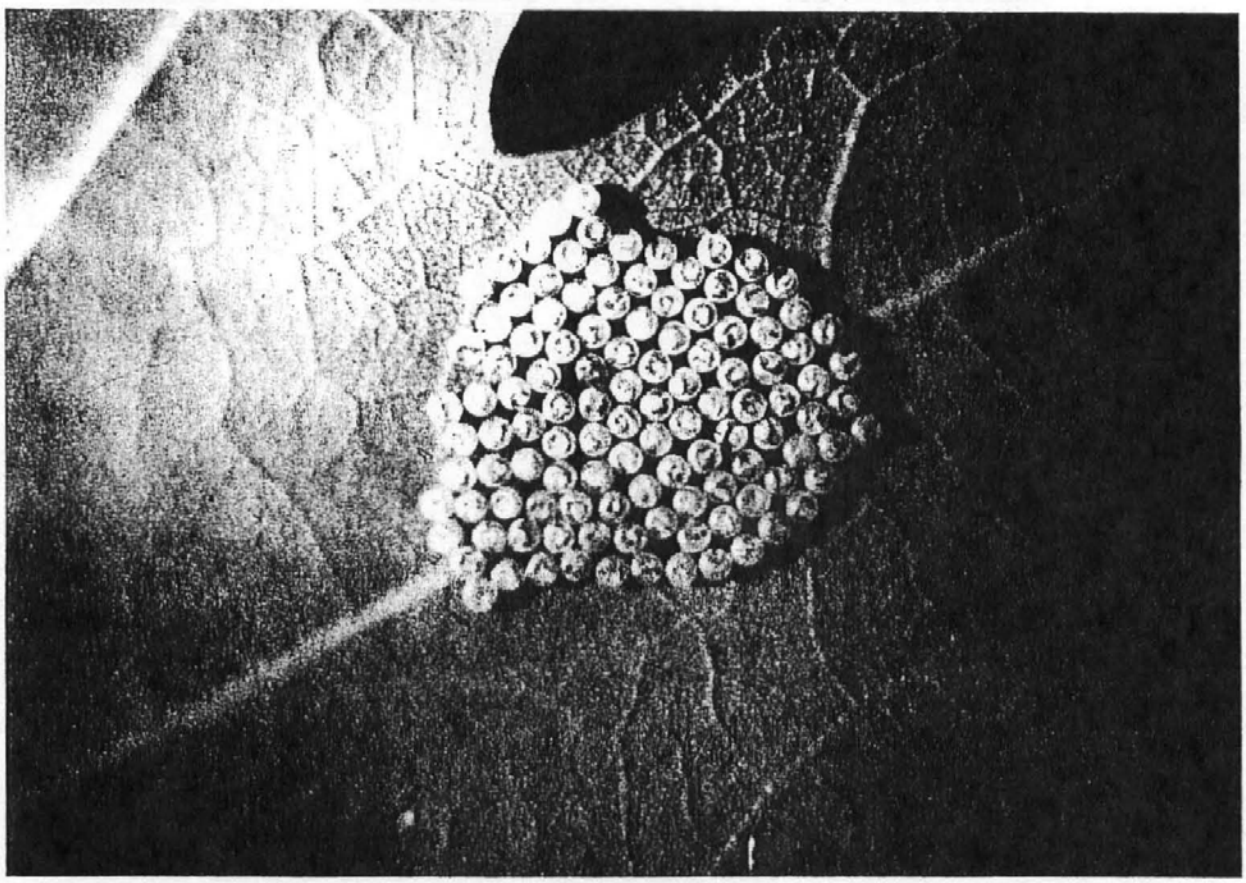
1972

FOREST PEST REPORT



MINNESOTA

DEPARTMENT OF AGRICULTURE

DIVISION OF PLANT INDUSTRY

The egg mass on the cover was produced by an adult moth of Symmerista sp., either S. canicosta or S. leucytis. Egg masses were collected in mid summer to project larval populations of the fall defoliator group.

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Introduction

The material in the 1972 Forest Pest Report is a combination of aerial and ground surveys, observations, and controls by members of the forest pest activity, Division of Plant Industry, Minnesota Department of Agriculture. Cooperative programs or comments by cooperating agents are cited in the text.

Members of the 1972 forest pest activity are:

Gerald Beach	- St. Paul	
Gerald Hecht	- St. Paul	
Ray Dolan	- Cloquet	1
Gene Schmidt	- Virginia	1
Jordan Wheeler	- St. Paul	1
Robert Tiplady	- Brainerd	1
Truman Lindvall	- Littlefork	1
Stan Bilben	- Walker	
Clifford Coombs	- Walker	
Leonard Braun	- Walker	2
Roger Burnside	- Walker	2
Lupe Barron	- Walker	3
Henry Dippold	- Walker	3
John Schroeder	- Walker	3

1 Permanent seasonal entomologists

2 Laboratory technicians - seasonal - white pine blister rust

3 Laborers - pathological pruning - white pine blister rust

Other members of the Division of Plant Industry assisting on field surveys and laboratory counts in 1972 are:

John Berends	- St. Paul
Bob Hoger	- St. Paul
Milton Marinos	- St. Paul
Al Pruszinske	- St. Paul
Gary Miller	- St. Paul
Ken Blanchard (soil samples)	- St. Paul

Gerald Beach, Supervisor
Forest Pest Survey and Control

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1972 Forest Pest Report

Spruce Budworm

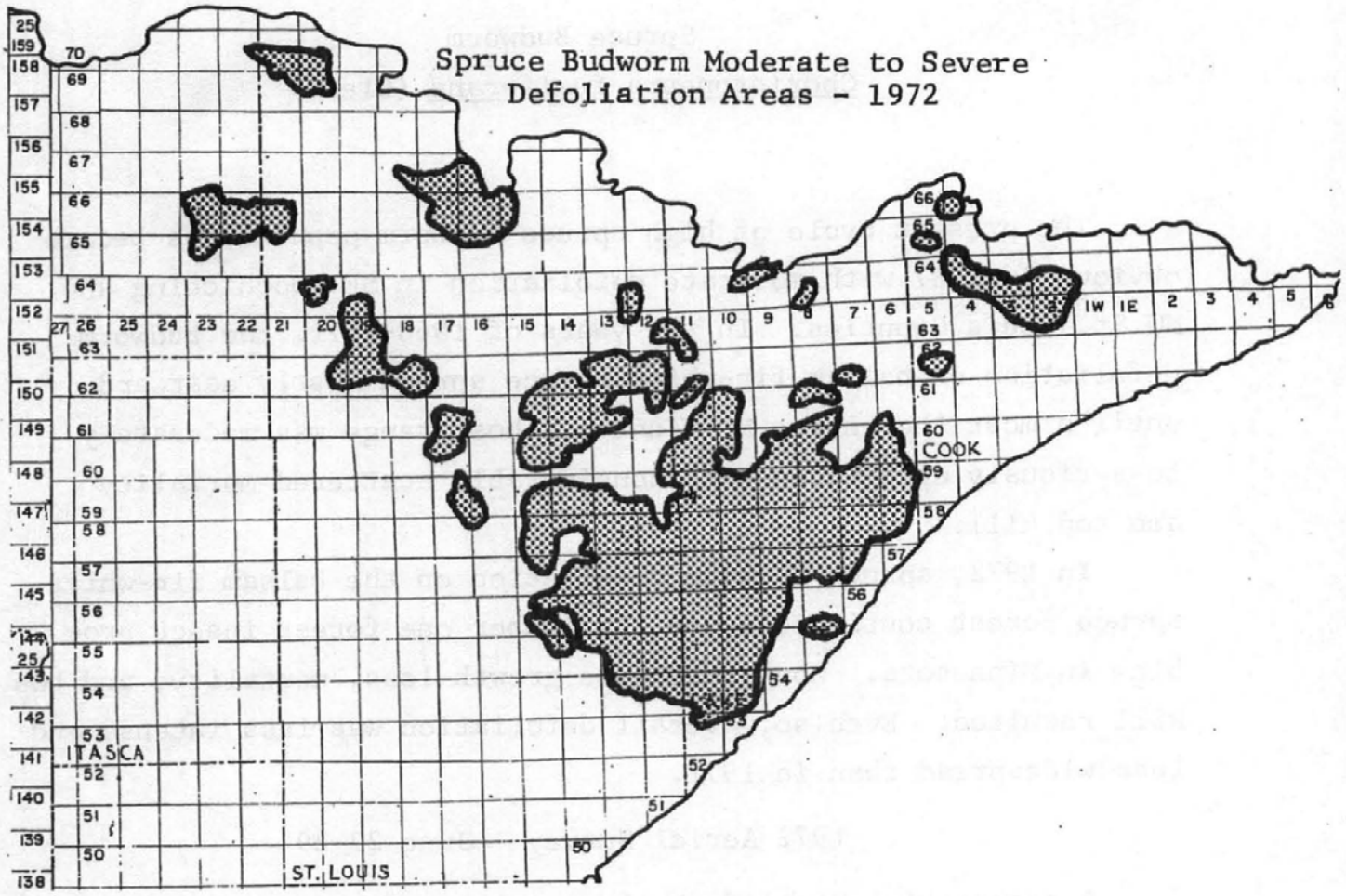
Choristoneura fumiferana (Clem.)

The present cycle of high spruce budworm populations became obvious in 1967 with moderate defoliation in SE Koochiching and NW St. Louis Counties. In the years of 1968-1971, the budworm defoliation on balsam fir-white spruce spread mostly eastward until almost the entire NE Minnesota host range was moderately to seriously defoliated with considerable scattered mortality and top kill.

In 1972, spruce budworm defoliation on the balsam fir-white spruce forest continued to be the number one forest insect problem in Minnesota. Continued tree growth loss, mortality, and top kill resulted. Even so, overall defoliation was less intense and less widespread than in 1971.

1972 Aerial Survey - June 27-29

A cooperative state-federal aerial survey of NE Minnesota was conducted by the Minnesota Department of Agriculture and the U.S. Forest Service, Forest Pest Control. The objective of the survey was to get the overall impression of 1972 defoliation, with mortality or other impact that could be observed from the air. Mortality or top kill cannot be estimated from this survey, and to do so needs evaluation on the ground. Aerial observations were conducted at 1,000 feet over the ground level, and flight lines were six and 12 miles apart, flown in a north-south direction. Observations are on the following map.



Ground Detection and Observation

The spruce budworm was mostly in the third instar on June 2, 1972 in northern St. Louis County. In some ground observations before and after the aerial survey, there was heavy defoliation with balsam fir mortality east of Finland-Isabella to Cloquet Lake and Greenwood Lake. Defoliation extends NE to the Gunflint Trail at Loon Lake with only light incidence eastward in Cook County. The area of Sullivan Lake (in Lake County) had light 1972 defoliation with pockets of moderate-heavy west to Wolf and Bear Lakes in southeast St. Louis County. The area in need of further

evaluation for possible 1973 or 1974 control is north and west of Silver Bay, and some distance north of Two Harbors. The 1973 proposed controls may be to recommend cutting the balsam fir in the severely defoliated areas.

Defoliation in western St. Louis County was generally light, spotted with moderate damage. The northwest corner of St. Louis County had about 40 square miles of light to severe defoliation on the Kabetogama Peninsula, described in more detail in a following summary. Southeast Koochiching County had light defoliation with scattered spots of moderate defoliation.

Egg Mass Survey

An egg mass survey was conducted in August, 1972, to determine the 1973 potential of spruce budworm in scattered locations of Cook, Lake, St. Louis, and Koochiching Counties. The survey was not comprehensive enough for a good 1973 prediction, but may be used as an indicator of the overall budworm population trend in northeastern Minnesota. Inaccessibility of many of the balsam fir forested areas make such a survey difficult and very time consuming. Sampling was from the midcrown area of the tree, using the 15 inch branch sample. Three samples were taken per tree.

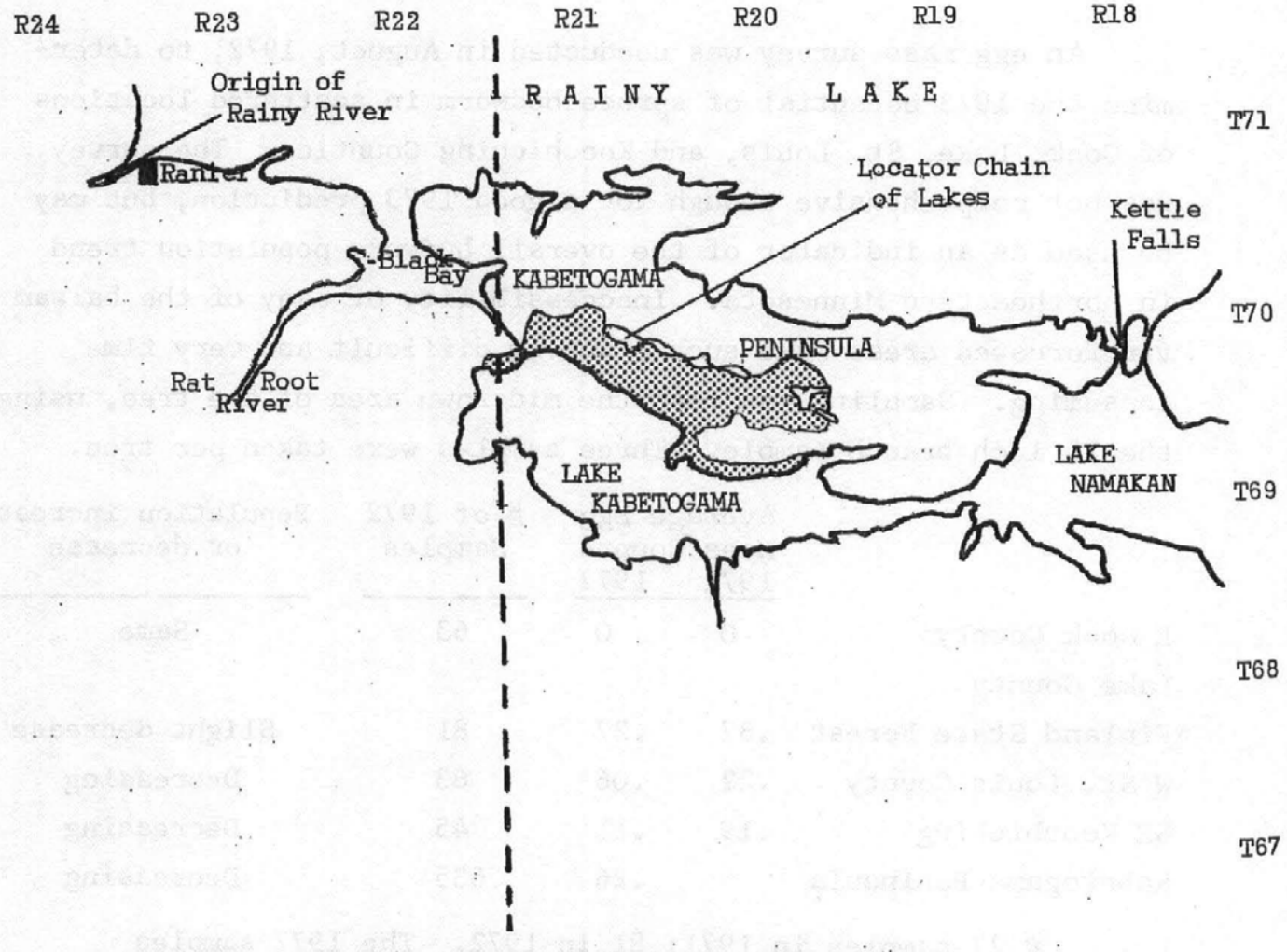
	Average Egg Mass Counts		# of 1972 Samples	Population increase or decrease
	1971	1972		
E Cook County	0	0	63	Same
Lake County				
*Finland State Forest	.37	.27	81	Slight decrease
W St. Louis County	.22	.06	63	Decreasing
SE Koochiching	.19	.11	45	Decreasing
Kabetogama Peninsula		.26	635	Decreasing

* 27 samples in 1971; 81 in 1972. The 1972 samples included two areas of light defoliation.

Kabetogama Peninsula Spruce Budworm Project

A cooperative state-federal spruce budworm impact survey was conducted by the Minnesota Department of Agriculture and the U.S. Forest Service, Forest Pest Control in July-August of 1973. The objective was to evaluate balsam fir losses to date in the current spruce budworm high population cycle (1967-1972) and the potential population for 1973 by egg mass counts.

The balsam fir forest on the Kabetogama Peninsula covers an approximate 40 square mile area south of the chain of lakes.



The gray area on the Kabetogama Peninsula illustrates the region of light to severe defoliation by the spruce budworm in 1972. The most heavily defoliated area is adjacent to Shoepack Lake, at the eastern end of the chain of lakes shown.

An aerial survey was conducted in late July with flight lines in an east-west direction, one mile apart. Altitude was 1,000 feet.

Aerial photos of the peninsula were used to more accurately describe the density of balsam fir. Based upon the aerial photos and the survey, 50 plots were selected within balsam fir type to determine defoliation, top kill, mortality, and egg masses. The 50 square mile area was divided into three defoliation regions; none to light, moderate to heavy, and severe.

Four satellite or subplots were selected at a distance of two chains from the plot center, stepped off in cardinal directions. The subplots were originally set at 1/5 acre, but after three plots were processed, it was determined there was sufficient balsam fir in a 1/10 acre area. Three plots, 4, 36, and 47 were not completed due to inaccessibility and available time.

Defoliation and top kill was estimated, and mortality counts were made on all balsam fir and white spruce within each subplot. Three 15" twig samples were selected from typically defoliated branches from the midcrown of one balsam fir in each subplot and either a white spruce or balsam fir at plot center (the latter was preferably white spruce). Egg mass and defoliation determinations were made at the U.S. Forest Nursery, Eveleth, Minnesota. Sample collections were flown to this nursery daily.

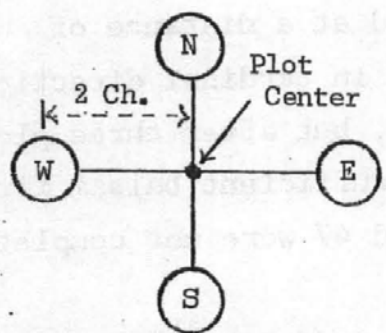
Crews were made up of personnel from the U.S. Forest Service - St. Paul Office, Minnesota Department of Agriculture, Boise Cascade Corp., and the Minnesota Department of Natural Resources. Two to three men per crew were assigned to three different regional transportation systems:

1. Two crews were flown to Shoepack Lake and used Minnesota Game and Fish housing and facilities for the period of one week.
2. One crew was flown into Locator, Warclub, and Loiten Lakes on the peninsula and out each day.

The airplane serving this crew also picked up the daily load of samples from Shoepack.

3. Usually two, and partially one crew operated with a boat on the north shore of Lake Kabetogama each day.

SPRUCE BUDWORM SURVEY CODES



Compass heading from starting point

Two chains from plot center to subplot center

Subplots 1/10th acre
Radius 37.2 ft.

PLOT DESCRIPTION		PLOT ASPECT		SUBPLOT CODES	
Rock outcrop	1	Level	0	North line	N
Upland	2	North Slope	1	East line	E
Lowland Wet	3	East Slope	2	South line	S
Lowland Dry	4	South Slope	3	West line	W
		West Slope	4		

Tree Species				Tree Condition	
Balsam fir	1	Tremb. Aspen	11	Alive	1
White spruce	2	Bals. Aspen	12	Dead	2
Black spruce	3	Birch	13	Top kill	3
Jack pine	4	Maple	14		
White pine	5	Elm	15		
Red pine	6	Ash	16		
Tamarack	7				
Cedar	8				

Defoliation				Tree Size Code	
0 - 5%	0	55 - 65	6	1 - 5"DBH	1
5 - 15	1	65 - 75	7	5 - 9"	2
15 - 25	2	75 - 85	8	9 - 15"	3
25 - 35	3	85 +	9	15 +	4
35 - 45	4				
45 - 55	5			Regeneration under 1"	

Field Data and Summarization

After the field forms were completed from the 47 plots, a computer program was written cooperatively with North Central Forest Experiment Station, St. Paul, Minnesota. In further summaries from the data tables presented in a special report, the following statistics are significant:

1/10 acre

SPRUCE BUDWORM

sheet (1)

Plot No 39 T plot Aspect Sec. PLOT Aspect CREW MAT Thelps & Schmid, Erickson DATE 7/27/72

Subplot N Desc 2 3							Subplot W Desc 2 0							Subplot S Desc 2 4							Subplot E Desc 1 4						
TREE				DEF. (DX)			TREE				DEF (DX)			TREE				DEF. (DX)			TREE				DEF. DX		
No	Sp	SIZE	COND	L	M	T	No	Sp	SIZE	COND	L	M	T	No	Sp	SIZE	COND	L	M	T	No	Sp	SIZE	COND	L	M	T
(1)	1	3	1	0	0	0	(1)	1	1	1	1	1	2	(1)	1	1	1	1	1	1	(1)	1	1	1	3	3	1
2	1	1	1	0	0	0	2	1	1	1	3	3	6	2	1	2	1	5	5	7	2	1	1	2	–	–	–
3	11	2	1	–	–	–	3	3	2	1	–	–	–	3	1	1	1	0	0	0	3	5	4	1	–	–	–
4	3	2	1	–	–	–	4	2	3	1	1	1	0	4	14	1	1	–	–	–	4	1	1	2	–	–	–
5	1	1	1	0	0	0	6	14	2	1	–	–	–	5	14	1	1	–	–	–	5	1	1	1	0	0	0
6	9	2	1	–	–	–	6	1	1	1	1	3	7	6	13	2	–	–	–	–	6	1	2	2	–	–	–
7	1	2	1	1	1	0	7	1	1	1	1	1	1	7	13	1	1	–	–	–	7	3	2	1	–	–	–
8	3	2	1	–	–	–	8	4	3	2	–	–	–	8	5	4	1	–	–	–	8	2	1	1	0	0	0
9	3	2	1	–	–	–	9	5	4	1	–	–	–	9	1	1	1	1	1	0	9	1	2	1	0	0	0
10	13	1	1	1	–	–	10	1	1	1	1	1	5	10	1	1	1	2	2	0	10	1	1	1	0	0	0
11	15	1	1	–	–	–	11	1	1	1	1	1	1	11	1	2	1	3	3	3	11	3	1	1	–	–	–
12	1	2	1	1	1	1	12	14	2	1	–	–	–	12	1	2	1	7	7	7	12	3	1	1	–	–	–
13	14	1	1	–	–	–	13	1	2	1	1	1	1	13	1	2	1	5	5	5	13	3	1	1	–	–	–
14	3	1	1	–	–	–	14	1	1	1	1	1	1	14	1	2	1	4	3	3	14	3	1	1	–	–	–
15	9	2	1	–	–	–	15	14	1	1	–	–	–	15	1	2	1	2	2	1	15	1	1	1	1	0	0
16	1	1	1	4	3	3	16	13	1	1	–	–	–	16	1	2	1	1	1	0	16	3	1	1	–	–	–
17	1	1	1	0	0	0	18							17	11	2	1	–	–	–	17						
18							18							18	1	2	1	0	0	0	18						
19							19							19	1	1	1	1	1	1	19						
20							20							20	13	1	1	–	–	–	20						
21							21							21	1	1	1	1	1	1	21						
22							22							22	11	2	1	–	–	–	22						
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Sample of Field Form Used on Kabetogama Peninsula Survey, According to the Survey Code Form

- 91.2% of all balsam fir from plot work are in a live condition.
- 63.1% of all live balsam fir are in the 1-5 inch size class.
- 57.5% of all balsam fir trees are in the 1-5 inch size class.
- 92% of balsam fir in the light defoliation region are alive.
- 1% of balsam fir in the light defoliation region show top kill.
- .12 egg masses per 15 inch twig in light area.
- 94% of balsam fir in 1-9 inch size in light area.
- 7.3% of the 1-9 inch trees dead in light area probably due to causes other than spruce budworm.
- Average of 178 live balsam fir per acre in light area.
- 93.5% live balsam fir in moderate defoliation area.
- .22 egg masses per 15" branch in moderate area.
- 87.6% of live balsam fir in 1-9 inch size class.
- Average of 190 balsam fir per acre in moderate area.
- 41.1% dead balsam fir in severe defoliation area.
- 1.6% top killed balsam fir in severe defoliation area.
- .32 egg masses per 15" branch in severe area.

The egg mass data projects a light to moderate population for 1973. In areas with less foliage, such populations will continue to have severe impact in 1973.

By the figures listed previously, the mortality in the severe area amounts to approximately 132 trees per acre. This could be converted to cords lost per acre if the heights and diameters of each tree was tabulated, but it was determined this estimate was better left to CFI plot information.

The top kill determinations were much lower than expected, and a continued Kabetogama Peninsula survey in 1973 will more carefully process this aspect.

References

Graham, S. A. and L. W. Orr, 1940. The Spruce Budworm in Minnesota. University of Minnesota Tech. Bulletin 142. 27 pages.

Spruce Budworm Damage on Balsam Fir and White Spruce - Kabetogama Peninsula 1972, Minnesota Department of Agriculture, Division of Plant Industry, and U.S. Forest Service, State & Private Forestry, Forest Pest Mgt.

1973 Spruce Budworm Program

With the mixed land ownership and with several different management and utilization outlooks on balsam fir management in Minnesota, the forest pest control section of the Minnesota Department of Agriculture has been processing towards regionalization of balsam fir forest areas by utilization and management outlook. A

work conference will be conducted in St. Paul in early 1973 with officials from private, county, state, and federal land managing agencies present, together with representatives from state and federal survey and control agencies. Those areas that have no forest utilization and limited use will be separated by areas of moderate to high use. Accessibility and both short and long-range markets will also be factors in determining the boundaries of such regions.

Projections at this time (subject to change) are for two successive aerial surveys. The first would be a general survey over the entire balsam fir forest type in years of light to severe budworm defoliation, at six mile flight lines. The second aerial survey would fly the moderate to severe spots at 1 mile intervals.

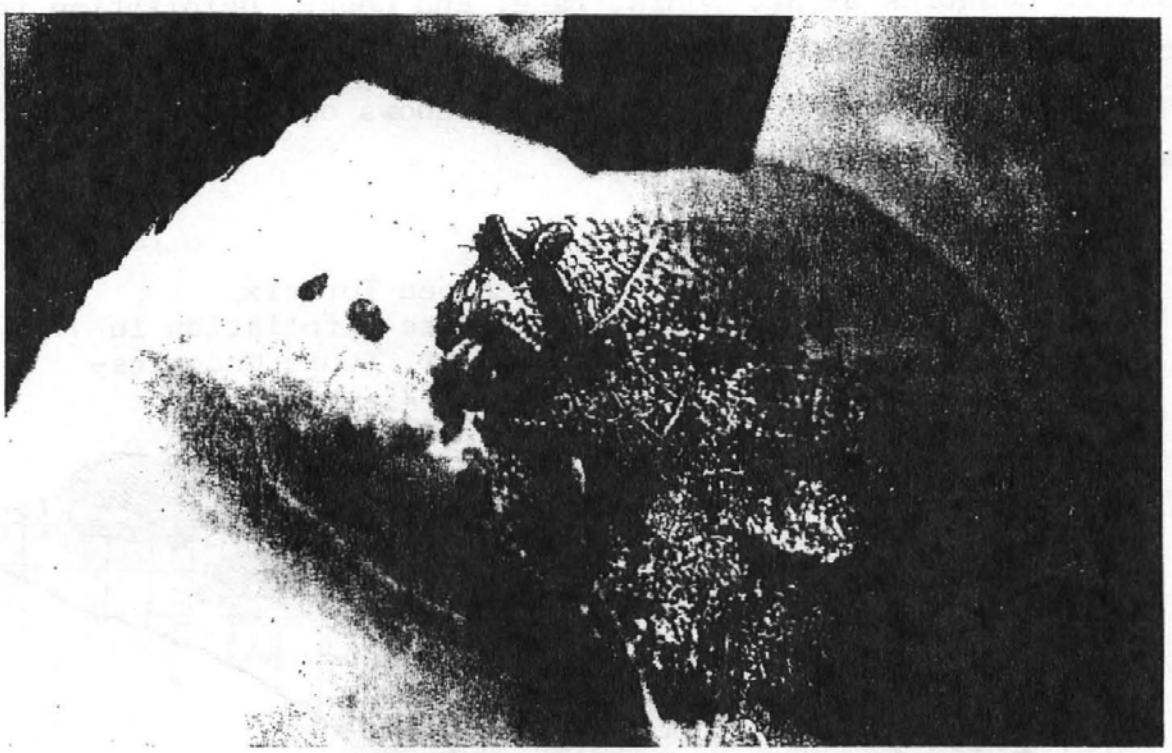
There would be ground follow-up only in moderate to severe defoliation areas, within the regions of utilization. Ground evaluation intensity would be partially determined by present and future market. The ground evaluation would also include egg mass counts.

Control would process forest management (primarily cutting of stands in severe areas) as the method to be used whenever possible. This would depend on maturity of stand and other variables. Bio-controls are also an important aspect, and increased attention will be given to this category. Chemical control requirements are fast changing, and control projects are often difficult to project in advance. Use of chemicals will most likely be in recreational areas with balsam fir and immature stands of balsam fir that are being severely defoliated.

Large Aspen Tortrix
Choristoneura conflictana (Walker)

1972 is the fourth consecutive year of severe aspen defoliation by the large aspen tortrix in northern Minnesota. St. Louis, Lake, Cook, and Carlton counties have had the most serious damage, with more widespread defoliation in Beltrami, Koochiching, Itasca, Cass, Aitkin, Pine, and Lake of the Woods counties.

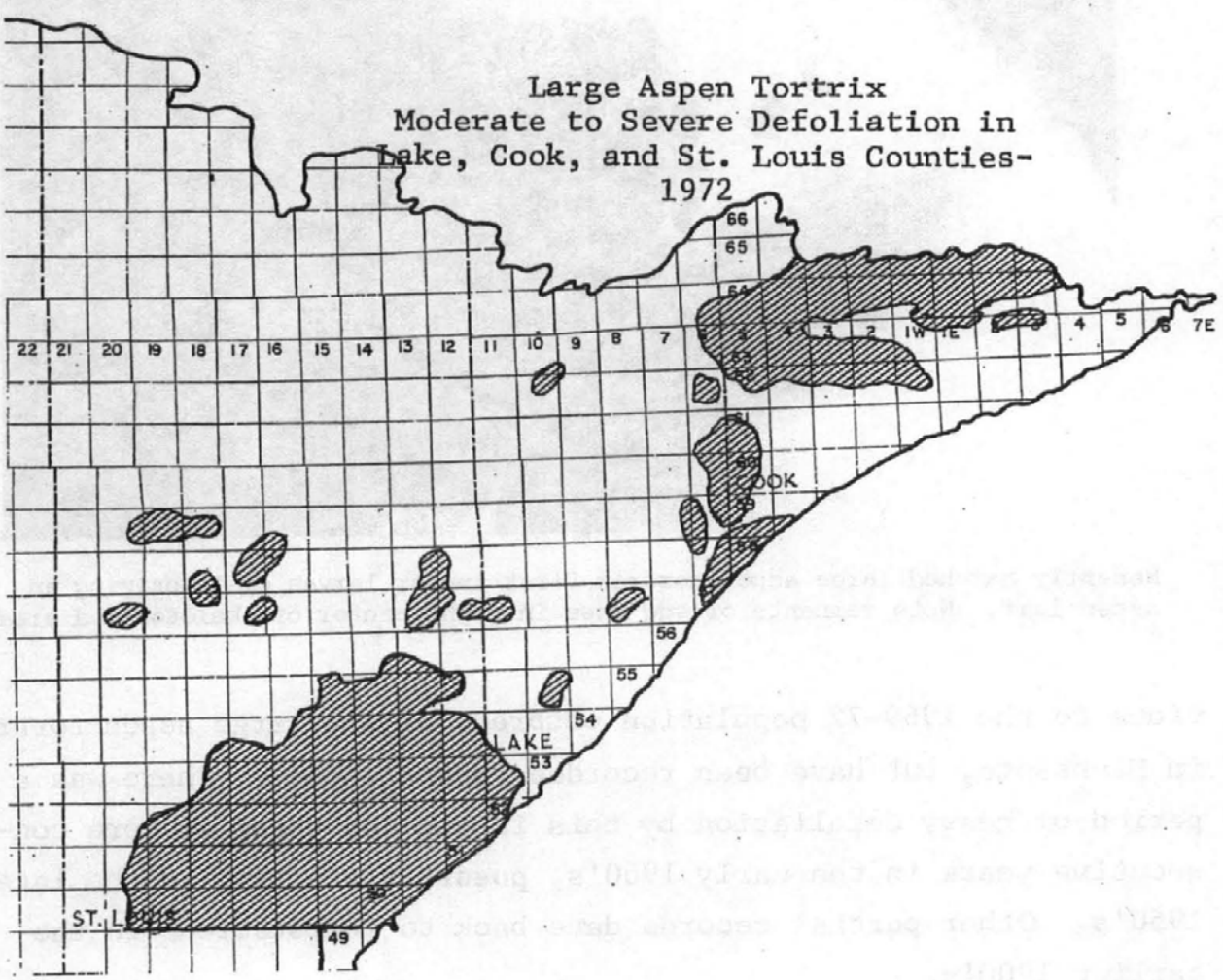
Widespread aspen defoliations have been observed in years previous to the 1969-72 population outbreak of the large aspen tortrix in Minnesota, but have been recorded in small part. There was a period of heavy defoliation by this insect for three or more consecutive years in the early 1960's, possibly starting in the late 1950's. Other partial records date back to infestations in the earlier 1900's.



Recently hatched large aspen tortrix first instar larvae skeletonizing an aspen leaf. Note remnants of egg mass in right center of skeletonized area.

It appears that large aspen tortrix impact on aspen forests may not be much different than that by the forest tent caterpillar. Later data shows at least three or four years of consecutive heavy defoliation in large regions of northeastern Minnesota. Recreational impact is quite different between the two insects. After a complete defoliation, the forest tent caterpillar migrates to new foliage areas in large masses, sometimes extending for miles across highways. The large aspen tortrix makes some attempt to migrate after complete defoliation, but doesn't seem to range too far. Starvation-disease causes considerable mortality.

1972 defoliation by the large aspen tortrix was considerably more widespread than in 1971, but was less intense in the northeastern counties of St. Louis, Lake, and Cook. Defoliation increased in 1972 in Koochiching, Beltrami, Lake of the Woods, and Itasca counties. The aerial defoliation map shows only the areas in St. Louis, Lake and Cook Counties.



Ground observations and collections were made in most of the major defoliation areas to determine that the defoliator was definitely the large aspen tortrix, to check defoliation levels according to aerial mapping, and to collect cocoon samples for pupal parasitism and adult emergence.

1972 Large Aspen Tortrix Development:

-	May 6	2nd instar larvae observed in buds
-	May 19	3rd instars; a few 4th's
-	May 25	3 8 to 1/2 inch long, defoliation just beginning to show
-	June 6-7	aerial survey
-	June 12	65-75% pupation
-	June 22	76% adult emergence
-	June 27	Adults still common and ovipositing
-	July 12	Major egg hatch

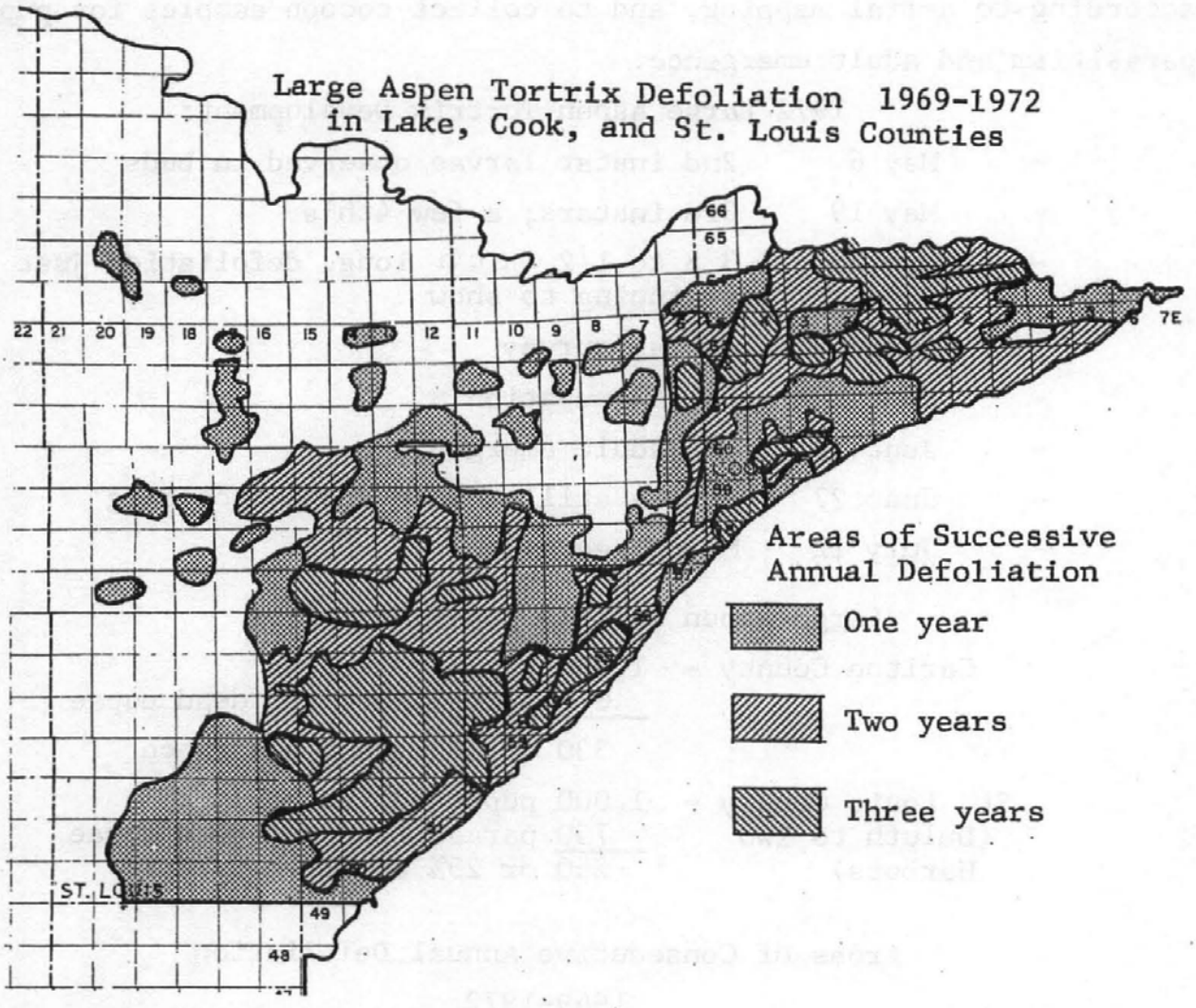
Large Aspen Tortrix Pupal Mortality

Carlton County -	1,000	pupae collected
	670	parasitized and dead pupae
	330	or 33% adult emergence
St. Louis County - (Duluth to Two Harbors)	1,000	pupae collected
	750	parasitized and dead pupae
	250	or 25% adult emergence

Areas of Consecutive Annual Defoliation

1969-1972

To begin determinations on defoliation impact on aspen forests by the large aspen tortrix, the defoliation maps for 1969, 1970, 1971, and 1972 were overlayed with the results on the following map. The areas of one to three successive annual defoliations are illustrated to show that there are large areas with at least two to three years of successive damage. Approximately one third of the forest type consists of aspen. Defoliation by the large aspen tortrix appears reasonably consistent as observed from the air, but when going through large aspen areas on the ground, there sometimes is considerable variation of defoliation from one stand to another and even on adjacent trees.



Successive Years of Annual Defoliation	Acreage	% of Total Four-Year Acreage
1	1,013,760	38.5%
2	944,640	35.9%
3	645,120	24.5%
4	27,648	1.0%
Total	2,631,168 acres	

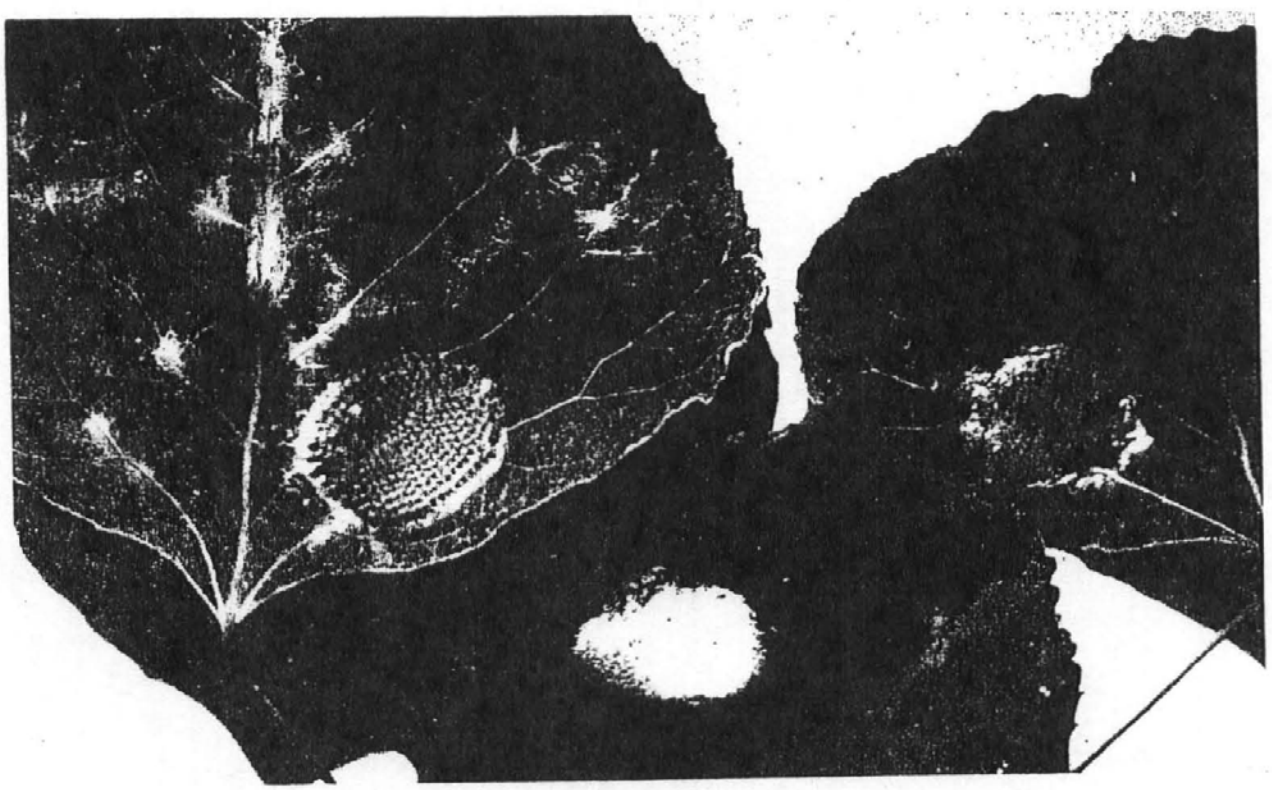
From the preceding information, there are large areas that are defoliated for three successive years, but little beyond that. Even so, three years of defoliation on aspen would appear to have impact on the forest stand by loss of growth, twig and branch dieback, and possibly added stress in the off site or more swampy locations.

There has been little measurement of the impact by large aspen tortrix defoliation to date. Some plots will be put in St. Louis, Lake, and Cook Counties in 1973 to evaluate this aspect.

Large Aspen Tortrix Egg Mass Survey and 1973 Potentials

An egg mass survey has been processed in some plots for the last three years in St. Louis, Lake, and Cook counties. Three 36" foliated branches are taken from one to three trees per plot, and the egg masses are totaled for all leaves per branch.

The objective of this survey is to obtain population potentials for the forthcoming year for large regions of aspen. The following tabulation shows the average egg masses per branch in 1970, 1971, and

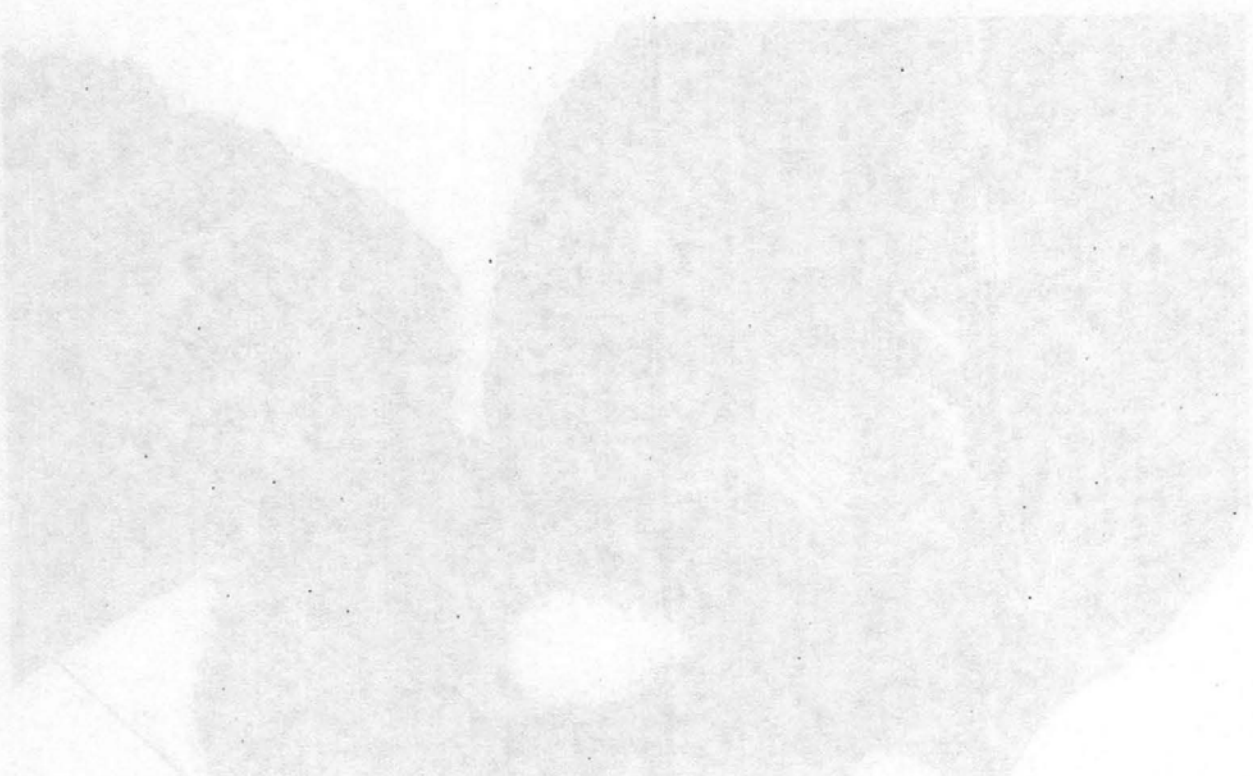


Egg masses of the large aspen tortrix on aspen leaves.

1972 in the four county areas indicated.

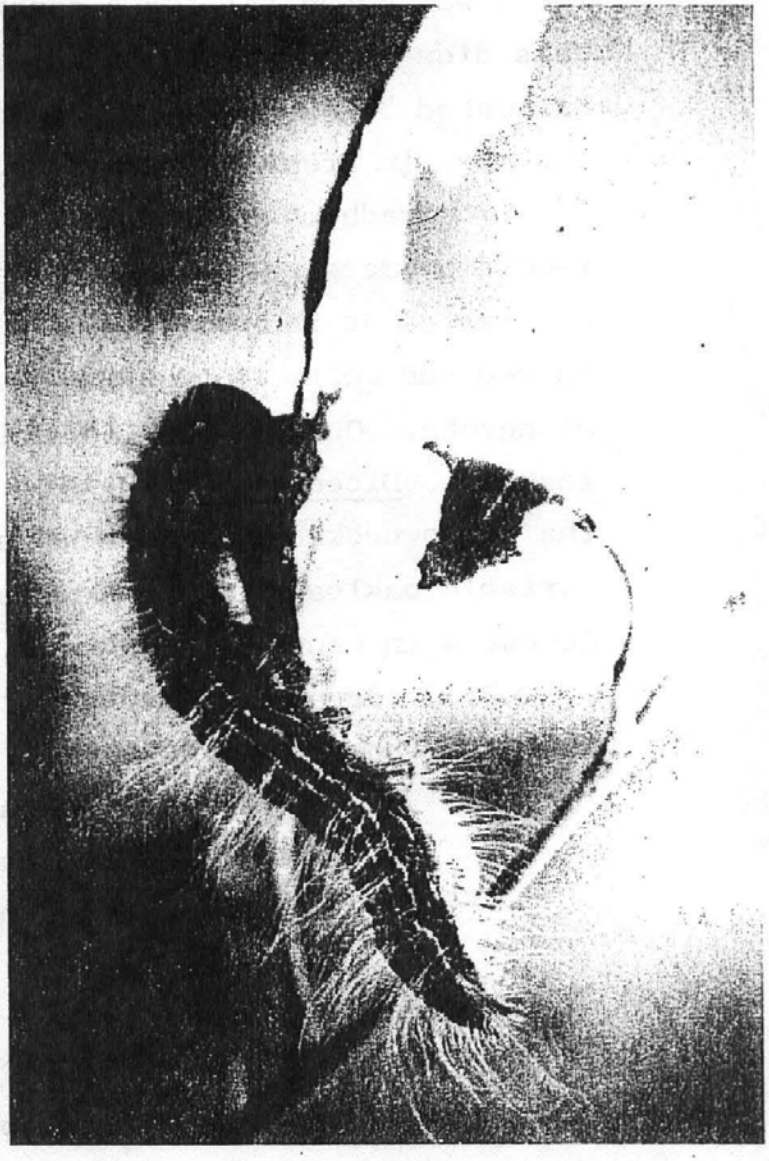
	1970	1971	1972
Cook County	.5	3.7	.75
Lake County		3.1	1.6
St. Louis West (Ranges 17-21)		.9	4.47
St. Louis East (Ranges 12-16)	.29	2.38	1.08

From this information, it appears that Cook, East St. Louis, and Lake County populations of the large aspen tortrix are on the decrease, and there is a sharp potential increase in 1973 in West St. Louis County.



Fall Defoliator Complex

The fall defoliator group includes the redhumped oakworm, Symmerista canicosta (Francl.), the orangehumped mapleworm, Symmerista leucitys (Francl.), the variable oakleaf caterpillar, Heterocampa manteo (Doubleday), the orangestriped oakworm, Anisota senatoria (Smith), and to a lesser degree, the yellownecked caterpillar, Datana ministra (Drury), Dicentria lignicolor (Wlkr.) and a host of minor defoliators. Oak was the favored host in most areas, followed by birch, basswood, and hard maple. Hazelnut, elm, ash, and soft maple were defoliated to a lesser degree.



Yellownecked caterpillar, one of the species included in the fall defoliator complex.

The population upsurge of the fall defoliator group began in 1969 (although a few small outbreaks were reported in 1968) in Ottertail and adjacent counties. In 1970, the areas of moderate to heavy defoliation included sporadic but widespread locations in Kandiyohi, Ottertail, Itasca, Mahnomen, Clearwater, and Beltrami counties. Light

defoliation and larval reports were received from Stearns, Pope, Isanti, Todd, and Cass counties. In 1971, populations and defoliation increased sharply from 1970, with innumerable locations of defoliation on areas ranging in size from 10 to 40 acres to areas five or more square miles in size. The total acreage of heavy - severe defoliation in 1971 in Minnesota was estimated at 725,000 acres.

From soil surveys of the overwintering stages of the fall defoliator group taken in the fall of 1971 and in the spring of 1972, there was potential for a considerable population increase in 1972. This didn't materialize, and August-September defoliation totaled an estimated 36,500 acres, a reduction of some 2,000% from one year to the next in area and intensity.

The redhumped oakworm and orangestriped mapleworm adults were recorded emerging on June 30, and some egg masses were collected on oak leaves at that same date. First and second instars were common on red and white oaks on August 11 in central and east central Minnesota. On August 18, the larvae were still mostly in the early instars. Dicentria lignicolor was 6 to 8 mm. long on August 11, the yellownecked caterpillar was noted hatching on July 14, and the variable oakleaf caterpillar was recorded at 7/16 inch long on August 4 in central Minnesota.

From larval collections at a number of distribution points in central Minnesota, percentages of larvae collected were as follows:

Variable oakleaf caterpillar	- 75.75%
Orangehumped mapleworm	- 18.00%
Redhumped oakworm	- 2.25%
Other species	- 4.00%

Parasite Study of the Variable Oakleaf Caterpillar and the Redhumped Oakworm

In the fall of 1971 and spring of 1972, soil collections of the overwintering pupal and pre-pupal stages of the redhumped oakworm and the variable oakleaf caterpillar were made near Stacy, Zimmerman, and Pillager, Minnesota, primarily to determine parasitism.

Two orangestriped oakworms, a yellownecked caterpillar, and one redhumped oakworm. These are part of the fall defoliator group.

In each area there were six plots, with five sampling points of 1/10 milacre (26 x 26 inches) at each plot in the fall, and three 1/10 milacre samples per plot in the spring. All duff was collected from the 1/10 milacre plots, the duff averaging about four inches in depth. All duff was processed in the field or laboratory for pupae or pre-pupae.

The variable oakleaf caterpillar stage was the pre-pupal form, and the fall collections were put in small containers and covered with dirt and wet sphagnum moss and stored at 0^{o} C. for 2.5 months, then at 15^{o} C. for development and adult emergence. The spring collected pupae and pre-pupae were immediately put at 15^{o} C.

All adults and parasites were allowed to emerge, and dead pupae and pre-pupae were counted. Identification of parasites was based on the keys of Allen (1972).

	Redhumped	Variable
Fall Collection	376	1,588
Adult Emergence	7.4%	21%
Parasites	0	4
Spring Collection	266	1,302
Adult Emergence	6	0
Parasites	13	0

Parasites from the fall collection, variable oakleaf caterpillar were Pateloa sp. (Tachinidae) and Phobocampe pallida (Ichneumonidae). The parasites from the spring collection of redhumped oakworms were four Coccygomimus pedalis and one unidentified Ichneumonidae, and eight Boettcheria latisterna.

Conclusions that were drawn from the soils collection project was the difficulty in rearing overwintering redhumped oakworm and variable oakleaf caterpillar to the adult stage, and that possibly the overwintering stages have low parasitism. One of the rearing problems was the infestation and rapid buildup of mites, molds, and other fungal growth in rearing containers.

Literature Cited

Allen, Douglas C. 1972 Insect parasites of the saddled prominent, Heterocampa guttivitta (Lepidoptera: Notodontidae), in the northeastern United States. Can. Entomol. 104 (10): 1609-1622.

Wetzel, Barbara W. 1972 History and Parasite Study of the Variable Oakleaf Caterpillar, Heterocampa manteo, and the Redhumped Oakworm, Symmerista canicosta in Minnesota. Unpublished Cooperative Report, Minnesota Department of Agriculture and the University of Minnesota.

Pine Tussock Moth
Dasychira plagiata (Walker)

From 1971 defoliation records and an egg mass survey on the pine tussock moth in August of that year, indications were that 1,000 to 1,500 acres of jack pine would suffer heavy defoliation in 1972 in the General Andrews State Forest, northeast of Willow River, Minnesota. Jack pine cones were collected from December, 1971 to February, 1972 to check the numbers of overwintering second instar pine tussock larvae. This survey method gives relative populations that are compared with cone collection surveys followed by outbreaks of the pine tussock moth. Estimates are simply for low, moderate, or high populations. There were 800 two to five year old cones collected from 16 plots covering the predicted jack pine problem location, and only *one* live larvae was found in the total. This contrasts with the average of several larvae per cone when such a survey is followed by heavy defoliation. Although the survey technique is not completely dependable, it does establish an indicator during the winter season that can be further checked by early larval surveys in May.

Thus, in May of 1972, dropcloth checks were made throughout most of the same jack pine stands, with very low numbers of larvae per dropcloth check. This same average was consistent through mid-June, and all control plans were dropped.

An egg mass survey was also made during the early and late winter months to check egg mass remnants for a hatch, non-hatch ratio. There were 873 eggs located in a eight hour search, and 52 percent were apparently hatched. Of the balance, 26 percent had parasite emergence holes, and 22 percent were non-hatched eggs. Together with the cone sample information, it appears a population decline took place after egg hatch and before the first or second instar

larvae reached protected overwintering locations.

Most of the overwintering second instar larvae were out of dormancy and were beginning to feed on jack pine needles on May 19.

June 2 - Larvae about ¼ inches in length; mostly in second and third instars.

June 9 - Mostly in third instar.

June 30 - Larvae in fourth to sixth instars; light populations.

July 7 - Larvae in late instars; approximately one week of feeding left.

July 14 - Ten percent pupation.

July 28 - Very few late instars still present. Over 90 percent pupation; some adult emergence.

Aug. 4 - Pupal and adult stages.

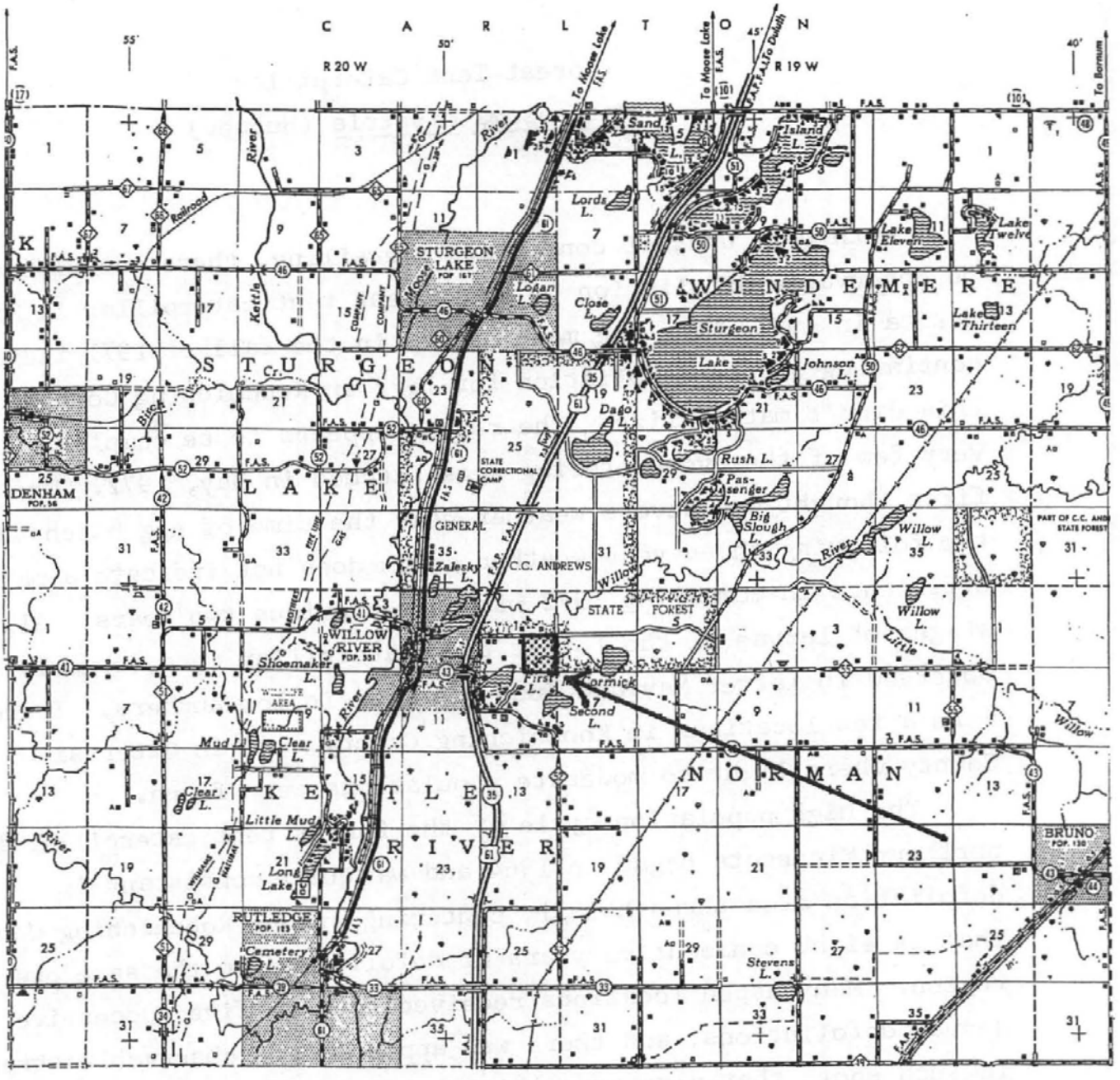
Aug. 11 - Surveys revealed very few egg masses.

Besides the egg mass survey information dated August 11, 1972, a pupal survey was conducted in late July, early August, and high percentages of the pupae were not viable. A total of 800 pupae were collected with the following results:

Adults emerged	2%
Parasitised pupae	60%
Dead pupae	38%

In 1972, moderate to heavy defoliation covered two spots totaling 80 acres in northern Pine County, as indicated on the map.

Indications are for low 1973 populations in Pine and Carlton Counties, and no controls are projected.

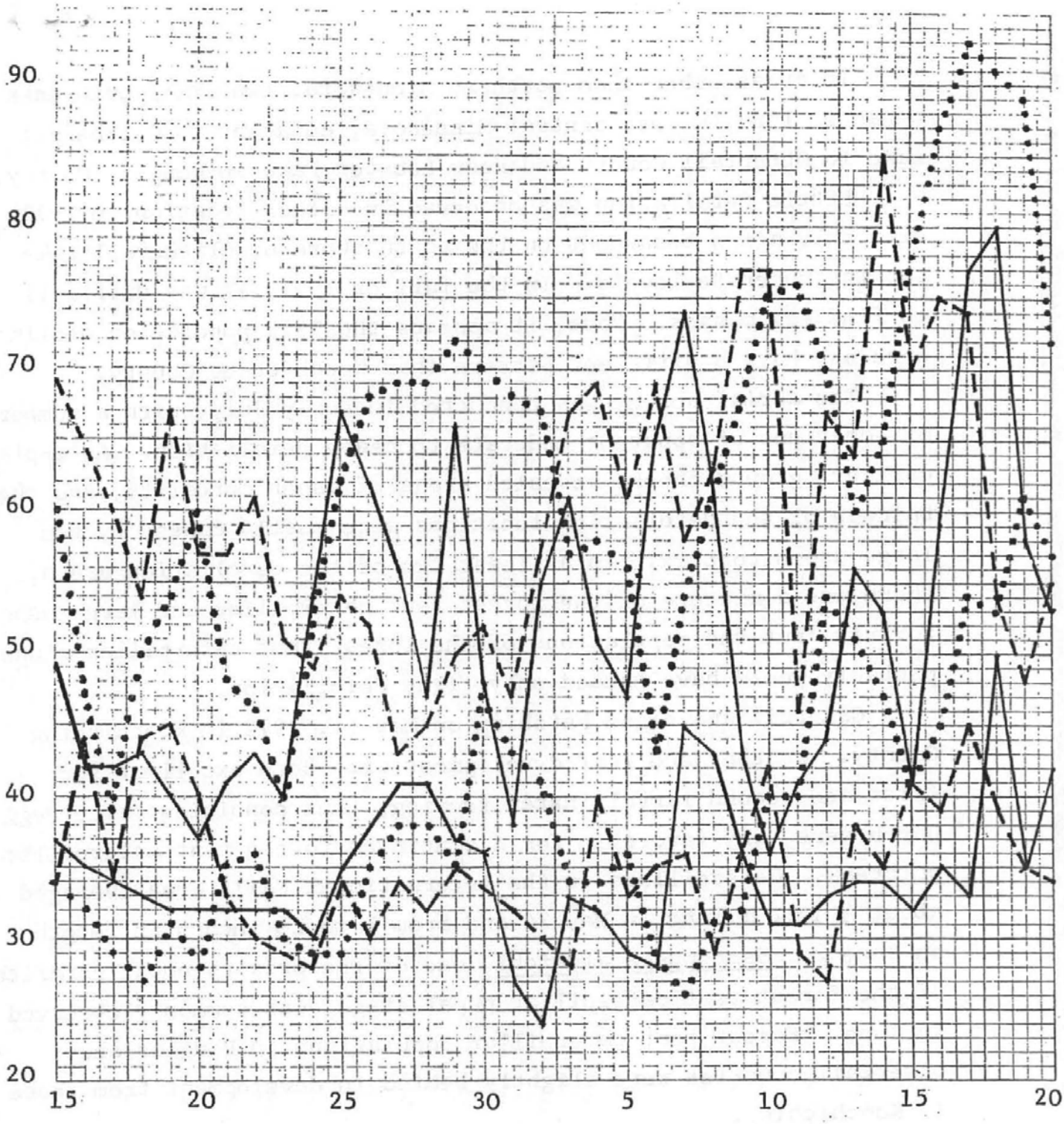


Eighty acres of the 160-acre location indicated had moderate to heavy defoliation by the larvae of Dasychira plagiata in 1972.

Forest Tent Caterpillar
Malacosoma disstria (Hubner)

With some unusual conditions prevailing, there was virtually no observable defoliation by the forest tent caterpillar in Minnesota in 1972. The egg mass survey in the fall of 1971 indicated continuing severe defoliation for 1972 in Koochiching County, but this didn't materialize. The reason appears to be complex, but very few of the overwintering eggs hatched in May, 1972. The first thought was severe weather near the time of egg hatch, but the following three year weather graph does not indicate a major difference in comparing 1972 with the previous two years. All stages of larvae of the forest tent caterpillar were commonly observed in latter May and June but were in low numbers. There were a few locations in Koochiching County, and in Ottertail County where light to moderate populations were found.

The high population cycle of the forest tent caterpillar in northern Minnesota began in 1964 and was quite consistent in defoliation area through 1971, centering around Koochiching County. That is eight consecutive years of defoliation in the same overall region. Many aspen locations received four to five successive annual defoliations, and there was apparent and observable stress in such spots that also had a high water table. These areas appeared as heavy defoliation from the air. There was little evaluation to attribute high water table or poor site mortality to the forest tent caterpillar defoliations, except for consistent annual defoliation records and by comparing similar sites within 35 miles that had received no forest tent caterpillar defoliation.



1970

1971

1972

Weather records for the three year period 1970-1972, showing the high and low daily temperatures from April 15 through May 20. The egg hatch dates were May 12, 1970, May 6, 1971, and May 11, 1972. The average temperatures for this time period were very close.

The three year temperature pattern for November-April 15 also showed little variation. This may indicate that adverse weather was not a factor in the poor FTC egg hatch.

In areas other than northern Minnesota, two small outbreaks began in 1969 in west central Minnesota, adjacent to Clitherall Lake in Ottertail County and near Lobster Lake in Douglas County.

Little defoliation was observed in either location in 1972, with only a few basswoods on the south shore of Clitherall Lake showing moderate levels. In the fall of 1971, it was difficult to find egg masses. Thus, it appears the 1972 population decline here may have a different pattern than Koochiching County.

The aerial survey was conducted in early July, with a number of locations of apparent moderate to heavy defoliation. As explained earlier, ground checks revealed areas of aspen mortality, and the balance of the defoliation locations were mostly caused by the large aspen tortrix. In at least two of the defoliation areas, there was a mixture of the forest tent caterpillar and large aspen tortrix, but the populations of the forest tent caterpillar alone probably would have caused only light defoliation.

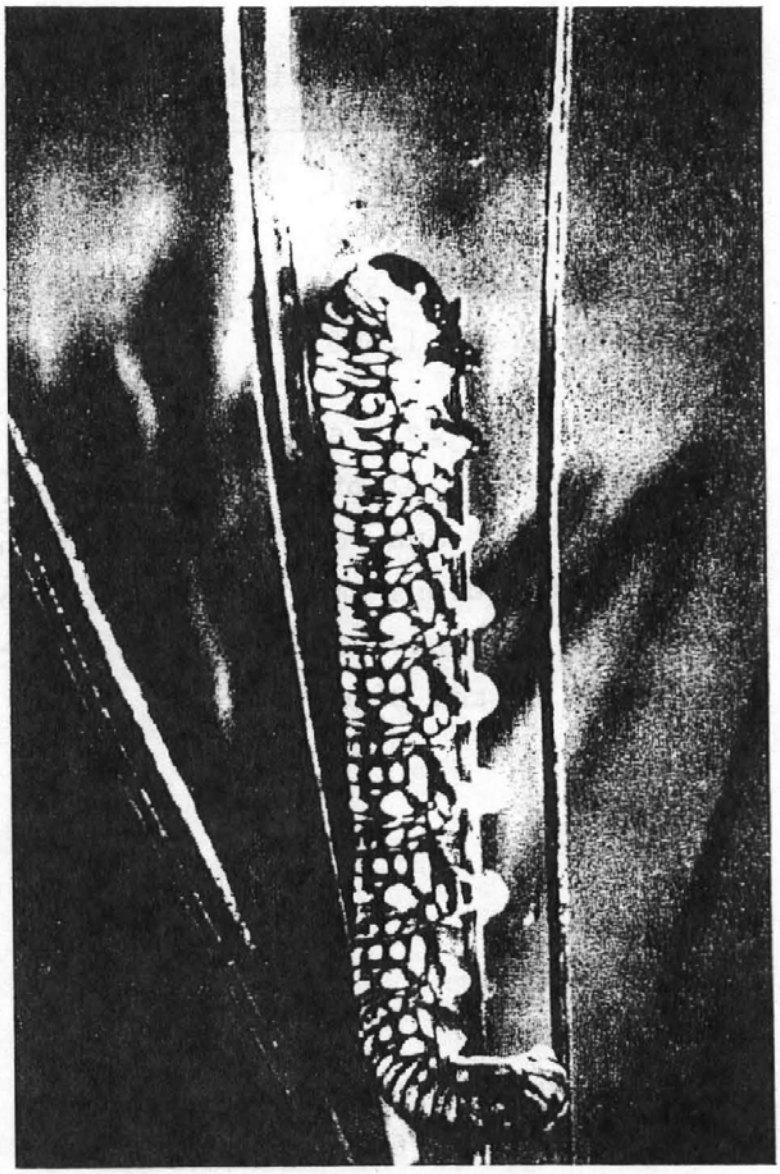
Caterpillars began hatching on May 11, 1972 in Koochiching County. Weather and leaf development were both excellent for first and second larval instar feeding, thus conditions after egg hatch were very favorable for a continued forest tent caterpillar outbreak. Caterpillars in the International Falls area averaged about ½ inch long on May 24 and from 1 to 1½ inches in length on June 2. Sarcophaga aldrichi, one of the primary pupal parasites of the forest tent caterpillar pupal stage, was commonly observed in June. Forest tent caterpillar populations in Douglas and Ottertail counties were slightly behind in development from those in Koochiching.

The egg mass survey conducted in October-December, 1972, indicates very light populations for 1973. The location with the most egg masses per plot (plot=three aspen trees) was west of Littlefork. One plot there had three egg masses; and another, six egg masses.

Introduced Pine Sawfly
Diprion similis (Htg.)

Several locations of mature white pine received moderate defoliation in Isanti, Anoka, Chisago, and Crow Wing Counties in September, 1971. With very moderate temperatures long into October, most of the introduced pine sawfly larvae were able to finish feeding, and the potential overwintering populations were higher in these locations than would normally be expected. The potential first generation population was very high for 1973.

A cooperative project (1972) between the Minnesota Department of Agriculture and the University of Minnesota was arranged to evaluate the parasites of the overwintering cocoon stage of the introduced pine sawfly. With this information, it was thought that the predictability of the sawfly population in 1973 would be more realistic, and at the same time further evaluate parasite control aspects.



Larva of the introduced pine sawfly.

Three stands of mature white pine were selected because of moderate or higher populations of the second generation introduced pine sawfly. The locations were near Stacy, Cambridge, and Carlos Avery Wildlife Preserve (west of Wyoming). Both aerial (above expected snow line) and soil cocoon samples were taken. The two collection periods were November, 1971 and April, 1972. All cocoons (fall collection) were put in an environmental chamber at 0^{o} C. for two months to complete diapause and later at 15^{o} C. Emerging parasites for both spring and fall were put in 95% alcohol. Parasites were tentatively identified and sent to Beltsville, Maryland for positive identification.

	# of whole cocoons from soil samples		# of whole cocoons from aerial samples	
	Fall	Spring	Fall	Spring
Stacy	146	297	644	268
Carlos Avery	573	693	2,801	372
Cambridge	1,896	579	5,098	1,408

Of all fall soil collections, there was 21.2% adult sawfly emergence, 2.5% bird predation, 31.4% rodent predation, 15.1% parasitism, and 18.5% unknown in the Cambridge location. The other locations were similar, except 7% adult emergence and 15.3% rodent predation in the Carlos Avery area and 16.3% rodent predation in the Stacy plot.

Parasite Data

	Cambridge	Carlos Avery	Stacy
Fall soil	3.7%	11.2%	13.0%
Fall aerial	22.4%	18.8%	23.1%
Spring soil	2.8%	10.1%	11.4%
Spring aerial	0.1%	1.1%	1.5%

Alphabetical List of Parasites

Aerial Collections - Fall

Agrothereutes lophyri (Nort.)
Bessa harveyi (Townsend)
Delomerista japonica (Cush.)
Delomerista novita (Cr.)
Eupelmella vesicularis (Retz.)
Eurytoma spp. (2 species)
Exenterus amictorius (Panz.)
Gelis tenellus (Say)
Monodontomerus dentipes (Dalm.)
*Pediobus tarsalis (Ashm.)
*Tetrastichus coerulescens (Ashm.)
*Trineptis scutellata (Mues.)

Aerial Collections - Spring

Delomerista japonica (Cush.)
Delomerista novita (Cr.)
Exenterus amictorius (Panz.)
Monodontomerus dentipes (Dalm.)
*Trineptis scutellata (Mues.)

*Hyperparasites

Soils Collections - Fall

Dahlbominus fuscipennis (Zett.)
Exenterus amictorius (Panz.)
Monodontomerus dentipes (Dalm.)

Soils Collections - Spring

Dahlbominus fuscipennis (Zett.)
Exenterus amictorius (Panz.)
Monodontomerus dentipes (Dalm.)

The best unit for soil collection of cocoons was a 1/10 milacre plot. There were high numbers of "dead" cocoons from spring and fall plots. Since the introduced pine sawfly can remain dormant for more than one season, it is possible that some of this category were still viable. Fungi were apparent on a number of cocoons from soil collections and was present on the dead remains inside the cocoon.

In the aerial cocoon collection, there was a severe drop in both adult sawfly emergence and parasites from the fall period to the spring collection. It appears that the cold weather exposure above the snow line is the apparent cause for this.

The parasitism percentages listed above were lower than were expected. The first generation population of the introduced pine sawfly was extremely low in virtually all white pine locations in Minnesota in 1972. This also continued into the second generation in September of 1972. It appears that the cocoon parasites played a very small part in the very light 1972 first generation. In the winter of 1971-72, there was very little frost in the ground due to early snow cover, that remained throughout the winter. The frost depth in the plot locations averaged two to four inches when samples were taken in the spring.

Cocoons of the introduced pine sawfly. The adult has emerged from the cocoon on the right.

References:

Wetzel, Barbara W., 1972 Insect Parasites of the Cocoon Stage of the Introduced Pine Sawfly, Diprion similis (Htg.) in Minnesota.

1972 Introduced Pine Sawfly Development

June 16 - Introduced pine sawfly populations considerably reduced from that expected. Size of larvae ¼ to 1 inch in length.

June 30 - No defoliation reports by first generation larvae.

July 28 - First generation in fifth instar and cocoon stage.

August 4 - First generation adults emerging and ovipositing in central Minnesota. Still some fifth instars present, although few in numbers.

August 11 - First generation adults still present.

September 5 - Second generation larvae from ½ to 1 inch in length. Populations low in most all white pine areas.

Larch Sawfly
Pristiphora erichsonii (Hartig)

Defoliation by the larch sawfly was quite reduced from that of 1971 over most of the 500,000 acres of tamarack in Minnesota. The average level of defoliation was estimated at 30-50 percent with the entire range considered. There was increased defoliation in some locations, especially the smaller acreages of tamarack in Crow Wing and Aitkin Counties where 90 percent foliage loss was common.

June 30, 1972	-	Larch sawflies in first-fourth instars, with some eggs still hatching.
July 7, 1972	-	Larvae mostly first-fifth instars, with reduced populations.
July 14, 1972	-	Second-fifth instars.
August 11, 1972	-	Larvae nearly completed feeding.

Gypsy Moth
Porthetria dispar (L.)

Some of the life stages of the gypsy moth have been "picked up" in Minnesota in the recent past; and with more widespread finds and several additional outbreaks in 1972, the problem is getting closer to Minnesota forests.

The closest infestation-defoliation area at the present time is in Michigan. A number of locations are involved, and defoliation covering some acreage is under close survey observation and control procedures.

A survey system in Minnesota is being organized at the present time. The primary tool here will be the use of a gypsy moth sex attractant trap that lures the male moths. Also, educational aspects will be stressed in 1973 to enable foresters and park-recreational managers to identify the various stages of this forest pest.

Yellowheaded Spruce Sawfly
Pikonema alaskensis (Rohwer)

The yellowheaded spruce sawfly continued to be a problem on white spruce plantation and roadside trees in 1972. A number of plantations were checked in Koochiching County, and about 80 percent of the plantations had defoliation. From 10 to 40 percent of the trees had moderate to severe defoliation. There were also several reports of damage by this sawfly on Colorado blue spruce and two reports on light defoliation in black spruce plantations.

June 15, 1972 - Third and fourth instars mainly, with some second instars present.

June 30, 1972 - Mostly in the fourth and fifth instars with very few seconds and some thirds.

July 7, 1972 - Feeding by larvae almost complete. Still many fourth and fifth instars present.

July 14, 1972 - Occasional fourth and few fifth instars observed. Most of the population in the duff and soil.

OTHER 1972 FOREST PROBLEMS

Forest Insect	Host	Location	Observation Date	Comments
Acantholyda erythrocephala (Linnaeus)	Jack and red pine	Scattered	April-Sept.	Scattered infestations, non-economic in plantations and ornamentals.
Adeges abietis (Linnaeus)	Spruce	Hubbard and Crow Wing Counties	April-June	Moderate numbers of galls on one plantation and ornamentals.
Agrilus anxius (Gory)	Birch	Scattered	April-Oct.	Commonly reported every year on ornamental trees.
Alsophila pometaria (Harris)	Broadleafs	Scattered, but most reports in Twin City area and Red River Valley	May-June	Cankerworms averaging ¼ to 5/16 inches on May 19, 3/4 inches on May 30, and estimated one week of feeding left on June 2 in Mpls.-St. Paul vicinity. Some chemical control in Mpls., St. Paul, and Red River Valley.
Andricus lanigeras (Ashm.)	Bur oak	Crow Wing County	August	One of many oak leaf galls that are common but seldom reported.
Aphrophora parallela (Say)	Scotch, white, and jack pine	Scattered	June-July	Very few reports. Lighter infestations observed in 1972.

Forest Insect	Host	Location	Observation Date	Comments
Arge sp.	Basswood	Crow Wing and Ottertail	July 21-Sept. 10	Heavy defoliation of basswood by this sawfly in association with other fall defoliators. High populations in this general area for the third successive year. Larvae averaging ¼ inch long on July 21.
Buccalatrix canidensisella (Chambers)	Birch	Scattered	June 15-30	First generation larvae mining birch leaves. Very few reports this year.
Cecidomyia resinicola (O.S.)	Jack pine	Central Minnesota	June-July	Low incidence on samples observed.
Cecidomyia verricicola (O.S.)	Basswood	Scattered	June-July	A midge, causing galls on the lower side of the leaves.
Cecidomyia verrucicola (O.S.)	Basswood	Scattered	Aug.-Sept.	Very common, but seldom reported.
Choristoneura pinus (Freeman)	Jack pine	Central and EC Minnesota	June-July	Very low populations in 1972. Budworms ¼ inch in length on June 2 and from ¼ to 1 inch long on June 16. Last larval instar and pupal stage on June 30.
Chrysomela scripta (Fabricius)	Robusta poplar cottonwood	South Central and SW Minnesota	August	Larval and pupal stages in mid August. Only a few infestations reported.

Forest Insect	Host	Location	Observation Date	Comments
Cincinnus melsheimeri (Harris)	Oak	Ottertail & Wadena Counties	September	Only a few casebearers collected in fall defoliator surveys.
Colopha ulmicola (Fitch)	Elm	Scattered	June-July	Very common in all municipalities or rural areas containing elm.
Corythucha arcuata (Say)	Oak	Central Minnesota	July-Aug.	Some browning of oak leaves in central Minnesota.
Dasineura communis (Felt)	Sugar maple	Fillmore County	June	Entire crown of some yard trees infested.
Dioryctria zimmermani (Grote)	Scotch, Austrian, Norway, and white pine	Scattered locations	June-Sept.	Reports and observations less than in 1971. Both shoot and stem boring reported.
Elaphidionoides villosus (Fabricius)	Oak	Entire oak area in Minnesota	July-Aug.	Always commonly reported because of fallen twigs on lawn.
Enaphalodes rufulus (Haldeman)	Red oak	Pine County	August	One location.
Eriophyes abnormis (Garm.)	Basswood	Roseau County	June	Causes gall formations on upper side of leaves.
Erranis tiliaria (Harris)	Basswood and bur oak	Ottertail County	June 12	Small location of defoliation at 10 percent level; less than one section.

Forest Insect	Host	Location	Observation Date	Comments
Fenusa ulmi (Sundevall)	Elm	Ramsey, Hennepin, and Wright Counties	June	Widespread in the areas reported and causing heavy browning to the leaves, giving the elms a very "diseased" appearance. Feeding completed by June 16
Gobiashia ulmifusae (Fitch)	Red elm	Carver County	June	One location of several trees with close to 100 percent infestation.
Hylobius radicis (Buchanan)	Scotch & Norway pines	St. Louis & Aitkin Counties	June-Aug.	One Norway pine plantation and several ornamentals with moderate to severe damage.
Hyphantria cunea (Drury)	Broadleafs	NE Minnesota	Early Aug.	Widely scattered in mid to late instars.
Ips pini (Say)	Pines	Scattered	June-Sept.	All reports secondary.
Lithocolletis sp.	Aspen	North Central & NE Minnesota	July	The aspen blotch miner has been commonly reported most every year. Population lower in 1972 than previous few years, except in localized spots. Has been determined Lithocolletis tremuloidella, but taxonomy apparently in some dispute.

Forest Insect	Host	Location	Observation Date	Comments
Neodiprion lecontei (Fitch)	Jack pine	Central and EC Minnesota	July 25-30	Third-fifth instar larvae causing minor damage in scattered roadside jack pine. Counties were: Pine, Carlton, Aitkin, Sherburne, Isanti, and Anoka.
Neodiprion rugifrons (Middleton)	Jack pine	Southern St. Louis County	July 28	Larvae in fourth-fifth instars causing defoliation to old needles in scattered roadside jack pine.
Nymphalis antiopa (Linnaeus)	Willow & elm	Mpls.-St. Paul & suburbs	June 5-15	Caterpillars up to two inches long in the Twin City vicinity.
Pachypsylla celtidismamma (Riley)	Hackberry	Scattered	August	Not reported or observed as much in 1972.
Paleacrita verata (Peck)	Broadleafs	Scattered, but most reports in Twin City area and Red River Valley	May-June	Cankerworms averaging ¼ to 5/16 inches on May 19, 3/4 inches on May 30, and estimated one week of feeding left on June 2 in Mpls.-St. Paul vicinity. Some chemical control in Mpls., St. Paul, and Red River Valley.
Paraclemensia acerifoliella (Fitch)	Sugar maple	Ottertail, Crow Wing, and Mille Lacs Counties	Aug. 18-20	The maple leafcutter causing observable damage on sugar maple. Larvae are in the casebearer stage on this date.

Forest Insect	Host	Location	Observation Date	Comments
Pemphigus populicaulis (Fitch)	Cottonwood	Scattered	June-Aug.	All cottonwoods observed.
Petrova albicapitana (Busck)	Jack pine	Central Minnesota and scattered statewide distribution	Throughout season	Minor damage causing some forking on small jack pine.
Physokermes picea (Schrank)	Spruce	Fillmore County	July 17	Only one report received, although usually observed in low numbers. At this date, eggs hatching and many crawlers observed.
Pineus strobi (Hartig)	White and mugho pine	Statewide	April-Sept.	Only a few reports in 1972. Appears to be a reduced problem from last few years.
Pissodes strobi (Peck)	White, jack, and red pines	Statewide	July-Aug.	Only a few white pine plantations reported with some problem. One Norway pine plantation in Crow Wing County with high incidence.
Pityophthorus sp.	Jack pine	Itasca County	---	Secondary invasion in low vigor trees.
Pulvinaria innumerabilis (Rathvon)	Mountain ash and basswood	Scattered	June-Sept.	High populations on mountain ash in a few spots in SW Minnesota.
Saperda calcarata (Say)	Lombardy poplar	Southern and SE Minnesota	Latter May	Causing trees in windbreaks to decline.

Forest Insect	Host	Location	Observation Date	Comments
Toumeyella numismaticum (Pettit & McDaniel)	Jack pine	East Central Minnesota	July 7	Crawler stage evident.
Tropidosteptes amoenus (Reuter)	Ash	Scattered	July 5-7	Second generation ash plant bugs feeding on underside of ash leaves.

Undetermined Tree Problems

A. Jack-Red Pine Mortality

There are several forested areas where jack, red, and white pine trees in Minnesota are dying. A number of determinations in 1972 have produced no causal agents, although a number of assumptions have been made from some of the tests.

There are at least six locations where jack pine stands or jack pine mixed with red pine have had very noticeable mortality over the past several years. Most of these locations are within 50 miles of the St. Paul-Minneapolis area but range as far as Blackduck. It is very probable there are many other similar locations that have not been reported. In a typical mixed jack-red pine stand near the Carlos Avery State Forest Nursery, west of Wyoming, Minnesota, about three to five percent of the jack pine have died annually for a period of three or more years before the first red pine has died. Dying and dead trees have been processed for signs of primary insects or diseases, but insects were found only in trees that were completely dead. Those trees with early problem symptoms (tree tops and some laterals with yellowing needles) had virtually no bark beetles or wood borers. As the stages of dying progressed, insect evidence increased. Former hail damage was common on at least one site and could possibly be a factor in the mortality, although this is unlikely. A number of branch samples were taken, and the dead tissue around the hail damage locations was minimal. A fungus was growing on the hail damage sites, and this has not been completely determined to date. Root and lower trunk areas showed little or no evidence of Armillaria or similar diseases. The soil was sifted for soil insects, with no positive developments; and there was virtually no evidence of insects feeding in aerial portions of the trees.

Soil samples were taken in three of the jack-red pine mortality areas, and three elements were found to be very low to extremely low. These were potassium, calcium, and magnesium.

More sampling procedures are scheduled for diseases, soils, and other possibilities in 1973. At this stage, it appears that the causal agent or agents are other than insects or diseases.

B. White Pine Decline

High percentages of mortality are occurring on at least one stand of mature white pine in Anoka County. Symptoms of this problem are similar to the visible effects caused by white pine blister rust in the crown area of white pine. A cankered area rings the perimeter of the stem 15 or 20 feet from the top of eighty year old trees with the white, resinous bleeding that typifies Cronartium ribicola. The similarity ends here, and to date a disease had not been identified. In addition to the upper stem cankering, branches and twigs in the crown area also had cankering. Whether the two areas of disease are caused by the same agent has not been established. To date, it appears that a disease should be involved with the problem. A system has been set up for sampling in the growing season of 1973, where samples will be taken each month.

Also, evaluations will include at least one additional location where a similar problem is occurring. Soil samples will be processed from both locations.

White Pine Blister Rust
Cronartium ribicola (Fisch.)

The white pine blister rust control program has historically pursued the control of this disease up to recent times. The primary approach had been to eliminate the alternate host of the disease, Ribes spp., which includes currant and gooseberry plants. This did not reduce the incidence in most areas to any appreciable degree for a number of reasons, and attempts for control moved in other directions. Chemicals were applied in recent years with little success, especially from forest viewpoints. Cultural methods had been somewhat used in early control work, and in the last few years has been the primary tool. Pathological pruning of infected limbs and lower whorls of branches up to six feet or nine feet is the only present acceptable control method. There are certain conditions to be met before such pruning is acceptable, especially the rate of blister rust incidence per year and the number of stems per acre.

Other methods of control are mostly in the silviculture field, with mixed species, or the underplanting of white pine with some of the broadleaf tree species. Although some of this has been done in Minnesota, there has been little long-range evaluation that shows clear results.

In the research field, the resistant tree approach is being investigated. Whether or not there is hope for the white pine in this area of work remains to be seen.

Within the Forest Pest Control activity, Minnesota Department of Agriculture, two men worked full time, with three laborers for pruning and two laboratory technicians to assist on evaluations and pruning in 1972.

Two pathological pruning areas were completed in the Paul Bunyan State Forest and in the Pillsbury State Forest. Data in

regards to disease incidence was collected on a total of 2,857 trees in the two control areas. Pathological pruning of white pine was performed on seven other locations on state and county lands in Cass and Hubbard County. Evaluations were made on ten other white pine sites totaling 1,073 acres.

-EVALUATION SURVEY-

Location and Ownership	Description S.	T.	R.	Type of Survey	Acres of W. P.
CASS COUNTY					
Pillsbury S.F.					
State land	1	134	30	Pruning plot	4
County land	17	140	31	Pre-pruning	188
	32	140	29	Type mapping Pre-pruning	74
	7	140	31	Pre-pruning	41
				Sub-total	307
HUBBARD COUNTY					
P. Bunyan S.F.					
Private land	7	141	32	Pruning plot	2
State land	5	142	33	Pruning Eval.	50
State land	25	142	33	" "	133
State land	14	142	32	" "	190
State land	21	142	32	" "	110
State land	35	142	32	Pre-pruning	281
				Sub-total	766
				TOTAL	1,073

-PATHOLOGICAL PRUNING-

Location and Ownership	Description S.	T.	R.	Acres W. P. Pruned	Ave. Trees Per/A.
CASS COUNTY					
Pillsbury S.F.					
State land	1	134	30	60	300
County land	32	140	29	229	200
			Sub-total	289	
HUBBARD COUNTY					
P. Bunyan S.F.					
County land	12	141	33	26	200
State land	7	141	32	12	200
County land	6	141	32	99	250
State land	31	142	32	40	250
State land	36	142	32	196	150
			Sub-total	373	
			TOTAL	662	

There will be one additional pathological pruning project in 1973, to be completed June 30, 1973. Starting July 1, 1973 there will be six months to two years of evaluation work, with little or no control of any kind. Evaluations will be made on pruning effectiveness, disease incidence in high and moderate hazard zones, crown incidence, effects on reproduction in different zones, and on white pine planted under other forest tree species.

In 1973, a request by the land manager or land owner will probably be necessary before control evaluations will be made. After such a request, a survey of the site will be processed to determine the incidence, area use, number of stems per acre, size of pines, and other information that will lead to a mutual determination on control procedure.

Reference:

Bilben, S.E., 1972 White Pine Blister Rust Report, Minnesota Department of Agriculture

Oak Wilt

Ceratocystis fagacearum (Bretz.)

The exact boundaries of the oak wilt distribution have not been well defined in Minnesota to this date. The supposed northern "line" extends roughly from St. Cloud to Taylors Falls, and the southwestern distribution of oak wilt in Minnesota is unknown.

In 1971 a cooperative sampling of a pocket of dying oak trees in the vicinity of Big Sandy Lake, Aitkin County, was made by the Minnesota Department of Agriculture and the Minnesota Division of Lands and Forestry. The result was a typical crude concentric pattern of mortality for several years. One of the samples taken was determined positive for oak wilt by the Department of Agriculture.[1]

In 1972 the Minnesota Department of Agriculture sampled the location again and sent the samples of the University of Minnesota, Department of Plant Pathology, for further tests.[2] With an additional positive, it was determined that the Big Sandy Lake area had an oak wilt infection center, and that the disease had been there at least several years. The origin of the disease at this location was impossible to determine.

Since there is no regulatory procedure for oak wilt in Minnesota, no control procedures were recommended by the State of Minnesota at this time. The 1973 program on oak wilt will include a close look at preventative measures to set up minimum guidelines for individual, municipal, and rural values and to conduct some aerial and ground surveys in the outlying disease locations.

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1 1971 Determinations by Milton Marinos, Plant Pathologist, Minnesota Department of Agriculture.

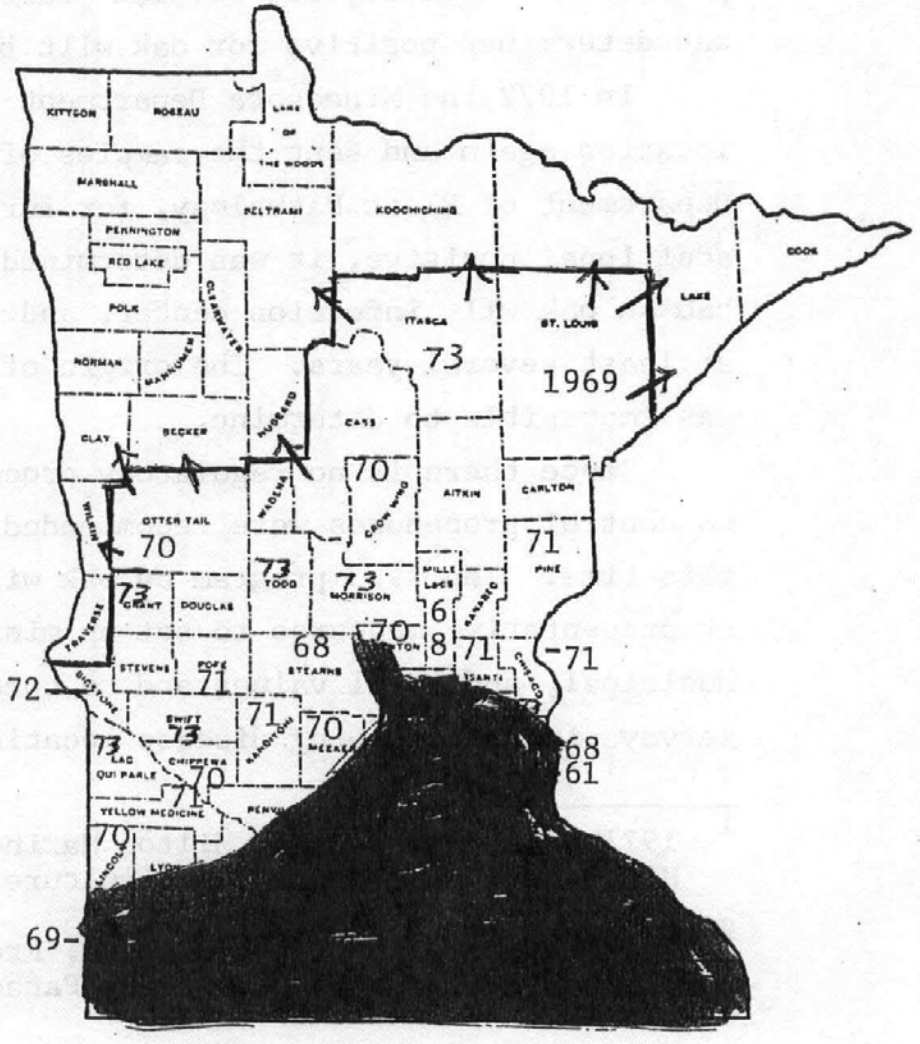
2 1972 Determinations by Dr. D. W. French, University of Minnesota, Department of Plant Pathology.

DUTCH ELM DISEASE REPORT - 1972

1973 48 new communities
7 new counties

Dutch elm disease continued to increase in severity and spread during the 1972 season. Thirty-one municipalities found their first positive case in 1972 as did two counties. Two hundred sixty municipalities now have DED - this represents 30% of the 854 incorporated cities and villages in Minnesota. Fifty-five of the 87 counties are infected. Outside of the Twin City metropolitan area the hardest hit cities were Rochester, Austin, Albert Lea, and Mankato. Austin appeared to have the highest rate of infection.

During the period June 1, 1972 to October 5, 1972, three thousand one hundred and ninety-four elm samples were submitted to the Minnesota Department of Agriculture Dutch Elm Disease Laboratory. Of these, 1882 were diagnosed as positive for Dutch elm disease. The City of Austin laboratory confirmed 187 positive cases, the St. Cloud laboratory 20, and the University of Minnesota Plant Disease Clinic 147. The City of St. Paul field diagnosed 480 positive



ANNUAL DISEASE PROGRESSION BY COUNTIES

cases in addition to the 319 diagnosed by our laboratory. The total of diagnosed cases in 1972 from all agencies was 2716. This represents 47% of the 5826 cases that have been diagnosed since Dutch elm disease was first discovered in St. Paul in 1961.

DED is becoming increasingly evident in rural areas especially along rivers and their tributaries. The Root, Cedar, and Blue Earth River valleys in southern Minnesota have many diseased and dead elm. Thousands of dead elm are found along the Mississippi River from Anoka to St. Cloud. An epidemic area exists along the St. Croix River from Bayport to Marine-on-the St. Croix. Undoubtedly there are other undiscovered foci of infection especially in southeast and south central Minnesota.

Reference:

Marinos, Milton 1972 Dutch Elm Disease Annual Report, Minnesota Department of Agriculture

OTHER DISEASE PROBLEMS IN 1972

Disease	Host	Location	Observation Date	Comments
Ascochyta sp.	Blue spruce	Yellow Medicine County	August	Moderate damage on windbreak. Disease probably on trees in weakened condition.
Chrysomyxa sp.	Black spruce	Northern half of Minnesota	Late summer and fall	Incidence much reduced in 1972 from previous two to three years. Trees less than two feet tall were quite heavily infected in some locations.
Coleosporium asterum	Pines	Scattered	June	Several reports in 1972; appears reduced incidence on old needles.
Fusarium solani	Populus spp. and green ash	Southwestern Minnesota	May-Aug.	This fungus was cultured from cankers on the tree species.
Gloeosporium sp. Gnomonia sp.	Broadleafs	Scattered	Summer	Two of the broadleaf anthracnose diseases. There are also other genera involved, these were found most often.
Scleroderris lagerbergii	Conifers	Northeastern Minnesota	---	No state surveys for the disease were made in 1972. Surveys are planned for 1973.
Sclerotinia whetzelii	Aspen	Northern Minnesota	July	Commonly observed, especially on reproduction aspen in 1972, but incidence light.