

# Minnesota Forest Health Annual Report 1999



Department of Natural Resources  
Division of Forestry, Forest Health Unit

# Minnesota Forest Health Annual Report - 1999

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## Softwoods

### Diplodia tip blight

*Sphaeropsis sapinea*

Diplodia tip blight infected white pine near Island Lake north of Duluth in St Louis County. The infected red pines were understory trees from 6 to 20 feet tall. The trees had many dead branch tips. *Sphaeropsis* fruiting bodies and spores were found on dead branch tips and on the bases of dead needles.

### Jack pine budworm

*Choristoneura pinus* Freeman

Host	Jack pine
Damage	None
Area	None
Severity	NA
Trend	very low to none

In Region 1, early larval surveys conducted on 12 plots in mid-June taken from stands with a history of JPBW outbreaks produced no larvae. Egg mass survey taken on 18 plots produced only 1 egg mass. The egg mass survey indicates that little or no defoliation is expected into the new millennium.

In Region 3, 1999 was the fourth consecutive year of zero budworm activity in Region 3.

### Larch sawfly

*Pristiphora erichsonii*

No defoliation was observed in Sec17-T52N-R21W in St Louis County in 1999. This tamarack stand was completely defoliated in 1997 and 1998. No other reports of larch sawfly defoliation were received in Region 2 this year.

### Lirula needlecast of spruce

*Lirula nervata*

Lirula needle blight has been found to be a minor disease of spruce in some areas, and one causing serious injury when present in other areas. The later seems to be true for a few trees found in a Fillmore County shelterbelt. This is only the second time we have seen this leaf disease affecting spruce in southeastern Minnesota in the last few years. Fungicide applications of chlorothalonil may control *Lirula* with two applications, one each in early June and July.



## **Pine tussock moth**

*Dasychira pinicola* (Dyar)

Host	Jack pine
Damage	None
Area	None
Severity	NA
Trend	After increasing sharply in 1998, pheromone trap catches leveled off in 1999 at the 1998 levels. We are still unable to find PTM caterpillars.

Since 1980 the numbers of pine tussock moth caterpillars in Pine and Crow Wing Counties have diminished or remained low. In 1996 and 1997 trapped moths in northeastern Wadena and southeastern Hubbard Counties increased sharply, and in 1998 numbers of trapped moths increased at 4 of these locations, remained the same but at high numbers at 1 location, decreased at 6 locations, and ranged from 30 to 111 moths at 3 locations not previously trapped. The number of moths trapped in 1999 in Wadena and Hubbard Counties was close to the number trapped in 1998. It is likely that pheromone trapping will be continued in Wadena and Hubbard Counties in 1999 but discontinued in Crow Wing and Pine Counties.

Actual trap catches can be found in the Survey Results section. This year, two different lures (2 sets of 10 and coded P and S), in addition to the lure used for many years (coded R) were placed in the field. The trap data revealed that the P lures were nearly as effective as the long-used R lures at all but one location, and that the S lures were ineffective in attracting male pine tussock moths. The P lures were in rubber septas (Trece Company). The S lures were in small screen cages fitted with paper clips (PheroTech Company). These two different lures were placed at least 30 yards away from the R lures.

## **Red turpentine beetles**

*Dendroctonus valens*

Pine trees dying with evidence of red pine turpentine beetles seems to be more common, in Region 2, in the past several years than previously. Most of these trees are older and are on sites where they have been stressed such as lawns, on or near construction sites, on partial cut timber sale sites or on under-burn sites. Some trees attacked by turpentine beetle had healthy looking crowns but still died after attack.

## **Root Collar Weevils**

*Hylobius radicis*

Twelve to 14 foot tall red pine in a backyard windbreak in La Prairie in Itasca County were being killed by root collar weevils. Trees started dying and tipping over about 3 years ago. Cultural and chemical control recommendations were made to try to save the remaining trees.

## Spruce budworm

*Choristoneura fumiferana* (Clements)

Host	White spruce plantations, balsam fir in natural stands
Damage	Defoliation, topkill and mortality
Area	69,620 acres
Severity	26,709 acres $\leq$ 50% defoliation and 42,911 acres $>$ 50% defoliation
Trend	Decreasing due to declining populations

Early larval surveys in Region 1 were taken in seven white spruce plantations approximately 30 years old during the month of June. On seven plots the number of larvae averaged 4.69 larvae per nine branches using the dropcloth method of survey. Larvae counts ranged from .22 larvae per branch to 8.88. The larval surveys indicated that the 1999 defoliation would be moderate to heavy in 1999. When doing the egg mass surveys in September, five sites had low to moderate defoliation and 3 sites had moderate to heavy defoliation during 1999.

When analyzing data from 1997-1998 surveys, it appears that the population began to decrease in 1998. (see chart)

Spruce budworm activity continued in Region 2. Less acreage was defoliated in 1999 as compared to 1998 and the level of defoliation also decreased. In 1998, 64% of the egg mass plots had heavy defoliation, 18% moderate and 18% light. In 1999 only 5% of the egg mass plots had heavy defoliation, 33% moderate and 62% light defoliation. Based on the 1999 egg mass survey light defoliation is predicted on 71% of the plots, and moderate on 29% of the plots in 2000. Heavy defoliation was not predicted on any of the egg mass plots in 2000. So the population and acreage of defoliation are expected to continue to decline next year.

1999 was a very wet summer with most of Region 2 receiving 150-175% of normal rainfall. This may have contributed to the decline in spruce budworm.

Larval, defoliation and egg mass surveys revealed that spruce budworm populations in white spruce and balsam fir are declining or remaining at low levels for a second consecutive year in most areas in Region 3. See Survey Results section. Both springs were warm, allowing the spruce and balsam to grow and lignify their needles which inhibited many budworm caterpillars from obtaining enough nutrients to reach the moth stage.

Acres of spruce budworm defoliation in Region 3 - 1999 - aerial survey results

County	Trace 0-25%	Light 26-50%	Moderate 51-75%	Heavy 76-100%
Aitkin		37		
Cass	59	42	192	
Chisago			42	
Crow Wing			133	



Morrison		59		207
Pine		71	81	
Stearns		209	34	
Totals	59	418	482	207
1166 acres				

Degree day calculations were made for eight locations in or near Region 3 and the results are presented below.

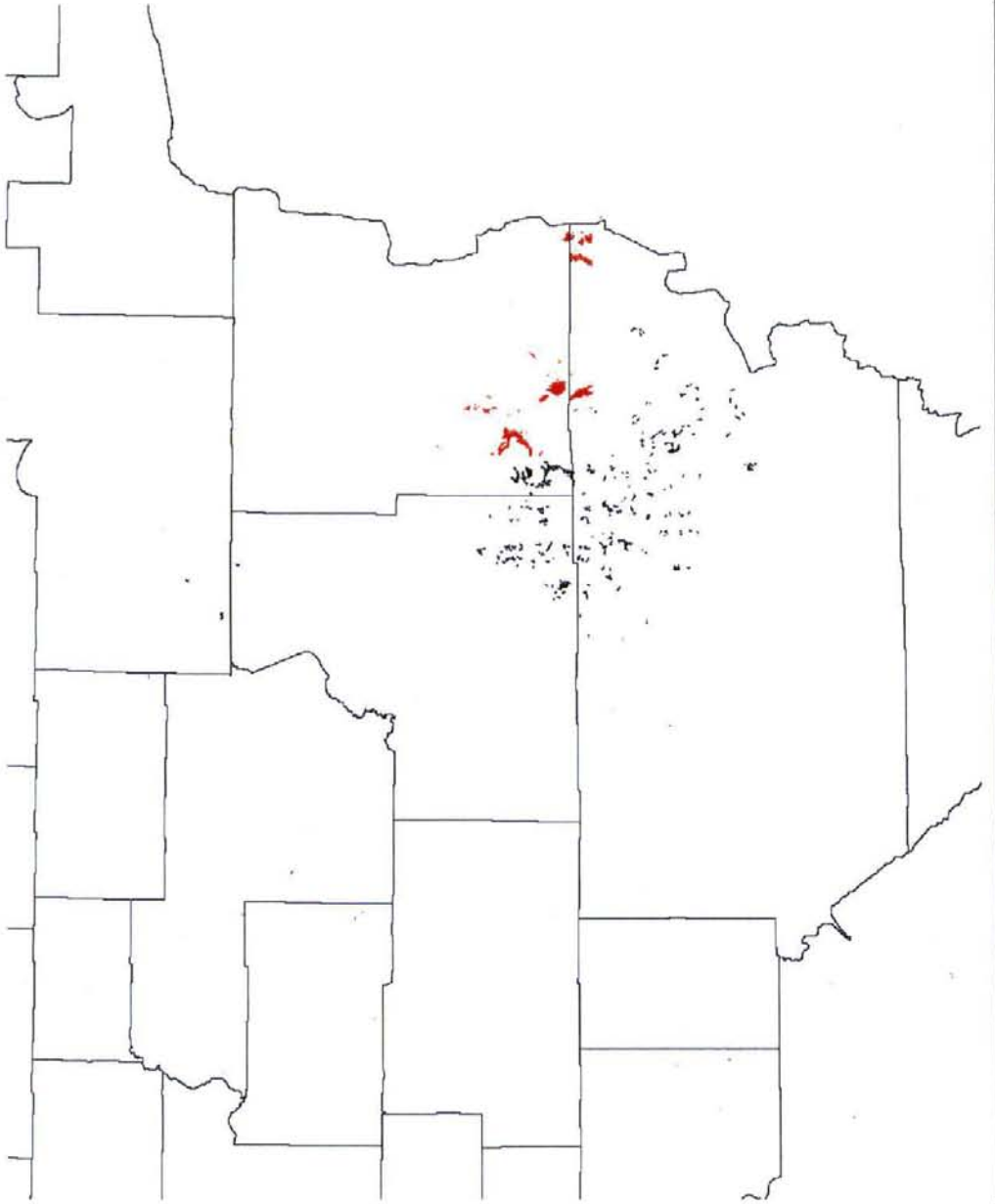
Week that spruce budworm larvae were expected to reach fourth instar		
Location	On balsam fir =309 DD	On white spruce = 280 DD
Aitkin	Week of May 30	Week of May 30
Becker	May 23	May 16
Cambridge	May 30	May 23
Duluth	June 6	June 6
Grand Rapids	May 30	May 30
Itasca State Park	June 6	June 6
St. Cloud	May 23	May 23
Staples	May 30	May 23

#### Phenology

- 5/1 Larvae were mostly in 2<sup>nd</sup> and 3<sup>rd</sup> instars with a few 4<sup>th</sup>. On some white spruce trees shoots were 1 inch long and on others the buds had not yet broken. This was also true for branches on the same tree. Kabetogama, St Louis Co
- 5/27 Approximately half of the larvae are a dark color and pairs of white dots are now visible. These larvae are about 1/2 inch long. The rest of the larvae are smaller. Most of the bud caps are off the white spruce trees except for the ones that are webbed onto the new shoot. This would be a good time to spray this plantation. Dandelions have gone to seed and jack pines are just beginning to shed pollen Balsam Township, Itasca Co
- 6/2 Jack pine pollen is being released. Would be a good time to spray white spruce for spruce budworm. Yellow mustard in bloom. Chisholm, St Louis Co
- 6/2 SBW larvae were in 3<sup>rd</sup> to final instars, primarily fourth instars on white spruce. Sand Dune State forest, Shereburne Co.



Spruce budworm defoliation 1999



- Defoliation Trace: 0-25%
- Defoliation Light: 26-50%
- Defoliation Moderate: 50-75%
- Defoliation Heavy: Over 75%
- Defoliation Mod-Heavy: Over 50%

- 6/2 SBW larvae were in fourth instar to pupal stages, primarily 7<sup>th</sup> instars.  
Sherburne National Wildlife Refuge, Sherburne Co.
- 6/4 SBW larvae on white spruce were in 4<sup>th</sup> and 5<sup>th</sup> instars. Barrows , Crow Wing Co.
- 6/4 SBW larvae were in 3<sup>rd</sup> through 6<sup>th</sup> instars, primarily third instars on white spruce.  
Morrison Co.
- 6/7 Ash River Campground sprayed with Bt from the ground for spruce budworm.  
Kabetogama, St Louis Co
- 6/14 Budworm are 30-50% pupated. Some red needle color starting to show in tree tops.  
Johnson Farm Rd, St Louis
- 6/30 All moths have emerged and most have finished flying and have died. Togo, Itasca Co

#### **Spruce budworm spraying in Ash River Campground**

Ash River Campground is a small State Forest Campground along the Ash River in Sec 5-T68N-R19W. It was heavily defoliated by budworm in 1998. The predominate species in the campground is white spruce. An egg mass survey in 1998 predicted moderate to heavy defoliation in 1999, so it was decided to spray the campground in 1999.

It was sprayed from the ground by Guardian Pest Control in Duluth using Dipel 2X at 3/4 pounds per 100 gallons of spray mix and applied at 2 to 3 gallons per tree. The site was sprayed on 6/7/99.

Larval surveys were conducted before and after spraying. Three 15 inch long branches were taken from the mid-crown of each of 3 trees. The results are listed below:

Date	Average # of larvae/15 inch branch	
6/2/99	15	Pre-spray
6/10/99	6.7	3 days post-spray
6/14/99	6.1	7 days post-spray

The accumulated degree days using a base of 46 degrees F at International Falls on 6/6/99 were 407.5F. The target date for spraying had been a week earlier but the operator was not available. We would have preferred to spray when the budworm were in peak 4<sup>th</sup> instar at an accumulated degree day on white spruce at about 280F.

Discussion- Neither, the pre-spray larval density or the percent mortality from the spraying were as high as expected. However overall the results were positive. Current year defoliation was very light. The egg mass survey conducted in August 1999 found no egg masses indicating no defoliation is expected in 2000.

## **Strawberry Root Weevils**

*Otiorhynchus ovatus*

Strawberry root weevils were found damaging rising 3-0 red pine in an industrial tree nursery in Cloquet on July 13. Patches of dead trees up to about one foot long in rows were scattered throughout the beds. Needle notching, where adults fed on the tips of the needles, could be seen. The outer cortex had been chewed off the roots on many of the live trees by the immature stage of the weevil. On many of these trees, all the lower roots were dead due to feeding by the larvae. These trees were being kept alive by new roots that had developed just below the surface of the soil down to about one inch. Chemical control recommendations were provided.

## **White pine needlecast**

*Canavirgella banfieldii*

An unknown condition affecting white pine needles was observed during the summer for the last four years, primarily in the Bemidji area. Last year it was more widespread occurring in a band from Duluth to Grand Rapids to Bemidji and Bagley. The tips of the current year needles are brown or tan but the base of the needles are still green and healthy looking. From a distance, it often gives trees a brownish or grayish cast especially in the lower and mid-crowns. See 1998 Minnesota Forest Health Annual Report where it was called semi-mature tissue needle blight of white pine. This summer fruiting bodies of *Canavirgella banfieldii* were found on needles affected last year. Fruiting bodies begin to develop in late fall and winter and mature spores may be released from budbreak through shoot elongation the year after symptoms develop. The mature fruiting bodies are dark grey and run along the length of the needle. Some are over an inch long.

Needles attacked by *C. banfieldii* are nearly always infected with other secondary fungi especially, *Meloderma desmazieresii*, some of which inhibit the development of the pathogen and appear to be natural control agents of the needlecast fungi.

Reference: Merrill, W., N. Wenner, T. Dreisbach. 1996. *Canavirgella banfieldii* gen. and sp. nov.: a needlecast fungus on pine. *Can.J.Bot.* 74:1476-1481.

## **White Pine Weevil**

*Pissodes strobi*

Approximately 1 to 1.5% of 10,000 white and blue spruce being grown for Christmas trees, near Grand Rapids, had current year damage by white pine weevils. The trees were 3-3.5 feet tall. Evidence of past years damage by white pine weevil was also present. On 7/21 the larvae were just beginning to form chip cocoons. The owner was cutting out the infested leaders as well as some entire trees and burning them as a control measure.

7/21 Larvae have just started forming chip cocoons.

Grand Rapids, Itasca Co



## Hardwoods

### **Ash anthracnose**

*Gnomoniella fraxini*

During the week of May 17<sup>th</sup>, many ash trees in central Minnesota dropped leaflets in great numbers after more than two weeks of cool, rainy weather. This disease is called ash anthracnose and it is caused by a fungus, *Gnomoniella fraxini*, one of the most common foliar disease of ashes in the United States.

### **Fall defoliator complex**

*Dryocampa rubicunda*      Greenstriped mapleworm, Rosy maple moth  
*Anisota senatoria*      Orangestriped oakworm  
*Anisota virginiensis*      Pinkstriped oakworm  
*Symmerista canicosta*      Redhumped oakworm

Hosts            Oaks, maples and other hardwoods  
Damage        Defoliation  
Area            2,349 acres; see table below  
Severity        Light to moderate defoliation  
Trend           This is the third year of rising numbers of these forest pests. Increasing in both population sizes and number of outbreak locations

Acres of defoliation caused by caterpillars of the Fall Defoliator Complex 1999 - aerial survey				
County Caterpillar	Trace 1-25%	Light 26-50%	Moderate 51-75%	Heavy 76-100%
Benton Oakworms		138		
Cass Mapleworms		160	227	
Crow Wing Mapleworm		565		
Morrison Oakworms			1000	
Todd Oakworms	259			
Totals	259	863	1227	0
	2,349 acres			

Ground survey observations:

Greenstriped mapleworm on red maple. Crow Wing- SW 1/4, S4, T134, R28 and NE 1/4, S9, T 134, R28 = 200 acres; NE, S4, T 132, R28 = 80 acres; NE 1/4, S28, T 135, R28= 80 acres; S6, T135, R27= 40 acres. Cass-S6, T133, R29= 60 acres; S13, T137, R32, and S19, T137, R31= 100 acres. Morrison-NE, S26, T132, R31= 40 acres. There were phone calls about this pest from people in other Crow Wing and SE Cass County locations.

Orangestriped oakworm on red and burr oak. Crow Wing NE 1/4, S28, T138,R28= 80 acres. Todd-SE 1/4 of SW 1/4, S29,T128,R33= 10 acres.

Pinkstriped oakworm on red and burr oak. Benton-NE 1/4, S24, T38, R31= 160 acres. Crow Wing-NE 1/4, S28, T135, R28= 80 acres. Morrison-S4,S10,and S15,T42,R32= 280 acres. Wadena - trace levels of defoliation in eastern half of county.

Pink Striped Oakworms were also reported and observed on bur oak in SE Hubbard County around the lake country development areas.

Red humped oakworm on red oak. Morrison - S10,T42,R32= 0 acres but did find 4 caterpillars.

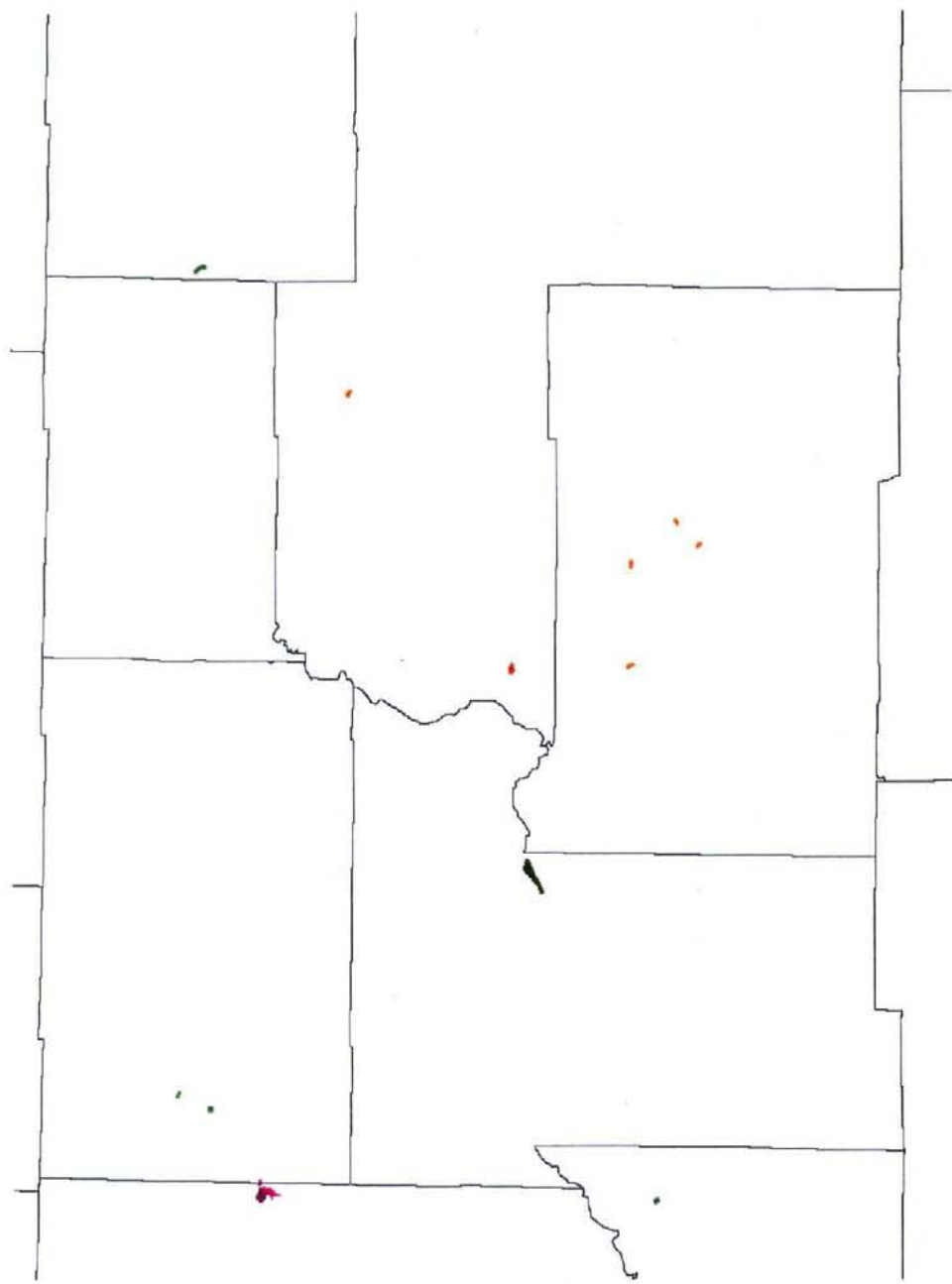
Greenstriped mapleworms, as well as, orangestriped and pinkstriped oakworms heavily defoliated maples and oaks at several scattered locations in central Minnesota. This is the third year of rising numbers of these forest pests.

By July 13<sup>th</sup>, nearly 10% of the orangestriped and pinkstriped oakworms had reached their full length of 1 1/2 inches and 1/4 inch thick bodies as "pre-pupae". These pre-pupae drop to the ground and form overwintering black pupae. At several other locations in central Minnesota, oakworms had heavily defoliated oaks and transformed into pupae by late July. Only a few orangestriped oakworms, 1/4 to 1 1/4 inch long, remained as defoliators of bur oaks in central Minnesota by September 1<sup>st</sup>. They were found in Todd County about two miles east of Little Sauk along county road # 6. In 1997 and 1998, this forest insect had heavily defoliated the oaks, but a buildup of parasites of eggs and caterpillars was observed in 1998. On August 30<sup>th</sup> this year, about 20% of the caterpillars were parasitized or diseased. Some were diseased when they were 1/2 inch long, some weeks ago, and the dead and shriveled caterpillars were still attached to leaves. This Todd County oakworm population lagged far behind those in nearby Morrison, Benton, and Crow Wing Counties in development. Very little defoliation by the orangestriped oakworm in the Little Sauk area is predicted for 2000.

Greenstriped mapleworms can heavily defoliate maples, and even lightly defoliate oaks and other trees growing among their preferred maple hosts. During 1997, greenstriped mapleworms were first observed along the southeast side of North Long Lake near Merrifield, in Crow Wing County and, during 1998, it had spread to maples in Cass, Crow Wing, Kanabec and Isanti Counties. This year, healthy populations were observed only in Cass and Crow Wing Counties.

Biological controls eventually cause declining numbers of fall defoliators, but few parasites and diseases have been observed this year.

Fall defoliators 1999



-  Oak Worms Defoliation Trace: 0-25%
-  Oak Worms Defoliation Light: 26-50%
-  Oak Worms Defoliation Moderate: 50-75%
-  Walkingstick Defoliation Moderate: 50-75%
-  Walkingstick Defoliation Heavy: Over 75%
-  Greenstriped Mapleworm Defoliation Light: 26-50%
-  Greenstriped Mapleworm Defoliation Moderate: 50-75%



## Flat leaftiers on oak

*Psilocorsis reflexella*

The flat leaftier, caused partial browning of leaves on many bur oaks in Crow Wing and northern Morrison Counties during August and September. This forest insect is one of the most common leaftiers. They use their sticky silk to tie together two or more leaves in a flat pattern, somewhat resembling a stack of pancakes. As each caterpillar grows to about ½ inch, it scrapes away the epidermis and soft tissue of leaf blades without removing the opposing epidermis and without completely browning leaves before moving to fresh leaves. Since the caterpillars do not cause death of entire leaves, they place minor stress on trees.

*P. reflexella* can be recognized by its pale green body, black head, dark brown thoracic shield and lighter brown end of its abdomen. This leaf tier feeds on other trees and can be found throughout eastern North America and Ontario. Leaf feeding continues until late September when caterpillars drop to ground, crawl under fallen leaves, change into pupae, overwinter. They emerge as small moths the following June. Each moth has a wingspan of up to 1 inch, and its forewings have gray brown mottling over a yellow brown ground color.

## Forest tent caterpillar

*Malacosoma disstria* (Hubner)

Host	Basswood, aspen, oak and other hardwoods
Damage	Defoliation
Area	488,889 acres
Severity	130,016 acres ≤50% and 358,873 acres >50% defoliation
Trend	Increasing

Forest Tent Caterpillar (FTC) was reported to be extensive in the NW counties. It has been fifteen years or so since a significant FTC population has been observed in this part of the region. Most of the defoliation was reported light in the Wannaska, Warroad forest areas and very light near Baudette.

Populations were up in Region 2. Scattered patches of defoliation ranging from thin tops to complete defoliation were found throughout the Region. The largest area of defoliation was several sections in size north of Nashwauk where the aspen were 100% defoliated. Populations and defoliation are expected to increase in 2000, but an egg mass survey has not yet been conducted.

In Region 3, typically, forest tent caterpillars survive in detectable numbers in basswood stands around lake edges and last year's field surveys revealed many, widely scattered forest tent caterpillar populations. In Region 3, there were 15,000 acres of defoliation. Some of these populations have been active for several years, causing moderate to heavy defoliation. Several lakeshore associations sprayed insecticides to control defoliation as they did in past years.

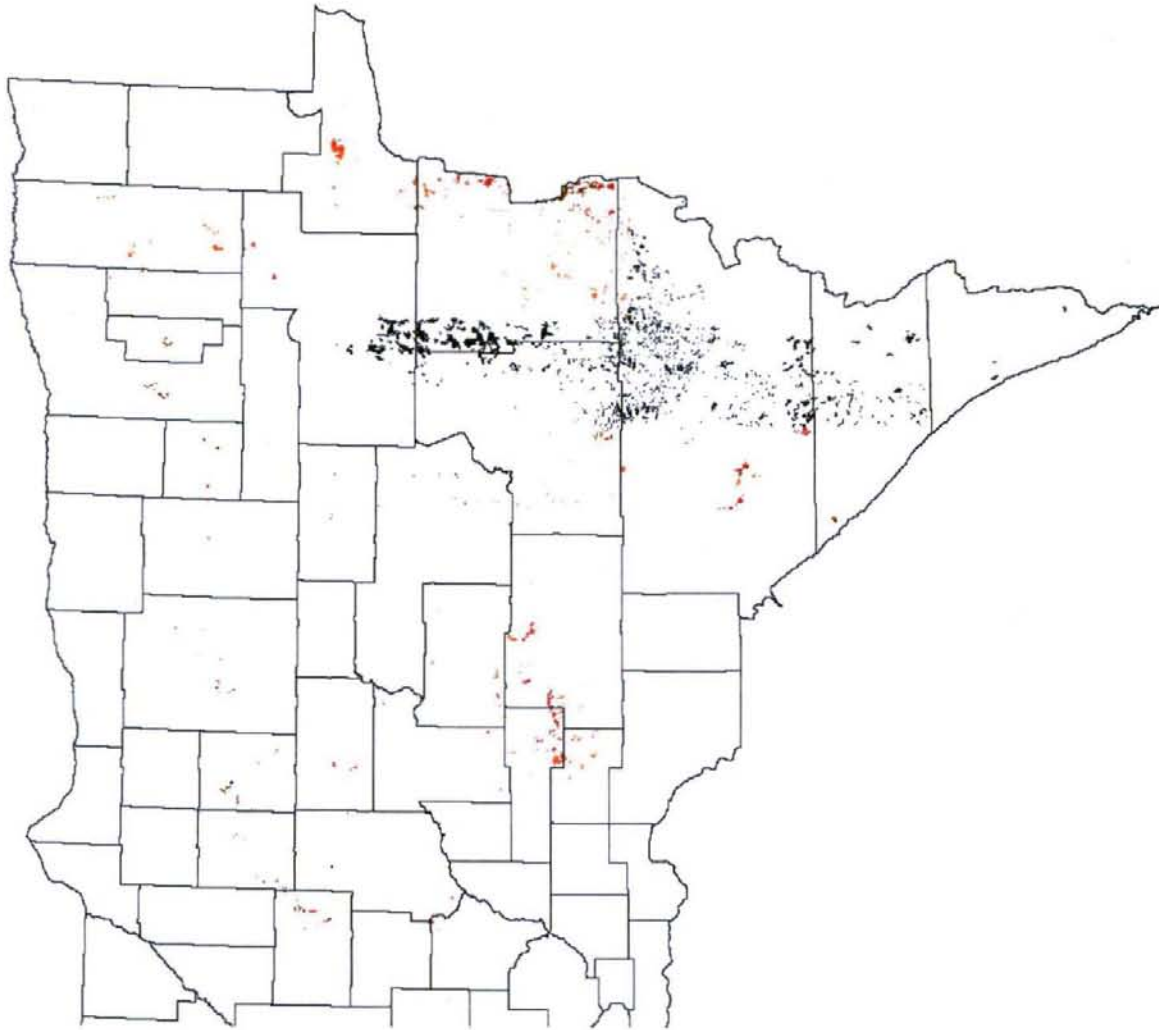
Aerial survey detected small and large polygons of FTC defoliation, particularly in Aitkin, Crow Wing, Kanabec, Mille Lacs and Todd Counties. Ground-based surveys found that FTC populations are well distributed throughout the Region, but only caused trace levels of defoliation. Again this year, the caterpillar's primary host was basswood but defoliation was also noted on aspen, birch and oak, particularly in Aitkin County. Where all the leaves were consumed, they spun down out of the trees in search of more food. Some natural controls, primarily diseases, were observed at scattered locations.

Acres of forest tent caterpillar defoliation in Region 3 -1999 - aerial survey results				
County	Trace 1-25%	Light 26-50%	Moderate 51-75%	Heavy 76-100%
Aitkin	4778	8717	1151	
Cass	410	138	1331	
Crow Wing	1114	748	704	
Kanabec	4074	943	573	
Mille Lacs	6666	6936	1717	
Morrison	175	501	71	
Pine	42			
Stearns		889	150	355
Todd		1015		
Wright		830		
Totals	17259	20717	5697	355
	44,028 acres			

Degree day calculation for FTC uses a threshold temperature of 32°F and a starting date of January 1<sup>st</sup>. Using this model, the peak of the FTC hatch should occur at 400 DD based on our past experiences. Degree day calculations were made for eight locations in or near Region 3 and the results are presented below.



Forest tent caterpillar 1999



- Defoliation Mod-Heavy: Over 50%
- Defoliation Trace: 0-25%
- Defoliation Light: 26-50%
- Defoliation Moderate: 50-75%
- Defoliation Heavy: Over 75%

Week that forest tent caterpillars were expected to be done hatching.	
Location	Week that DD reached 400.
Aitkin	Week of May 2
Becker	April 25
Cambridge	May 2
Duluth	May 2
Grand Rapids	May 2
Itasca State Park	May 9
St. Cloud	April 25
Staples	May 2

#### **Forest Tent Caterpillar egg mass survey**

Egg mass surveys were conducted at 8 locations in Region 2 over the winter of 1998 -1999 with the following results:

County	Legal Description	Ave DBH	Total # of Egg masses	Predicted defoliation
St Louis	S2-T50N-R18W	3.3	0	0
St Louis	S36-T50N-R15W	2.6	1	Light
St Louis	S32-T51N-R13W	3.5	1	Light
Lake	S23-T63N-R11W	3.5	1	Light
Lake	S12-T63N-R10W	3.3	1	Light
Cook	S32-T63N-R4E	2.5	2	Light
Cook	S36-T64N-R3E	2.6	2	Light
Cook	S16-T63N-R1E	2.3	0	0

#### Phenology:

4-19	Poplars blooming. Red maples blooming. Willow and box elder leaves showing.	East central Minnesota
4-27	At Wealthwood, bloodroot blooming, <i>Hydrophyllum</i> is 4" tall, wood anemone is blooming. Saw 1 bumble bee. Elsewhere, larch buds greening up. Aspen leaf buds breaking, a few individuals and clones have a green tint to them.	Aitkin



4-27	FTC still inside egg masses. Basswood and aspen leaf buds slightly expanded. Oak buds look like it's winter yet.	Mille Lacs
4-28	Aspen leaves explode out of buds: leaves are just a hint of green in morning and are 3/4 inch long by evening. Also blooming = arrow wood and <i>Hepatica</i> .	Itasca
4-29	FTC eggs hatching (first instar). Paper birch catkins well developed. Oak leaves showing. Basswood buds up to 3/4 in.	Todd
4-29	Aspen leaves expanding at variable rate: some barely green, some 50% emerging. Largest leaves are 1.5 inches long. <i>Hepatica</i> in bloom.	Cass
4-29	Aspen leaf emergence and leaf expansion nearly complete. Dandelions blooming. Silver maple leaves showing.	Crow Wing
4-30	FTC first instar. Ash, oak, and box elder blooming. (Ruttgers, Bay Lake)	Crow Wing
4-30	At Father Hennepin State Park: FTC larger than hatchlings and beginning to cluster. Basswood still in bud, bud expansion is 1/2 to 3/4 inch. In bloom = dwarf trout lilies and <i>Hepatica</i> . At junction of Highways 47 and 18: FTC hatching today. Basswood buds still covered and only slightly expanded. Maple and hickory buds are 1 inch long. Aspen leaves are 1" long. <i>Hepatica</i> and dwarf trout lilies in bloom.	Mille Lacs
5-3	Red oak leaves are 1 inch long. Bigtooth aspen leaf buds are opening. <i>Amelanchier</i> and <i>Diervilla</i> just starting to bloom.	Itasca
5-12	Green-up and leaf development are at a standstill due to low temperatures and constant rain. Oak leaves are 2 inches, white spruce buds enlarging, about 1/2 inch, and <i>Amelanchier</i> still holding petals.	Itasca
5-12	Oak leaves 1-2 1/2 inches, basswood 1/2 to 1 1/2 inches. <i>Trillium</i> , crabapples and yellow rocket blooming.	Mille Lacs
5-13	Aspen fluff is flying. Dandelions are blooming.	Pine
5-13	Aspen fluff is flying. In bloom = pussy toes, dandelions, creeping phlox, pin cherries and marsh marigolds.	Carlton

5-13	Some aspen fluff is flying. First dandelions looking fluffy. In bloom = marsh marigolds, crab apples and bridal wreath.	Itasca
5-17	Basswood leaves ½ full size. Chokecherries blooming	Crow Wing
5-18	Aspen leaves are full sized. Ash leaf buds breaking. Lilacs starting to bloom. In bloom = wild strawberries and bastard toadflax. At junction HWY. 200 and 84: In red pine, pine bark beetle galleries are 3 inches long, but attack is not heavy. Thinned red pine plantation has green tops yet from the winter activity.	Cass
5-20	FTC ¾ inch and starting to disperse.	Todd
5-20	FTC defoliation (nearly 100%) on basswood. FTC are ¾ to 1 inch long at Birch Lake Campground. Lots of basswoods are 100% defoliated.	N. Stearns
5-24	FTC ½ to 1 inch and dispersing. Overall, 60% defoliated today. Large, old basswoods up to 100% defoliation.	Aitkin (E side of Mille Lacs Lake)
5-24	FTC 1 inch and dispersing, some spinning down. Primarily defoliating basswoods, top leaves shredded or missing. No ash anthracnose.	Mille Lacs (Father Hennepin S. Park)
5-26	At junction Hwy. 47 & 18: FTC is ½ inch long, just molted. One or two clumps of aspen with heavy defoliation. Many scattered overstory basswood with heavy defoliation. Monarch butterflies are here. In bloom = wild geranium, <i>Trillium</i> , lilacs (just past peak), cotton-grass and choke cherries. Dandelions are fluffy.	Mille Lacs
5-26	FTC to 1 ½ inch	Wright
6-1	FTC and <i>Sarcophaga</i> flies near Clear Lake.	Stearns
6-1	FTC larvae approximately 1 inch long	Int'l Falls, St Louis Co
6-2	Larvae 2 inches long and have completely defoliated some roadside aspens	St Louis Co
6-4	Caterpillars crossing roads and have completely defoliated an area several sections in size.	Nashwauk, Itasca Co



6-8	FTC 1¾ inch long. FTC on basswood, oak and aspen (moderate defoliation on aspen). In bloom = Solomon's Seal, waterleaf, wild geranium and black locust (peak).	Mille Lacs
6-11	FTC numerous (Grandview area-Dutchman's Bluff)	Cass
6-11	FTC cocooning ( Mille Lacs Lake)	Aitkin and Crow Wing
6-14	Lots of caterpillars still feeding, but a few have formed cocoons	Chisholm, St Louis Co
6-16	FTC 1½ to 2 inches long, no pupae yet. Basswood just finished blooming. Juneberries are starting to turn purplish pink. Birch Lake State Forest.	Stearns
6-22	Larvae spinning cocoons	St Louis Co
7-9	Moths have emerged	Itasca Co
7-12	Moths have emerged	Gooseberry St Pk, Lake Co
7-13	FTC defoliation still evident, but trees are refoliating. Basswood in full bloom.	Mille Lacs
7-15	FTC moths present.	Stearns

## Gypsy moth

*Lymantria dispar* (Linnaeus)

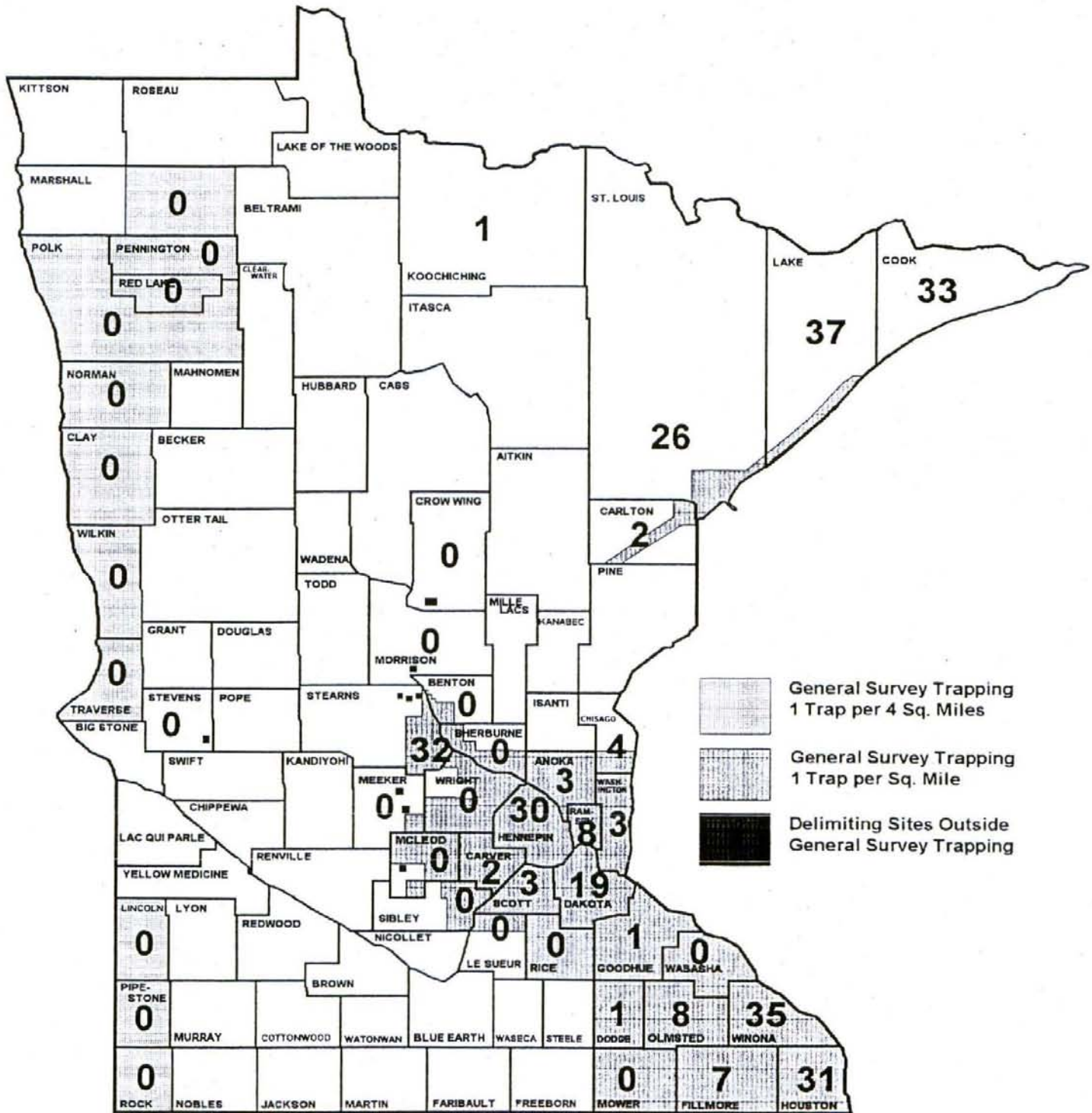
The MDA along with cooperators set nearly 18,000 traps statewide this season. Cooperators included DNR Divisions of Forestry and Parks, and the US Forest Service. A total of 286 moths were caught in Minnesota in 1999. See map.

A total of 99 gypsy moths were caught in Region 2 in 1999. This is by far the most moths ever caught in Region 2 to date. The previous high catch was 7 moths in 1997. Only one moth was caught in 1998.

DNR set 158 traps in Region 2 and caught 11 moths as indicated below:

Judge Magney S.P.	2 moths in 1 trap
Grand Marais Area- Elbow Lake	1 moth
Grand Marais Area -Horseshoe Bay	1 moth
Grand Marais Area - Ester Lake	1 moth
International Falls Workstation	1 moth
Kabetogama Workstation - Ash River Campground	1moth
Tower Area	2 moths

# 1999 Minnesota Gypsy Moth Catches By County



Total Moths: 286



Floodwood Workstation - Wayside

1 moth

Delimiting trapping was conducted in the Owens Lake Campground in Effie Area for the second year in a row. No moths were caught in either year of delimiting trapping at this location. This delimiting trapping was done because 6 moths were trapped in this campground in 1997.

Total moth catch by county and the agency that placed the trap in Region 2 is listed below:

County	Total	DNR	Dept of Ag	
Carlton	2		2	
Cook	32	6		26
Koochiching	1	1		
Lake	37		32	5
St Louis	27	4	21	2
Totals	99	11	55	33

Dept of Agriculture placed traps at one trap per square mile in an area from Jay Cooke State Park to Split Rock State Park, in the townships bordering Lake Superior. These traps caught the majority of the moths, a total of 55

The highest numbers of moths were caught in several townships along Lake Superior. These included:

Township	County	Number of moths caught
T52,51N-R12W	St Louis	6
T52N-R11W	Lake	7
T53N-R11W	Lake	16
T53N-R10W	Lake	6 moths

Other concentrations of moth catches occurred in the Grand Portage reservation where the USFS caught 6 moths and in Crescent Lake FS Campground where 9 moths were caught..

A possible explanation for the increased trap catches is that the increase spread and population levels in Wisconsin have resulted in more moths and egg masses being transported by tourists, and/or on plant materials such as nursery stock, Christmas trees, pulp or sawlogs coming from locations where Gypsy moths are present. Also the past two mild winters may have allowed more Gypsy moths to survive and buildup.

A total of 231 traps were set out in Region 3 by DNR Foresters, Park Managers and Camp Ripley cooperators. 36 of those traps were set out to delimit a 1998 multiple catch site in Crow Wing County. No gypsy moths were caught by DNR trappers.

For Region 3 the tally is as follows:

32 moths	St. Cloud (1 nursery facility) in Stearns Co.
4 moths	Chisago Co.
2 moths	Carlton Co.

With all field reports in, the statewide picture of gypsy moth activity in Minnesota for 1999 looks pretty good, though this year has had its share of surprises. Statewide the entire season's moth catch totaled 286 moths compared to 953 in 1998. The most welcome surprise is a dramatic decline in moth catches through all of the southeastern counties and the Seven-county Metro Area.

Several nurseries produced gypsy moths. When alternative life stages were found, three nurseries were placed under USDA Emergency Action Notification/MDA Stop Sale Orders. Each entered into USDA/MDA Compliance Agreements for certification and movement of nursery stock, pending release after treatments in Spring 2000. The most alarming incident was trapping 32 gypsy moths at one nursery. This was in St. Cloud. Follow-up inspections yielded over one hundred egg masses - detected and destroyed. The sources of the nursery infestations continue to be under investigation.

### Large aspen tortrix

*Choristoneura conflictana* (Walker)

Host	Aspen
Damage	Defoliation
Area	336,170 acres
Severity	146,704 acres $\leq$ 50% and 189,466 acres $>$ 50% defoliation
Trend	Increased in extent, acreage and severity compared to last year.

Early spring defoliation of aspen caused by the Large aspen tortrix in Region 2, was common along the North Shore from Duluth to the Canadian border. Most of the defoliation was light to moderate and was patchy. Much of it looked like aspen clones leafing out late in the spring rather than defoliation, but close examination revealed tortrix larvae. A good acreage estimate for large aspen tortrix defoliation was not obtained with the aerial survey. The aerial survey was conducted too late in the season to pick up the peak defoliation. Most of the trees had re-leafed by the time of the aerial survey. Some of this defoliation could still be observed because the foliage looked thinner than normal. However, the forest tent caterpillar defoliation was mixed in with the large aspen tortrix defoliation making it difficult to differentiate them from each other from the air.

Large aspen tortrix defoliation in Region 3 - 1999			
County	Trace 1-25%	Light 26-50%	Moderate 50-75%
Aitkin	4171	143	
Carlton	2265		



Cass	563		
Crow Wing	1042	71	
Kanabec	2404	716	7
Mille Lacs	2814		
Morrison	597		
Pine	7889	1460	427
Todd	182		
Totals	21927	2390	434
		24,751	

Large aspen tortrix populations occurred from Todd and Morrison Counties to Cook County and up to Thunder Bay, Ontario. Although the heaviest defoliation occurred along the North Shore, Pine, Kanabec, Mille Lacs, Aitkin and Crow Wing Counties sustained a substantial number of acres of defoliation. The last large outbreak of LAT covered millions of acres and occurred from 1969 to 1973. Outbreaks often precede or coincide with forest tent caterpillar outbreaks.

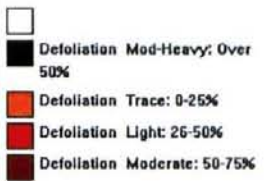
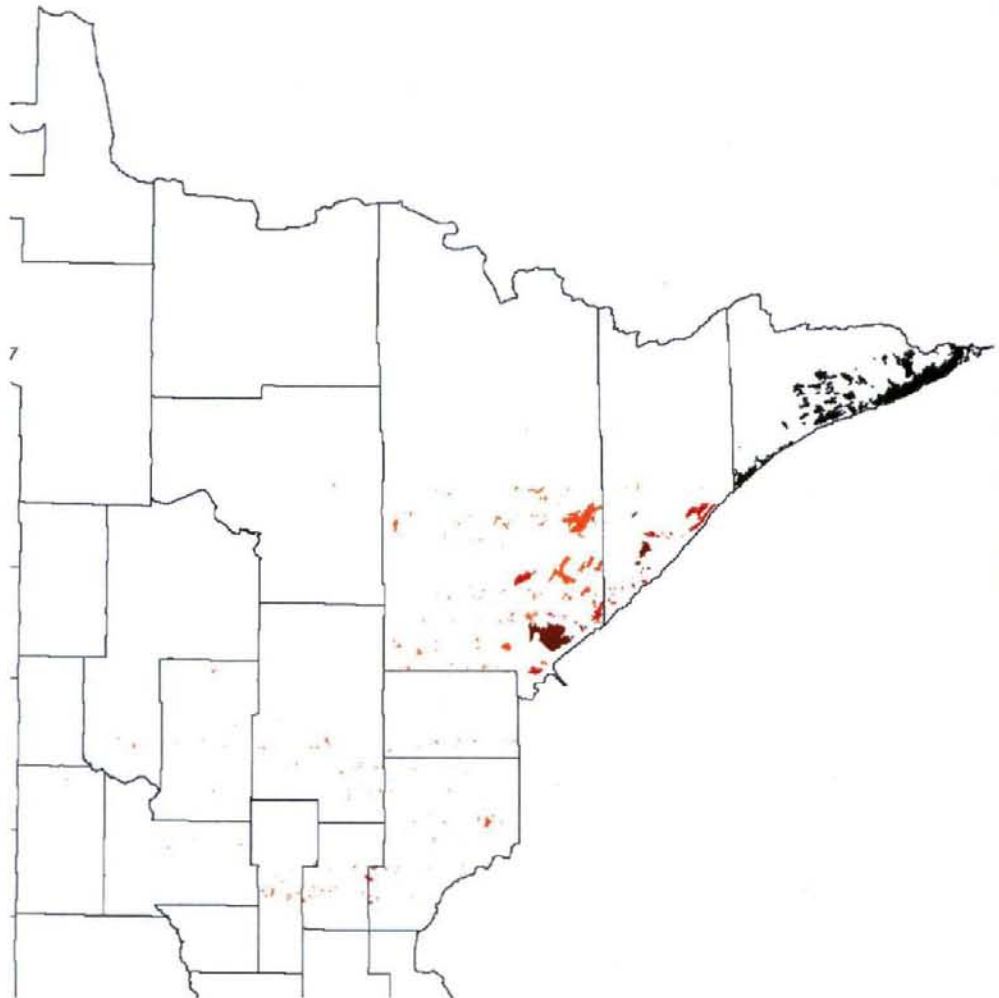
- 5/18 Larvae approximately 1/4 to 5/16 inch long with a few up to 1/2 inch, webbing leaves together. Leaves 1/2 to 1 1/2 inches long. Duluth, St Louis Co
- 5/30 Larvae approximately 3/4 inch long, some light defoliation Grand Marais, Cook Co
- 6/21 Moths have emerged from pupal cases. Duluth, St Louis Co

### **Oak Anthracnose** *Apiognomonina quercina*

In late May and into early June across southern Minnesota there was a widespread outbreak of oak anthracnose on mostly Bur oaks. Reports came in from Mankato to Houston county. Oak anthracnose occurs from the eastern provinces of Canada to the Gulf of Mexico. Occurring to some extent in most years in Minnesota, outbreaks can occur whenever environmental conditions are conducive for disease development. A weather pattern that began in the early spring and continued into mid-summer brought a lot of rain and moderate temperatures continuously across the region.

Oak anthracnose is caused in part by *Apiognomonina quercina*, which in its conidial state is *Discula quercina*. Hosts in Minnesota include all the oak species. The symptoms vary greatly with the host species, the weather conditions, and the stage of plant development at the time of

Large aspen tortrix 1999





infection. Symptoms tend to follow one of three patterns.

1. Rapidly developing blight of leaves and shoots, characterized by browning and shriveling of young leaves during the period of leaf expansion. Occurs very infrequently, and could be easily confused with frost. Weather data from Rochester during this period would indicate little opportunity for late spring frost.
2. Large irregular dead areas on distorted leaves that otherwise remain green. Usually evident in most years in late summer on bur oak.. A classic outbreak occurred this year in late July in several areas in southeastern Minnesota.
3. Small necrotic spots on leaves that have reached mature size. This seems to always be evident to some extent in most years.

Outbreaks of anthracnose are promoted by wet weather and moderately cool temperatures. The leaf disease becomes prominent on the lower branches then spread upwards. Enlarging lesions on the leaves tend to follow the veins or midrib and to be bounded by them often killing all the leaf tissue on the side of a midrib or major vein and thus causing distortion. After drying, lesions are papery in texture and turn tan to nearly white before weathering to a grayish white. At the edge of the lesions there is an abrupt transition from brown to the normal green tissue. With all types of anthracnose on oaks the acervuli of the pathogen become visible even to the unaided eye as raised brown flecks on the lower surfaces of the foliar lesions.

Anthracnose outbreaks usually subside before midsummer with the exception of Bur oaks which can develop the disease in August.

Defoliation from anthracnose does not impact long term health of the oaks. Control measures are generally not warranted.

### **Oak tatters**

Host: Bur oak  
Damage: Leaf deformity  
Area: 130,000 acres  
Severity:  
Trend: Increasing

Oak tatters affected much of the oak across southern Minnesota in late May and early June. About 130,000 acres of bur oak were affected in 13 southeastern counties. By late June all the affected trees in several counties did recover new foliage.

Oak tatters is a relatively new condition that affects the first emerging oak leaves in the spring, causing them to appear lacy or tattered. It has been observed throughout several mid-western states for the last few years. The first reports were from Iowa in the 1980's. In the last few years

it has been observed in Minnesota and Wisconsin.

Oak tatters affects primarily the bur oaks. It has also been observed on a few other species including eastern white oak, and northern red oak. The newly emerged leaves of affected trees have reduced leaf tissue between the veins, which gives the leaves a lacy or tattered appearance. The injury appears at the time of leaf emergence, late May. Generally large portions of the landscape have been affected. However, within the affected area a few unaffected trees can be found. Within a few weeks a new flush of leaves will appear and be free of the symptoms.

The cause remains unknown. The pattern of symptoms suggests internal injury to developing tissues, at the time of leaf development inside the overwintering bud. Herbicide injury is also suspected. Oak tatters can be confused with early season outbreaks of oak anthracnose, and the effects of late spring frosts. Both of which are possible to see in any combination. The risk of continuing outbreaks of oak tatters is eventual dieback in the bur oaks.

## Oak wilt

*Ceratocystis fagacearum* (TW Bretz) J. Hunt

Host            Oaks  
 Damage        Mortality  
 Area            4472 acres; see table below  
 Severity        Varies  
 Trend            Increasing in Region 3. Currently, 29% of the existing oak wilt infection centers have been treated and controlled in Region 3.

Oak wilt in Region 3: Summary data for active and controlled sites						
County	Total area with active or controlled oak wilt (ac)	Total number of active and controlled sites (ac)	Number of active sites remaining	Percent of sites controlled	Average acreage of active oak wilt per sq. mile	Average number of active sites per sq. mile
Chisago	617	437	307	30	1.37	1.61
Isanti	916	549	371	32	1.03	0.97
Mille Lacs	6	7	7	0	0.09	0.08
Sherburne*	2888	1222	681	44	1.67	1.41
Stearns	45	13	8	38	0.81	0.15
Regionwide	4472	2228	1374	28.8	0.994	0.844

\* = Excludes state land in the Sand Dunes State Forest.



LCMR and MN ReLeaf grant monies have been used by Counties and Soil & Water Conservation Districts to develop and implement oak wilt control programs. 1999 was the second year of the biennium and 82 infection centers were vibratory plowed in the above counties.

#### **On state land**

In November, 1999, three sites were treated in the Sand Dunes State Forest (Sherburne Co.) with a total of 1100' vibratory plow line (800' of the total were 2 sites on Forest Trust Land). There were no potential spore producing trees (SPT) on any of the sites. Other, older sites are being used as firewood cutting areas and SPT's are marked and covered as needed. Mike Peltier, Zimmerman Station, notes that there were fewer SPT's this season.

In the Sand Dunes Scientific and Natural Area, oak wilt has spread over the brink of the dunes towards the lake. The situation has been like that since about 1997. So it's impossible to use a vibratory plow on those steep slopes. However it may be possible to use the vibratory plow in a semi circle away from the lake. Part of the perimeter is natural barriers of grass cover types. Vibratory plow work is no more disruptive than the active timber sales in progress in the same area in the oak and pine stands. Root grafts may not occur as frequently on the steep slopes. Natural barriers may also hold there.

Mike Peltier has noticed that, on slopes, root grafts may not occur as frequently on the contours of the slope. There are two sites where OW did spread up or down steep slopes but did not spread laterally along the slope. It seems the slightest disturbance of the soil may cause enough root damage to discourage root graft formation. This may only be true on steep slopes on dune soils.

#### **Pale Green Weevils**

*Polydrusus impressifrons*

Complaints about the pale green weevil were again numerous. From millions of them on mail boxes in Hermantown to stories of dive bombing weevils, complaints were received from throughout northern Minnesota. Reports of beetles started in mid-June and continued to early August. Populations in the Grand Rapids area appeared to be down from the past several years. However, other areas reported increased populations, and still others reported the presence of weevils in locations that have not observed them in the past.

#### **Septoria leaf blight**

*Septoria musiva*

By early August, balsam poplars through out northern Minnesota were heavily defoliated by *Septoria musiva* leaf infections. Most of Minnesota received 150 to 175 % of normal rainfall during the growing season. All that rain increased the amount of leaf fungi including *Septoria musiva*.

## **Venturia shoot blight on aspen**

*Venturia masularis*

Heavy *Venturia* shoot blight infection occurred in a 9 acre stand of one year old aspen in Carlton County in NWNW Sec23-T49N-R21W. The aspen suckers averaged three to five feet in height. The terminal shoot on 90% of the stems was dead. Some of the trees were completely defoliated due to heavy leaf infection. The most severely damaged trees were killed back to about one foot above the ground, and only a few live buds and shoots were developing at this point. As of 6/10 the trees with less damage were developing new shoots with large healthy leaves. The month of May was very wet in 1999. There is concern by the land manager that the severely damaged stems may develop multiple stems

## **Walkingsticks**

*Diaperomera femorata* (Say)

Host	Oaks and other hardwood shrubs and trees
Damage	Defoliation
Area	936 acres; 891 in Stearns Co. and 46 in Todd Co.
Severity	Moderate to heavy defoliation
Trend	In 2001, increasing in Birch Lake State Forest in Stearns Co., perhaps also in Sherburne, Cass, Morrison and Crow Wing Counties.

Great numbers of 1 to 2¼ inch long walkingsticks were found feeding on oaks and hazel brush in the Birch Lake State Forest area in northern Stearns County on July 15<sup>th</sup>. By August 30<sup>th</sup>, most walkingsticks had grown to their adult size of 2½ to 3½ inches and were mating. Since walkingsticks have a two year life cycle, most eggs will remain unhatched throughout the summer of 2000 and will hatch in 2001.

Very low populations of this insect have also been observed in southern Sherburne, southeastern Cass, northeastern Morrison, and west central Crow Wing Counties. No noticeable defoliation of oaks or other hardwoods or shrubs occurred at these locations.

When walkingsticks occur in areas where there has been heavy forest tent caterpillar defoliation in May and June, continued leaf loss to walkingsticks in late July and August may cause branch dieback. This is just what is happening at Birch Lake State Forest in Stearns and Todd Counties. Fortunately, by mid July, the oaks had formed many new leaves and seemed quite vigorous.

Whenever a woodlot or forest is subjected to heavy spring and fall defoliations, the impact is worse than the sum of their individual effects. In this case, heavy FTC defoliation occurred in 1998 and 1999 and is predicted for 2000 and 2001. We expect heavy defoliation by walkingsticks this year, but will wait to see what transpires. If extensive dieback occurs this fall, we may intervene with a control treatment next spring. If chemical control is chosen where these two forest pests are present in high numbers, the biological insecticide, *Bacillus thuringiensis*, would be applied to prevent defoliation by the forest tent caterpillar, thereby allowing trees to store energy and form leaf buds next year.



## **Abiotic**

### **Wind Storm ( Derecho)**

A major blowdown occurred on July 4, 1999 due to a derecho or straight line winds. It swept across three counties, (St Louis, Cook and Lake) and into Ontario. A good record of the speed of the wind is not available because the weather stations in the area were all destroyed. Estimates are that it exceeded 80 miles per hour. Trees were blown down on approximately 400,000 acres in the following percentages;

10-30% = 180,000 acres

31-66% = 158,000 acres

67-100% = 140,000 acres

There were no fatalities but lots of medical evacuations out of the BWCA. After July 19<sup>th</sup>, activities in the BWCA went from search and rescue to recovery and rehabilitation of the canoe portages and campsites. The FHU provided hazard tree training to crews clearing campsites and portages out of Grand Marais and Ely. Future work will concentrate on the fire hazard. Much of this area has abundant dead balsam fir from years of spruce budworm defoliation. A lot of conifers were blown down. The dead needles on these trees will provide a high danger of fire next year. Also, most of the area is on the Canadian shield and has shallow soil over bedrock which dries out quickly with a shortage of rain.

Damage from a buildup of bark beetles is possible. By mid-August bark beetles were abundant in downed jack pine in the Tower Area on the west end of the blowdown area. A drought across this area in 1997 and 1998 resulted in increased bark beetle populations and tree mortality of red and jack pine especially on rocky outcrops. The tree mortality stopped in the fall of 1998 when rains returned, but bark beetle populations may have still been elevated when the storm hit in 1999. In contrast, few bark beetles were found in down trees on the Grand Marais end of the storm, when checked in August and September. However with hundreds of thousands of trees down, small beetle populations spread through them would have been difficult to detect. Next years bark beetle population will depend on the weather. If there are adequate rains there likely will be few problems with bark beetles. Drought will likely bring bark beetle problems especially since many of the remaining standing trees have top, branch and likely root damage. Wood borer populations will also increase.

In order to assist landowners, homeowners and resort owners newsarticles, and mailings, were made dealing with bark beetles etc. One article titled "Do's and Don't of dealing with storm damaged trees" provided information on what trees to cut down, and what trees to try to save and how to help them. Another article titled "Clean up storm damage now to avoid bark beetle damage later" encouraged people to utilize or dispose of downed pines in a timely manner in order to avoid bark beetle problems in 2000.

### **Winds and heavy snow in Region 1**

Strong straight line winds accompanied by heavy wet snow in early November of 1998 left many

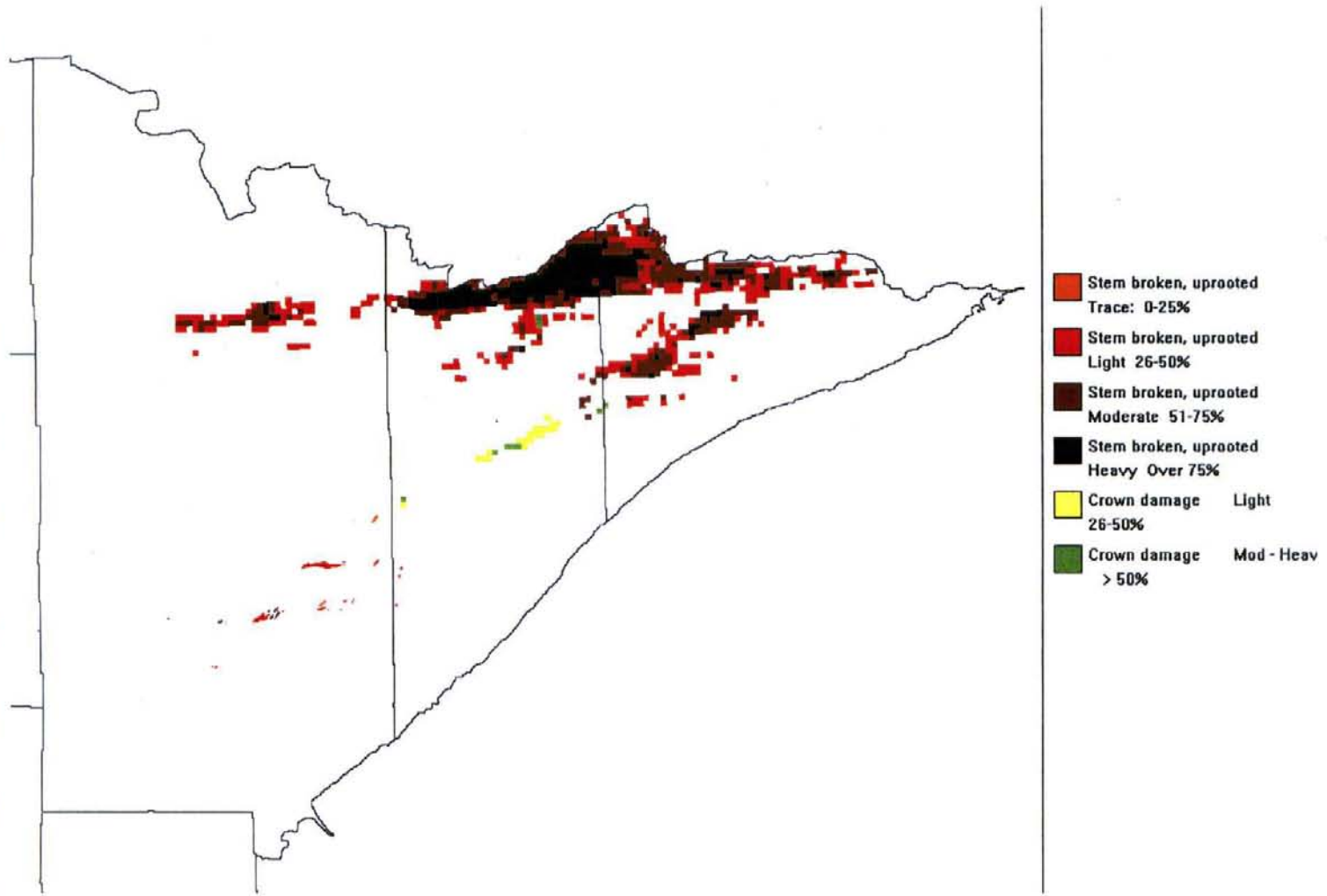
acres of jack pine with broken tops and wind throw. Foresters in Park Rapids along with Potlatch Corp. were facing anticipated losses and new bark beetle dilemma. However the frequent heavy rains of the 1999 season all but erased the concern. Most of the trees have recovered much of the lost crown. Potlatch Corp. carried out extensive sanitation cutting by way of their shortwood harvesting and clear cutting in stands that suffered heavy damage.

### **Unknown yellowing of white spruce needles**

Almost all of the 1998 needles turned yellow or tan and were starting to fall off trees in a white spruce plantation on May 27<sup>th</sup>. The trees were 15-18 years old and growing in Sec27-T59N-R24W in Itasca County. Only the 1998 needles were affected and 1999 growth seemed to be developing properly. No fruiting bodies were found. On a few trees the lower most branches appeared normal while on the remainder of the tree all of the 1998 foliage was affected. The cause is unknown but some environmental factor or condition is suspected. Possibly the lower most branches were covered by snow and therefore protected while the remainder of the tree was damaged. The condition of the trees will be watched next year.



Wind damage 1999



## Incidental Pests

Insects and Mites	Host	County	Comments
Abbot's sphinx caterpillar <i>Sphecodina abbottii</i>	Woodbine	Crow Wing	
Aphids <i>Cinara</i> sp.	Jack pine	Pine	
Ash flower gall mite <i>Aceria fraxiniflora</i>	Ash	Morrison	
Aspen leafblotch miner <i>Phyllonorycter salicifoliella</i>	Trembling aspen, Balsam poplar	Aitkin	
Aspen tortrix <i>Choristoneura conflictana</i>	Trembling aspen	Carlton, Crow Wing, Pine	
Bark beetles <i>Ips pini</i>	Pines	Central Minnesota	Stressed yard trees
Bronze birch borer <i>Agrilus anxius</i>	Paper birch	Crow Wing	Stressed yard trees
Dogwood sawfly <i>Macroemphytus tarsatus</i>	Dogwood	Crow Wing, Stearns	
Eastern spruce gall adelgid <i>Adelges abietis</i>	White spruce	Crow Wing	
European fruit lecanium <i>Parthenolecanium corni</i>	Red oak	Wadena	
Flat leaftier <i>Psilocorsis reflexella</i>	Bur Oak	Crow Wing, Morrison	
Greenstriped mapleworm <i>Dryocampa rubicunda</i>	Red maple	Cass, Crow Wing	
Introduced pine sawfly <i>Neodiprion sertifer</i>	Red and white pine	Morrison	
Leaf roller Unknown species	Basswood	Crow Wing	
Long horned beetle <i>Monoctonus</i> sp.	Pine	Morrison	
Maple bladder gall mite <i>Vasates aceriscrumena</i>	Maple	Crow Wing	
Mites <i>Phytopus emarginatae</i>	Plum	Pine	Yard trees



Insects and Mites	Host	County	Comments
Mountain ash sawfly <i>Pristiphora geniculata</i>	Mountain ash	Crow Wing	Yard trees
Northern pine weevil <i>Pissodes approximatus</i>	Scotch pine, Blue spruce	Morrison, Todd	In stressed pines
Oak apple gall <i>Amphibolips sp.</i>	Oaks	Morrison	
Oak button gall <i>Neuroterus umbilicatus</i>	Burr oak	Morrison	
Oak webworm <i>Archips fevidanus</i>	Trembling aspen	Pine	
Oak leaf blister mite <i>Aceria mackei</i>	Bur Oak	Crow Wing	
Orangestriped oakworm <i>Anisota senatoria</i>	Oaks	Crow Wing	
Pine root collar weevil <i>Hylobius radialis</i>	Scotch pine	Crow Wing, Wadena, Morrison	Stressed yard and plantation trees
Pine webworm <i>Tetralopha robustella</i>	Pine	Crow Wing	
Plum web-spinning sawfly <i>Neurotoma inconspicua</i>	Wild plum	Morrison	
Poplar petiole gall aphid <i>Pemphigus populitransversus</i>	Cottonwood	Crow Wing	
Red turpentine beetle <i>Dendroctonus valens</i>	Norway pine	Crow Wing	Stressed yard trees
Red pine sawfly <i>Neodiprion nanulus</i>	Jack pine	Todd	Plantation
Redhumped oakworm <i>Symmerista canicosta</i>	Bur Oak	Morrison	
Shoot moth <i>Rhyacionia sp.</i>	Jack pine	Todd	Plantation
Strawberry root weevil <i>Otiiorhynchus ovatus</i>	Pine seedlings	Carlton	Observed elsewhere in homes in central Minnesota
Tilehorned prionus <i>prionus imbricornis</i>	Hardwoods	Morrison	
Two lined chestnut borer <i>Agrilus bilineatus</i>	Oak	Stearns	Stressed yard trees

Insects and Mites	Host	County	Comments
Walkingsticks <i>Diaperomera femorata</i>	Oaks	Stearns	
White pine bark adelgid <i>Pineus strobi</i>	White pine	Crow Wing	
Wood borers <i>Cerambycids and Buprestids</i>	White spruce, pines	Central Minnesota	Stressed yard trees
Zimmerman pine moth <i>Dioryctria zimmermani</i>	Blue spruce	Todd	Yard trees
Bark beetles	Red, jack pine	Becker, Cass	piled wood in thinned pine stands
Carpenter ants	households	Beltrami, Hubbard	scattered locations
Root collar weevils, northern pine weevils	Red, jack pines	Hubbard, Beltrami	stressed, open, growing windbreak trees
Cottony maple scale	Silver maple	Beltrami	yard ornamentals, annual pest
Pink striped oakworm	Bur oak	Hubbard	
Eastern pine shoot moth	Red pine	Becker, Hubbard	declined from 1998
Poplar vagabond aphid	Eastern cottonwood	Hubbard	Heartland Park
Introduced pine sawfly	White pine	Hubbard, Beltrami	Increase from 1998
Ash plant bug	Green, black ash	Hubbard, Becker	Forest and yard trees
Red humped oakworm	Apple trees	Beltrami	early September
Basswood square blotch	Basswood	Becker	Forest trees, September defoliator
White pine bark aphid	White pine	Hubbard, Beltrami	Associated with sooty mold
Pine needle aphids	Jack pine	Hubbard, Beltrami, Becker	
Oak lace bugs	Bur oak	Becker, Beltrami, Hubbard	
Yellowheaded spruce sawfly	White spruce	Beltrami	few scattered trees



Insects and Mites	Host	County	Comments
Oak twig pruner	Bur oak	Hubbard, becker	
Red pine shoot moth	Red pine	Hubbard	down from previous years
Birch leaf miners	Paper birch		as common as in 1998
Bronze birch borer	Paper birch		common in extensive birch areas

DISEASES	HOST	COUNTY	COMMENTS
Ash anthracnose <i>Discula umbrinella</i>	Ash	Crow Wing, Pine	
Black knot <i>Apiosporina morbosa</i>	Pin cherry, plum	Crow Wing	
Dutch elm disease <i>Ceratocystis ulmi</i>	American elm	Central Minnesota	Scattered and few trees
Eastern and western gall rust <i>Cronartium and Endocronartium</i>	Scotch and jack pine	Crow Wing, Todd	
Elm anthracnose <i>Stegophora ulmea</i>	Elm	Morrison	Yard tree
Fire blight <i>Erwinia amylovora</i>	Apple	Crow Wing	
Leaf and shoot blight <i>Venturia macularis</i>	Trembling aspen, balsam poplar	Central Minnesota	Widespread
Leucostoma canker <i>Leucostoma kunzei</i>	Spruce	Pine	Yard tree
Maple anthracnose <i>Unknown species</i>	Red and sugar	Pine	Yard tree
Needlecast <i>Rhizosphaera kalkhoffii</i>	Spruce	Crow Wing, Todd	
Oak anthracnose <i>Apiognomonium quercina</i>	Burr oak	Central Minnesota	Yard trees
Root rot <i>Armillaria sp.</i>	Norway pine, Jack pine	Crow Wing, Pine	Stumps of mature oaks harvested about 10 years ago allowed buildup of this fungus

<b>DISEASES</b>	<b>HOST</b>	<b>COUNTY</b>	<b>COMMENTS</b>
Sapwood rot <i>Cerrena unicolor</i>	Sugar maple	Kanabec	
Septoria leafspot <i>Septoria musiva</i>	Trembling aspen, balsam poplar	Central Minnesota	Widespread
White pine blister rust <i>Cronartium ribicola</i>	White pine	Crow Wing, Morrison	Yard trees
Willow shoot blight	Black willow	Beltrami	mature willow clumps in yards
Venturia shoot blight	aspen, cottonwood, hybrid poplar	Hubbard, LOW, Beltrami	widespread in scattered parts of Region 1
Septoria leaf spot	Poplar species, Balm of Gilead	Throughout Region 1	widespread, common from mid-summer to fall
Rhizosphaera needlecast	White, blue spruce	Widespread in region	more common in last 3 years, yard trees
Diplodia tip blight	Red pine	Becker, Hubbard, LOW, Beltrami	drought stressed yard and growing plantation sapling sized trees, transplanted trees
Armillaria	Balsam fir, jack pine, red pine oaks	Widespread	stressed yard trees, plantations, past years of drought
White pine needlecast	White pine	Beltrami, Hubbard, clearwater	more noticeable than in previous years
Anthracnose leaf blight	Oak, ash, Maple	Widespread	yards, windbreaks and forest trees

<b>ANIMAL &amp; ABIOTIC</b>	<b>HOST</b>	<b>COUNTY</b>	<b>COMMENTS</b>
Carpenter ants	Pines	Central Minnesota	Excavate nests in decayed heartwood
Gopher	Red pine	Todd	Plantation
Hail damage	White pine, ash, poplar	Crow Wing, Morrison	
Herbicide drift	White pine, ash, poplar	Morrison, Wadena	Minor dieback
High water chlorosis	White spruce	Todd	



Road compaction dieback and mortality	White pine	Morrison	Gravel and oil on road near trees
Root confinement	White cedar	Cass	Burlap root covering was not removed or cut after transplanting
Root damage	Norway pine	Cass, Morrison	Excavations
Sapsucker	Ash, birch, spruce	Central Minnesota	Scattered
Snow weight	Scotch pine	Todd	Plantation
Winter dessication	Red pine	Pines	Expressway side trees
Iron chlorosis	White spruce	common in NW counties of Region 1	associated with high water table, seedlings to saplings esp.
Wind-heavy snow	Jack, red pine	Hubbard, cass	storm damage
Herbicide	Mixed hardwoods	Becker	landowner used excess amt of 2,4-D to kill dandelions and damaged neighbors tres
High water table	Hardwoods, conifers	Throughout Region 1	17-35 inches rain from June to September
Hail damage	Balsam fir, aspens	Beltrami	
Mechanical	Red pine, white spruce	Beltrami	machine planted dead, dying, leaning trees in windbreaks and yards
Construction	Red pine, boxelders, maple, oak	Beltrami, Cass, Hubbard, Becker	new construction, utility lines, urban development
Winter burn	Red pine	Becker	yard windbreaks, ipen plantation trees
Porcupine	Red pine, white pine	Beltrami, Becker	tops of 70 ft plus yard trees, suburban homes

### Phenological Notes - 1999

Date	Event	County
3-24	Daffodils emerging.	Ramsey
3-25	Silver maple flowers opening.	Ramsey
3-26	First poplars show greening bark.	Ramsey
4-2	Silver maples blooming	Crow Wing
4-7	Aspen catkins out. Dogwood sticks are bright red. Grasses are brown and starting to turn green.	Pine, Chisago
4-12	Aspen catkins 100% out. Most everything brown except dogwood and willow twigs which are turning color.	Aitkin
4-15	Elms blooming.	Crow Wing
4-15	Red maple blooming.	Itasca
4-19	Poplars blooming. Red maples blooming. Willow and box elder leaves showing.	East central Minnesota
4-20	Dandelions blooming.	Morrison
4-20	Red and silver maple blossoms being shed. In Wealthwood, wild onion is the green of the forest floor. Just up = Dutchman's breeches and trout lily. Saw one bud on wood anemone.	Aitkin
4-20	Peak hazel bloom.	Itasca
4-22	Crabapple leaves showing.	Crow Wing
4-26	Box elder blooming.	Crow Wing
4-27	At Wealthwood, bloodroot blooming, <i>Hydrophyllum</i> is 4" tall, wood anemone is blooming. Saw 1 bumble bee. Elsewhere, larch buds greening up. Aspen leaf buds breaking, a few individuals and clones have a green tint to them.	Aitkin



### Phenological Notes - 1999

4-27	FTC still inside egg masses. Basswood and aspen leaf buds slightly expanded. Oak buds look like it's winter yet.	Mille Lacs
4-28	Aspen leaves explode out of buds: leaves are just a hint of green in morning and are 3/4 inch long by evening. Also blooming = arrow wood and <i>Hepatica</i> .	Itasca
4-29	<i>Hepatica</i> and blood root blooming.	Becker
4-29	FTC eggs hatching (first instar). Paper birch catkins well developed. Oak leaves showing. Basswood buds up to 3/4 in.	Todd
4-29	Boxelder leaves are about 1 inch long; boxelder blooming.	Itasca
4-29	<i>Hepatica</i> in bloom. Aspen leaves expanding at variable rate: some barely green, some 50% emerging. Largest leaves are 1.5 inches long.	Cass
4-29	Silver maple leaves showing. Aspen leaf emergence and leaf expansion nearly complete. Dandelions blooming.	Crow Wing
4-30	FTC first instar. Ash, oak, and box elder blooming.	Crow Wing (Ruttgers, Bay Lake)
4-30	At Father Hennepin State Park: FTC larger than hatchlings and beginning to cluster. Basswood still in bud, bud expansion is 1/2 to 3/4 inch. In bloom = dwarf trout lilies and <i>Hepatica</i> . At junction of Highways 47 and 18: FTC hatching today. Basswood buds still covered and only slightly expanded. Maple and hickory buds are 1 inch long. Aspen leaves are 1" long. <i>Hepatica</i> and dwarf trout lilies in bloom.	Mille Lacs
5-2	Chokecherry blooming	Mille Lacs
5-2	Plum and pear blooming	Crow Wing
5-2	Ribes blossoming. <i>Uvularia</i> (large-bellwort) just starting to bloom.	Itasca
5-3	Red oak leaves are 1 inch long. Bigtooth aspen leaf buds are opening. <i>Amelanchier</i> and <i>Diervilla</i> just starting to bloom.	Itasca

### Phenological Notes - 1999

5-4	<i>Trillium</i> blooming just south of Grand Rapids. Pin cherries starting to bloom. <i>Amelanchier</i> in full bloom.	Itasca
5-5	Marsh marigold and white trillium blooming	Mille Lacs
5-5	Bigtooth aspen leaves showing	Crow Wing
5-6	Norway and white pine buds elongating	Crow Wing
5-6	All bud caps still on white spruce shoot buds. Bigtooth aspen leaves 1 inch long. Aspen fluff flying. Oak leaves are 1-2 inches long. Butternut leaves are 4 inches. Blooming = <i>Amelanchier</i> , marsh marigolds, dandelions, pin cherries, crabapples and <i>Uuvularia</i> (sea oats). Poison ivy leaves are 1 inch long.	Isanti
5-7	Jack pine shoots greatly elongated	Crow Wing
5-9	Basswood thrips <u>very</u> active. Adults are expanding basswood leaves (2½" long leaves).	Itasca
5-11	Pine bark beetles are boring into bark, no nuptial chambers yet. Probably emerged in last 2-3 days.	Morrison
5-12	Green-up and leaf development are at a standstill due to low temperatures and constant rain. Oak leaves are 2 inches, white spruce buds enlarging, about ½ inch, and <i>Amelanchier</i> still holding petals.	Itasca
5-12	Pin cherries, <i>Amelanchier</i> , marsh marigolds and yellow rocket in bloom.	Aitkin
5-12	Oak leaves 1-2½ inches, basswood ½ to 1½ inches. <i>Trillium</i> , crabapples and yellow rocket blooming.	Mille Lacs
5-12	Spruce budworm caterpillars are < ½ inch long.	Anoka
5-13	Aspen fluff is flying. Dandelions are blooming.	Pine
5-13	Aspen fluff is flying. In bloom = pussy toes, dandelions, creeping phlox, pin cherries and marsh marigolds.	Carlton
5-13	Some aspen fluff is flying. First dandelions looking fluffy. In bloom = marsh marigolds, crab apples and bridal wreath.	Itasca
5-14	Lilacs blooming	Crow Wing



### Phenological Notes - 1999

5-14	Spruce budworm 3/16 inch (2 <sup>nd</sup> and 3 <sup>rd</sup> instars). Spruce buds mostly 50% capped.	Sherburne
5-17	Basswood leaves ½ full size. Chokecherries blooming	Crow Wing
5-18	Aspen leaves are full sized. Ash leaf buds breaking. Lilacs starting to bloom. In bloom = wild strawberries and bastard toadflax. At junction HWY. 200 and 84: In red pine, pine bark beetle galleries are 3 inches long, but attack is not heavy. Thinned red pine plantation has green tops yet from the winter activity.	Cass
5-18	Overwintering <i>Ips pini</i> adults have emerged and are constructing egg galleries	Duluth, St Louis Co
5-18	Jack pine candles are 1-3 inches long. Male cones are still immature, but turning yellow. Pine bark beetles with nuptial chambers and some with egg galleries that are up to 3 inches long. In bloom = hoary puccoon pin cherry and marsh marigold.	Wadena
5-18	Large aspen tortrix larvae approximately 1/4 to 5/15 inches long with a few up to ½ inches, webbing leaves together. Leaves ½ to 1 ½ inches long	Duluth, St Louis Co
5-19	At Barrows: spruce budworm 3 <sup>rd</sup> and 4 <sup>th</sup> instars. Jack pine pollen shedding. Hoary puccoon and choke cherries blooming.	Crow Wing
5-19	Wood anemone in bloom and Juneberry is done flowering	Kab, St Louis Co
5-19	Spruce budworm mostly 2 <sup>nd</sup> and 3 <sup>rd</sup> instars with a few 4 <sup>th</sup> . On some white spruce the shoots are 1 inch long and on others the buds have not yet broken. This is true for branches on the same tree	Kabetogama, St Louis CO
5-20	FTC 3/4 inch and starting to disperse.	Todd
5-20	FTC defoliation (nearly 100%) on basswood. FTC are ¾ to 1 inch long at Birch Lake Campground. Lots of basswoods are 100% defoliated.	N. Stearns
5-24	Ash leaves showing	Crow Wing
5-24	FTC ½ to 1 inch and dispersing. Overall, 60% defoliated today. Large, old basswoods up to 100% defoliation.	Aitkin (E side of Mille Lacs Lake)

### Phenological Notes - 1999

5-24	FTC 1 inch and dispersing, some spinning down. Primarily defoliating basswoods, top leaves shredded or missing. No ash anthracnose.	Mille Lacs (Father Hennepin S. Park)
5-25	Rosy maple moths emerging	Crow Wing
5-26	At junction Hwy. 47 & 18: FTC is ½ inch long, just molted. One or two clumps of aspen with heavy defoliation. Many scattered overstory basswood with heavy defoliation. Monarch butterflies are here. In bloom = wild geranium, <i>Trillium</i> , lilacs (just past peak), cotton-grass and choke cherries. Dandelions are fluffy.	Mille Lacs
5-26	FTC to 1 ½ inch	Wright
5-26	Blue-eyed grass in bloom.	Pine
5-26	Mountain ashes are blooming.	Carlton
5-27	Many rosy maple moths	Crow Wing
5-27	SBW larvae about ½ inches long, the rest are smaller. Most bud caps are off the white spruce trees except for ones webbed on by SBW. This would be a good time to spray this plantation. Dandelions have gone to seed and jack pines are just beginning to shed pollen.	Itasca Co
5-28	Jack pine pollen 90% shed. Norway pine pollen starting to shed.	Crow Wing
5-30	Large aspen tortrix larvae approximately ¾ inches long, some light defoliation	Grand Marais, Cook Co
6-1	FTC and Sarcophaga flies near Clear Lake.	Stearns
6-1	Larvae approximately one inch long	Int'l Falls, Koochiching Co
6-1	Swarms of stoneflies hitting car windshields	Two Harbors, Lake Co
6-2	Yellow mustard in bloom	Chisholm, St Louis Co
6-2	Jack pine pollen being shed. Good time to spray white spruce for spruce budworm. Yellow mustard in bloom	Chisholm, St Louis Co



### Phenological Notes - 1999

6-2	FTC larvae 2 inches long and have completely defoliated some road side aspens	St Louis Co
6-4	Caterpillars crossing roads and have completely defoliated an area several sections in size	Nashwauk Itasca Co
6-4	Spruce budworm being eaten by cedar waxwings.	Morrison
6-4	Pinkstriped oakworm moths mating and laying eggs	Benton
6-4	White pine blister rust aecia sporulating	Cook Co
6-4	Meadow cranesbill, common buttercup, vetch, and Canada thistle blooming	Crow Wing
6-4	Painted cup and blue-eyed grass blooming	Morrison
6-7	Ash River Campground sprayed with Bt from the ground for spruce budworm	Kabetogama, St Louis Co
6-8	FTC 1¼ inch long. FTC on basswood, oak and aspen (moderate defoliation on aspen). In bloom = Solomon's Seal, waterleaf, wild geranium and black locust (peak).	Mille Lacs
6-8	White pine pollen in male cones, yet. Some defoliation of aspen along Hwy. 6; lone aspen trees).	Crow Wing
6-11	FTC numerous (Grandview area-Dutchman's Bluff)	Cass
6-11	FTC cocooning (E. Side of Mille Lacs Lake)	Aitkin and Crow Wing
6-14	Northern bedstraw blooming	Crow Wing
6-14	SBW are 30-50% pupated. Some red needle color starting to show in tree tops.	Johnson Farm Rd, St Louis Co
6-14	Lots of FTC caterpillars still feeding but a few have formed cocoons	Chisholm, St Louis Co
6-16	FTC 1½ to 2 inches long, no pupae yet. Basswood just finished blooming. Juneberries are starting to turn purplish pink. Birch Lake State Forest.	Stearns
6-16	Downy phlox, wild lily of the valley, and blue iris blooming	Crow Wing
6-16	Oxeye daisy blooming	Aitkin
6-16	Orange hawkweed blooming	Pine

### Phenological Notes - 1999

6-20	Mountain ash sawfly larvae 1/8 to 5/8 inches long	Itasca Co
6-21	Large aspen tortrix moths have emerged from pupal cases	Duluth, St Louis Co
6-22	FTC larvae spinning cocoons	Duluth, St Louis Co
6-25	Fireweed blooming.	Itasca
6-26	First Juneberries are ripe. Blooming = dogbane, black-eyed Susans and purple fringed orchis.	Itasca
6-28	Blue harebells in bloom.	Itasca
6-30	Greenstriped mapleworm 1/4 inch. Tall meadow rue blooming	Crow Wing
6-30	All SBW moths have emerged and most have finished flying and have died.	Itasca Co
6-30	A few YHSS larvae still feeding but most have finished and dropped to the ground	Northome, Koochiching Co
7-8	Fireweed blooming	Crow Wing
7-9	FTC moths emerging	Itasca Co
7-12	Butterfly weed, bladder campion, and milkweed blooming	Crow Wing
7-12	FTC moths have emerged	Gooseberry ST PK Lake Co
7-13	FTC defoliation still evident, but trees are refoliating. Basswood in full bloom. In bloom = pink milkweed and black-eyed Susans.	Mille Lacs
7-13	Strawberry root weevil adults present	Carlton Co
7-13	Turk's cap lily, tansy, wild bergamot, and early goldenrod blooming	Crow Wing
7-15	Greenstriped mapleworm 1 inch	Morrison (Lake Alexander area)
7-15	Walkingsticks 1 to 2 1/4 inch long. FTC moths present.	Stearns
7-16	YHSS larvae 5/8 inches long	Duluth, St Louis Co



### Phenological Notes - 1999

7-18	Fall sunflower blooming	Crow Wing
7-19	A few YHSS larvae still feeding but most have completed the larval stage	Flood Bay, Lake Co
7-20	<i>Canavirgella danfielii</i> fruiting bodies with ascospores in them. Cause of white pine discoloration last year.	Itasca
7-21	Greenstriped mapleworm 1 and 1/4 inch	Crow Wing
7-21	White pine weevil larvae just starting to form cocoons	Itasca Co
7-26	Pinkstriped oakworm 98% pupated	Morrison NW
7-27	Greenstriped mapleworm 1 and 1/4 inch	Cass
8-6	Spotted knapweed blooming	Pine
8-9	Greenstriped mapleworm pupated	Crow Wing
8-10	Spotted Joe-Pye weed and blazing star blooming	Central Minnesota
8-10	Greenstriped mapleworm, orangestriped oakworm, and pinkstriped oakworm 90% pupated	Crow Wing
9-7	Introduced pine sawfly 2 <sup>nd</sup> generation larvae are mature	Morrison
	Abnormally long, warm and dry fall in 1999. The <u>first</u> snow storms were the weekend of December 10th.	

## **Special Projects**

### **Oak wilt aerial photography**

On Friday, May 15<sup>th</sup>, 1998, a straight line wind caused wide spread tree breakage throughout the Anoka Sand Plain, in Sherburne and Anoka Counties. This is the worst time of year for wounding oaks because the oak wilt fungus is sporulating and the picnic beetles are very active. There hasn't been a storm of this magnitude since oak wilt became widespread in this area.

Sherburne County was aerially photographed in the summer of 1999 to locate all oak wilt infection centers on all ownerships and allow the effects of this storm to be documented. Parts of Wright and Hennepin Counties along the Mississippi River were photographed as well. DNR Forestry Resource Assessment did the photography. Oak wilt infection centers were digitized by a private vendor and LMIC added them to existing statewide maps.



### 1998 Oak wilt activity in Region 3 - MN ReLeaf Program

											# sites	
Community/ Township	County	Acres	Total Treatments	Treatments in 1998	Number Inactive	Number Active	Total Sites	MCD Acres	MCD Sq. Mi.	Active/ Sq Miles	Active Sq. Miles	
Amador township	CHISAGO	32.002	42	10	12	6	18	19556.833	30.558	0.2	0.167	
Chisago Lake township	CHISAGO	17.721	2	2	2	15	17	35410.094	55.328	0.3	0.258	
Franconia township	CHISAGO	2.44	0	0	0	4	4	20434.922	31.93	0.1	0.076	
Harris city	CHISAGO	2.962	0	0	0	2	2	12696.404	19.838	0.1	0.149	
Lent township	CHISAGO	132.193	48	6	38	72	110	22662.259	35.41	2	2.261	
North Branch city	CHISAGO	252.788	69	28	54	105	159	23029.06	35.983	2.9	4.56	
Rushseba township	CHISAGO	0.497	0	0	0	1	1	20855.444	32.587	0	0.015	
Stacy city	CHISAGO	5.023	0	0	0	3	3	733.387	1.146	2.6	4.383	
Sunrise township	CHISAGO	49.302	4	0	2	26	28	29371.444	45.893	0.6	0.876	
Taylor's Falls city	CHISAGO	0.781	2	0	1	0	1	2578.773	4.029	0	0.194	
Wyoming city	CHISAGO	11.17	4	0	3	24	27	1690.165	2.641	9.1	3.507	
Wyoming township	CHISAGO	110.057	24	2	18	49	67	20791.102	32.486	1.5	0.046	
		616.936	195	48	130	307	437			1.61	1.37	
Athens township	ISANTI	139.552	17	5	14	62	76	20305.469	31.727	2	3.237	
Bradford township	ISANTI	237.433	38	5	30	110	140	23006.145	35.947	3.1	5.565	
Cambridge city	ISANTI	15.841	31	3	20	8	28	3582.417	5.598	1.4	0.244	
Cambridge township	ISANTI	3.397	5	0	2	3	5	20665.581	32.29	0.1	0.046	
Isanti city	ISANTI	1.915	0	0	0	1	1	835.927	1.306	0.8	1.466	
Isanti township	ISANTI	40.568	23	4	13	11	24	20770.661	32.454	0.3	0.554	
Maple Ridge township	ISANTI	1.964	0	0	0	3	3	22822.833	35.661	0.1	0.055	
North Branch township	ISANTI	61.59	17	2	12	33	45	22373.819	34.959	0.9	1.185	
Oxford township	ISANTI	45.925	4	0	3	26	29	15172.957	23.708	1.1	0.323	
Spencer Brook township	ISANTI	21.106	8	1	7	11	18	22654.125	35.397	0.3	0.269	
Springvale township	ISANTI	25.331	13	1	11	8	19	22662.183	35.41	0.2	0.253	
Stanford township	ISANTI	320.384	81	11	66	94	160	25206.767	39.386	2.4	0.183	
Wyanett township	ISANTI	0.791	0	0	0	1	1	22828.055	35.669	0.02	0.02	



Community/ Township	County	Acres	Total Treatments	Treatments in 1998	Number Inactive	Number Active	Total Sites	MCD Acres	MCD Sq. Mi.	Active/ Sq Miles	Active Sq. Miles
		915.797	237	32	178	371	549			0.97	1.03
Greenbush township	MILLE LACS	3.022	0	0	0	3	3	23862.539	37.285	0.08	0.081
Princeton township	MILLE LACS	3.583	0	0	0	4	4	21084.637	32.945	0.12	0.109
		6.605	0	0	0	7	7			0.1	0.095
Baldwin township	SHERBURNE	127.407	123	17	46	25	71	22633.615	35.365	0.7	0.937
Becker township	SHERBURNE	601.155	88	17	27	114	141	35526.619	55.51	2.1	6.311
Big Lake city	SHERBURNE	12.977	4	0	3	6	9	2447.498	3.824	1.6	0.16
Big Lake township	SHERBURNE	646.6	253	29	95	157	252	28383.769	44.35	3.5	0.03
Blue Hill township	SHERBURNE	190.96	72	11	29	51	80	23292.758	36.395	1.4	3.179
Clear Lake township	SHERBURNE	28.327	2	0	1	4	5	23727.192	37.074	0.1	0.355
Elk River city	SHERBURNE	650.446	328	37	147	167	314	28031.384	43.799	3.8	0.026
Haven township	SHERBURNE	0.688	0	0	0	1	1	23069.085	36.045	0	0.019
Livonia township	SHERBURNE	85.538	102	15	39	31	70	21338.555	33.341	0.9	1.168
Orrock township	SHERBURNE	374.563	170	18	101	84	185	23182.17	36.222	2.3	6.479
Palmer township	SHERBURNE	48.403	26	9	14	24	38	23349.462	36.484	0.7	0.833
Santiago township	SHERBURNE	117.635	86	24	38	15	53	23224.654	36.289	0.4	1.695
Zimmerman city	SHERBURNE	3.052	2	0	1	2	3	1450.399	2.266	0.9	0.538
		2887.751	1256	177	541	681	1222			1.41	1.67
Lynden township	STEARNS	40.799	0	0	0	6	6	16354.185	25.553	0.2	1.597
St. Augusta township	STEARNS	4.457	5	2	5	2	7	24366.766	38.073	0.1	0.026
		45.	5	2	5	8	13			0.15	0.81
<b>REGION TOTALS</b>		<b>4472.</b>	<b>1693</b>	<b>259</b>	<b>854</b>	<b>1374</b>	<b>2228</b>			<b>1.2</b>	<b>1.3</b>



## Oak Wilt Suppression: Using Herbicides Region 5

**Observations** - following one year of applications of herbicides to suppress oak wilt disease. Results to date (fall-99), are reported for 123 treated trees, on 5 sites, all cooperating private land ownerships.

Question: Can herbicides be used to stop the spread of oak wilt disease?

Further research will be needed to determine this. However! In the 1960's the old Pennsylvania Method tested for controlling oak wilt with Ammate was extremely successful. See note and reference below.

Question pertinent to these observations: Will herbicides kill treated red oak trees sufficient to appear completely dead and not produce sprouts?

Answer: YES after one year of treatments and observations.

Herbicide option;

The problem: In the past oak wilt control using herbicides has not been known to be effective in Minnesota due to the inability of the selected herbicides to sufficiently kill the treated red oak barrier trees. One of the signs of this ineffectiveness was sprouting at the root collar of treated trees. This leaves open the a possible and likely surviving underlying root system that would presume to continue to act as a conduit to the spread of the oak wilt disease.

What will red oak completely (no sprouting), and within one season?

The Answer? Stalker and Garlon 4.

What was used: HERBICIDE CONTROL OPTION: For OAK WILT DISEASE<sup>1</sup>  
(Initial recommendations, fall1998)

The approved chemical control option; use of approved forest herbicides is as follows.

Application method: Low - Volume Basal Treatment:

Mix: 3 Quarts of Riverside Diluent XLT

1 Qt. Garlon 4

3 Ounces Stalker

Apply with a backpack sprayer, equipped with a cone nozzle. Spray should be misted on to the lower 18 of the stem. Spray for coverage only, not to the point of runoff.

For oak trees greater than 8 inches dbh, cut axe notches around base of tree every 3 inches, just before treatment.

### TREATMENT SITES:

All treatments were completed by a trained contractor.

All treated trees were pre-marked on each site by the Forest Health Specialist. All secondary and primary trees are treated on these sites, a 50' to 60' barrier. This is the disadvantage of using a herbicide option. All the secondary and primary trees must be killed. The host is effectively destroyed for 50' to 60' feet depending on the site.

Treatments began in the fall 1998 and were completed by winter 1999. (Dates listed by site.)

All sites were on private land with the landowners consent.

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<sup>1</sup>Where plowing is not an option.

**Site 1, Waldorff, Treated 1/25/99.**

Results: All trees leafed out in the spring. Signs of herbicide activity continued throughout the summer. At the time of the final field check, 9/24/99 all trees were completely dead, no sprouts.

Comments: Appears to be extremely effective. In follow-up observations next year and in later years, this site will offer observations on:

1. Flash-back, (movement of the herbicide through treated tree root system into adjacent root grafted untreated tree root system, some early fall color noted on one side of an untreated oak right next to a small treated oak),
2. Effects on untreated bur oaks adjacent to treated red oaks.
3. The eventual opportunity to see if the oak wilt spreads out of either treatment area.

There were 2 separate treatment sites, on this property.

#1 A barrier between an active infection center and area of red oaks to be saved.

15, trees all pin oak, recorded in dbh. All dead after one year, no sprouts.

9.1	10.2	10.2	11.3	8.2	13.7	6.9	6.7
6.4	6.5	5.9	8.7	10.1	6.9	9.0	

#2 active infection center on west side of property.

10, trees all pin oak, in dbh. All dead after one year, no sprouts.

13.9	4.3	2.5	1.9	4.5	9.2	8.5	9.5	10.1	12.5
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**Site 2, Elwood, Treated 11/30/98.**

Results: Some trees did not leaf out in the spring. By early August all oaks were completely dead, no sprouts.

This was a classic new, from the edge, infection center. Spreading rapidly through high density small diameter pin oaks. A site that would be difficult to isolate or get ahead of with a vibratory plow. There were approximately 35 trees 2 to 6" in dbh all pin oaks.

Comments: Again appears to be extremely effective. Follow-up observations this site will offer the opportunity to see if the oak wilt spreads out of treatment area.

In addition, on August 18<sup>th</sup>, two 5 inch pin oaks trees were removed from this site to observe their root systems. One treated and one live tree donated by the landowner. The root collar on the treated tree was discolored throughout the root collar zone and well below ground line. Armillaria was evident throughout the root collar. The only parts of the tree that did not appear dead were 2 feet below ground, quarter inch diameter roots. The way stalker works, these roots may only appear alive. (See notes below on how imazapyr works.) Slides of these excavated root systems are available. Trees were excised from the ground by MCC crew.

**Site 3, Smith, Treated 11/30/98.**

Results: As of field check on 9/24/99, the average dieback was 50%. This treatment site was an large, old but still active infection center where basically all the remaining red oak on the site were killed to prevent future sporulation. The site is within a quarter mile of several vibratory plow sites installed in 1998.



Comments: This treatment was not as effective as some of the others and obviously not what we would like to see. The possible reasons include, under treatment (not enough herbicide applied), a less intensive frill than what may be needed, or something else.

See current recommendations below. We recommend a more intensive frill (continuous) and have increased the stalker to 4 ounces.

Follow-up observations; Re-treatment is likely not needed. There is a good chance all of these trees will not even leaf out to the spring of 2000. If they did it would be interesting to see if they could survive attack by to the 2-lined chestnut borer past July 1<sup>st</sup>. ( note that borer activity is common on all dead trees that were examined in 99).

This looks like an effective treatment with 3 ounces of stalker and 1 quart of Garlon 4 within a year and one half of treatment.

15, trees 12" to 18" dbh. One bur oak, the rest pin oak. Trees by dbh and % of crown dead on 9/24/99.

15, Bur-100%	14.8-40%	12.9-25%	12- 20%	13-40%	14.6-20%	11.1-90%	7.4-100%
13.6-50%	16.9-40%	18.7-70%	15.9-90%	14-100%	12.1-10%	15.9-75%	

**Site 4, Ward, treated 9/15/98.**

Results: By mid season the activity level was low. By August 1 it became evident that the site was under treated (not enough herbicide was used or the amount of frill was not enough). The only symptom on the treated trees was generally smaller leaf size. The site was retreated in August 99. There is little chance these trees will be alive after mid-June in 2000, they will likely not leaf out. Comments: This was a large old active multiple (2) infection centers with multiple wilting trees. Follow-up observations next year will determine any symptom development and time of mortality.

35, trees all pin oak recorded in dbh.

11.6	14.2	12.5	13.8	9.6	11.9	14.2	10.4
9.1	11.9	13.5	11.8	10.0	15.9	13.0	11.7
12.0	11.3	9.0	10.7	10.1	9.7	12.2	15.4
13	15.9	14.8	3	5	4	5	6
2	3	4					

**Site 5, Kepp, Treated 12/18/98.**

Results and comments will be the same as See Smith above.

12 trees, average 19.6" dbh. Trees by dbh and % of crown dead on 9/24/99.

15.1-5%	18.9-50%	19.1-100%	19.2-40%	14.7-100%	17.3-100%	17.7-100%	30.2-100%
14.5-50%	25.6-80%	25-25%	17.9-25%				

Plans for year 2000.

Treat as much oak wilt on state land as possible. Increase sign-ups in wooded areas on private land in Marion township in Olmsted county. Especially adjacent established plow lines.

### **Oak Wilt Control: The Pennsylvania Method**

On 62 test plots, diseased oaks and healthy oaks within 50 feet of and of the same species group as the diseased tree were felled. Stumps of all diseased and healthy trees were treated with Ammate herbicide. After 10 years it was deemed to be 90% successful. Only 9 trees became infected on the 62 test plots receiving this treatment as opposed to 98 new wilt trees on the 59 check plots. Of the 9 new wilt trees on the 62 test plots, 2 resulted from long distance spread, 1 from apparent local spread from a red oak to a chestnut oak, and the other 6 from apparent local spread from infected red oaks to red oaks that were missed in the application of the chemical measures.

Jones, T. W. An Appraisal of Oak Wilt Control Programs in Pennsylvania and West Virginia. U.S.D.A. Forest Service Research Paper NE-204, 1971.

### **Herbicide Control Option: Oak Wilt<sup>2</sup> 1999-2000**

(Where plowing is not an option)

For herbicide control of Oak Wilt Disease;

Method: Low - Volume Basal Treatment:

Mix:

3 Quarts of Terra Riverside Diluent XLT

1 Quart of Garlon 4

4 oz. Stalker

For oak trees greater than 8 inches dbh, cut a continuous frill with an axe, hatchet, or chain saw around the tree at 18 inches just before treatment.

Apply the herbicide with a backpack sprayer, equipped with a cone nozzle. Spray the frill and the lower 18 inches of the stem. Spray for complete coverage.

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## **Spruce budworm and white spruce thinning focus fund project.**

How should white spruce plantations be managed? What are the thinning recommendations? Does white spruce older than 30 years respond to thinning? Would thinned white spruce be more or less susceptible or vulnerable to spruce budworm? Should white spruce be grown in pure monoculture plantations? Should you thin during a spruce budworm outbreak?

Lots of questions with few answers. While there are over 100,000 acres of white spruce plantations in Minnesota alone, a managers handbook does not exist. Spruce budworm on balsam fir has been researched extensively, however budworm on white spruce in the Lake States has received much less attention.

To answer some of the questions, Mike Albers MN-DNR and Steve Katovich USFS-S&PF developed a Focus Fund proposal titled Developing Guidelines for Managing White Spruce Plantations Threatened by Spruce Budworm. It successfully competed for Federal Assistance with proposals from 20 northeastern states and was awarded \$35,000.

Dr Klaus Puetzman, Dept of Forestry, University of Minnesota agreed to be the project coordinator. Mike Saunders is a research associate working on the project. Cooperators include MN-DNR, USFS-S&PF, USFS-NCFS and Blandin Paper Company.

Plantations are currently being selected for the study. The plan calls for thinning 6 to 8 plantations yet this summer. Additional plantations will be thinned next year. Some of the plantations will have a continuing history of spruce budworm defoliation and others will not. Permanent plots will be established in these plantations to monitor the long term impact.

The goals of the project include developing management guidelines for established white spruce plantations. Interim recommendations are to be developed within one year. These will be refined as new information is derived from the study. The study will also determine if thinning conducted during an ongoing budworm outbreak is beneficial in reducing growth loss, top-kill or mortality. Publications, workshops, and training materials aimed at forest managers and private woodlot owners will be developed. Stay tuned for further developments.

## Forest insect degree day calculations on the web

Whether you are trying to find an insect or plant in a certain stage of development or trying to control a certain insect with a pesticide you need to know when you should be out there spraying or looking. You can put a reminder on a calendar based on when the right time was in past years. But you know some years things happen a lot earlier or a lot later than other years. That is because certain conditions are required for growth and development.

Development can only occur within a certain temperature range, moisture regime and day length, etc. Some of these requirements like temperature and moisture vary from one year to the next, so the time of moth flight or the flowering of a plant varies from year to year. This relationship between weather and development is called phenology.

With insects, the most influential factor is usually temperature. Being cold-blooded, their development is directly related to temperature. The time it takes for an insect to develop from one stage to another depends on temperature. The insects develops faster when the temperature is optimal and slower when outside the optimum range.

Scientists have used the accumulation of daily maximum and minimum temperatures above a minimum threshold temperature (degree days or DD) to predict the stage of development of some insects. An insect can be expected to be in a certain stage of development when a certain number of degree days have accumulated regardless of the calendar date.

For an example, lets say a certain insect only develops when the temperature is above 45 degrees F. Today's average temperature is 46°. You have accumulated 1 degree day for today. If the next day the average temperature is below 45° say 43° you do not accumulate any degree days because the average temperature was below the base or threshold temperature of 45°.

A degree day model for spruce budworm, developed by Timothy J. Lysky, was described in a paper titled "Stochastic Model of Eastern Spruce Budworm Phenology on White Spruce and Balsam Fir." Degree day predictions developed in one location may not be accurate if applied to another location. This model was developed in Canada but did contain a number of plots just north of Minnesota and hopefully is close enough for our use.

This model uses 46.4° F as the threshold temperature and a starting date for accumulation of degree days of March 1. Based on this, the peak occurrence of the various life stages of spruce budworm can be expected at the following accumulated degree days:



<b>Accumulated spruce budworm degree days</b>		
<b>Peak stages of insect development</b>	<b>Balsam fir</b>	<b>White spruce</b>
2 <sup>nd</sup> instar	192 F	197 F
3 <sup>rd</sup> instar	226	217
4 <sup>th</sup> instar	309	280
5 <sup>th</sup> instar	399	366
6 <sup>th</sup> instar	563	492
Pupae	775	698
Adult	872	818
Base temperature = 46 F. Starting date = March 1.		

“All well and good” you say, “but how do I know what the accumulated degree days are for my locale?” Glad you asked! The Climatology Working Group has agreed to post this information on the Internet for us. Accumulated degree days for spruce budworm at 40 locations around the state can be found on the Internet at the Climatology Working Group web site at <http://climate.umn.edu/doc/forestpests.htm>. So for example, if you want to collect some moths from white spruce you should be out there by the time the accumulative degrees days reach 818, or if a control recommendation is to spray a pesticide when the budworm is in peak 4<sup>th</sup> instar you should be spraying at 280 DD on white spruce or 309 DD on balsam. You will want to use this information along with other information such as the development of the host, etc. before actually spraying. Give it a try. See if it seems to be accurate for your area.

We were not able to locate a similar model for the **forest tent caterpillar**. However, degree days for FTC using a threshold temperature of 32°F and a starting date of January 1<sup>st</sup> is also posted on this web page. Using this model, the peak of the FTC hatch should occur at 400 DD based on our past experiences. And, indeed, this model was borne out by 1999's hatching data.

## Publications, handouts etc.

### Oak wilt and its look-alikes

	Oak Wilt	Anthracnose	Two-Lined Chestnut Borer	Oak Decline
<b>Host Range</b>	All red and white oaks, more common on red oaks	Common on white oaks.	All red and white oaks, especially associated with stress.	All red and white oaks.
<b>Causes</b>	Fungus <i>Ceratocystis fagacearum</i>	Fungus <i>Apiognomonia quercina</i> , <i>Discula quercina</i>	Insect <i>Agilus bilineatus</i>	Multiple stressors including: insect defoliators (e.g. leaf skeletonizers and miners) fungi (e.g. <i>Armillaria</i> spp.) And abiotic (e.g. drought, flooding, fluctuating water table, construction damage)
<b>Pattern of Tree Damage on Site</b>	Expanding pockets or isolated trees. New infection may be associated with tree wounding (construction, pruning, storm injury).	General and widespread, particularly during prolonged wet periods in spring and summer.	Often scattered, not necessarily in pockets. Associated with stress (defoliation, drought, construction, etc.).	Scattered to widespread (depends on site factors).
<b>Symptoms and Patterns of Damage on Tree</b>	<b>Red Oak</b> - fast (< 8 weeks) progression. Wilting and browning of entire crown. Heavy premature leaf fall. <b>White Oak</b> -slow (1-5 yrs) progression. Wilt and browning of individual branches. Light leaf fall. <b>Both</b> -Leaves brown from tip and margin inward; "water soaked" appearance of leaves. Sapwood discoloration.	Seasonal progression. Lower, inner portions of crown most heavily affected. Individual leaf spots anywhere on leaves. Spots coalesce into large, brown blotches. Leaf drop may occur if infection is severe.	Slow to rapid progression of damage. Upper, outermost portion of crown affected first or individual branches. Leaf browning, without leaf fall. Dead branches from previous year's infestations visible year round. Insect tunneling - look for larval galleries beneath bark of the branches and main stem.	Slow progression (2-5 yrs). Leaves may appear chlorotic, dwarfed or sparse. Foliage may be "tufted" in crown. Individual branches may be killed. Branch dieback common. Leaves not dropped.
<b>Time of Symptoms</b>	Usually mid to late summer.	Spring and early summer occasionally later summer and fall if wet conditions persist.	Leaf browning in late summer/fall. Leaves are not shed early.	Variable.
<b>Impact on Host</b>	Red oaks killed quickly. White oaks die gradually, some may live.	Defoliation renders trees unsightly as shade trees. Defoliation reduces vigor. If heavy damage occurs, trees may re-leaf.	Usually will not kill oaks in the absence of some other stress factors, especially drought, construction and defoliation.	Often results in tree death.
<b>Other Comments</b>	Overland spread by Nitidulid beetles. Local spread to neighboring trees is via root grafts. Red oak to red oak; white oak to white oak.		If stress persists, can cause tree death (1-5 years).	Caused by a complex of factors, which may include: defoliation, tree age, site, drought, frost, <i>Armillaria</i> root disease, oak cankers, two-lined chestnut borer, etc.

Compiled from the combined contributions of USFS, NCRS and S&PF and Minnesota, DNR.

The best method of distinguishing oak wilt infections from all the other types of oak problems is to take a sample and have it analyzed at the Shade Tree Lab (free) or Disease Clinic at the University of Minnesota (\$20).



## Survey Results

### Forest Tent Caterpillar egg mass survey

Egg mass surveys were conducted at 8 locations in Region 2 over the winter of 1998 -1999 with the following results:

County	Legal Description	Ave DBH	Total # of Egg masses	Predicted defoliation
St Louis	S2-T50N-R18W	3.3	0	0
St Louis	S36-T50N-R15W	2.6	1	Light
St Louis	S32-T51N-R13W	3.5	1	Light
Lake	S23-T63N-R11W	3.5	1	Light
Lake	S12-T63N-R10W	3.3	1	Light
Cook	S32-T63N-R4E	2.5	2	Light
Cook	S36-T64N-R3E	2.6	2	Light
Cook	S16-T63N-R1E	2.3	0	0

### Pine Tussock Moth Pheromone Trapping

Pine tussock moth pheromone trapping - 1999						
COUNTY	LOCATION	DATE TRAP PLACED	TRAP NO. OR NAME	DATE TRAP CHECKED	MALE P.T. MOTHS IN TRAP	COMMENTS
Crow Wing	NENW 9-136-27	6-16	1R	6-30	25	
			1R	7-7	9	
			1R	7-21	14	
			1R	8-10	12	
			1R	9-1	12	
			1R	9-15	2	
			1P(Trece)	6-30	10	
			1P	7-7	9	
			1P	7-21	9	
			1P	8-10	9	
			1P	9-1	8	
			1P	9-15	2	
			1S(PheroTech)	6-30	0	
			1S	7-7	0	
			1S	7-21	0	
			1S	8-10	0	
1S	9-1	0				
1S	9-15	0				

**Pine tussock moth pheromone trapping - 1999**

COUNTY	LOCATION	DATE TRAP PLACED	TRAP NO. OR NAME	DATE TRAP CHECKED	MALE P.T. MOTHS IN TRAP	COMMENTS
Crow Wing	NE 9-136-27	6-16	2R	6-30	6	
			2R	7-13	2	
			2R	7-27	6	
			2R	8-10	1	
			2R	9-1	0	
			2R	9-15	4	
			2P(Trece)	6-30	10	
			2P	7-13	6	
			2P	7-27	3	
			2P	8-10	7	
			2P	9-1	3	
			2P	9-15	3	
			2S(PheroTech)	6-30	0	
			2S	7-13	0	
			2S	7-27	Trap Missing	
Hubbard	10-139-32		Cutoff Rd	7-2	33	
				7-20	21	
				8-2	5	
				8-25	1	
				9-3	0	
Hubbard	16-139-32		F Nursery	7-20	22	
				8-2	14	
				8-25	3	
				9-3	0	
Hubbard	16-139-32		C Nursery	7-2	21	
			R	7-20	21	
			R	8-2	15	
			R	8-25	5	
			R	9-3	0	
			P	7-2	24	
			P	7-20	25	
			P	8-2	13	
			P	8-25	5	
			P	9-3	0	
			S	7-2	0	
			S	7-20	0	
			S	8-2	0	
S	8-25	0				
S	9-3	0				



**Pine tussock moth pheromone trapping - 1999**

COUNTY	LOCATION	DATE TRAP PLACED	TRAP NO. OR NAME	DATE TRAP CHECKED	MALE P.T. MOTHS IN TRAP	COMMENTS
Hubbard	20-139-32		Oschalger's R R R R R	7-2 7-20 8-2 8-25 9-3	16 22 15 8 0	
Hubbard	36-139-33		109 Bend R R R R R P(Trece) P P P S(PheroTech) S S S S	7-2 7-20 8-2 8-25 9-3 7-2 7-20 8-2 8-25 9-3 7-2 7-20 8-2 8-25 9-3	27 26 20 10 0 32 24 17 17 3 0 0 0 0 0	
Hubbard	9-139-32		Woodland Tour R R P(Trece) S(Phero Tech)	7-2 7-20 7-2 7-2	26 Harvested 22 0	

**Pine tussock moth pheromone trapping - 1999**

COUNTY	LOCATION	DATE TRAP PLACED	TRAP NO. OR NAME	DATE TRAP CHECKED	MALE P.T. MOTHS IN TRAP	COMMENTS
Hubbard	34-139-33		Hunterville Ct. Rd. R R R R R P(Trece) P P P P S(Pherotech) S S S S	7-2 7-20 8-2 8-25 9-3 7-2 7-20 8-2 8-25 9-3 7-2 7-20 8-2 8-25 9-3	17 22 16 7 0 15 12 15 6 6 0 0 0 0 0	
Hubbard	17-139-32		Tripp Lake R R R R R	7-2 7-20 8-2 8-25 9-3	27 14 11 5 1	
Hubbard	25-139-33		Old Landing R R R R R	7-2 7-20 8-2 8-25 9-3	27 30 29 23 6	
Hubbard	26-139-33		Roadside R R R R R	7-2 7-20 8-2 8-25 9-3	30 16 20 7 0	



**Pine tussock moth pheromone trapping - 1999**

COUNTY	LOCATION	DATE TRAP PLACED	TRAP NO. OR NAME	DATE TRAP CHECKED	MALE P.T. MOTHS IN TRAP	COMMENTS
Pine	NWSW 25-45-19	6-16	3R	7-1	4	NW side of General Andrews Nursery
			3R	7-16	5	
			3R	8-6	3	
			3R	8-27	0	
			3R	9-17	0	
			3P(Trece)	7-1	2	
			3P	7-16	7	
			3P	8-6	10	
			3P	8-27	4	
			3P	9-17	0	
			3S(Pherotech)	7-1	0	
			3S	7-16	0	
			3S	8-6	0	
			3S	8-27	0	
3S	9-17	0				
Wadena	14-138-33		Impoundments R			
			R	7-2	11	
			R	7-20	7	
			R	8-2	0	
			R	8-25	3	
			P	9-3	0	
			P	7-2	22	
			P	7-20	12	
			P	8-2	6	
			P	8-25	6	
			S	9-3	3	
			S	7-2	0	
			S	7-20	0	
			S	8-2	0	
S	8-25	0				
	9-3	0				

**Pine tussock moth pheromone trapping - 1999**

COUNTY	LOCATION	DATE TRAP PLACED	TRAP NO. OR NAME	DATE TRAP CHECKED	MALE P.T. MOTHS IN TRAP	COMMENTS
Wadena	10-138-33		Sprucerow R	7-2	22	
			R	7-20	19	
			R	8-2	11	
			R	8-25	7	
			R	9-3	16	
			P	7-2	25	
			P	7-20	22	
			P	8-2	18	
			P	8-25	16	
			P	9-3	8	
			S	7-2	0	
			S	7-20	0	
			S	8-2	0	
			S	8-25	0	
S	9-3	0				
Wadena	7-138-33		Shell River R	7-2	25	
			R	7-20	12	
			R	8-2	13	
			R	8-25	9	
			R	9-3	0	
Wadena	10-138-33		Roadsign R	7-2	35	
			R	7-20	16	
			R	8-2	18	
			R	8-25	14	
			R	9-3	0	
Wadena	11-138-33		Duckhole R	7-2	NA	
			R	7-20	30	
			R	8-2	16	
			R	8-25	15	
			R	9-3	5	



**Pine tussock moth pheromone trapping - 1999**

COUNTY	LOCATION	DATE TRAP PLACED	TRAP NO. OR NAME	DATE TRAP CHECKED	MALE P.T. MOTHS IN TRAP	COMMENTS
Wadena	2-138-33		Gamefarm R	7-2	23	
			R	7-20	26	
			R	8-2	20	
			R	8-25	10	
			R	9-3	1	
			P	7-2	25	
			P	7-20	22	
			P	8-2	19	
			P	8-25	7	
			P	9-3	16	
			S	7-2	0	
			S	7-20	0	
			S	8-2	0	
			S	8-25	0	
S	9-3	1				

### Spruce budworm survey - 1999

Location	Species	1996	1996	1997	1997	1998				1999	1999					2000
						Larval survey		Egg mass survey			Larval survey		Egg mass survey		Notes	Predicted defoliation
		defoliation	Ave # egg mass	defoliation	Ave # egg mass	% of buds on twig	Ave # of larvae on twig	Actual defoliation	Ave. # egg masses	Predicted defoliation	%of buds on twigs	Ave # of larvae on twig	Actual defoliation	Ave # egg masses		
<b>Aitkin Co.</b>																
NENE 7-51-23	WS		0.1		0.55			58	0.44	Moderate						
NENE 17-52-24	WS		0.1		0.11			9	0	O-Very Light						
<b>Becker Co.</b>																
SESE 21-141-36	WS				1.33			Heavy-Moderate	0.77	M			M-H	1.11		M
<b>Beltrami Co.</b>																
NESE 26-149-30	WS		1.5													
NWSW 12-147-30	WS				1.55			Heavy	1.33	M			L	0		0
SWSW 12-147-30	WS				0.33			VL	.01	L			VL	0		0
NENE 26-149-30	WS				1.0			H	0.88	M						
SESE 2-147-31	WS				2.1			H	0.55	M			M-H	0.55		L











### Spruce budworm survey - 1999

Location	Species	1996	1996	1997	1997	1998				1999	1999					2000
						Larval survey		Egg mass survey			Larval survey		Egg mass survey		Notes	Predicted defoliation
		defoliation	Ave # egg mass	defoliation	Ave # egg mass	% of buds on twig	Ave # of larvae on twig	Actual defoliation	Ave. # egg masses	Predicted defoliation	%of buds on twigs	Ave # of larvae on twig	Actual defoliation	Ave # egg masses		
Itasca Co.																
NESE 2-61-23	BF			M	0.33	80	7.8	88	0.66	M			L-M	0.2		L-M
NENW 34-62-22	BF	L	0.44	VL	0.77	55	5.7	29	0.22	M						
NWSE 26-62-23	BF	L	0	L	0.55	20	3.1	32	0.22	M						
NWSW 3-58-24	WS	L	0	O	0.0	<1	0	<1	0	O						
SWNE 3-58-24	WS	O	0	O	0.0	<10	.1	<1	0	O	2	0.44	0	0	vigorous	
SWSW 35-58-24	WS			M	1.22											
NENW 23-59-24	BF					<10	0	<1	0	O						
SWSE 36-62-24	WS	H	0.77													
NENE 17-53-25	WS			M	1.99											
NWSW 35-58-24	WS	L	1.1	M	1.2	90	15.6	40	0.44	M	67	23.78	H	0.1		L



### Spruce budworm survey - 1999

Location	Species	1996	1996	1997	1997	1998				1999	1999						2000
						Larval survey		Egg mass survey			Larval survey		Egg mass survey		Notes	Predicted defoliation	
		defoliation	Ave # egg mass	defoliation	Ave # egg mass	% of buds on twig	Ave # of larvae on twig	Actual defoliation	Ave. # egg masses	Predicted defoliation	%of buds on twigs	Ave # of larvae on twig	Actual defoliation	Ave # egg masses			
NWNE 7-60-25	WS	O	0														
NW 9-56-25	WS	O	0.44														
NWNE 4-60-26	WS	O	0														
SENW 12-53-26	WS	VL	0.1		0.11	25	1.11	3	0.11	L							
SESW 11-53-26	WS	VL	0.1	VL	0.66	40	3.1	17	0	O-VL	59	15.33	M	0.44	vigorous	M	
SWSE 17-60-26	BF	VL	0			<10	0	1	0	O							
<b>Koochiching County</b>																	
NWNW 4-65-22	BF			H	1.2	90	5.7	98	1.33	Modrate - Heavy	less than 10%	2.67	L-H	0	new shoots shot	0	
NWNW 19-65-22	WS,BF	M	2.0	L	1.1	80	6.7	74	0.77	M							
NENE 24-65-23	BF			M	0.55												
10-67-22	WS							H	0.55	M-H							

### Spruce budworm survey - 1999

Location	Species	1996	1996	1997	1997	1998				1999	1999					2000
						Larval survey		Egg mass survey			Larval survey		Egg mass survey		Notes	Predicted defoliation
		defoliation	Ave # egg mass	defoliation	Ave # egg mass	% of buds on twig	Ave # of larvae on twig	Actual defoliation	Ave. # egg masses	Predicted defoliation	% of buds on twigs	Ave # of larvae on twig	Actual defoliation	Ave # egg masses		
SENE 23-67-22	BF	L	1.2													
NESW 31-70-26	WS				0.1	60	9.3	60	0.22	M			L	0	near shoot shot	
SENE 4-71-22	BFWS				0.44	80	7.8	82	0.55	M			L	0		
SESE 35-71-24	WS	L	0.11													
SESE 8-69-23	BF				0.11	35	6.0	57	0.44	M			L	0	vigorous	
SESE 16-69-23	BF	L	0													
NWNE 22-65-23	BF			M	0.55	90	8.5	83	0.88	M			L- M	0	vigorous	N-L
SWSW 25-69-23	WS					12	5.3	41	0.44	M						
NWSE 5-70-23	BF							95	0.77	M						
SWSE 36-62-24	BF WS	M	0.77	H	1.0	95	16.3	99	0.33	M						

### Spruce budworm survey - 1999

Location	Species	1996	1996	1997	1997	1998				1999	1999					2000
						Larval survey		Egg mass survey			Larval survey		Egg mass survey		Notes	Predicted defoliation
		defoliation	Ave # egg mass	defoliation	Ave # egg mass	% of buds on twig	Ave # of larvae on twig	Actual defoliation	Ave. # egg masses	Predicted defoliation	%of buds on twigs	Ave # of larvae on twig	Actual defoliation	Ave # egg masses		
SENE 27-70-25	WS					70	16.8	80	0.44	M			L	0		
NWNE 27-158-26	WS					<10	.22									
<b>Lake Co.</b>																
SWNE 11-55-8	BF		0	0	0.0	<10	0	<1	0	0						
SWSE 5-59-8	BFWS		0	0	0.0	<10	.1	0	0	0						
NESE 28-61-10	WS		0													
SENE 11-61-11	WS,BF		0													
SENW 31-62-11	WS,BF		0.1													
<b>Mille Lacs</b>																
SWSE 1-35-27					1.0											
<b>Morrison Co.</b>																



### Spruce budworm survey - 1999

Location	Species	1996	1996	1997	1997	1998				1999	1999						2000
						Larval survey		Egg mass survey			Larval survey		Egg mass survey		Notes	Predicted defoliation	
		defoliation	Ave # egg mass	defoliation	Ave # egg mass	% of buds on twig	Ave # of larvae on twig	Actual defoliation	Ave. # egg masses	Predicted defoliation	% of buds on twigs	Ave # of larvae on twig	Actual defoliation	Ave # egg masses			
NENE 1-41-29	WS		1.6		0.33			6	0	O-VL							
NESW 11-42-32	WS		0		0.44												
Sherburne Co.																	
NWNW 33-34-27	WS		0.55		0.22			31	0.1	L							
St. Louis Co.																	
NESE 22-62-12	WS,BF		0.55	L	0.33	30	3.3	12	0	O-VL							
NWNE 6-63-12	BF		0.1														
SESE 31-58-13	WS,BF		0	O	0.0	0	0	<1	0	O							
NWNE 4-62-13	BF		0.22														
NESE 6-63-17	BFWS		0.1	M	1.55	70	9.3	35	0.77	M	30	9.44	L	0			



### Spruce budworm survey - 1999

Location	Species	1996	1996	1997	1997	1998				1999	1999					2000
						Larval survey		Egg mass survey			Larval survey		Egg mass survey		Notes	Predicted defoliation
		defoliation	Ave # egg mass	defoliation	Ave # egg mass	% of buds on twig	Ave # of larvae on twig	Actual defoliation	Ave. # egg masses	Predicted defoliation	% of buds on twigs	Ave # of larvae on twig	Actual defoliation	Ave # egg masses		
NESW 12-64-21	BF	H	.022		.066	90	10.9	95	1.55	M	6	2.89	L-M	0.01	few and short shoots	L
NWSW 15-67-21 Thinned 1998	WS thinned 1998							H	0.44	M			M	O	30+ yrs old short shoot	O-L
NWSW 15-67-21 Planted 1978	WS							H	0	O			L	O		O-L
16-67-21	WS							L	0.3	L			L	O		O-L
NWNW 30-67-21	WS							L	0.44	M			L	0.3	West End	M
NWNW 30-67-21	WS							H	0.44	M			L	0.3	East End	M
SESW 12-68-21	WS		0.77	H	1.55	100	14	83	1.22	M			L	0	shoots short and tufted	VL
SESE 13-64-21	BF			L	0.66	80	11.2	96	0.33	M						



### Spruce budworm survey - 1999

Location	Species	1996	1996	1997	1997	1998				1999	1999						2000
						Larval survey		Egg mass survey			Larval survey		Egg mass survey		Notes	Predicted defoliation	
		defoliation	Ave # egg mass	defoliation	Ave # egg mass	% of buds on twig	Ave # of larvae on twig	Actual defoliation	Ave. # egg masses	Predicted defoliation	%of buds on twigs	Ave # of larvae on twig	Actual defoliation	Ave # egg masses			
5-68-19 Ash River Campground	WS										7	15.44	L	0	Ash River Campground; sprayed 6/99 BT	VL	
10-67-22 Velpar Short trees	WS												L	0.6		M	

MINNESOTA DEPARTMENT OF NATURAL RESOURCES  
COOPERATIVE FOREST HEALTH PROGRAM  
PROGRAM ACCOMPLISHMENTS FFY 1999

I. INTRODUCTION

**Staffing.** *Staffing of the Minnesota Forest Ecosystem Health Program (MFEHP) includes:*

- 1 - Fire, Forest Health, Urban and Nursery Programs Supervisor*
- 1 - Forest Health Program Coordinator*
- 5 - Regional Forest Health Specialists*
- 2 - Seasonal Plant Health Specialists*

Discussion

In June, the Regional Forest Health Specialist position in the Metro Region became vacant. This position also served as the statewide entomologist and the gypsy moth liaison. The vacancy in this position led to missed technology transfer opportunities within the Metro Region and the need to reassign another Regional Forest Health Specialist to cover gypsy moth liaison responsibilities.

II. FOREST HEALTH MONITORING - PLOT NETWORK

**Forest Health Monitoring Plots.** *Minnesota first established forest health monitoring plots in 1994. There are 1,037 FHM plots in Minnesota. Coordination and implementation of the FHM program are accomplished by the Resource Assessment Unit. Personnel from this Unit participate at the Regional and National levels in planning, training, and debriefing meetings. Forest Health personnel participate in training of Forest Health Monitoring crews.*

Item	Accomplishments	Targets
New plots	65	65
Remeasured plots	57	55
Lichen plots	57	55

III. FOREST HEALTH MONITORING - OFF-PLOT ACTIVITIES

**General Detection Surveys.** *Major forest survey activities will include a general aerial detection survey of the major forested areas of MN from early June through mid-July. During the aerial survey, each Forest Health Monitoring plot will be checked. Ground verification will be carried out to validate aerial survey observations. Survey data will be digitized and stored as data layers for use with the EPIC GIS program. Survey results will be made available to USFS State and Private Forestry. Additional aerial and ground surveys will focus on spruce budworm, jack pine budworm, pine tussock moth, forest tent caterpillar, large aspen tortrix, and respond to specific reports of additional pest outbreaks.*

GENERAL DETECTION SURVEYS

Item	Accomplishment	Target
General detection survey	13,000,000 acres	13,000,000 acres
Check FHM plots	320 plots	All forested plots

1999 TOTAL FORESTED ACRES WITH DAMAGE OR MORTALITY	
ACRES	PERCENT of MINNESOTA FOREST LANDS WITH DAMAGE or MORTALITY
1,631,555	9.7%

SURVEY RESULTS: DEFOLIATION and DISCOLORATION				
CAUSAL AGENT	DAMAGE	TOTAL ACRES	ACRES	
			Percent of FOLIAGE affected	
			<51%	>50%
Forest tent caterpillar	Defoliation	488,889	130,016	358,873
Large aspen tortrix	Defoliation	336,170	146,704	189,466
Oak anthracnose	Discoloration	150,000	150,000	
Wind	Discoloration and Defoliation	70,523	50,154	20,369
Spruce budworm	Defoliation	69,620	26,709	42,911
Flooding	Discoloration and Defoliation	3,724	2,693	1,031
Oak worms	Defoliation	1,707	706	1,001
Greenstripe mapleworm	Defoliation	954	727	227
Walkingsticks	Defoliation	939	---	939
Jack pine budworm	Defoliation	37	37	---
TOTALS: Defoliation & Discoloration		1,122,563	507,746	614,817



SURVEY RESULTS: DIEBACK, BROKEN and MORTALITY				
CAUSAL AGENT	DAMAGE	TOTAL ACRES	ACRES	
			Percent of TREES affected	
			<51%	>50%
Wind	Broken/uprooted	465,882	181,843	284,039
Flooding	Mortality	34,767	32,960	1,807
Flooding	Dieback	6,902	6,699	203
Oak wilt	Mortality	1,441	1,441	---
TOTALS: Dieback, Broken, & Mortality		508,992	222,943	286,049

#### Discussion

**Spruce budworm.** This defoliator continued to cause defoliation in northeastern Minnesota. Total acreage declined from last year's defoliation, but there are still some areas of heavy defoliation in Itasca, Koochiching, and St. Louis Counties. Defoliation in white spruce plantations continued in north eastern Minnesota, but there has been a 2 year decline in central Minnesota.

**Forest tent caterpillar and large aspen tortrix.** Acreages of defoliation from both of these defoliators has increased over 1998 defoliation. In Minnesota forest tent caterpillar outbreaks occur on about a 10 year cycle. The last outbreak was in the early 1990's. It is anticipated that the increase in forest tent caterpillar acreage signals the start of another cycle where historically Minnesota can see 4 to 5 million acres defoliated. Large aspen tortrix activity often occurs immediately prior to forest tent caterpillar outbreaks. The forest tent caterpillar outbreaks then simply overwhelm the large aspen tortrix.

**Oak anthracnose.** The cool, wet spring promoted foliage diseases. The most prominent occurrence was in southeastern Minnesota where approximately 150,000 acres of oaks of all species showed typical anthracnose symptoms. Later in the summer as conditions turned warmer and drier, the incidence and severity of oak anthracnose diminished.

**Wind.** The most significant happening in Minnesota in 1999 was a catastrophic windstorm occurring on July 4. The total area affected was estimated to be 478,000 acres. Aerial sketch mapping completed a short time after the storm event mapped the following:

<u>Severity of blowdown Acres affected</u>	
10 - 30 %	180,000
31 - 66 %	158,000
67 - 100 %	140,000

**Gypsy Moth Monitoring.** *Detection monitoring for gypsy moth will include Division personnel placing traps in state forest recreation areas and state parks as well as in areas of public concentrations in rural forested counties. These efforts are coordinated with the Minnesota Department of Agriculture as the lead agency for detection activities.*

GYPSY MOTH MONITORING		
Item	Accomplishments	Targets
Pheromone traps	637	700
Delimiting trapping	2 areas trapped	No target
DNR TRAPPING RESULTS		
County	# Moths	#Locations
Cook	6	4
Houston	1	1
Koochiching	1	1
St. Louis	4	3
Winona	1	1
<b>TOTALS</b>	<b>13</b>	<b>10</b>

1999 Statewide Gypsy Moth Trap Catch Summary			
	1999	1998	1997
Total # of traps	18,000	25,362	12,965
Total # moths caught	260	953	261
Total # sites	188	679	154
Total # of counties	20	26	25

Discussion

Statewide, catches were down in SE Minnesota, the Metro area and in nurseries. However, trap catches increased significantly along the North Shore of Lake Superior. It is believed that the cool, wet spring and summer affected trap catches in southeastern Minnesota and the Metro area. It is also believed that the high trap catches along the North Shore of Lake Superior was due to tourists bringing in hitchhiking moths and pupae since this area is the premier vacation spot of Minnesota. However, many of the trap catch locations are not associated with recreation areas or resorts. These would be prime locations for trap catches if in fact the trap catches were due strictly to hitchhikers on tourists' vehicles. There is a major wood using industry located along the North Shore which imports sawlogs from Wisconsin. Perhaps this also has contributed to the high moth catches especially in areas along the North Shore not associated with recreation.

**Oak Wilt Survey.** *Oak areas in Wright and Sherburne Counties will be aerially photographed with color infra red film to document where oak wilt pockets are located. These pockets will be ground checked and if active oak wilt is found, control strategies will be developed.*

OAK WILT SURVEY		
Item	Accomplishments	Targets
Photograph & interpret	20 townships	20 townships



### Discussion

In southeastern Minnesota, 50 suspected oak wilt pockets were checked to determine if the mortality pockets were caused by oak wilt and if so, determine if oak wilt was still active. Information was then transferred to GIS maps.

**Pest and Host Evaluations.** *Populations of spruce budworm, jack pine budworm, pine tussock moth, bark beetles and forest tent caterpillar will be monitored and impacts to their hosts will be evaluated. In the oak types, pockets of dead trees observed through aerial detection surveys and aerial photography will be checked for oak wilt. Follow-up ground verification of selected aerial survey polygons will be done, and checking of unknown polygons detected from the aerial survey. Finally, evaluations will be conducted of new pest outbreaks to determine severity and trend, and control measures prescribed when appropriate.*

EVALUATION SURVEYS		
Item	Accomplishments	Targets
Evaluation surveys	1,500,000 acres	500,000 acres
SURVEY DETAILS		
Insect	Survey	Trend
Spruce budworm	14 larval & 39 egg mass plots	Defoliation in 2000, but general population decline
Jack pine budworm	5 larval & 18 egg mass plots	No defoliation; population non-existent
Pine tussock moth	37 pheromone traps	Population down in Pine and Crow Wing Co.; steady to increasing in Wadena and Hubbard Co.
Forest tent caterpillar	17 larval; 8 egg mass plots	Population increasing; significant defoliation in 2000
Fall defoliator complex	14 larval plots	Populations decreasing

### IV. PREVENTION AND SUPPRESSION

**White Pine.** *In 1997, the Minnesota Legislature appropriated \$1,500,000 over two years for a white pine initiative to increase white pine in Minnesota. The appropriation included funding for management of white pine on state lands, cost sharing for white pine management on private lands, grants to counties for white pine management on county lands, and white pine research.*

WHITE PINE PROTECTION ACCOMPLISHMENTS (State Lands, only)		
Item	Accomplishments	Targets
Pathological pruning	1,047 acres	500 acres
Bud capping	1,364 acres	900 acres
Apply deer repellent	11 acres	100 acres
Underplant	708 acres	400 acres
Fencing & shelters	108 acres	Not part of original work plan



**OTHER PREVENTION ACTIVITIES.** *There will be a continued focus on implementing the forest health mitigation strategies identified within the Generic Environmental Impact Statement on Expanded Timber Harvesting in Minnesota. Insect and disease implications and management considerations will be included in discussion and production of site-level forest management guidelines. Continued assistance will be provided to communities in developing Oak Wilt Action Plans for addressing expanding losses in the rural-urban interface. Gypsy moth information and education efforts will be continued in cooperation with Project Learning Tree activities. Training in the mitigation and prevention of hazard trees in both recreation and urban areas will continue.*

*Regional specialists will continue to provide input and direction to the development and review of Regional Plans, State Stewardship Work Planning, and Urban and Community Forestry Work Planning.*

Discussion

Oak wilt planning assistance was provided to Wright and Sherburne Counties.

**Oak Wilt Suppression.** *Active oak wilt sites will be treated by vibratory plow and/or with herbicides. Potential spore bearing trees will be cut down and either covered with plastic or removed. Technical support and assistance will continue to be provided for state lands, communities, and individual landowners in cooperation with the Minnesota Department of Agriculture.*

OAK WILT SUPPRESSION		
Item	Accomplishments	Targets
Treat oak wilt pockets	90 pockets	150 pockets

**Bark Beetle Suppression.** *Itasca State Park was in the direct path of a severe and intense July, 1995 wind storm. Many of the scenic old-growth white and red pine stands, by which the park is noted, were damaged. Bark beetle populations were monitored after the storm, and an increase in beetle activity was noted. Because the stands are visible and are managed for their aesthetics and to preserve examples of undisturbed pine ecosystems, little salvage cutting was carried out in response to the storm damage. To try to minimize the risk of bark beetle populations building up and drastically altering the aesthetics and the ecosystem, pheromone traps have been placed in heavy use areas and in areas of old growth pine. 1999 will be the fourth year of trapping; however, trapping will be done at a significantly lower intensity than during previous years. Bark beetle populations generally are reduced and only the high value areas will be trapped.*

BARK BEETLE SUPPRESSION		
Item	Accomplishments	Targets
Pheromone traps	70	200 traps

Discussion

The only trapping in 1999 was associated with an on-going bark beetle dispersal study by SUNY. The study's objective was to determine how far bark beetles disperse from their point of emergence. Concentric rings of pheromone traps were established around beetle infested logs treated with fluorescent dust which marked the beetles as they emerged. The numbers of fluorescent marked beetles reaching the traps would determine their dispersal distance. Study results are not yet available.

**Nursery Pest Suppression.** *Routine spraying of insect pests on nursery stock including such insects as aphids, leafhoppers, and grasshoppers will be carried out as needed.*

NURSERY PEST SUPPRESSION		
Item	Accomplishments	Targets
Treat nursery beds & windbreaks	174	140 acres

**Vegetation Management.** *Technical support and assistance will be provided for vegetation management on state, county and private lands. Vegetation management primarily involves the use of herbicides for preparing tree planting sites, releasing trees from competing vegetation, and controlling noxious weeds.*

VEGETATION MANAGEMENT		
Item	Accomplishments	Targets
Control competing vegetation	3,171	3,500 acres (state lands)



OTHER SUPPRESSION ACTIVITIES		
Item	Accomplishments	Targets
Spruce budworm	5 acres	Not part of original work plan
Forest tent caterpillar	500 acres	Not part of original work plan
Gopher control	296 acres	Not part of original work plan

Discussion

**Spruce budworm.** The Ash River State Forest Campground in St. Louis County was sprayed with Bt from the ground by a private contractor to protect the trees from spruce budworm feeding. Bt killed feeding larvae, and defoliation was reduced.

**Forest tent caterpillar.** 500 acres around Gilchrist and Scandia Lakes in Pope County were sprayed with Foray 48B. This is an area of chronic forest tent caterpillar activity primarily in large basswood trees which dominate the forest stands around these lakes. The Lake Associations contracted with a private applicator. MN DNR provided technical assistance and conducted post spray surveys.

V. NORTH AMERICAN MAPLE PROJECT

*The North American Maple Project (NAMP) monitors and reports on the long-term trends in sugar maple health in eastern North America. Under a 1987 Memorandum of Understanding between Canada and the United States, NAMP supports the annual collection, analysis, and reporting of data from sugarbush and non-sugarbush plots for healthy sustainable forests. Despite funding limitations for NAMP, Minnesota will remeasure the clusters in 1999 which marks the seventh measurement.*

NORTH AMERICAN MAPLE PROJECT		
Item	Accomplishments	Targets
Remeasure plots	0 clusters	8 clusters
Defoliation surveys	None	2: early and late season
Training	None	Crew certification

Discussion

Funding was not renewed for this project. The plots were "dismantled." Tree tags were pulled, and any flagging and visible markings of plot layout were removed. Thank you letters were sent to the landowners. However, plot center stakes were left intact in case renewed interest in this project occurs in the future.



## VI. FOCUS FUND PROJECT

**Interactive Internet Diagnostic Tool.** *This project will include scanned photos of common and important forest insects and diseases in the Lake States, an interactive menu to lead the inquirer to a reasonable diagnostic solution, and a link to additional Internet sites for more in-depth information.*

INTERNET DIAGNOSTIC PROJECT		
Item	Accomplishments	Targets
Project Status	Project redesigned	Completion

### Discussion

The project was not completed. When the project was looked at critically, it was determined that improvements needed to be made before putting it on the Internet.

Project changes included:

- ✓ Symptom list was altered to reflect readily apparent damages that non-professionals could relate to rather than symptom terminology used by tree health care professionals.
- ✓ Host species list was expanded to include all Minnesota tree species.
- ✓ Insect and disease list was expanded.
- ✓ More photographs of insects, diseases and related damages were added.
- ✓ A cross reference to Minnesota zip codes was added to capture location information.

## VII. SPECIAL PROJECTS

**Basswood Project.** *Cooperate in multi-state forest health evaluation project to study the health of basswood in the Lake States. Primary involvement will be in locating basswood stands for inclusion in study. Michigan DNR is the coordinating agency.*

### Discussion

Basswood stand information was provided to the project coordinator. Thirty basswood stands were selected in Minnesota, and a crew from Michigan installed plots and collected data.

**Ash Bacterial Dieback.** *Cooperate in a multi-state technology development project coordinated by Iowa State University. The immediate task will be to provide ash stand locations and help in collecting samples.*

### Discussion

The project was never funded to include collections in Minnesota. However, a survey was undertaken in the Lewiston area in southeastern Minnesota and the trees showing symptoms attributed to ash bacteria dieback could not be found.

**White Spruce Plantation Management Guidelines.** *If funded, implement a Focus Fund project titled: "Developing Guidelines for Managing White Spruce Plantations Threatened by Spruce Budworm."*

Discussion

The project received \$35,000 in funding. The funding was a pass through to the University of Minnesota. MN DNR did provide stand information and assisted in develop funding objectives.

**Monitoring the Health of Black Ash.** *Install forest health monitoring type plots in black ash stands to monitor long term change in the health of black ash.*

Discussion

Conversations were held with Dr. Tom Harrington of Iowa State University regarding collection of black ash samples. However, no samples were ever collected due to lack of funding and other priorities for both MN DNR personnel and Dr. Harrington. FHM plots with black ash were identified and a subset of black ash plot data was developed from the FHM plot data collected since 1994. As plots are being remeasured, we will be better able to see trend in crown characteristics of black ash. MN 1994-98 FHM data has 280 live black ash on 42 plots.

**Pine Tussock Moth Larval Collection.** *Cooperate with Canadian researchers by collecting pine tussock moth larvae.*

Discussion

Thirty-seven pheromone traps were placed at 19 locations in 4 counties with historic pine tussock moth occurrence. This year two different lures were used in addition to the lure used for many years in this trapping project. Trap data showed that one of the new lures was nearly as effective as the long-used lure in all but one location. The other new lure was ineffective in catching moths. Only one moth was caught in all traps and locations using this particular lure.

**Herbicide Efficacy Trials for Oak Wilt Control in SE Minnesota.** *Study the efficacy of herbicides in killing red oaks and reducing the spread of oak wilt.*

Discussion

In 1998, 123 oaks associated with 6 oak wilt pockets on 5 sites in southeastern Minnesota were treated with herbicides. A low-volume, basal stem treatment applying a mix of 3 quarts of Riverside Diluent XLT, 1 quart Garlon 4, and 3 ounces of Stalker was used. A backpack sprayer equipped with a cone nozzle was used to cover the basal 18 inches of the stems for trees 8 inches and less in diameter at the point of treatment. For trees greater than 8 inches, notches were cut with an ax into the base of the tree every 3 inches around the circumference before the herbicide mix was applied. In all cases, herbicide treatment was chosen when the oak wilt pockets were inaccessible to the vibratory plow.

All sites were checked in mid summer and results are summarized as follows:

Site 1 - All trees had 100% of their crowns dead, and no sprouting was observed.



- Site 2 - All trees had 100% of their crowns dead, and no sprouting was observed.
- Site 3 - Crown dieback ranged from 10 to 100%.
- Site 4 - No crown dieback; leaves appeared to be smaller.
- Site 5 - Crown dieback ranged from 5 to 100%.

Site 4 was retreated with a herbicide mix containing 4 ounces of Stalker instead of 3 ounces. Prior to spraying, a continuous frill around the circumference of the stem was made instead of ax cuts spaced 3 inches apart.

**Hazard Tree Manual Update.** *Update Minnesota's "How to Detect, Assess and Correct Hazard Trees in Recreational Areas."*

Discussion.

A revised tatum guide was developed for a series of training sessions. The tatum guide reflected an update of the assessment of defects chapter in the manual. The tatum guide will serve as a guide for continued revision of the manual.

**Managing Hazard Trees in Urban Areas.** *Cooperate in an interagency project to develop a hazard tree manual for urban areas. Leadership for this project is provided by the USFS, State and Private Forestry.*

Discussion

An interagency committee was formed. Format discussions were held, and MN Forest Ecosystem Health personnel agreed to draft the defect chapter of the manual. Work is on-going.

**BMP's for Bare Root Production.** *Cooperate with University of Minnesota and the USFS, State and Private Forestry in developing best management practices (BMPs) for nurseries for producing bare root seedlings.*

Discussion

The two state nurseries were made available for research and trials established to develop recommended nursery BMP's.

VIII. TECHNOLOGY TRANSFER

**Training and Presentations.** *Training emphases will be on A) ecological concepts and how ecological concepts impact managing insects and diseases; B) insect and disease diagnoses; and C) hazard tree management, particularly in the urban environment.*

TRAINING and PRESENTATIONS		
Item	Accomplishments	Targets
Number of events	47	15
Number of people	1,455	1,500



Event	# of events	# participants
Hazard Tree Workshops	11	460
MN Christmas Tree Growers Assn	1	120
Tree Inspector Workshop	2	80
Area Training	8	80
FIA Crew Training	2	70
Aitkin Co Logger Workshop	1	70
Community Forestry Workshop	1	70
SWCD State Meeting	1	60
Tri-State Forestry Meeting	1	40
White Pine Tour	1	40
NCFPW: State Report	1	40
NCFPW: Oak Defoliation Report	1	40
Woodland Council Field Trip	1	40
Lake Associations	2	40
CSA Inventory Training	2	30
Vermillion Community College	1	30
U of MN Entomology Class	1	30
MN City Clerks	1	20
Sherburne Co Oak Wilt Training	1	20
Woodland Advisors	1	15
Development Program Leaders	1	15
Aitkin County Board	1	10
Aitkin Co Master Gardeners	1	10
Moose Lake High School Class	1	10
Wright Co Oak Wilt Training	1	10
MCC Pruning Training	1	5

**Written Materials.** Publications include a Forest Health Newsletter produced monthly during the growing season and an annual summary of pest conditions and program activities. In addition, news releases are prepared in response to new and on-going pest occurrences and tree damage.

WRITTEN MATERIALS		
Item	Accomplishments	Targets
Forest Health Newsletters	5	5
Annual Report	2	1
Other written materials	18	10
Radio/television releases/interviews	2	Not part of original work plan

Discussion

All of the "Other written materials" were news releases addressing current problems. Examples included forest tent caterpillar, oak anthracnose, bark beetles, and storm damage.

**Posters, Displays and Demos.** *Displays will be produced for conferences, workshops, and meetings to address current forest health issues.*

POSTERS and DISPLAYS		
Item	Accomplishments	Targets
Posters/displays	1	2

Discussion

A poster titled, "A 45 Year History of Spruce Budworm in Minnesota" was developed for a Timber Productivity Workshop in Duluth.

**Requests for Assistance.** *An important function of the program is to respond to foresters and general public who have questions or need assistance with pest identification, tree damage, or pest management issues and problems. Responses can occur via phone, letter, e-mail, walk-ins, and field visits.*

REQUESTS for ASSISTANCE		
Item	Accomplishments	Targets
Assistance	990	1,200

## IX. COMMITTEE, COORDINATION and MEETING ACTIVITIES

*Forest Ecosystem Health personnel are called on to participate in work groups, task forces, and standing committees. Their roles include providing pest management and tree health information, and providing a broader ecological perspective.*

### Committees - Groups - Meetings

Minnesota Gypsy Moth Program Advisory Committee (GMPAC)

Tri-State Gypsy Moth Group

Minnesota Shade Tree Advisory Committee (MNSTAC)

Forest Health Sub-Committee (MNSTAC)

Governor's Integrated Pest Management Taskforce

Minnesota Stewardship Committee

North American Maple Project

North Central Forest Health Cooperators Meeting

Western International Forest Disease Work Conference

Annual Community Forestry Workshop (NE MN)

Northeastern Forest and Conservation Nursery Association

Minnesota Nursery and Landscape Association

Minnesota Society of American Foresters

National Society of American Foresters