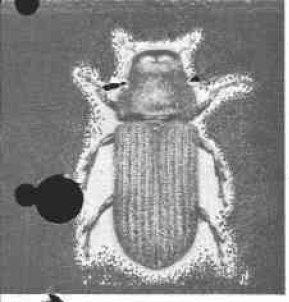
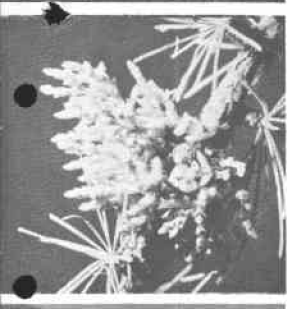
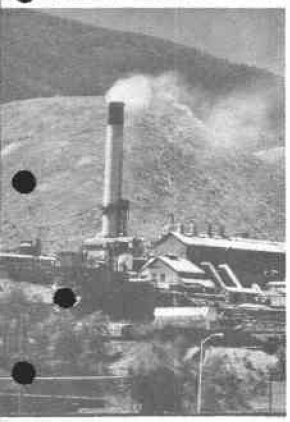


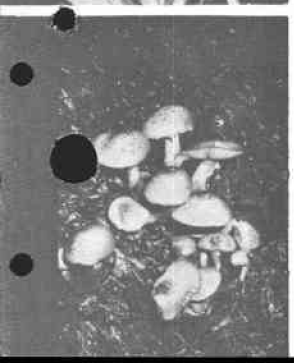

FOREST ENVIRONMENTAL PROTECTION

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EVALUATION OF MOUNTAIN PINE BEETLE INFESTATIONS, SNELL CREEK AND WARLAND PEAK AREAS, FISHER RIVER DISTRICT, KOOTENAI NATIONAL FOREST MONTANA

by

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ABSTRACT

Mountain pine beetle infestations in the Snell Creek and Warland Peak areas were evaluated in October 1975. Based on current buildup ratios, tree diameter distributions, stand composition and phloem thicknesses, there appears to be limited opportunity for epidemic potential in either area. Management alternatives are discussed. Selective logging is recommended to further decrease epidemic potential and reduce the infestations to endemic status.

Infestation Synopses

		Trend
Snell Creek		
Number of infested trees per acre-1975	6.4	Static/Increasing
Buildup ratio (1974 to 1975)	1:6.18	Static/Increasing
Mean diameter of currently attacked trees	9.0 in.	Decreasing
Mean diameter of residual green stand	9.5 in.	Decreasing
Mean phloem thickness of currently attacked trees	0.07 in.	Decreasing
Mean phloem thickness of residual green stand	0.07 in.	Decreasing
Percentage of residual green stand ≥ 10 inches d.b.h.	33	Decreasing
Percentage of stand mixed species	51.7	Increasing

Recommendation: Conduct selective logging to remove lodgepole pine component and convert to greater mixed species composition.

Warland Peak		
Number of infested trees per acre-1975	0	Static/Decreasing
Buildup ratio (1974 to 1975)	1:0	Static/Decreasing
Mean diameter of currently attacked trees	N/A	N/A
Mean diameter of residual green stand	11.05 in.	Decreasing
Mean phloem thickness of currently attacked trees	N/A	N/A
Mean phloem thickness of residual green stand	0.08 in.	Decreasing
Percentage of residual green stand ≥ 10 inches d.b.h.	73.4	Decreasing
Percentage of stand mixed species	28.2	Increasing

Recommendation: Allow natural decline to occur and/or selectively log to remove lodgepole pine component and convert to greater mixed species composition.

INTRODUCTION

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., infestations in the Snell Creek and Warland Peak areas, Fisher River District, Kootenai National Forest (Figure 1), were detected during the annual insect and disease survey of the Region. Evaluations of the areas were requested by the District Ranger to determine infestation boundaries, estimate tree losses, and measure buildup ratios.

METHODS

Ground surveys were conducted in the Snell Creek and Warland Peak areas in October 1975. Within each area, ten 1/10-acre plots were established at 5-chain intervals on lines through the

KOOTENAI NATIONAL FOREST

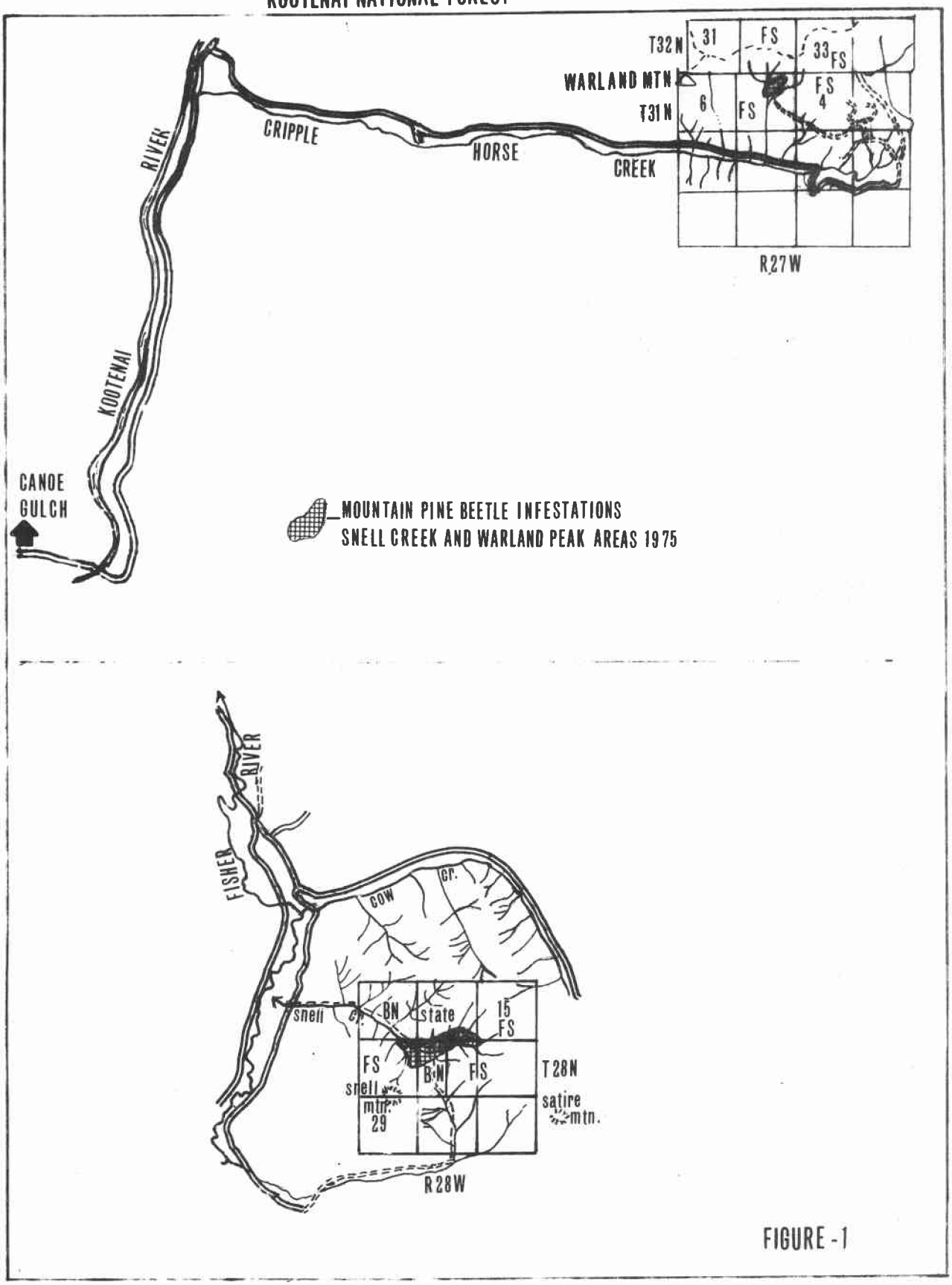

FIGURE - 1

infestations. Hypsometers were used to determine if trees fell within plot boundaries. All green trees were recorded by species and measured by diameter at breast height (d.b.h.). Estimates of phloem thickness for each diameter class were obtained from bark samples removed from opposite sides of two trees in each d.b.h. size class. Phloem thickness was measured to the nearest 1/100 inch using a steel ruler. Tree diameters were measured to the nearest inch.

In addition to the ten 1/10-acre plots, twenty ¼-acre plots were taken to determine level of beetle infestation and buildup ratio.

Infested trees in each plot were recorded by species, diameter at breast height, and categorized into the following classes:

1 - 1975 attack; green or partially faded foliage, brood in cambium, and blue stain present.

2 - 1974 attack; red foliage, brood emerged.

3 - 1973 or prior attack; majority of needles dropped.

4 - unsuccessful attack or pitchout; brood and blue stain absent.

RESULTS

Stand descriptions.--Habitat types in the Snell Creek drainage range from Douglas-fir/ninebark to Douglas-fir/pine grass (8). Stand composition is lodgepole pine, *Pinus contorta* Dougl., 48.2 percent; Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, 30.2 percent; Larch, *Larix occidentalis* Nutt., 13.7 percent, and ponderosa pine, *Pinus ponderosa* Laws, 7.8 percent. The majority of the current infestation in Snell Creek occurs on State and privately owned or administered lands. Habitat types in the Warland Peak area range from subalpine fir/grouse whortleberry to subalpine fir/beargrass. The infested stand is composed of: lodgepole pine, 71.8 percent; larch, 11.6 percent; spruce, *Picea engelmannii* Parry, 9.9 percent; subalpine fir, *Abies lasiocarpa* (Hopk.) Nutt., 5.8 percent; and Douglas-fir, 1 percent, and occurs on Forest Service land.

Intensity of infestation.--The Snell Creek infestation averaged 6.4 infested trees per acre in 1973 and 3.4 trees per acre in 1974. Level of infestation increased to 21.0 trees per acre in 1975. This represents a 1:0.5 ratio of old to newly attacked

trees from 1973 to 1974, and a 1:6.18 buildup ratio from 1974 to 1975. Infested trees each year averaged approximately 9 inches d.b.h. Numbers and percentages of infested trees by diameter class are shown below (Table 1).

Table 1.--Number and percent of infested trees by diameter class, Snell Creek drainage, Fisher River District, Kootenai National Forest, 1973-1975.

Year and percent	D.b.h. size class (in inches)											
	5	6	7	8	9	10	11	12	13	14	14+	Total
1973	0	0	3	8	9	9	1	2	0	0	0	32
%	0	0	9.3	25.0	28.1	28.1	3.1	6.2	0	0	0	
1974	0	0	0	3	7	3	3	1	0	0	0	17
%	0	0	0	17.6	41.2	17.6	17.6	5.9	0	0	0	
1975	4	11	23	24	7	16	8	2	7	4	0	106
%	3.8	10.4	22.1	22.6	6.6	15.0	7.5	1.9	6.6	3.8	0	

Average phloem thickness of 1975 attacked trees was 0.07 inch. Phloem thickness of remaining green trees ranged from 0.03 to 0.10 inch and averaged 0.07 inch (Table 2). Thirty-three percent of the residual green stand is 10 inches d.b.h. and larger.

Table 2.--Summary of phloem measurements of residual lodgepole pine, Snell Creek drainage, Fisher River District, Kootenai National Forest, 1975.

D.b.h.	Mean	Standard deviation	Standard error
5	0.064	0.015	0.005
6	.069	.018	.005
7	.063	.021	.007
8	.064	.014	.004
9	.068	.017	.004
10	.072	.024	.007
11	.069	.022	.005
12	.085	.007	.005
13	.090	.000	.000
14	.095	.007	.005

The Warland Peak infestation is exhibiting a natural decline. Average number of infested trees per acre was 17.6 for 1973. This decreased to 3.0 infested trees per acre in 1974 and no currently infested trees were located in 1975. Infested trees in 1973 and 1974 averaged 8 inches d.b.h. Numbers and percentages of 1973 and 1974 infested trees by diameter class are shown in Table 3.

Table 3.--Number and percent of infested trees by diameter class, Warland Peak, Fisher River District, Kootenai National Forest, 1973-1974.

Year and percent	D.b.h. size class (in inches)											
	5	6	7	8	9	10	11	12	13	14	14+	Total
1973	7	6	16	12	17	12	3	10	1	2	2	88
%	7.9	6.8	18.1	13.6	19.3	13.6	3.4	11.3	1.1	2.2	2.2	
1974	0	2	1	6	2	2	0	1	1	0	0	15
%	0	13.3	6.6	40.0	13.3	13.3	0	6.6	6.6	0	0	

Seventy-two percent of the residual green stand in this area is lodgepole pine and of these 73.4 percent are 10 inches d.b.h. or larger. Phloem thickness of remaining green trees ranged from 0.03 to 0.14 inch and averaged 0.08 inch (Table 4).

Table 4.--Summary of phloem measurements of residual lodgepole pine, Warland Peak, Fisher River District, Kootenai National Forest, 1975.

D.b.h.	Mean	Standard deviation	Standard error
5	---	---	---
6	0.049	0.008	0.003
7	.066	.017	.005
8	.062	.023	.007
9	.064	.020	.005
10	.068	.020	.005
11	.071	.021	.004
12	.095	.022	.004
13	.088	.024	.005
14	.076	.020	.005
14+	.100	.010	.006

DISCUSSION

Infestations of mountain pine beetle usually develop in stands 80 years and older, containing many trees 10 inches d.b.h. and larger. Under outbreak conditions, stand depletion can increase 4 to 9 percent with each diameter class increase above 6 inches d.b.h. (10). Epidemic conditions can exist until the larger diameter trees and those with thick phloem ($\geq$ 0.10 inch) are killed, resulting in an average diameter of the residual stand usually below 8 inches d.b.h.

Number of trees killed during outbreaks is dependent on population density, which is influenced by phloem thickness, tree diameter, stand density, and habitat type (4, 10). Phloem thickness is considered the principal factor regulating brood production (1). Amman's studies (1, 2) have shown brood production to be positively correlated with phloem thickness and phloem thickness positively correlated with tree diameter. Others (5) have concluded that correlations of phloem thickness over diameter become effective measurements for evaluating infestation potential in a stand.

Evaluations of the Fisher River infestation indicate that in Snell Creek, 33.3 percent of the trees are 10 inches d.b.h. or larger. Average diameter of the lodgepole pine component is 9.5 inches. Around Warland Peak, 73.4 percent of the lodgepole pine are 10 inches d.b.h. or larger with an average tree diameter of 10.6 inches. From phloem samples taken 3.9 percent of all trees in Snell Creek had phloem thickness greater than or equal to 0.10 inch, while in the Warland Peak area, 22.7 percent of all trees sampled had a phloem thickness greater than or equal to 0.10 inch. In both areas, it is the larger diameter trees which have thicker phloem.

Mountain pine beetle prefers larger diameter trees each year as well as over the life of an infestation (6, 7, 3). Reid (9) observed that beetle survival increased with tree diameter. Our data for the Fisher River District infestation show that as the infestations have progressed over the last 3 years, *D. ponderosae* has progressively taken the larger diameter, thicker phloemed trees first.

As these larger trees are removed from stands, either by beetles or by selective logging, infestations decline in intensity.

MANAGEMENT ALTERNATIVES

Several alternatives are currently available for dealing with mountain pine beetle infestations. These are:

1. Do nothing.

2. Apply direct controls

   a. Fell and burn infested trees.
   b. Salvage log infested trees.

3. Apply silvicultural practices

   a. Selectively log to remove infested trees and that component of the stand containing phloem greater than or equal to 0.10 inch.

   b. Selectively log to remove lodgepole pine component and convert to desired crop trees of mixed species.

In the event that no controls are exercised, the infestations may decline of their own accord. In Snell Creek nearly 60 percent of 1975 attacked trees were 8 inches or less d.b.h., an indicator that the larger size classes have already been attacked and killed. In the Warland Peak area, no 1975 attacked trees were located and buildup ratios for this area indicate a natural decline.

Applied suppression by felling and burning or salvage logging infested trees may serve as holding actions although they do not lessen overall stand susceptibility.

By selectively logging infested trees and generator trees (i.e., trees having phloem thickness greater than or equal to 0.10 inch) or by converting to greater mixed species, the stand structures can be altered resulting in continued beetle population declines in both areas.

It is our recommendation that a planned harvesting strategy, employing selective logging practices, be considered to reduce the beetle to endemic status and reduce stand susceptibility.

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