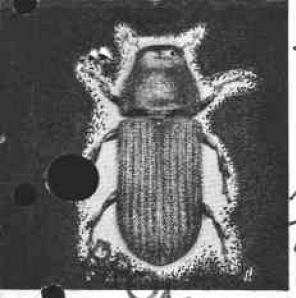

FOREST INSECT & DISEASE MANAGEMENT

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STATUS OF MOUNTAIN PINE BEETLE INFESTATIONS IN SECOND-GROWTH PONDEROSA PINE STANDS LITTLE BELT AND BIG SNOWY MOUNTAINS, LEWIS & CLARK NATIONAL FOREST, MONTANA, 1976

by

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ABSTRACT

Mountain pine beetle infestations in second-growth ponderosa pine have been chronic in the Little Belt and Big Snowy Mountains since 1947. In 1976, increasing numbers of attacked trees were observed. Current infestation intensity averages 82 trees per hectare. Losses are expected to continue as long as stands remain stagnated. Commercial sales and thinning to reduce basal area below 34 m^2/ha* are recommended. Precautions are given to prevent population buildup of secondary bark beetles.

INTRODUCTION

The mountain pine beetle (Dendroctonus ponderosae Hopk.) is a serious pest of second-growth ponderosa pine (Pinus ponderosa Laws) throughout the western United States (Dolph 1966; Keen 1952). Outbreaks appear in overstocked, 60-to 80-year-old, stagnated stands. Tree killing is indiscriminate with trees of all diameter classes attacked. Infestations usually reach epidemic levels rapidly and continue for several years before declining.

Infestations in the Little Belt and Big Snowy Mountains on State, private and National Forest lands have been chronic since 1947 (Evenden 1950). Aerial detection surveys in 1976 indicated increasing numbers of widely scattered groups of infested trees. Ground surveys were conducted to determine trend, and tree and volume losses.

*See Metric Conversion table, page 6.

SURVEY METHODS

Variable plot cruises (BAF-20) were conducted in six areas (figure 1). Plots were located at 100-m intervals on cruise lines 100 m apart within infested areas. Trees $\geq$ 12.7 cm diameter at breast height (d.b.h.) within plots were recorded by species, d.b.h., and total height and categorized into the following classes:

0 = green, uninfested.
1 = 1976 attack; green or partially faded foliage, brood and blue stain present.
2 = 1975 attack; red foliage, brood emerged.
3 = 1974 or prior attack; majority of needles dropped.
4 = unsuccessful attack or pitchout; green foliage and pitchtubes present; blue stain absent.

Approximately 918 ha were surveyed. Data were analyzed using a modified R-1 sale cruise program.

RESULTS

Ponderosa pine attacked in 1976 occurred as scattered singles and in groups up to 25 trees per group. Older attacked trees were found adjacent to newly infested trees. These two factors and the historical record indicate that infestations have been chronic for many years.

Summaries of tree mortality are provided in table 1. Approximately 49 percent of the attacked trees were killed in 1976, 41 percent in 1975, and 10 percent in 1974 and prior. Infestation levels average 82 infested trees per hectare (ha) and range from 0 in Casino Creek to 128 in Hansen Creek. Mean diameter of infested trees ranged from 20.3 to 30.5--average 25.4 cm d.b.h. Volume loss per hectare increased yearly and ranged from 0-1,760 m^3--mean 686 m^3 in 1974; 534 to 9,291 m^3--mean 3,580 in 1975; and 0 to 5,504 m^3--mean 2,948 in 1976. Twelve percent of the trees attacked in 1976 were classed pitchouts. Infested trees averaged 88 years of age.

Green stand data indicate that $>$ 85 percent of the remaining stands are ponderosa pine, 13 percent are Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Beissen) Franco), and $<$1 percent lodgepole pine (*Pinus contorta* var. *latifolia* Engelm.). Stem basal area ranged from 17 to 41, average 29 m^2/ha.

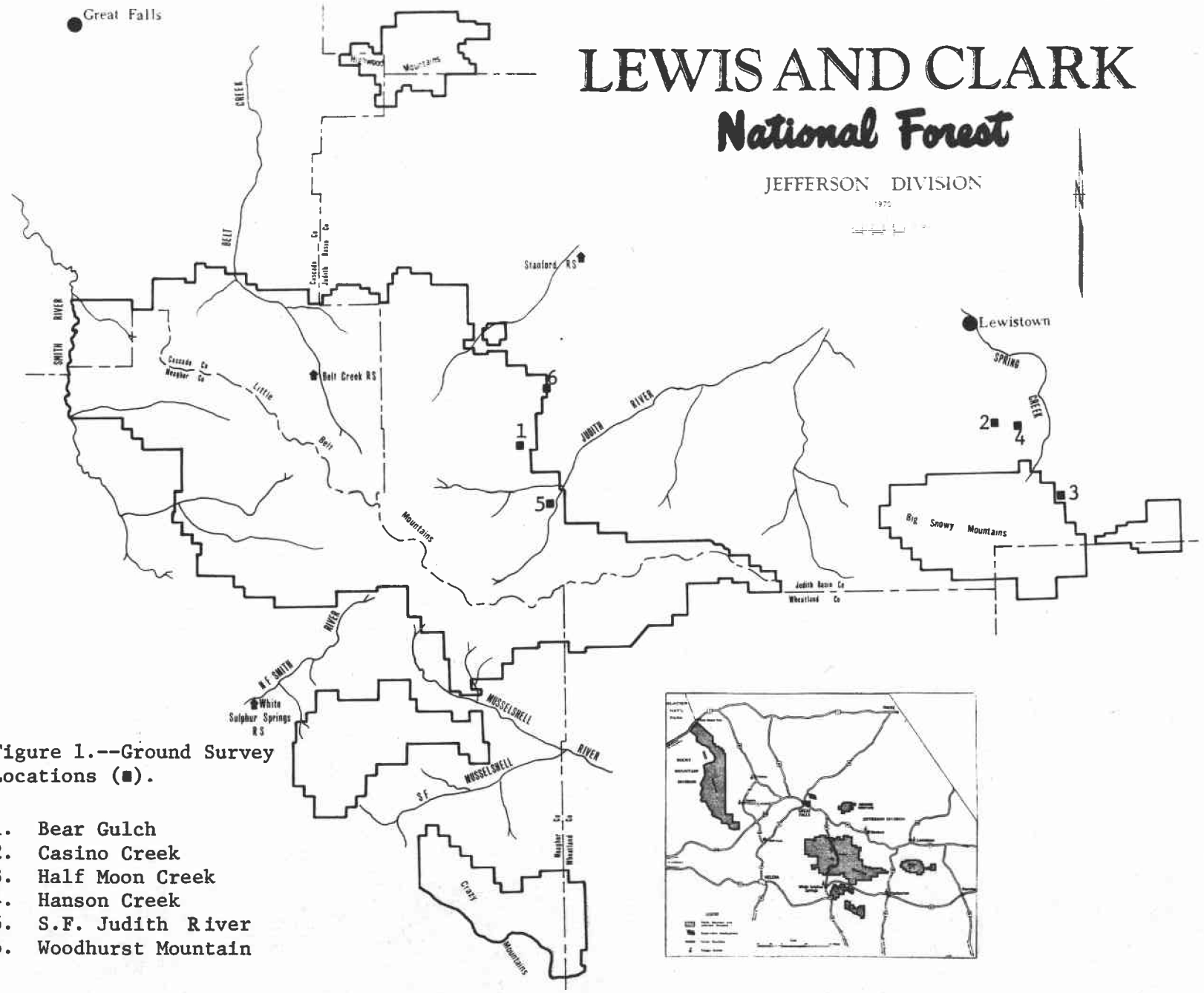

Figure 1.--Ground Survey Locations (■).

1. Bear Gulch
2. Casino Creek
3. Half Moon Creek
4. Hanson Creek
5. S.F. Judith River
6. Woodhurst Mountain

Table 1.--Estimated tree and volume losses to mountain pine beetle in second-growth ponderosa pine, Little Belt and Big Snowy Mountains, MT., 1976

Plot	Area (in ha)	Infested trees/ha						Estimated vol. loss (m^3)		
		1974	Mean d.b.h.	1975	Mean d.b.h.	1976	Mean d.b.h.	1974	1975	1976
Bear Gulch	405	17.3	22.9	74.1	27.9	101.3	20.3	1,092	9,291	4,787
Casino Creek	101	0	-	12.4	30.5	0	-	0	534	0
Half Moon Creek	121	12.4	20.3	79.1	27.9	84.0	30.5	222	3,572	5,504
Hansen Creek	49	9.9	27.9	59.3	27.9	128.5	25.4	230	1,120	2,284
S.F. Judith River	202	51.9	25.4	128.5	25.4	118.6	20.3	1,760	4,414	2,789
Woodhurst Mtn.	223	12.4	27.9	66.7	25.4	61.8	25.4	814	2,549	2,321
Total or average	1,100	17.3	25.4	69.2	27.9	81.5	25.4	686	3,580	2,948

DISCUSSION

Outbreaks of mountain pine beetle in 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: 20- to 30.5-cm d.b.h.;
5. Stand density: stem basal area generally in excess of 34 m^2/ha.

Infestations in the Little Belt and Big Snowy Mountains conform to all of these criteria except basal area, which averaged 29 m^2/ha, slightly less than the "critical minimum" 34 m^2/ha. These conditions also occurred in recently infested ponderosa pine stands on the Ninemile District, Lolo National Forest, northwest of Missoula, MT. (Bousfield et al. 1973; Ciesla and McGregor 1970; McGregor et al. 1974).

Overstocked ponderosa pine stands are generally more susceptible to attack by mountain pine beetle (Sartwell 1971). The relationship of beetle-caused mortality to stand density is believed to occur because over-crowding reduces tree vigor and allows the beetle to kill a larger proportion of trees in a dense stand than in a sparse one.

In the Ninemile drainage, Griffin (1975) found that thinning affected the stand in several ways: (1) tree mortality by the beetle was significantly reduced; (2) growing conditions for residual trees were improved with lower stand densities, and (3) uninfested portions of thinned stands are less likely 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

Data indicates that the most viable option for managing second-growth ponderosa pine stands to prevent outbreaks or to reduce mortality is through commercial thinning or silvicultural management. Sales to remove infested trees and open stands, leaving mixed species composition, is encouraged. Unmerchantable infested trees should be salvaged or skidded to a central landing and burned prior to beetle emergence. These management practices will improve stand vigor and reduce and/or prevent incidence of mountain pine beetle.

If drought conditions develop as predicted in 1977, between-tree competition for moisture will occur. Trees will weaken and become more susceptible to attack by primary as well as secondary bark beetles, e.g. Ips spp. If the drought continues, and if any type of cutting is conducted, certain conditions should be considered. Ips beetles, frequently associated with logging slash and thinning operations, prefer slash to standing green trees. However, if sufficient slash is not available to absorb emerging adult populations during spring (April and May), summer (June and July), and late summer (August and September), beetles will attack groups of moisture-stressed trees.

Damage to trees can be minimized by: (1) providing constant supply of green slash from April through September, (2) thinning large areas by progressively thinning blocks of $\pm$ 4 ha during summer months, and (3) piling and burning slash as it becomes infested and 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, use chippers to destroy beetle broods.

Slash $\leq$7.6 cm in diameter dries rapidly, and prevents brood development. Slash exposed to direct sunlight dries faster than shaded slash and causes brood mortality.

In logging and thinning areas, leaving logs decked until they become infested with Ips, then transporting them for processing will reduce beetle populations. At mill sites, process logs and burn slash prior to beetle emergence to prevent infestation of adjacent forests.

These practices will improve stand conditions and should reduce mountain pine beetle populations to tolerable levels. Secondary bark beetle population buildups should also be prevented.

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METRIC CONVERSIONS

m^2/ha x 4.35	= ft^2/acre
trees/ha x 2.471	= trees/acre
cm x 0.3937	= inches
m^3/ha x 0.075	= ft^3/acre
m^3 x 35.31	= ft^3