particularly in winter range areas. Slash or down trees in excess of 2 feet in depth will reduce deer use 50 percent.[1/]

Approximately 3,027 trees are currently infested in high use areas (table 2). District personnel marked 11,000 green trees in these units to be protected by spraying with Sevimol 4®. If the buildup ratio is only 1:1, more than 3,000 of the high valued trees will be killed in 1978. If the buildup ratio is 1:2, then more than half of these trees will be killed; and if the buildup ratio is 1:3, about three-fourths of the trees will be killed in 1978.

Pine snags in high use areas create problems of needle shedding, dead branches, and portions of the tip or trunk weakened by decay (Wagner 1963). Falling snags increase the hazard of human deaths or injuries and property damage to vehicles and structures. Protecting high valued trees until the infestation subsides will prevent the need to rehabilitate campgrounds by planting to protect esthetic values.

1/ 1975. Letter designated 2360 to Forest Supervisors and Staff Directors. The publication was a product of the Elk-Logging Study and will be included in the 1975 Annual Progress Report.

RECOMMENDATIONS

Stands where loss is predicted to continue at a high level can be managed in the following ways, depending upon land use objectives (Amman et al. 1977):

1. Recognizing that the beetle concentrates heavily on large diameter older trees (80+ years), continuous forests can be broken up by small clearcuts; that will result in different age and size classes, and reduce the area likely to be infested at any one time. When specific stands approach high risk conditions, they should be harvested.

2. Because the beetle shows preference for large diameter trees, selective cutting prior to beetle attack will greatly reduce infestation potential. Removal of trees $\geq$ 7.9 inches d.b.h. will "beetle-proof" most lodgepole stands. When partial cuts are prescribed, the residual stand should be numerically adequate and physically vigorous to maintain stocking and stand productivity.

Partial cutting may not be the best method of managing beetle populations in understocked or in overstocked stands, particularly if trees are on highly productive sites and growing well. In such stands, a high proportion of trees in diameter classes $\leq$ 7.9 inches d.b.h. may have thick phloem which is conducive to beetle production. These trees may then maintain the infestation at epidemic level. Clearcutting and regenerating these stands may be the best method of management.

3. Another management alternative for particularly susceptible stands is to favor nonhost trees such as Douglas-fir (Pseudotsuga menziesii var. glauca (Beissn.) Franco). In mixed species forests, nonhost trees will result in greater residual stocking should an outbreak develop. Data show that the beetles infest lodgepole pine in mixed species forests as readily as in pure forests (Amman and Baker 1972; Hamel and Oakes 1977). Conversion to another species (Douglas-fir, spruce, or subalpine fir) may result in depredations by other insects such as western spruce budworm (Choristoneura occidentalis Free.), Douglas-fir beetle (Dendroctonus pseudotsugae Hopk.), spruce beetle (Dentroctonus rufipennis (Kirby)), or the western balsam bark beetle (Dryocoetes confusus Swaine).

Potential losses from the mountain pine beetle can be minimized through an accelerated program of (1) logging infested trees, and (2) silvicultural treatment to reduce the inventory of large diameter, thick-phloemed, highly preferred trees. This should be directed to those stands rated as moderate and high hazard as to susceptibility to beetle attack. Beetle populations are expected to remain at epidemic level until the average tree diameter of the stand is reduced to < 7.9 inches d.b.h.

In high use areas we recommend green lodgepole pine 7 inches d.b.h. and larger be sprayed to a 5-inch top with Sevimol 4® to prevent attack by mountain pine beetle (Gibson 1977). Hazard (dead) trees should be removed or felled and used for firewood. Removal of infested trees prior to beetle flight would reduce the potential for beetle buildup.

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