
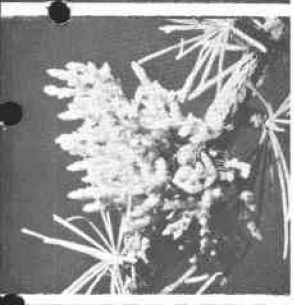
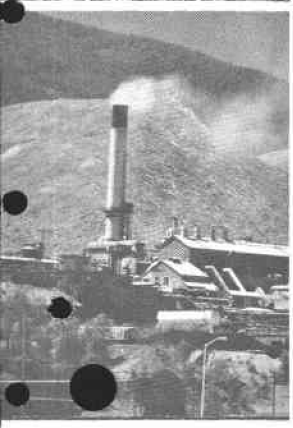

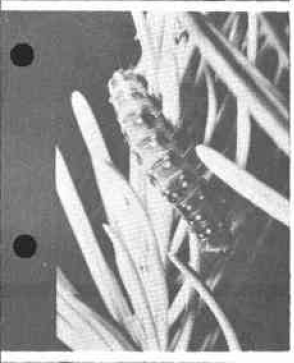
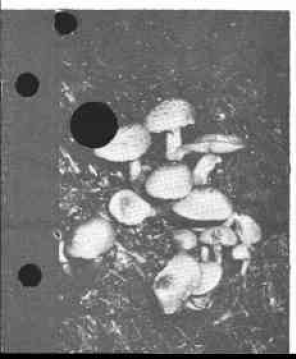

FOREST INSECT & DISEASE MANAGEMENT

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WESTERN SPRUCE BUDWORM IN THE NORTHERN REGION IN 1977 AND PREDICTIONS FOR DEFOLIATION IN 1978

by

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INTRODUCTION

The western spruce budworm, *Choristoneura occidentalis* Freeman, is a chronic pest in the Northern Region. From 1948 to 1971 approximately 10.1 million acres have been infested for varying periods of time in northern Idaho and western Montana. Most budworm outbreaks have lasted from 3 to 10 years, but at least one infestation has persisted for 52 years (Johnson and Denton 1975).

Annual aerial surveys are made by personnel from the Forest Insect and Disease Management staff to monitor changes in budworm infestations. When needed, aerial surveys are followed by egg mass surveys to predict defoliation during the next growing season.

In the Northern Region the vast area infested by the budworm has precluded sampling more than one plot per drainage. Often only three or four drainages were sampled in an entire mountain range. Consequently predictions on defoliation have not been as accurate as desired.

An effort to improve budworm egg mass sampling and defoliation predictions was initiated in 1976 with the formation of the Western Spruce Budworm Egg Mass-Defoliator Working Group. This group is made up of representatives from most of the western Regions and is chaired by the U.S. Forest Service Methods Application Group at Davis, California. Data from the 1976 egg mass surveys made throughout the West were analyzed to determine the number of egg mass sample plots necessary to have a sampling precision with a standard error of 20 percent or less, 90 percent of the time. Sampling units, or entomological units, were defined as an area of varying size but of uniformly susceptible host type in which budworm populations could be managed independent of surrounding infestations. All predictions were to be made for the entire entomological unit rather than individual sample points. In order to increase the data base, the

cooperating Regions agreed to collect the data in a manner so that it could be pooled for analysis.

Analysis of the 1976 egg mass survey indicated that a minimum of 20 egg mass plots were required per entomological unit to meet the desired precision level. Sampling the entire budworm infestation in the Northern Region at this intensity would require a substantial increase in effort over the normal workload. Therefore, each land-managing agency in the Region was asked to identify those areas where they needed predictions on defoliation. As a result of this request, 10 entomological units were established in 1977.

METHODS

Aerial surveys of host type were made during August and September 1977, and visible defoliation mapped on one-half inch to-the-mile forest maps.

Egg mass surveys were made on 10 entomological units that were established at the request of land managers. In some cases, the areas of interest to the land manager were small and scattered over a fairly large area defying formation of entomological units. Areas of this type were grouped together.

Estimates of host type within each entomological unit proved impossible. The best we could do was estimate the total forested area. This was accomplished by using U.S. Army Map Service overlays for forest type. The forest type in each entomological unit was estimated by making a reduced scale transparency of each unit and measuring the percent of the forested area with a Special Data Systems Datacolor Enhancer and Color Monitor coupled with an Eyecom Image Scanner (Vidicon type).

Sampling was done according to guidelines prepared by the working group (Grimble and Young 1977). With a few exceptions, 20 plots were established in each entomological unit. Plots were sampled for 1977 egg masses and 1977 defoliation was estimated.

Branch samples were examined for egg masses in the laboratory under black lights as described by Acciavatti and Jennings (1976). This technique proved 15 times more efficient than similar work under white lights during the 1976 survey. It also was more accurate--only one old egg mass and two parasitized egg masses (which are black) were missed during 1 day's work.

Predictions on defoliation were based on the following egg mass-defoliation classes:

Mean No. egg masses per 1,000 sq. in. foliage	Predicted defoliation (%)	Damage category
0	0	None
1- 3	1- 25	Light
4-10	26- 40	Moderate
11-40	41- 55	Heavy
>40	56-100	Very heavy

RESULTS

Aerially visible defoliation on each forest area is reported in Table 1. In Idaho the defoliated area decreased slightly on two forest areas and increased substantially on the third. Overall, however, the defoliated area in northern Idaho declined 1.3 percent. Most infested areas in Montana increased in size during 1977. The Lewis and Clark National Forest showed the greatest increase. Infestations declined slightly to moderately on four forest areas.

Results of the egg mass survey are presented in Table 2. Defoliation is predicted to be heavy on five units, moderate to heavy on three, light to moderate on one, and light on one unit. The infestation on the Lolo National Forest has not spread west onto the Wallace Ranger District, Idaho Panhandle National Forests, at the time of this survey.

It should be noted that the mean egg mass density/unit is generally in the lower range of the "heavy" class. This accounts for the "moderate to heavy" designation in some units, as the lower end of the confidence limits extend into the next lower defoliation class.

Since this is the first year sampling is based on entomological units, we cannot make comparisons with previous surveys to estimate infestation trend. Some idea of infestation trend can be gained from the net change in area infested on each aerial survey reporting unit.

Table 1.--Acres of aerially visible defoliation caused by the western spruce budworm in the Northern Region, 1976 and 1977

Unit	Acres of visible defoliation			
	1976	1977	Net change	Percent change
Northern Idaho				
Clearwater NF	358,070	286,407	- 71,663	- 20.01
Idaho Panhandle NF's	190,591	176,454	- 14,137	- 7.42
Nezperce NF	107,050	184,315	+ 77,265	+ 72.18
Subtotal	655,711	647,176	- 8,535	- 1.30
Montana				
Beaverhead NF	250,427	173,250	- 77,177	- 30.82
Bitterroot NF	413,641	451,495	+ 37,854	+ 9.15
Custer NF	5,155	7,370	+ 2,215	+ 42.97
Deerlodge NF	223,666	183,207	- 40,459	- 18.09
Flathead Indian Res.	68,156	129,438	+ 61,282	+ 89.91
Flathead NF	99,801	54,527	- 45,274	- 45.36
Gallatin NF	286,325	427,990	+141,665	+ 49.48
Helena NF	313,161	412,979	+ 99,818	+ 31.87
Kootenai NF	9,685	20,029	+ 10,344	+ 106.80
Lewis and Clark NF	5,927	116,499	+110,572	+1,865.56
Lolo NF	820,330	947,941	+127,611	+ 15.56
Subtotal	2,496,274	2,924,725	+428,451	+ 17.16
Yellowstone NP	114,572	79,330	- 35,242	- 30.76
Grand total	3,266,557	3,651,231	+384,674	+ 11.78

Table 2.--Egg mass survey results and defoliation predictions

Unit	Acres of forested land	No. of samples	Mean number of egg masses/unit /1,000 in.^{2}	Mean number of egg masses/unit /m^2	Predicted defol.[1/]
Helena NF					
Lincoln	573,432	20	14.20 ± 5.37	22.01 ± 4.35	Mod.-Heavy
Elkhorn Mountains	482,411	16	12.24 ± 4.14	18.97 ± 6.41	Mod.-Heavy
Big Belts	424,765	22	16.50 ± 8.33		Heavy
Bitterroot NF	570,398	18	11.40 ± 2.63	17.67 ± 4.07	Mod.-Heavy
Gallatin NF					
Bridger Mountains	124,395	20	22.06 ± 4.79	34.19 ± 7.42	Heavy
Yellowstone River	391,390	20	16.22 ± 5.06	25.14 ± 7.85	Heavy
Gallatin Canyon	476,343	21	19.17 ± 4.15	29.72 ± 6.43	Heavy
Lewis and Clark NF	709,964	20	21.94 ± 7.47	34.01 ± 11.58	Heavy
Flathead Indian Res.	--	10	5.37 ± 1.85	8.32 ± 2.86	Light-Mod.
Beaverhead NF	--	16	1.32 ± .78	2.05 ± 1.21	Light
Idaho Panhandle NF's Wallace RD[2/]	--	3	0	0	None

1/ Based on egg mass densities.

2/ Samples were taken along Idaho-Montana divide to determine if the infestation in Montana had crossed into the Wallace District.

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