Wisconsin Forest Health Highlights

Divison of Forestry
WI Dept of Natural Resources

December 2004

Average to above average precipitation brought both hardwood and coniferous forests back to a healthier state. Oak mortality that had been occurring over the past 2 years in north west Wisconsin stabilized. Oak mortality did continue in Marinette County, where several years of defoliation by the gypsy moth, drought and infestation by the two-lined chestnut borer stressed the resource. Populations of the gypsy moth took a dramatic downturn; only 20 acres of defoliation were observed in 2004, compared to the 65,000 observed in 2003. This good fortune was due in part to a successful spray program and a cool, wet spring and early summer. The weather was favorable for organisms that infect larvae of the gypsy moth. Populations of the jack pine budworm increased in west-central and northwestern Wisconsin. Populations of this insect are expected to peak in 2005, particularly in northwestern Wisconsin. Statewide surveys for two new exotic forest pests, the Emerald Ash Borer and Phytophthora ramorum (the cause of Sudden Oak Death) revealed no findings of either of these organisms. John Kyhl, gypsy moth suppression coordinator and entomologist for the southeast region, left the department for a position with the USDA Forest Service. Bria Radtke was hired as a gypsy moth suppression coordinator for the west central region.

THE RESOURCE

—Forests are important to the economy of Wisconsin, not only in the form of wood products, but also for recreation and tourism. The primary and secondary wood products industry is the second largest employer in the state and puts Wisconsin first in the nation in the production of fine paper, sanitary paper products, children's furniture, and millwork. The value of shipment of these products annually exceeds $19.7 billion. Forest and water resources in Wisconsin are a primary tourism attraction for both residents and visitors. The variety of Wisconsin's forest ecosystems support a great diversity of wildlife species, while recreational use of the forests continues to grow and expand. The area of forestland in Wisconsin has been steadily increasing in recent decades and currently stands at almost 16.0 million acres, representing 46 percent of the total land area. The state now has the most forest land that it has had at any time since the first forest inventory in 1936. Wisconsin's forests are predominately hardwoods, with 84 percent of the total timberland area classified as hardwood forest types. The primary hardwood forest type in the state is maple-basswood, which makes up 5.3 million acres (34%) of Wisconsin's timberland area. Conifer types represent 16% of the total timberland area (pine forests: 8%, spruce-fir: 6%, and swamp conifers: 2%).

In this issue:

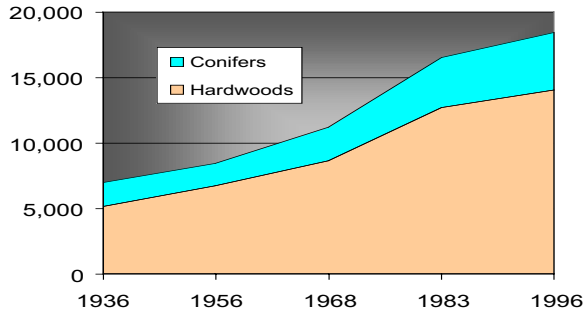


Figure 3. Growing stock volume (in million cubic ft) on timberland in Wisconsin, 1936-96. Data taken from 1996 FIA survey.

EXOTICS

Emerald Ash Borer

Agrilus planipennis

—During the summer of 2004 both visual and trap tree surveys of Wisconsin's ash resource were conducted in state park and forest campgrounds. The objectives were to:

1) detect any emerald ash borer infestations and
2) determine the overall health status of Wisconsin's ash trees in state parks and forests.

Adult emerald ash borer

Surveys targeted ash trees in campgrounds because firewood is often the source of new introductions. All state forests and parks with campground facilities were surveyed (50 sites).

State Park Surveys

Data were collected from a maximum of two ash trees per campsite and included canopy health (branch dieback, yellowing, epicormic sprouting), signs of emerald ash borer (larvae, adults, bark cracks, serpentine galleries, D-shaped exit holes) and signs of other ash pests and diseases.

No infestations of EAB were detected during the visual surveys. However, other insects and diseases which create symptoms similar to those caused by emerald ash borer were identified. These included the red-headed ash borer (*Neoclytus acuminatus),* a long-horned beetle, and the ash borer (*Podosesia syringae),* a clearwing moth. Ash yellows, a phytoplasma which disrupts the tree's vascular system was also detected. Ash yellows is the suspected agent causing the ash decline observed at Wyalusing and Nelson Dewey State Parks.

The results of this survey indicate that the general health of Wisconsin's ash resource in state parks is fairly good, however some chronic stressors were observed statewide. Minor issues affecting ash health include a variety of pathogens, mites and insects, environmental factors and mechanical wounding. The foliar disease, anthracnose, was by far the most prevalent health issue detected across study sites. Common insect and mite pests included the ash bark beetle (*Hylesinus* sp.) and the ashleaf gall mite (*Aceria chrondriphora),* which was also quite common. The ash resource has also been stressed by several years of unusual weather, including summer drought and low winter snow cover. Many ash trees throughout the state showed symptoms of thin crowns with tufted foliage. Lastly, mechanical wounding by hatchets, nails and automobiles/campers on the tree bole were also prevalent throughout all sites.

State Forest Surveys:Trap Tree& Visual Observations

In addition to the visual survey of campgrounds, trap trees were established in order to lure EAB and other ash boring insects which might be present but not easily detected by simple inspection. A total of twenty four trap trees were installed this spring in 10 state forest campgrounds, 1 county campground, and 1 boat landing. Traps were checked every other week from the beginning of June through September. Trees were paired at each location and one of the pair was cut down and debarked in the fall in order to check for wood boring insects. The remaining trees will be cut down next year. Insects were collected from traps but there was ***no confirmation of emerald ash borer at any of the traps during collection or debarking.*** Additional wood boring insects are being processed for identification.

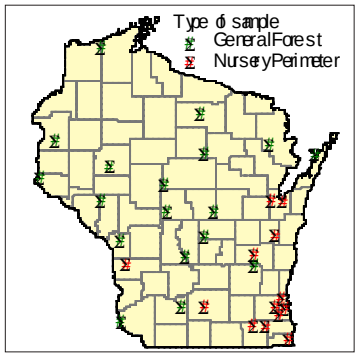
Visual surveys of each of the trap tree sites were also conducted during the summer. The Manitowoc Ferry park area was also surveyed. ***No evidence of emerald ash borer was detected during these surveys.*** A number of declining ash were noted at the entrance area to Long Lake Campground in the Northern Unit of the Kettle Moraine State Forest and at a picnic area in the Bois Brule campground of the Brule River State Forest. Ash yellows was suspected at the Long Lake site and possibly weather-related issues at the Bois Brule site. Ash trees at Point Beach State Forest campground were also showing symptoms of dieback with some mortality in low areas. This may be due to water logging and subsequent root rot. Additional investigations are planned for 2005.

Sudden Oak Death
- *Phytophthora ramorum*

—Since the mid 1990's mortality of several species of oak has been detected in northern California. A new disease caused by a fungus-like organism *Phytophthora ramorum* has been identified and is now know to occur in 14 coastal California counties from Monterey to Humboldt, as well as in Curry County, Oregon.

The origin of this disease is unknown. It causes bleeding cankers on several trees including tanoak, coast live oak, California black oak, Shreve oak, and canyon live oak. Infected trees typically die several years after infection. This disease also causes leaf spots, and branch tip dieback on a wide variety of woody understory species. Pathogenicity tests have shown that northern red oak, Quercus rubra is susceptible.

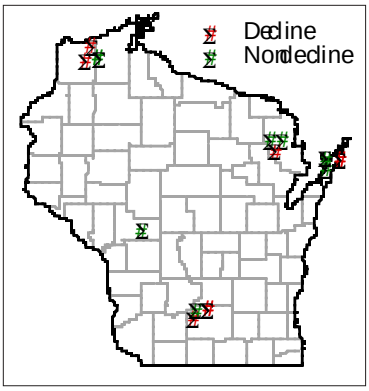
In 2003, plant inspectors found that nursery stock had been shipped from an infected nursery in southern CA to several states, including WI. This prompted a national survey in 2004 of nurseries receiving this stock and the oak woodlands surrounding these nurseries. Dr. Neil Heywood, a UW Stevens Point professor from the Department of Geography & Geology was hired by DNR to conduct this survey. Eighty-one sites were examined and 31 chosen for close inspection. DNR and DATCP cooperated in this effort; DATCP surveyed nurseries and DNR surveyed 13 oak woodlands within 0.25 mile of selected nurseries and 18 additional oak sites throughout the state. Samples (409) included understory vegetation with leaf spots resembling those caused by *P. ramorum* and tissue from bleeding oak cankers. Samples were sent to Ohio State and Mississippi State for analysis. All samples were negative for *P. ramorum*. Wisconsin will continue to participate in the national survey in 2005.



In addition to the planned SOD survey, several reports of oak dieback and mortality were investigated during 2004. A small group of dying oaks on the south side of Minoqua were closely examined and sampled as they showed symptoms of SOD including small bleeding cankers and dieback on red oak. Samples of Rhododendrons from a nursery in close proximity to the dying oaks were also taken. Analysis was conducted by the Wisconsin Department of Agriculture, Trade and Consumer Protection. ***All samples were negative for Phytophthora ramorum.*** The oak dieback and mortality is a result of several years of defoliation by the forest tent caterpillar, drought and infestation by the two-lined chestnut borer. The weeping cankers are likely a symptom of wetwood, a bacterial disease of hardwoods or may be caused by another species of Phytophthora.

Phytophthora Survey
in Healthy & Declining Oak Stands

—In an effort to determine what species of Phytophthora are already present in Wisconsin's forest soils, a survey was conducted of eight oak stands (4 declining and 4 non-declining) as part of a national effort. Soil was sampled at the base of five trees at each site and sent to the Forest Service in St. Paul for processing. Results of the spring collection showed the presence of Phytophthora fungi at 3 of the eight sites (2 declining stands and 1 non-declining stand). The Forest Service has not yet determined the species of Phytophthora present.



A second fall sampling was conducted at all the previous sites negative for Phytopthora in the spring sampling. Replacement sites were found to replace the three positive sites. Results of the fall sampling are still in progress.

Giant hogweed
found in Wisconsin

—Giant hogweed *Heracleum mantegazzianum*, is an exotic plant that is native to the Caucasus region of Eurasia. It was introduced into North America as a garden curiosity in the early 1900's. Since then, it has been observed in Pennsylvania, Maryland, Connecticut, District of Columbia, Maine, Massachusetts, Michigan, New York, Ohio, Oregon, Washington, and now in Wisconsin. This plant was found in two locations in Iron County (Hurley, and Iron Belt) this summer. Giant hogweed looks like cow parsnip, which is native to Wisconsin. However, as the name implies, giant hogweed grows much taller than cow parsnip. It can be 8-14 feet tall and leaves are up to 5 feet across. This plant can cause painful, burning blisters to sensitive people. At this point, we have no data regarding the distribution within Wisconsin other than the two locations in northern Wisconsin. If you find this plant, please contact the USDA Animal Plant Health Protection Service, at 608-231-9553.

Common Pine Shoot Beetle
Quarantine Expanded

—As of July 1, 2004, nine counties were under quarantine in Wisconsin for common pine shoot beetle (*Tomicus piniperda*). Quarantine counties are Dane, Grant, Green,

Jackson, Kenosha, Lafayette, Rock, Sauk, and Walworth counties. A county is designated as quarantined once a beetle is found in the county. Quarantine means that the movement of the following materials is regulated:

- pine shoot beetle in any living stage
- live or cut plants of *Pinus* spp. (larger than 18 inches in height)
- timber or logs of *Pinus* spp. with bark attached
- ornamental foliage from *Pinus* spp.

The movement of the regulated materials from quarantined to non-quarantined counties is prohibited unless they are inspected and certified by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) or USDA Animal and Plant Health Inspection Service (APHIS). Receiving mills (saw and pulp) in non-quarantined counties must have a signed compliance agreement and are not allowed to receive pine logs from regulated areas from April 1 to July 1. Outside of that time frame, mills must process the regulated logs by April of the following season. If you plan to set up a timber sale of *Pinus* spp. in quarantined areas, make sure to avoid the transportation of logs to mills in non-quarantined counties during the restrictive period.

For more information about common pine shoot beetle quarantine regulations and infested areas, please contact the Wisconsin DATCP at 608-224-4573 (transportation of logs within Wisconsin) or USDA APHIS Plant Protection & Quarantine at 608-231-9545 (transportation of logs to out-of-state).

HARDWOOD PROBLEMS

Oak Mortality

Three years of defoliation by the Gypsy Moth, summer drought and infestation by the two-lined chestnut borer has caused mortality of oak on approximately 2,600 acres in central Marinette County (see photo). Mortality began to occur in 2003 and continued in 2004. The average basal area of oak in this area is approximately 80 square feet/acre. Mortality is estimated to be approximately 50% of the oak or 90 trees/acre. Any one of these stress factors would not be expected to cause this level of mortality. The coincidence of repeated defoliation and drought occurring to oak growing on well-drained soil, made the oak more susceptible to infestation by the two-lined chestnut borer. The collapse of the gypsy moth population in 2004, followed by a return to near normal rainfall levels, should limit oak mortality in 2005.

Oak Stressors

Late-Season Leaf Discoloration of White and Bur Oak: Drought/Tubakia Leaf Spot/Two-lined Chestnut Borer

History and Symptoms:

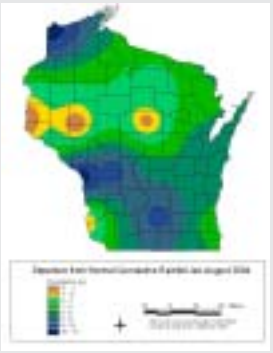
For the past several years, the foliage on white and bur oaks in southern Wisconsin has been turning brown and shriveling up in August and September. These symptoms begin to show in the lower part of the crown and progress upward. By mid-September, a severely affected tree may appear to be dead, with no green foliage. Other trees, less severely affected, may only show symptoms on the lower half of the crown. Usually, these trees will produce foliage the following spring, yet twig and branch dieback and in rare cases mortality may occur.

Potential Causes:

Observations over the past three years have revealed the presence of a leaf spot fungus, *Tubakia dryina*. This fungus has been detected on oak in Wisconsin for many years and can infect all of Wisconsin's native oak species. Typically, Tubakia does not cause significant damage to a tree but does give the tree a "sick" or "unthrifty" appearance. Coincidentally, Wisconsin has been experiencing a drought during the summers of 2001, 2002 and 2003. This drought compromised the health of many trees, including the white and bur oaks. The two-lined chestnut borer, *Agrilus bilineatus*, has been found infesting the top branches of white and bur oaks affected by Tubakia. The combination of drought, Tubakia and two-lined chestnut

Adult two-lined chestnut borer

Abnormal weather in 2004: both good and bad effects



Two abnormal weather patterns in 2004 had both good and bad consequences for forest health in Wisconsin: 1) a 5-6 day period of abnormally warm weather in mid-April along with 2 days of below freezing weather in early May and 2) above normal precipitation (see map) and below normal temperatures (see table) in most of the state this summer. These departures from normal caused unusually active fungal disease problems such as aspen leaf spot, ash anthracnose, as well as a dramatic decrease in the survival of gypsy moth larvae.

	Wausau	Eau Claire	Rhinelander	Madison	Milwaukee
April	0.9	1.7	0.5	1.6	2.0
May	-3.3	-3.4	-3.7	-0.5	-1.1
June	-2.9	-3.1	-2.2	1.2	-2.3
July	-2.5	-1.8	-2.7	-1.9	-2.8
August	-5.0	-5.1	-5.5	-3.7	-3.8

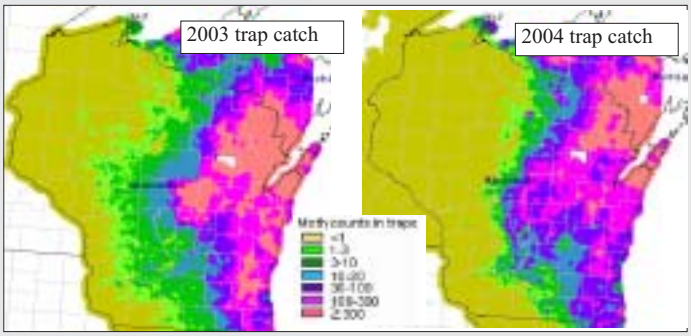
Average departure from normal temperatures for 5 weather stations in Wisconsin in 2005.

Gypsy Moth 2004

(See also oak mortality under "hardwood" section.)

In late 2003, male moth trapping results and egg mass surveys indicated the likelihood of extensive outbreaks and defoliation in the summer of 2004 in northeastern, southeastern and central Wisconsin. Responding to this threat, communities in 20 counties applied to the suppression program. In May and early June, 51,450 acres in 311 blocks were sprayed by small plane: 46,225 acres were treated with the *Bacillus thuringiensis kurstaki* based insecticide Foray and 5,225 acres were treated with the viral insecticide Gypchek. Treatments were successful on all blocks. This success was aided by weather in May and June that was very unfavorable for the gypsy moth. Heavy and frequent storms stressed young caterpillars and encouraged mortality from *Entomophaga maimaiga* and Nucleopolyhedrosis virus. These mortality factors resulted in great decreases in the population across the state. Only 20 acres were defoliated this summer, down from 65,000 acres in 2003. This decline in the population is reflected in the male moth trapping results for 2004 (see map). In 2003, eastern and central counties had large areas where the number of males per trap were in excess of 300 (orange), indicative of a large population which could cause defoliation the following spring. In 2004, however, the area with trap catches this high had shrunk considerably. For 2005, we are expecting some defoliation in Marinette county and upper Oconto county, possibly also in the lower Door Peninsula in favored hosts and in the Fox River Valley cities. Scattered defoliation is possible where male moth counts are above 100 if weather and hosts are favorable.

Entomophaga maimaiga



Aspen leaf spot

Frequent spring and summer rains contributed to necrosis on aspen leaves throughout the state this summer. Infected leaves showed brown flecks with yellow halos to large coalesced black blotches. Severe infection led to premature defoliation, which caused crowns to appear very thin. Samples collected from Dane, Richland, Brown , and Forest counties showed infection by *Marssonina* sp. and *Phyllosticta* spp. These fungi overwinter primarily on fallen leaves. In spring, during wet conditions, spores are released and carried by wind and rainsplash to attack new leaves. This year's wet weather allowed the fungi to continue to produce spores and infect leaves through summer. Heavily infected trees will experience growth reduction. In general, aspen is resilient to defoliation. For healthy stands, a large-scale mortality is not expected from this year's damage. Mortality may occur on already stressed trees.

Ash leaf drop

Sparse foliage and leaf drop on ash trees was observed throughout south-central, southeastern and northeastern Wisconsin this spring. Reports often came with observations that these trees leafed out late, then developed black dead spots on leaves, and leaves started to drop, causing the crown to look even thinner. Two frost events, in early and mid-May, as well as heavy infection by the anthracnose group of fungi were the major causes of ash leaf drop. Late spring frosts can cause developing buds to be injured or die and anthracnose can cause early defoliation. Stress from last year's drought may also have contributed to the sparse leaf-out this spring. This condition was also observed in 2003. In both years, heavily defoliated trees produced more leaves in June and July and the affected trees did not show symptoms of decline for the rest of the season.

borer has overcome some of these oaks and caused mortality. Mortality has not been common but has been observed on ridgetops and south and west facing slopes with shallow soils.

Biology and Management: Tubakia overwinters on infected twigs and leaves. During the summer, spores are produced on this infected material and are spread by wind and rain. Removing and destroying fallen infected leaves may reduce the amount of spores at the local level and be an option for disease management for a yard tree. During the growing season, water oak trees during prolonged dry periods. In the forest, follow forest management practices that reduce stress and favor vigorous crown development. This will minimize the effects of both Tubakia and the two-lined chestnut borer. Controlled burning will destroy infected leaves on the ground and reduce the local source of inoculum but this disease is so widespread in the forests of southern Wisconsin the impact of reducing disease through local control is unknown.

Basswood thrips

—Basswood thrips (*Thrips calcaratus*) populations were low in 2004 but higher than in the last two years. Dramatic population increases occurred between Drummond and Grandview in Bayfield County, and in the Penokee Range in Ashland County. Thrips numbers appear to be rising in the Blue Hills of Rusk County but only small (<10 acres) widely scattered spots of defoliation were observed. A similar pattern of small, scattered spots was seen in Sawyer County between Ojibwa and Winter.

Thinned basswood crowns caused by thrips feeding.

Large Aspen Tortrix

—Large Aspen tortrix *(Christoneura conflictana)* produced tens of thousands of acres of aspen defoliation. Pockets of moderate to near total defoliation ranging in size from 100 to 2,000 acres were scatterred across the entire northern part of the state. Unfortunately, this is occurring just as aspen is recovering from forest tent caterpillar. Growth reductions will probably occur as a result of this defoliation.

CONIFER PROBLEMS

Tortricidae

—This summer, three species insects in the family Totricdae dominated the defoliation scene in northern Wisconsin: 1) Jack pine budworm (*Christonuera pinus*) 2) Spruce budworm (*Christonuera fumiferana*) and 3) Large aspen tortrix (*Christoneura conflictana,* see Hardwood Problems).

Jack Pine Budworm

Northwest Region—Jack pine budworm populations increased across the north producing about 36,000 acres of moderate to heavy defoliation. While almost 2/3 of the defoliation occurred in Douglas County, small pockets (~40-50 acres) of intense feeding were found as far east as Vilas and Oneida counties. Population surveys indicate a real chance for a massive outbreak (100,000 acres or more) in 2005.

West Central Region —Based on egg mass counts from 2003, the jack pine budworm population was on the rise indicating there would be defoliation in several counties in 2004. That did not occur this year. Weather extremes (summer and fall drought in 2003, a cool wet spring in 2004) played a part in the decline of the jack pine budworm population in most counties. However, moderate to heavy defoliation occurred in Eau Claire and Marathon counties. This was the second year of defoliation for the site in Marathon County. Based on egg mass counts, the population has crashed in west central Wisconsin in all areas except Marathon County where moderate to heavy defoliation can be expected again in 2005.

Larval stage of the jack pine budworm

In Adams County, light defoliation of red pine in a 20 year-old plantation is thought to be due to jack pine budworm, because of the type of feeding damage and pupal cases. This phenomena has also been reported in Minnesota. The area will be checked for old egg masses.

Spruce Mortality

—Mortality of white spruce was observed in 2003 on approximately 3,800 acres on the Chequamegon National Forest. Spruce in several of these plantations has shown signs of poor vigor since the late 1980's. These signs include poor diameter growth and premature needle loss on the lower and inner portion of the crown. Investigations by the USDA

Forest Service have shown that the 2002-2003 summer drought including the most recent and defoliation by the spruce budworm in 2003 and 2004 have likely played a significant role in the mortality. The fungal species, *Setomeloanomma holmii* has also been observed on the twigs and foliage of some of the affected trees. The role of this fungus is unknown; it has been associated with spruce needle drop or "SNEED".

Spruce Budworm

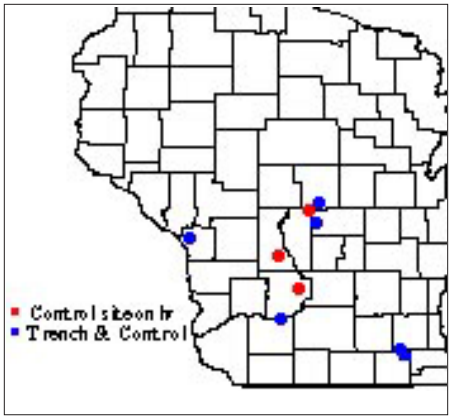
—Spruce budworm (*Christonuera fumiferana*) was also observed feeding on spruce in a few scattered plantations in Sawyer, Price, Rusk and Ashland counties. With the exception of one small (~200 acres) area in Price County, the feeding was confined almost entirely to white spruce plantations.

Red Pine Pocket Mortality

—This year, progress was made on several fronts in studying red pine pocket mortality in Wisconsin. These included:

1. The initiation of a National Science Foundation project coordinated by Prof. Ken Raffa of the Department of Forest Entomology at UW Madison in collaboration with the Dept. of Natural Resources Forest Health Protection Program, and other experts from around the country
2. The second year of a project conducted by DNR forest health staff mapping pocket expansion over time and investigating possible relationships between time of thinning and populations of bark beetles
3. A DNA analysis of *Leptographium* species conducted by Dr. Glen Stanosz of the University of Wisconsin, Madison.

In the first year of the NSF project, several sites were delineated for a root trenching trial (see map in next column). There are 6 sites (blue dots) where both a trenched pocket (roots severed along the outside perimeter of dead trees) and an untrenched control pocket were established. In addition, 3 sites (red dots) will serve as controls only: either in untrenched symptomatic pockets or asymptomatic stands.



Trenching was done in late April of 2004. At the same time, trees within and around the pockets were tagged, their crowns rated and insect traps set up. These traps were then monitored throughout the summer for several species of bark and root beetles.

In 2003, the first year of a project by Forest Health staff to monitor rates of pocket expansion, c. 123 pockets in over 50 stands were mapped. The center of each pocket was located with GPS and each tree was accurately mapped using a rangefinder. Symptomatic trees were then rated as to disease severity and the presence or absence of turpentine beetle pitch tubes. These pockets were revisited in the summer of 2004. New symptomatic trees were noted as was the presence of new pitch tubes. In conjunction with this project, turpentine beetle traps were set up in 2 groups of thinned stands. The first group had been thinned in the summer of 2003 and the second group in February through May of 2004. Traps were set up in early May 2004 but few turpentine beetles were caught. This may have been due to a 6 day period of extremely warm temperatures in mid-April (between 15 and 25 degrees (F) above normal in much of the state), which may have caused the flight season to occur in April before traps were set. This project will be repeated in 2005.

The third project involves the DNA analysis of fungal species involved in pocket expansion. Isolates of possible *Leptographium* fungus pathogens have been obtained from numerous collections of red pine bark and wood supplied by DNR Forest Health specialists. These fungi are being compared with known isolates from culture collections and other researchers around the US. Because morphological characteristics of these fungi can be variable and overlap (making identification difficult), DNA of these fungi is being studied. Particular differences in DNA sequence can provide "markers" for rapid and unambiguous identification of different fungal species. It is hoped that discovery of specific markers will allow clarification of the frequency and abundance of the various *Leptographium* species associated with dying red pines, and help to explain the initiation, distribution, and rate of expansion of red pine pocket mortality in Wisconsin.