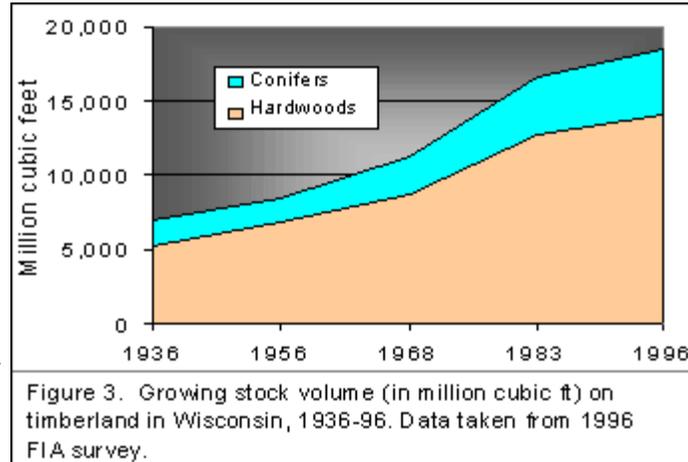


Detection and evaluation surveys on approximately 13 million acres revealed that populations of the forest tent caterpillar have collapsed. This insect along with the two-lined chestnut borer, left their mark on the oak resource causing scattered mortality throughout northern Wisconsin. Populations of the jack pine budworm begin their cyclical increase. The gypsy moth continued to march west and the combination of defoliation followed by dry weather in July initiated oak decline and mortality, particularly in central Wisconsin. A new one-day workshop highlighting the impacts of gypsy moth on the oak resource and mitigation through silviculture was offered in Waupaca County. DNR forest health specialists teamed with Ken Lallemond of Timber Resources to offer 5 hazard tree identification and mitigation sessions for state forest and park personnel. Forest health specialists traveled to Michigan to view the widespread mortality of ash trees caused by the Emerald Ash Borer (EAB), an exotic insect.

The Resource

Forests are important to the economy of Wisconsin, not only in the form of wood products, but also in the form of recreation and tourism. The primary and secondary wood products industry is the second largest employer in the state and puts Wisconsin first in the nation in the production of fine paper, sanitary paper products, children's furniture, and millwork. The value of shipment of these products annually exceeds \$19.7 billion. Forest and water resources in Wisconsin are a primary tourism attraction for both residents and visitors. The variety of Wisconsin's

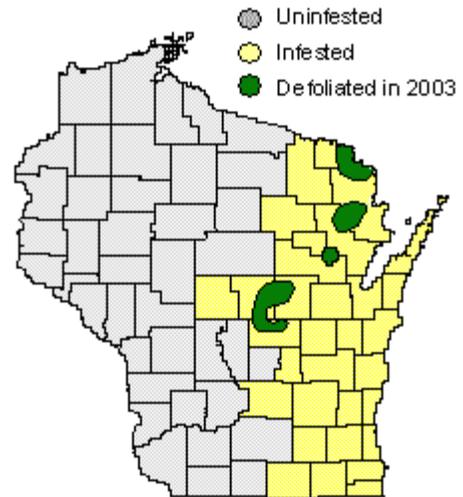


forest ecosystems support a great diversity of wildlife species, while recreational use of the forests continues to grow and expand. The area of forestland in Wisconsin has been steadily increasing in recent decades and currently stands at almost 16.0 million acres, representing 46 percent of the total land area. The state now has the most forest land that it has had at any time since the first forest inventory in 1936. Wisconsin's forests are predominately hardwoods, with 84 percent of the total timberland area classified as hardwood forest types. The primary hardwood forest type in the state is maple-basswood, which makes up 5.3 million acres (34%) of Wisconsin's timberland area. Conifer types represent 16 percent of the total timberland area (pine forests - 8%, spruce-fir - 6%, and swamp conifers - 2%).

Special Issues

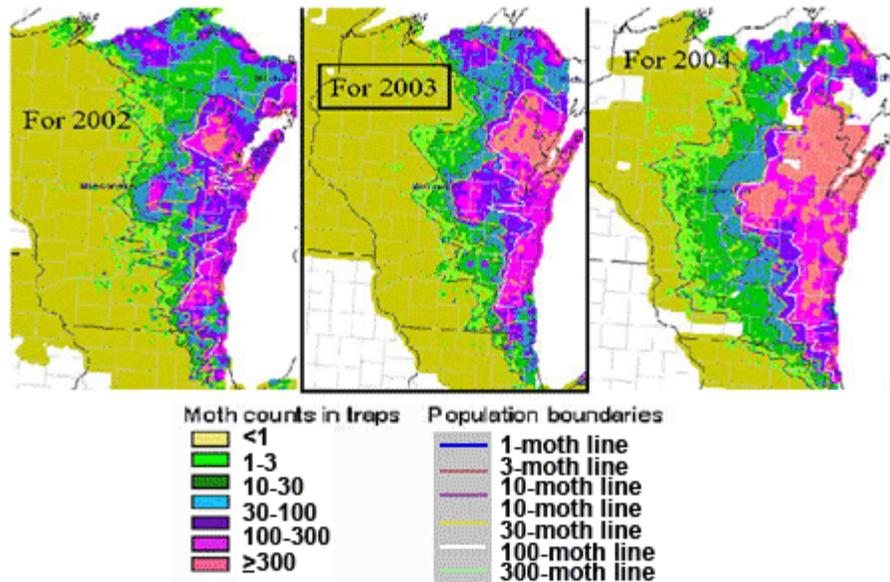
Gypsy Moth — In 2003, gypsy moth (*Lymantria dispar*) populations in eastern and central Wisconsin continued the steady increase we have seen in these areas since 2000. Outbreaks caused moderate to heavy defoliation over 65,000 acres this year, up from 24,000 acres in 2002. The intensity and extent of defoliation was reduced in last year's hotspot, Marinette County (13,000 acres down from 33,000), in part due to poor egg survival. Populations were up dramatically in western Waupaca, eastern Portage, and adjoining areas of Waushara counties which accounted for about

Gypsy moth distribution



40,000 acres of defoliation this summer. The acreage treated in the suppression program reflected the gypsy moth population increase, 26,000 acres were treated with Bt, up from 6,000 in 2002. Spray treatments were successful in the prevention of defoliation in all but 2 of the 177 treatment blocks (99% success rate).

Results of the trapping program indicate that we can expect to see further increases in the caterpillar population and their defoliation in the central counties of Shawano, Portage, Waupaca, and Waushara in 2004. Florence, Forest and Langlade may have pockets of defoliation. In Marinette and Oconto counties, trap catch numbers are still high and we can expect defoliation but probably in areas that previously



had not been heavily defoliated. Populations of gypsy moth in Waushara and Washington counties are uniformly high and we can expect defoliation in many communities and wooded areas next June. The numbers in Milwaukee, Kenosha and Racine have declined and may indicate that the populations there are beginning to collapse.

Hardwood Pests

Forest Tent Caterpillar —The outbreak of the forest tent caterpillar (*Malacosoma disstria*) in northern Wisconsin is finally over. There was virtually no defoliation in the northwest, and a few scattered pockets in northeastern Wisconsin. We did, however have pockets with very high populations of friendly flies (*Sarcophaga aldrichi*). These flies, which parasitize cocoons of the forest tent caterpillar, stayed numerous in areas that had high caterpillar populations in 2002, especially in parts of Douglas, Bayfield, and Florence counties. Despite the current abundance, populations are down significantly from 2002. These populations will drop even further in 2004 as a result of the steep decline in the numbers of forest tent caterpillars this year.



Friendly Flies

Ash Yellows — Phytoplasma —Ash yellows, caused by a phytoplasma, was confirmed in 2003 in Jefferson and Dodge counties (see map below). Confirmation of infection was based on the presence of brooms along the lower portion of the infected trees' stems. Ash yellows is now confirmed in 13 counties. This disease is typically more common in urban settings or in woodlots bordering agricultural fields.



Brooms or epicormic branches are indicative of ash yellows. Ash yellows was confirmed for the first time in Jefferson and Dodge counties this year (shown in black on the map).

Two-lined Chestnut Borer — Despite the demise of the forest tent caterpillar, we continued to have associated damage to our oaks caused by the two-lined chestnut borer (*Agilus bilineatus*). Larvae of this insect feed on a tree's conductive tissues, causing top dieback and eventual mortality. Infested trees will show browning of leaves and top dieback, which progresses downward. Mortality was observed throughout the Northern Region particularly in Bayfield, Douglas, Sawyer, and Vilas counties. Damage was heaviest, however, in the Lake Nebagemon and Iron River areas.



Adult two-lined chestnut borer

This native woodborer is a secondary pest, and usually only attacks stressed or weakened trees. Several years of heavy defoliation by the forest tent caterpillars and hot and dry summers have been major factors in recent outbreaks. Damage appeared to be most severe in areas where heavy defoliation by the forest tent caterpillar was observed in 2002. Given the dramatic recent decline in forest tent caterpillar numbers, we expect to see a respective

drop in mortality caused by the two-lined chestnut borer.



Oak trees with tip dieback create green & brown two-tone appearance on the crown

Oak Tip Flagging — This summer you may have noticed that many black and pin oak trees had brown leaves at the tips of their branches. Though wilted and browned, the leaves were still attached to the tree. This tip flagging was observed scattered throughout the tree and usually within 12 inches of the tip of a twig.

There were two common causes of this leaf flagging: the fungus *Botryosphaeria quercuum* and one of several scale insects including Kermes species.

Twigs infected with *Botryosphaeria quercuum* had blackened bark, were cracked and had dark streaks underneath the bark. Damage caused by this fungus

typically does not extend more than 6 inches down the twig, and should not cause serious harm to the health of a tree. This problem occurs cyclically, and usually lasts only a year or two.

Several different types of scale insects were found on affected twigs, but the Kermes scale was most common. Female Kermes scales are light-brown and globular. Females are immobile and often clustered near buds of a twig or branch. These scales feed on sap causing a loss of plant vigor and growth, as well as twig dieback. While a heavy infestation may cause young trees to be stunted or deformed, natural enemies are usually plentiful and control is not necessary.



Kermes scale



Adult Emerald Ash Borer

Emerald Ash Borer — Forest health specialists from the Lake States area have their antennae up these days on the lookout for an exotic insect, the Emerald Ash Borer (EAB), *Agrilus planipennis*. This insect has NOT been detected in Wisconsin but is present in Michigan. Discovered in Michigan in May 2002, EAB is native to Asia. It is suspected that EAB was initially introduced on material that came into the Detroit International Airport, although other introduction sites are possible. EAB was likely introduced at least 5 years prior to the actual

discovery. Since the initial discovery in southwestern Michigan where 13 counties are now under quarantine, EAB has also been found across the border in Ohio, and Windsor Ontario, Canada. There are some additional spot infestations at a few nurseries in Michigan, in Hicksville Ohio which is near the Indiana border, and at a nursery in Maryland where the trees came from Michigan.

Hosts and Life cycle

All species of ash native to Wisconsin including black, green and white are hosts for this insect. The adult is a small brilliant green beetle about the same

size as a Bronze Birch Borer. In Michigan the adults are present from the end of June to the first week in August. The emergence hole is an obviously D-shaped hole, about 3-4 mm in diameter. You can easily fit two D-shaped exit holes on the top surface of a pencil eraser (with some room to spare). Adults can lay up to 90 eggs and fly about 3 miles a day to find the perfect tree with the perfect spot for each separate egg. Upon hatching, the tiny larvae bore under the bark and begin feeding in the cambium of the tree.



D-shaped exit hole



Serpentine galleries

The larvae feed in a winding serpentine pattern, eventually reaching 1 to 1 ½ inches in length. Larvae may be ready to emerge as adults after a single year of feeding but are capable of taking 2 years to complete development. The mature larvae have segments that appear to be bell-shaped. The larvae will bore just into the sapwood to create a pupal chamber prior to emerging as adults.

Large numbers of larvae can be found in a relatively small area of cambium. Their feeding disrupts the water and food conducting ability of the tree causing decline and death. At low population densities the larvae act like two-lined chestnut borers or bronze birch borers, but at high population densities they can act like bark beetles, seeming to mass attack a tree and doing significant damage to the cambial layer. Larvae will feed on all species of ash, but in Michigan they appear to be killing green ash, and all green ash cultivars, more easily than they are killing white ash. It is not known at this time whether white ash is showing some resistance, is less attractive to the beetle, or if they just put up with more damage than green ash before showing decline. EAB in Michigan is infesting both urban trees and forest trees but shows a slight preference for open grown sun-warmed trees.



EAB larvae

Survey plans for 2004

In 2004, the forest health program will be conducting a survey of Wisconsin's state parks and forests. These areas are at a high risk for introduction of this insect as it is most likely to enter the state via infested firewood. A statewide coordinated effort is also under way to survey nurseries and communities at high risk. Other agencies involved include the Wisconsin Department of Agriculture, Trade and Consumer Protection, USDA Forest Service and Animal Plant Health Inspection Service, and the University of Wisconsin.

What to look for and Who to contact

You will find a handout enclosed in this publication that illustrates the signs of the EAB. If you suspect an EAB find, contact your regional forest pest specialist. Additional information may be obtained from the web site: www.emeraldashborer.info.

Conifer Pests

Jack Pine Budworm — In the summer of 2003, moderate defoliation by the jack pine budworm was observed in the Northern Region. Approximately 1,500 acres were defoliated in Burnett and Washburn counties, with small pockets of defoliation in Lincoln, Oneida, and Vilas counties. Larval and pupal surveys also detected a rapid increase in the jack pine budworm population in these areas. Given favorable weather conditions, we should expect more widespread defoliation in 2004 and possibly a full-scale outbreak in 2005. Populations are also increasing in Adams, Clark, Eau Claire, Jackson, Juneau, and Monroe counties. Based on egg mass counts, expect to see light defoliation in Adams and Monroe counties, light to moderate defoliation in Clark, Jackson, and Juneau counties, and light to heavy defoliation in Eau Claire County in 2004. A small jack pine stand in Marathon County suffered heavy defoliation this past summer.



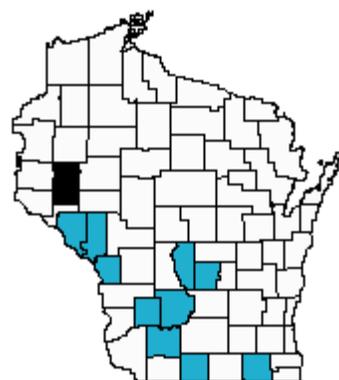
Larval stage of the jack pine budworm

Jack pine budworm is native to North America and its population periodically reaches outbreak levels. The last major outbreak of budworm in Wisconsin occurred in the early 1990's. In 1993, the insect defoliated 400,000 acres in northern and central Wisconsin, an area equal to more than $\frac{3}{4}$ of the state's total jack pine acreage.

Larval feeding of needles can cause growth loss, top kill, and tree mortality. Stands older than 45 years growing on very sandy sites or under stressed conditions due to overstocking or drought are particularly vulnerable to damage. In general, 1 year of heavy defoliation can cause mortality in 5% of trees and top dieback in another 10 –15 %. With two consecutive years of heavy defoliation, mortality of up to 25% of trees with top dieback in another 50% may occur.

Annosum Root Rot Update — In 2003 one additional county (Dunn County) was confirmed to have Annosum root disease (*Heterobasidion annosum*) This brings the total number of counties with annosum to eleven: Adams, Buffalo, Dunn, Green, Iowa, La Crosse, Marquette, Richland, Sauk, Trempealeau, and Walworth counties. In Wisconsin, annosum root disease has been observed primarily in red pine plantations, occasionally in white pine, and once attacking an individual jack pine. The primary mode of infection for annosum root disease is through freshly cut stumps. Spores land on the stump, germinate and grow through the root system to adjacent healthy trees, causing a "pocket" of mortality.

A publication outlining the symptoms/signs and management recommendations for annosum can be observed at the following web site: www.dnr.state.wi.us/org/land/forestry/fh/fhissues/annosum.htm. For a copy, email: jane.cummings-carlson@dnr.state.wi.us or call 608-275-3273.



Annosum was discovered in Dunn County in 2003

Tamarack mortality — Thousands of acres of dead 80 year-old tamarack were observed in the Sheboygan Marsh in northwest Sheboygan County. Eastern larch beetle, *Dendroctonus simplex*, was observed on the trees. Apparently healthy trees were found scattered among dead ones. There was no evidence of bark beetles, needle feeders (including larch sawfly, larch

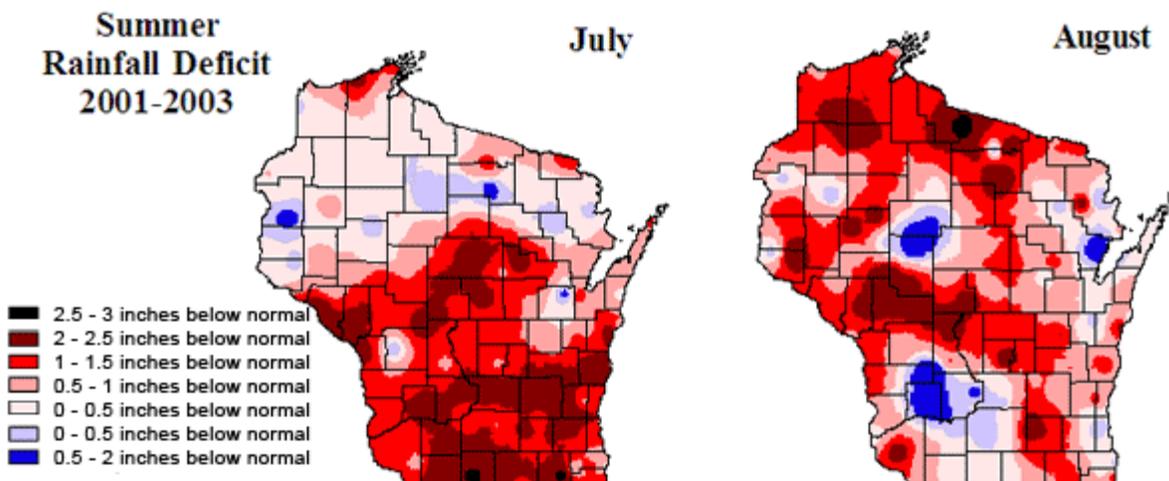
casebearer, or gypsy moth), or fungal infection. Earlier in the year, the water level in the marsh had been lowered in order to manage weeds. Given the large area of tamarack death and decline, this may have been a key factor in tree mortality.



Tamarack defoliation in Sheboygan

Soil Moisture Deficit affects forest health — In 2003, the most significant factor affecting the health of Wisconsin's forests was the severe deficit of precipitation. Soil moisture levels affect whether or not numerous other injurious agents are successful in infesting and killing trees. Bark beetles; Sphaeropsis shoot blight, canker and collar rot; two-lined chestnut borer; Armillaria root disease and numerous canker-causing organisms are all favored by low soil moisture. For the past three years, parts of Wisconsin have suffered from very dry periods in July and August. This is particularly a problem for hardwoods that are attempting to refoliate following defoliation by forest tent caterpillar or gypsy moth. In 2003, the most destructive impact of the lack of moisture occurred on oaks in northern Wisconsin, where low moisture levels resulted in elevated mortality caused by the two-lined chestnut borer. Many of these trees had reduced levels of carbohydrates in their roots as a result of defoliation by the forest tent caterpillar. In addition to oak dieback and mortality, increased mortality in first year plantings and premature coloration and leaf drop by paper birch and basswood was observed.

It is premature to make widespread predictions of long range effects on the forest. Many areas of the north received substantial rainfall in mid-September yet October turned dry once again. An average or above average snowfall coupled with an average to wet spring would aid in replenishing ground water levels. Land managers should be alert to the potential continued impacts on oak and birch. These species need average or above soil moisture to return to full health and fend off the two-lined chestnut borer and bronze birch borer. There were no significant outbreaks of pine bark beetle reported in 2003. Mortality of seedling and sapling red and jack pine started to occur in late October and early November in western and northwestern Wisconsin. This mortality is related to the dry fall weather and infection by *Sphaeropsis sapinea* shoot blight and canker.



Average precipitation deficit for July (left) and August (right) 2001-2003 compared to 30 year normals. Normal rainfall totals are about 4 inches per month statewide so a deficit of 2 inches would be 50% below normal.

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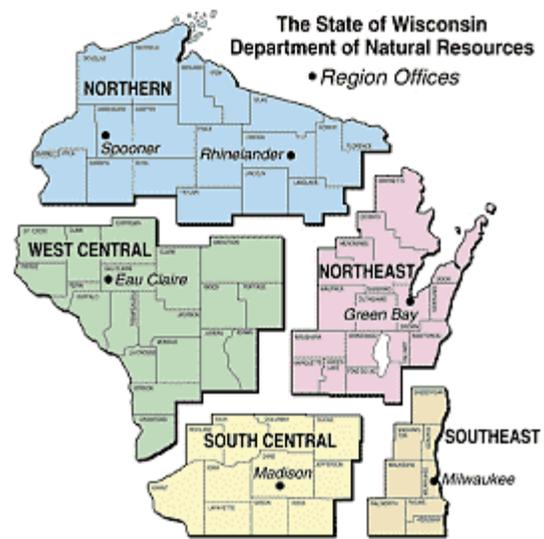
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Updated: January 2004