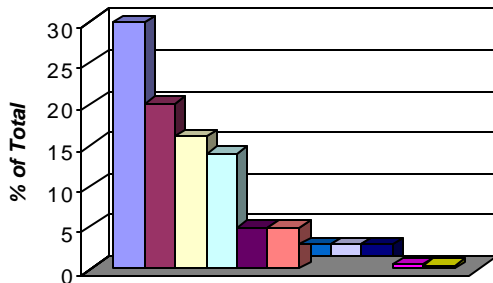


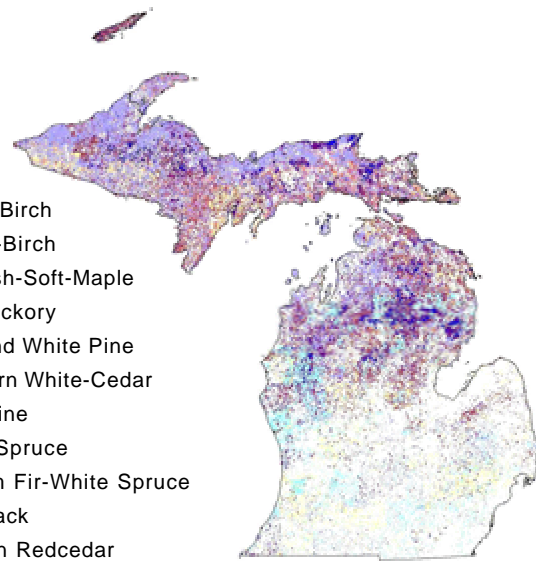


Forests comprise 53% of the land area of the state, or about 19.3 million acres. These forests are a critical component of Michigan's environment and economy for the recreational opportunities and the products they provide. Forestry related industries and manufacturing employ 150,000 people statewide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

### Major Forest Types Of Michigan



- Maple-Birch
- Aspen-Birch
- Elm-Ash-Soft-Maple
- Oak-Hickory
- Red and White Pine
- Northern White-Cedar
- Jack Pine
- Black Spruce
- Balsam Fir-White Spruce
- Tamarack
- Eastern Redcedar



Michigan's newest exotic forest pest, the **Emerald Ash Borer (EAB)** (Buprestidae: *Agrilus planipennis*), attacks all ash (*Fraxinus* spp). At present EAB predominately infests 13 counties in Southeast Michigan (Figure 1.) These counties are under a Michigan Department of Agriculture (MDA) quarantine. The EAB Quarantine prohibits the movement of all firewood and ash materials of any type including logs and branches unless chipped to 1" or less. Additionally, there is a one-year moratorium on the sale and movement of ash nursery stock into or within Michigan's Lower Peninsula.

Estimates place the EAB toll to date in Southeast Michigan at 6 million trees infested or dead. Michigan is home to an estimated 700 million ash trees.

Several small EAB populations known as outlier populations were detected to the north and west of the generally infested areas in 2003. The MDA is actively evaluating and taking actions to eradicate outliers which pose a significant breach of containment strategies. Emerald Ash Borer strategies are currently focused in five main program areas: 1) insect survey, 2) regulatory activities, 3) public education, 4) urban and rural forest restoration and 4) active management of outlying isolated populations. For further information on these and other activities visit the EAB website at:



<http://www.emeraldashborer.info>

**Michigan DNR 2004 EAB Plans** include a statewide detection survey in cooperation with the US Forest Service, St. Paul, MN. Trap trees will be used to survey high risk areas throughout the state. Trap trees are ash trees that are girdled. Girdled trees have proven to be ten times more attractive to adult beetles.

The purpose of this survey is to detect EAB populations currently below detectable limits (e.g. below-damage threshold populations) which may exist in other parts of Michigan. Selected survey sites have a significant ash resource and a significant numbers of visits from people living in EAB infested counties.

The Michigan State Parks Visitor Database was used to select State and Federal camping sites at high risk of movement of EAB infested firewood. State Park visitors from EAB infested zip code areas in SE Michigan were tracked for the period of mid-April through Mid-August for the years 2001 to 2003. Cumulative visitor days were then used to rank State Parks from most to least frequently visited (Figure 1).

Survey locations cover the entire state outside of the 13 quarantined counties. In total 116 sites were selected, 46 State Parks, 47 State Forest Campgrounds and 23 USFS Campgrounds.

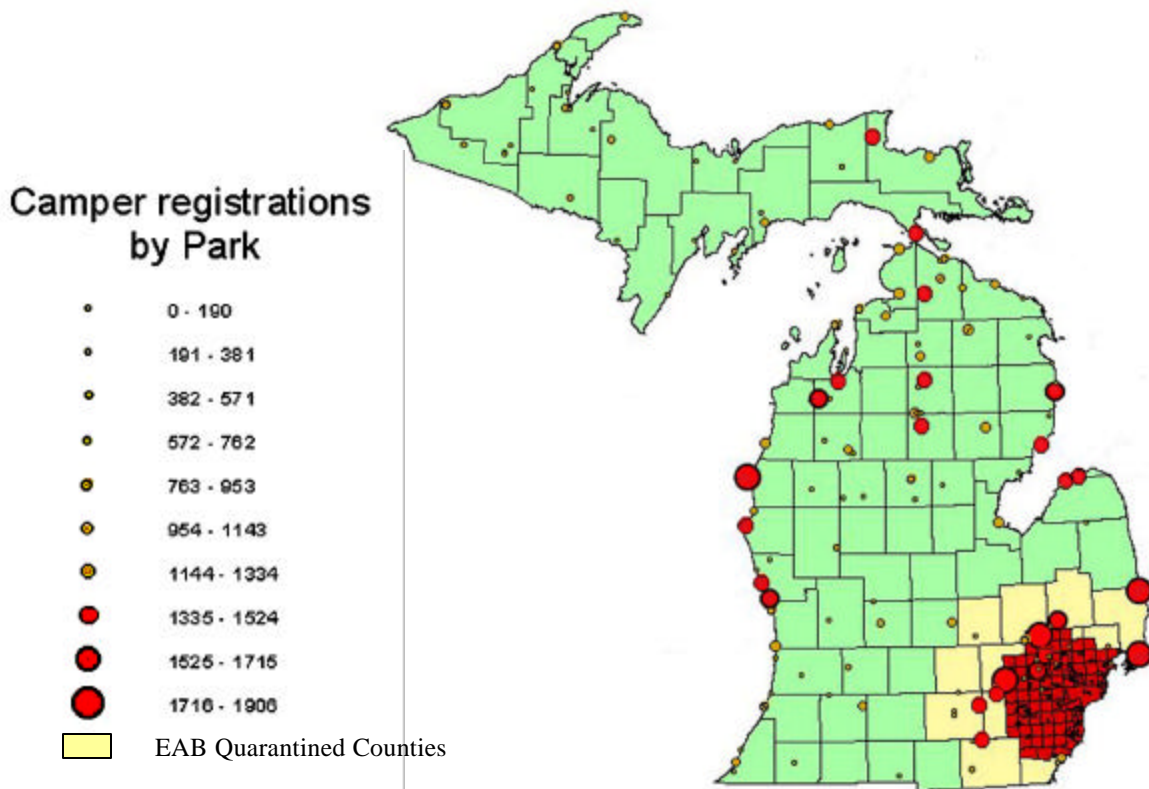


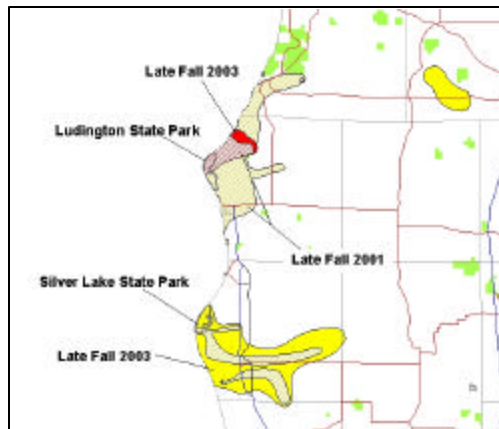
Figure 1. EAB quarantined counties and number of State Park visits from EAB infested areas.








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. Rapid early detection surveys for the adelgid have been conducted statewide in hemlock stands and in areas adjacent to nurseries since 2001. No hemlock woolly adelgids were found in 2003.

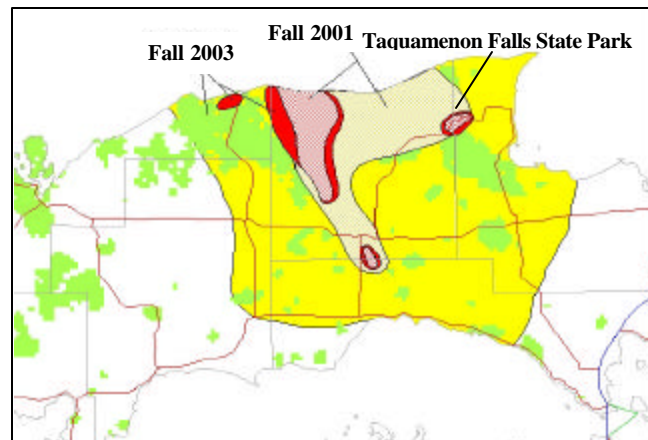


**Beech Bark Disease** (BBD) is a serious threat to Michigan's 7.2 million acres of Maple-Beech-Birch type. This represents 138 million beech in all size classes. Of these, 15 million larger beech in the > 9 inch diameter class are highly vulnerable to damage. BBD is greatly impacting the beech resource in areas infested with beech scale for 10 years or more (Figure 1). Two thousand acres of beech forest land within the Luce County in the Upper Peninsula are currently being salvaged.



#### Legend

-  2001 Killing Front
-  2003 Killing Front
-  2001 Scales Only
-  2003 Scales Only
-  Beech dominated forest



Michigan State University is studying the **Effects Of Beech Bark Disease On Forest Resources And Wildlife Habitat** in Michigan. They are quantifying impacts of beech bark disease on stand composition, productivity, and wildlife values. They are also studying the relative abundance and distribution of the three causal fungi (*Nectria galligena*, *Bionectria ochroleuca*, and *N. coccinea* var. *faginata*). To date they have discovered:

- Canopy dieback was extremely variable within and among stands
- Trees with greater than 30% dieback occurred more commonly in stands with heavy beech scale, regardless of beech density.
- No apparent patterns in canopy dieback occurred in relation to varying beech density.



The University of Michigan continues expand their **Beech Bark Disease Monitoring & Impact Analysis System**. Results to date:

- Scale likely arrived in Michigan ~1985
- Heaviest in two epicenters are in Luce (Upper Peninsula) and Mason Counties (Lower Peninsula)
- 202 Plots - 36% infested
- Mortality is only high in stands with high scale densities
- Killing front plots: 5% dead basal area in 2001 to 18% dead basal area in 2003
- Foliage transparency - 38% higher from 2001 to 2003
- Crown dieback – 66% greater from 2001 to 2003

The Northeastern Research Station, USDA Forest Service, Delaware, OH is identifying mechanisms of **Beech Bark Disease Resistance** with the goal of producing resistant seed and seedlings. They have successfully crossed resistant parents and resistant & susceptible parents. The resulting 1,600 seedlings have been outplanted. They are currently conducting insect challenge experiments to determine the resistance phenotype of cross progeny.

The Michigan DNR and Department of Agriculture have been on the alert since the first reporting of **Sudden Oak Death** (SOD)(*Phytophthora ramorum*). The MDA inspects rhododendrons in nurseries for SOD, and has not detected SOD to date. The DNR is educating public and private resource professionals to increase awareness and ability to recognize SOD symptoms. Michigan will cooperate with the proposed national baseline survey of *Phytophthora* species in oak forests in 2004.

**Sphaeropsis Canker** (*Sphaeropsis sapinea*) which plagued many red and jack pine areas in Michigan during the drought of 2000 and 2001 was not noticeable in 2003. Many of the hardest hit plantings in 2000-2001 were on drought susceptible, light soils.

Michigan DNR funded research titled “*Sphaeropsis sapinea* in diseased Red and jack pine stands of Michigan” by Gerard Adams, Michigan State University reported that the high mortality of red and jack pines following drought stress was caused by the Type B strain and not the more virulent and aggressive introduced Type A strain of *S. sapinea*.

Earlier studies of red and jack pine seedlings in DNR nursery ground beds revealed that most plants had endophytic infections with Type A strains. The next step is to examine such seedlings after out planting to determine whether Type A strains continue to predominate in tree tissues.

**Eastern Larch Beetle** (*Dendroctonus simplex*) populations in Eastern and the South Central Upper Peninsula declined in 2003. This bark beetle became epidemic in tamarack (*Larix laricina*) stressed trees from the drought of 2000-2001 and repeated defoliation by the **Larch Casebearer** (*Coleophora laricella*).



The threat of **Invasive Plants** to Michigan's Forest Resources is gaining much attention in many public and private sectors. The Michigan Invasive Plant Council created in 2001 continues to seek partnerships and expand its service. Visit the MIPC website at:

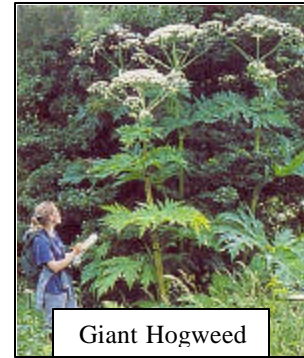
<http://forestry.msu.edu/mipc/>



About 30 acres of **Garlic Mustard** (*Alliaria petiolata*) were treated with herbicides and prescribed fire in Mackinac County. Public agencies are cooperating in an effort to keep garlic mustard from establishing in the Upper Peninsula.

During the spring of 2003, the Michigan DNR and Seney Wildlife Refuge joined forces to combat **glossy buckthorn** (*Rhamnus frangula*) adjacent to private land along Highway M-77. Treatments included herbicides and use of brush saws.

Reports of **Giant Hogweed**, *Heracleum mantegazzianum*, in the Upper Peninsula have initiated education and detection efforts to keep this invasive plant from gaining a foothold.



Giant Hogweed

Incidence of the vascular disease **oak wilt** continues to increase from 2002 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. Under a grant from the USFS State & Private, efforts have begun to eradicate oak wilt from Menominee and Dickinson counties. This work is also being funded by MDNR Wildlife and the Wildlife Habitat Improvement Program (WHIP). Oak wilt pockets are being isolated with root graft barriers and the wood burned or chipped to destroy the fungus.



The **Red-Headed Pine Sawfly** (*Neodiprion lecontei*) is an important defoliator of young red and jack pines. Building sawfly populations were detected in many areas of the Eastern UP and the Northern Lower Peninsula in 2002. Dimlin 4L was used to protect 1,321 acres of plantation red pine in 2003.

**Gypsy moth** (*Lymantria dispar*) populations continue on 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 was locally heavy in some northern Lower Peninsula and Upper Peninsula counties. A total of 38,119 acres were defoliated statewide.



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 minimize budworm-caused tree mortality and reduce the threat of damaging wildfires, and create suitable conditions for jack pine regeneration. A buildup of jack pine budworm populations began in the Eastern UP in 2000. In 2003, 131,809 acres of jack pine were moderately to heavily defoliated. This epidemic will spread westward affecting most of the UP jack pine resource in the next 2 to 3 years.



In the Lower Peninsula, jack pine budworm numbers rebounded in 2003 after having declined since 2001. Approximately 196,000 acres were defoliated. 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.



**Forest Tent Caterpillar** (FTC) (*Malacosoma disstria*) defoliated 167,000 acres in 2003. Affect areas were primarily counties bordering Wisconsin in the south central Upper Peninsula. This is the tail end of a 45 year epidemic which defoliated 11.5 million acres in its peak year, 2001.



**Spruce Budworm** was active in Marquette and Schoolcraft counties in Michigan's Upper Peninsula. Areas of light budworm defoliation have been visible for the last few years.

During 2003 the Michigan DNR embarked on several GIS projects, providing new tools to resources managers for evaluating potential forest health impacts across the landscape. The most significant of these projects is the construction of a set of **forest habitat type maps** for northern Michigan. The system, developed by Dr. John Kotar and Timothy Burger of the University of Wisconsin in cooperation with the Michigan DNR, is "...based on the identification of repeatable patterns in the composition of understory vegetation". Once an area is classified, assessments can be made about forest health, forest productivity, forest diversity and land-use planning. Through the use of soil, geomorphic and climatic maps a forest habitat type map was created for northern Michigan, allowing resource managers to assess forest health risks and impacts in individual forest stands across the state. Maps like this will continue to play a significant role in long-range planning and in enabling foresters to maintain healthy forests. The draft map can be seen at:

[www.mcgi.state.mi.us/forestHabitatTypes/](http://www.mcgi.state.mi.us/forestHabitatTypes/)

To determine the potential risk for **emerald ash borer** across the lower 48 states a multi-criteria model was constructed. This type of computer model provides a process for combining multiple criteria based on the importance or influence of each factor. The EAB risk model provides a tool for assessing where EAB is likely to occur in the future.



Our on-line mapping system for forest pest infestations is in its second year. In addition to pest information mapped annually as part of the MDNR aerial survey program, a map depicting gypsy moth defoliation since the 1980's is available for viewing. The current extent of EAB in Michigan is visible in the 2003 pest map. The maps can be found at:

[www.mcgi.state.mi.us/forestHealth](http://www.mcgi.state.mi.us/forestHealth).

A project by Michigan State University in cooperation with MDNR to determine the presence and distribution of **Dogwood anthracnose** continued in 2003. This exotic pest was introduced into the United States in the mid-1970's and has become established in Michigan in recent years. Dogwood anthracnose infects the leaves shortly after they expand in the spring, eventually causing cankers that kill stems and shoots. Infected trees die in 1 to 3 years.



Because healthy trees are much better at coping with the disease than stressed trees, management strategies focus on watering, mulching and moderate fertilization. Fungicides can be effective if applied beginning at bud break and reapplied every 10 to 14 days until leaves are fully expanded.



The map shows the distribution of dogwood in Michigan and the current distribution of dogwood anthracnose.

Increased usage of **road de-icing salt** last winter damaged pines and hardwoods alike along many of the major highways in Michigan's Northern Lower Peninsula. The most evident damage occurred on white pines which are highly susceptible to salt injury. Trees within 150 feet of a highway are easily reached by salt spray produced by fast moving vehicles. De-icing salt damage usually occurs on the side of the tree closest to the road. Earlier in the winter, each passing car sent up clouds of water with a little salt dissolved in it. This salty water settles on nearby objects, including needles, twigs and

buds. Salt can burn and accumulate to toxic levels in plant tissues resulting in dead needles back and in extreme cases, branch dieback starting at the branch tip.



Several hardwood defoliators were active across Michigan in 2003, including **oak skeletonizer** and **fall webworm**. Oak skeletonizer attacks red oak trees, feeding on the upper and lower leaf surfaces and leaving the veins exposed. The small, pale green larvae form white cocoons, 3 mm long, on vegetation and other surfaces. There are two generations per year. Trees usually recover completely; no treatments are recommended.



**Fall webworm** is a late season defoliator that feeds on the leaves of dozens of species of forest and shade trees. Newly emerged larvae immediately begin to spin a silken web over the foliage on which they feed; as they grow, they enlarge the web to enclose more and more foliage. The webworm is of no great economic importance to forest trees, but it can be a serious aesthetic pest of shade and ornamental trees. Outbreaks usually subside after 1 or 2 seasons. Webs can be removed safely by pruning.

