



The Forest Health Protection Unit and Regional Forest Pest Specialists provided a wide variety of programs and information on forest pests, and continued to teach integrated pest management principles to DNR foresters, industrial foresters, and private woodland owners. They successfully educated about 3,100 individuals at 78 different training sessions. At the same time, insect and disease detection surveys were conducted on approximately 10.9 million acres, and evaluation surveys on 2.5 million acres.

The Resource



The area of **forest land** 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 than 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%).

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.

Exotic Pests



Three treatments were used to reduce **gypsy moth** infestations on a total of 54,420 acres. Two applications of *Bacillus thuringiensis* var. *kurstaki* (Btk) were used on 42,520 acres at 40 sites. Pheromone flakes were distributed from the air over 7,500 acres at 11 sites where there were concerns for impacts on nontarget species. Gypchek (nucleo-polyhedrosis virus) was used at 7 sites where there was concern for effects on Karner blue butterfly for a total of 4,400 acres. We were also assessing the use of Gypchek on low density populations for possible wider use in a future Slow the Spread program. Trapping and egg mass survey results indicated that populations were substantially reduced at sites treated with Btk. Results were disappointing at the Gypchek sites. We will not know the results of the treatments with pheromone flake until next year.

Biological control agents were also released in 7 counties in eastern Wisconsin. The egg parasite, *Ooencyrtus kuvanae*, was released in Marinette, Outagamie, Sheboygan, Dodge and Waukesha counties. The larval parasite, *Cotesia melanoscelus*, was released in Waukesha and Milwaukee counties and the fungal pathogen, *Entomophaga maimaiga*, was released in Milwaukee, Waukesha and Kenosha counties. More releases are planned this winter.

The survey of **natural enemies** of gypsy moth recovered *Entomophaga maimaiga* from three new sites in 1999. *Ooencyrtus kuvanae* continues to spread particularly in the Milwaukee area where it was found infesting gypsy moth egg masses at very high density. Nucleo-polyhedrosis virus (NPV) was found in nearly every county surveyed around Green Bay and in the Milwaukee area. Dipteran parasitoids were also commonly found in gypsy moth populations throughout the established range of the pest.

The entire state was trapped in the 1999 growing season at densities varying from 1 to 9 traps per square mile. 125,791 moths were captured a new high for Wisconsin. Compared with catches in 1998, the population declined in the south and south central parts of the state but increased dramatically in the north. The majority were captured in the 20 quarantine counties in southeast Wisconsin (Figure 1). Populations continue to build in the shoreline counties, Milwaukee and the Fox River Cities, with the average number of moths caught in some areas approaching levels often associated with the development of outbreaks.

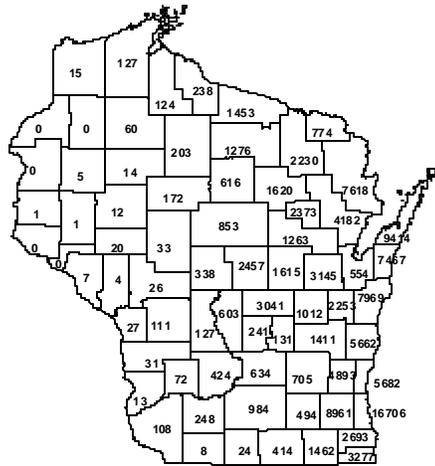


Figure 1. 1999 Wisconsin Gypsy Moth Trapping Results (Wisconsin Dept. Agriculture & Consumer Protection 11/99)



A number of interceptions of **longhorned beetles** in Wisconsin is the result of increased international trade. A single Japanese citrus longhorned beetle emerged from a bonsai maple that had been purchased in Kenosha county. No infested trees were found near the nursery. Two species of Japanese cedar longhorned beetles, *Callidiellum rufipenne* and *C. villosulum* were found in imported artificial Christmas trees in 5 Wisconsin counties, Langlade, Wood, Sheboygan, Waukesha, and Green. The host material were center posts made from

untreated Japanese cedar (*Crytomeria*) which had the bark still attached. No infestations have been found.

Broadleaf Problems



Over the past 4 years, **white and bur oaks** have been the victim of leaf pathogens, insects and weather-related injuries. Any of these injury-causing agents by themselves or occurring on an occasional basis are not significant yet several of these factors have been occurring together for the past 4 years. During the spring of 1999, anthracnose and tatters were widespread in south-central and southern Wisconsin. Observations of trees that have been affected by these and other injury-causing factors reveal branch dieback in the upper and outer crown. Continued injury by these pests is likely to induce further decline and mortality of white and bur oak in southern Wisconsin.

The cool, wet weather of 1999 provided perfect conditions for the fungus *Discula* sp. to cause widespread leaf blight or **anthracnose**. White oak was the species most commonly affected. Symptoms of anthracnose include chlorosis and necrosis of the leaf margins and in spots along the leaf veins. Heavily infected leaves turned completely brown and hung on the tree in small, curled bunches. Refoliation or the production of new leaves was common in late June; new leaves were unaffected.

White and bur oak in south-central and southwestern Wisconsin produced small, torn and “**tattered**” leaves in the spring of 1999 (Figure 2). Trees with severe damage produce a new crop of foliage in a few weeks but several years of damage may lead to tree mortality. Although no single cause is known, cool temperatures or high winds at the time of bud expansion may contribute.



Figure 2 Leaves of tattered oak.

Oak wilt was reported for the first time in Florence county, at 3 separate sites in Spread Eagle. The disease is now present in 52 of Wisconsin's 72 counties (figure 3).

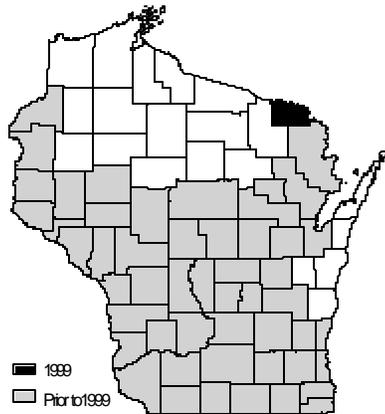


Figure 3. County distribution of oak wilt - 1999.

Populations of **forest tent caterpillar** were on the rise in northern Wisconsin. Scattered pockets of mostly aspen and some oak defoliation occurred from St. Croix in Polk county to Minocqua in Vilas county. Defoliation was more prominent in the eastern part of this region. A light to heavy infestation of **aspen blotchminer** was found in Lincoln and Oneida Counties. This was the second year of defoliation caused by the **large aspen tortrix**, but the area affected was smaller and defoliation was lighter than in 1998.

The **greenstriped mapleworm** caused heavy defoliation of red maple in Chippewa and Washburn Counties, though populations are declining in most

of northwestern Wisconsin. **Bruce spanworm** caused moderate to severe defoliation of sugar maple in Forest and Florence Counties again this year and, for the first time, in Menominee county. Some trees were completely defoliated. **Maple leaf roller** in Oneida and Forest Counties and **maple webworm** in Vilas county caused light to moderate defoliation.

Although populations of **introduced basswood thrips** were down from last year in northwest Wisconsin, moderate to severe defoliation was seen in Forest, Florence, Lincoln, and Oneida Counties.

Butternut canker, caused by the pathogen *Sirococcus clavigignenti-juglandacearum*, has spread quickly in Wisconsin since 1967 (Figure 4). This is the 5th year of a cooperative project with the Menominee tribe, testing the growth and health of seedlings planted on 3 different habitat types and in openings ranging from 0.03 to 2 acres. Height and diameter as well as the presence of cankering have been measured annually since 1994. Results will be presented in the WI DNR Forest Health Protection Annual Report, 1999.

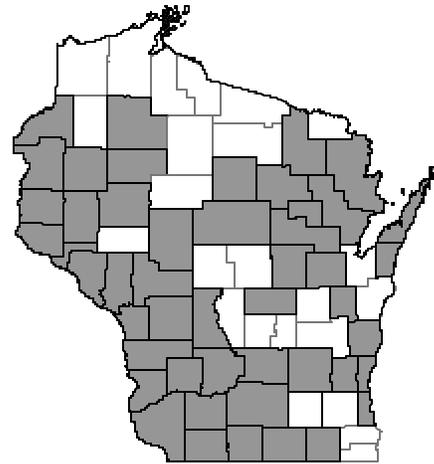


Figure 4. Distribution of butternut canker - 1999.

Conifer Pests



Mortality of plantation-grown **red pine** seedlings was reported from northeast, western and central Wisconsin in 1998 and 1999. Seedlings planted within the last 8 years showed symptoms of top dieback, branch mortality and whole tree mortality. A survey of the most severely affected sites was conducted during 1999 and the pathogen, *Sphaeropsis sapinea*, was observed causing collar rot. *S. sapinea* is widespread in Wisconsin and causes mortality of elongating shoots and whole branches of red pine. Collar rot or infection of the root collar area is a relatively new disease phenomenon. A relationship between drought stress and accelerated growth of *S. sapinea* has been proven through research and is likely a key to the recent mortality. Results of the 1999 survey will be summarized in the WI DNR Forest Health Protection Annual Report, 1999.

Populations of **jack pine budworm** declined dramatically in Washburn, Douglas, and Bayfield Counties but rose in Polk county where moderate defoliation occurred on 250 acres. Defoliation was light in Adams and Juneau Counties although high egg counts here may cause defoliation again in 2000.

In April and May of 1999, **chlorosis and casting** of 1998 needles occurred on **white pine** throughout Wisconsin. The incidence of premature casting was higher in western and southern Wisconsin than northern and eastern parts of the state. This premature needle loss gave a dramatic appearance to affected white pine until the 1999 needles appeared. Both plantation-grown and natural stands were affected. No mortality was observed and the effect of premature needlecast is likely to be a slight decrease in growth for 1999. Two factors were associated with the casting: highway salt damage and infection by the fungus, *Mycosphaerella dearnessii*, the cause of brown spot needle blight. Both of these factors are common in Wisconsin on a small scale, yet widespread needlecast of white pine as observed in 1999 is not typical. Affected trees were located both close to salted highways and more than a ¼ mile away, eliminating salt damage as a singular causative

agent. Premature needlecast in some locations could not be attributed to either of these factors. Similar symptoms were reported in the Lower Peninsula of Michigan and eastern Minnesota.

The **white pine pitch midge**, *Cecidomyia candidipes*, first reported last year in Jackson county, appears now to be generally distributed in Wisconsin. Larvae were collected from pitch on white pine trunks in Clark, Iowa and Winnebago counties. The larvae cause no apparent damage to the pines but some infested Christmas trees have been condemned when shipped to other states.

Adult **pine shoot beetles**, *Tomicus piniperda*, were trapped in pine plantings in Green and Rock counties which, along with Grant county, make up the Federal Pine Shoot Beetle quarantine in Wisconsin. A severe **defoliation on tamarack** was found in Oneida county. Heavily infested trees reflushed in June. This is a second-year infestation in some areas. Tamarack should withstand a single year of defoliation, but several years may cause some tree mortality. In addition, drought stress for the last 2 years may be contributing to the decline.

For several years, *Heterobasidium annosum*, a cause of **root rot** (on red pine primarily) has been known to be present in two locations in Wisconsin; one in Adams county on private property and one on the Arena School Forest in Iowa county. This year, three additional pockets, two in Sauk county and one in Richland county, were found near Lone Rock along Hwy. 14.

Weather Damage

On July 30, 1999, a **windstorm** traveled through southern Douglas county and southwestern Bayfield county. The storm caused heavy damage to 28,300 acres and damaged \$14.8 million worth of timber in both counties. Timber on industrial lands and on the Brule River State Forest will be salvaged by commercial loggers.

Vilas and Oneida counties also experienced wind damage, amounting to 4,699 acres of heavy damage and about \$2.4 worth of damaged timber. This will also be salvaged commercially.

Regional Issues

Efforts to detect changes in forest health on a regional (Lake States) basis continues through **data collection** on permanent plots - 92 for Forest Health Monitoring (FHM) and 18 for the North American Maple Project (NAMP). Data for both of these plot programs centers on monitoring crown conditions, including dieback, foliage transparency, and crown density.

