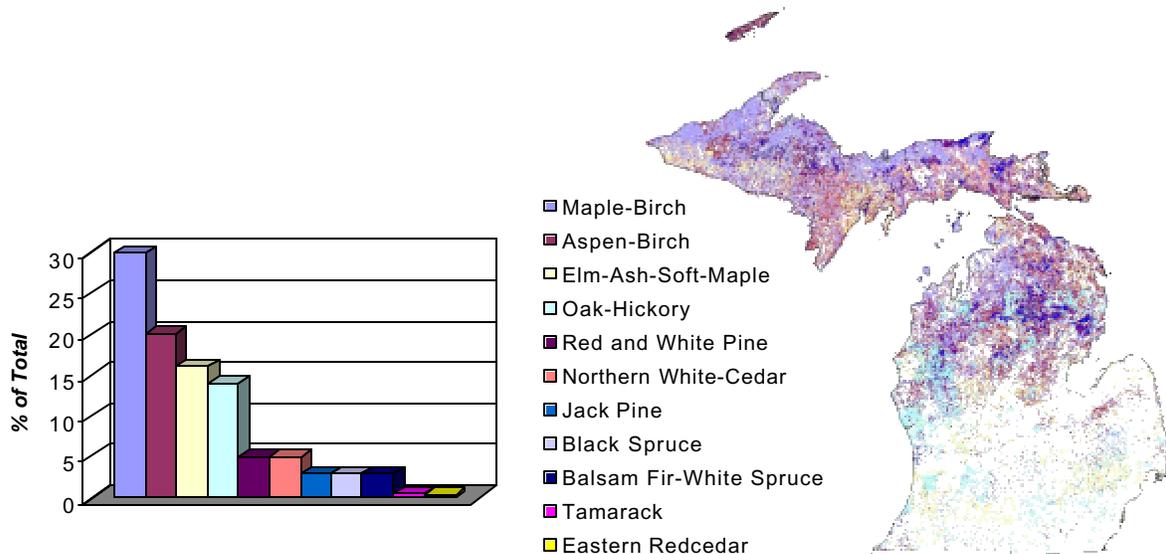




Forests comprise 53% of the land area of the state, or about 19.3 million acres. These forests are a critical component of Michigan's environment and economy for the recreational opportunities and the products they provide. Forestry related industries and manufacturing employ 150,000 people statewide 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, water, and reduce soil erosion.



The introduction of **exotic organisms** is the most serious health threat to our native forest ecosystems. State and federal agencies are preparing contingency responses and increasing resistance to the possible introduction of exotics such as the **Asian longhorned beetle**, the **Hemlock Woolly Adelgid**, the **Balsam Woolly Adelgid**, and **Sudden Oak Death**.



Add the **emerald ash borer** to a rapidly-growing list of exotic pests that have worked their way into the Michigan landscape. This small, green metallic beetle, previously unknown to North American forests, is killing ash trees throughout southeast Michigan, as well as Toledo, Ohio and Windsor, Canada.

The emerald ash borer (*Agrilus planipennis*) has so far killed hundreds of thousands of ash trees in Wayne, Oakland, Macomb, Monroe, Washtenaw and St. Clair and Livingston Counties, where specialists from

universities and from local, state and federal agencies are working to identify the extent of the infestation and to devise a strategy aimed at slowing the spread of the insect.

Native to China, Korea, Japan and the Russian Far East, the emerald ash borer likely found its way to Michigan hidden in wooden crating or other shipping material. Evidence suggests that the insect has been active in the state since at least 1997.

Symptoms and Signs. Larvae of the emerald ash borer feed below the bark in the phloem and outer sapwood, producing galleries that eventually girdle branches and entire trees. Half the branches of infested trees may die after one year, and trees are often killed within two to three years of the initial attack.

All varieties of ash trees appear susceptible, including white ash, green ash and black ash, as well as several horticultural varieties.



Adult beetles lay eggs on the bark of ash trees in mid-summer. Larvae emerge from the eggs and chew through the bark, where they begin feeding on the cambium. After overwintering as full-grown larvae, the adults emerge from infested trees beginning in May the following year.

Adult beetles form characteristic D-shaped holes in the bark as they chew their way out of the tree.

Declining trees can develop epicormic (trunk) sprouts, and dense root sprouting may occur when trees die.



Like its native cousins the bronze birch borer and the two-lined chestnut borer, stress brought on by drought and soil compaction probably set trees up for attack by emerald ash borer.

But the insect attacks and kills apparently healthy trees, too, including trees that have been fertilized and irrigated regularly.

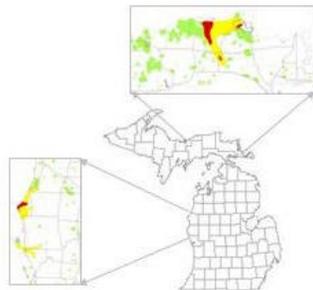
Fighting Back. The Emerald Ash Borer Invasive Species Response Team, a multi-agency task force formed this summer, is responding on several fronts. Led by representatives from the Michigan Department of Agriculture, MDNR, USDA Forest Service and Animal Plant Health Inspection Service, Michigan State University and Michigan Technological University, the team is developing an integrated emerald ash borer management plan that includes:

- Quarantine enforcement
- Detection and evaluation monitoring
- Information and public outreach
- Emerald ash borer population management
- Research and development

A Hemlock Woolly Adelgid quarantine continues to restrict movement of eastern hemlock into Michigan from infested counties of other states. All eastern hemlock shipments require a phytosanitary certificate. This follows the interception of the insect at two Michigan nurseries in 2000. A rapid early detection survey for the adelgid was conducted statewide in hemlock stands and in areas adjacent to nurseries in 2002. No hemlock woolly adelgids were found.



Beech bark disease (BBD) was detected in the spring of 2000 and is established in the western Lower Peninsula and in the eastern Upper Peninsula.



Yellow: advancing front
Red: killing front
Green: beech forest

The interaction of an exotic scale insect (*Cryptococcus fagisuga*) and a native and exotic canker-causing fungus (*Nectria* sp.) cause beech bark disease. Once infected by the fungus, trees usually decline and trunks may break at canker sites. The Michigan Beech Bark Disease Monitoring and Impact Analysis System was begun in 2001 to:

- Delineate the advancing & killing front of the scale
 - Identify & quantify tree, stand & site factors influencing rates of decline
 - Identify potentially resistant trees
 - Measure impacts of native & exotic *Nectria*
 - Study regeneration of beech & other tree species
- Evaluate wildlife impacts
 - Revise beech productivity models to ensure the affected forest resource is sustainably managed.

Findings in 2002 include:

- Decreased tree vigor in plots with higher scale infestations
- Increased dead beech in plots with higher scale infestations
- Higher scale densities in stands with higher number of beech trees
- Reduced radial wood growth in infested stands
- Beech regeneration is primarily seed origin
- Denser beech regeneration in the Upper Peninsula versus the Lower Peninsula

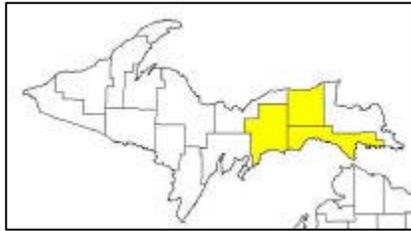
We continue to cooperate with the USDA Forest Service Northeastern Research Station in Delaware, Ohio to identify mechanisms of beech bark disease resistance and produce resistant seed and seedlings.

Sudden Oak Death (SOD) poses a potential threat to Michigan's forest resources. This pathogen has killed thousands of oaks, and caused disease symptoms in many other tree and shrub species in California and Oregon since 1995. A copy of this report is available upon request. The Forest Health, Inventory and Monitoring Program is educating Forest Resource and Parks managers, and has taken the lead in a national SOD risk assessment effort. For more information visit <http://www.suddenoakdeath.org>

In the past decade **Sphaeropsis** (*Sphaeropsis sapinea*) has been increasingly associated with damage and mortality of red and jack pine in Michigan. Prior to the 1980s, damage by the pathogen was rare in the Lake States. Increasing damage by the pathogen has been correlated to the increasing prevalence of a more virulent and more aggressive form called Type A. Severe damage is often associated with site stresses, and drought years. Questions to answer: 1) Are there susceptible and non-susceptible sites? 2) If susceptibility is site related, what are the risk factors? 3) At what frequency do predisposing stresses occur on susceptible sites? Answers provided by current research efforts will likely result in for red and jack pine sustainable yields.

The **Eastern Larch Beetle**, *Dendroctonus simplex*, is epidemic in several areas of the Eastern and the South Central Upper Peninsula. This bark beetle is killing tamarack (*Larix laricina*) in stands ranging in size from a cluster of a few trees to stands of 100 acres. Because infested trees often enter the fall with apparently healthy crowns, mortality is

often overlooked until trees fail to leaf out the following spring. Upon closer inspection, these "green" trees are completely girdled with beetle galleries. Both native tamarack and exotic larch species are susceptible to this beetle. Apparently healthy trees can be



attacked and killed by the bark beetle. However, many infestations are associated with stressed trees. Stresses from the drought of 2000-2001 and repeated defoliation by the **larch casebearer** (*Coleophora laricella*) are likely predisposing factors contributing to the current epidemic. The larch casebearer is an exotic insect introduced to the Lake States in the early 1900's. It derives its name from the "case" it constructs

from a mined-out needle. Defoliation for two or more consecutive years can cause tree decline and mortality. Populations generally collapse after a single year of damage thanks to two parasites imported from Europe.

Exotic invasive plants have the advantage of not being limited in growth or reproductive potential by biological controls such as insects feeding on leaves, roots, flowers or seeds. This gives them a very strong competitive advantage over native flora which are limited by these forces due to many years of co-evolution. Thus, native floras are competitively displaced, disturbing natural flora, fauna and ecosystem functions. One exotic invasive plant receiving much attention in Michigan and the nation is **garlic mustard** (*Alliaria petiolata*). The **Michigan Invasive Plant Council** (MIPC) and the Michigan DNR are pursuing a broad-based strategy for managing garlic mustard. Conventional control strategies are effective if introductions are small and caught early via effective monitoring. However, we have many heavily infested areas in the Southern Lower Peninsula for which biocontrol currently offer our only real hope. So, a critical part of our statewide strategy is exploring the safe and effective use of the biological control agents to be offered by Blosssey and Nuzzo, Cornell University, New York.

Incidence of the vascular disease **oak wilt** continues to increase from 2001 levels in several areas around the Upper Peninsula and the northern Lower Peninsula of Michigan.

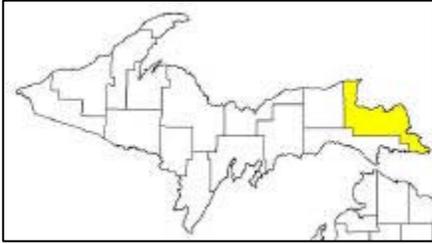


To slow the overland spread of oak wilt, harvesting restrictions are being exercised on state land. Forest stands with oak trees are not being cut between April 15 and July 15 in areas where the risk of oak wilt is high. These dates mark the period when the **sap-feeding beetles** responsible for spreading oak wilt are most active. These small (1/4-inch long) beetles are attracted to fresh tree wounds and transmit spores to oak trees that have been damaged during logging operations.



Other Michigan Forest Health Issues

Gypsy moth (*Lymantria dispar*) populations have begun an upward trend statewide. This follows a long period of population decline that began in the early 1990's and culminated in 2001 when, for the first time in over a decade aerial surveys detected no defoliation in the state. Since then, egg mass numbers have been increasing steadily and defoliation is expected to be locally heavy in some northern Lower Peninsula counties.

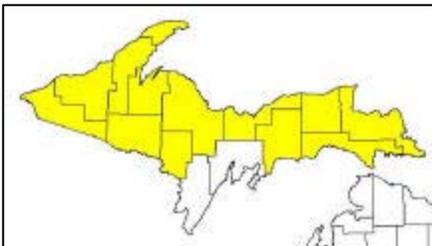


The **Jack pine budworm** (*Choristoneura pinus pinus*) is considered the most significant pest of jack pine. Stands older than 45 years that are growing on very sandy sites and suffering from drought or other stresses are very vulnerable to damage. Tree mortality and top kill resulting from budworm defoliation creates fuel for intense wildfires. Harvesting and other management activities can avoid budworm caused

tree mortality and reduce the threat of damaging wildfires while providing suitable conditions for jack pine regeneration. A buildup of jack pine budworm populations began in the Eastern UP in 2000. In 2002, 105,000 acres of jack pine were moderately to heavily defoliated. An additional 130,000 acres were partially affected forest with a component of jack pine. This epidemic will spread westward affecting most of the UP jack pine resource in the next 3-4 years.



In the Lower Peninsula, jack pine budworm numbers have declined from 2001 levels. This is likely the tail end of an outbreak that began in 1997. Stands that were defoliated previously and show signs of heavy population buildup are at risk of mortality. These stands will be harvested. Chemical treatment of jack pine budworm infestations is rarely cost-effective.



The **Forest Tent Caterpillar** (FTC) (*Malacosoma disstria*) defoliated 1.3 million acres in 2002. A little more than half of these acres were partially affected stands with a component of susceptible trees species. The FTC is a native leaf-feeding caterpillar. FTC prefers to eat aspen and oak leaves in the UP though it also readily consumes paper birch, green and white ash, basswood and willow leaves. Sugar maple is readily

consumed only in the Northern Lower Peninsula. Epidemics occur about every 10-15 years in the Great Lakes region, and last for 2-4 years. FTC can defoliate trees for several years with little ill effect. This is especially true for years with average or above average rainfall. Parasites were abundant in this year's populations, signaling a likely significant population reduction in these areas next year.

The **Red-Headed Pine Sawfly** (*Neodiprion lecontei*) is an important defoliator of young red and jack pines. Heaviest infestations are in pines growing under stress, particularly those at the edges of hardwood forests, on poor soils, and where there is heavy competitive vegetation. In general, it infests and damages trees less than 15 feet tall. Moderate to heavy defoliation stunts height growth of infested trees and forking may result from top kill. Complete defoliation usually kills the tree. Building sawfly populations were detected in many areas of the Eastern UP and the Northern Lower Peninsula in 2002. Early detection and suppression of damaging populations is needed to protect high value resources.