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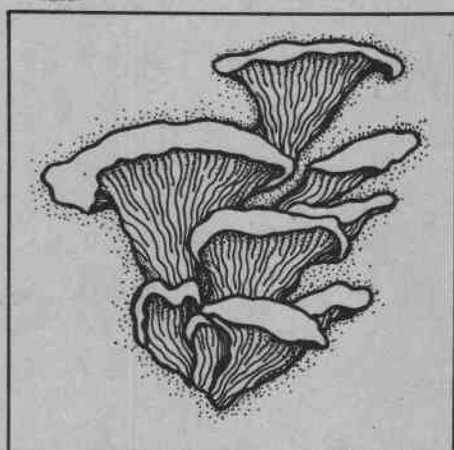
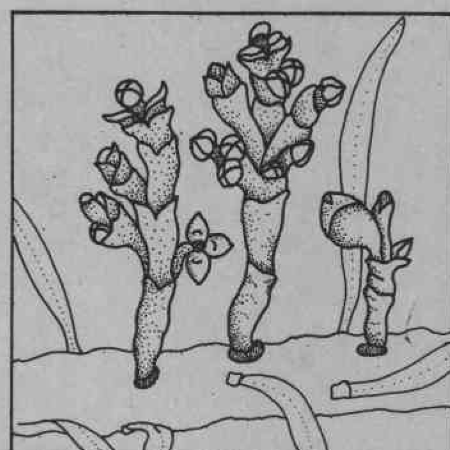
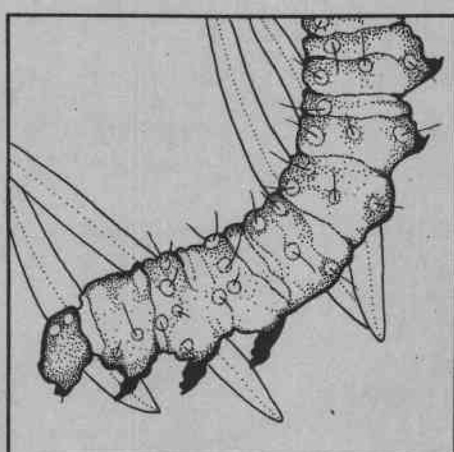
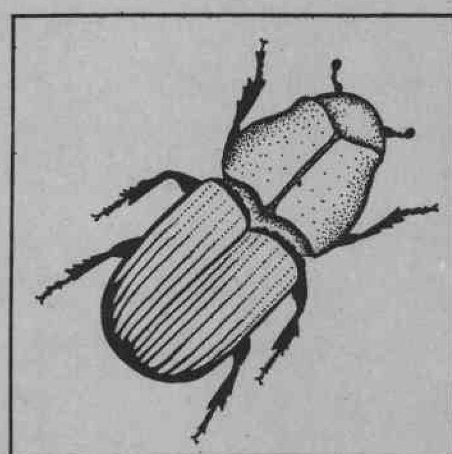
ESTABLISHMENT REPORT:

PERMANENT MOUNTAIN PINE BEETLE POPULATION TREND PLOTS, Montana, 1979

by K.E. Gibson, M.D. McGregor, and D.D. Bennett

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ESTABLISHMENT REPORT: PERMANENT MOUNTAIN PINE BEETLE POPULATION TREND PLOTS, MONTANA 1979

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ABSTRACT

Thirty permanent mountain pine beetle population trend plots were established in each of six areas in the State in 1979. Infestation levels ranged from 0 to 47.8 new attacks per acre. The potential for increased mortality is considered high for all areas. Each area will be evaluated for 5 years to determine the course of the infestation and resultant impact to the stands.

INTRODUCTION

The mountain pine beetle is now entering the third consecutive decade in the current epidemic. In the Rocky Mountain West, it has firmly established itself as the most damaging insect pest of lodgepole pine throughout its range. In Montana, epidemics which began in the early 1960's are now beginning to wane as the preferred host of the beetle becomes depleted. However, many stands have recently become infested as the beetle moves from one susceptible stand to another.

In various parts of the beetle's range, as epidemics grew, then faded, population trend studies were conducted to measure beetle impact on a particular stand. Parker (1973) described one such study in Yellowstone National Park. Gibson and Bennett (1978) detailed a similar evaluation on the Targhee National Forest in southeastern Idaho. No such trend studies have been done in Montana during the current series of epidemics. Differences in stand structure, climate, and infestation intensity between Montana and locations where other studies have been done make direct comparisons difficult. For this reason, we believe beetle population trend evaluations pertinent to local conditions are of value to land managers in the State. Six sites were selected where beetle populations were low (at the time of their selection), but where stand susceptibility is regarded as high. Stands were selected so that each of the current infestations was represented. They are: (1) Centennial Valley, BLM; (2) Madison River, Madison River RD, Beaverhead NF; (3) Murr Creek, Plains RD, Lolo NF; (4) Boulder Creek, Rexford RD, Kootenai NF; (5) Dunsire Creek, Tally Lake RD, Flathead NF; and (6) Cedar Creek, Spotted Bear RD, Flathead NF (figures 1-7).

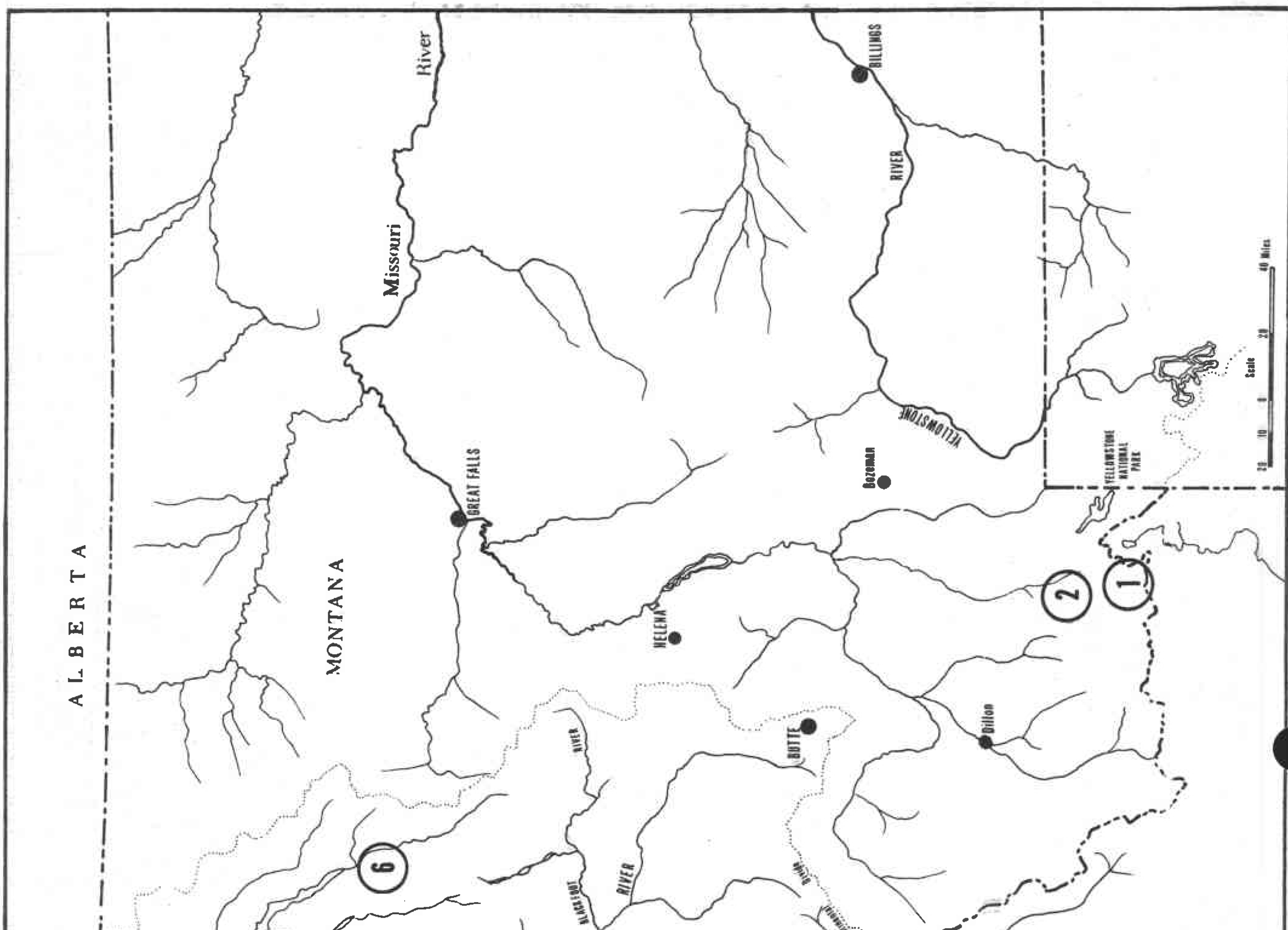

Figure 1.--Locations of permanent mountain pine beetle trend plots in Montana. Numbers correspond to area numbers in figures 2 through 7.

Errata Sheet for Establishment Report: Permanent Mountain Pine Beetle Population Trend Plots, Montana, 1979, by K. E. Gibson, M. D. McGregor, and D. D. Bennett (USDA-Forest Service, Northern Region, Forest Insect and Disease Management Report No. 80-8).

Plot location maps, pages 3 through 8:

Figure 2. Centennial Valley map on page 7
Figure 3. Madison River map on page 3
Figure 4. Murr Creek map correct as printed
Figure 5. Boulder Creek map on page 4
Figure 6. Dunsire Creek map on page 6
Figure 7. Cedar Creek map correct as printed

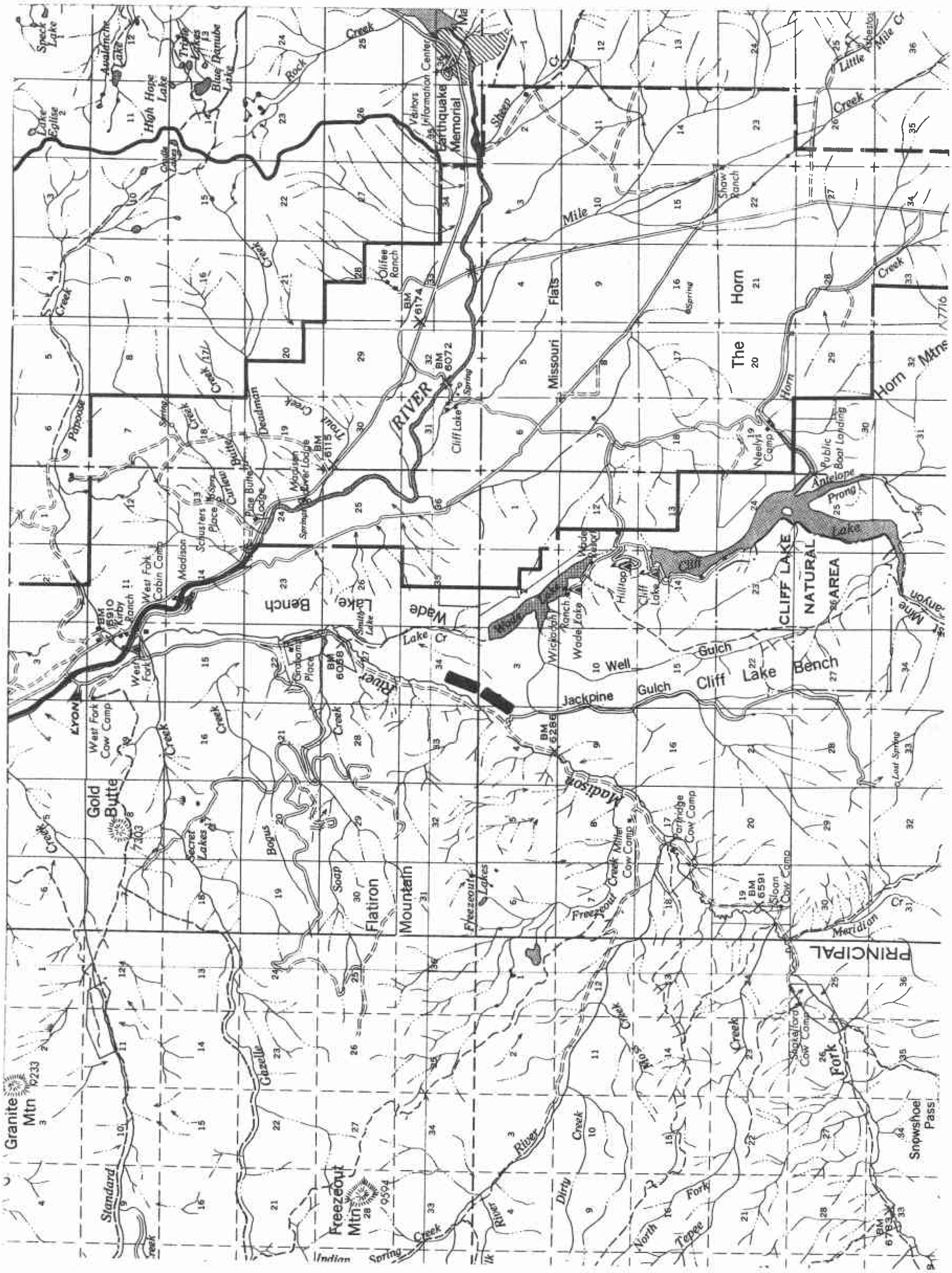

Figure 2.--Centennial Valley permanent plot area (1). Bars (▬) show approximate plot locations.

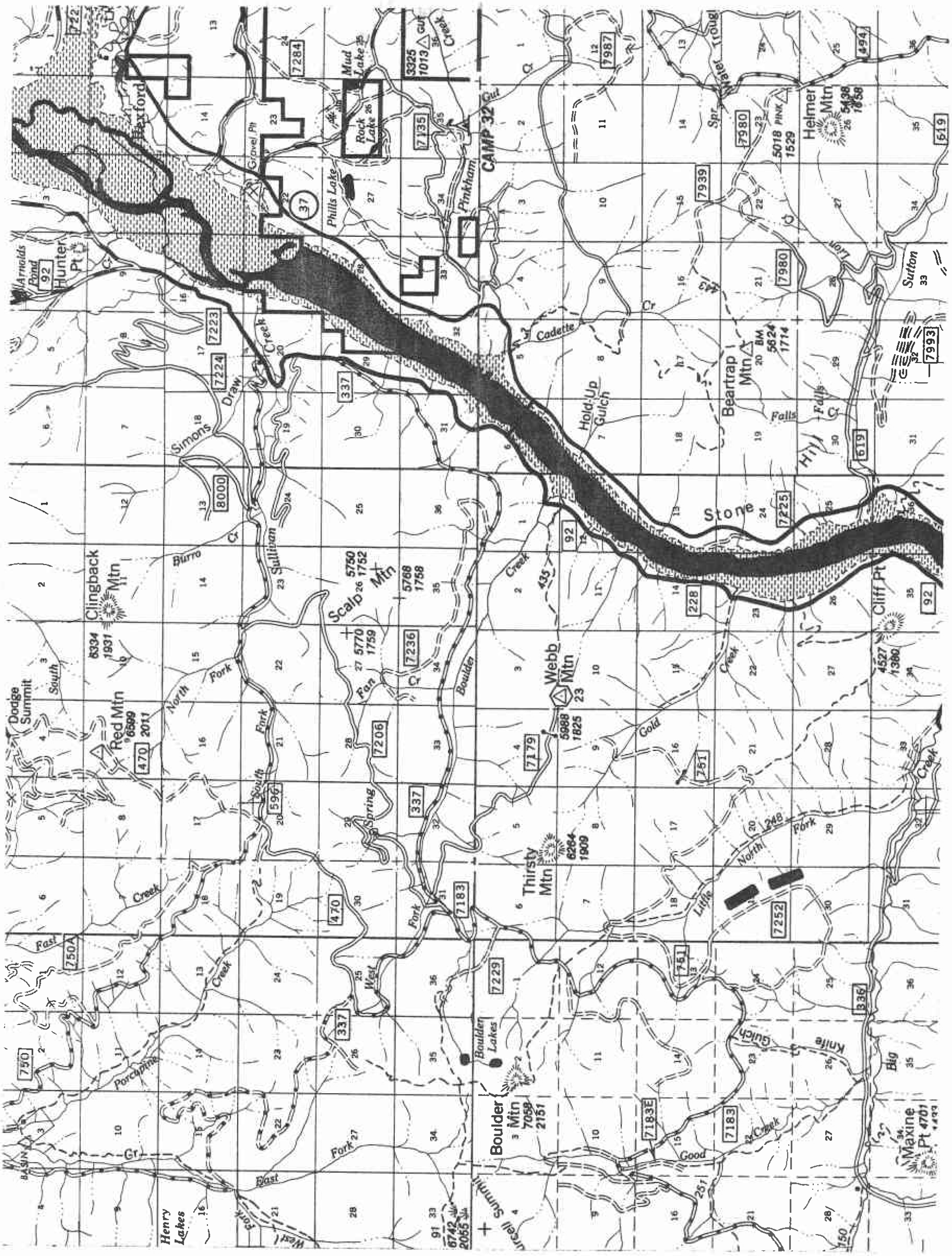

Figure 3.--Madison River permanent plot area (2). Bars (▬) show approximate plot locations.

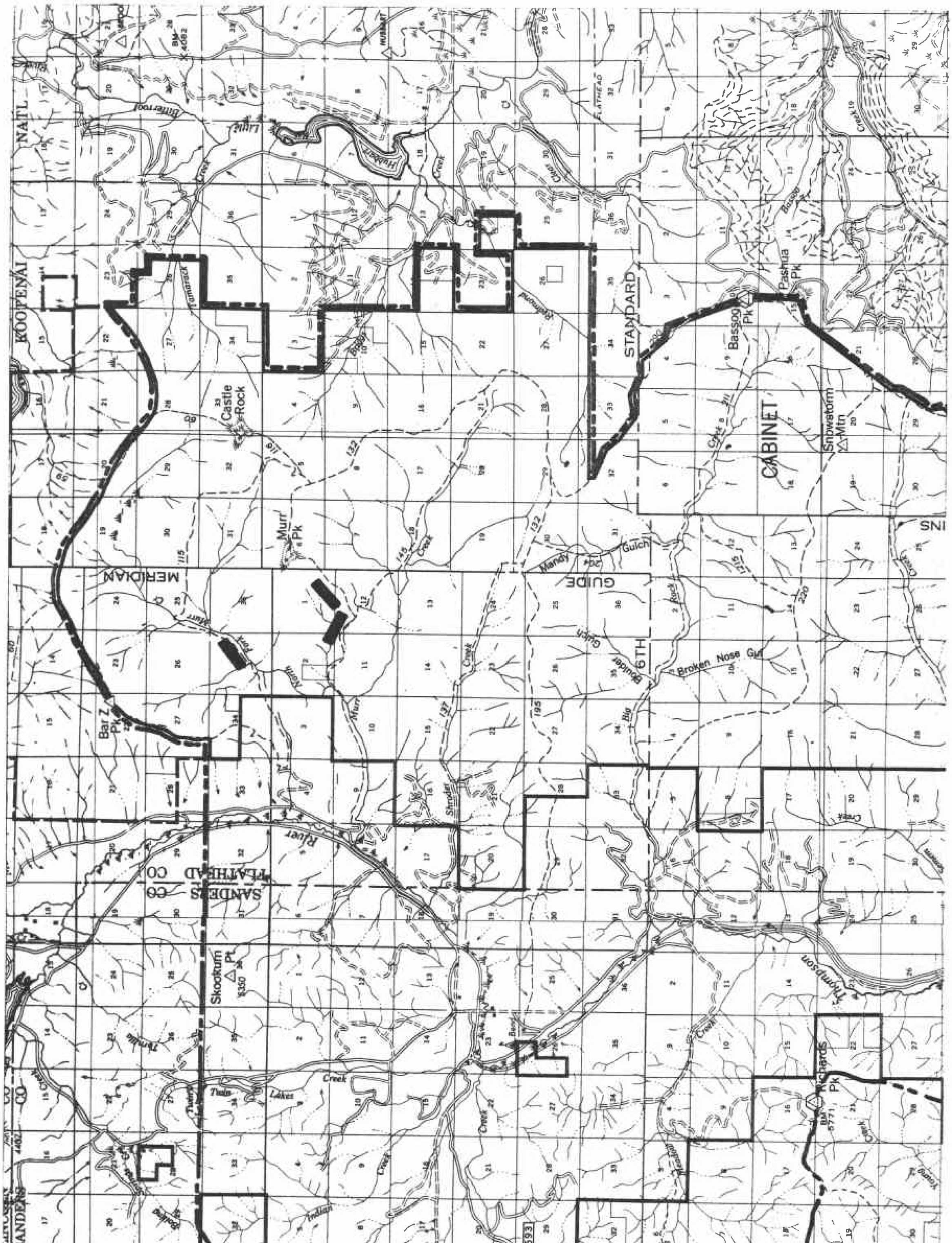

Figure 4.--Murr Creek permanent plot area (3). Bars (▬) show approximate plot locations.

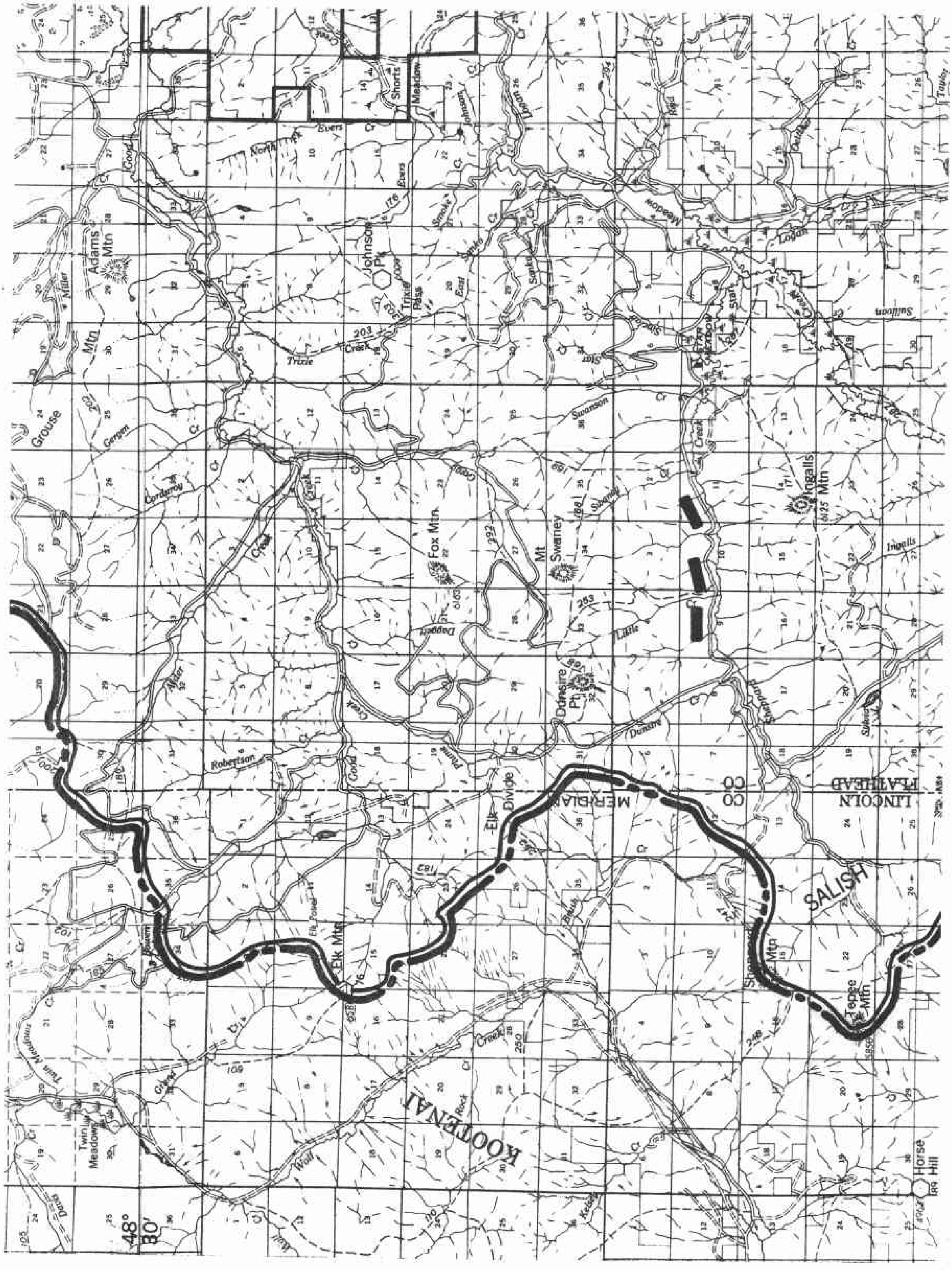

Figure 5.--Boulder Creek permanent plot area (4). Bars (▬) show approximate plot locations.

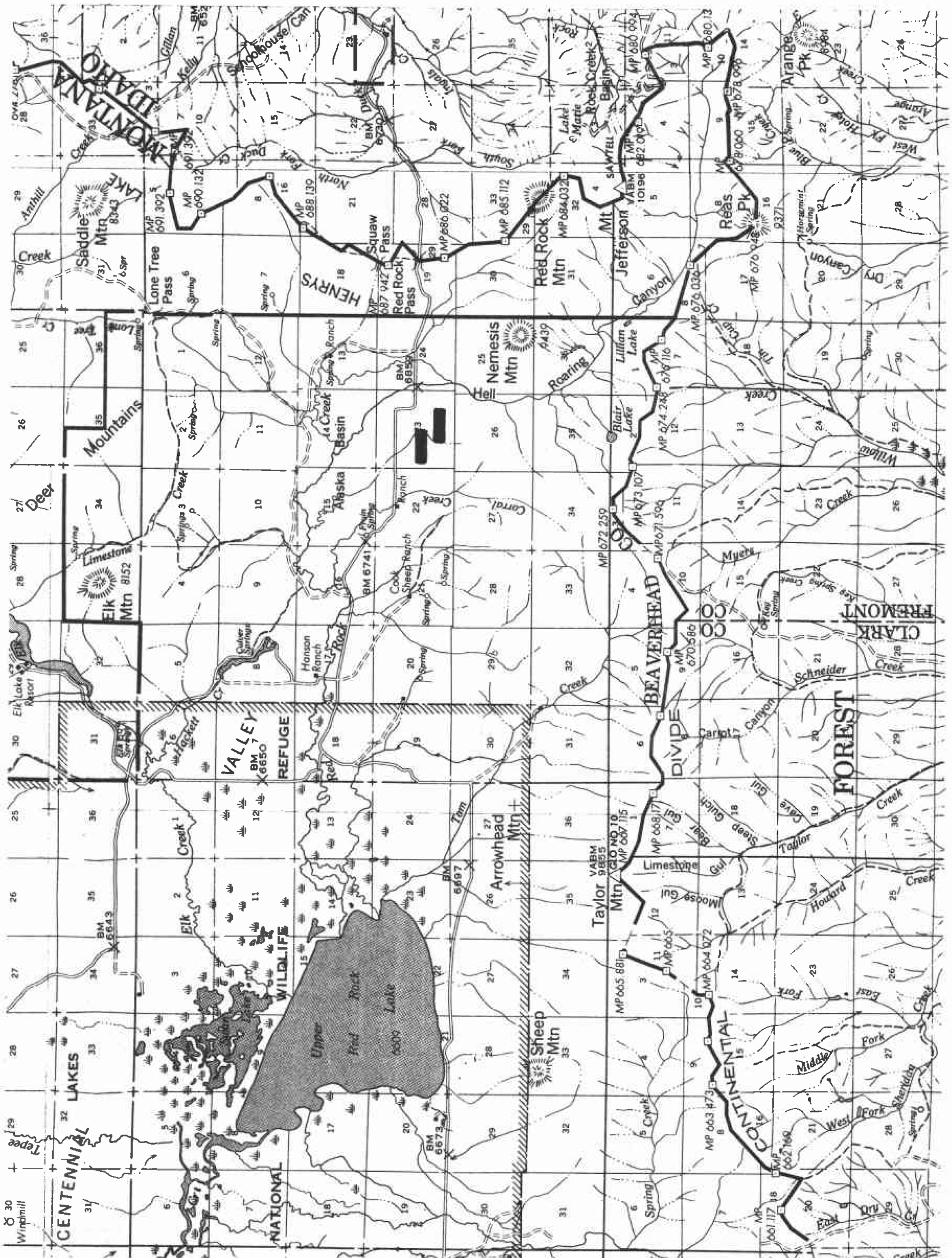

Figure ~~4~~ 2.--~~Dunsire Creek~~ CENTENNIAL VALLEY permanent plot area (5). Bars (▬) show approximate plot locations.

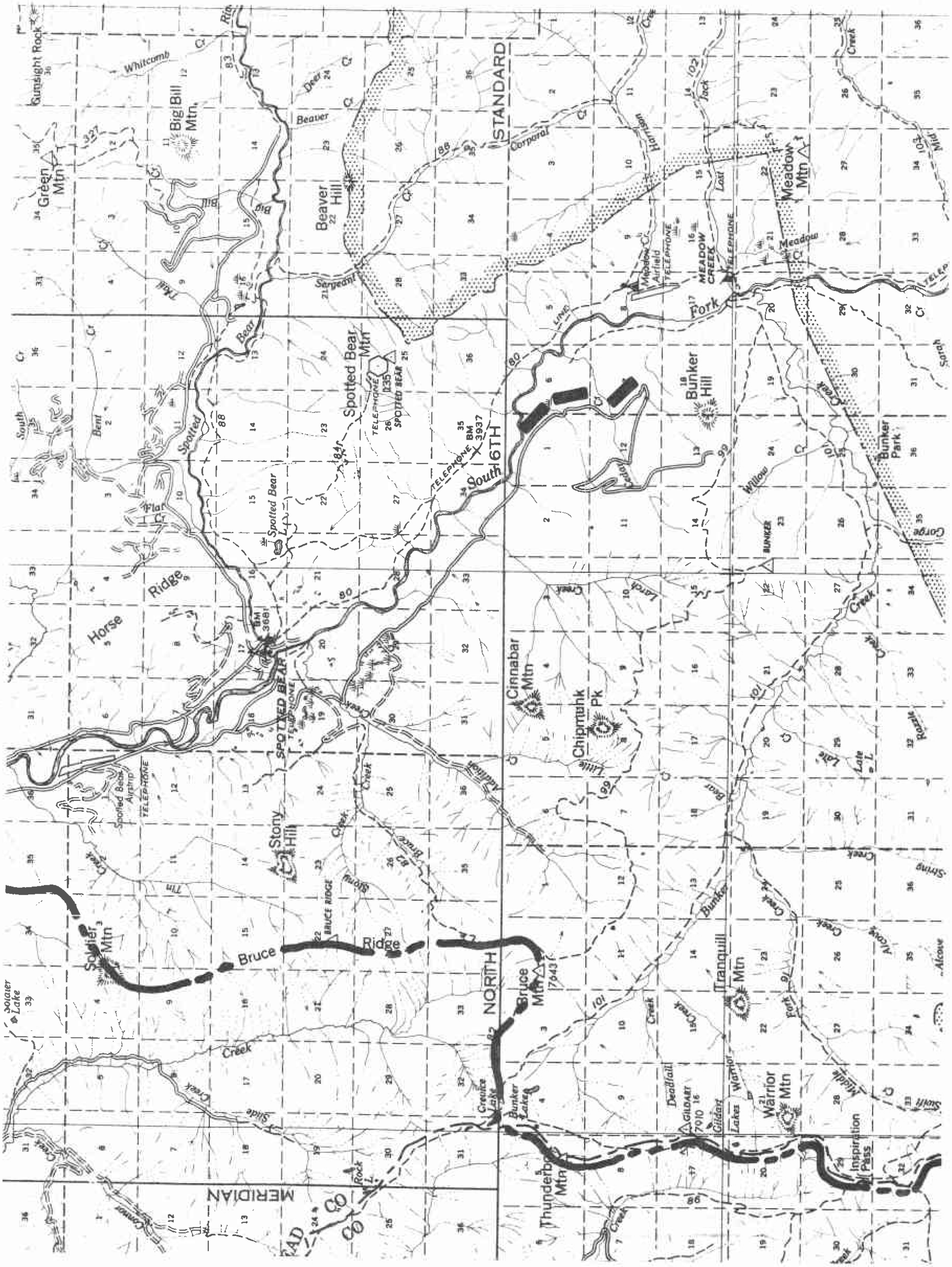

Figure 7.--Cedar Creek permanent plot area (6). Bars (▬) show approximate plot locations.

METHODS

Potential survey sites were selected from aerial survey maps. Following that, personnel from the several Districts were contacted to either confirm our selection or choose an alternative site. One important criterion to be met was that sites would not be logged for the next 5 years. Finally, sites were evaluated on the ground to ascertain that they would satisfy our needs.

Plots were established prior to beetle flight in July and August 1979. We determined that 30 variable-radius plots per area would provide an adequate number of trees to make the data statistically meaningful. 1/ The initial center was located randomly, usually 2 chains from a road or forest opening. For convenience, we then proceeded on a compass line paralleling a road, drainage, or ridgeline. Where possible, plots were at 5-chain intervals on each transect. We offset where needed to avoid nonhost type or openings. Using that technique, we spaced 30 plots throughout the particular area we intended to survey.

A painted, numbered stake was driven at each plot center. Then using a relaskop (basal area factor (BAF) 10 scale) to determine "in" trees, we tagged, measured, and recorded each such tree in the plot. Trees were identified with numbered aluminum tags. The diameters of live trees ≥ 5 inches d.b.h. (diameter breast height) were recorded to the nearest 1/10 inch, regardless of species. Mountain pine beetle host trees were given a "damage" classification: uninfested, currently infested, infested last year (fader), older attack (snag), current unsuccessful attack (pitchout), or current strip-attack. Dead host trees killed by other than mountain pine beetle we recorded as having been killed by secondary bark beetles or "other" mortality. We also measured heights of the first two trees of each species for volume estimations. In addition to the variable-radius plot, a 1/300-acre fixed plot (radius 6.8 feet) was taken at each plot center from which we collected regeneration data for all tree species greater than 6 inches tall and smaller than 4.9 inches d.b.h. All data was analyzed using the computer program INDIS (Bousfield 1977).

Following establishment of the 30 plots in each area, a detailed map was prepared which would allow the plots to be found and read yearly. Plots will be read each year until the stands are logged or the infestation subsides.

RESULTS

Table 2 details complete stand structures for each area at the time the plots were established. Tables 3 and 4 show the effect the mountain pine beetle has had on the lodgepole component of those stands--table 3 showing data from prior to beetle flight in 1979 and table 4 listing post flight data.

Pertinent lodgepole pine data has been taken from those tables and capsulized in table 1.

1/ Jensen, C. E., Statistician, Intermountain Forest and Range Experiment Station, Ogden, Utah, personal communication.

Table 1. Lodgepole pine stand component: Prior to and following beetle flight, 1979. (All figures pertain to lodgepole ≥ 5 d.b.h. in trees/acre.)

Plot Area	Green Lpp 1/ Preflight	Percent of Total Stand	Lpp Killed in 1978	Lpp Killed in 1979	Remaining 2/ Green Lpp
Centennial Valley	276.4	81.3	13.5	47.8	212.0
Madison River	158.5	66.1	14.9	8.8	145.9
Murr Creek	291.7	77.2	4.2	3.6	295.6
Boulder Creek	268.7	78.0	0	0.8	267.9
Dunsire Creek	177.1	71.6	0.6	0	177.1
Cedar Creek	251.2	82.5	1.0	0	251.9

1/ Does not include 1978 unsuccessful attacks and strip attacks which were still green.

2/ Includes unsuccessful attacks and strip attacks from both 1978 and 1979 which are still green.

Table 2. Permanent Mountain Pine Beetle Trend Plots--Prior to Beetle Flight, 1979. Green Stand--All Species

Plot Area		LPP 1/		AF		DF		S		L		WLP		PP		GF		ASP		TOTAL	
		T/A 2/	BF/A 3/	T/A	BF/A	T/A	BF/A	T/A	BF/A	T/A	BF/A	T/A	BF/A	T/A	BF/A	T/A	BF/A	T/A	BF/A	T/A	BF/A
Centennial	<5	140.0	-	850.0	-	60.0	-	-	-	-	-	30.0	-	-	-	-	-	-	-	1,080.0	-
Valley	≥5	276.4	1,455.9	36.4	245.7	25.9	1,092.9	1.3	-	-	-	-	-	-	-	-	-	-	-	340.0	2,794.5
Madison	<5	380.0	-	-	-	510.0	-	20.0	-	-	-	100.0	-	-	-	-	-	10.0	-	1,020.0	-
River	≥5	158.5	2,169.7	-	-	73.2	3,439.4	-	-	-	-	-	-	-		-	-	1.2	-	232.9	5,609.1
Murr	<5	140.0	-	-	-	230.0	-	40.0	-	20.0	-	20.0	-	-	-	30.0	-	-	-	480.0	-
Creek	≥5	291.7	4,648.1	-	-	19.4	96.5	4.9	22.5	62.0	1,406.9	-	-	-	-		-	-	-	378.0	6,174.0
Boulder	<5	160.5	-	270.0	-	220.0	-	-	-	30.0	-	-	-	-	-	-	-	-	-	680.5	-
Creek	≥5	268.7	4,455.4	17.9	110.6	22.5	579.2	4.5	-	30.8	2,277.1	-	-	-	-	-	-	-	-	344.4	7,422.3
Dunsire	<5	30.0	-	150.0	-	660.0	-	30.0	-	-	-	-	-	-	-	-	-	-	-	870.0	-
Creek	≥5	177.1	8,255.1	7.9	204.9	47.4	3,038.4	10.4	959.4	1.6	314.3	-	-	0.3	181.5	-	-	2.6	208.7	247.3	13,162.3
Cedar	<5	80.0	-	250.0	-	180.0	-	35.0	-	5.0	-	-	-	-	-	-	-	-	-	550.0	-
Creek	≥5	251.2	7,635.5	-	-	21.0	641.9	4.4	403.5	27.9	844.7	-	-	-	-	-	-	-	-	304.5	9,525.6

1/ LPP, lodgepole pine; AF, subalpine fir; DF, Douglas-fir; S, Englemann Spruce; L, western larch; WLP, whitebark/limber pine; PP, ponderosa pine; GF, grand fir; ASP, quaking aspen.

2/ Trees/acre

3/ Board feet/acre

Table 3. Permanent Mountain Pine Beetle Trend Plots--Prior to Beetle Flight, 1979. Mortality and Mountain Pine Beetle Damage - Lodgepole Pine

Plot Area		1978 MPB Attack	1977 MPB Attack	MPB Older Dead	1978 MPB Unsuccesful Attack	1978 MPB Strip Attack	Total Killed MPB	Mortality Other Bark Beetles	Mortality Unknown Causes	Total Standing Dead
Centennial Valley	T/A	13.5	9.9	4.2	1.9	0	27.6	9.9	3.0	40.5
	BF/A	446.4	549.8	114.8	104.3	0	1,111.0	34.1	-	1,145.1
Madison River	T/A	14.9	4.2	3.8	7.9	4.6	22.9	22.1	9.3	54.3
	BF/A	703.8	285.1	38.3	74.7	176.2	1,027.2	36.3	-	1,063.5
Murr Creek	T/A	4.2	2.6	2.8	7.5	0	9.6	11.1	10.9	31.6
	BF/A	88.0	47.2	113.2	204.0	0	248.4	-	142.3	390.7
Boulder Creek	T/A	0	0	0	0	0	0	3.7	19.6	23.3
	BF/A	0	0	0	0	0	0	-	48.5	48.5
Dunsire Creek	T/A	0.6	0	0	0	0	0.6	2.6	32.5	35.7
	BF/A	121.8	0	0	0	0	121.8	58.9	418.7	599.4
Cedar Creek	T/A	1.0	0.3	1.1	0	0.7	2.4	5.9	38.3	46.6
	BF/A	102.1	59.4	106.6	0	46.2	268.1	102.8	236.5	607.4

Table 4. Permanent Mountain Pine Beetle Trend Plots--Post Beetle Flight, 1979 Mortality and Mountain Pine Beetle (MPB) Damage - Lodgepole pine

Plot Area		1979 MPB Attack	1979 MPB Unsuccessful Attack	1979 MPB Strip Attack	Total MPB Mortality	1979 Other Bark Beetles	1979 Unknown Mortality	1979 Total Dead	Remaining Green LPP ≥5"
Centennial Valley	T/A	47.8	3.0	15.7	75.4	18.5	0	106.8	212.0
	BF/A	1,057.7	67.1	247.0	2,168.7	34.1	0	2,236.9	468.4
Madison River	T/A	8.8	5.1	6.2	31.7	16.3	0	79.4	145.9
	BF/A	497.3	39.4	251.6	1,524.5	50.6	0	1,611.4	1,872.7
Murr Creek	T/A	3.6	0	1.3	13.2	0	0	35.2	295.6
	BF/A	45.9	0	-	294.3	0		436.6	4,455.4
Boulder Creek	T/A	0.8	1.0	0.5	0.8	0	0	24.1	267.9
	BF/A	-	100.1	46.4	-	0	0	48.5	4,455.4
Dunsire Creek	T/A	0	0	0	0.6	0	0	35.7	177.1
	BF/A	0	0	0	121.8	0	0	599.4	8,255.1
Cedar Creek	T/A	0	0	0	2.4	0	0	46.6	251.9
	BF/A	0	0	0	268.1	0	0	607.4	7,681.7

DISCUSSION

A primary objective in establishing these study areas is to determine what trend the mountain pine beetle will assume in a lodgepole stand of certain characteristics over a specified period of time. Knowing this, we will be better able to make management recommendations to the land manager. The establishment of these areas required some assumptions based on previous knowledge of infestation development. Among them are the following; identified by Safranyik 2/ as some criteria for determining the likelihood of beetle migration into uninfested areas:

1. Historic evidence of beetle activity in surrounding areas.

2. Recent beetle activity--within the past 3 to 5 years. Are beetle populations in adjacent areas building?

3. Stand parameters in the uninfested area. Are trees of a susceptible age and size class, and does the stand have a high percentage of host species?

4. Large contiguous areas of high hazard, uninfested trees.

5. Major beetle outbreaks near the uninfested area. There is much evidence to show that beetle populations do migrate into, as well as develop in, a particular stand.

6. Relationship of elevation and latitude.

Many of these same criteria have been incorporated into a hazard rating system developed by Amman, et al. (1977). Their criteria for a high hazard lodgepole pine stand are:

1. Average stand age greater than 80 years.

2. Average stand diameter greater than 8 inches d.b.h.

3. Elevation less than 7,000 feet (at 45° N latitude).

An examination of just those parameters for each of the six stands reveals all would be considered high risk for mountain pine beetle infestations. If these high hazard indicators are capable of predicting whether or not an infestation will occur--as we believe they are --our trend data should verify resultant damage. In those two areas where beetle populations are presently high, Centennial Valley and Madison River, we believe most of the susceptible lodgepole pine will be killed within the next 3 to 5 years. The four remaining areas, where beetle numbers are low, will take somewhat longer.

CONCLUSION

This evaluation, conducted during the next 5 years or longer as dictated by the duration of the infestations, will provide data valuable to forest managers. By enabling us to more accurately determine the effect of a mountain pine beetle infestation on a particular lodgepole stand, this effort will enhance our management recommendations. Further, as we observe these stands after the infestations have subsided, we will obtain more comprehensive impact and stand recovery data. Such continuing evaluations will enable us to provide information useful to the land manager as he reviews and updates silvicultural prescriptions.

2/ Safranyik, L., 1979. Research Entomologist, Pacific Forest Research Center, Victoria, B.C., Canada, personal communication.

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