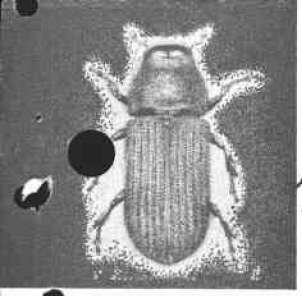
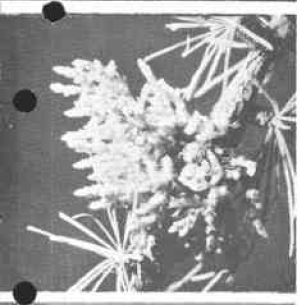

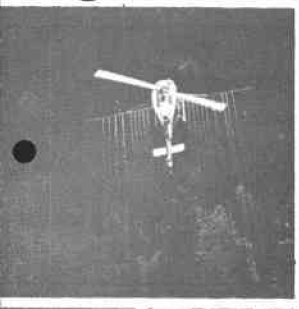
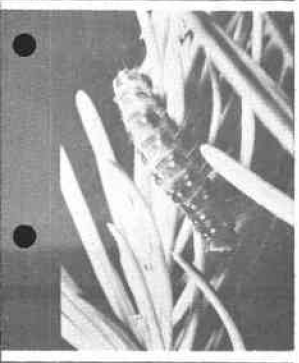
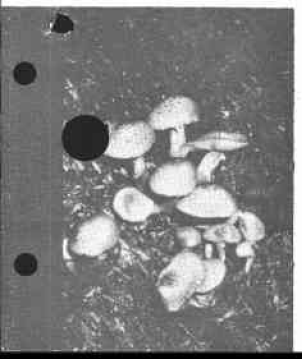

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POTENTIAL DEFOLIATION BY THE FOREST TENT CATERPILLAR IN THE TURTLE MOUNTAINS, NORTH DAKOTA DURING 1979

BY

SCOTT TUNNOCK[1/], JOHN HARD[1/], and TOM KARCH[2/]

ABSTRACT

The forest tent caterpillar, Malacosoma disstria Hbn., began defoliating trembling aspen stands, Populus tremuloides Michx., in 1976 in the Turtle Mountains of North Dakota. Heavy defoliation was scattered through about 150,000 acres in 1978. Pupal mortality from parasites and disease was almost 100 percent in cocoons on understory shrubs and trees during July. However, biological evaluation in October showed egg masses present in tree crowns in 42 of 63 plots sampled throughout the infested area. Egg viability was high and averaged 91 percent. An average of 3 percent of the eggs were parasitized. Moderate defoliation is predicted for 1979 on 9 plots and light defoliation on the other 33 plots.

We predict defoliation in 1979 will be spotty and light throughout the aspen stands of the Turtle Mountains, but several spots of moderate defoliation are expected around Lake Metigoshe and east of Carpenter Lake.

1/ Entomologists, USDA Forest Service, State and Private Forestry, Missoula, Montana.

2/ Forester, North Dakota State Forest Service, Bottineau, North Dakota.

INTRODUCTION

Conditions favorable for outbreaks of the forest tent caterpillar, Malacosoma disstria Hbn., existed in the Turtle Mountains of North Dakota in 1976 and 1977. By 1978, defoliation was heavy in many stands of trembling aspen, Populus tremuloides Michx., scattered through about 150,000 acres.

During July 1978, cocoons were examined throughout the epidemic to determine survival. Pupal mortality, caused mainly by disease and dipterous parasites, was 100 percent in all samples checked. This indicated a downward trend, but because of the vast numbers of cocoons present a fall egg mass survey was conducted.

This is a report of the October egg mass survey to predict potential defoliation in 1979.

LIFE HISTORY AND HABITS

The forest tent caterpillar feeds on almost all broad-leaved trees and understory brush species. Its favored hosts in North Dakota are aspens, oaks, elms, basswood, and ash. Three or more years of complete defoliation can kill aspen.

Caterpillars overwinter as first-instars inside the eggs, which encircle twigs in cylindrical masses (fig. 1). Larvae emerge in the spring when leaves begin to unfold, and at high population levels form silken mats on trunks and branches. They feed and pass through five instars in about 5 or 6 weeks, then spin silken, pale-yellow cocoons in folded leaves (fig. 2) and pupate. Moths emerge in about 10 days, near the end of July, and concentrate egg laying in upper crowns. Egg masses are coated with a frothy, glue-like substance, which hardens and turns glossy dark brown. There is only one generation a year (Batzer and Morris 1971).

Figure 1.--Overwintering forest tent caterpillar egg masses on aspen twig.

Figure 2.--Forest tent caterpillar cocoons spun within folded aspen leaves.

METHODS

Sixty-three plots scattered throughout the Turtle Mountains were sampled for egg masses. An aerial survey map of the infestation was used for plot selection. Only sections that showed visible defoliation in June were sampled, and stands selected were at least 1 acre.

A sequential egg mass sampling method was used. It was developed by Shepherd and Brown (1971) for aspen stands in Alberta, Canada. Dominant or codominant trees were chosen, and two branches were cut from their upper crowns with an extendable pole pruner. New egg masses were counted on the outermost 18 inches of each branch and any lateral branches initiating within that distance. The number of trees sampled on a plot depended on the cumulative number of egg masses per two-branch sample listed in a sequential table of decision lines for three defoliation levels. Shepherd and Brown (1971) set the boundary between light and moderate defoliation at 1.2 egg masses per two upper branches, and the boundary between moderate and heavy at 2.4 egg masses per two upper branches.

On each plot, the undergrowth of shrubs and trees (not over 8 feet high) was also examined for new egg masses for 15 minutes. Number of masses observed were rated as follows:

Very light - eggs hard to find.

Light - eggs found with a little searching.

Moderate - eggs fairly easy to find.

Heavy - eggs found readily, numerous in area.

A possibly more accurate prediction method for the Turtle Mountains' infestation is one used in Manitoba and Minnesota and based on Hodson's (1941) studies. It consists of cutting down three larger aspens per plot and counting all egg masses on them. However, this destructive sampling procedure could not be used without landowners' permission, and since exact sampling locations were not selected before the survey we did not have time to contact private landowners.

From each plot, up to five new egg masses were collected and placed in a paper bag. These eggs were examined in the laboratory for viability and parasitism. This was done by slicing off the tops of the eggs and examining their contents through a microscope.

RESULTS

New egg masses were found on 42 of the 63 sample plots and ranged from 0.2 to 2.2 egg masses per two branches. None of the plots contained enough egg masses (over 2.4 per two branches) to predict heavy defoliation in 1979. Moderate defoliation was predicted on only nine of the plots. For the Turtle Mountains as a whole, the average was 0.7 egg masses per two branches which indicates light defoliation in 1979 (table 1).

Egg viability was high and averaged 91 percent. On one plot, it was as low as 48 percent, but only one egg mass was available for examination. An average of 6 percent of the eggs were infertile, and an average of 3 percent were parasitized (table 1).

New egg masses were found on the understory shrubs and trees at only 3 of the 63 plots (table 1).

Table 1 gives plot location; this is illustrated in figure 3, which includes predicted defoliation in that section during 1979.

Table 1.--Predicted defoliation in 1979 on forest tent caterpillar egg mass plots in the Turtle Mountains.

Plot No.	Location	Percent Viable Eggs	Percent Infertile Eggs	Percent Parasitized Eggs	Egg Masses in Understory	Avg. No. Egg Masses Per Two Branches	1979 Defoliation
1	T164N,R76W,S.27	91	8	1	VL	0.6	Light 1/
2	T163N,R76W,S.1	92	2	6	0	0.5	Light
3	T163N,R76W,S.11	94	4	2	0	0.5	Light
4	T163N,R76W,S.13	91	9	0	0	0.2	Light
5	T163N,R75W,S.7	96	3	1	0	0.6	Light
6	T163N,R75W,S.18	97	2	1	0	0.5	Light
7	T164N,R75W,S.31	93	5	2	0	0.5	Light
8	T164N,R75W,S.32	79	17	4	0	0.5	Light
9	T164N,R75W,S.33	97	3	0	0	0.2	Light
10	T163N,R75W,S.9	97	2	1	VL	1.5	Moderate 2/
11	T164N,R75W,S.34	93	5	2	VL	1.2	Moderate
12	T163N,R75W,S.3	73	23	4	0	0.7	Light
13	T163N,R75W,S.33	-	-	-	0	0	0-Light
14	T163N,R75W,S.23	-	-	-	0	0	0-Light
15	T163N,R75W,S.11	79	17	4	0	1.0	Light
16	T163N,R75W,S.1	98	1	1	0	1.3	Moderate
17	T164N,R75W,S.36	69	26	5	0	0.5	Light
18	T164N,R74W,S.31	-	-	-	0	0	0-Light
19	T163N,R74W,S.7	97	2	1	0	1.5	Moderate
20	T163N,R74W,S.18	95	4	1	0	0.7	Light
21	T164N,R74W,S.32	94	4	2	0	2.2	Moderate
22	T164N,R74W,S.33	96	3	1	0	0.2	Light
23	T163N,R74W,S.9	90	8	2	0	0.5	Light
24	T163N,R74W,S.20	94	2	4	0	0.2	Light
25	T163N,R74W,S.28	96	2	2	0	0.2	Light
26	T163N,R74W,S.10	95	2	3	0	0.2	Light
27	T163N,R74W,S.2	91	7	2	0	1.8	Moderate
28	T163N,R74W,S.27	99	1	0	0	0.2	Light
29	T163N,R74W,S.34	-	-	-	0	0	0-Light
30	T162N,R74W,S.2	-	-	-	0	0	0-Light
31	T162N,R74W,S.10	48 3/	23	29	0	0.2	Light
32	T162N,R73W,S.7	-	-	-	0	0	0-Light
33	T163N,R73W,S.3	-	-	-	0	0	0-Light
34	T164N,R73W,S.35	-	-	-	0	0	0-Light
35	T163N,R73W,S.1	93	5	2	0	0.7	Light

1/ Light: No trees showing complete defoliation. Feeding damage nil or confined to top of aspen crowns.

2/ Moderate: Occasional aspen completely defoliated; most aspen with tops thin.

3/ Based only on one egg mass.

Table 1.--Predicted defoliation in 1979 on forest tent caterpillar egg mass plots in the Turtle Mountains of North Dakota. (con.)

Plot No.	Location	Percent Viable Eggs	Percent Infertile Eggs	Percent Parasitized Eggs	Egg Masses in Understory	Avg. No. Egg Masses Per Two Branches	1979 Defoliation
36	T164N,R72W,S.33	-	-	-	0	0	0-Light
37	T163N,R72W,S.1	95	3	2	0	0.7	Light
38	T163N,R72W,S.11	98	2	0	0	0.5	Light
39	T163N,R72W,S.16	-	-	-	0	0	0-Light
40	T163N,R72W,S.21	-	-	-	0	0	0-Light
41	T163N,R72W,S.29	-	-	-	0	0	0-Light
42	T162N,R72W,S.8	-	-	-	0	0	0-Light
43	T162N,R73W,S.11	98	2	0	0	0.2	Light
44	T162N,R72W,S.10	-	-	-	0	0	0-Light
45	T163N,R72W,S.36	-	-	-	0	0	0-Light
46	T163N,R72W,S.13	98	1	1	0	0.2	Light
47	T163N,R71W,S.8	96	2	2	0	2.0	Moderate
48	T163N,R71W,S.4	94	4	2	0	0.5	Light
49	T164N,R71W,S.32	71 3/	28	1	0	0.2	Light
50	T163N,R71W,S.15	-	-	-	0	0	0-Light
51	T163N,R71W,S.33	83	3	14	0	0.2	Light
52	T162N,R71W,S.5	93	3	4	0	0.2	Light
53	T162N,R71W,S.3	89	7	4	0	0.7	Light
54	T162N,R71W,S.9	-	-	-	0	0	0-Light
55	T163N,R71W,S.26	95	4	1	0	0.2	Light
56	T163N,R71W,S.2	91	5	4	0	0.6	Light
57	T163N,R70W,S.6	86	11	3	0	0.2	Light
58	T163N,R71W,S.13	-	-	-	0	0	0-Light
59	T163N,R70W,S.20	-	-	-	0	0	0-Light
60	T162N,R70W,S.4	-	-	-	0	0	0-Light
61	T163N,R71W,S.35	-	-	-	0	0	0-Light
62	T163N,R71W,S.30	96	10	4	0	1.7	Moderate
63	T163N,R72W,S.6	96	2	2	0	1.2	Moderate
	Average =	91	6	3	-	0.7	Light

3/ Based only on one egg mass.

CONCLUSIONS AND RECOMMENDATIONS

Our prediction for 1979 is that defoliation by the forest tent caterpillar will be spotty and light throughout the aspen stands of the Turtle Mountains. However, several spots of moderate defoliation are expected around Lake Metigoshe and east of Carpenter Lake (fig. 3). Considering that only one localized area was sampled in a chosen section, zero egg masses in a sample does not necessarily indicate that defoliation will not occur in another part of the section.

Pupal parasites and diseases built up to a high level during 1978. Dr. V. Hildahl 3/, Canadian Forest Service, stated that these agents were probably responsible for terminating a severe infestation in Manitoba in 1978. There is a good possibility these factors could end the outbreak in the Turtle Mountains in 1979.

The microbial insecticide Bacillus thuringiensis Berliner (Bt), prepared from a bacterium, is registered for controlling the forest tent caterpillar in North Dakota. It can be applied as an aerial or ground spray when mixed according to the instructions on the label.

Where defoliation is predicted to be moderate in 1979, landowners may decrease the amount of damage in their aspen stands by applying Bt when the larvae emerge from eggs and feed on opening leaves. Migrating larvae from surrounding unsprayed stands will probably reinfest the treated area, but at a lower level. If the stand has been heavily defoliated for 3 years, treatment may avert some tree mortality or branch kill.

Continuous heavy defoliation for 3 years or more can reduce radial growth of aspen as much as 90 percent (Batzer and Morris 1971). Very little aspen is grown for commercial purposes in the Turtle Mountains so growth loss is a minor factor.

3/ Telephone conversation with Dr. Hildahl on September 6, 1978.

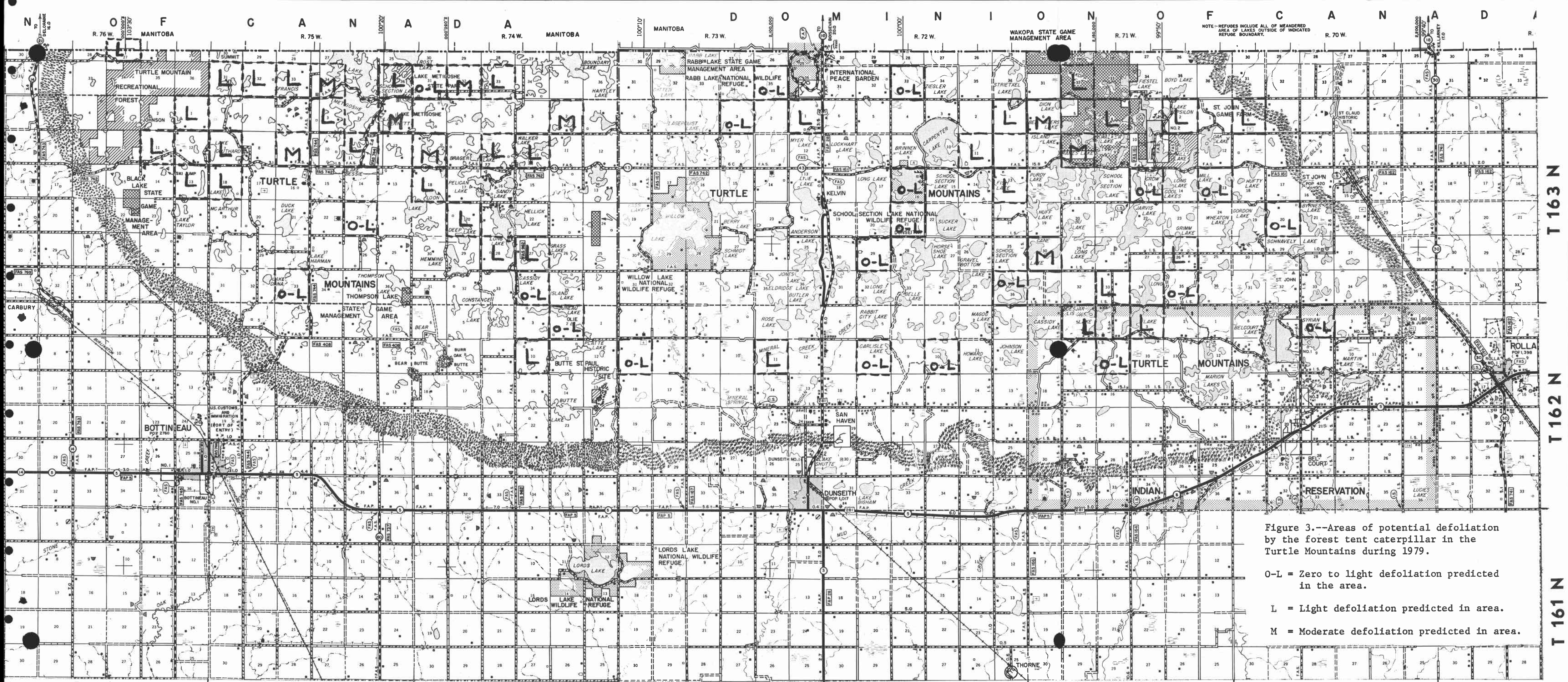

Figure 3.--Areas of potential defoliation by the forest tent caterpillar in the Turtle Mountains during 1979.

O-L = Zero to light defoliation predicted in the area.

L = Light defoliation predicted in area.

M = Moderate defoliation predicted in area.

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