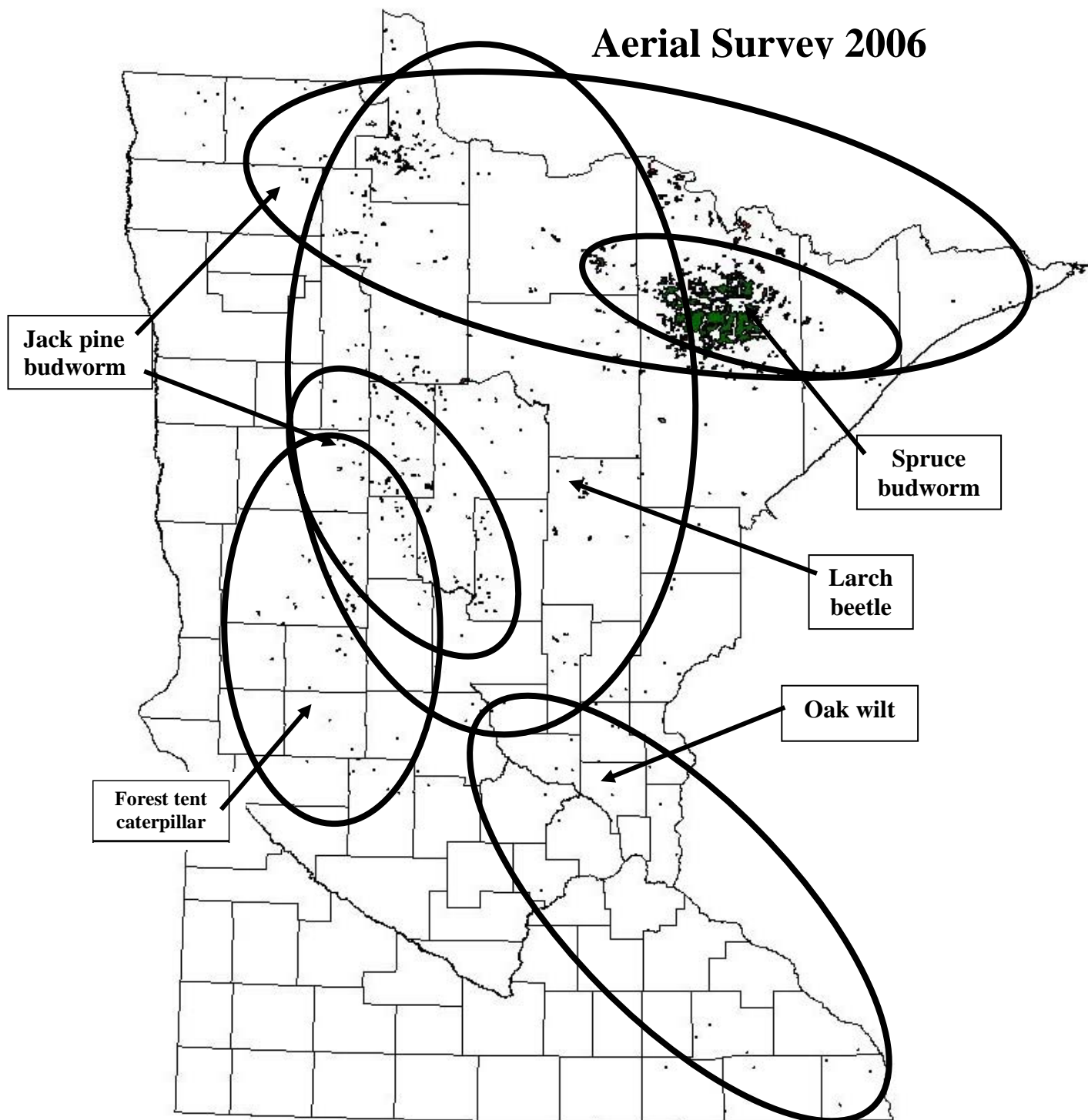


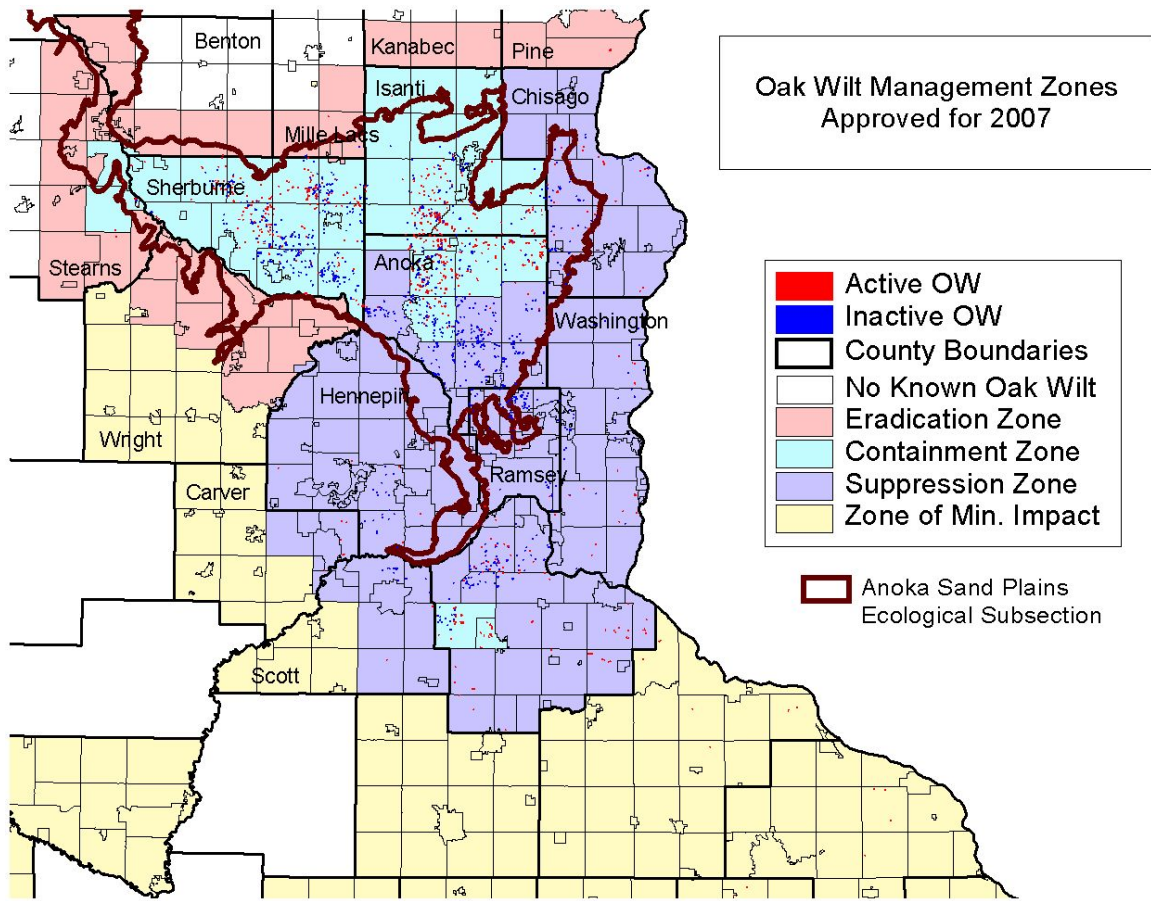


2006 Minnesota Forest Health Highlights

Aerial Survey 2006



Pest Detection Survey Results * FY06	
Causal Agent	Acres
Spruce budworm	83,200
Jack pine budworm	47,700
Aspen mortality	(due to FTC) 27,500
Ash decline	27,000
Aspen decline	(due to FTC) 22,900
Forest tent caterpillar	10,500
Larch beetle	10,000
Larch casebearer	6,700
Flooding damage	4,000
Birch mortality	(due to FTC) 3,200
Oak wilt	3,000
Red pine mortality	600
Wind damage	500
Two-lined chestnut borer	250
Birch decline	(due to FTC) 200
Wildfire damage	200
Dutch elm disease	(not in Twin Cities) 160
Herbicide damage	60

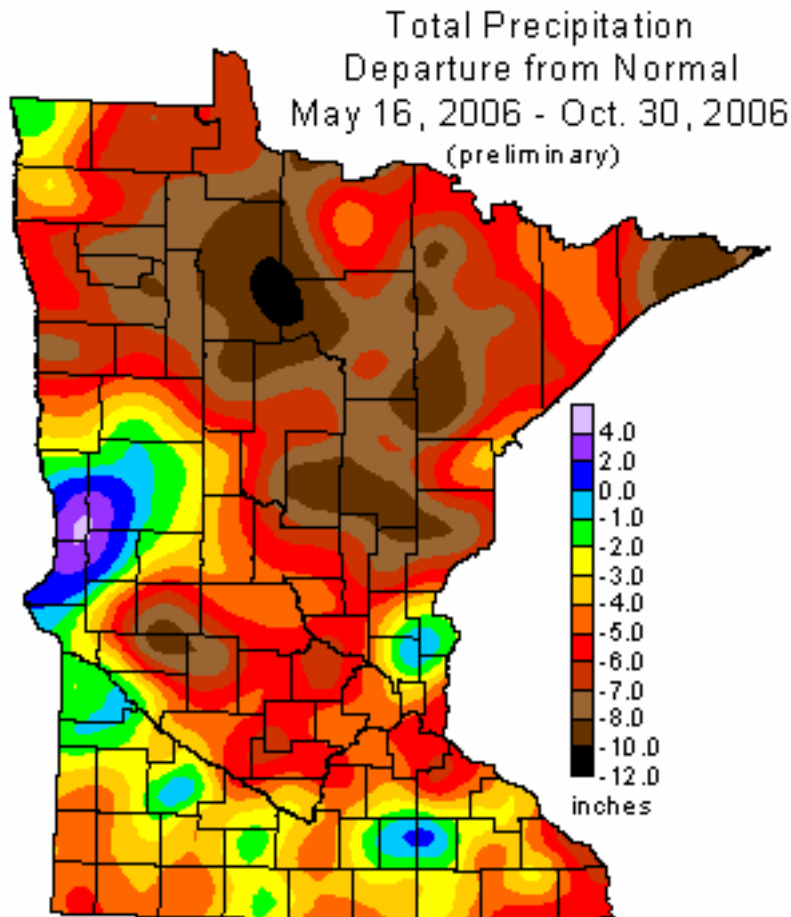


Record setting drought

A term, *flash drought*, was coined by the State Climatology group and refers to a relatively sudden drought onset brought on by the prolonged absence of significant precipitation during the middle of a hot growing season. Such was the case this past summer when much of Minnesota was in a surplus moisture situation going into the month of May, but by the end of July, many northern and eastern counties declined to the Severe and Extreme Drought categories as a result of the prolonged absence of rainfall combined with very high summer temperatures. This rapid onset of drought over a 2-3 month period is a rare occurrence in Minnesota history, having only occurred previously in 1896 and 1933 at a comparable rate. Other severe droughts have taken much longer to establish.

It was extremely dry in the north and north-central counties and here are some of the facts:

- Growing season precipitation levels were well short of the historical averages for much of the northern 2/3rds of Minnesota, deviating by more than 4 inches in most areas. See map.
- Rainfall deficits exceeded 6 inches in many areas. This is the equivalent of receiving ZERO rainfall for the entire month of June and half of July. Deficits exceeded 12 inches in Blackduck Area, which normally receives 19 inches of rain during the year.
- When compared to other years, this year's rainfall totals rank among the lowest ever recorded in northern counties.
- The USGS indicated that the stream discharge values for most streams and rivers rank below the 25th percentile and, in many cases; they rank below the 10th percentile. When streams reach this level, the DNR may suspend water appropriation permits.



State Climatology Office - DNR Waters

Ash decline

Ash decline continues to be a concern both because of the loss of the ash and because it could hide or mask the emerald ash borer once it enters Minnesota. See figure. Ash decline and mortality were mapped by aerial survey on 27,000 acres in 2004, on 4322 acres in 2005, and on an additional 662 acres in 2006. These reported acres may be just the tip of the iceberg since decline is difficult to detect from the air and since forest managers from many different agencies seem to feel that most of their black ash is in a state of decline. Site and weather conditions are still considered to be the primary factors that have stressed and /or killed the trees rather than any particular insects or fungi. The significant drought that started in the spring of 2006 and continues will hinder recovery and likely increase the problem.

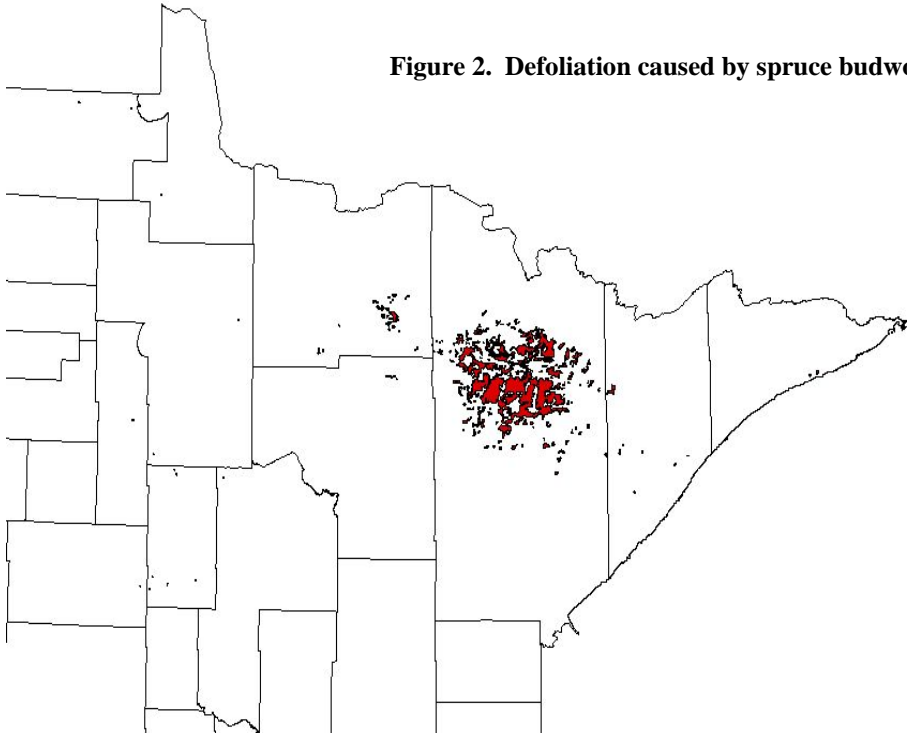


Figure 1. Ash decline symptoms.

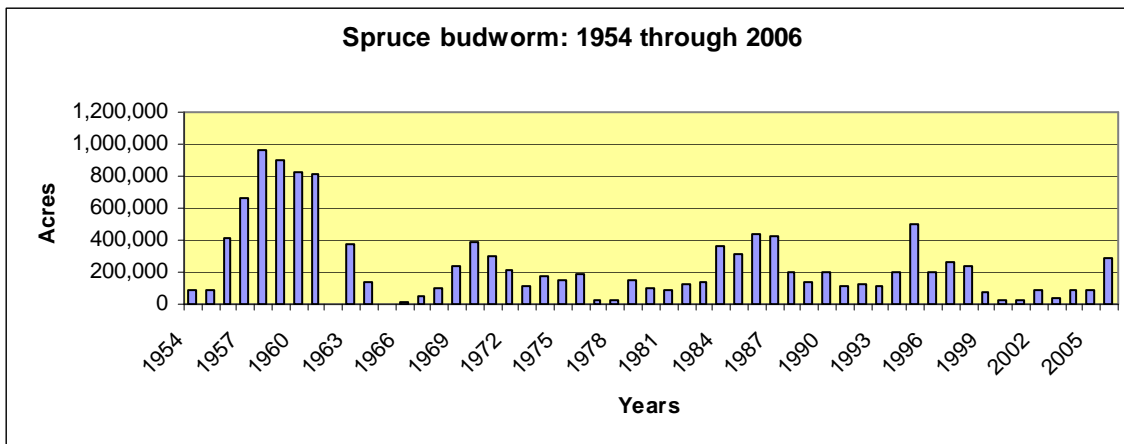
Spruce budworm

Spruce budworms defoliated trees on 287,220 acres this year. This was a large increase from the 92,500 acres defoliated in 2005. Budworm activity continues to be centered in northern St. Louis County with some defoliation also occurring in southeastern Koochiching County, northeastern Itasca County and central Lake County, as well as a number of scattered locations in other parts of the state. In addition to white spruce and balsam fir, budworm defoliation occurred on black spruce and tamarack on the west end of Lake Vermillion in northern St. Louis County.

Figure 2. Defoliation caused by spruce budworm in 2006.



In northeastern Minnesota, budworm defoliation has been noticeable and mapped continuously since 1954. See chart below. The chart shows two years with no acreages. Historic maps have not been found for these two years but historic newsletters indicate that spruce budworm defoliation was observed during those two years. There has been an average of 220,000 acres of defoliation mapped each year over this 53-year period.



Jack pine budworm

Despite a patchy pollen cone crop this spring in the west-central counties, jack pine budworm defoliation decreased to 19,400 acres; about a 4-fold decrease in acreage compared to last year. Unfortunately, that decrease was matched by a 51,390 acre increase in the northeastern counties and in Roseau and Lake of the Woods Counties. All-in-all, 70,790 acres were affected this year. See map 1. The northern portion of our outbreak, from Lake of the Woods County to Cook County, is probably associated with the current and severe budworm outbreak in adjacent Canada located between Kenora, Dryden and Fort Francis.

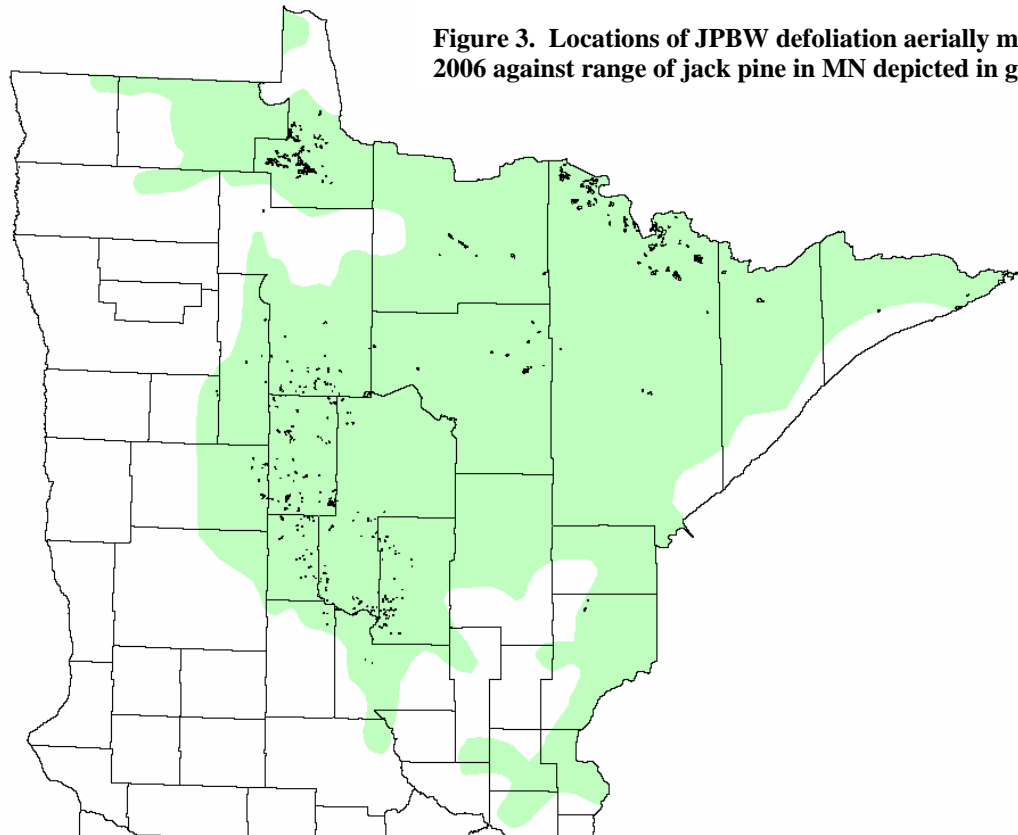


Figure 3. Locations of JPBW defoliation aerielly mapped in 2006 against range of jack pine in MN depicted in green.

In the west-central counties, this is the fourth year of the outbreak and, typically, the “beginning of the end” of the budworm outbreak. There were indications this spring and summer of their imminent demise.

- During the early larval study, only a few plots had larvae on them and populations were very low.
- Pollen cones, necessary for survival of young larvae, were scarce. This indicates that the natural feedback mechanism in jack pine trees is handling the problem. Fewer pollen cones this year means fewer larvae next year.
- Egg mass studies predict declining populations for 2007 in Beltrami, Hubbard and Wadena Counties. Elsewhere, the studies are not complete.

Even though aggressive salvage and pre-salvage harvesting was used to mitigate the effects of prolonged defoliation, 250 acres of mortality were mapped in a single stand on county and private land in Hubbard County.

Last year, budworms caused 6,000 acres of defoliation in red pine stands in Beltrami, Hubbard, Wadena and Crow Wing Counties. This year, only 500 acres were defoliated, primarily near Park Rapids in Hubbard County. See photograph. Early larval, pollen cone phenology and egg mass studies in red pines also found that populations are decreasing. For example, on the red pine impact study plots, the average number of egg masses per 36 inch branch dropped from 1.4 to 0.2, which indicates a decreasing population.



Figure 4. Jack pine budworm defoliation of red pine trees.

This is the third year of the jack pine budworm outbreak in Roseau and Lake of the Woods Counties. In 2004, each of the counties had less than 25 acres of mapped defoliation. Subsequently, no further defoliation occurred in Roseau County. In Lake of the Woods County during 2005, the defoliated area increased to 2263 acres and peaked at 13,071 acres in 2006. Jack pine mortality was mapped on 130 acres in four stands in Beltrami Island State Forest. Egg mass surveys indicate that defoliation levels will be very low next year.

Jack pine budworm defoliated 37,496 acres in the northeast Region in 2006. This is the first time jack pine budworm defoliation has been reported in this part of the state since an outbreak in 1982-1986. In the current outbreak the largest area of defoliation is in northern St Louis County with smaller acreages defoliated in northeastern Itasca, central Koochiching, central St Louis and scattered stands in Lake and Cook Counties. Defoliation was mostly heavy in northeastern Itasca County and many of the affected stands are 65 years and older. Itasca County plans to cut most of their affected older stands in this area. In Koochiching County, on state administered lands, foresters plan is to monitor the outbreak and not to start any harvesting at this time. The affected stands in northern St Louis County are mostly within the Boundary Waters Canoe Area Wilderness and Voyageurs National Park where cutting is not allowed and so will only be monitored. Based on the previous outbreak (see below), it is felt that in the northeastern part of the state overall impact will be minor. This could change however if the current drought continues adding significant stress to defoliated trees.



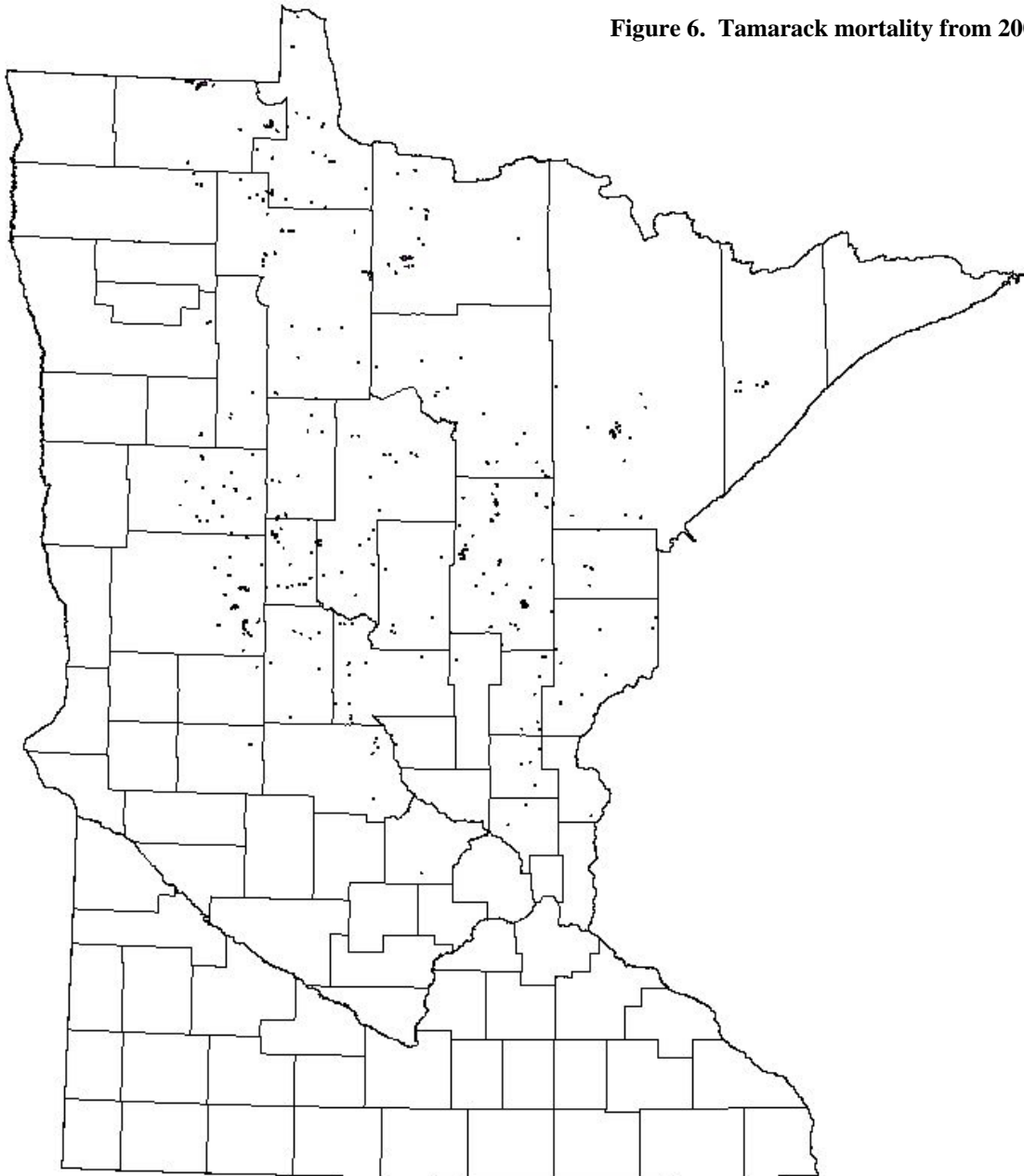
Figure 5. Jack pine budworm defoliation of jack pine in Itasca

The previous outbreak in northeastern Minnesota started with light defoliation on about 2000 acres in 1984, expanded to approximately 2800 acres of generally light defoliation with scattered moderate and heavy defoliation in both 1983 and 1984. The outbreak in this area then collapsed and caused some top kill but little whole tree mortality. Considerable harvest occurred in mature and overmature stands as a result of the outbreak. In 1984, 150,000 acres of trace to light defoliation was mapped in northern St Louis, Lake and Cook counties along the Canadian, mostly in the Boundary Water Canoe Area Wilderness. This increased to approximately 200,000 acres of defoliation in 1985 with a slight increase in severity to mostly light-moderate. Scattered heavy defoliation was observed north and east of Ely in Lake County and near Gunflint Lake in Cook County. Top kill was observed in some stands north and east of Ely where trees were growing on shallow soils on rock outcrops. Populations collapsed and in 1986 slightly less than 14,000 acres of defoliation were mapped. Rainfall was well above normal in 1985 and may have contributed to the population collapse and also helped to keep tree mortality to a minimum.

Eastern larch beetle

Eastern larch beetle continues to kill tamarack. Although only 8927 acres of mortality were mapped by aerial survey in 2006, mortality due to eastern larch continues to be very common and widespread. From 2001 through 2006, aerial survey mapped tamarack mortality on 53,734 acres in 911 stands. See figure below. No consistent stress factor contributing to the current mortality by eastern larch beetle has been found. Trees from 40 to 160 years and older have been killed by the beetle. Mortality has occurred on upland as well as lowland sites and in pure stands as well as in mixed stands. Larch casebearer has been common during the same period of time that tamarack mortality has been occurring, but most stands with larch casebearer have not been experiencing mortality.

Figure 6. Tamarack mortality from 2001 to 2006.



Larch casebearer

Larch casebearer continues to be active, mining tamarack needles and turning trees brown. See figure below. Larch casebearer was mapped on 6013 acres in 2006. The duration and extent of the current outbreak is unusual. Prior to 2000, larch casebearers were seldom seen and required a careful and intentional search to find them, but since then, damage has been obvious enough to be mapped annually during the aerial survey. The amount of needle damage needs to be quite high before it becomes obvious and mappable using aerial survey. In some years, like 2000, the damage has been very widespread but light in many stands, 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 four to five years. So far no dieback or mortality has been associated with this damage.



Figure 7. Larch casebearer defoliation.

Forest tent caterpillar: Down but not out!

Even though natural controls had caused the disappearance of forest tent caterpillars in most northern areas of our State, these defoliating insects were found in rather large numbers this year in northeastern Grant and northeastern Stearns Counties. These populations usually inhabit oak and basswood forests along lakeshores in the west-central counties. The population of forest tent caterpillars last peaked in northern Minnesota in 2002 but has a fairly constant presence every year in the western lake country.

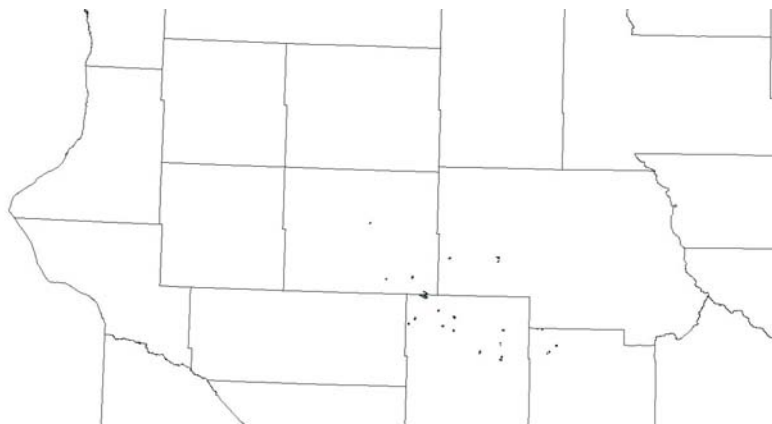


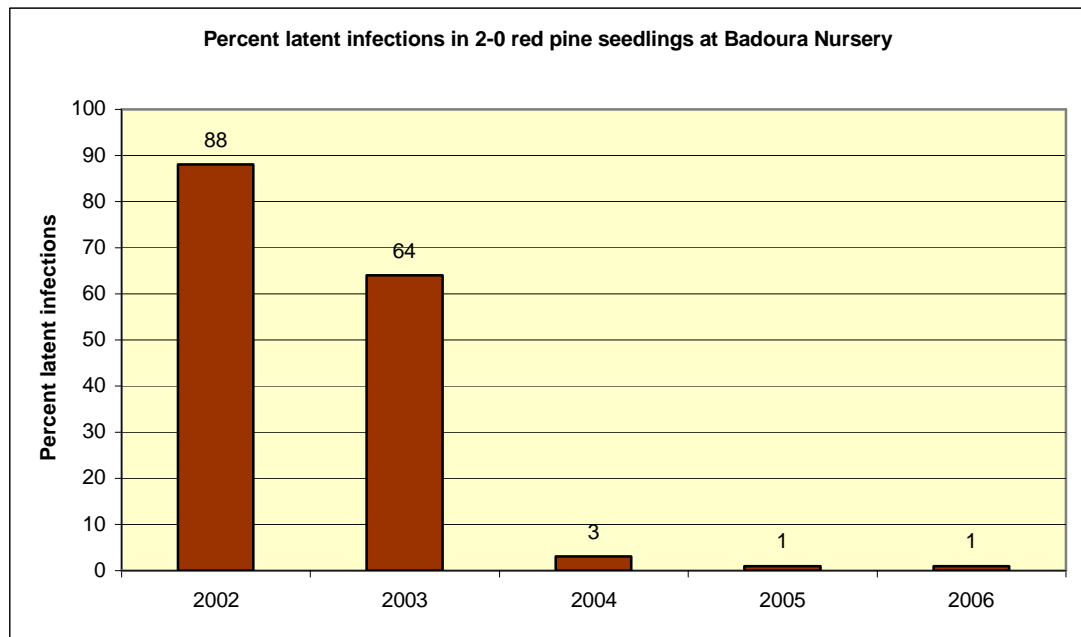
Figure 8. FTC defoliation in

***Diplodia* in red pine nursery stock**

Until the turn of the century, the prevailing pathological belief was that if shoot blight infections in the nursery seedbeds were absent, then there were no *Diplodia* infections of the seedlings. That belief was turned upside down by the work of Glen Stanosz at the University of Wisconsin. Stanosz and co-workers found that there could be *Diplodia* infections without and symptoms, because *Diplodia pinea* is a “latent pathogen”.

In 2002, this arcane biological fact became all too apparent when 65% of the red pine seedlings in plantations died due to the effects of latent *Diplodia* infections. A non-systematic survey done in the spring found that 88% of the seedlings had latent infections where shoot blight was prevalent the year before. Our best course of action was to eliminate the sources of infections in the Nurseries by removing the pine windbreaks. So, we did just that. In the winters of '02-03 and '30-04, Badoura Nursery removed 1250 cords of red pine windbreaks. Nursery managers also reinstated fungicide spray regimes, regularly rogued seedbeds and always pre-cooled seedlings prior to shipping, among other actions. The windbreak removals would have an impact, but not immediately. Seedlings that were alive in 2002, prior to the removal of windbreaks, had already been exposed to *Diplodia* and some of them were already latently infected.

In 2003, a systematic survey of the entire 2-0 red pine crop was done. Dr. Stanosz’s lab found averages of 40% to 71% latent infections in the red pine fields. So, the entire crop of two million seedlings at Badoura Nursery was rejected and destroyed. In 2004, we anticipated a drop in latent infection levels because most of these seedlings had emerged after the windbreaks were removed. Another systematic survey of the 2-0 red pine crop was done and we were delighted to find only 2.5 % latent infections in the nursery beds. We continued to assay seedlings for the presence of latent infections and, in 2005, we found another decrease in latency levels. *Diplodia* infections were down to 1.25%. Another systematic survey in 2006 found similar results.



White spruce mortality and decline in 30 + year old plantations

Mortality and decline were observed in a number of white spruce plantations throughout northeastern Minnesota. Multiple factors seem to be involved including drought, defoliation, secondary organisms, etc. Needle loss due to spruce budworm or *Rhizosphaera* needlecast or a combination of both reduced growth and vigor. *Rhizosphaera* appears to have caused as much defoliation in some of the 30 year old and older plantations as spruce budworm caused in others. Northern spruce engraver beetle, *Imps perturbed*, was found in dead and declining trees in some plantations and a weevil, the small spruce weevil *Episodes rotundities*, was found in others. Armillaria root disease was easy to find on dead trees and might be playing a role as well. These plantations were affected by droughty weather in 2002 and 2003.



Figure 9. White spruce decline with *Rhizosphaera* present.



Figure 10. Small crown ratios in white spruce.

In addition to the pest problems, lack of timely management is likely part of the problem. Some of these plantations have been thinned and others have not. As white spruce plantations reach thirty years of age their growth slows, their vigor declines, and their live crown ratio declines sometimes to as little as 25%. As their vigor declines, they pick up multiple pests that cause further stress and can lead to mortality. The thinned plantations showing problems were 30+ years old when thinned and have been slow to respond to the thinning. Mortality continues even 5 years after the thinning in some plantations. In order for white spruce to respond rapidly, thinning should occur while they have a good live crown ratio and before the trees have accumulated too many pests and stresses.

Bitternut hickory mortality

Observations of hickory mortality have been made throughout the southeast region for the last twenty years. In fact, Dr. Eugene Smalley, from the University of Wisconsin, had described a new *Ceratocystis* species now named *C. smalleyi* in association with hickory bark beetle many years ago. He never published the taxonomy, however the US Forest Service did publish a Pest Alert on hickory mortality some time ago.

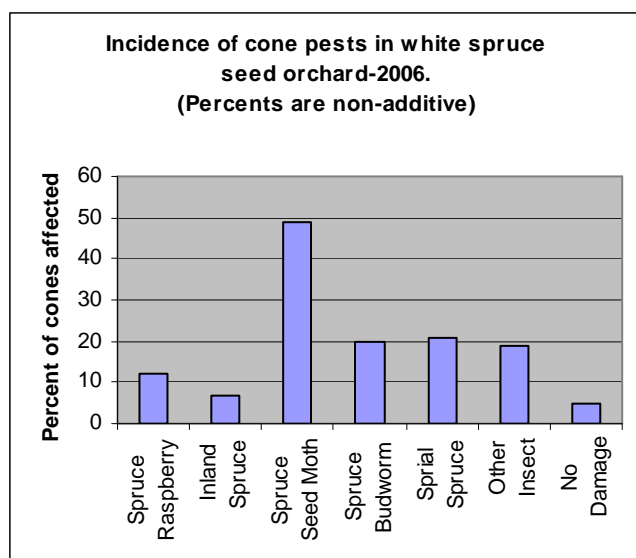
In 2006, the US Forest Service, in cooperation with the states of MN, Iowa, and WI, has begun surveys to begin looking at the causes of hickory mortality. In the field, symptomatic trees will exhibit crown dieback and small chlorotic foliage. Many of the affected bitternut hickories have indications of cankers on the stems. Examinations under the bark of these cankers reveal brown discolored lesions of varying sizes. At the center of most of these lesions is one single entrance hole that appears to be made by a species of ambrosia beetle, yet to be identified. The upper crowns of felled trees have entrance holes and plenty of activity from the hickory bark beetle *Scolytus quadrispinosus*. On occasion Phomopsis galls are found on branches and main stems. From the US Forest Service lab, cultures are finding isolates of *Ceratocystis* fungi. Additionally they are finding "Fusarium-like" isolates, and "Sporothrix-like" isolates. They plan to work with these fungi to see if they can be identified down to species.

In the recent past a species of *Ceratocystis*, *C. carya* was associated with a "canker-wilt" disease on hickory. It causes wilting, but is not a true vascular wilt pathogen in that it doesn't clog the xylem, but instead colonizes parenchyma tissue. It has been particularly associated with wounds and may be brought in by ambrosia beetles. *Ceratocystis smalleyi* is very closely related to *C. carya*, but has some distinct morphological characteristics and is associated with the hickory bark beetle, *Scolytus quadrispinosus*. *C. smalleyi* may also play a significant role in hickory mortality as it may have some adaptations related to its association with the bark beetles that are unique. These species are considered to be wound colonizers. Either the bark beetles are coming into the trees followed by ambrosia beetles bringing in the fungi or the reverse happens.

Plans for the 2007 field season include continued sampling and expansion of the surveys to additional sites. What needs to be done is to see symptomatic trees early in the season, fell and check high up in the crowns to see if the bark beetles are getting in there first. For landowners with hickory mortality, we advise continued management selecting against hickory. It is not known if sanitation would be of benefit to reduce mortality in nearby unaffected hickory.

Cone pests affecting seed production in the white spruce seed orchard

Insects and fungi damaged most of the cones in a grafted white spruce seed orchard in northeastern Minnesota. Two rusts and three insects caused most of the damage. The chart below shows the percent of cones damaged by each of the pests. These percentages are not additive since many of the cones were damaged by more than one insect or rust. Overall 19% of the cones had rust, 87% had insect damage and 5% had no damage.



In the "Other insect damage" category, a few of these cones were damaged by spruce seed midge and a few others were damaged by coneworms, likely *Dioryctria abietivorella* which has been found in this seed orchard in the past. This survey was conducted a bit late in the season making it impossible to identify the insects that had damaged many of the cones in this group.

In order to identify insects that damaged the inside of the cone and the seed the cones were cut in half longitudinally and examined. These cones were rated as 'good' if 50% or more of the seeds cut through in this process looked healthy. Cones were rated as 'no good' if less than 50% of the seeds were healthy. Fourteen percent of the cones were rated as good and 86% were rated as no good. Most of the cones rated as no good had 3 or less healthy looking seeds in the viewed dissections.

Cones were collected in the seed orchard this fall and sent to Badoura State Nursery for extraction. Extraction is not yet complete, so there are no figures on seed yield at this time.

Spruce raspberry rust = *Pucciniastrum americanum*
Inland spruce cone rust = *Chrysomyxa pirolata*
Spruce seed moth = *Cydia strobilella* – formerly *Laspeyrisia youngana*
Spruce budworm = *Choristoneura fumiferana*
Spiral spruce cone borer = *Strobilomyia neanthracina* formerly *Hylemya anthracina*
Spruce seed midge = *Mayetiola carpophaga*
Fir coneworm = *Dioryctria abietivorella*



Figure 1. *Chrysomyxa pirolata*, inland spruce cone rust on white spruce cone.



Figure 2. Dissected white spruce cone showing larva of spruce seed moth, *Cydia strobilella*.

Gypsy moth

Prepared by: Kimberly Thielen Cremers, Gypsy Moth Program Team Leader, MN Dept. of Agriculture

2006 General Survey Program

The Minnesota Department of Agriculture (MDA) was the lead agency during the 2006 gypsy moth detection survey program. Other cooperators, who set detection traps included the Three Rivers Park District (65 traps) in the Twin Cities metro area and the USDA FS (55 traps). Staff in the cooperative program set 19,039 delta traps across the state and 411 male moths were caught. In 2006, MDA hired a record high 47 seasonal staff. This group set and monitored 18,919 traps and covered 41 standard trapping routes.

The 2006 season marks Minnesota's third year as a formal member of the Slow the Spread (STS) Foundation. In 2004, Minnesota became a member of the STS Foundation when the STS action boundary moved into southeast Minnesota at the conclusion of the 2003 season, to include portions of Houston and Winona Counties. In the fall of 2004, due to increase in moth captures, 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 County. Then in 2005 and 2006 Minnesota felt some reprieve, the STS action boundary stayed constant in Cook and Lake County, but retreated a bit in SE Minnesota, dropping completely out of Wabasha County and only including a small portion of Winona County and all of Houston County.

For the 2006 trapping season, the state was divided into two distinctively different trapping regions, north and south, to account for the climatic differences within the state. The southern region began setting traps on June 5 and trap set was complete by July 7. The northern region's season was delayed by three weeks with trap set beginning on June 26 and ending on July 28. Traps remained in the field for five weeks in the south and 6 ½ weeks in the north. Trap removal for the south began on August 14 and was completed by August 31. Trap removal for the north began on September 14 and was completed by October 4.

Additional traps were set at state parks, mills, and nurseries within the standard trapping grid. Thirty-five of Minnesota's 72 state parks were within the standard trapping grid and received additional 1-2 traps each. Three moths were caught in state parks; all were on Minnesota's north shore. 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. Ten moths were caught at mill locations and 43 moths were caught at nurseries for the 2006 season. The ten moths caught at the mill locations were within the STS action area along the North Shore of Minnesota. Trap data surrounding the mill showed no correlation between the number of moths being caught and the activities of the mill operation rather the natural front of gypsy moth moving into that particular area. Trapping data surrounding the 43 nursery finds, on the other hand, did indicate some correlation with the activities of the nursery business.

Gypsy moth finds at Minnesota nurseries continues to be a problem. Thirty five percent of the 123 moths found in the southern one-half of the state were found at nursery operations. Ten nurseries in Minnesota accounted for the 43 moths found. Two of the 10 nurseries had greater than 10 moths captured at their place of business; one of the sites is under a Federal/State Compliance Agreement after alternate life stages (female moth and egg mass) were found during a follow up survey at the site. MDA continue to work with the industry to minimize their risks of transporting gypsy moth into the state.

Four mills (three pulp and one saw mill) and one nursery are under Federal/State 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. Thirty six 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.

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 123 of the total number of moths captured. See map. In the southeast (Houston, Winona, Olmsted, Wabasha Counties), an area, prior to 2005 that has had consistent increase in moth numbers in the past decade, only ten moths were caught. This is the second consecutive year with record low moth numbers in the SE. Prior to the 2005 season, the last time moth numbers were this low was in the early 1990's. Areas of concern in the central and southern part of the state, included one delimit site near Cambridge that had two traps with 11 moths, one standard detection trap in Hopkins that had five moths and a site near Shokopee that had one trap with three moths and an adjacent trap with a single moth. These sites will be delimited during the 2007 season.

The majority of the moths caught in Minnesota, 68%, were confined to the two far NE counties of the state (Lake and Cook). This was no surprise after a record 1,077 moths were caught in Cook County in 2005. There had been an increase in moth captures, from about 25-30 for the entire county since 2000, to 193 moths in 2004, then 1,077 moths in 2005. Moth numbers for Cook County are down with only 210 moths being captured. This decrease is associated with the 138,000 acres treated in Cook County during the 2006 season. Only three moths were caught within the treatment blocks however, moth numbers continue to climb in areas surrounding the blocks. Data is being evaluated at this time and MDA will be working closely with the agencies responsible for the management of lands within these areas to determine management strategies for 2007. It is likely that treatment proposals will be forthcoming.

General Treatment Program

2006 was a record breaking year for gypsy moth treatments in the state of Minnesota. Approximately 138,000 acres were treated in the state for gypsy moth. This is a drastic increase from the past five year's average of 760 acres annually. As the gypsy moth front moves closer to Minnesota treatment acreage is expected to increase to meet the overall statewide objective of decreasing natural spread rates of approximately 15 miles per year to less than 6 miles per year. Prior to the 2006 season, the cumulative total treated acreage was just over 4,700 acres (from 1980-2005). Majority of the historical acreage were within the Eradication phase of gypsy moth management. This year alone we surpassed the state's historical summation of acres by 29 times mainly resulting from the natural population front and the STS Action Area moving into Minnesota from the east.

Many challenges were met with this year's treatment program. Not only did Minnesota treat a historical high amount of acreage the treatment blocks were spaced out across two geographically separate counties; Cook and Hennepin (235 miles apart), two different management zones; Eradication and Slow the Spread, and crossed into multiple land jurisdictions; Indian Reservation, National Forests, state parks/forest, county, city, and private lands.

There were two Btk blocks and four mating disruption blocks across the state. One Btk block was within the Eradication zone in Hennepin County and the second Btk block and the four mating disruption blocks were in Cook County within the STS Action Area. There were three distinctly different application periods; mid-May, early-June, and late July due to the geographical distribution of the blocks and the treatment product utilized.

Two separate Environmental Assessments (EA) were completed with three separate decision notices (DN) one for Grand Portage Indian Reservation, one for Superior National Forest, and a third to cover all other lands-state, county, city, private, etc.

ERADICATION: (58 total acres)

Btk Treatments:

One site within the Twin Cities metropolitan received two applications of Btk, spaced seven days apart. In the fall of 2005 an egg mass was found within the treatment block. This was a small site of 58 acres, within Hennepin County in the city of Brooklyn Park. The site was highly urbanized and composed of several single family homes, a town home development, several apartment complexes and a city park. Treatments were conducted on May 16 and 23, 2006. Both applications were conducted by helicopter. An EA was not conducted at this site due to the fact the treatment was covered 100% by state funds, and was not required by state regulations.

To determine treatment success, the treatment block was trapped on a 250 meter grid density with the core surrounding the egg mass find at 3/acre. Four gypsy moths were caught during the 2006 season; three within the treatment block and a fourth just outside the treatment block within the delimit boundary. However, a second year of intensive trapping is needed to make certain the treatment was a success or failure.

SLOW THE SPREAD: (137,677 total acres)**Btk Treatments:**

One site in NE Minnesota, Cook County, within the STS Action Area received two applications of Btk, spaced 7-10 days apart. This was a 2,015 acre block within the Grand Portage Indian Reservation. This site was almost completely forest covered with no resident living within the block. There was one road that ran parallel to the bottom 1/3 of the block. Treatments were conducted on June 8 and 15, 2006. A separate EA and DN/Finding of No Significant Impacts was conducted and signed for this particular site. Funding for this project was covered 100% by STSF funding.

To determine treatment success, the treatment block was trapped on a 250 meter grid density. Thirty-three traps were set and only one gypsy moth was caught during the 2006 season. With only one moth being recovered it is likely that this treatment was successful, however, a second year of intensive trapping is needed.

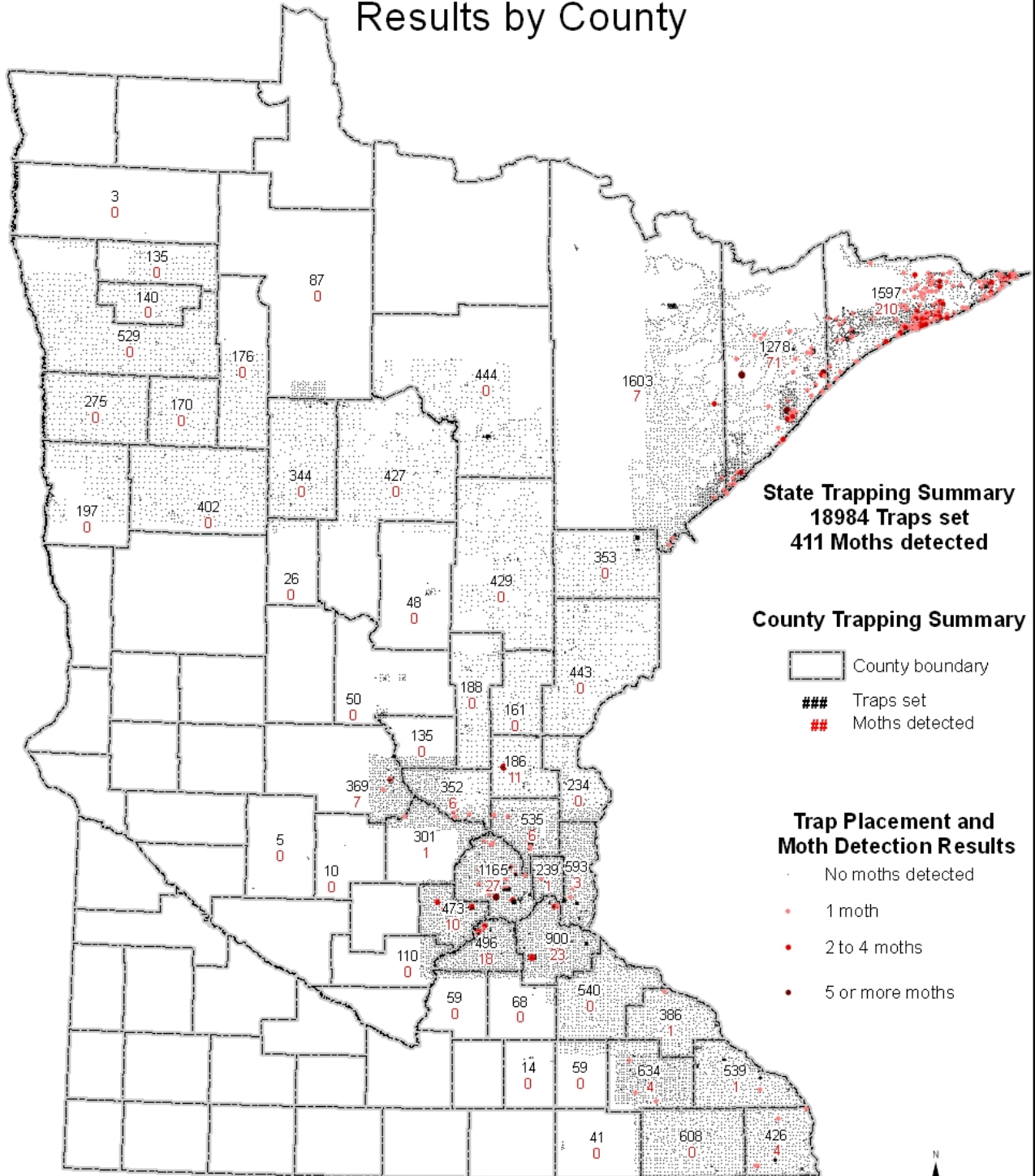
Pheromone Flake Treatments:

135,662 acres were treated with pheromone flakes in 2006. The four Mating Disruption blocks in Cook County were the Schroeder Complex, 90,697 acres; Tom Lake, 35,797 acres; Farquhar Peak, 5,539 acres; and Kadunce River, 1,242 acres. Each block was treated utilizing the 6 grams of active ingredient per acre. Applications occurred on July 24, 25 & 26, 2006. Applications were moved up one week due to unseasonably warm conditions and the advancement in moth development in the Madeline Islands of WI. In just 2 ½ days all 135,662 acres were treated. Follow up trapping was conducted at the pheromone flake sites at a 2 km trap density and three moths were recovered within the Schroeder Complex block.

EGG MASS SURVEYS:

Several surveys were conducted in the fall of 2006, in response to relatively high numbers of moths trapped in several locations across the state. Only one site near the city of Cambridge (Spectacle Lake) warranted an egg mass survey. The survey was conducted on October 19, 2006 and no egg masses were found at the site. This site will receive intensive trapping during the 2007 season. In addition to the egg mass survey conducted in the Twin Cities metro area, several site surveys were conducted in Cook County surrounding several high find locations. No egg masses or alternate life stages were identified during this survey.

2006 Minnesota Gypsy Moth Trapping Summary Results by County



Firewood as a vector of invasive species

Expanding national and international trade and the movement of people across the United States has greatly increased the risk of invasive forest insects and diseases coming into Minnesota. Given the importance of state forest resources to local economies, plant and animal communities, and the quality of life for state residents, this is a major concern for the Minnesota DNR. Raw wood products or unfinished products with the bark left on have been involved in a number of introductions documented in the past. Past research and existing regulations focus on logs, solid wood packing material and wood pulp, but little attention had been paid to the movement of firewood, until recently.

Firewood is capable of moving a large number of forest pests. But the need to consider firewood movement has gained public attention only during this last year when a number of new infestations of the emerald ash borer (EAB) were traced back to recreational campers. As a result, Michigan, Ohio, Indiana, Wisconsin, and Canada have enacted new legislation to govern the movement of firewood into and within areas under their jurisdictions. There is considerable pressure for Minnesota to follow suit.

The movement of raw wood products is one of the primary means by which invasive insects and tree diseases are introduced into Minnesota. Expanding national and international trade, along with the rapid growth of national firewood suppliers and “big box” retailers, have increased the risk of disease and invasive insect introductions. Limiting the movement into Minnesota of raw wood products, including firewood, could decrease that risk.

Firewood can serve as a vehicle for a variety of forest insect and disease pests, including the fungi causing oak wilt and Dutch elm disease, wood stain fungi, gypsy moths, Sirex wood wasps, ambrosia beetles, bark beetles, and long-horned beetles. Although the movement of forest diseases and pests in firewood has been an ongoing concern, the approach of the emerald ash borer (EAB) has brought the issue to the forefront in Minnesota and nearby states.

The arrival of EAB in Minnesota is probably inevitable, but steps can be taken to delay introduction, primarily by limiting the importation of firewood from infested areas. Canada has banned the movement of all firewood (not just ash), with stiff penalties for knowingly moving firewood across the border. Michigan has banned the movement of all ash firewood. Previously, Wisconsin had launched a firewood information campaign, “If you bring it, burn it!” This year, the Wisconsin DNR dropped that particular message and has instead enacted a ban on all firewood originated from more than 50 miles away.

Minnesota campgrounds are one place where pests like gypsy moth and EAB can be introduced because of the transport of personal firewood supplies from infested areas. There are 637 campgrounds in Minnesota, 85 percent privately owned and 15 percent managed by DNR. As part of a one-day survey of 2005 state park campers:

- 56% of all campers brought their own firewood,
- 35% of out-of-state campers brought their own firewood.

Parks and Recreation Division reservation data indicates that about 14 percent of reservations come from out-of-state.

Visitors can also transfer personal firewood supplies long distances from other states during hunting, fishing, and other recreation trips. Nearly a quarter million nonresident hunting and angling licenses are sold in Minnesota each year. Recreation users in outdoor settings are often involved in several activities such as hiking, boating, camping, and ATV riding. Fire building may be a part of the recreation experience. It is likely that some of these out-of-state visitors are bringing firewood from home.

Limiting the movement of firewood into Minnesota will be challenging. The firewood business is diverse and dynamic, with small, medium, and large operations perpetually getting into and out of the firewood business. Larger commercial firewood businesses serve multi-state markets, with operators from as far away as Texas supplying firewood to national retailers and chain convenience stores.

To begin to describe the issues, the DNR Forestry Division and Minnesota Department of Agriculture have developed a list of Minnesota firewood processors. Preliminary efforts are underway to explore firewood pathways and educate industry representatives. The effort has recently been expanded to include commercial campgrounds. The DNR began a planning process this spring to address firewood coming onto DNR managed lands. The result of that effort to date is the review and possible revision of state statutes regarding forest pest prevention and management. So stay tuned this winter as decisions are rolled out and an outreach campaign is launched.

Emerald ash borer trap tree surveys

In cooperation with the Minnesota Department of Agriculture, the Forest Health Unit again participated in the early detection surveys for the Emerald Ash Borer (EAB). Forty-five ash trap trees were established on state land in fourteen state parks or state forest campgrounds. The trees that were peeled this fall showed no evidence of EAB. The remaining trees will stand through another growing season and will be peeled in the fall of 2007. At this time not all the trap trees may have been peeled, however to date nothing was found in the surveyed trees. We realize that our efforts are the proverbial 'drop in the bucket', however, our goal is to do our assigned part in the multi-agency detection surveys in Minnesota and in the Midwest.

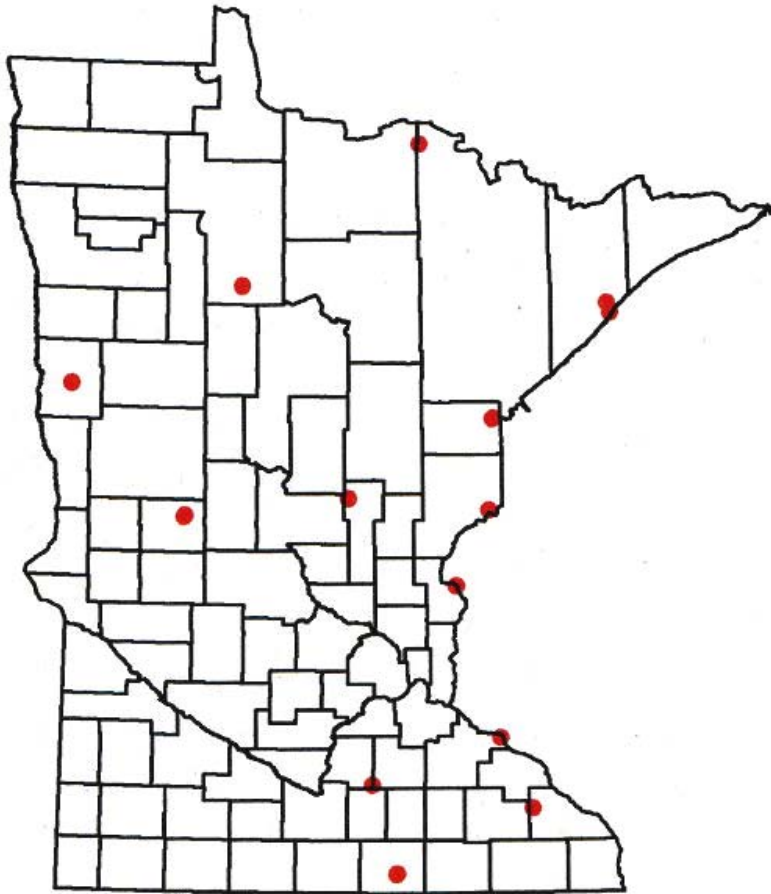
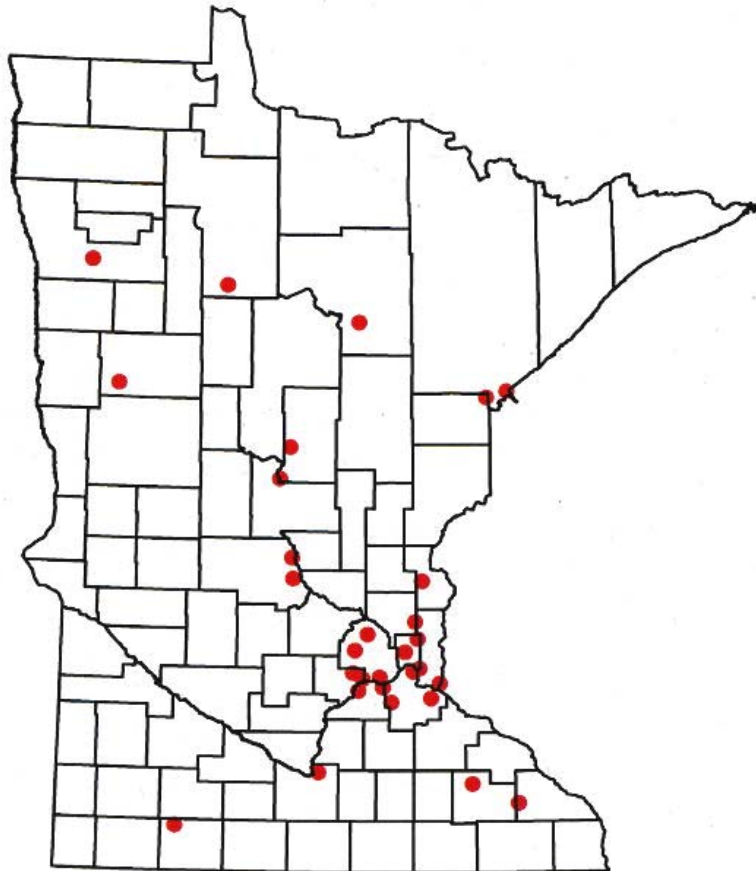


Figure 11. Locations of DNR campgrounds where EAB trap tree surveys were conducted in

Sudden oak death survey

For the third consecutive year, DNR of Forestry participated in the national *Phytophthora ramorum* survey. Field surveys were conducted adjacent to several major nurseries and in rural forested areas around the state. Thirty sites were surveyed in twenty-one Minnesota counties. Samples were collected from hosts known to be susceptible to *P. ramorum*. 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. Again, all were negative for *P. ramorum* by PCR testing.



Map 1. Survey locations, Minnesota 2006 SOD Survey.

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