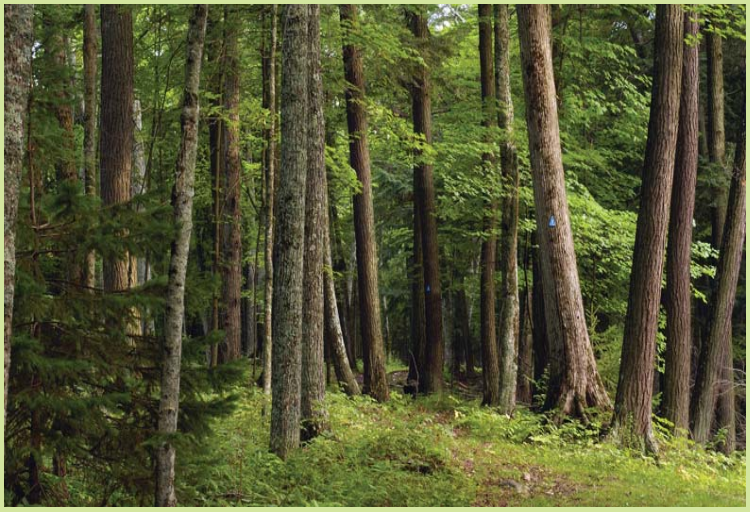
2009 Michigan Forest Health Highlights

In this Issue:

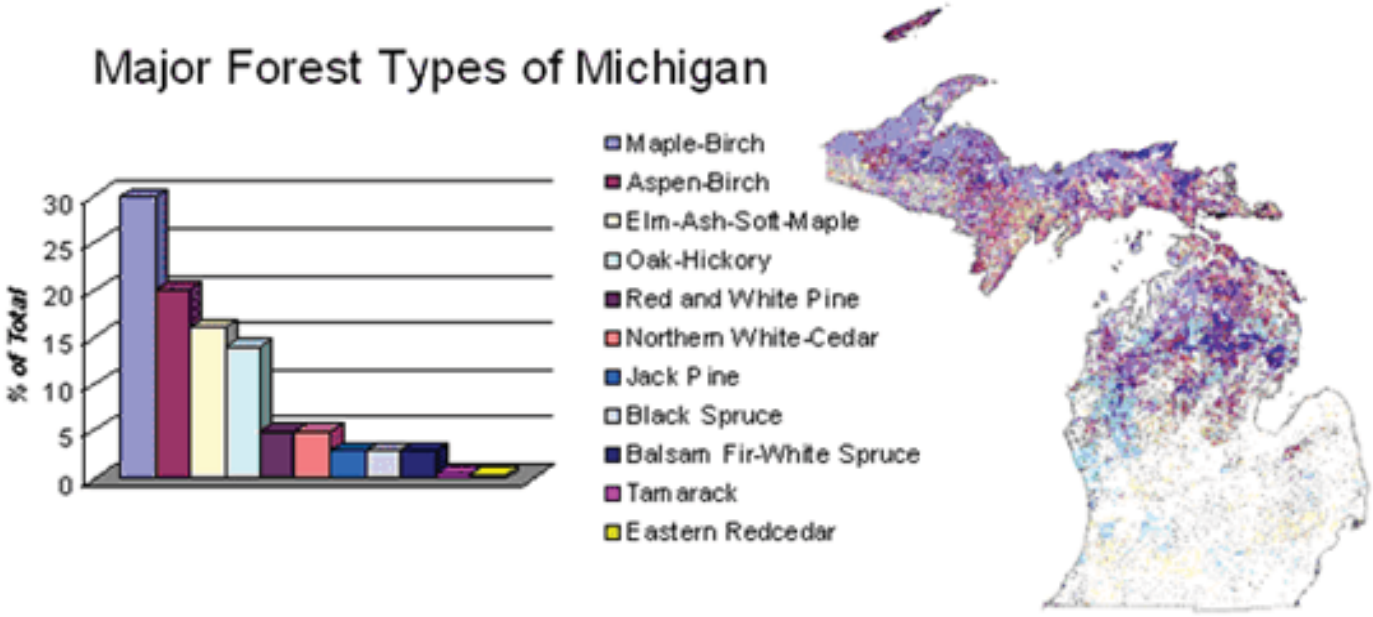


Michigan Department of Natural Resources and Environment
Forest Management Division
www.michigan.gov/foresthealth

Forest Resource Overview

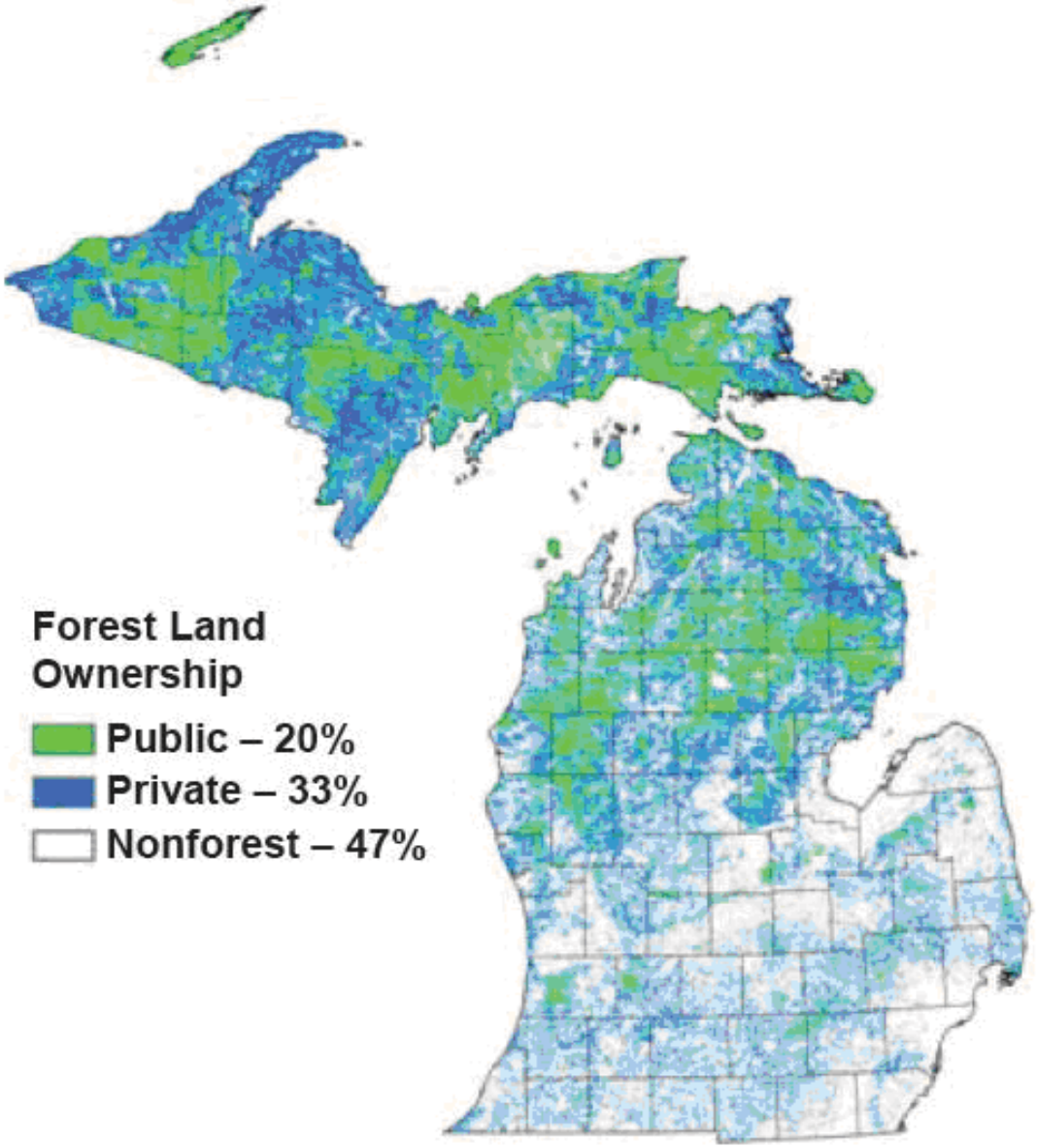
Michigan is a state like no other in the nation with two peninsulas and a large latitudinal span. From the warmer agriculture and urban areas in the south to the colder wooded lands in the north, the State offers unique ecosystems, land uses, and one of the most diverse forests in the United States. Nearly all of the forest land in Michigan was cut and/or burned during European settlement. The bulk of the lumber boom and most of the fires occurred in the late 1800s and early 1900s. By 1920, the lumber boom had ended and secondary succession was in full swing with the recovery of the forests. Since then, these forests have been maturing.

Today, Michigan has more forest land than any other state in the Northeast or Midwest. And, Michigan's State Forests and a number of large private ownerships are certified as practicing sustainable forestry through the Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI). The U.S. National Forests are managed under the National Forest Management Act and National Environmental Protection Act. There also are numerous assistance programs to help small forest-land owners.



Michigan Forest Facts

- Among the 50 States, Michigan ranks 22nd in land area but 10th in forest-land area.
- Forest land accounts for 19.3 million acres or 53 percent of land in Michigan; 97 percent or 18.7 million acres is timberland.
- Sugar maple/beech/yellow birch is the predominate forest type (22 percent of timberland). Aspen (13 percent) is the second most abundant forest type. Northern white-cedar (7 percent) and red pine (5 percent) are the most abundant softwood forest types.
- All prominent species in Michigan have moderate to high percentages of average annual net growth to volume.
- Of Michigan's forest land, 62 percent or 11.9 million acres are owned by families, individuals, private corporations and other private groups. The remaining 38 percent (7.4 million acres) is managed by Federal, State and local government agencies.
- Sixty-five percent of the plots sampled for nonnative species had at least one identifiable nonnative species. Higher percentages of nonnative to total species were evident in the Lower Peninsula. Likewise, the percentage of nonnative-species ground cover to total ground cover was higher in the Lower Peninsula.



Asian Longhorned Beetle Resurfaces in Massachusetts

A serious threat to North American hardwood forests has resurfaced in a big way in Worchester, MA. The Asian Longhorned Beetle (ALB) is an invasive insect which attacks sugar maple and other hardwoods such as horse chestnut, elms and aspen.

The 2008 discovery of a 62 acre ALB infestation in Massachusetts involving thousands of maples is a call for all states to intensify ALB detection efforts.

The Bug

ALB was first discovered in Brooklyn in 1996, entering the USA in infested wooden pallets and crates. To date, ALB has been detected in small areas of New York, Chicago, Massachusetts, New Jersey and Toronto, Canada.

ALB is native to China and other areas of the Far East. It is a large black beetle with white spots on its wing covers. The beetle's body is 1 to1.5 inches long with very long white and black banded antennae. Wood boring larvae develop from eggs deposited in the bark. The ALB larvae tunnel deep into the tree's heartwood. The following summer, the showy adults emerge starting the cycle all over by laying eggs. Emerging beetle leave a large (3/8" diameter), perfectly circular hole as they chew their way out of the tree.

Trees Affected

ALB attacks 11 genera of deciduous trees. Among them are maples, elm, willow, birch, horse chestnut, London planetree, aspen, ash, and mountain ash. Larval tunneling damages the vigor and structural integrity of the tree and can eventually kill trees. The wood of infested trees is not useable for dimensional lumber or hardwood veneer. Also impacted are maple syrup production, ornamental and landscaping trees, and tourism.

Hard maple and aspen alone constitute 27% (7.2 billion cubic feet) of the timberland volume in Michigan. These two species constitute 43% (155 million cubic feet) of the commercial harvests statewide.

Response Strategy

After discovering ALB, U.S. customs regulations were changed to stop introductions of ALB and other wood-infesting pests. These regulations require wooden packing materials entering the USA to be chemically treated or kiln dried. The current goal of the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) is to eradicate ALB wherever found in the United States.

Michigan has been on the look out for ALB since it was first detected in 1996. However, the new find in Massachusetts re-energized early detection and prevention efforts. Public, Industrial, University, MSU Extension and private natural resource professionals, and State and Federal Departments of Agriculture are combining resources to meet this challenge. Many ALB detections have come from the public. Thus, we are continuing to educate Michigan's citizens to recognize ALB. We must also educate the public to limit the movement of firewood. If all firewood would be used locally, our ability to stop the spread of introduced pests like ALB would be greatly enhanced.

2009 Survey Report

No ALB was detected in Michigan in 2009. There was a renewed education and outreach effort by the DNR, MDA and APHIS in 2009. Targeted audiences included natural resource professionals, forest recreation staff and visitors, firewood dealers and users and the general public. Many inquiries were handled including possible detections, many were other showy Cerambycids like the white spotted sawyer.

The nature conservancy provided their member list for an APHIS survey for ALB in Southeastern Michigan. Over 5,000 of their members in the metro Detroit area took part in ALB detection efforts.

The DNR screened its State Park visitor database for visits in the last 10 years from Worcester, MA. We had four visits from ALB infested areas of Massachusetts, two in the Lower Peninsula in Muskegon and Berrien counties, and two in the Upper Peninsula in Chippewa and Luce counties. These sites will be intensively surveyed for ALB in the spring, 2010.

Forest Tent Caterpillar

The forest tent caterpillar (FTC), *Malacosma disstria*, defoliated 368,205 acres of hardwood forest in Northwestern Lower Michigan in 2009 (See map). Defoliation was very heavy in areas around Gaylord, Cadillac, Traverse City and Petoskey.

Widespread outbreaks of FTC occur at intervals of 10 to 15 years. Historically, outbreaks peaked in 1922, 1937, 1952, 1967, 1978, 1990, and 2002. Although statewide areas with high numbers of caterpillars last for 3 to 5 years, outbreaks in any one locality normally last for 2-3 years. Outbreaks normally collapse quickly due to natural causes.

FTC is a native defoliator of a variety of hardwood trees and shrubs. It feeds primarily on sugar maple, aspen, oaks, and birch and will also occasionally feed on other associated hardwoods. Historically, widespread outbreaks of FTC occur at intervals of 10 to 15 years. Population buildups follow drought cycles, especially warm, dry springs. Outbreaks which last for 3 to 5 years normally collapse quickly due to natural causes. Defoliation normally begins in late-May with the greatest leaf loss occurring in the first three weeks of June.

Damage

Defoliation from FTC generally does little damage to tree health. Trees generally develop a second set of leaves after attack if more than 50% of the canopy is lost. These new leaves and leaves formed the year following an outbreak are often smaller. By the second year after the collapse of an outbreak 80% of the trees have normal sized leaves.

Trees rarely die from FTC defoliation alone. However, prolonged defoliation can kill trees if combined with other problems such as drought, late spring frost, or other late season defoliators. Such combined stresses can weaken trees enough to make them more susceptible to attack by other pests. This is the first year of the current FTC epidemic in most areas, so significant impacts on tree growth or mortality are not expected.

FTC Nuisance

During outbreaks, FTC caterpillars can number from 1 to 4 million per acre. They create an extreme nuisance to people living or vacationing in infested forested areas. Young larvae spin a thread and fall from the trees onto picnic tables, patios, and people causing serious annoyance. Mature larvae wander widely in search of food, often migrating in large numbers across roads and open areas.

Mass flights of tent caterpillar moths in late-June to early-July are common during outbreaks. These flights can move millions of moths many miles, creating a nuisance where the flight ends. Mass flights can trigger outbreaks in new areas the following year.

Life Cycle

The FTC overwinters in an egg mass on twigs of host trees. Eggs hatch in the early spring about the time of bud break.

As caterpillars grow, they are easily identified by the white keyhole-shaped or footprint pattern along their backs. As the larvae grow, they consume increasing amounts of leaves and wander widely in search of food.

Once mature, larvae spin silk cocoons with white to yellow threads on vegetation, buildings, and other stationary objects to begin pupation. This begins in mid to late June. Adults emerge 7 to 10 days later. The adult moth has a one-to-one-and-a-half inch wing span, is buff colored and has a broad brown band across the front wings. They are night fliers and are attracted to lights in large numbers. It is common to find high populations in areas where nighttime lighting.

Natural Control

The FTC is a native insect that has evolved in the forest ecosystems of North America. Natural control mechanisms have also evolved which help to keep outbreaks from seriously damaging forested areas. One mechanism that causes population collapse is starvation induced by the caterpillars' feeding. During the early stages of an outbreak, the trees have enough foliage to support the increasing number of caterpillars. After a year of two of complete defoliation, the large number of caterpillars need more foliage than is available. Starvation typically kills 75-95% of the caterpillars. Starvation also weakens the population, making it more susceptible to naturally occurring bacteria and virus. Cool, wet spring weather also plays a role by slowing the development rate of the insects while aiding disease transmission. These forces, along with building populations of a parasitic fly commonly known as the "Friendly Fly", reduce populations to undetectable levels for many years.

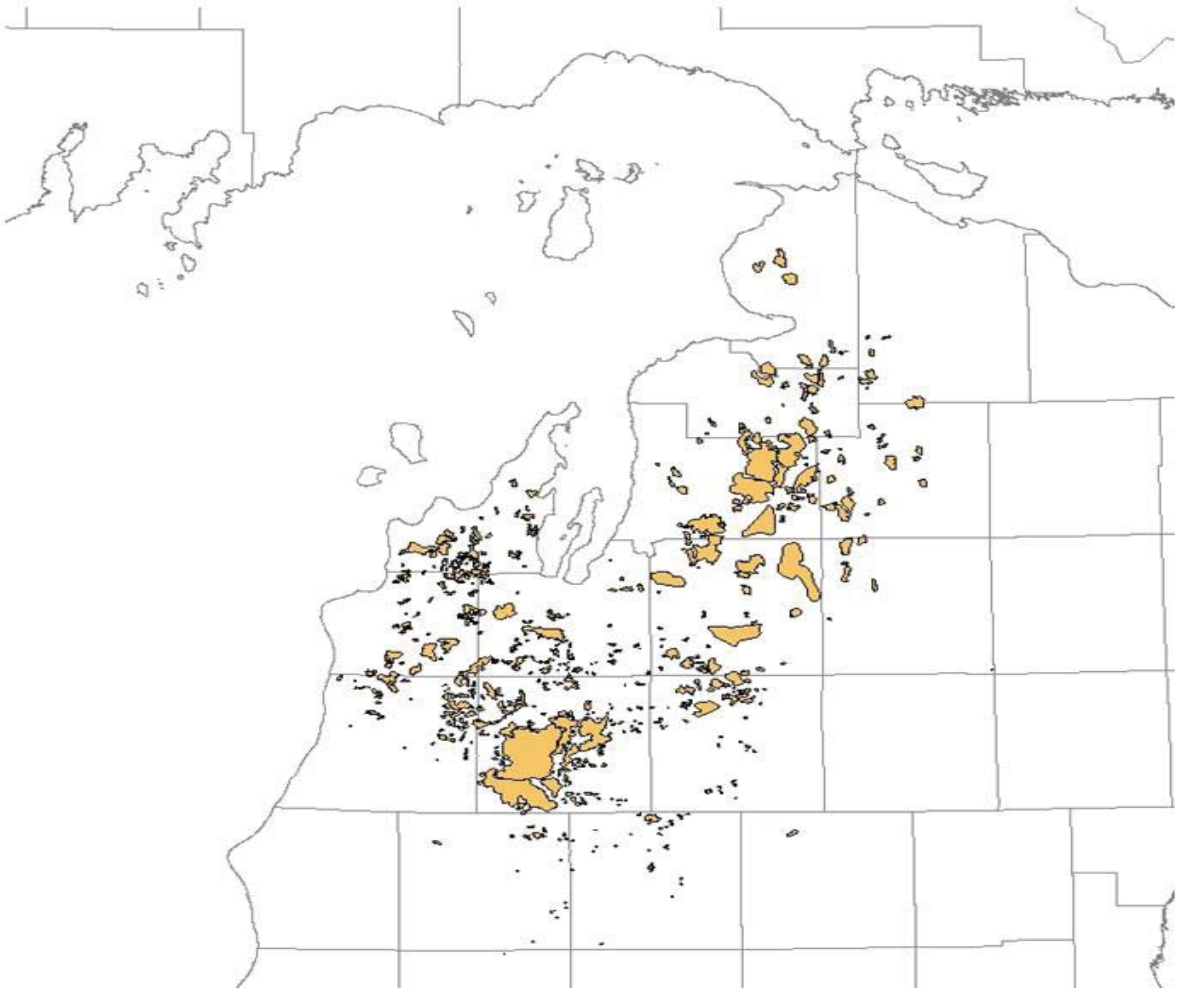
The "Friendly Fly" is a significant natural control occurring near the end of an outbreak cycle. This native fly, *Sarcohpaga aldrichi*, parasitizes FTC pupae in their cocoons. These fly populations often increase as FTC quickly disappears from the landscape. The result is people forget FTC and

focus on this new nuisance. The DNRE is often accused of releasing this very effective biocontrol agent, but the credit…and blame... rests squarely on Mother Nature.

Although tourism and homeowners would receive relief from the large number of caterpillars present in June and the temporary loss of leaves in the forest landscape, the costs are unacceptable. A state sponsored FTC spray initiative is not economically or ecologically responsible. FTC impacts are temporary and primarily just a nuisance. A spray program of this magnitude would unnecessarily impact many non-target species of moths and butterflies. It could also extend the duration of the outbreak by interfering with forces such as starvation and the buildup natural biocontrol agents.

The forest tent caterpillar rarely causes severe damage to trees. The FTC is a native insect, and a part of a natural and balanced ecosystem. The DNRE generally restricts insecticide-spraying operations on state lands to the use of biologically sound products (e.g. Bt or *Bacillus thuringiensis*) and only if outbreaks pose a serious risk to the survival of the forest, or present a significant nuisance in areas of concentrated recreational use. Private landowners may desire and justify spraying to protect the leaves and preserve aesthetics. In making this decision, the landowner should consider goals and environmental concerns.

Forest Tent Caterpillar Defoliation - 2009



Ash Decline and Ash Yellows

Ahead of the advancing emerald ash borer, studies have been undergoing to evaluate the health of white ash stands across Michigan. There have been a number of reports in recent years that white ash trees were developing top dieback and mortality within a period of just a few years.

The ash decline study is designed to determine the following:

- Distribution and severity of ash yellows, root rots and butt rots
- Frequency of these diseases
- Impact of these diseases (tree ring study)
- Risk factors, e.g., climatic, soil conditions and stand management histories

Historically, ash decline periods in the eastern United States have been associated with drought stress, ash yellows, and Cytospora branch dieback. Ash yellows is a disease caused by bacteria that grow in the food-conducting tissue (phloem) of hardwood trees. The disease symptoms usually include narrower growth rings, witches' brooms and epicormic sprouts, sprouts with buds that lack winter dormancy, cracking at the base of the trunk and abnormal patterns of branching. The bacteria are transmitted from tree to tree by piercing-sucking insects but no single species of insect has been implicated. The bacteria do not produce cell walls so they are too fragile to exist on plant surfaces or anywhere outside the interior of the phloem tissue. The disease spreads remarkably slowly in the forest. Forest health surveys of the incidence and frequency of ash yellows were completed during the 1990s in several of the North Central states, using chemical and immunological tests for diagnoses. However, there has been no survey of Michigan for ash yellows, although observations have reported the disease as being present in Ann Arbor street trees. The detection technology for diagnosing the pathogen is now much improved.

The survey of ash yellows in Michigan has been coordinated with emerald ash borer detection tree surveys so that samples could be collected by surveyors as they examined EAB survey trees. Ash 'trap trees' are created by girdling living ash trees, which triggers the release of chemicals attractive to EAB adults. Girdling also stimulates the production of witches' brooms, which were collected and sent to the diagnostic laboratory. Over 1000 ash tree from around the state were sampled and tested for ash yellows. Based on visual symptoms, twenty-seven percent of trees had ash yellows. However, sensitive laboratory detection of the bacterial pathogens diagnosed only 11% as infected. The distribution of the disease was wide in Michigan and also reached into and across the Upper Peninsula. Ash trees from such northern locations in Michigan have not been observed to show the typical disease symptoms, however.

Ash stands that originated on abandoned farm sites were found to generally exhibit from 40-50% ash yellows infection in the central Lower Peninsula (Wexford County). Similar stands in the northern Lower Peninsula (Emmet County) exhibited no ash yellows infection despite presence of positive trees in nearby rural settings. Occurrence of ash yellows in white ash forest stands was not accompanied by presence of sprouts, brooms, basal cracks, or ash yellows-type branching patterns. However, in urban green ash, these symptoms were associated with ash yellows infection. Basal cracks were associated with certain butt rots. Also, crown thinning and decline were not associated with ash yellows infection in the forests but were associated with many successive years of reduced growth prior to visible crown dieback.

Average tree diameter and yearly growth rates were the same for ash yellows-infected and non-infected white ash trees in the Wexford County study area where infection was highest.

Forest white ash trees showed evidence of declining crown size, crown density and live crown ratio, and increasing crown transparency and crown class approximately 3-4 years before mortality, despite 10-25 years of insufficient incremental growth. Michigan white ash decline did not share the characteristics reported in earlier studies of ash decline in New York and northeastern North America. For example, Cytospora cankers and fruiting bodies were not present on branches in declining canopies, nor was ash yellows infection associated with decline. Drought stress from prior years did not appear to be a factor in decline since decline in incremental growth began ten to 25 years prior to our studies.

Soils were similar in texture, structure and nutrition in the sites we studied despite large differences in decline and mortality. The stand exhibiting highest mortality and decline was the only stand with a history of grazing. This stand also exhibited an unusual top layer of root mat on the soil which resembled root mats typical of tropical forests. Further study of the origins of this soil problem is needed to understand its role in decline and mortality of white ash and other tree species.

Root and butt rots were common in stands with little incremental growth for more than ten years. Trees affected with Armillaria root rot had reduced crowns, rapid crown thinning and decline over approximately three years, and often standing death. Wind throw generally occurred after death

Pine Spittlebug and *Diplodia Canker*

Branch flagging and tree mortality of understory white pine have been occurring for four years along the Manistee and AuSable River corridors. The affected area has expanded each year along both the corridors and has also spread to some inland areas in Crawford County. Flagging has been reported to occur on some bigger canopy white pine. Estimates are that this problem has caused 70-90% mortality in the young white pine at the worst locations and has significantly reduced the amount of white pine in other sites.

Terminal twig cankers and small to large cankers are common on individual branches and running cankers have been observed to move into trunks and kill young trees. This year the pine spittlebug has been associated with the origin of the cankers. Competition stress among the crowded understory white pine created conditions for severe pine spittlebug infestations. The nymphs, which cover themselves in frothy spittle and feed on the plant juices in early summer, have caused twig mortality in proximity to the puncture sites. Additionally, adult spittlebugs have been puncturing the bark of branches. Cankers are occurring at the puncture sites. Competition stress and spittlebug infestation has resulted in fungal pathogens entering the puncture sites, particularly on the branches where the cankers coalesce, increasing in size and advancing down the branches.

One of the primary fungi causing the cankers is the pathogen *DIplodia scrobiculata*, known for its shoot blight on pines. This pathogen has been reported on E. white pine in Wisconsin and in Connecticut. *Diplodia* exists as a latent pathogen within a healthy host and several years of pine spittlebug infestation, competition stress, and possibly drought stress have triggered the pathogen. Other pathogenic fungi are also being isolated from the branch cankers and their role in the disease is being assessed.

An unusual feature of the branch cankers has been that many originated under dark olive green lichens rather than on bare bark or under light green lichen species. Lichens are not plant pathogens and the mystery of the association of dark green lichens and cankers possibly is the result of spittlebug behavior. The brown adult spittlebugs are less noticeable on the surfaces of the dark lichens than at other feeding sites.

Measures that could be taken to reduce the pine spittlebug infestation might include removing dead and dying branches and trees to reduce egg laying sites. Thinning the understory white pines to relieve competition stress should help to protect the healthy stands and may be useful in some of the infested stands.

Drought

After 2-3 years of drought, rainfall returned to near normal levels in 2009. However, the effects of the drought are long-lasting. It takes years for trees to rebuild food reserves. The drought has been a major influence especially in the Western Upper Peninsula and areas of the Northern Lower Peninsula. Droughts cause visible declines in tree canopy vigor. Hardest hit are tree species on dry sites with light, sandy soils or on lowland sites with significant water table fluctuations. Drought-stressed trees are susceptible to a host of secondary pests, from defoliators to wood boring insects to root rot fungi. As a result, increases in tree mortality in oak from the two-lined chestnut borer (*Agrilus bilineatus*); in paper birch from the bronze birch borer (*Agrilus anxius*); in larch from the eastern larch beetle (*Dendroctonus simplex*), and in jack and red pine saplings from *Diplodia* and *Armillaria* were more common. Defoliators such as the gypsy moth, linden looper, fall cankerworm and spruce budworm were also epidemic as susceptible hosts became vulnerable to damage due to drought stresses. It will take a few years of normal or higher amounts of precipitation for trees to fully recover starch reserves and return to normal growth patterns.

The Emerald Ash Borer (EAB)

The Emerald Ash Borer (EAB) was detected in two new locations in the Eastern half of Michigan's Upper Peninsula in 2009. The current EAB Quarantine now encompasses eight of the fifteen Upper Peninsula Counties (See Map). For detailed information on the EAB quarantine, visit the Michigan Department of Agriculture (MDA) website at:

http://www.michigan.gov/mda.

The MDA in cooperation with the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS), continue to survey the uninfested counties in the Western Upper Peninsula. They deploy purple traps baited with an aromatic lure knows as Manuka Oil. Traps are placed in and adjacent to high-risk locations such as campgrounds, recreation areas and sawmills and along travel corridors. In addition, traps will be placed in a few Level III quarantine areas in the U.P. (e.g. South Houghton, Alger, and Chippewa counties) near remote, outlying single tree detections.

A pilot project was initiated in 2008 to test the latest research concepts for managing EAB outlier populations. The areas selected for this study include 3 outlier infestations in the Upper Peninsula. The project is called 'SL.A.M' to stand for Slow Ash Mortality. The goal is to employ and carefully monitor and measure the impact of multiple strategies to slow the rate at which EAB expand and impact ash trees. The primary goals of the project include:

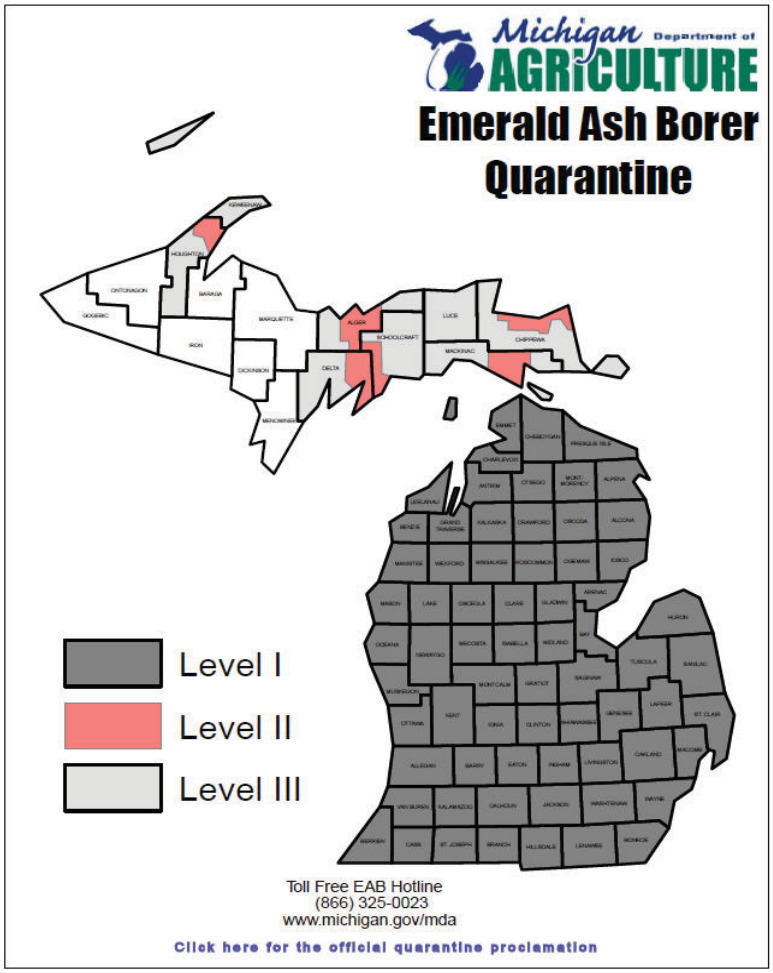
Reducing EAB population growth and rates of tree mortality in the core areas.

Detecting and preventing satellite populations from expanding and becoming core populations.

Developing and maintaining regular communications and consistent messages with the local landowners in and around the project area.

Assisting local woodland owners and homeowners in making environmentally and fiscally responsible decisions regarding their ash trees and woodlands.

The DNRE conducts annual Firewood sweeps in December after closure of the firearm deer hunting season. All hardwood firewood left at State Forest Campgrounds and State Parks is burned. This eliminates the risk of EAB emerging from infested firewood the following spring. During the camping season, Parks and Recreation employees inspect all campers entering state parks. State forest staff conducts random inspections of state forest campgrounds. When found, firewood which is not in compliance with the EAB quarantine and the DNRE Director's order is seized and burned. The Director's order prohibits moving ash wood onto state lands unless that ash is without bark attached.

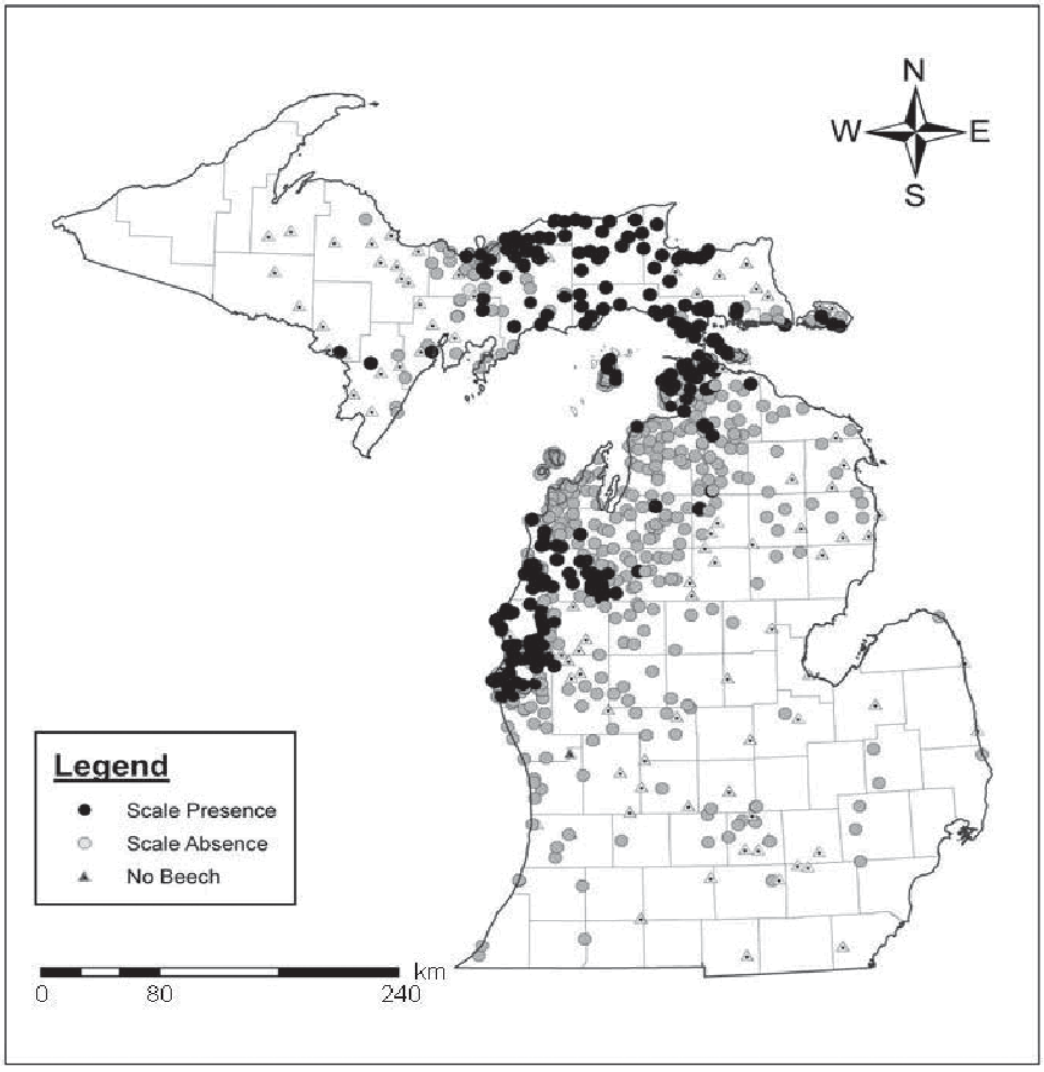


Beech Bark Disease

The DNRE in cooperation with Michigan State University, the University of Michigan and Michigan Technological University continue to monitor the movement of beech scale and the progress impacts of Beech Bark Disease (BBD). The BBD advancing front (e.g. areas infested with scale before fungal infection) continues to spread east and west in the Upper Peninsula and to new areas in the North Lower Peninsula (See map). Isolated, satellite populations of beech scale occur well ahead of the advancing front in both the Western UP and NLP. These outliers are being studied to better understand scale movement to new areas, and colonization rates within stands after arrival.

The USDA Forest Service Research Facility in Delaware, Ohio continues to collect scions from Michigan's resistant trees to study Beech Bark Disease Resistance. These trees resist scale establishment. Without the scale, beech are not susceptible to infection by Nectria species which cause beech bark disease. Beginning in the fall of 2010, Michigan will establish the first seed orchard with BBD resistant stock. The seed from these orchards will be used to restore an American beech component in BBD impacted hardwood forests. The DNRE continues efforts to detect and protect BBD resistant trees.

Michigan Technological University received an USDA Forest Service Evaluation Monitoring grant supporting a systematic survey effort to detect, mark and protect resistant American Beech in Michigan's BBD Advancing and Killing front Areas. This effort will support and cooperate with the BBD Resistance project in Delaware, OH mentioned above.



Gypsy Moth

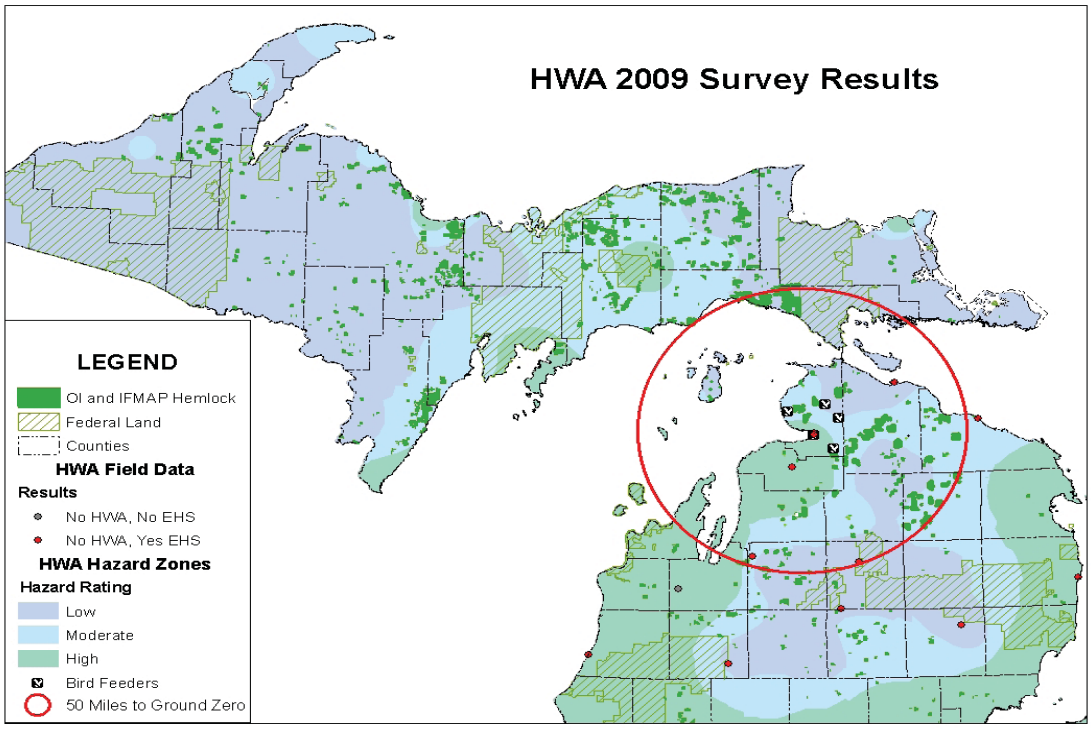
Gypsy moth populations have been declining steadily across much of Michigan's oak and aspen forests in recent years. Caterpillar numbers were high enough in a few areas to be noticeable and to cause feeding damage that could be seen from the ground. Defoliation must exceed 50% to be visible from the air, however, and no gypsy moth defoliation was detected during this year's aerial survey. What has been termed aspen decline was again visible in many areas of the Upper Peninsula. Many of these areas were initially mapped as potential gypsy moth infestations during aerial surveys, but gypsy moth presence was not confirmed by follow-up ground evaluations.

This decline in gypsy moth activity is likely attributable to the insect becoming naturalized. Native to forests in Europe, the gypsy moth was accidentally introduced to Massachusetts in the late 1800's and was first detected in Michigan in the 1950's. Populations spread steadily in the 1970's and, by the late 1980's, hundreds of thousands of acres of trees were being defoliated annually. Since then, a natural enemy complex of native and introduced insect parasites and predators, as well as fungal pathogens and other gypsy moth-specific organisms has become established across much of the state. This complex is responsible for causing outbreaks to collapse and for keeping low-level populations of gypsy moths from reaching defoliating levels for extended periods. In many Michigan forests, gypsy moths now behave like a native insect, with short periodic outbreaks followed by extended periods of low activity.

Hemlock Woolly Adelgids (HWA)

In August 2006, hemlock wooly adelgids (HWA) were found on landscape hemlock trees in Harbor Springs, Michigan. This is only the third time HWA have been detected in Michigan and the first time it has been found outside of nurseries. After determining that the infested hemlock came from a nursery in West Virginia, the Michigan Department of Agriculture conducted trace-back surveys of hemlock originating from nurseries in the region to determine where additional infested nursery stock was out-planted in Michigan.

Elongate hemlock scales (EHS) were introduced



Hemlock Woolly Adelgids (HWA) con't

to the northeastern U.S. in the early 1900's from Japan. Records of this insect exist for Michigan. EHS have been correlated with early stages of hemlock decline in conjunction with HWA. In eastern states, hemlock decline in some areas has been significantly correlated with EHS abundance but not HWA abundance. Also, there is evidence that damaging outbreaks of EHS may be enabled by HWA feeding.

Use high-resolution digital products, including color infrared aerial photography and FIA-derived hemlock basal area surfaces, to determine where forest hemlock occurs in the HWA high hazard zones.

Conduct a stratified, standardized sampling survey to detect HWA and elongate hemlock scale in forest hemlock and in hemlock adjacent to nurseries that sell hemlock in the northwestern Lower Peninsula.

Collect spatial, site and tree information on landscape and forest hemlock for use in validating 30-meter FIA-derived hemlock basal area maps derived by FHTET. These maps will provide the host layer for the HWA component of the new regional and national forest risk maps.

Evaluate the use of bird feeders as a tool for monitoring HWA infestations.

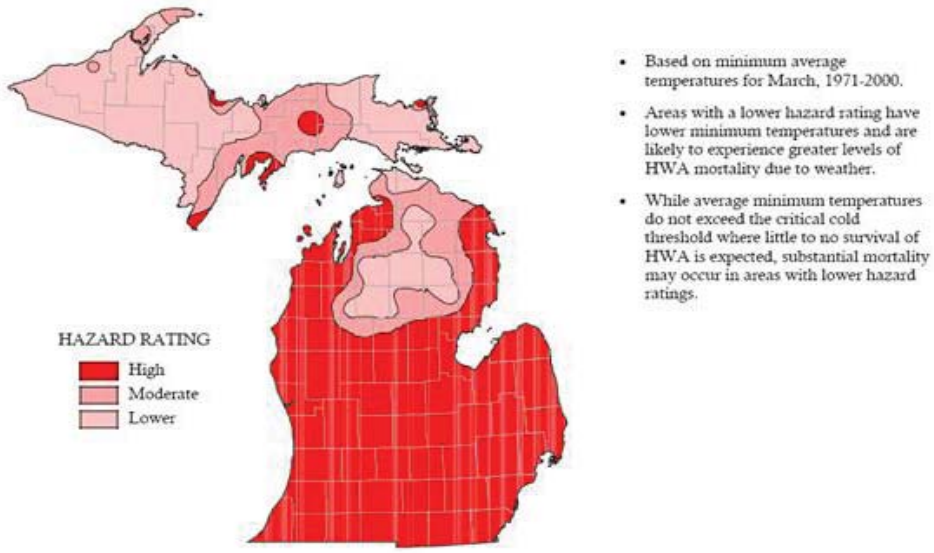
The survey of forest hemlock is based on a standardized sampling method for detecting and monitoring HWA in eastern hemlock forests (Costa and Onken, 2006). Site and stand level information (county, ownership, TRS, GPS coordinates, habitat type, age, stocking) were recorded. HWA Hazard Zones were determined as a function of proximity to the 2006 infested area and by annual over-wintering HWA mortality estimates (Siegert and McCullough, 2006). Hemlock density within the northern Lower Peninsula risk zones were used to determine plot locations, with areas of highest density given highest priority. The plot locations are shown below. A total of 82 plots were surveyed in 2008. The USFS Digital Aerial Sketchmapping System (DASM), a GPS-linked, tablet PC-based moving map display system, and a Trimble Nomad Handheld Computer were used to log the location, site and tree information and HWA survey data.

Bird feeder systems designed to collect HWA crawlers were placed in hemlock trees at five sites in Emmet County, where the infestation was detected. These feeders and associated trees were monitored regularly for life stages of HWA by DNRE and MDA staff.

All surveyed hemlock stands and bird feeder monitor trees were negative for HWA. This is the third season following the initial detection that no HWA have been found in Michigan.

Unidentified armored scales were found on needles of hemlock at several sites. Scales will be collected in 2010 to determine whether they are EHS.

Statewide HWA Hazard Hierarchy



- Based on minimum average temperatures for March, 1971-2000.
- Areas with a lower hazard rating have lower minimum temperatures and are likely to experience greater levels of HWA mortality due to weather.
- While average minimum temperatures do not exceed the critical cold threshold where little to no survival of HWA is expected, substantial mortality may occur in areas with lower hazard ratings.

Invasive Plants: A Framework for Action Adopted

The Department of Natural Resources and Environment (DNRE) adopted Meeting the Challenge of Invasive Plants: A Framework for Action in 2009. Strategic goals set forth in this document encompass a central framework of prevention, early detection-rapid response, and long-term control at strategically prioritized sites. They also include leadership to set direction and empower staff, assessment and research to help identify winnable battles and education and outreach to improve and expand success. Four themes common to all the goals are presented as guiding principles.

- Use best available science and commit to the integration of new information.
- Prioritize treatments based upon values, threat, distribution, and feasibility of control.
- Collaborate with colleagues and partners to find optimal solutions and share resources.
- Monitor to ensure efficient and effective use of resources.

Preliminary lists of priority invasive species, sorted into recommended action categories are presented for Michigan's four major ecoregions to assist decision-making.

Goal one calls for the designation of a Wildlife Division invasive species coordinator and regional point staff to facilitate and coordinate action, assess progress, and set new priorities annually.

Maple Decline in the North Central Upper Peninsula

Maple decline in northern hardwood stands is being observed across the Upper Peninsula of Michigan. It is believed that a combination of edaphic, management, and drought stresses are contributors. Michigan Technological University has been awarded an USDA Forest Service Evaluation Monitoring grant to determine the cause(s) and the rate of progression of decline within effected stands and across the landscape. Forest management practices may need to be altered; short-term and long-term expectations may be revised on some habitat types/soils; and management practices during drought influence periods may also need to be modified.

Pine Bark Beetles

Aerial surveys detected pockets of tree mortality in red pine plantations in several areas of the Upper Peninsula. They were initially coded as porcupine-caused. Field visits found bark beetle (*Ips pini*) caused whole tree mortality associated with porcupine damage. The severe drought of 2006-2007 predisposed porcupine girdled red pine and adjacent pine to bark beetle attacks. Several of the porcupine impacted plantations in areas hard hit by drought were growing on productive sites. No Ips activity was detected in 2009.

Maple Tar Spot

Many Norway maples and varieties of Norway maple (e.g. Crimson King, Schwedler) shed their leaves in September before fall color. This is the second year that leaves of heavily infected trees were covered with tar spots caused by fungi in the genus Rhytisma. A late cold spring and early summer created ideal conditions for spore survival, dissemination and leaf infection. Generally, maples are not overly stressed by this late season loss of leaves.

Oak Wilt

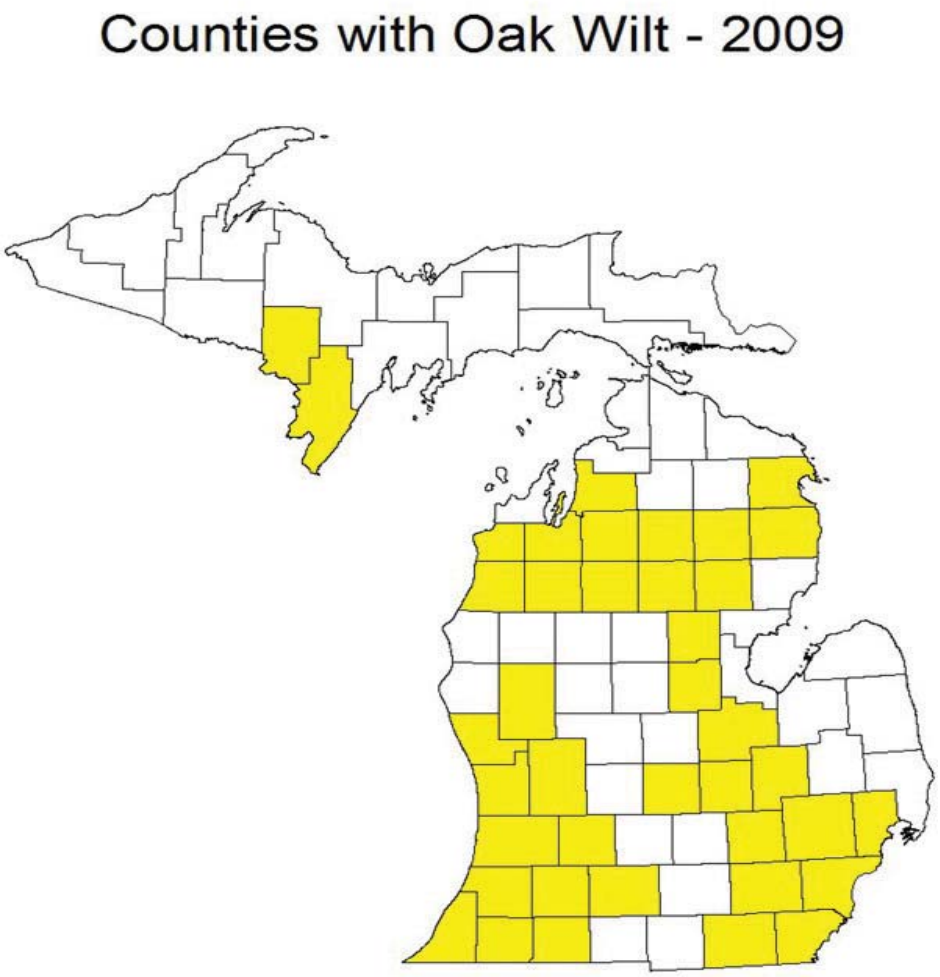
The USDA Forest Service continues to provide ak wilt suppression funds supporting a joint MSU Extension and DNRE effort to rid the Upper Peninsula of oak wilt. Oak wilt has been detected in two counties, Menominee and Dickinson (See map). The objectives of this program are to: 1) remove oak wilt from the UP by detecting and treating all infection centers; 2) educate affected communities to prevent the reintroduction of oak wilt; and 3) demonstrate an approach for detecting and effectively treating oak wilt infection centers throughout Michigan. In 2009, a vibratory plow was used to establish 19,723 feet of root graft barriers to treat 32 oak wilt epicenters. Although much has been achieved, oak wilt is still active in areas of both counties.

The DNRE was awarded ARRA USFS Invasive Species funds to remove oak wilt from infected oak stands on state forest land in Grand Traverse, Crawford and Missaukee counties in Michigan's Northern Lower Peninsula. This will prevent the spread of oak wilt to neighboring oak resources and prevent long distance transmission via the difficult to regulate movement of infected firewood taken from recently killed trees on state lands.

A new initiative to create a national oak wilt database has been joined by DNRE, Wisconsin DNR, Texas Forest Service and the USDA Forest Service, Northern Research Station, St. Paul, MN, and the USDA Forest Service, Forest Health Technology Enterprise Team (FHTET), Fort Collins, CO. The national oak wilt database will have a web based platform supported by FHTET. A draft database design has been agreed upon and an oak wilt confirmation protocol was established to ensure data input integrity. The National Risk Mapping process is also an integral part of the detection and evaluation protocol. Oak wilt risk maps will be used to both prioritize survey efforts and as the database is populated, the data will be used to improve oak wilt risk mapping.

Dr. Gerry Adams, Michigan State University has received a USDA Forest Service Evaluation Monitoring grant to begin detecting, confirming and recording surveys data on the national database. The oak wilt database will serve two needs: 1) an impact analysis needed to project expected short and long-term resource losses; and, 2) operational guidance for prevention and suppression efforts.

Beginning in mid-summer, 2009, Dr. Adams visited reported oak wilt sites to confirm the presence of oak wilt. If sites met the confirmation standards established by the National Database effort, they were mapped and recorded. Most of the 2009 reports and assessments occurred in Roscommon, Crawford, Otsego, Grand Traverse, and Alcona Counties. Sixty-eight epicenters in Menominee and Dickinson Counties which had been assessed in previous years were also included in the oak wilt mapping database.



Oak Wilt con't.

Two-Lined Chestnut Borer (TLCB) and Armillaria: Not Oak Wilt

In Crawford County in Michigan's Northern Lower Peninsula there was a high incidence of mortality of mature northern pin oak. There has generated public concern in this area as the mortality continued to spread over the past three years. The cause was believed to be oak wilt until careful assessment was made as part of the oak wilt mapping project. While oak wilt was occasionally encountered, the past three years of advancing mortality was found to be caused by years of infestation by the two-lined chestnut borer (*Agrilus bilineatus*) and Armillaria root rot. Four successive years of drought on the sandy soils of this region in combination with the over-maturity of the resource predisposed this northern pin oak resource to attacks by these pests. Symptoms included sudden browning and wilting of all foliage in August. The following year it was common to see a single lower or mid-crown branch with green leaves remaining on an otherwise leafless tree. The xylem of the lower trunk remained white and moist until attacked in the late summer by a final infestation of TLCB.

Spruce Budworm

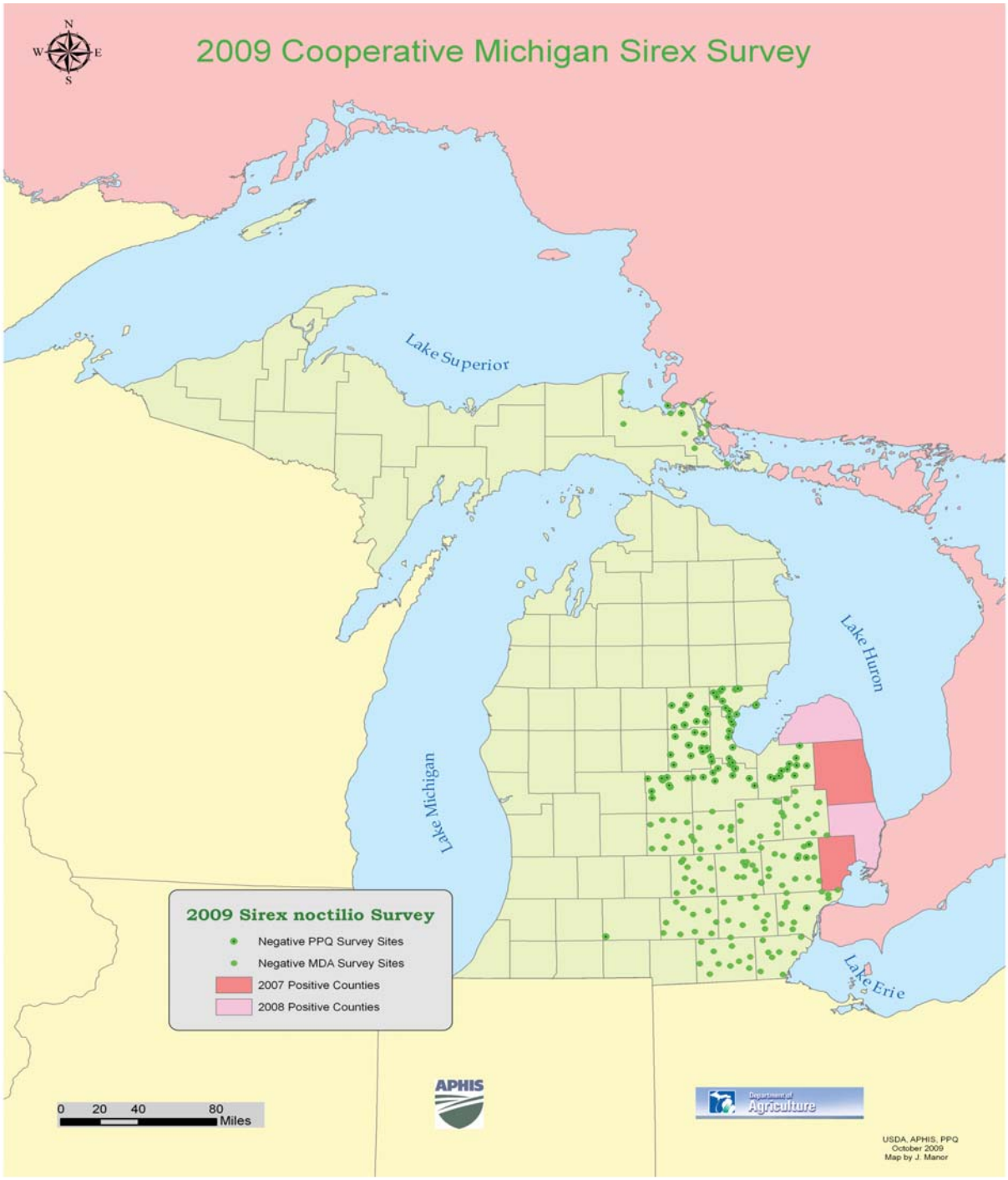
Spruce Budworm (*Choristoneura fumiferana*) is slowly expanding its defoliation of spruce and fir in several counties in Michigan's Upper Peninsula. Isolated areas of mature to over mature spruce/fir in the south central and north central Upper Peninsula have top kill and tree mortality caused by repeated defoliations. The spruce budworm is one of the most destructive native insects in the northern spruce and fir forests of the Eastern United States and Canada. Periodic outbreaks of the spruce budworm are a part of the natural cycle of events associated with the maturing of balsam fir. Balsam fir is the species most severely damaged by the bud-worm in the Lake States. White and black spruces are also hosts with some feeding on tamarack, pine and hemlock. Spruce mixed with balsam fir is more likely to suffer budworm damage than spruce in pure stands.

Sugar Maple Defoliation in the Upper Peninsula – Cankerworms

There were numerous reports of light to moderate defoliation in hardwoods dominated by sugar maple. Observed insects included both the Bruce spanworm, Operophtera bruceata, and the fall cankerworm, *Alsophila pometaria*. Defoliation localized to certain sections in several Upper Peninsula counties. Several counties reported light to abundant fall moth flights in 2009. No hardwood defoliation was visible via aerial surveys.

Sirex Noctilio

Since its detection in New York State in 2004, the European wood wasp, Sirex noctilio, has been confirmed at trap sites throughout the eastern Great Lakes region of Ontario, Canada. This exotic wood wasp (commonly referred to as horntail wasp) is native to Europe, Asia and northern Africa and was collected in Fulton, New York in September 2004. The New York find marks the first time the insect has been documented in North American forests. This wood wasp is rarely a pest in its native areas where it confines its attacks to dead or dying trees. In areas where it has been introduced, however, it is a major pest of pine plantations, where it attacks living trees and can cause up to 80% mortality. Outbreaks often build up in stressed trees and then spread to more vigorous trees. Widespread outbreaks have occurred in Australia, New Zealand, South Africa and South America.



Female Sirex are attracted to stressed trees where they insert their sword-like ovipositors into the outer sapwood, deposit their eggs and introduce a toxic mucus and fungus (Amylostereum areolatum). Larvae feed only on the fungus, which, together with the mucus, kills infested trees.

Symptoms of Sirex infestation include:

- Exit holes approximately 1/8 to 3/8 inches in diameter;
- Tree crowns turning light green then yellow to reddish brown in the late spring or early summer;
- Larval galleries (tunnels) in the wood, packed with a fine powdery frass (insect-produced sawdust);
- Beads of resin or streams of resin on the bark, exuding from holes created during egg-laying.

Pitch or resin will often weep from the tiny puncture wounds made by the adult females when they lay their eggs. The damage can be very subtle or quite obvious and care must be taken in using this symptom as a feature of fresh attacks. In Michigan, most 2- and 3-needle pines are considered susceptible, including Scotch, jack, red and Austrian pines.

The Eastern Regional office of the USDA Animal Plant Health Inspection Service's Plant Protection & Quarantine (PPQ) conducted a Sirex survey in 17 uninfested counties in southeastern Michigan to continue delimiting the spread of Sirex.

Traps were placed in Scotch, red, jack and Austrian pine and baited with 70% alpha-pinene/30% Beta-pinene blend.

New detections of Sirex were made in Huron and St. Clair counties. A single female was caught in St. Clair County and 4 females were caught in Huron County at two different sites. All catches were made in mature Scotch pine and were either single trees or Scotch pine mixed with hardwoods. No detections were made in dense overstocked stands of host material. Positive catches were made between early August and mid September.

Trapping data from across the region indicates that Sirex populations are spreading naturally along the shoreline of Lake Huron to the north after spreading into Michigan from Ontario, Canada.

MTU continues to work on a USDA Forest Service-funded Sirex detection survey. Sites were established in 2007 using groups of 3 to 5 herbicided pine trees. The herbicides cause stress that increases the trees' attractiveness to the wood wasp. Traps are hung from these trees and a subset is cut in the spring to look for larvae of the wood wasp. In addition, funnel traps baited with alpha and beta pinene are placed in the trees.

To determine whether an insect that you have collected is Sirex noctilio, contact the MSU Plant Pest Diagnostic Clinic at 517-355-4536, or your local county MSU Extension office.

For more information about Sirex, link to:

http://na.fs.fed.us/spfo/pubs/pest_al/sirex_woodwasp/sirex_woodwasp.htm

http://www.aphis.usda.gov/plant_health/plant_pest_info/sirex/index.shtml

http://www.treesearch.fs.fed.us/pubs/12997

To determine whether an insect that you have collected is Sirex noctilio, contact the MSU Plant Pest Diagnostic Clinic at 517-355-4536, or your local county MSU Extension office.

Thanks to the following agencies for providing content for this newsletter:
Michigan State University, Michigan Technological University, Michigan Department of Agriculture, USFS State & Private Forestry Unit and USDA APHIS.