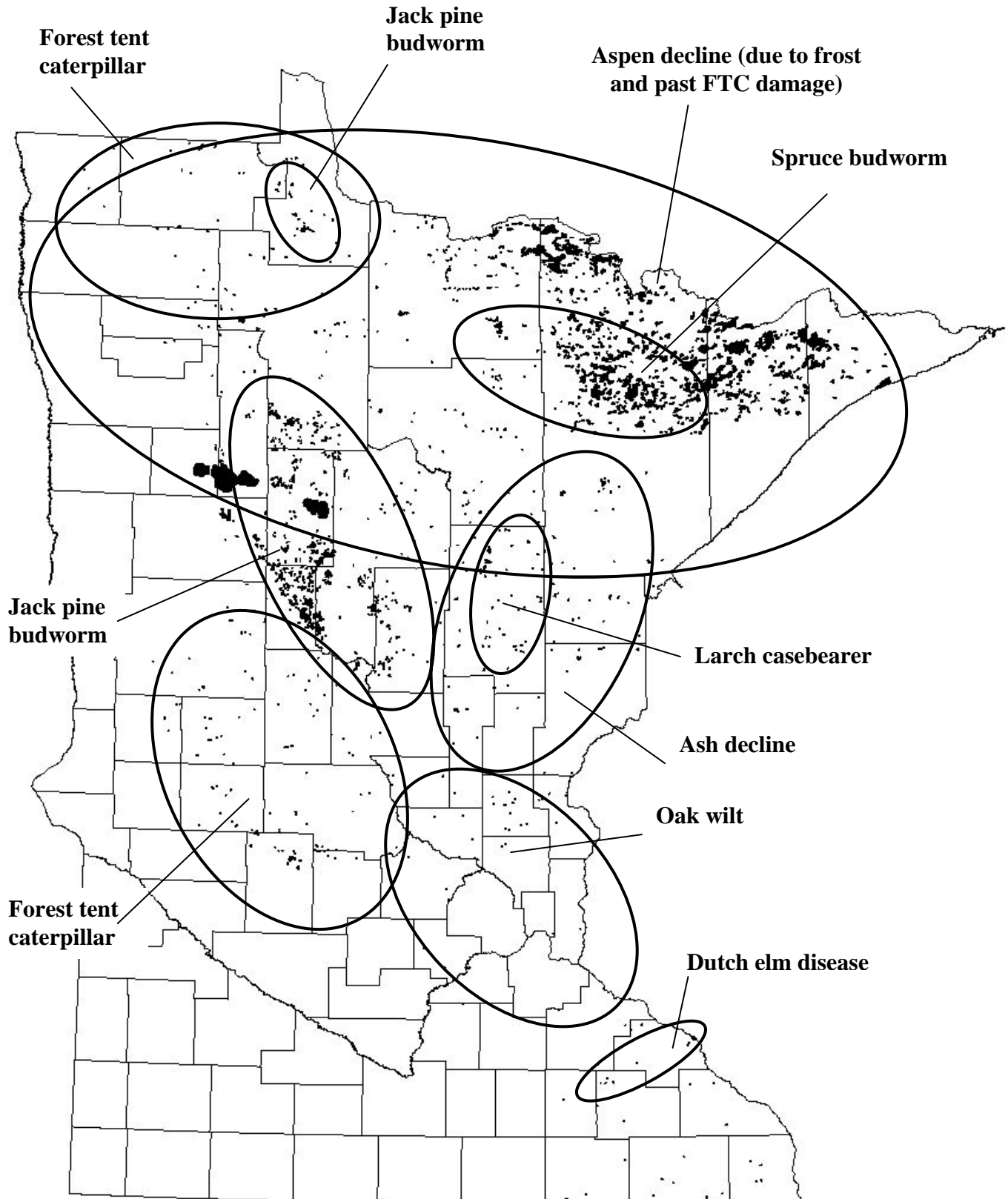


Forest Health Highlights in Minnesota for 2005

Aerial Survey - 2005



Polygon and acreage totals from aerial survey in 2005		
Agent name	Number of polygons mapped	Total acreage of all polygons
Aspen decline (due to spring frost and past forest tent caterpillar defoliation)	587	410,500
Ash decline	58	4,300
Dutch elm disease	12	560
Flooding	70	3,700
Forest tent caterpillar	109	9,800
Jack pine budworm	830	75,600
Larch beetle	187	11,000
Larch casebearer	52	4,600
Spruce budworm	192	92,500
Two-lined chestnut borer	11	770
Wind damage	91	3,400
Totals	2199	616,730

Hardwood pests and problems

Ash decline

Decline of black ash continues to be a concern both because of the loss of the ash but also because it could hide or mask the emerald ash borer. Surveys have found no emerald ash borer in the state. Aerial survey mapped 4322 acres in 58 stands scattered across the northern 2/3 of the state. This is a decrease from the 27,000 acres reported last year. Surveyors attempted to map the change from last year rather than map previous years of mortality. But again this is difficult to do and so it is hard to have a clear picture of a change in the condition of the black ash from last year. In stands examined on the ground it appeared that the problem did not continue to expand much if at all. At the same time trees with a lot of dieback did not appear to be showing much in the way of improvement either. Site and weather conditions are still considered to be the primary factors that stressed and killed the trees rather than any particular insects or fungi.



Thin aspen crowns

There were 587 pockets of aspen with thin foliage throughout northern Minnesota this summer; acres totaled 410,500. The trees had leaves but the leaves were small being only the size of a nickel to a quarter. These trees often were the largest and oldest on the sites. This situation was not examined until late in the summer making it somewhat difficult to make a positive determination of the cause. There appears to be a number of causes of this across the state. In most locations insects do not appear to have been involved. Some places spring frosts at the time of aspen leaf break killed portions of the tender new leaves and caused other trees to drop all their new leaves. In northeastern Minnesota another common cause appears to be stress from past years of forest tent caterpillar and drought. The affected trees are putting on little or no growth and the shoot growth is abnormally short. No forest tent caterpillar was mapped in northeastern Minnesota but forest tent caterpillar cocoons were

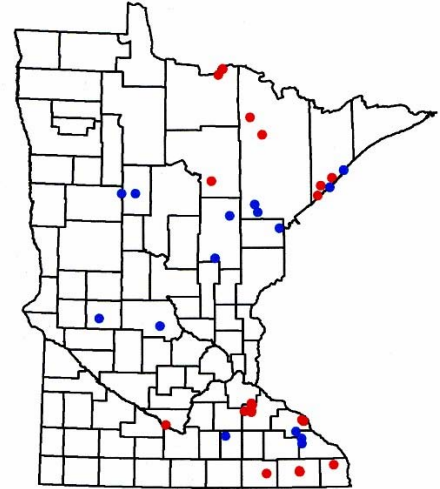
collected at a location near Johnson Lake in northern St Louis County suggesting that low levels of the insect may still be active in at least a few locations in the northeast.

Aspen mortality and dieback was reported on 50,000 acres across northern MN last year. This was attributed to stress from forest tent caterpillar and drought. No mortality was reported this year but stands with trees showing the thin crowns need to be watched to see if they recover or start to experience mortality.

Emerald ash borer (not in MN)

In 2005 the DNR participated in the first early detection surveys for the Emerald Ash Borer, *Agrilus planipennis*. The first survey was a visual survey of ash trees around several mill sites in cooperation with AHIS. The second was a trap tree survey following protocol established by the USDA Forest Service at several locations in both southern and northern Minnesota. No evidence was observed in either the visual mill survey or during the destructive sampling of trap trees. See map.

EAB Survey locations (red- mill survey, blue- trap tree survey)



Gypsy moth

Minnesota Department of Agriculture 2005 Gypsy Moth State Report

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The statewide gypsy moth detection program is a cooperative effort among state and federal agencies. In 2001 a Gypsy Moth Strategic Plan was signed by the state Commissioners of Agriculture and Natural Resources, the State Health Plant Director (USDA Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), and the Field Representative from the USDA Forest Service (FS). The strategic plan describes the objectives and administrative structures necessary to manage the gypsy moth in Minnesota. It provides a mission statement, a framework for decision making, and outlines the strategies and mechanisms to implement the plan. On a bi-annual basis representatives from the four agencies and the University of Minnesota come together to discuss issues related to gypsy moth management. It is this cooperative effort that has built a strong gypsy moth program in the state of Minnesota.

2005 General survey program

The Minnesota Department of Agriculture (MDA) was the lead agency during the 2005 gypsy moth detection survey program. Other cooperators included USDA APHIS PPQ; USDA FS; Department of Natural Resources (DNR); and the Three Rivers Park District in the Twin Cities metro area. Staff in the cooperative program set 20,596 delta traps across the state, and 1,310 male moths were caught. This surpassed the 1998 record high of 953 moths.

In 2004, Minnesota became a member of the Slow the Spread (STS) Foundation when the STS action boundary moved into southeast Minnesota to include portions of Houston and Winona Counties. Due to increases in moth captures, in the fall of 2004 the action boundary was expanded into northeast Minnesota to include all of Cook and Lake Counties, and shifted

westward in southeast Minnesota to include all of Houston, the majority of Winona and a small portion of Wabasha Counties. As a result, the program's protocol of trapping on available road systems within these areas shifted to trapping on a pre-determined grid laid across the landscape. We emphasized placing traps in grid target circles off available road systems. This change reduced trapper productivity due to the time needed to hike cross-country through extremely wooded terrain, but it did increase trap monitoring in very remote areas of northeast Minnesota.

As a result of the STS program moving into northeast Minnesota and to compensate for the reduction in traps placed per seasonal staff, MDA hired a record high 44 seasonal staff. This group set and monitored 17,385 traps, or 84.4 percent of all traps set in the state and covered 39 standard trapping routes. The state was divided into two distinctively different trapping regions: the south, which included the "road kill" sites and the northeast, which included the "hike-in" sites. (Hike-in was also conducted in the STS area in the far southeast but it was limited due to the extensive road network which allowed trappers to place traps within target circles without having to leave the road network). Each "road kill" route consisted of an average of 665 traps and the northeast "hike-in" routes averaged 236 traps each. In addition to the standard routes, MDA had five lead workers, setting an average of 120 traps of their own and overseeing five to nine trappers each. Other cooperators - Three Rivers Park District (84 traps), FS (<50 traps), and APHIS PPQ (3,127 traps) set approximately 3,271 traps or 16 percent of the traps set in the state.

Several grid densities were utilized across the state to be consistent with APHIS PPQ trapping protocols and yet allow for a smooth transition into STS protocols and data collection during the 2005 survey season (see attached map). The STS action area was trapped on a two kilometer grid, with several areas of concern, particularly along the North Shore, receiving a higher density of traps. Areas outside the STS action area that were considered high-risk for the introduction and establishment of gypsy moth received traps on a 1500 meter grid - a similar density to the one trap per square mile (1/1) APHIS PPQ general detection density protocol. One exception was St. Louis County; due to its large area and limited road access, this county was trapped at a 2 km grid density rather than a 1500 meter grid density. Areas are considered high risk for the introduction and establishment of gypsy moth based on human activity levels, preferred habitat for gypsy moth, and the advancing gypsy moth front from Wisconsin. The remainder of the state received traps at one trap per four square miles (1/4) or a three kilometer grid, which is on a four-year rotation, with approximately one-third of the state receiving traps annually. In addition to the standard trapping densities, areas which had moth catches in the past received intensive trapping to determine if a potential population exists. These trapping densities were: one trap per 250 meter, 16 traps per square mile, one trap per 500 meter, or one trap per one kilometer

Additional traps were set at state parks, mills, and nurseries within the standard trapping grid. Twenty-three of Minnesota's 69 state parks were within the standard trapping grid and received additional 1-2 traps each. Two moths were caught in the state parks. Mills and nurseries were trapped according to the risk of gypsy moth introduction. Nurseries that are wholesale dealers, report stock sources from gypsy moth-quarantined areas, or have a history of pest problems are considered high/moderate-risk, and each received between two and twelve traps this year. High-risk mills throughout the standard trapping grid also received two randomly placed traps. Mills are considered high-risk if it is known or likely that they have out-of-state sources and if they are within 60 miles of Wisconsin counties that trap fifty or more moths. There are 62 high-risk mills throughout Minnesota and 170 nurseries that are considered high/moderate-risk. Five moths were caught at mill locations and 17 moths were caught at nurseries for the 2005 season. No regulatory action is being taken at this time.

Four mills (three pulp and one saw mill) and one nursery are under Federal Compliance Agreements for gypsy moth in Minnesota. A Compliance Agreement is designed to decrease the risk of gypsy moth establishment in Minnesota while still allowing the mills and nursery to transport logs from gypsy moth-quarantined areas for milling or pulpwood, or in the case of the nursery, for bark mulch to utilize in a potting mixture. No gypsy moths were captured at these sites.

Trapping for Asian gypsy moth was conducted at the northern Minnesota seaport of Duluth. Eighteen traps were set around the port and traps were checked every two weeks throughout the season. One moth was caught and sent to OTIS Laboratories for DNA analysis. In fact, all Minnesota moths that were caught in St. Louis, Lake, or Cook Counties were sent to OTIS Laboratories for Asian gypsy moth DNA analysis. No Asian gypsy moths have been identified as of this time.

The FS provided funding to MDA to trap all other National Forest land and Bureau of Indian Affairs land within MDA's standard trapping grid. Superior National Forest, including the Boundary Waters Canoe Area Wilderness (BWCAW) was the only national forest, and Fond du Lac and Boise Forte were the only reservations that were within the state's standard detection grid, i.e. outside the STS Action Area, for the 2005 trapping season. Six hundred eighty-eight traps were set and five moths were caught on Superior National Forest lands within St. Louis County. Seventeen traps were set on Boise Forte Reservation, and 69 traps were set on Fond du Lac Reservation. No moths were caught at either of these two Reservations.

Moth numbers were down to record lows in the central and southeast parts of the state (St. Cloud to the Iowa border), accounting for only 58 of the total number of moths captured. In the southeast (Houston, Winona, Olmsted, Wabasha Counties), an area that has had a consistent increase in moth numbers in the past decade, only seven moths were caught. It has been over 15 years since the trap catch numbers were this low in southeast Minnesota. One delimit site in Brooklyn Park had 13 moths that were caught in seven traps, accounting for 22% of the moths caught in this part of the state. An additional 29% (17 moths) were caught in nursery operations, indicating that gypsy moth life stages "hitch-hiking" on nursery stock continue to be a concern for Minnesota.

The big surprise for the 2005 season was the record number of moths in Cook County, the far northeastern county in Minnesota. Cook County alone surpassed the state record (953 moths) by catching the 1,068 of the 1,310 moths captured in the state for the 2005 season. There had been an increase in moth captures, from about 25-30 for the entire county since 2000, to 193 moths in 2004. The jump to over 1,000 moths this year is unexplainable. Treatment recommendations of over 229,000 acres are expected to be forth-coming. To date, Minnesota combined treated acreage is just over 4,500 acres. The majority of the land in Cook County is Superior National Forest, with several State Parks and an Indian Reservation. MDA will be working closely with these agencies to determine the best management strategy for this area.

General treatment program

In 2004, MDA conducted gypsy moth pheromone flake treatments at a 225 acre site (Rollingstone Site) in Winona County. Initial follow-up trapping indicates that this site has been eradicated; no moths were caught in 2004 or this past season (2005). However, a third year of monitoring is required to determine treatment success of a flake block.

In 2004, Minnesota also conducted a gypsy moth Btk ground eradication project at a 5 acre site in the Twin Cities Metropolitan area (Edina Site). After two consecutive years of follow-up trapping with no moth captures, this site is considered eradicated.

2005 Btk Treatments:

In the fall of 2004, MDA's seasonal survey program identified a gypsy moth infestation just 8 miles northeast of Tower, Minnesota in St. Louis County. In 2003, the site had been a standard detection trapping site (1 trap per four square miles) and two gypsy moths were caught in a single detection trap. In 2004, this site was trapped at a target density of 16 traps per square mile and 37 total moths were caught in five traps; one trap alone captured 28 moths. A follow-up egg mass survey was conducted on October 26, 2004 and two egg masses were identified. This was the northern-most gypsy moth infestation on record.

Due to the proximity of the moth captures to the BWCA and the finding of positive gypsy moth traps on the Superior National Forest, the FS was contacted to discuss treatment options. A 640 acre treatment block was proposed and encompassed federal, state, county, city and private lands. Superior National Forest land within the treatment block consisted of 44.2% and the remaining 55.8% was on state and private lands. Due to the mix of ownership it was decided that a joint Environmental Assessment (EA) would be conducted with two separate Decision Notices. An EA was conducted for the site and a public meeting was held in Tower on January 18, 2005. The proposal received a lot of support from local residents as well as environmental groups. In mid-April, the forest supervisors from both the Superior National Forest and FS State and Private Forestry signed off, giving the green light for treatments to proceed.

Btk treatments (Foray 48F) were conducted via fixed wing aircraft on both June 6 and June 16, 2005 at a rate of 30 Forestry Toxin Units (FTU) per acre. Two data loggers placed in the block as well as caged egg masses were utilized to determine treatment timing. A FS observation aircraft was utilized during treatments to assist in communication between the spray aircraft and the ground crew. Applications were conducted without any aircraft incidents.

To determine treatment success, the treatment block was trapped on a 250 meter grid density, surrounded by an 8 mile area with a 500 meter grid density. No gypsy moths were caught during the 2005 season. However, a second year of intensive trapping is needed to make certain the treatment was a success.

Site Name	Acres	Product	Rate/acre	Application Equipment	Date of First Application	Date of Second Application	Cost/Acre
Tower	640	Foray 48F	30 FTU (80 oz.)	Airtractor 502B	June 6, 2005	June 16, 2005	\$38,592 (\$30.15 acre)

2005 Pheromone Flake Treatment:

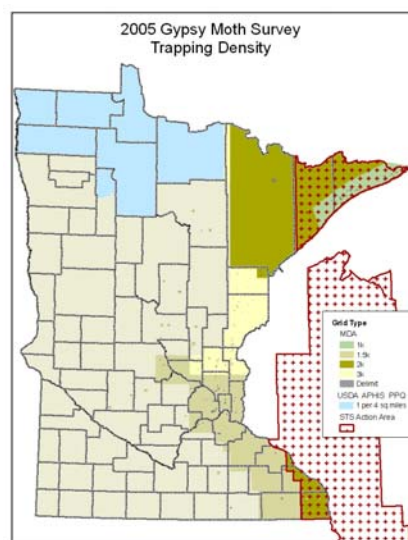
Minnesota did not have any flake treatments in 2005.

Egg mass surveys

Several surveys were conducted in the fall of 2005, in response to relatively high numbers of moths trapped in several locations across the state. Only one site within the Twin Cities metro area (Brooklyn Park) warranted an egg mass survey. The survey was conducted on September 19, 2005 and two egg masses (more likely, one egg mass in which the female was interrupted during egg laying) were found at the site. This site is being proposed for a 58 acre Btk treatment in the Spring of 2006 to eradicate this isolated population.

In addition to the egg mass survey conducted in the Twin Cities metro area, several site surveys were conducted in Cook County surrounding several of the high find locations. No egg masses or alternate life stages were identified during this survey. However, this area is within the STS Action area and treatments are being proposed on over 150,000 acres.

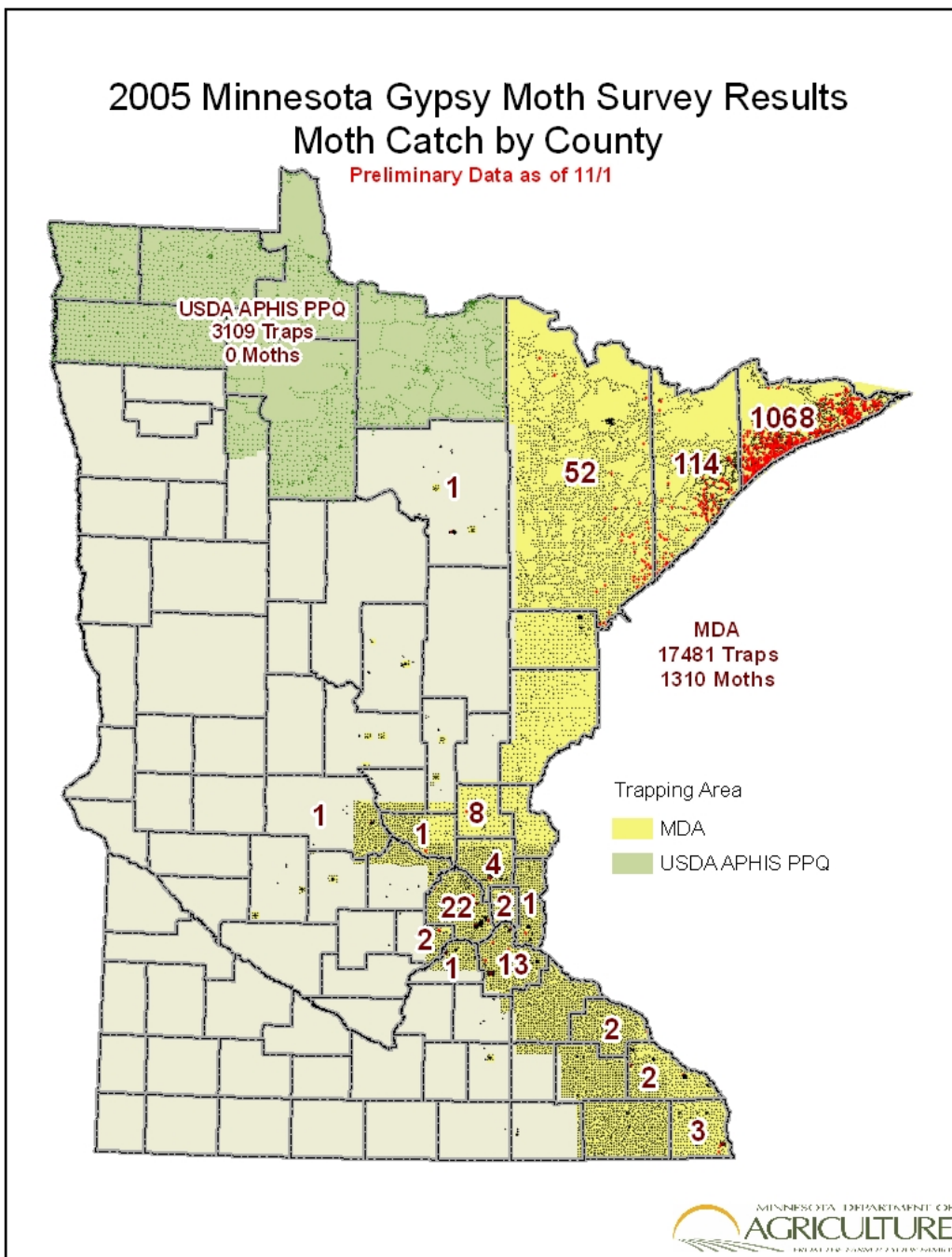
Number of routes	Agency
39	MDA
5	USDA
Moth counts	Type of trap
1,025	Standard detection (1500m, 2K, 3K, & 1 trap per 4 sq mile)
240	Delimit
17	Nursery
21	Random
5	Mill
2	Park
1,310	TOTAL
Number of delta traps set	Agency
17,385	MDA
3,127 (18 AGM)	USDA-APHIS, PPQ
	USDA-FS
84	Three Rivers Park District
Approx. 20, 596	TOTAL
Number of seasonal staff	Agency
44 (5 lead workers)	MDA
5 (no lead workers)	USDA



2005 Minnesota Gypsy Moth Survey Results

Moth Catch by County

Preliminary Data as of 11/1



Oak tatters

Oak Tatters has been a condition that affects emerging oak leaves, causing them to appear lacy or tattered. It has been observed throughout the Midwestern United States, including Minnesota, Michigan, Wisconsin, Iowa, Illinois, Indiana, Ohio, and Missouri. It was first reported during the 1980's in Iowa, Indiana and Ohio, but has been observed sporadically for the last ten years in Minnesota and Wisconsin. The cause has eluded surveyors in all of those years.

In 2004, researchers in Illinois hypothesized that tatters on oaks was due to herbicide drift from applications onto corn and soybean fields. In controlled experiments two year old potted white oaks were exposed to varying concentrations of Chloracetamide herbicide products including Harness Xtra and Dual Magnum. Both products produced the tatters symptoms on the treated oaks. After 45 days following the



herbicide application, the leaves of the treated oaks showed tattered symptoms.

treatments, the oaks produced new leaves free of the tatters symptoms, as they do in the field. The study indicates that drift of Chloracetamide herbicides may be the cause of what has been at times large portions of the landscape affected by oak tatters. ,

This spring, in Minnesota, an effort was made to attempt to link reports of tatters to possible herbicide drift from nearby cornfields. As it happened, tatters was for the most part a non-event across the state. It seems that the phenology of the oaks did not coincide with the potential drift from applications of Chloracetamide herbicides applied to nearby cornfields. However, in two separate areas, tatters symptoms did develop on the oaks. Mid-season follow-up investigations found that both instances fields adjacent to the affected oaks received applications of Harness Xtra. These herbicides are applied at the time of leaf emergence of the oaks and other affected species.

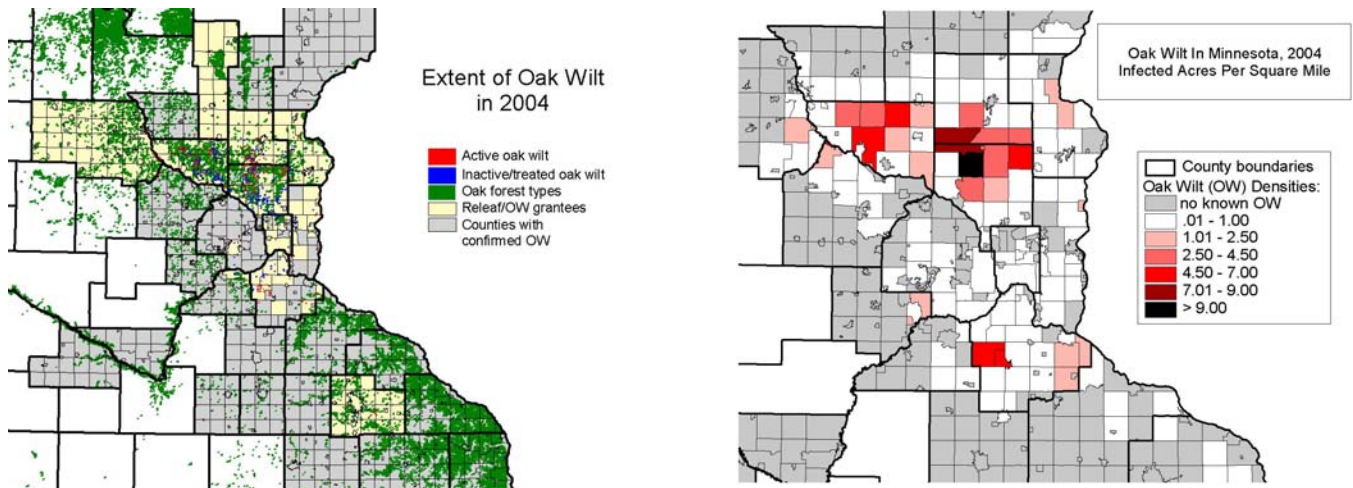
Oak wilt

Suppression

Oak wilt suppression was funded through a federal pest suppression grant and administered through the MN Releaf Program. The MN Releaf program provides a combination of state and federal funding in the form of matching grants to local units of government for a wide-range of practices aimed at promoting ecosystem management.

In that context, 29 communities and 5 counties in the developing rural-urban interface received matching grants ranging from \$2,000.00 to \$65,000.00 for the up-coming treatment year. In the '04-05 treatment year, a total of 1114 individual oak wilt infection pockets covering 622 acres were treated during the '04-05 treatment season. Estimated treatment costs, averaged \$939.28 per pocket or \$1682.26 per acre, with 50% of those costs paid by participating landowners.

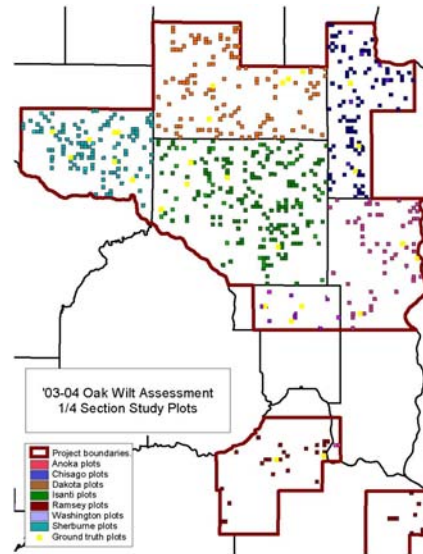
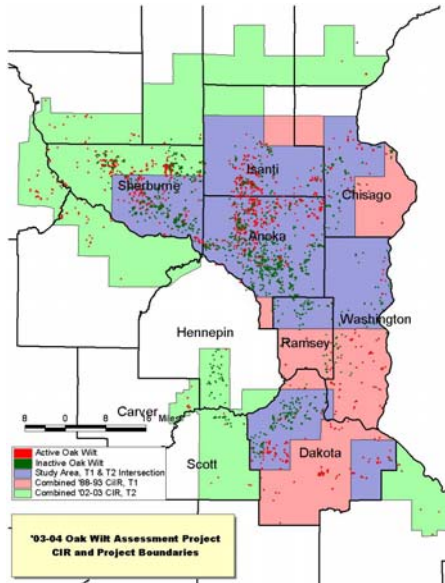
At the end of 2004, the density of active oak wilt infection pockets across MN Releaf grant recipients was calculated to be 1.71 infected acres per square mile with individual communities ranging from 0 to 10.54 infected acres per square mile. That included a total of 3122 active pockets statewide (grant recipients only), covering 3616 infected acres. The average size for infection pockets still active at the end of the year was 1.13 acres per pocket.



Assessment

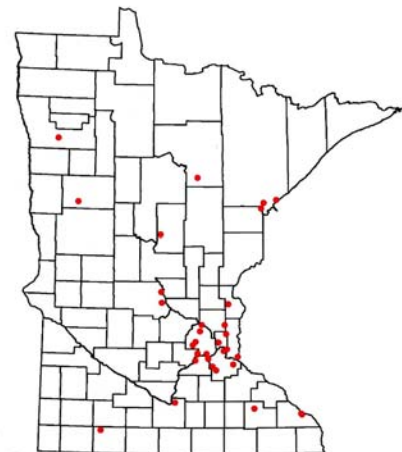
An assessment project was launched in 2003 and completed during the '04-05 treatment season. Rectified color-infrared photography from two photos periods approximately ten years apart were used to describe the change in oak wilt occurrence and evaluate factors influencing that change across the study area. Four categories of community programs, soil texture and 12 categories of land use were evaluated using 640 randomly selected ¼ section plots (40 acres each). Change in population density was also evaluated but was not found to be correlated to the change in oak wilt. The other three factors were highly correlated to changes in disease incidence. The lack of active suppression activities (communities without an active program) and sandy soils were correlated to higher disease incidence. A significant reduction in disease incidence was correlated to communities with active programs.

Because the sampling scheme was based on a minimum of 15% forest cover, a large number of plots fell in undeveloped rural woodlands. In these areas, the incidence of oak wilt was higher than in developing areas and the rate of increase in disease incidence seemed to be higher. The high incidence in undeveloped areas may be associated with a number of severe windstorms that occurred during peak spore pad production over the ten-year study period. Besides the general loss of oak woodlands, the implication for the MN Releaf program is that as communities expand into these areas, they will be inheriting a substantial pest problem. Various options are being explored to address related issues.



Sudden oak death (not in MN)

In 2005 the Minnesota DNR Division of Forestry again participated in the national *Phytophthora ramorum* survey. Field surveys were conducted adjacent to several major state nurseries and in rural forested areas around the state. Twenty-six nursery sites and seven rural forested sites were surveyed in nineteen Minnesota counties. On sites, one hundred and thirty two transect surveys collected just over fifty suspect samples. Samples were collected from known *P. ramorum* host genera. The samples were processed at two labs, the Minnesota Department of Agriculture Lab in St. Paul, and the Forest Products Lab at Mississippi State, Mississippi. Twenty-eight samples were tested at the MDA lab in Minnesota and twenty-two were tested at the Mississippi lab. All were negative for *P. ramorum* by PCR. This was the second year of survey for *P. ramorum*.



SOD Survey locations

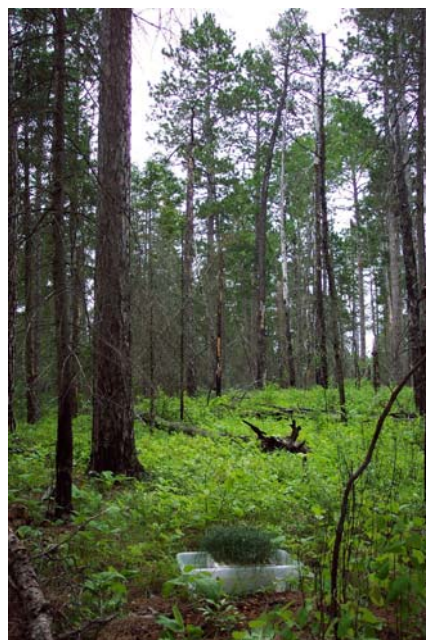
Conifer pests and problems

Diplodia study at Itasca State Park

Itasca State Park is having difficulty regenerating red pine in spite of excellent site preparation using prescribed fire on suitable sites with excellent seed sources. Questions remain regarding the influence of animal browse or shrub competition and environmental parameters such as duff depth and amount of light reaching the forest floor. Until this study, no one had looked into the possibility that diseases could be having a deleterious influence on red pine regeneration. From recent studies and surveys elsewhere in Minnesota, we know that *Diplodia pinea* can have a huge effect on nursery seedlings and the success of outplanted seedlings due to its ability to cause latent infections. Internal water deficits, such as those caused by droughty weather, release latent infections to cause disease symptoms and seedling death.

A study was designed to determine if live, containerized red pine seedlings could be used to “trap” *Diplodia* spores and produce disease symptoms by placing the seedlings under overstory red pine trees. This might indicate the presence and, perhaps, level of *Diplodia* inoculum in the stand.

On May 28th, containerized seedlings were placed in 8 red pine stands and 1 hardwood stand in Itasca State Park. There are no red pine seedlings or saplings in any of the stands. All of the red pine stands are classified as FDc34 in Minnesota’s ecological classification scheme. Blocks of containerized seedlings were produced in a greenhouse and had never been exposed to overstory pines, the predominant source of *Diplodia* inoculum. Two locations in each stand received a half-block containing approximately 90 seedlings. Seedlings were watered and monitored weekly then collected on July 21st. Overall, seedlings broke bud and grew 2 to 3 inches in height during that time and set new buds. Only one half-block was destroyed by bear depredation. On July 21st, the blocks of seedlings were stored in a sunny garage and watered for one more month. After that they were allowed to dry out, giving the latent infections an impetus to cause disease and produce fruiting structures. Once the root mass had completely dried out, 50 seedlings were collected from each half block. Each seedling was examined using binocular scopes for the presence of classic shoot blight symptoms, internal stem and root collar symptoms, presence of *Diplodia* pycnidia and other damaging agents. For this report, seedlings that showed internal symptoms of *Diplodia* infection after being drought-stressed will be termed “latently” infected seedlings.



Fallen cones were also collected to provide another determination of the amount of inoculum in the stands. 100 fallen red pine cones were collected in mid-November under the overstory red pines where the seedlings were set out earlier in the year. Efforts were made to collect the youngest, freshest cones. In the lab, each cone was visually inspected for the presence of *Diplodia* infections. Each cone was tallied as either infected or uninfected. Infections were verified by microscopic examination of the pycnidia and spores.

Results: Containerized seedlings exposed to overstory red pine trees for eight weeks in the spring exhibited classic shoot blight symptoms of *Diplodia* infection. Diagnosis was based on external and internal symptoms and by the presence of *Diplodia* pycnidia, when present. The number of blighted seedlings was small, ranging from 3.3 to 10.2%. Using in containerized seedlings, the presence of classic shoot blight symptoms can indicate that *Diplodia* is present in the red pine overstory.

Since all the seedlings were drought stressed to induce latent disease symptoms and sporulation, using internal symptoms was much more descriptive of the true level of infection than was using external symptoms alone. Latent stem infections occurred on an average of 55% of the exposed seedlings (range 25-74%). Most of the latent infections were stimulated to produce internal disease symptoms and, very often, pycnidia. In fact, the production of pycnidia was highly correlated with the presence of internal symptoms on latently infected seedlings ($R = 0.96897$). The levels of classic shoot blight and the levels of latent stem infections from each stand were moderately correlated ($R = 0.7737$).

Three percent latent stem infections were found on the control seedlings. This could be explained by either the use of infected seeds in the greenhouse or by the proximity of several mature red pine trees to the control site (closest tree was approx. 220 feet). This study couldn't distinguish between these possibilities.

Overall, 48% of the cones were infected by *Diplodia* (range 12-60%). Cone infection levels were only moderately correlated with the shoot blight levels, latent infection levels and the total amount of disease (shoot blight plus internal stem infections). Based on this study, cone infections are not descriptive of the amount of disease in a stand but only show a general trend. However, lower cone infection levels might be used to predict where regeneration may be successful. Further work needs to be done developing the relationship between cones and regeneration success, as there were no stands with less than 12% cone infection in this study.

Jack pine budworm

75,600 acres were defoliated this year, almost doubling last year's total acreage. Within the existing outbreak area, stands that the budworms missed in the previous two years were found and defoliated this year. The outbreak also spread out in all directions reaching jack pine stands in Lake of the Woods, Koochiching, Itasca, Pine, Morrison, Ottertail and Mahnomen Counties. See map. In Pine County, the defoliated acres (540) surround the Gen. Andrews State Nursery. Salvage harvesting operations continued this year, particularly in Beltrami, Hubbard and Wadena Counties, which have suffered two or three years of heavy defoliation with subsequent topkill and mortality.

The bigger news is that the jack pine budworm outbreak has spread into red pine plantations!



Some red pine plantations from Brainerd to Bemidji were hit with affected stands having very high incidences of shoot infestation. The only other time damage to red pines has been documented was in the late 1950's. That outbreak on red pine was concurrent with an outbreak on jack pine during 1957 and 1958 and was limited in geographical extent to four populations near Bemidji, Pequot Lakes, Badoura and Cloquet. Unfortunately, there was no record of the number of acres defoliated. We do know that most of the affected red pines were adjacent to defoliated jack pine stands. Severe defoliation and subsequent topkill of red pines were documented on staminate-cone bearing trees only near Bemidji and Pequot Lakes.

The current outbreak is much more extensive and occurs in red pine plantations that are literally miles from the nearest jack pine stands. Many red pine plantations showed signs of heavy infestation. Two of these stands have been studied more thoroughly, a young stand near Baxter in Crow Wing Co. and an older stand north of Bemidji in Beltrami Co. In both stands, at least 93% of all the shoots had been defoliated to some extent, ranging from trace to severe, with the leader always suffering the heaviest defoliation. See table. On both sites, the terminal and lateral buds were well formed and plump indicating that tree vigor is high and that the red pines should be able to withstand defoliation in 2006. Egg mass counts were very high in the young stand and were low on the older stand while both stands had low levels of egg parasitism.

Examination of ten red pine trees for egg masses and impact of jack pine budworm after one year of defoliation.							
	Egg masses			Terminal leader			Entire tree
	Ave. number of EM per 36' branch	Range of EM per branch	Percent parasitism of EM per branch	Percent with live bud in terminal	Percent '05 foliage remaining	Percent '04 foliage remaining	Percent bud infestation on all branches
Near Bemidji	2.1	0 - 9	23	100	27	31	78
Near Baxter	16.7	7 - 34	32	90	25	10	93

Eastern larch beetle



Mortality of tamarack was mapped on 11,593 acres in 193 stands throughout the range of tamarack. This acreage is an increase from those reported in 2004, but shouldn't necessarily be viewed as an indication that eastern larch beetle activity has increased. It always has been difficult to get an accurate picture of larch beetle activity from the air. Tamarack stands usually have a component of dead trees and these trees stand for a long time. Trying to map the change in the number of dead trees in these stands from year to year is difficult. However, we can say that larch beetle continues to be active and continues to kill trees although ground surveys suggest the populations of the beetle have declined at least in stands where they have been active for a number of years. The trend of the larch beetle population is unknown.



Larch casebearer

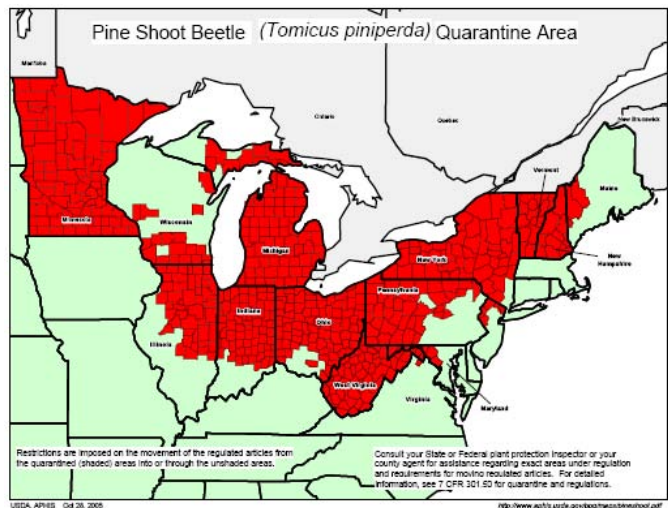
Larch casebearer continued to be active mining tamarack needles and turning trees brown last summer. Casebearer activity has been noticeable in the state every year since 2000. The amount of needle damage needs to be quite high before it becomes obvious and mappable using aerial survey. The amount of acres affected and the level of damage since 2000 is unusual. Prior to 2000, casebearer was seldom seen and required a careful and intentional search to find it but, since then, it has been obvious enough to be mapped during the aerial survey. In some years the damage has been very widespread but light in many stands as it was in 2000 while in other years it has been less widespread but more intense in individual stands. Casebearer damage has caused high levels of needle damage in some stands in Aitkin County for three to four years. So far, no dieback or mortality has been associated with this damage.



Common pine shoot beetle

On September 16, 2005, a quarantine of all counties in Minnesota was established by the USDA for pine shoot beetle, *Tomicus piniperda*. Pine shoot beetles were caught in traps in Anoka, Dakota and Ramsey Counties in 2004. As a result Minnesota Department of Agriculture (MDA) established a state emergency quarantine for pine shoot beetle covering these 3 counties. MDA repealed the state quarantine of the three counties in Aug 2005, resulting in the USDA establishing the federal, statewide quarantine.

The statewide quarantine regulates the interstate movement from Minnesota of pine trees and pine products with bark attached. For example all shipments of pine Christmas trees leaving Minnesota and going to non-quarantine areas must be certified free from pine shoot beetle. There are two ways to get a shipment certified. The first is to have a Plant Protection and Quarantine officer inspect the shipment and issue a certificate. The second way is for the grower or producer to attend an annual training and sign a compliance agreement. This allows them to inspect the shipments themselves. For more information on the quarantine, inspections or compliance agreements please contact the USDA APHIS at 952-853-1904



Red pine pocket mortality

Although caused by a complex of native species, red pine pocket mortality is relatively rare in Minnesota (MN). The story is quite different in Wisconsin (WI), where the syndrome is found scattered across the state. Over the last several years, a large number of infection pockets have been found in the Sand Dunes State Forest (SF), just outside of Zimmerman, MN in Sherburne County. The relatively high concentration of pockets in the Sand Dunes stands in stark contrast with the relative lack of infection pockets elsewhere in MN. So the concern is why here and why now, and what do we do about it.

A brief history

During stand inventories conducted in the late 1990's and early 2000's, a number of pockets of advancing tree mortality were discovered. After several field trips, DNR forest health staff members were unable to confirm the cause of the damage. Then in late 2004, wood samples with black staining resembling that associated with black stain root rot caused by *Leptographium wageneri* in Douglas fir and by *Leptographium procerum* in white pine were collected and cultured by the University of MN plant disease clinic (UMN). Based on fruiting structures and characteristics in culture, the UMN identified the fungus as *Leptographium*, most likely *procerum*.



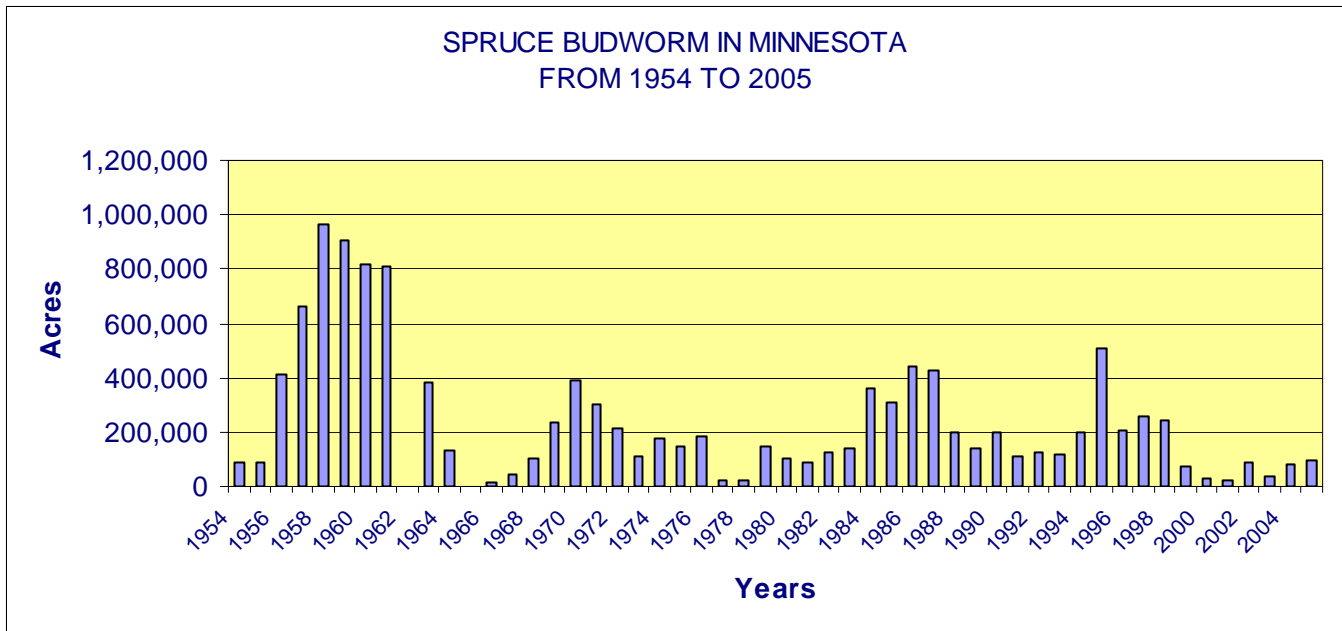
The cultures were then sent to Dr. Glen Stanosz at the University of WI. He confirmed all four cultures sent to him (collected at one sites on two different occasions) were related to the larger group of ophiostromoid fungi (those producing spores on coremia) in which *Leptographium* belong. The taxonomy of *Leptographium spp.* as a group is complex and not completely understood. But one of the four cultures seems to most closely resemble *Ophiostroma aureum* or a close relative of *L. terebrantis*. The identity of the other three fungi has not yet been confirmed, primarily because they are not responding to the same genetic trials – perhaps suggesting a different species. So the work continues.

The current plan

Given the lack of clear answers and the value of the affected stands in the Sand Dunes SF, a combination of treatments are planned as funding permits. In the most valuable stands, vibratory plowing will be combined with a cut buffer approach. This involves about ¼ of the known infection pockets. Four additional stands are more or less linear or are buffered by non-pine forest types, providing an opportunity for a trail. In the trial, half of each pocket will be plowed and the other half will receive a cut-buffer. Both halves will be monitored and the results compared. Several of the affected stands were cut and thinned in the recent past, so there no active symptoms at this time. These stands will be monitored and any additional symptoms noted and mapped. The remaining stands are considered of too low a priority to treat and/or too young to thin. These will be monitored for continue spread of the disease complex and will serve as controls for our trial. In the meantime, we survey other plantations in the area to make sure we aren't missing something. Then we watch and wait for word from those studying the taxonomy of this complex group of fungi.

Spruce budworm

Defoliation increased to 92,500 acres, approximately a 10,000 acre increase from last year. Budworm activity continues to be centered in northern St Louis County with minor acreage of defoliation also occurring in southeastern Koochiching County and northeastern Itasca County. A number of white spruce plantations were defoliated in widely scattered locations in other parts of the state. In northeastern counties, budworm defoliation has been noticeable and mapped pretty much continuously since 1954. See chart. You'll note that the chart shows two years with no acreages depicted. No historic maps have been found for these two years, but newsletters from that time period indicate that spruce budworm defoliation was observed in those years. There has been an average of 220,000 acres of defoliation mapped each year over this 55 year period.



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