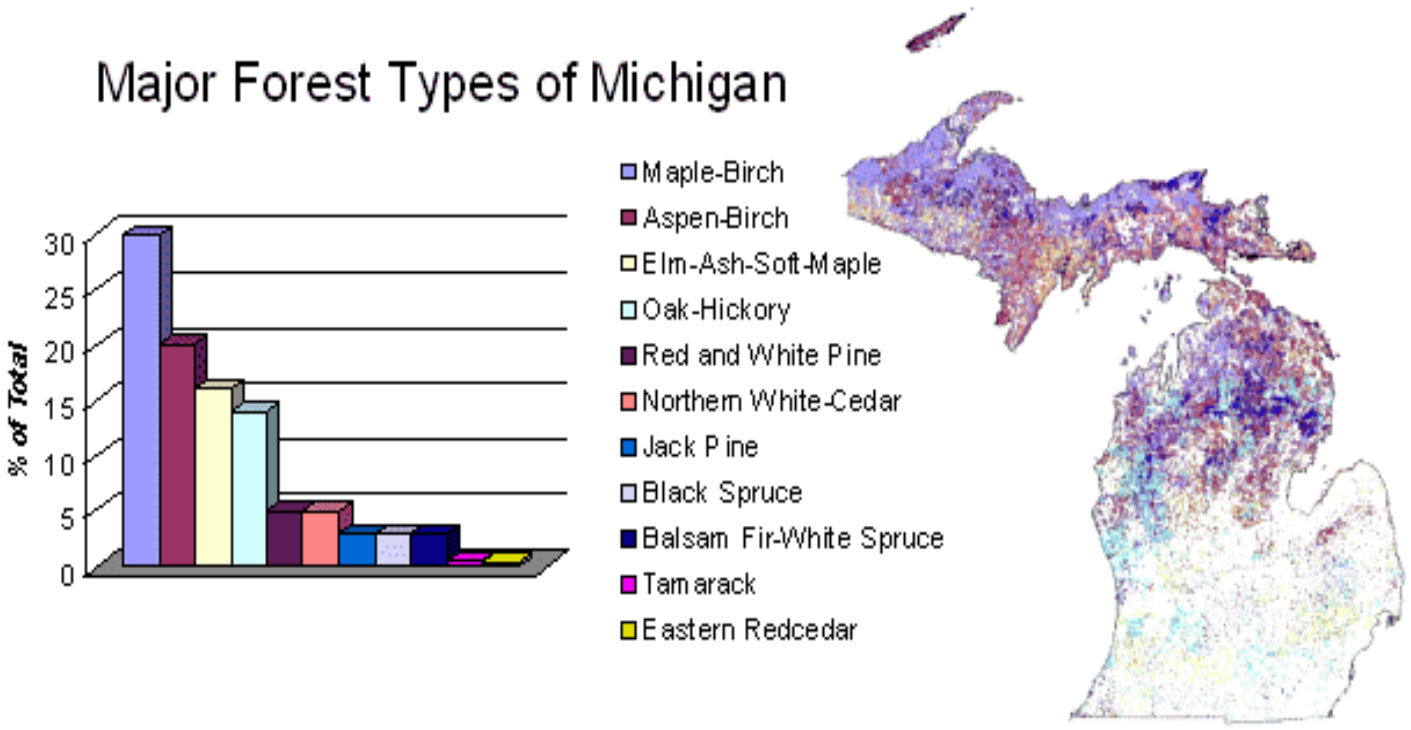
2007 Michigan Forest Health Highlights

Inside This Issue.....

Resource Overview Forests comprise 53% of the land area of the state, or about 19.3 million acres. These forests are a critical component of Michigan's environment and economy for the recreational opportunities and the products they provide. Forestry related industries and manufacturing employ 150,000 people statewide and annually contribute $9 billion to the state's economy. Additionally, forest-based tourism and recreation support 50,000 jobs and add $3 billion to Michigan's economy. Michigan's forests contribute to clean air and water and reduce soil erosion.

Prepared by Forest, Mineral & Fire Management Division



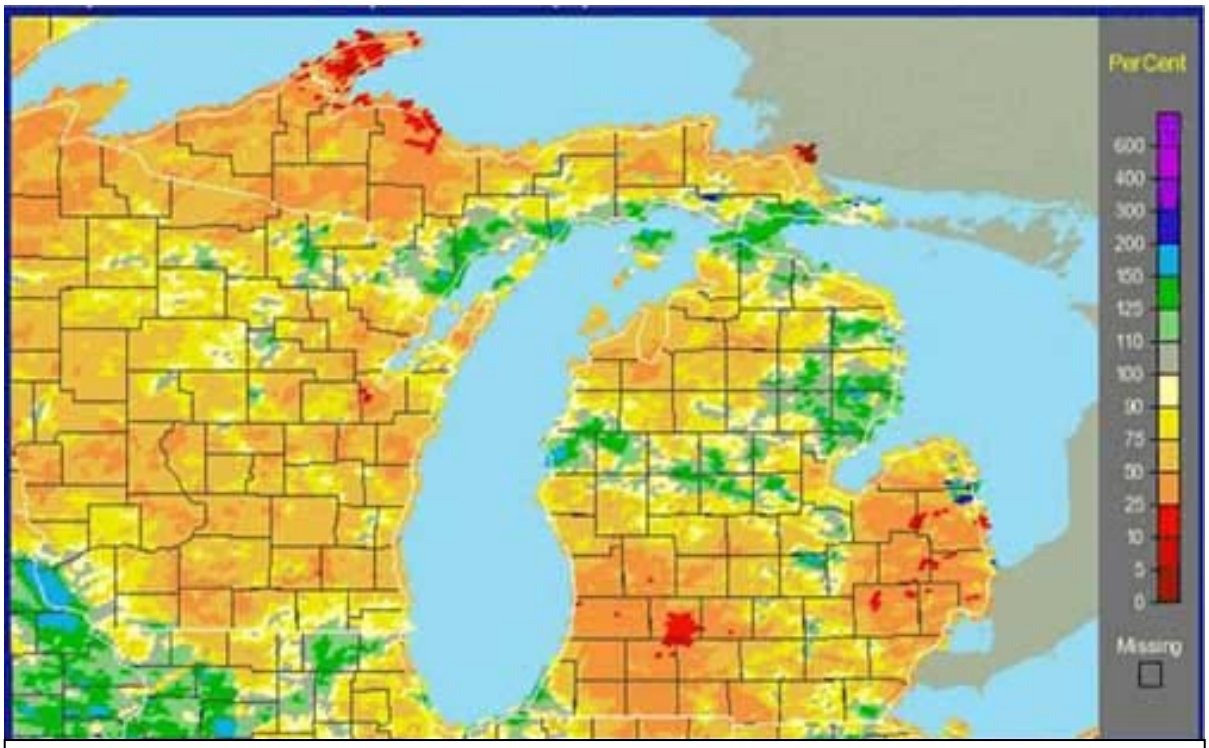
FEATURE ARTICLE

Drought continues to affect the health of Michigan's forests. Many already drought stricken areas received only a fraction of normal precipitation in 2007. Precipitation totals across the state as estimated by National Weather Service radar are shown on the map below. The areas of greatest precipitation deficits were southwestern and eastern Lower Michigan and the western Upper Peninsula, where rainfall totals remained less than 25 percent of normal. In some areas of the state, the month of July was one of the five driest on record.

The Palmer Drought Severity Index depicts areas of long term precipitation surpluses and deficits. This index as of August 4, 2007 placed the entire U.P. and many areas of Lower Michigan in "Severe" and "Extreme" drought categories.

Prepared by Forest, Mineral & Fire Management Division

The effects of the drought are long-lasting. It takes years for trees to rebuild food reserves. The drought has been a major influence causing declines in susceptible tree species, especially when growing on dry sites with light, sandy soils or on lowland sites with significant water table fluctuations. Declining 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 in 2007. Defoliators such as the gypsy moth, linden looper, fall cankerworm, jack pine budworm and spruce budworm were also epidemic as mentioned in other sections of this report.



Percent of normal precipitation between June 2 and July 31, 2007
Precipitation values are based on National Weather Service Stage III precipitation estimates (courtesy of the National Oceanic and Atmospheric Administration).

Prepared by Forest, Mineral & Fire Management Division

Annosum root rot (*Heterobasidion annosum*), a serious disease of red pine in the eastern United States, occurs in Michigan but has never been detected north of Lansing in the south-central Lower Peninsula. Root decay from this disease often kills infected conifers; infected trees that survive grow more slowly and are susceptible to windthrow and bark beetle attack.

Surveys conducted in Wisconsin in 2006 detected the disease in red pine stands at latitudes found in the Northcentral Lower Peninsula. The Michigan Forest Health Monitoring Program has stepped up detection efforts in northern Michigan to determine whether Annosum root rot is present. Recently harvested stands are at particular risk since fresh stumps provide an entry route for the fungus. Once established, the disease spreads to adjacent trees through root contact.

Symptoms are similar to those exhibited by bark beetle-infested stands: pockets of dead trees, top-down dieback and thin crowns. Conks (mushrooms) and pocket rot on decaying stumps and roots can occur, but can be difficult to identify in the field. Also, bark beetles are often attracted to trees stressed by Annosum root rot and can make diagnosis of the primary cause of decline difficult.

More information is available at:

http://na.fs.fed.us/spfo/pubs/fidls/annosus/fidl-ann.htm

If you come across conifer stands exhibiting symptoms similar to those described above, please contact your MDNR forest health specialist.

Prepared by Forest, Mineral & Fire Management Division

Ash yellows continues to be implicated in ash decline occurring around Michigan. FIA estimates place the total number of ash trees in Michigan at nearly 800,000,000. Data from the **Rural Ash Monitoring Plot System (RAMPS)**, an FHM off-plot monitoring network established in 2004, indicates that white, green and black ash trees continue to decline across a variety of moisture and soil regimes within the monitoring gradients

Ash trees under stress from ash yellows and ash decline are highly susceptible to attack by **emerald ash borer**, *Agrilus planipennis*. Identification of high-risk stands is a critical step in rapid early detection of EAB populations, and in employing silvicultural measures to reduce stand susceptibility and mortality.

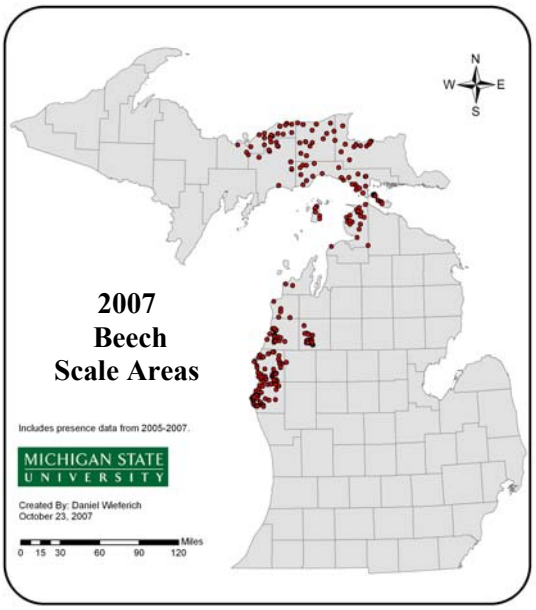
In cooperation with MDNR, Michigan State University began a project to assess decline and contributing diseases in white ash stands in Michigan. Objectives of the study are to:

- Determine the distribution and severity of ash yellows, root and butt rots in urban, rural and forest ash trees across Michigan.
- Determine the frequency of occurrence of these diseases in forest stands with ash decline.
- Identify risk factors associated with these diseases in forested stands, including stand dynamics, climatic, physiographic and edaphic site factors and stand management history.
- Evaluate impact of these diseases on radial growth of ash.
- Quantify relationship between ash decline, ash yellows and various field symptoms, including deliquescent branching, witches'-brooms, basal bark cracks and epicormic sprouts.
- Assess role of insect vectors in establishment of ash yellows in forested stands.

Information from this study will also be used to improve the ash decline component of the national risk map model.

Beech Bark Disease

The MDNR, in cooperation with Michigan State University, University of Michigan and Michigan Technological University, continue to monitor the movement of beech scale and the development and impacts of **Beech Bark Disease** (BBD). The BBD advancing front (e.g. areas infested with scale before fungal infection) has spread as far west as Munising in the U.P. and to Emmet and Charlevoix counties in the Northern Lower Peninsula (NLP) (See map). Isolated, satellite scale populations well ahead of the advancing front in both the Western U.P. and NLP are being studied by MSU to better understand scale spread rates to new areas, and colonization rates within stands after arrival.



Created by Daniel Wieferich, MSU

Management plans for beech containing stands anywhere in Michigan should now consider BBD vulnerability. Guidelines to manage American beech both within and ahead of BBD affected areas have been developed. Management strategies are influenced by the abundance and size of beech trees, and distance from the BBD advancing front. The goal is twofold: 1) To reduce BBD impacts ahead of the BBD killing front by decreasing the beech component such that a fully stocked stand remains to sustain production of both commodity and non-commodity forest resource values, and 2) To increase tree species diversity, thereby decreasing stand susceptibility and vulnerability to BBD and other new pests which target a single tree species or genera. These guidelines retain a beech component even in heavily BBD impacted areas. Keeping a minor beech component minimally affects sustained forest productivity and offers an extended period of mast production. Heavily scale infested trees are considered hazard trees in recreation and other high use areas.

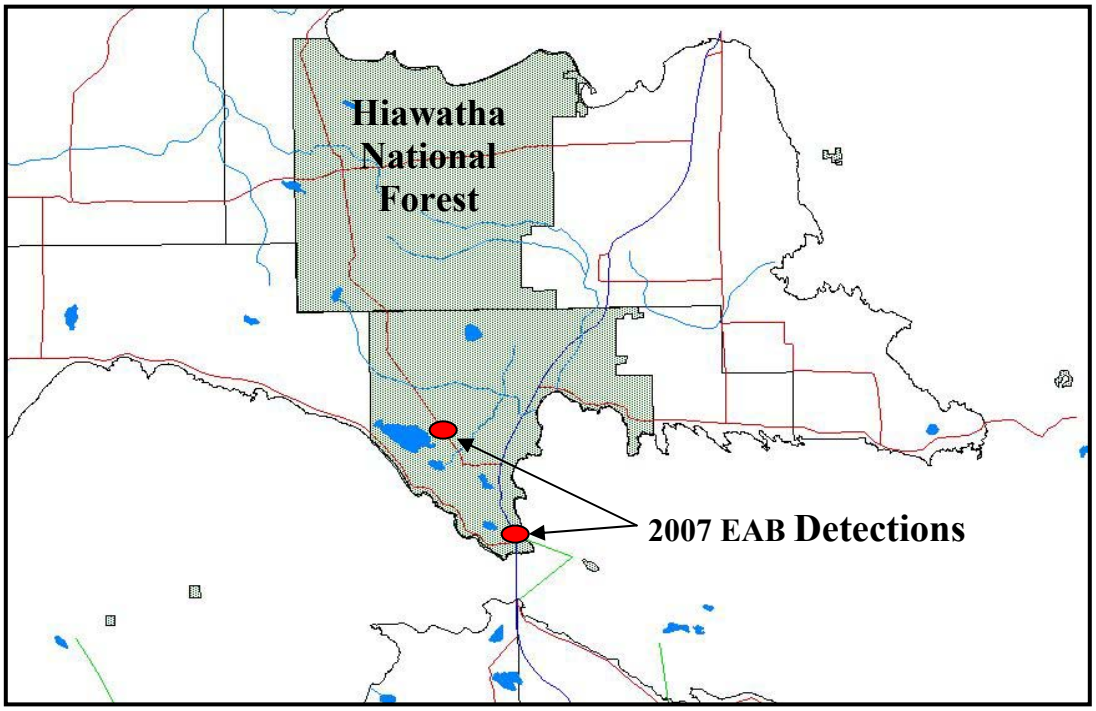
Once infected, these trees will break off or "snap" unexpectedly. Scale infested beech are therefore removed if they pose a threat to human safety.

Photo by Jennifer Koch

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 trees are not susceptible to infection by *Nectria* species which cause beech bark disease. Scions from resistant American beech have been collected from infested areas of both the U.P. and LP. Michigan has agreed to develop and maintain 1 or 2 seed orchards in the next few years. Eventually, resistant trees will be used to restore an American beech component in BBD-impacted forests and to establish resistant trees in unaffected beech stands. The objective of this research is to develop regional repositories of resistant beech germplasm and establish seed orchards and seed production areas that consist of a genetically diverse population of resistant beech. (Paraphrased from proposal written by Dr. Jennifer Koch, USDA Forest Service.)

The **Emerald Ash Borer** was detected in two new locations in Michigan's Upper Peninsula in 2007. Both finds - Moran and St. Ignace State Forest Campground - were just north (within 15 miles) of the Straits of Mackinac (See map below). The current **EAB Quarantine** now encompasses the Moran site, and will be modified again once all 2007 survey activity is completed and the St. Ignace site has been delimited. For detailed information on the EAB quarantine, visit the MDA website at: http://www.michigan.gov/mda

Map of EAB Detections in the Upper Peninsula



New 2007 EAB detections were the result of trap tree surveys conducted by the MDA and Michigan Technological University (MTU). The MTU survey is sponsored by the USDA Forest Service in cooperation with the Michigan DNR. MTU used maps of the state's ash resources and state park databases showing visits from residents of EAB infested counties to define areas of high EAB risk to focus survey efforts. Trap trees were deployed in state and federal parks and campgrounds throughout Michigan and Wisconsin. The survey effort also included visual inspections of firewood and ash trees in these and adjacent areas. The MDA surveys were more extensive, with over 4000 trap trees in the Northern tip of the LP and the Upper Peninsula monitored.

The MDNR conducts annual **firewood sweeps** in December, following 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 Division employees inspect vehicles entering state parks for firewood. MDNR staff conduct random inspections of state forest campgrounds. When found, firewood that is not in compliance with the EAB quarantine or the MDNR 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.

Guidelines to manage ash (*Fraxinus sp.*) in stands within and outside of EAB affected areas have been developed. Management strategies are influenced by the abundance and size of ash trees, and distance from EAB populations. The guide recommends reducing EAB vulnerability by reducing ash where abundant, and increasing tree species diversity. Vigorous pole-size and smaller ash should be targeted for retention. Removing one large ash has a much greater effect on reducing EAB population potential than removing many saplings or a few pole size trees. The objective is to create a stand that will remain fully stocked, or that will recover rapidly in the event ash is killed by EAB.

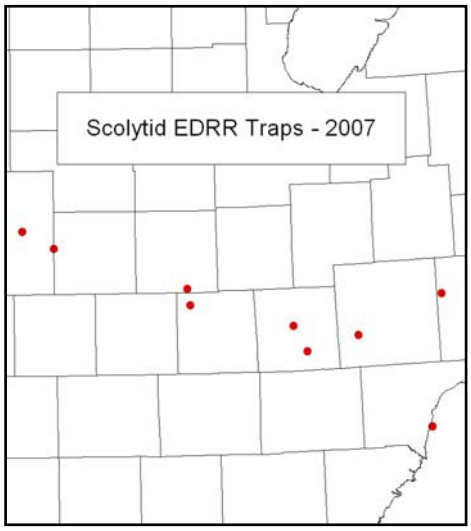
Three exotic EAB parasites from China were released in EAB-infested areas of SE Michigan in 2007. The USDA Forest Service Research Station in East Lansing, Michigan released two parasites: an egg parasite, *Oobius agrili,* and a larval parasite, *Tetrastichus planipennisi*. USDA APHIS PPQ released an EAB larval parasite, Spathius *agrili*.

Spathius agrili.

Prepared by Forest, Mineral & Fire Management Division

Early Rapid Detection – Scolytid

In cooperation with USDA Animal and Plant Health Inspection Service and Michigan State University, the MDNR Forest Health Program conducted a **Scolytid Early Detection/Rapid Response (EDRR) Survey** in southern Michigan in 2007. This effort was part of a nationally coordinated survey for non-native bark beetles. Beginning in FY 2007, the EDRR Project for non-native bark and ambrosia beetles was implemented nationally. A fully funded national program will not survey every state annually but, at anticipated funding levels, approximately 1/3 of the states will be surveyed each year. A National EDRR Team will set survey priorities, select target species, and develop protocols for state participation.



Nine sites were monitored in southern Michigan, using Lindgren funnel traps and 3 types of lures. These lures are specific to a variety of conifer- and deciduous-feeding exotic bark beetles in the family Scolytidae.

No species were trapped that were new to Michigan.

Gypsy Moth

Gypsy moth (*Lymantria dispar)* populations were down slightly in Michigan in 2007 with 25,359 acres defoliated, compared with 31,545 acres in 2006 and 148,525 acres in 2005.

While rainfall levels were below normal in many parts of the state beginning in early June, spring rainfall was average or above average and temperatures were cool. This weather was favorable to development of the fungal pathogen *Entomophoga maimaiga* and likely contributed to the statewide decline in gypsy moth numbers.

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The Michigan Department of Agriculture no longer sponsors the Cooperative Gypsy Moth Suppression Program, which provided communities cost-share assistance for aerial pesticide applications. A handful of communities conducted locally-funded programs around Michigan in 2007. (Photo Courtesy – Dan Hermes)

Eastern Hemlock Looper (*Lambdina fiscellaria)* larvae can be extremely destructive to hemlock, balsam fir, and white spruce. Hemlocks may die after one year of severe defoliation, fir in one or two years. Loopers have been epidemic in isolated areas of the state in the last few years. Populations moved from the Eastern U.P. to areas of Northern Lower Michigan and the central U.P. in 2006. This year saw the second year of defoliation causing thin crowns, top kill and some tree mortality. Because loopers feed first on lower branches, it is impossible to detect feeding damage with aerial surveys until trees are heavily damaged. Hemlock should not be harvested in stands where defoliation is expected because: 1) Insects are concentrated on residual hemlock after cutting; 2) New openings can reduce moisture availability by increasing amount of sunlight reaching the forest floor. Drought stress further predisposes hemlock to injury; and 3) Careless harvesting wounds trees and causes stress, which contributes to stand mortality. Aerial spraying of biological insecticides containing B.t. (*Bacillus thuringiensis*) effectively protects hemlock stands from potentially damaging looper populations.

Hemlock Woolly Adelgid

The Michigan Department of Natural Resources (MDNR) continues to cooperate with the Michigan Department of Agriculture (MDA) and Michigan State University in efforts to prevent the **Hemlock Woolly Adelgid** *(Adelges tsugae)* (HWA) from establishing in the Northern Lower Peninsula. HWA is an exotic invasive insect which feeds on tree sap, killing needles, twigs and branches. Infested trees eventually die. HWA was detected on native eastern hemlock in the Harbor Springs Area in 2006. In 20 years of HWA survey activities this is the third time the pest has been detected in Michigan. The previous two findings in 2001 were restricted to nursery stock that was quickly destroyed. This is the first time that HWA has been found on native hemlock.

All imported hemlock and adjoining native trees were removed and destroyed. The MDA also treated a perimeter of hemlock with a systemic insecticide to eradicate difficult to detect HWA. Treatments were repeated in the spring of 2007. These sites will be treated again in the spring of 2008. The MDA continues to look at other hemlock in the area to determine whether additional infested nursery stock have been planted in Michigan.

The MDA established a **Hemlock Woolly Adelgid Quarantine** in December 2000. The quarantine prohibits the movement of hemlock seedlings and nursery stock, logs, lumber with bark, uncomposted chips with bark and uncomposted bark from infested counties of eastern states and from California, Oregon, Washington and British Columbia.

The MDNR Forest Health, Inventory and Monitoring Program completed **Hemlock Woolly Adelgid and Beech Scale Rapid Early Detection Surveys** for the fourth straight year. Areas

throughout the state with abundant hemlock, either near recreation sites or adjacent to nurseries, were surveyed for HWA. If American beech were present in HWA survey areas and survey sites were outside of known beech scale areas, they were examined for beech scale. No adelgids or new beech scale areas were found in 2007.

Invasive Plants

This was the 4th year of an effort to eradicate **garlic mustard** (*Alliaria petiolata*) from an eighty acre northern hardwoods site in the Eastern Upper Peninsula. This is a seven year prescribed burn project which includes follow-up use of glyphosate herbicide to treat plants missed by the spring burns. Treatments are designed to stop the spread of the plant and eventually eliminate garlic mustard. Garlic mustard populations have been greatly reduced with few second year, fruit-bearing plants produced. Additional monitoring of plant community responses to burning and herbicide treatments is planned for 2008.

Jack Pine Budworm

The **Jack Pine Budworm** (*Choristoneura pinus pinus*) defoliated 158,500 acres in 2007, a slight increase from 150,645 acres in 2006. The budworm is the most significant pest of jack pine in North America. Stands older than 50 years are most susceptible to damage. Jack pine over 50 years old that has suffered 2 or more defoliations during the past 3 years is at highest risk of top kill or mortality.

Damage surveys in 2007 were conducted to assess potential tree mortality and project future volume losses. In the Lower Peninsula, affected stands were only lightly or moderately defoliated this year and had little or no defoliation in 2006. Little mortality or top kill is expected in these stands in 2008; no pre-salvage sales are scheduled but defoliation levels will be monitored next season. The management objective is to reduce jack pine rotations on state land to 50 to 60 years, significantly reducing the risk of budworm-triggered mortality.

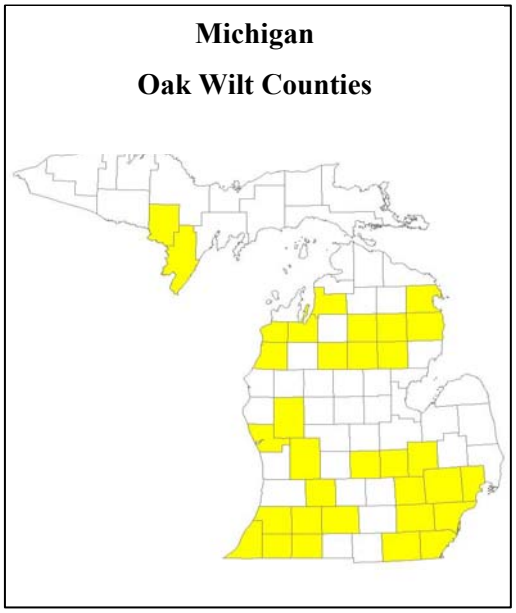
Jack pine stands in Iron and Dickinson Counties in the southwestern Upper Peninsula are experiencing top kill and mortality as a result of repeated budworm defoliation. Harvest operations are underway to salvage dying trees and to remove high-risk stands.

Significant budworm defoliation also occurred in the Yellow Dog Plains in Marquette County, the Danaher Plains in Schoolcraft County and in Luce County. In addition to older, high-risk stands, defoliation is also occurring in young, sapling- and pole-sized jack pine stands.

Oak Wilt (*Ceratocystis fagacearum*) continues to spread naturally and artificially through much of the Lower Peninsula. Overland spread of oak wilt through firewood movement and the wounding of oak by activities such as branch pruning continue to plague efforts to slow the spread of this fatal disease. **Sap-feeding beetles** (*Nitidulid sp.)* responsible for spreading oak wilt are most active in the spring and early summer. These small (1/4-inch long) beetles pick up spores from diseased trees and transmit them to oak trees that have been injured. To slow the overland spread of oak wilt, harvesting restrictions are observed on state land. Forests where red oak trees will remain after the harvest cannot be cut between April 15 and July 15.

Beginning in 2004, U.S. Forest Service **Oak Wilt Suppression** funds have supported a joint MSU Extension and MDNR effort to rid the Upper Peninsula of this threat to its oak resources. Oak wilt has been detected in two counties, Menominee and Dickinson (See map above). The objectives of this program are to: 1) Remove oak wilt from the U.P. 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 2008, 22,053 feet of

root-graft barriers were created around 25 oak wilt epicenters using a vibratory plow. Red oak within the epicenters will be removed before the spring, 2008 to prevent overland spread from infected trees. These treatments will remove oak wilt from approximately 600 acres of oak forest. Landowner and public education was achieved via newspaper articles, training sessions, site visits generated via detection efforts and public inquiries, and distribution of educational materials. To date, 20 miles of root-graft barriers have been established and approximately 150 oak wilt epicenters removed. With one more year of suppression activities, most epicenters will have been treated, greatly reducing the potential for overland spread.

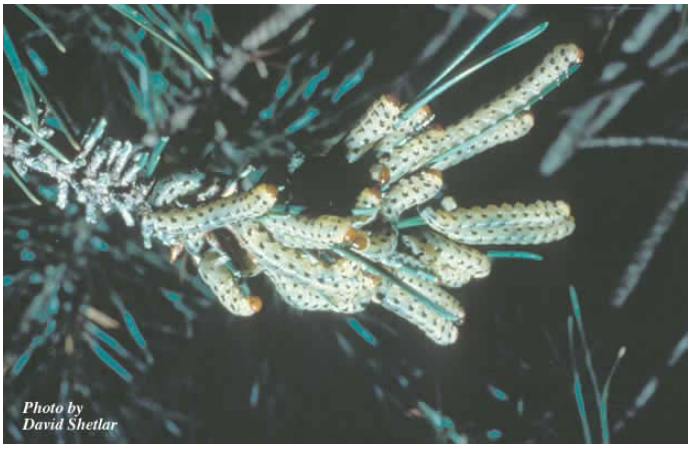


In cooperation with USFS S&PF Unit pathologists, MDNR Forest Health Program conducted **oak wilt** suppression activities on two infection centers in the northern Lower Peninsula. Root graft barriers were created by severing symptomatic trees and extracting stumps using backhoes and excavating equipment. Extracted stumps were inverted, placed back into the hole and covered with dirt. Only symptomatic trees were treated. Treatment areas will be monitored for 3 years and additional symptomatic trees will be removed if found. Wood from infected trees was burned to prevent development of **spore-producing pressure pads.**

Prepared by Forest, Mineral & Fire Management Division

Cost analyses indicate that, if effective, this method is more cost-effective than traditional root graft barrier installation using a vibratory plow. Also, it can be used in soils too rocky to allow vibratory blades to penetrate.

The **Red-Headed Pine Sawfly** (*Neodiprion lecontei*) is an important defoliator of ornamental, natural-growing, and plantation pines. Heaviest infestations are commonly on pines growing under stress, particularly those at the edges of hardwood forests, on poor soils, and where there is heavy competitive vegetation. The sawfly primarily infests trees less than 15 feet tall. Heavily defoliation results in top kill and tree mortality. Moderate to heavy defoliation stunts height growth and forking of the main stem often results. Sawfly populations have been active in the eastern Upper Peninsula and the northern Lower Peninsula since 2002. Sawfly populations collapsed in Mackinac County plantations that were treated with Dimilin from 2003 through 2006. However, the sawfly remains epidemic in other areas of the central and eastern U.P., most notably western Chippewa, northern Luce and Marquette counties.



Spruce Budworm (*Choristoneura fumiferana*) defoliated 24,669 acres in several counties in Michigan's Upper Peninsula. Areas of light to heavy budworm defoliation have been

visible for the last few years. 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.

Sirex Noctilio Wood Wasp

EAST LANSING, Mich. -- An exotic wood wasp, *Sirex noctilio*, has made its way to Michigan, according to Deb McCullough, Michigan State University (MSU) forest entomologist.

"The wasp was recently captured in a trap in Macomb County," McCullough says. "The larvae of this insect feed in stressed, dying or recently killed pine trees. *Sirex noctilio* has been an important pest in pine plantations in Australia, New Zealand and some South American countries."

McCullough says the wood wasp is native to Europe, Asia and North Africa, but was discovered in New York in 2005 and in Ontario in 2006.

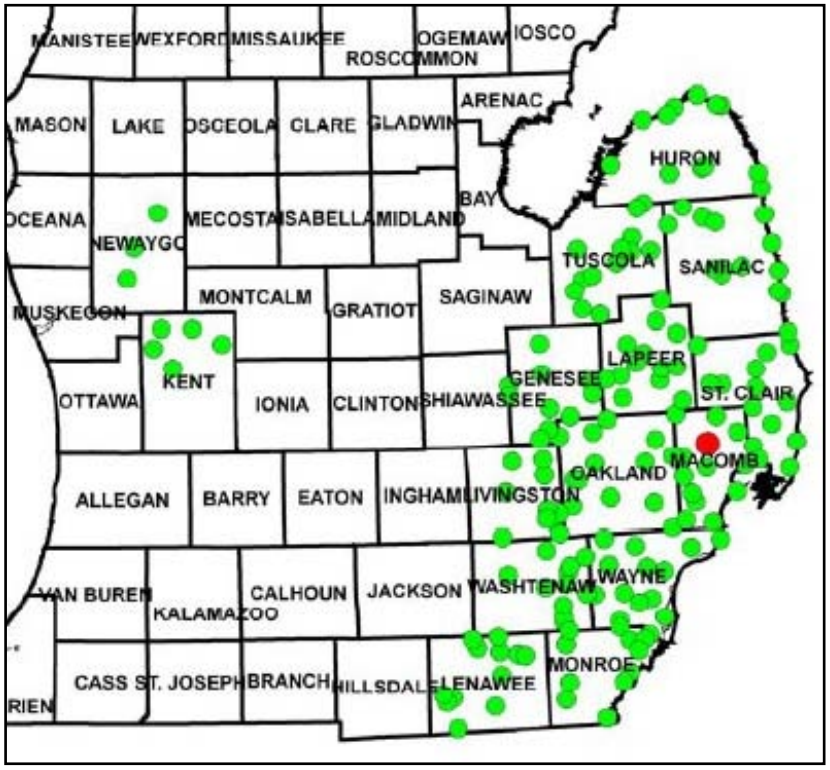
"Like many other wood-boring insects, it probably came to North America in solid wood packing material and it was likely present for several years before it was discovered," she says.

The discovery of *Sirex* has led to many residents' claims that their trees may be infested with the pest. There are some important aspects of the *Sirex noctilio* capture in Michigan that residents need to know before they claim they have seen or have trees infested with the pest.

"First, horntails, including *Sirex noctilio*, are related to wasps," McCullough says. "Horntails can look very similar to a wasp, and many people will likely mistake the bluish-black wasps that they see around their home for a horntail.

"Second, there are 23 different species or subspecies of horntails that are native to North America," she adds. "Some species colonize pines or other conifer trees. Other horntail

species colonize hardwood trees -- beech, for example, is a common host. Virtually all horntails are some combination of yellowish-brown or black in color and they all look alike. Even entomologists have a difficult time trying to distinguish one species from another. Native horntails are not considered a problem. Because they colonize dying or recently dead trees, they play an important role in decomposition and nutrient cycling."



Whether *Sirex noctilio* will become an important pest of pine in Michigan or other areas of North America is yet to be determined, McCullough says.

"We have many insect species that colonize stressed, dying or recently killed pines," she says. "*Sirex* wood wasps will have to interact with and compete with those native insects for that same pine resource. In addition, we do not yet know if *Sirex noctilio* is established in Michigan or if the insect collected in the trap was simply dispersing from an infestation in Ontario. Wood wasps are very good fliers and it's quite possible this particular insect originated in Ontario. Many traps were set in Michigan this year for *Sirex noctilio* following the identification of the infestations in Ontario last year. After horntail flight ends (late summer) and once all the horntails collected from traps or trap trees have been identified, we'll have a much better idea of whether *Sirex noctilio* is actually established in Michigan."

She also notes that *Sirex noctilio* will face native natural enemies in North America and possibly an introduced biological control. There are at least two groups of native parasitoid wasps that will attack the horntail larvae. In addition, an active biological

control program that was developed in Australia makes use of parasitic nematodes. Methods have been developed to inoculate pines and introduce the nematode into *Sirex noctilio* populations. Research is underway in the U.S. to assess potential non-target effects of the nematode. If results indicate that the nematode can be safely released, the methods developed in Australia will likely be used to establish the nematode in Michigan.

More information about Sirex noctilio can be found on several Web sites including: 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, and http://www.treesearch.fs.fed.us/pubs/12997.

To determine if you have an insect that could be *Sirex noctilio*, contact the MSU Plant Pest Diagnostic Clinic at 517-355-4536, or your local county MSU Extension office. Contact: Robin Usborne 517-432-1555, ext. 169 or Deborah G. McCullough 517-355-7445

White pine branch mortality has been observed in a number of areas in the Northcentral Lower Peninsula. This phenomenon was first noted in 2006 and was significantly more wide-spread in 2007. While present across a number of habitat types, it is particularly evident in and adjacent to the Au Sable and Manistee riverine systems. It was determined that white pine blister rust was not the cause of this branch mortality.

Examination of the boles of trees near the affected branches revealed numerous small, angular cankers not apparently associated with wounds or branch stubs. The identity of the fungus causing these cankers is not known. Michigan State University will attempt to isolate a causal agent from these cankers from samples collected at the site.

Ips bark beetles, black staining in the branches and bole, and pockets of resin on the affected branches were also observed. Forest Health staff with the Michigan DNR will continue to monitor the situation for development of additional symptoms, or spread of the problem to other areas. *(Photo U.S. Service)*

White pine mortality was observed, in a residential private woodlot in Crawford County in the Northcentral Lower Peninsula. Several sapling-sized white pines in this area were killed during the current growing season, where no appreciable mortality was noted for the previous several years. Mortality was scattered, and the trees all seem to have been affected at about the same time. Examination of the trees consistently revealed the presence of insects in the root collar area, accompanied by a black stain, presumably related to ***Ceratocystis*** or ***Leptographium***. In addition, activity of ***Ips*** **bark beetles** was noted in the boles of most of these trees, but it is not known whether these insects contributed to the death of these trees. The trees likely died due to the combined effects of drought, insect attack and root injury caused by the black stain fungus. DNR personnel will monitor this site for development of additional mortality, and Michigan State University will attempt to isolate the cause of the black stain in the root collar area.

Contributed by Dr. Joe O'Brien, USFS