



Michigan Forest Health Highlights 2011

Michigan Department of Natural Resources

Acknowledgements

Forest Health Highlights is a summary of the condition of Michigan's forests during 2011 and the work done to preserve and protect them by Forest Management Division, Department of Natural Resources.
www.michigan.gov/foresthealth

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The Michigan Department of Natural Resources is committed to the conservation, protection, management, use and enjoyment of the state's natural and cultural resources for current and future generations.

For more information, visit www.michigan.gov/dnr

Cover photo: Balsam fir in conifer wetlands, Montmorency County.

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Forest Resource Overview

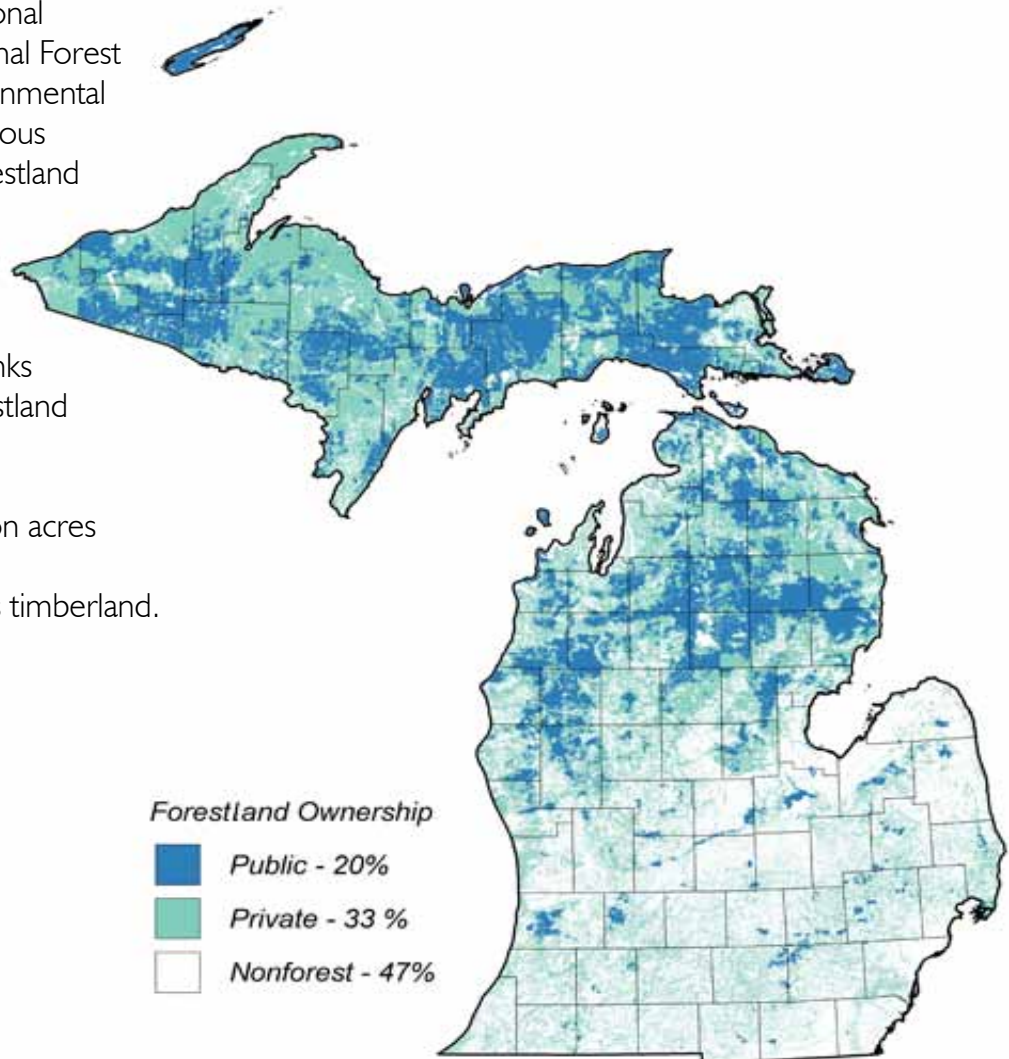
From the warmer agriculture and urban areas in the Southern Lower Peninsula to the colder wooded lands to the north, Michigan offers unique ecosystems and one of the most diverse forests in the United States. Nearly all of the forestland in Michigan was cut and/or burned during European settlement. The 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.

Today, Michigan has more forestland than any other state in the Northeast or Midwest. 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 forestland owners.



The Mackinac Bridge spans the Straits of Mackinac, connecting Michigan's Upper and Lower peninsulas.

- Among the 50 states, Michigan ranks 22nd in land area but 10th in forestland area.
- Forestland 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 predominant 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 forestland, 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.
- 65 percent of the National Forest Inventory & Analysis plots sampled for nonnative species in Michigan had at least one identifiable nonnative species. The Lower Peninsula had higher percentages of nonnative species. Likewise, the percentage of nonnative-species ground cover was higher in the Lower Peninsula.



Insects and Diseases

Healthy and productive forests are comprised of a diversity of native tree, shrub and herbaceous plant species, as well as an even larger number of faunal species for which forests provide habitat. Forested ecosystems have continuously adapted and evolved over thousands of years, as insect, plant, and animal species are naturally, intentionally or inadvertently introduced or extirpated from ecosystems. Prevention and mitigation of invasive plants, insects and disease introductions is important for the maintenance of healthy and productive forests.

From 'Michigan Forest Resource Assessment & Strategy'

June 2010

Heterobasidion Root Disease

With the discovery of *Heterobasidion* root disease (HRD) in the Northern Lower Peninsula this summer, the DNR Forest Health Program has stepped up efforts to determine how widespread the disease is in Michigan. Caused by the fungus *Heterobasidion irregulare* (formerly *Heterobasidion annosum*, which was formerly *Fomes annosum*), this disease is considered among the most destructive fungi in North American conifer forests. While over 200 species of conifer trees are susceptible to the disease, red, white and jack pine are especially vulnerable to attack in the Lake States.



Root rot fruiting bodies

Unlike many forest insects and diseases that are attracted to stands that are stressed due to lack of management, HRD is most commonly found in actively managed forest stands. Fresh-cut stumps provide an ideal entry path for spores of HRD, which move through grafted roots to infect healthy trees. Infected trees suffer from thin crowns and reduced height, diameter and shoot growth. Over time, circular pockets of dead and dying trees mark the progression of the disease. Bark beetles often build up in trees stressed by HRD, hastening the decline and death of affected trees.

Once the distribution of the disease in Michigan is determined, guidelines will be developed to help minimize its introduction and spread. In Wisconsin, where HRD is established across much of the state, infected trees are burned on site to reduce the formation of spore-producing fruiting bodies. Fungicides are also applied to freshly cut stumps to prevent HRD from entering and moving to healthy trees through the root system.



Root rot aerial photo.



Asian Longhorned Beetle

The Asian longhorned beetle (ALB) is an invasive insect that most commonly attacks five genera of deciduous trees: maples, elm, willow, birch and horse chestnut. Other genera are susceptible to ALB but are less commonly attacked.

The 2008 discovery of a 62-acre ALB infestation in Massachusetts involving thousands of maple trees provided reason and momentum to intensify efforts to detect ALB in Michigan. This infestation is currently estimated to affect over 100 square miles of forest.

On June 17, 2011, Ohio became the fourth state to detect Asian longhorned beetle since the insect



Asian Longhorned Beetle on a leaf.

was first discovered

in the U.S. in 1996. ALB has also been confirmed in Ontario, Canada outside of Toronto.

Adult beetles were found in three ornamental maple trees growing in a private vineyard in Bethel, Ohio, 30 miles southeast of Cincinnati. Ohio's governor has signed an executive order restricting the movement of firewood, hardwood logs and host nursery stock out of the infested county to help prevent the spread of ALB.

With ALB found a short four-hour drive from Michigan's southern border, the Michigan DNR has stepped up efforts to detect this destructive forest pest to prevent its establishment here. In cooperation with the Forest Management Division, DNR Parks and Recreation Division surveyors searched for ALB in 35 state parks across Michigan this summer. Surveyors looked for adult beetles, as well as the large (3/8-inch) holes ALB make when they chew their way out of infested trees. No signs of ALB were found.



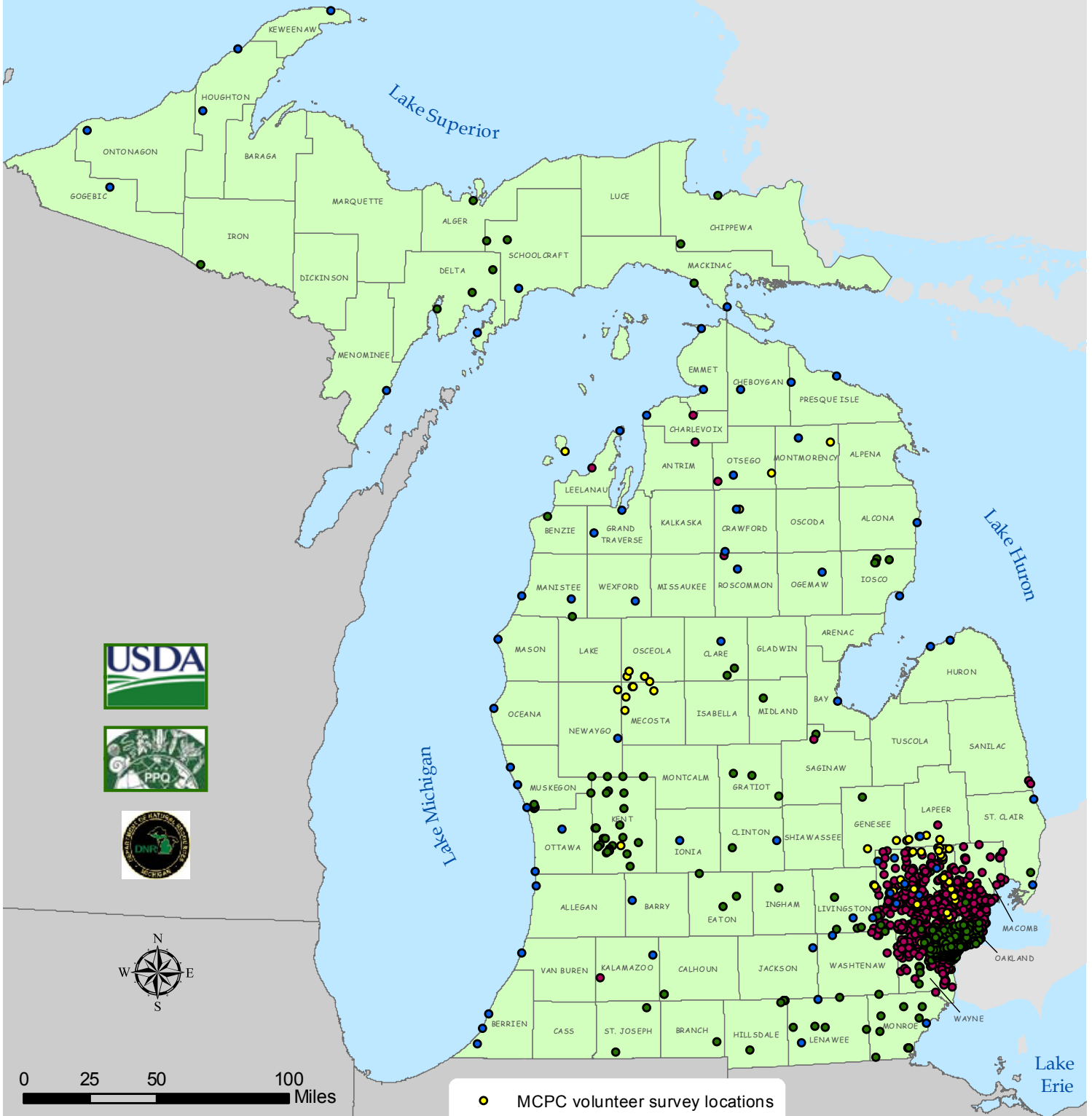
Asian Longhorned Beetle on the cross section of an infested log.

In autumn 2011, a second round of ALB surveys was conducted in these parks. Surveying after leaf fall aids in detecting emergence holes in upper branches, where the ALB first invades trees.



Asian Longhorned Beetle emergence hole.

2009-2011 Cooperative Michigan Asian Longhorned Beetle Surveys



0 25 50 100 Miles

- MCPC volunteer survey locations
- NC member survey locations
- APHIS/PPQ survey locations
- MI DNR 2011 survey locations

Source data: USDA/APHIS/PPQ (2009-2011)
 Nature Conservancy (NC) mail survey (2009)
 Michigan Cooperative Pest Cadre survey (2009)
 State of Michigan DNR (2011)
 December 1, 2011
 map author: dbopp

DISCLAIMER: The U.S. Department of Agriculture's Animal and Plant Health Inspection Service collected the data displayed for internal agency purposes only. This data may be used by others; however, they must be used for their original intended purposes.

Beech Bark Disease

Since its discovery in Michigan in 2000, beech bark disease (BBD) continues to pose a serious threat to Michigan's forests. This disease is initiated by a scale insect that attaches to the tree and feeds on sap from the inner bark layer. Damage from this feeding allows one of two *Neonectria* fungus species to invade the tree. The fungus inhibits the flow of sap, killing infested portions of the tree and eventually killing the entire tree.



BBD-resistant Beech tree planting

Controlling the natural spread of the disease is not an option because both the scale and fungus can be transported by the wind. Michigan Technological University received a USDA Forest Service grant in 2009 to continue surveys to detect and protect BBD-resistant American Beech in BBD-affected forests.

The area of infestation continues to spread east and west in the Upper Peninsula and into uninfested areas of the Northern Lower Peninsula. Spot infestations of the scale insect have been found far outside the primary infestation front.

According to the latest USDA Forest Service Forest Inventory and Analysis (FIA) data for the period 2006-2010, there are 32.5 million American beech trees ≥ 5 " diameter and 2.3 million standing dead beech in the same size category. FIA estimates annual beech mortality in this time period of 8.6 million cubic feet or 103.8 million board feet per year. Much of this loss has been in the Eastern Upper Peninsula where most of the beech resource has been greatly affected. As BBD spreads throughout the Northern Lower Peninsula, the number of live beech trees will greatly diminish.

Since the fungus cannot invade the tree without the scale, researchers are focusing on trees resistant to the scale. The USDA Forest Service Northeastern Research Station in Ohio and the Michigan DNR Forest Management Division have been collecting cuttings from scale-resistant beech. Researchers at the Ohio research facility then graft these cuttings onto beech root stock. Fifteen grafts for each of the 20 resistant trees will be used to establish an orchard of 300 resistant trees.

The seed orchard will be completed in autumn of 2012. In the meantime, 135 beech trees with varying degrees of beech scale resistance produced by this project were planted in the Upper Peninsula in November 2011. This planting was fenced to protect the trees from deer browse. The planting was in a heavily BBD-affected area that had many beech trees lost to BBD. The newly planted trees will be observed for many years to monitor growth characteristics and resistance to beech scale.

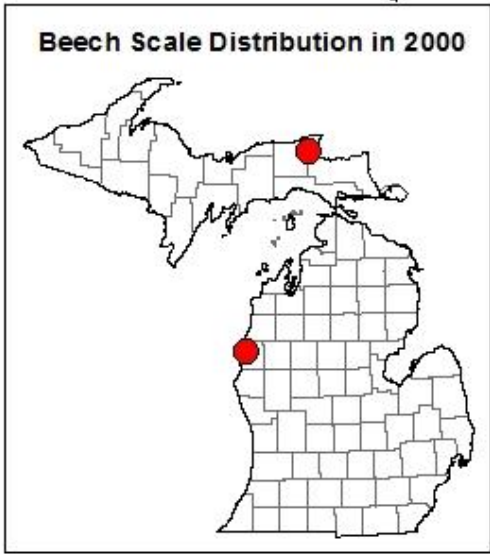
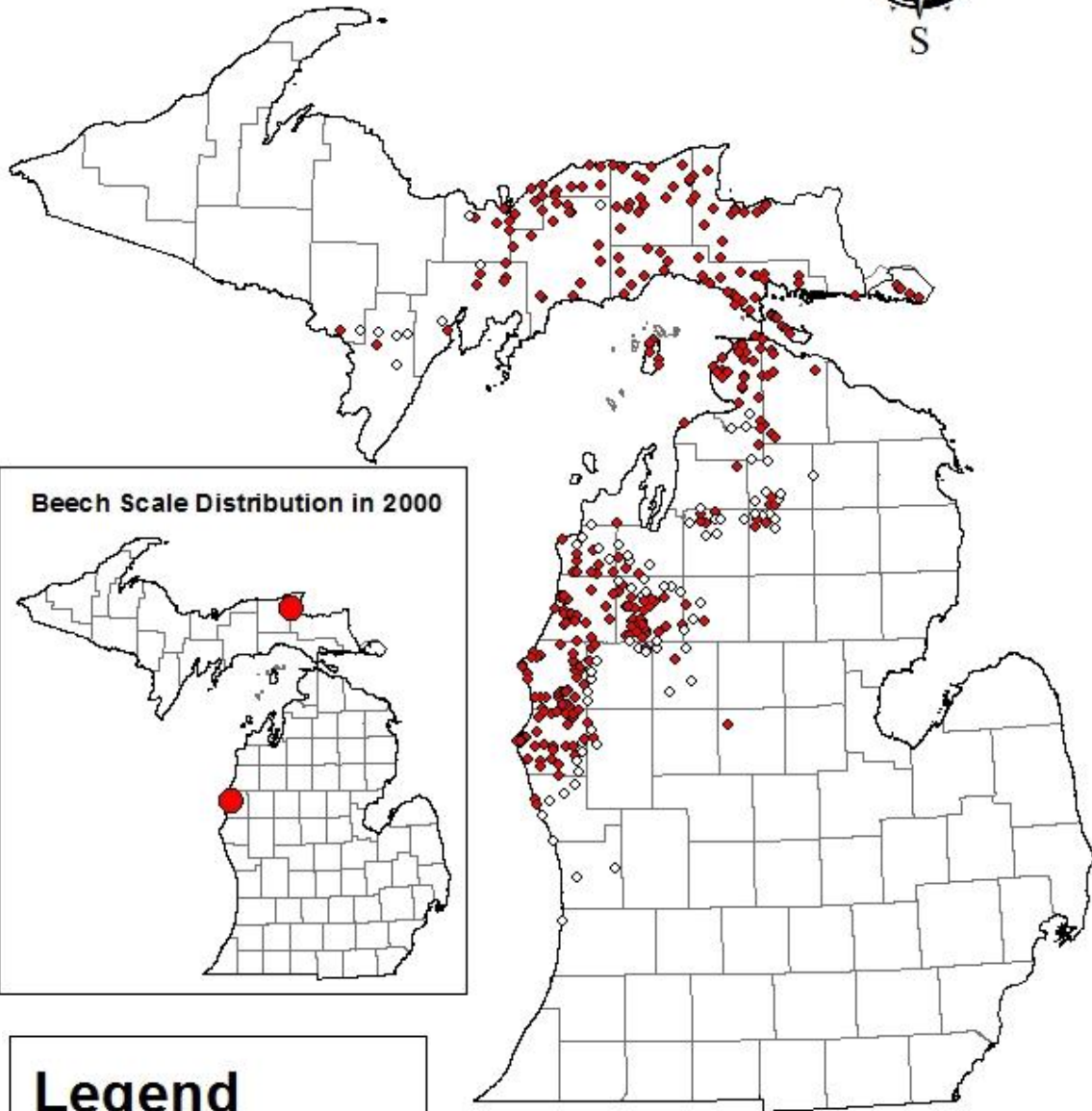


BBD affected area - Luce County

Beech Bark Disease in Michigan

Beech Scale Distribution - 2011

J. Wieferich & D.G. McCullough



Legend

- ◊ Scale Absence
- ◆ Scale Presence



Emerald Ash Borer

The DNR is involved in many projects to survey and prepare Michigan's urban and rural forests for arrival of the emerald ash borer (EAB).

Surveying

No new counties were added to the EAB quarantine in 2011. The Michigan Department of Agriculture and Rural Development (MDARD), in cooperation with the USDA Animal and Plant Health Inspection Service, continue to survey the uninfected counties in the Western Upper Peninsula. They deploy purple traps baited with an aromatic lure known as Manuka Oil. Traps are placed around high-risk areas such as campgrounds and sawmills and along travel pathways. There were no detections in the uninfested, nonquarantined counties of the Western Upper Peninsula. Traps were also placed in a few areas in the Upper Peninsula (Houghton, Alger and Chippewa counties) near remote single-tree infestations.

Slowing infestation

A pilot project was initiated in 2008 to test the latest concepts for managing EAB populations. The project is called SLAM, which stands for "Slow Ash Mortality."

The areas selected for this study include two outlying infestations in the Upper Peninsula. These EAB outliers are in the St. Ignace/Moran area of Mackinac County, and the Laurium area of Houghton and Keweenaw counties.

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.



EAB adult (actual length is 1/2-inch)

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

Three Asian wasps that attack EAB eggs or larvae were released in Southern Michigan in 2007: *Tetrastichus planipennis*, *Spathius agrili* and *Oobius agrili*. All three wasps were released in the Upper Peninsula in 2011 at the Houghton County SLAM sites and an additional EAB site on the Garden Peninsula in the south-central area of the Upper Peninsula.

For more information on SLAM, visit www.slameab.info



Galleries below ash bark made by EAB larvae.

The current quarantine area for the emerald ash borer encompasses all of the Lower Peninsula and eight of the 15 Upper Peninsula counties. There are still areas of the Lower Peninsula, especially the northern areas that have not yet been affected by EAB. So, although it is legal to move ash wood within the Lower Peninsula, it is advised to limit the movement of ash firewood within the Lower Peninsula as much as possible. For detailed information on the EAB quarantine, visit the MDARD website at www.michigan.gov/mdard

During the camping season, DNR Parks and Recreation Division employees inspect all firewood brought in by campers entering state parks. State forestry employees also conduct random inspections of firewood brought in by guests at state forest campgrounds. When found, firewood that is not in compliance with the EAB quarantine is seized and burned. In addition, the DNR conducts annual firewood sweeps in December. All hardwood firewood left at state forest campgrounds and parks

is burned, eliminating the risk of EAB emerging from infested firewood the following spring.

According to the latest USDA Forest Service Forest Inventory and Analysis data for the period 2006-2010, there are 162.8 million ash trees ≥ 5 " diameter, and 15.5 million standing dead ash in the same size category. This number does not include ash on nonforest lands, such as cities and urban environments. FIA estimates annual ash mortality in forested environments of 29.1 million cubic feet or 350 million board feet per year. (This is calculated by comparing 2001-2005 inventory data with 2006-2010 data.)

For more information on the emerald ash borer, visit www.emeraldashborer.info

Forest Tent Caterpillar

Forest tent caterpillar (FTC) activity decreased dramatically across the Northern Lower Peninsula in 2011. FTC defoliation declined from nearly 445,000 acres affecting 23 counties in 2010 to scattered, light defoliation in a few areas across the region this year. Starvation, parasitism by the 'friendly fly' and an increase in a naturally occurring pathogen called nucleopolyhedrosis virus (NPV) led to a rapid drop in forest tent caterpillar numbers after two or three years of activity.



Forest tent caterpillars

Widespread outbreaks of FTC occur at approximately every 10 to 15 years. In the past, outbreaks peaked in 1922, 1937, 1952, 1967, 1978, 1990 and 2002. While statewide caterpillar populations may remain high for up to five years, outbreaks in any one locality normally last for two to three years. Outbreaks decline quickly once parasites and other natural

enemies become active. FTC is a native defoliator of a variety of hardwood trees and shrubs. It feeds primarily on sugar maple, aspen, oaks and birch, but occasionally feeds on other associated hardwoods, particularly during outbreaks.

As this current outbreak winds down across the Northern Lower Peninsula, the effect on trees defoliated during this period is not expected to be serious. Trees rarely die from FTC defoliation unless they have already been seriously weakened by drought, late spring frost damage or other stressors. Consecutive heavy defoliation can reduce growth for a period of time, but trees normally recover within a few years after FTC populations decline.



Virus killed tent caterpillars

Gypsy Moth

Right on schedule, gypsy moth populations crashed across the Northern Lower Peninsula and the Upper Peninsula in 2011, making it difficult to find a caterpillar in the forests across the region. It was a dramatic change from 2010, when gypsy moth defoliated 943,000 acres of oak and aspen trees in 32 counties.

The gypsy moth feeds on the foliage of a variety of hardwood trees, including oak, aspen, willow, basswood, birch and dozens of



Gypsy moth larva

other species. It is common for a population of gypsy moths to defoliate, or eat, most of the leaves off trees. When moth populations are high and competition for food



increases, they will feed on other tree species, including conifers like spruce and pine. Fortunately, trees usually recover from defoliation as long as they are growing well and have adequate water and nutrients available. Even repeated defoliation rarely kills a tree, unless drought, old age or other stressors have weakened it.



Gypsy moth-parasitic wasp.

Gypsy moth populations are expected to remain low for the next several years.

For more information about gypsy moths, visit www.fs.fed.us/ne/morgantown/4557/gmoth

Eastern Larch Beetle

We continue to receive occasional reports of Eastern larch beetle (*Dendroctonus simplex*) effects on tamarack (*Larix laricina*) in the eastern and south-central areas of the Upper Peninsula. This bark beetle became epidemic as tamarack was stressed by the drought of 2000-2001 and repeated defoliations by the larch casebearer (*Coleophora laricella*), which is an introduced needle-mining insect. Casebearer populations collapsed after two years of heavy tamarack defoliation. We do not anticipate any building of

ELB populations given the current condition of the tamarack resource in Michigan. Existing satellite populations of ELB should diminish unless future events such as drought and/or return of the larch casebearer cause significant stress.

Hemlock Woolly Adelgid

The Eastern hemlock is an important component of Michigan's forests.

Based on inventory data, it exists in over 12 percent of the state's timberlands.

The hemlock woolly adelgid (HWA), *Adelges tsugae*, is a small, aphid-like insect.

This insect is native to Asia and was transported to the United States on trees brought into the U.S. from that region. The HWA feeds by piercing small branches of hemlocks and feeding on the sap within. Infested needles turn brown and die. Infested hemlock trees often die within several years. Drought conditions and damage from other insects or diseases can increase the rate at which trees die.

HWA was found on naturally growing hemlock near Harbor Springs, Michigan in August 2006. This is the third time this pest was found in Michigan and the first time the insect was reported outside of nursery stock. It is believed the insect arrived with infested landscape trees that were shipped from outside Michigan. HWA has been attacking Eastern and Carolina hemlock in the Eastern forest since its initial discovery near Richmond, Virginia, in 1951.

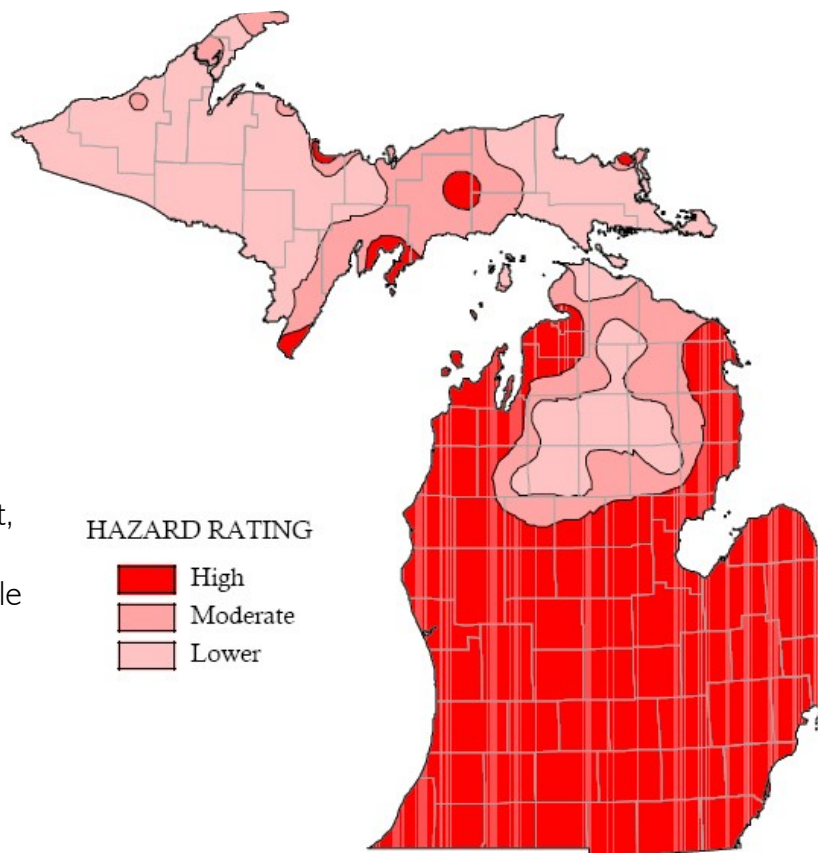
Since 2006, the Michigan DNR and Michigan Department of Agriculture and Rural Development have cooperated in early detection surveys for the HWA. In 2010 surveyors found new infestations on ornamental hemlock trees in three counties: Emmet, Macomb and Ottawa. The infested hemlock trees were destroyed. Surveys of hemlock within one mile of the infested trees were conducted in 2011. No HWA were found. Surveys were also conducted in natural stands of hemlock in high-risk forests in the Eastern Upper Peninsula and in the Northwestern Lower Peninsula. No HWA were found.



The ability of HWA adults to survive in Michigan is a function of minimum overwintering temperatures. Studies indicate that HWA cannot survive temperatures below approximately -10 to -15 degrees F. Because minimum winter temperatures are higher near Lake Michigan, HWA may survive better in hemlock forests in these areas.

Researchers at Michigan State University have developed an HWA risk map that takes into account average minimum winter temperatures across the state. Areas where minimum winter temperatures are highest are at highest risk and where HWA is most likely to survive. These high-risk areas are shown in red on the HWA risk map.

A second insect, the elongated hemlock scale insect (EHS) is believed to increase the damage caused by HWA. This insect arrived from Japan in the early 1900s and has been documented in Michigan. Health decline in hemlocks has been documented in the Eastern forests where populations of EHS are high, but not in Michigan. Some evidence indicates that damaging outbreaks of EHS can occur where HWA feeding is heavy. EHS surveys are being conducted along with HWA surveys in Michigan.



Oak Wilt

Oak wilt (*Ceratocystis fagacearum*) is one of the most serious tree diseases in the Eastern United States, killing thousands of oaks each year in forests, woodlots, and home landscapes.

Oak wilt was first identified in 1944. The extent of its impact wasn't realized until the 1980's. Only in the last few years has oak wilt been reclassified as an exotic disease.

Although oak wilt can infect many species of oak trees, trees in the Northern red oak, pin oak, black oak, scarlet oak, and red oak hybrids are most susceptible. Infected red oaks die within days or weeks of being infected. Members of the white oak group are much less susceptible and rarely die from the disease. Oak wilt spreads from tree to tree through connected root systems. Untreated, the fungus spreads to adjacent red oak trees, often killing large groups of trees within a few years eventually killing all nearby, root-grafted oaks. Oak wilt spores that can spread the disease overland are produced only in the year following tree mortality. Insects move these spores to fresh oak wounds from April through July. Trees, logs and firewood from killed trees produce these spores.



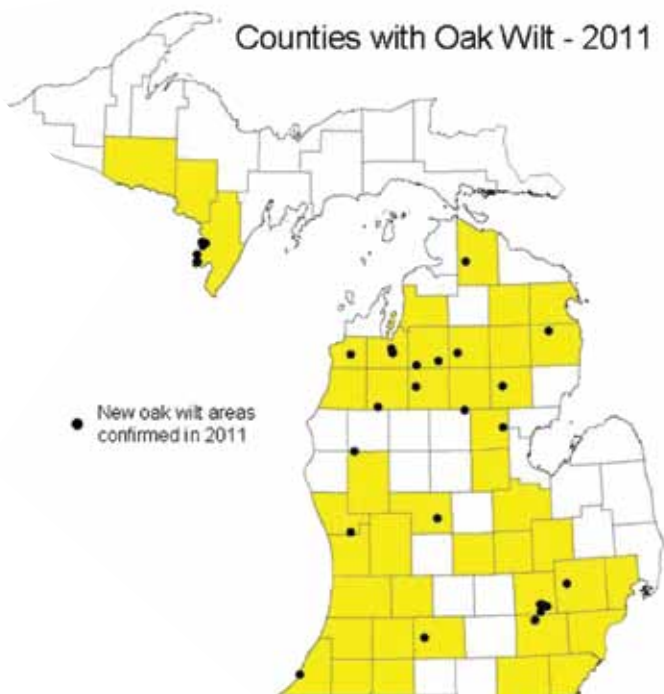
Oak wilt is established widely in the Southern Lower Peninsula with spotty distribution in the Northern Lower and Upper Peninsulas. One method of spread is by movement of firewood, so as the public moves northward into forested areas, the risk of spreading this disease grows. Cut wood is used on camping trips where it can be a source of fungus the following year.

Property values can be significantly reduced due to the loss of many trees when a single tree is infected. Acorns produced by oaks are a valuable food source of wildlife.

More than 180 different kinds of birds and mammals use oak acorns, including popular species such as white-tailed deer, squirrels, turkey, wood ducks, woodpeckers and others.

Effective oak wilt management programs use a variety of strategies to limit the spread of oak wilt.

- Avoid wounding oaks from April 15 to July 15.
- Do not move infected wood off-site without debarking, chipping, or properly drying it. If infected wood cannot be destroyed before the following April, tightly cover cut logs or firewood with plastic tarps from April 15 to July 15.
- Stop the underground spread of oak wilt by breaking root-graft connections between likely diseased and healthy oaks.
- Special plows used to lay underground cable are used to break roots, stopping the underground spread of oak wilt.
- If oak wilt is caught in the year it was newly introduced via overland spread from diseased firewood or logs to a wounded healthy red oak, removing the infected tree and stump removes oak wilt without impacting adjacent oaks.



Oak Wilt Initiatives

The DNR's Parks and Recreation Division purchased a vibratory plow in autumn 2011. This unit will have a vibratory plow blade that can disrupt root-grafts to a depth of 5 feet. It will be used to treat oak wilt infections in state parks, state forest campgrounds and state forest lands. This is a much-needed boost to Michigan's efforts to remove and slow the threat of oak wilt to Michigan's vast oak resources.

The USDA Forest Service did not provide oak wilt suppression funds in 2011. Michigan State University Extension and the DNR had received this funding beginning in 2005 for the purpose of ridding the Upper Peninsula of oak wilt. The objectives of this program were to:

- Remove oak wilt from the Upper Peninsula by detecting and treating oak wilt pockets.
- Educate affected communities to prevent the reintroduction of oak wilt.
- Demonstrate an effective approach for detecting and treating oak wilt throughout Michigan.

Oak Wilt – ARRA Project

As part of a two-year effort, the Michigan DNR received American Recovery and Reinvestment Act (ARRA) funds to identify and treat oak wilt outbreaks in high-use recreation areas and in high-value stands of red oak in the Northern Lower Peninsula. As oak wilt establishes in new areas, spores produced by the fungus increase the likelihood of transmission to healthy oak trees. The risk of movement of oak wilt through spring and early summer wounds and firewood are at historic highs. Early detection and treatment of oak wilt outbreaks in urban, rural and forest landscapes can slow the spread of the disease and minimize the potential effect on Michigan's oak trees.

Through a combination of aerial and ground surveys, staff identified oak wilt on 3,026 acres of state forest land in Crawford, Missaukee, Benzie and Grand Traverse counties. Active pockets of oak wilt were

MSU Extension evaluated past suppression efforts in 2011. Many treated areas in Menominee and Dickinson counties remain free of oak wilt. Although much has been achieved, untreated oak wilt pockets remain. These untreated areas serve as a source of inoculum for the continued overland spread to adjacent oak resources and to more distant areas via movement of firewood and logs.

A second grant from the USDA Forest Service will be used to detect, confirm and record oak wilt in a national database. The oak wilt database serves two needs:

- An impact analysis needed to project expected short and long-term resource losses.
- Operational guidance for prevention and suppression efforts.

defined and trees showing symptoms of oak wilt were marked as potential spore-producing trees. Root graft barriers were established between infected trees and healthy trees using a vibratory plow. Over 7,200 feet of plow line was installed. Infected trees were cut and destroyed or sold for timber. Mills that purchase infected red oak trees process them quickly to insure the disease will not spread to new areas.

Because the fungus can remain in root systems for up to 3 years, treatment areas will be monitored during this period to ensure that the disease has been eliminated.

Spruce Budworm

Spruce budworm outbreaks periodically cause extensive damage and tree mortality in spruce and fir forests across the Northeastern United States and Canada. Balsam fir is the species most severely damaged. Spruce mixed with balsam fir is more likely to suffer budworm damage than spruce in pure stands.

There was a significant decrease in the area of budworm defoliation in 2011. This was a welcome downturn following an alarming increase in the area defoliated by the spruce budworm in 2010. Repeated defoliation of mature and over-mature spruce and fir continues to occur in isolated areas.

The Western Upper Peninsula has the largest area of budworm activity due to the abundance of over-mature spruce/fir forest. Top kill and tree mortality is common in these stands. Periodic outbreaks are part of the natural cycle associated with maturing trees.

Since 1909 there have been recorded outbreaks of the budworm in both the Eastern United States and Canada. These regional budworm epidemics have historically occurred every 30 to 50 years. The last epidemic ended in Michigan in 1982. Outbreaks typically last 10-15 years and result in the loss of millions of trees. Drought cycles over the last decade likely contributed to the 2010 buildup. A return to more normal amounts of precipitation will help restore the vigor of Michigan's spruce/fir resources.

Thousand Cankers Disease of Walnut

In May 2010, the Michigan Department of Agriculture and Rural Development established a quarantine to protect walnut (*Juglans spp.*) from thousand cankers disease (TCD). TCD is an insect-disease complex involving the walnut twig beetle, *Pityophthorus juglandis* and a fungus, *Geosmithia morbida*.



TCD currently occurs in Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Washington and Utah, states where the walnut twig beetles are native. The disease affects only eastern black walnut that has been transplanted in these western states; native walnut species appear to be resistant. Walnut twig beetles carry the fungus to black walnut trees where cankers form at the feeding site. Heavily attacked trees produce many cankers, which eventually kill the trees. It appears that the range of this beetle is slowly expanding eastward, threatening walnut trees in adjacent states. In 2011, Virginia and Pennsylvania were added to Tennessee as states east of the Mississippi with TCD.

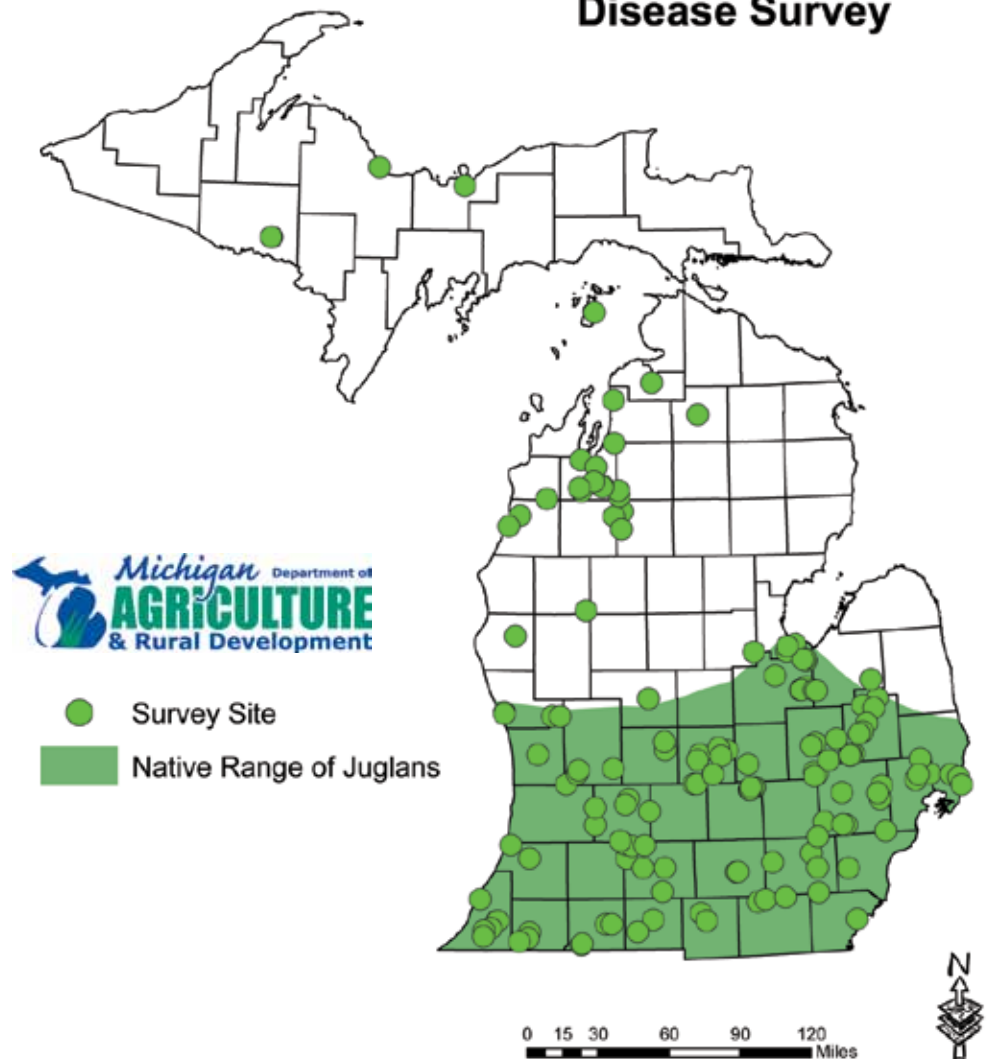
Michigan's quarantine restricts movement of the following from infected states into Michigan:

- All plants and plant parts of the genus *Juglans*, including but not limited to: nursery stock, budwood, scionwood, green lumber; other living, dead, cut or fallen wood, including logs, stumps, roots and branches; and composted and noncomposted chips;
- Hardwood firewood; and
- Any article, product or means of transport that risk the spread of the walnut twig beetle or fungus.

Articles that are not a threat and are exempt from the quarantine include:

- Nuts, nut meats and hulls;
- Processed lumber that is 100 percent bark-free and kiln-dried with squared edges; and
- Finished wood products without bark.

2011 Thousand Cankers Disease Survey



Maple Tar Spot

2011 was another banner year for maple tar spot (*Rhytisma spp.*) across much of the state. Shiny black raised areas on the upper leaf surface of native maple trees, including silver, sugar, red and box elder (yes, box elder is a member of the maple family), were a common sight this summer.

Norway maple, an exotic invasive species commonly found in many parts of Michigan, is also susceptible to tar spot and was heavily infected in many locations. Trees infected with the tar spot fungus typically drop their leaves prematurely. Tar spots on infected leaves produce spores that will infect new leaves next spring if weather conditions are favorable. Maple tar spot infections occur most commonly in years when spring weather is cool and wet.

Fortunately, this leaf disease causes little damage to trees and no control measures are necessary. Interestingly, maple tar spot will not infect trees growing in areas with high concentrations of sulfur dioxide, an air pollutant produced by burning coal and oil. So, you can breathe a little easier next time those spots show up on your maple trees!



Forest Decline

Forest decline refers to a gradual loss of tree growth and vigor. Declining trees often have some combination of off-color leaves, early leaf drop, poor growth and dieback of twigs and branches. This condition usually progresses slowly over several years. During this time trees may be susceptible to some combination of insect attacks, diseases and adverse weather conditions like drought and late frosts. These stressors can further reduce growth and may increase the likelihood that the tree will die.

Following is a section on the contribution of past drought years to many of Michigan's forest declines, and sections describing observed declines of aspen, hickory, maple, oak and white pine.

Drought

Following the 2006-2008 drought, rainfall returned to near normal levels beginning in 2009. Areas in the Western Upper Peninsula, however, continued to experience moderately dry conditions in 2011. Although we are in the third year of near normal rainfall, it takes years for trees to rebuild food reserves. The drought has been a major influence on tree health, especially in the Western Upper Peninsula and parts of the Northern Lower Peninsula, which saw consecutive years of extreme drought.

Droughts can trigger significant declines in tree canopy health. Hardest hit are trees that grow in light, sandy soils or on lowlands exposed to significant water table fluctuations. Drought-stressed trees are susceptible to a host of insect pests and diseases. Oak is affected by the two-lined chestnut borer (*Agrilus bilineatus*); paper birch is affected by the bronze birch borer (*Agrilus anxius*); larch is affected by the Eastern larch beetle (*Dendroctonus simplex*); and jack and red pine saplings are affected by *Diplodia* and *Armillaria*.

Aspen Decline

Aspen decline continues to be reported in many areas of the Lake States. The first reports were recorded in 2008.

Observations include:

- Thin crowns with small leaves; and
- Increased rates of top kill and tree mortality.

These problem areas occur in pockets, likely corresponding to aspen clones, site conditions and/or older clones. A similar decline in aspen was observed after the extreme 1976-77 drought. Other observed pests included *Armillaria* root rot, the bronze poplar borer (*Agrilus liragus*) and *Septoria* leaf spot (*Septoria musiva*).

Mortality of larger aspen is often associated with *Hypoxylon* canker. Significant periodic defoliation by the forest tent caterpillar, gypsy moth and the large aspen tortrix in the last decade has also contributed to this decline in aspen vigor and overall health. The aspen leafblotch miner (*Phyllonorycter apparella*) and *Septoria* leaf spot discolored aspen canopies in many parts of the state in 2011.



Poplar borer



Decline of aspen caused by some combination of disease, insects and environmental stresses.

Hickory Decline

Decline and death of bitternut hickory, *Carya cordiformis*, was reported in Michigan for the first time in 2010. Hickory decline has been reported in several northeastern states and Wisconsin for the past six years. The decline is characterized by thinning crowns with small, yellow leaves. This problem has historically been attributed to outbreaks of the hickory bark beetle, *Scolytus quadrispinosus*, during extended periods of drought. Recently a new fungus, *Ceratocystis smalleyii*, associated with the bark beetle is causing numerous bark cankers. The cankers impair the tree's ability to transport water and nutrients.

In 2010, decline in hickory was detected along the Menominee River in Southwest Menominee County. No new areas of hickory decline were reported in 2011.



Cankers underneath the bark of an infected hickory.



Defoliation of hickory trees.

Maple Decline Increases in the Western Upper Peninsula

Maple dieback has been reported for the last few years in Michigan's western Upper Peninsula and continues to be investigated by Michigan Technological University. On 118 monitoring plots established across industry, state and federal lands in the Upper Peninsula, northern Wisconsin and eastern Minnesota, the average sugar maple dieback level increased from just over 12 percent in 2010 to 16.5 percent average dieback in 2011. A vigorous sugar maple stand should have less than 10 percent average dieback. Information continues to be processed on growth rings, climate, management, soil and foliage nutrients, and other

potential factors associated with historical maple dieback in other regions. Initial findings from foliar nutrient analyses suggest imbalances in some nutrients compared with levels reported in the literature.

Research will continue to investigate these factors and monitor the progress of maple dieback in the region, with the ultimate goal of incorporating findings into management plans to prevent loss from maple dieback in northern hardwood forests.

White Pine Decline

Dieback and mortality of understory white pine continues to expand in the north-central Lower Peninsula. First detected in 2006, this decline is associated with white pine growing underneath oak and aspen trees on sandy soils adjacent to the Au Sable and Manistee River corridors.



Pine spittlebug

Branch flagging and dieback appear to be associated with stem cankers, often found below lichen attached to the affected branches. To date, two fungi – *Diplodia* and *Therrya* spp. – have been isolated from these cankers.

In addition, feeding scars caused by the pine spittlebug, *Aphrophora parallela*, are commonly found on trees suffering from dieback. While populations of pine spittlebug were noticeably lower in 2011 than in previous years, symptoms of white pine decline described above were widespread.

Further research is needed to determine the role of pine spittlebug damage and the fungal pathogens associated with this problem, and to assess whether drought and other stressors are predisposing white pine to this decline.



The needles and branches on this white pine are dying.



Canker underneath the bark of a white pine.

Invasive Plant Projects

The existence and health of Michigan's natural places depends on controlling the introduction and spread of invasive plants. Invasive species are foreign to the ecosystem and are likely to cause economic, environmental or human harm.

American Recovery and Reinvestment Act



In 2010, the Michigan DNR contracted the inventory and removal of invasive plant species from four forest areas with funding provided by the American Recovery and Reinvestment Act (ARRA). The four sites were: Maxton Plains Alvar (Chippewa County), Shakey Lakes Oak-Pine Barrens (Menominee County), Van Etten Floodplain (Iosco County) and locations along the Au Sable River (Crawford and Otsego counties). Staff identified many species of invasive plants, including: spotted knapweed, purple loosestrife, common mullein, St. John's-wort, Canada thistle, leafy spurge and white sweet clover.

In some locations, native species listed as rare, threatened or endangered were also found near the invasive species, requiring special care in planning and removing the invasive plants. Rare, threatened or endangered species encountered include: prairie dropseed, false pennyroyal, downy oatgrass, Cooper's milk vetch, calypso orchid, Hill's thistle, Richardson's sedge, bulrush sedge, flattened spike rush, prairie avens, Alaska orchid and small skullcap. The surveys were completed in 2010.

The DNR completed treatment and removal of the most serious invasive plants at these four sites in the summer of 2011. Various control methods were used, including hand pulling and disposal, hand swiping with herbicides, and spot sprays targeted at individual plants and small groups of plants. Directed herbicide sprays were used to protect native, rare, threatened and endangered plant species. Special care was taken within 25 feet of rare, threatened and endangered species to ensure that these plants were not harmed. The DNR will continue to monitor the treated areas in the upcoming years to determine effectiveness of these treatments.