Wisconsin DNR Forest Health 2012 Annual Report

Photo: Emerald Ash Borer mortality in Ozaukee County.
Photo by Bill McNee.

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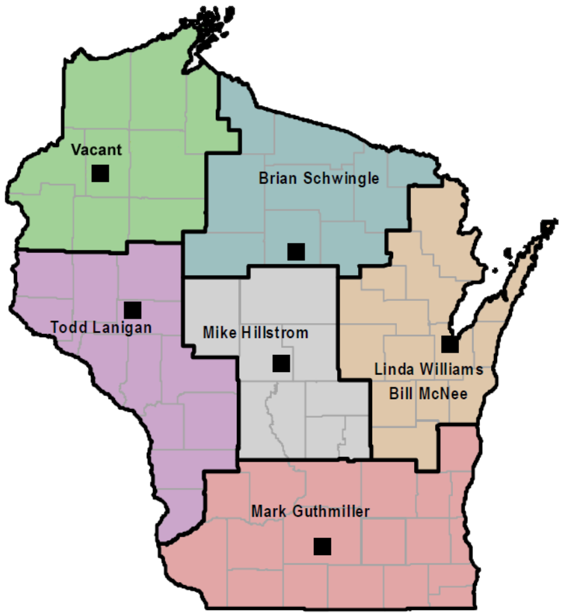
Wisconsin DNR Forest Health Staff

(as of December 31, 2012)



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Forest Resources in Wisconsin

Wisconsin's forests are critical for providing wildlife habitat, clean air and water, reducing erosion, and improving the quality of life in urban and rural areas. Forests are also important to the economy of Wisconsin for wood products, recreation and tourism. The primary and secondary wood products industry is one of the five largest employers 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 annual value of these products is about $20 billion. Forest and water resources in Wisconsin are a primary tourism attraction for both residents and visitors. The variety of Wisconsin's forest ecosystems supports a great diversity of wildlife species, while recreational use of the forests continues to grow and expand.

Area of forests by type and age class

The area of forest land in Wisconsin has been steadily increasing in recent decades and currently stands at approximately 16.6 million acres, representing over 46 percent of the total land area (Figure 1). Wisconsin now has more forested land than at any time since the first forest inventory in 1936.

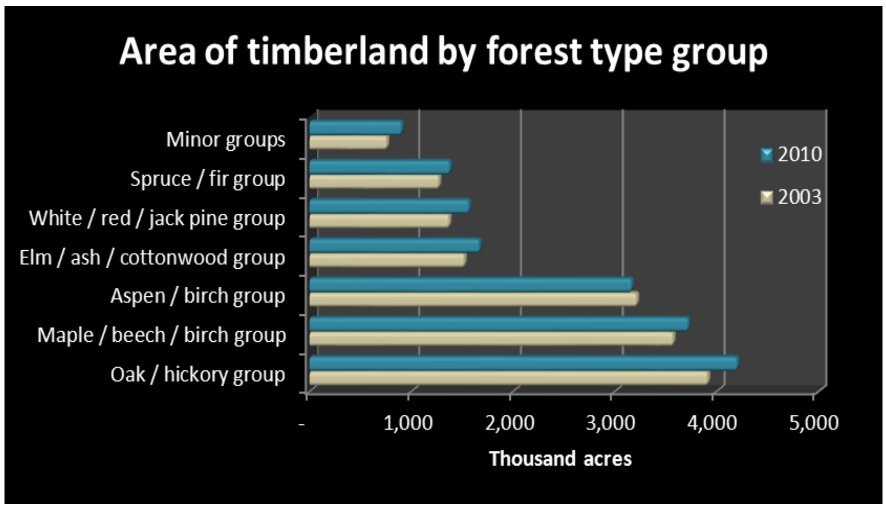


Figure 1. Wisconsin timberland area by forest type, 2003 and 2010 (FIA data, USDA Forest Service).

Wisconsin's forests are predominantly hardwoods, with 78% of the total timberland area classified as hardwood forest types (Figure 1). The primary hardwood forest types are oak-hickory at 25% of total forested acreage, maple-beech-birch at 22% and aspen-birch at 19%. Conifer types, mainly red, white and jack pines and spruce-fir, represent about 22% of the timberland. In addition, the forests are becoming middle-aged, with less acreage in young

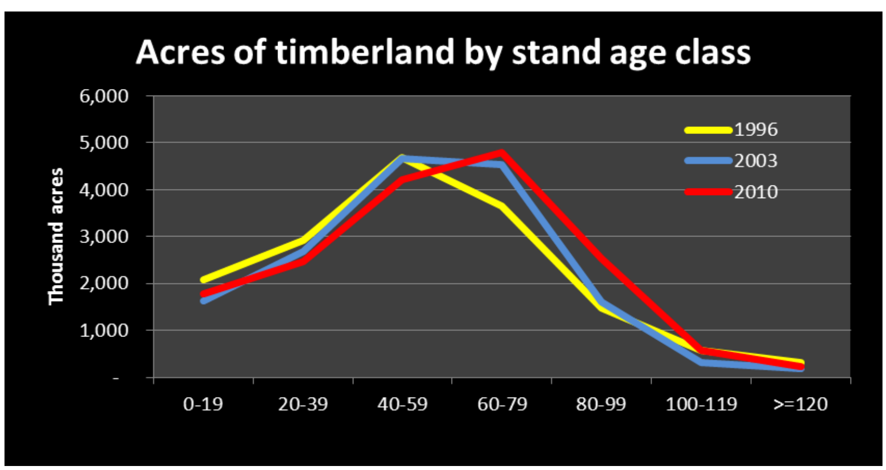


Figure 2. Timberland acreage by stand age class 1996, 2003, and 2010 (FIA data USDA Forest Service).

and old stands and a sharp increase in stands 60 to 100 years old (Figure 2).

Volume and trends in major species

Since 1996 there have been some dramatic changes in growing stock volume of major species groups (Figure 3). The greatest volumes of any major species in 2010 were in the soft maple group (red and silver maple) and in northern red oak. The large volume of red oak is important because this species is affected by major insects and diseases, including gypsy moth and oak wilt.

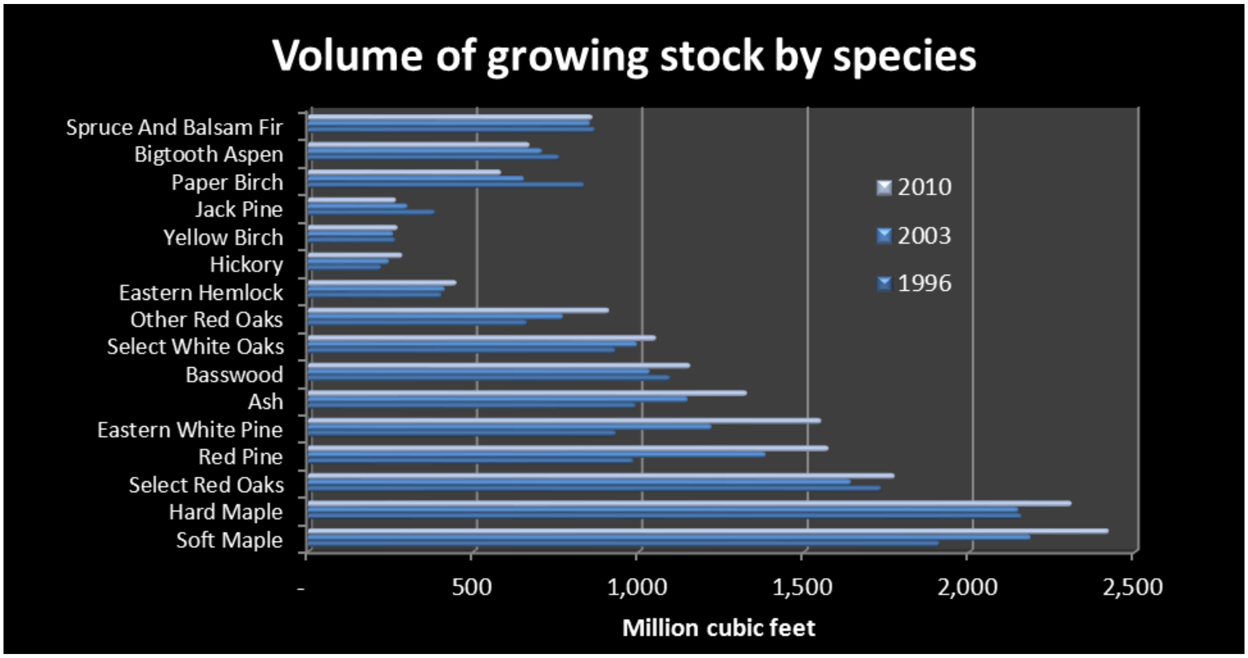


Figure 3. Trends in volume of growing stock by species group (FIA data, USDA Forest Service).

The greatest volume gains in the last 14 years have been in eastern white pine (+67%), red pine (+60%) and black and northern pin oaks ('Other Red Oaks' +38%). In the future, ash populations will be dramatically affected by emerald ash borer, which has been found in Wisconsin. The volume of elm (American elm, slippery elm, rock elm and Siberian elm) has increased 14% in the last 14 years, evidence that this species group may be recovering from heavy losses due to Dutch elm disease.

The greatest volume losses in the last 14 years have been in jack pine (-31%), paper birch (-30%) and bigtooth aspen (-12%). This change is due to a combination of natural succession and harvest losses that have not been replaced. Several species with volume declines are of commercial importance.

Invasive Pests and Diseases

Annosum Root Rot

Annosum root rot is caused by the fungus, *Heterobasidion irregulare* (formerly *Fomes annosus*, or *H. annosum*). The fungus causes a decay of the roots and lower stem, attacks the cambium and kills infected trees. In Wisconsin, Annosum root rot has been primarily found in red pine plantations. The primary mode of infection is through freshly cut stumps. Spores that are produced from a fruit body land on the stump, grow through the root system and infect adjacent healthy trees through root contact. Understory seedlings and saplings are also subject to infection and mortality. Fruit bodies may be found at the root collar of dead and dying trees and infected stumps (Figure 1). Annosum root rot is known to occur in 23 Wisconsin counties (Figure 2).

Figure 1. Fruit bodies of *H. irregulare* on a stump.

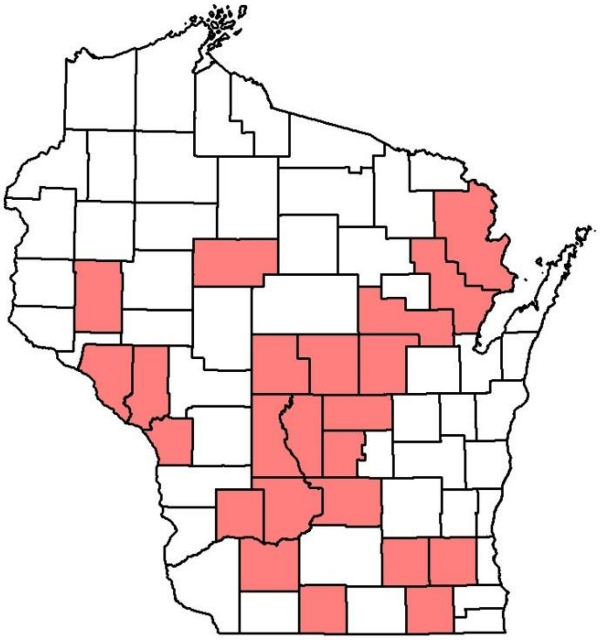


Figure 2. Counties where Annosum root rot has been found.

In Wisconsin, the disease has been found on red, white, and jack pines as overstory trees, and on understory red, white and jack pine, balsam fir, white spruce, eastern red cedar, buckthorn, black cherry and oak. Of those species, mortality from the disease has been observed or suspected on red, white and jack pines, balsam fir and eastern red cedar.

Annosum treatment guide

In May 2012, a risk-based guide for fungicide treatment of new stumps to prevent Annosum root rot was developed by the Annosum root rot committee and submitted to the Division of Forestry for its consideration on state lands. The proposed guide tries to balance the future health of the pine resource with the ability to efficiently harvest the existing resource.

Public/partner listening sessions were held in Eau Claire, Green Bay, Wausau and Wisconsin

Dells in June 2012. Written comments on the proposed guide were received from 24 individuals or organizations. These issues and options were presented at the Council on Forestry (COF) meeting in September for their input. The Annosum guide was also discussed at the COF meeting in December 2012 in order to provide additional recommendations to the DNR Division of Forestry.

Annosum root rot host susceptibility study

A study to test the pathogenicity of *H. irregulare* was conducted in the greenhouse in 2011. Seedlings of seven species that are native to Wisconsin (black cherry, hemlock, red oak, jack pine, red pine, white pine and white spruce) were selected for this study. Seedlings were either 1-0 (black cherry), 2-0 (red oak, jack pine, red pine, white pine, white spruce) or 3-0 (hemlock). Seedling age depended on the species availability in state nurseries. The study used two isolates of *H. irregulare* that had been obtained from red pine plantations in Juneau and Waupaca Counties.

On July 6, 2011, each seedling was artificially inoculated using an agar plug filled with one isolate of *H. irregulare* conidia and mycelial growth (Figure 3). Eleven seedlings of every species were treated with each of the isolates. The health of each seedling was assessed and recorded every month until the end of November 2011. Data were analyzed in 2012.

Figure 3. Inoculation of seedlings with an agar plug containing *H. irregulare*.

At the end of the study in November 2011, there was limited mortality of the treated seedlings. Mortality was only observed on white spruce, jack pine, red pine and white pine (Table 1). Although the Juneau County isolate had a greater effect on the seedlings than the Waupaca County isolate, the overall effect of *H. irregulare* was not statistically significant. This is likely due to limited symptom development during the study period.

Seedling species	Control	Treated with Juneau County isolate	Treated with Waupaca County isolate
White spruce	0/11	1/11	1/11
Jack pine	0/11	0/11	1/11
Red pine	0/11	2/11	0/11
White pine	0/11	1/11	0/11

Table 1. Seedling mortality from *H. irregulare* during the study.

Reisolation of *H. irregulare* from all of the seedlings was attempted at the end of the study by plating wood slices onto selective media. The pathogen was reisolated from 1 cm beyond the inoculation point in 86% of the seedlings, and from all seven tree species (Table 2). Reisolation was often successful both above and below the inoculation point.

Seedling species	Control	Treated with Juneau County isolate	Treated with Waupaca County isolate
White spruce	0/11	11/11	9/11
Jack pine	0/11	7/11	4/11
Red pine	0/11	2/11	1/11
White pine	0/11	5/11	1/11
Hemlock	0/11	0/11	2/11
Cherry	0/11	8/11	4/11
Red oak	0/11	1/11	1/11

Table 2. Number of seedlings with successful reisolation of *H. irregulare* five months after inoculation.

It is possible that the limited seedling mortality was due to reduced pathogenicity of the isolates that were used in the study, as the pathogen isolates had been transferred to a new media plate more than one year prior to use in this study. Alternatively, it is possible that symptom development requires more time than the five month duration of this study.

The study was repeated in May 2012 using a fresh *H. irregulare* culture that was isolated directly from infected wood materials. The seedlings will be kept in the greenhouse during the winter of 2012-13 to continue to monitor for symptoms of Annosum infection.

Beech Bark Disease

Surveys conducted in 2012 found that beech scale (*Cryptococcus fagisuga*), the insect associated with beech bark disease, is now present throughout most of the range of American Beech (*Fagus grandifolia*) in Wisconsin (Figure 4). Current year surveys were done by staff from UW-Stevens Point and Menominee Tribal Enterprises. First detections were made in Dodge, Forest and Menominee Counties. At present, high populations of beech scale and incidence of beech bark disease have only been found in Door County. More information about beech scale, beech bark disease and forest management can be found online at: http://dnr.wi.gov/topic/foresthealth/beechbarkdisease.html.

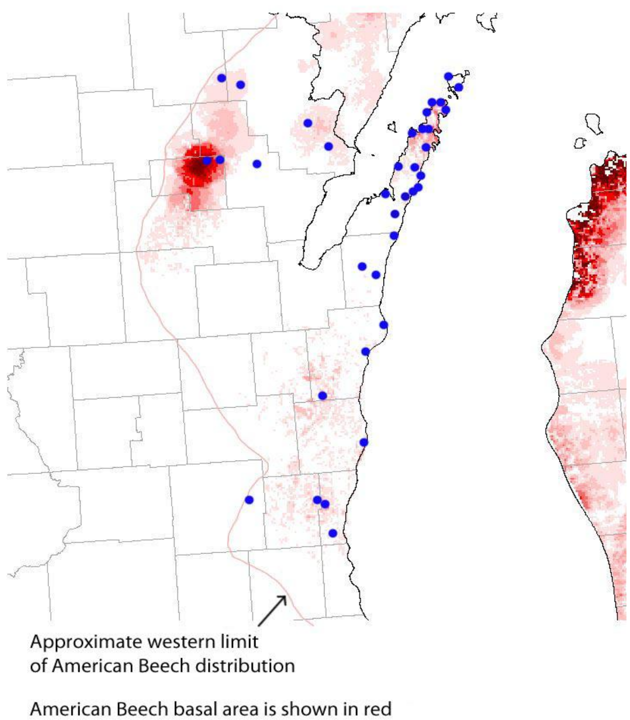


Figure 4. Map of beech scale detections (blue dots) and beech abundance (shaded red).

Crazy Worms (*Amynthas*/*Amynthus* spp.)

Amynthas spp. (Figure 5) are as the common name suggests: Crazy. They are extremely active, aggressive and have voracious appetites. They can easily outcompete any of the other invasive earthworms and they have an incredibly high reproductive rate. Their movement is their most distinctive characteristic. They will jump and thrash immediately if handled and will behave more like a threatened snake than a worm. Their size is comparable to *Lumbricus rubellus* but their appearance is what will make *Amynthas spp.* identification relatively easy. Their clitellum (the band in the middle of the worm) is not raised as it is on most other species, and unlike most earthworms, they have both a pointy head and tail.

Figure 5. Crazy worm, *A. diffringens*. Photo from University of California Sustainable Agriculture Research & Education Program, www.sarep.ucdavis.edu.

As of December 2012 there have been no confirmed detections of crazy worms in Wisconsin. Staff have received several false reports, though, as crazy worms can be easily confused with several species sold in bait stores and used for composting. Species that are most commonly confused with crazy worms are red wigglers (*Eisenia fetida/foetida*) and leaf worms (*L. rubellus*).

Earthworms

Surveying for invasive earthworms continued across much of northern Wisconsin in 2012, with an emphasis on documenting earthworm-free areas as well as abundant sugar maple (*Acer saccharum*) regeneration that may or may not be coupled with an intact duff layer. Further emphasis has focused on examining mycorrhizal associations in the presence or absence of earthworms, and whether these earthworms are impacting the regeneration of sugar maple and other hardwood species. Staff have also been documenting the presence of terrestrial invasive species that appear to benefit from the presence of earthworms in a variety of locations (i.e. wetlands, lowlands, uplands, varying soil types, hardwood and coniferous stands).

After 2 years of surveys, staff can comfortably say that several earthworm-free areas still remain in Wisconsin. These worm-free areas are likely tied to the fact that over 60 percent of Wisconsin’s forested lands are privately owned. Currently, the largest known worm-free area is located in Price County and is surrounded by a wetland that has kept earthworms from encroaching. This site was logged in January 2012, and staff will return to this site to survey for earthworms and other terrestrial invasives that may have been inadvertently introduced through the access road and logging equipment.

Three additional earthworm-free areas have been documented in the Northern Highland American Legion State Forest in northern Wisconsin. These areas are 5, 10 and 30 acre parcels that have an intact duff layer and abundant hardwood regrowth (including yellow birch and sugar maple). It is notable to mention that evidence of deer browse is apparent while this lush regeneration is occurring.

In 2012, DNR introduced its education and awareness campaign, "Contain Your Crawlers," and it was embraced by the public, bait dealers and Aquatic Invasive Species coordinators. Wisconsin DNR also provided Minnesota and Michigan with these materials, as the spread of earthworms is a shared concern.

Future program goals include a better understanding of long distance worm dispersal, continuing to map earthworm species in Wisconsin, and identifying how forestry can best adapt to the presence of earthworms.

Emerald Ash Borer

The summer of 2012 marked the fourth anniversary of finding emerald ash borer, *Agrilus planipennis*, (EAB) in Wisconsin (Figure 6). Detection of EAB continued to be a high priority in 2012, as early detection gives local landowners and communities more management options, such as salvaging live ash trees or beginning insecticide treatments before there is major tree decline. Aerial survey found pockets of very heavy ash mortality in southeast Wisconsin, most notably around Newburg and in southern Milwaukee County.

Figure 6. Emerald ash borer adult.

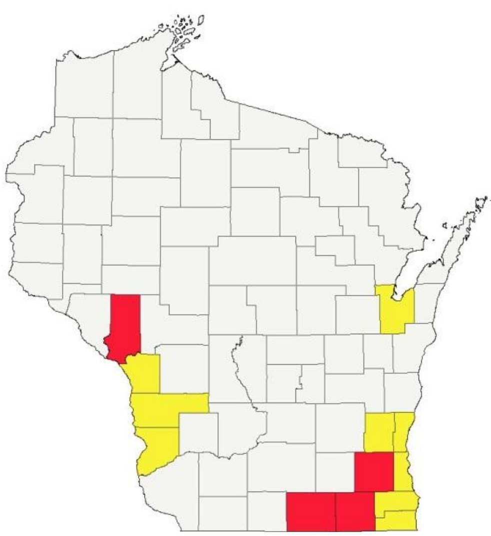


Figure 7. Counties with first EAB detections in 2012 are shown in red. Counties in yellow had earlier detections.

In 2012 EAB was found in four additional counties (Rock, Trempealeau, Walworth and Waukesha), bringing the number of known-infested counties to 13 (Figure 7). Rock, Trempealeau, and Walworth Counties were added to the EAB quarantine area in 2012 (Figure 8). Waukesha County had previously been quarantined in 2009 due to its proximity to EAB detections in Milwaukee County. The pest was detected on DNR properties for the first time – at Richard Bong State Recreation Area in Kenosha County, Big Foot Beach State Park in Walworth County, and Perrot State Park in Trempealeau County.

The current year saw a dramatic increase in the number of communities where EAB has been detected, primarily in southeast Wisconsin. Infested trees were located in downtown Green Bay, in the immediate vicinity of a trap that caught an adult beetle in 2009.

New 2012 municipal detections were:

Kenosha Co. – Pleasant Prairie, Twin Lakes, Wheatland
La Crosse Co. – La Crosse
Milwaukee Co. – Brown Deer, Milwaukee
Ozaukee Co. – Port Washington
Rock Co. – Clinton, Janesville
Walworth Co. – Fontana, Lake Geneva, Linn, Town of Walworth
Waukesha Co. – Mukwonago

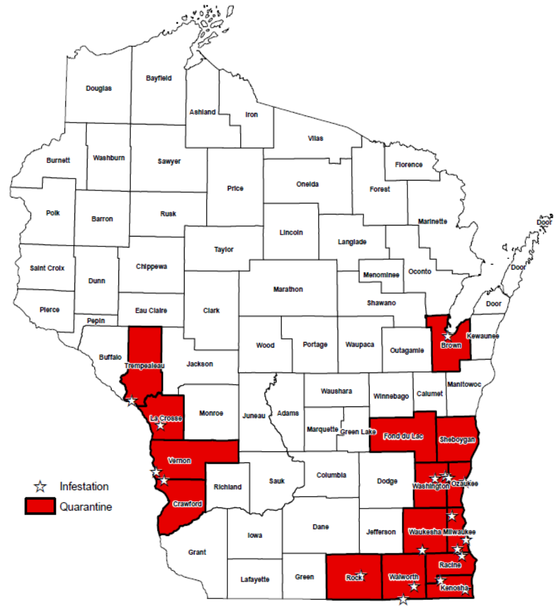


Figure 8. Counties quarantined for emerald ash borer as of December 2012.

The DNR Forest Health program prepared double-decker EAB traps (Figure 9) at a number of state properties in 2012. This trap has been shown to be effective at finding low populations of EAB. This trapping effort was successful, as the pest was detected at three state properties - Richard Bong State Recreation Area in Kenosha County, Big Foot Beach State Park in Walworth County, and Perrot State Park in Trempealeau County. Future trapping plans include use of the double-decker trap in 2013.

Figure 9. Double-decker EAB trap at Potawatomi State Park in Door County.

For the past few years, three species of stingless Asian wasps have been released in select infested areas to act as biological controls and help reduce emerald ash borer populations. Two species, *Spathius agrili* (Figure 10) and *Tetrastichus planipennisi*, attack EAB larvae beneath the bark. A third wasp species, *Oobius agrili*, attacks EAB eggs on the bark. In 2011 the three species were first released in Wisconsin near Newburg (Ozaukee County).

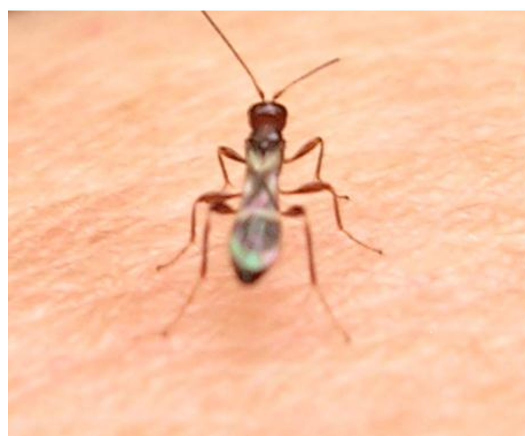


Figure 10. *Spathius agrili*, a stingless wasp that attacks EAB larvae beneath the bark. Actual size is ¼” in length.

In 2012, these three natural enemies were released in western Wisconsin for the first time, near Victory (Vernon County). One thousand *T. planipennisi*, 1,200 *S. agrili*, and 900 *O. agrili* were released between mid-May and mid-June. Many states, including Illinois, Michigan and Minnesota, have also released these biological controls.

Firewood Regulations

The Wisconsin DNR regulates firewood that may enter DNR lands, including campgrounds, as part of the effort to prevent the spread of wood-borne invasive pests and diseases of trees. Invasive pests and diseases that could be spread through firewood include emerald ash borer, Asian longhorned beetle, gypsy moth, oak wilt and thousand cankers disease of walnut. In 2012, no changes were made to regulations which currently require wood entering state campgrounds, park, forests and other properties to be all of the following:

1. from within Wisconsin,
2. from within 25 miles of the state property or campground, and
3. from outside of a quarantined area, unless the property is also within a quarantine.

Firewood that is certified by the Wisconsin Dept. of Agriculture, Trade and Consumer Protection as having been treated to kill infesting organisms, or is certified by the US Dept. of Agriculture as having been treated to EAB standards, is exempt from this requirement and may be brought into any state property.

In 2012, DNR initiated changes to the firewood supply at state campgrounds, and to regulations that will go into effect in the future. The DNR Secretary directed all state properties that supply firewood at their campgrounds to obtain the wood from that property or from a vendor certified as treating their wood to kill infesting organisms. This switch should be complete by summer 2013, and will be accompanied by an education campaign to explain what certified firewood is and why it is helpful in reducing the spread of wood-borne invasive pests and diseases. An administrative rule change was also initiated in 2012, to decrease the distance from origin for wood allowed into state properties from 25 to 10 miles. This proposed change to the law will go through a public comment process and is expected to go into effect in the spring of 2014.

Gypsy Moth

<u>Defoliation and population trends</u>

Populations of gypsy moth, *Lymantria dispar*, (Figure 11) remained low in most of Wisconsin following a large caterpillar die-off in 2010. DNR staff received a small number of nuisance complaints in 2012, primarily from northeast Wisconsin, Waukesha County and the Bayfield Peninsula. Approximately 14,500 acres of moderate and heavy defoliation was observed on aspen and oak in Bayfield County in far northern Wisconsin (Figure 12). In Marinette County, a few large

Figure 11. Gypsy moth caterpillar.

roadside oaks were heavily defoliated and caterpillar reports predict a larger outbreak in 2013. Very light oak defoliation was seen at Lake Arbutus campground in Jackson County. Egg mass sampling predicts defoliation in 2013 at Governor Dodge State Park in Iowa County, and plans are being made to aerially spray part of the property in 2013.

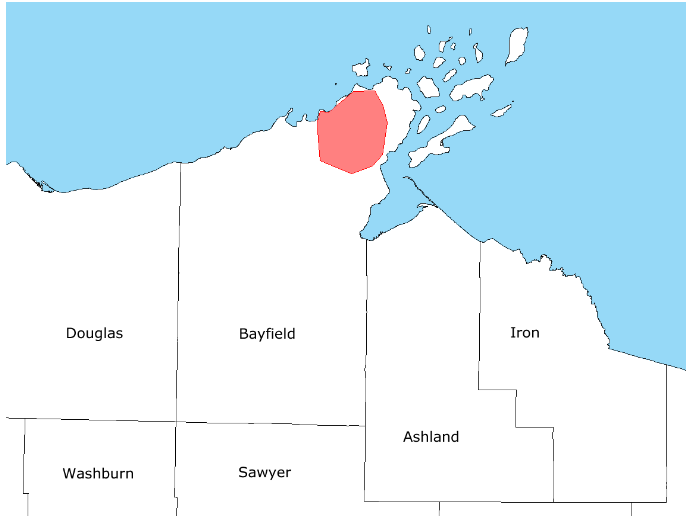


Figure 12. Reported area of gypsy moth defoliation in Bayfield County.

Warm Weather

The spring of 2012 was among the warmest on record and 80^{o} days were common in March. As a result, egg hatch occurred very early and was first seen on April 2 in Green County (southwest Wisconsin). The early hatch was especially remarkable given that 2011 was a very cold spring. The first slow-the-spread spraying in 2012 occurred a full two weeks earlier than the first hatch seen in 2011. The summer of 2012 was warm and very dry, likely helping to increase 2013 populations.

Suppression Program

The suppression program treated only one site in 2012, a 190-acre area at Governor Thompson State Park in Marinette County that was sprayed on May 17. The treatment used Foray 48B at ¾ gallon per acre (36 CLU per acre) and was done by Al's Aerial Spraying of Ovid, Michigan. Spray cost was $39.43 per acre. The treatment area (campground and boat landing) was successfully protected and no reports of nuisance caterpillars were received from campground users.

Hemlock Woolly Adelgid Surveys

Surveying for hemlock woolly adelgid (*Adelges tsugae*) on state, county and privately-owned land was completed during the spring and summer of 2012 (Figure 13). Survey sites were chosen because of introduction risk at tree nurseries, campgrounds, recreation areas or seasonal homes. At each site, two branches from opposite sides of up to 50 hemlock were examined for the presence of the adelgid's white, woolly egg sacs. If present, the egg sacs would be most easily seen from late fall through early summer. No signs of hemlock woolly adelgid were found in 2012. For more information, visit: http://dnr.wi.gov/topic/foresthealth/adelgid.html.

Figure 13. Hemlock woolly adelgid survey sites in 2012.

Invasive Plants

Education continues to be the strongest weapon in fighting the spread of terrestrial invasive species, and in 2012, staff provided more than 80 training sessions statewide. This number of sessions is monumental in alerting the public about the threat of invasive species.

Field Guide

The invasive plants program completed an addition to the "Field Guide to Invasive Plants in Wisconsin" with the inclusion of 13 additional species that tend to be associated with wetlands and moisture-rich soil. For more information on these species visit: dnr.wi.gov/files/pdf/pubs/fr/fr0436a.pdf.

Best Management Practices

The Forestry Best Management Practices (BMPs) continue to be the strongest mechanism to educate loggers and foresters about the pervasiveness of invasive species and especially their northward expansion in Wisconsin. Staff have partnered with the Great Lakes Timber Professionals Association to provide Sustainable Forestry Initiative BMP training several times per year. The other three BMP tracks (Recreation, Urban Forestry, and Transportation and Utility Right-of-Way) are being widely utilized for educating the public at large. The Recreation BMPs continue to reach a wide range of individuals, especially in public parks and forests. The Urban Forestry BMPs are being used in many communities, and a more extensive push will be initiated with further implementation of Invasive Species Rule NR 40. Utilities have tailored their BMPs to specific habitat types and working conditions to a degree that can only be seen as cutting-edge prevention. More information on all BMP tracks is available at: http://dnr.wi.gov/topic/invasives/bmp.html.

NR 40 Invasive Species Classification

Invasive Species Rule NR 40 initiated a second round of species review with a goal of listing additional species. Though the completion of the second round is still more than a year away, staff are confident that several widely-sold species with notable invasiveness will be listed as a 'Restricted' species, thus halting their ability to be legally sold. Until then, outreach and education continue to be the key in reaching the public.

State Forests

State forests continue to be the main focus in preventing and limiting the spread of terrestrial invasive plants. Working with state, federal, and county forests as well as numerous loggers, staff continue to provide statewide training on BMPs in the field.

State Fair

The annual State Fair was again an immense success, as invasive species were the focus of the entire Forestry Division display area (Figure 14). Anyone who didn't walk away with

Figure 14. Invasive plants display at State Fair in West Allis.

knowledge about earthworms, EAB, and garlic mustard… wasn't at the fair.

Suppression

Invasive plants suppression funding has been utilized statewide for treating and eradicating species such as porcelain berry and Japanese knotweed. Additional funding has been applied for so that these efforts will continue.

Thousand Cankers Disease Surveys

Black walnut (*Juglans nigra*) is a greatly valued tree species for its high quality of wood and wildlife benefits. The black walnut resource in Wisconsin is estimated at 350 million board feet of saw timber, with an estimated value of more than $436 million in 2010 dollars. Black walnut trees are also a small component of the urban forest in Wisconsin.

In order to protect the walnut resource in Wisconsin, it is imperative to be on the lookout for thousand cankers disease (TCD) (Figure 15). This disease was first observed in New Mexico in the 1990s and has since spread to eight additional western states, Pennsylvania, Tennessee and Virginia. In Wisconsin, both eastern black walnut and butternut (*J. cinerea*) are susceptible to TCD, with black walnut being particularly susceptible. *Geosmithia morbida*, the fungus that causes thousand cankers disease, is vectored by *Pityophthorus juglandis*, the walnut twig beetle (WTB, Figure 16).

Figure 15. A tree infected with thousand cankers disease develops numerous cankers beneath the bark. Photo courtesy of Whitney Cranshaw, Colorado State University, www.Bugwood.org.

To date, TCD and WTB have not been found in Wisconsin. However, the risk of introduction has been elevated as a result of TCD detections within the native range of eastern black walnut in Tennessee in 2010 and Virginia and Pennsylvania in 2011.

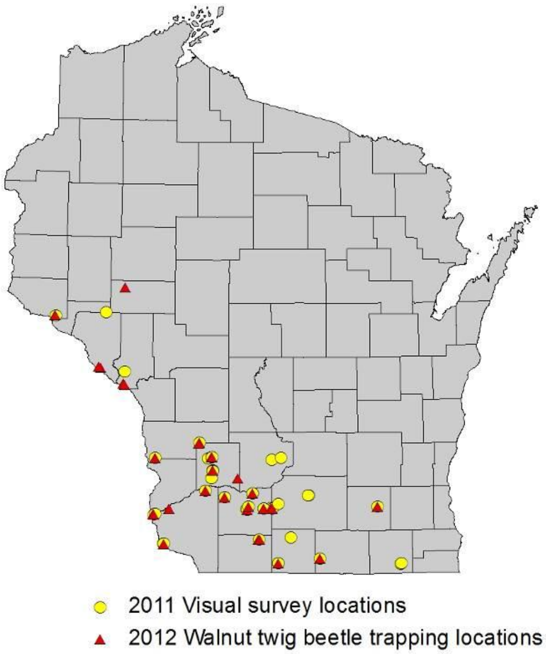
Detection surveys for walnut twig beetle were conducted using detection traps (Figure 17). Survey efforts focused on state parks and private lands with dead or declining walnut (Figure 18), using reports of declining walnut from 2011 TCD surveys. Additional survey sites were also chosen from state parks where a significant walnut resource was present.

Figure 16. Walnut twig beetle adult. Actual size is 1.4-1.9 mm in length. Photo courtesy of Steven Valley, Oregon Department of Agriculture, www.forestryimages.org.

Walnut twig beetle traps consisted of a four funnel Lindgren trap baited with a WTB attractive lure (Contech Enterprises Inc., Victoria, British Columbia). Collection cups were filled with nontoxic RV antifreeze (propylene glycol). Traps were hung in the lower canopy of walnut trees and were monitored biweekly between June and August.

Figure 17. (Left) Four funnel Lindgren trap baited with a walnut twig beetle lure. (Right) Baited funnel trap hangs in a declining walnut tree canopy.

Thousand cankers disease surveys using WTB detection traps were conducted in eight state parks and 13 private properties across 13 counties. Traps were placed in Buffalo, Dane, Eau Claire, Grant, Green, Iowa, Jefferson, Lafayette, Pierce, Rock, Richland, Trempealeau and Vernon Counties. A total of 42 traps were deployed, with an average of two traps per site.



State Property	County
Blue Mounds State Park	Dane/Iowa
Governor Dodge State Park	Iowa
Merrick State Park	Buffalo
Nelson Dewey State Park	Grant
Perrot State Park	Trempealeau
Tower Hill State Park	Iowa
Wyalusing State Park	Grant
Yellowstone Lake State Park	Lafayette

Figure 18. Location of 2012 walnut twig beetle detection surveys (shown in red). State Parks with traps are listed at right.

No walnut twig beetles were collected during these surveys. However, numerous other bark beetles, ambrosia beetles and weevils were collected, most notably ambrosia beetles from the *Xyleborinus* and *Xylosandrus* genera.

Wisconsin DNR is planning continued detection efforts for TCD in 2013. The availability of WTB traps allowed staff to expand TCD survey efforts in 2012 and this survey method will likely be continued in 2013. Future survey work is also expected to include visual and branch peeling survey methods in an effort to survey for the presence of *G. morbida*, the fungus that causes thousand cankers disease.

Hardwood Health Issues

Ash Yellows

Ash yellows is a disease caused by a phytoplasma, "*Candidatus* Phytoplasma fraxinii," a wall-less bacteria-like microorganism. Symptoms of ash yellows include small and yellow foliage, slow twig growth, thin crown, branch dieback, vertical cracks near the base of the tree, and brooms on the stem or at the base of the tree. Mortality of infected white ash has been observed in forest settings. Ash yellows has been found in 26 counties in Wisconsin.

Sampling in 2012 did not detect ash yellows in any new counties. However, a phytoplasma was detected on black walnut and butternut in counties where ash yellows has been confirmed by the Polymerase Chain Reaction (PCR) test performed by Agdia (see the "Walnut Yellows Phytoplasma Testing" section of this report).

Banded Elm Bark Beetle

The banded elm bark beetle, *Scolytus schevyrewi*, (BEBB, Figure 1) is an exotic bark beetle native to northern China, central Asia and Russia. Although the beetle was first identified in North America in 2003, museum collection specimens confirm its presence as early as 1994. The host range of BEBB in the U.S. includes American, Siberian, English and rock elm.

Figure 1. Banded elm bark beetle adult. Adult beetle size is 3-4 mm. Photo courtesy of Pest and Diseases Image Library, Bugwood.org.

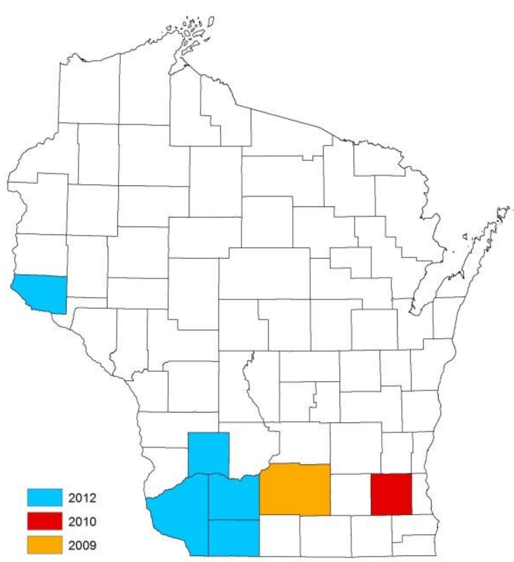


Figure 2. Detections of banded elm bark beetle in Wisconsin.

Banded elm bark beetle distribution across the U.S. is fairly widespread, particularly west of the Mississippi River. In Wisconsin, BEBB was first detected in Dane County in 2009 (Figure 2). Subsequent insect samples of BEBB were collected from a Siberian elm in Waukesha County in 2010.

In 2012, BEBB specimens were collected from pheromone-baited traps used to survey for the walnut twig beetle in Grant, Iowa, Lafayette, Pierce and Richland Counties.

Severe infestations of BEBB have been found to kill drought-stressed trees. Banded elm bark beetles are also suspected to vector the fungal pathogen causing Dutch elm disease, *Ophiostoma novo-ulmi*. In Wisconsin, banded elm bark beetles are often found at seemingly low population levels and intermixed with higher populations of the smaller European elm bark beetle, *Scolytus multistriatus*.

The impact of BEBB on the elm resource in Wisconsin is uncertain. However, good sanitation practices are always recommended in order to keep elm bark beetle populations low. Remove and destroy infested trees or materials by debarking, chipping or burning. Dead trees with the bark no longer attached are not a threat. Avoid moving firewood long distances and cover freshly-cut elm firewood with plastic sealed at the bottom with dirt. This will prevent new attacks to fresh cut wood and may reduce emergence from infested firewood. Additionally, during a prolonged dry spell consider watering yard trees to fend off threatening invasions.

Box Elder Blight

Figure 3. Box elder cross section showing common red streaking and an unidentified black fungus under the bark.

In 2012 it was common to observe box elder with blighted foliage and dieback. Box elder is prone to drought injury and sensitive to herbicides, both of which were impacting this species in southern Wisconsin. In addition to foliage issues there was both internal, red heartwood staining and black streaking in the cambium (Figure 3). The red internal staining is a general response to injury and has not been shown to be pathogen-related. Lab cultures did not confirm an exact cause, but Fusarium canker or Botryosphaeria canker is suspected. Incubated samples had evidence of *Fusarium* spp. with typical spores. This fungus can function as both a pathogen and a saprobe, so without direct culturing and conducting of Koch’s postulates, pathogenicity is not certain.

Bur Oak Blight

Since the 1990s, bur oak blight (BOB) has been reported in Midwestern states including Iowa, Kansas, Minnesota, Nebraska and Wisconsin. Inoculation studies by Dr. Tom Harrington of Iowa State University recently confirmed that *Tubakia iowensis* is the cause of the disease (in contrast to *T. dryina*, the causal agent of Tubakia leaf spot).

In 2012, new detections of BOB were made in the following counties: Buffalo, Dunn, Grant, La Crosse, Monroe, St. Croix, Pepin, Pierce, Trempealeau, Vernon and Winnebago. Currently, BOB is confirmed in 20 counties in Wisconsin (Figure 4).

Bur oak blight symptoms usually start appearing in late July and early August. Infected leaves develop purple-brown lesions along the midvein and major lateral veins on the underside of leaves. Later, chlorosis and necrosis expand on leaves and the affected leaves wilt and die. Severely affected trees may die after many years of infection in combination with other pest issues. Severe symptoms of BOB have been observed only on *Quercus macrocarpa var. oliviformis*, a variety of bur oak that produces smaller acorns. More information about bur oak blight is available at: http://na.fs.fed.us/pubs/palerts/bur_oak_blight/bob_print.pdf.

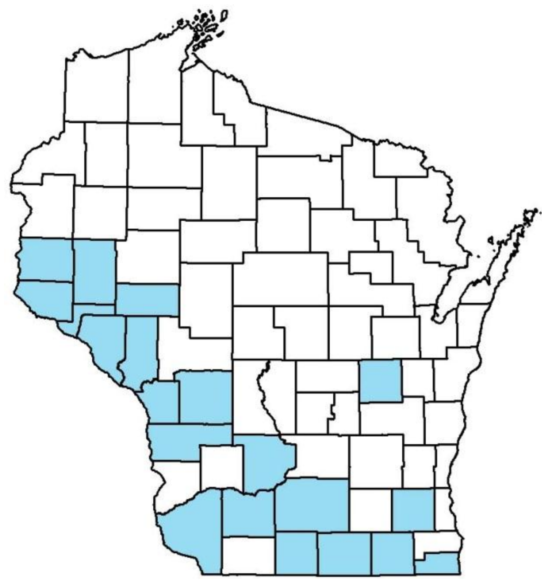


Figure 4. Known distribution of bur oak blight.

Chestnut Blight Study

A multi-state cooperative research project to control chestnut blight using virus-infected strains (hypovirus) of the chestnut blight fungus, *Cryphonectria parasitica*, continued in 2012 in the 90-acre chestnut stand in West Salem (La Crosse County). Selected cankers were inoculated with hypovirus, either through small punch wounds or scratch wounds. A history of the research study can be found in the 2011 Forest Health Annual Report, pages 37-38.

In 2012, a total of 147 new cankers were discovered in 12 long-term plots. A total of 3,187 cankers have been detected in the plots since 1992. Bark plug samples were taken from the canker surface to assess the movement of the hypovirus. Data from 2012 are being analyzed.

Oak Wilt

Oak wilt, caused by the fungus, *Ceratocystis fagacearum*, is a disease that is almost always fatal to black, red and pin oaks. Oak wilt is commonly found in southern two-thirds of Wisconsin, but the disease appears to be spreading into more counties in northern Wisconsin.

In the summer of 2012, oak wilt was confirmed for the first time in Lincoln, Sawyer and Vilas Counties. All diseased oaks were located on privately-owned riverfront or lakeshore properties. Forest Health staff have advised property owners of their options for controlling the spread of oak wilt. DNR and UW-Extension have cooperated in local public outreach efforts to prevent oak wilt spread. Oak wilt has now been detected in 58 of Wisconsin's 72 counties (Figure 5).

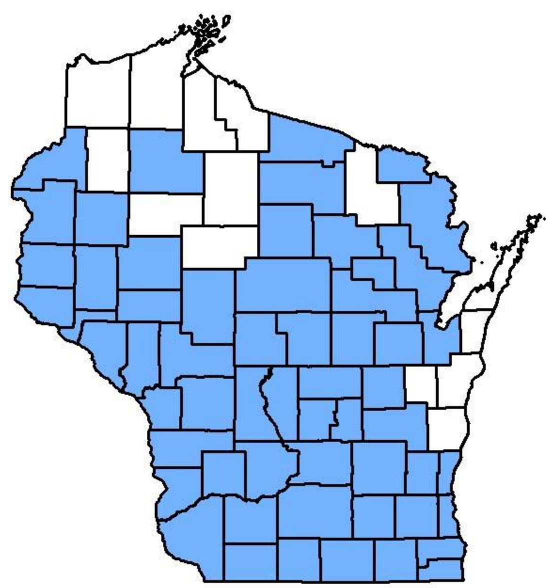


Figure 5. Known distribution of oak wilt.

Spring Defoliators

Figure 6. Eastern tent caterpillars returning to the tent after a pre-dawn feeding run.

Eastern Tent Caterpillar

Eastern tent caterpillar, *Malacosoma americanum*, populations (Figure 6) were very high, most notably in Sauk County and the southern third of Wisconsin. The pest generated numerous calls from homeowners. This insect is primarily a defoliator of fruit tree species in the genus *Prunus* and is generally not considered a major forest pest. Warm spring temperatures were favorable for eastern tent caterpillar in 2012.

Forest Tent Caterpillar

In the last few years forest tent caterpillar, *Malacosoma disstria*, a major native defoliator, has been at high numbers in southern Wisconsin (Figure 7). In 2012, populations were high in Crawford, Grant, eastern Richland and western Sauk Counties.

Figure 7. Forest tent caterpillars.

In northern Wisconsin, the only report of forest tent caterpillar defoliation was in the Balsam Lake area of Polk County, primarily on basswood. However, more reports of caterpillars were received from the northern third of Wisconsin than in the previous 5 years.

Other Defoliators

Elm spanworm was associated with forest tent caterpillar defoliation in western Sauk and eastern Richland Counties. Reports of June beetle defoliation were also received from Grant County.

Walnut Decline and Mortality

Agrilus Rearing from Walnut Branches

In 2011, staff examined declining walnut stands in southern Wisconsin to look for signs of thousand cankers disease (which has not been found in Wisconsin). Galleries and larvae of buprestid beetles were commonly observed at visited sites.

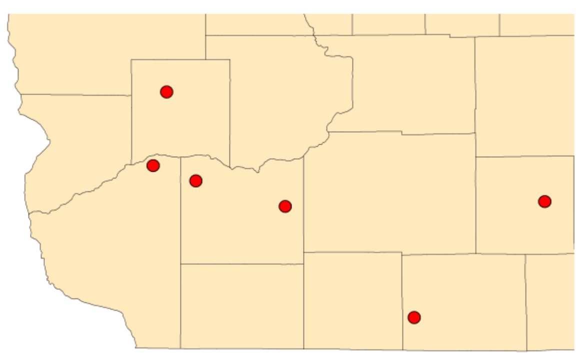


Figure 8. Location of walnut branch collection sites in 2012.

Branch samples were collected in spring 2012 to rear out wood-boring beetles from a subset of sites visited in 2011 (Figure 8). Rearing chambers were constructed using 5 gallon plastic pails, with a hole in the lid and a plastic food container used to collect emerged beetles (Figure 9).

Figure 9. Rearing buckets used to incubate walnut branches.

Three species of *Agrilus* woodborers (*A. arcuatus, A. transimpressus* and *A. cliftoni*) were reared from five of the six collection sites. All three species have been previously recorded from walnut. All emergence came from dry and dead branches, suggesting that these beetles are playing a secondary role in the observed walnut decline. No walnut twig beetles were collected from these rearing chambers.

Walnut Yellows Phytoplasma Testing

In 2011 and 2012, samples of walnut showing symptoms of walnut yellows, a phytoplasma disease, were tested. Four sites had samples that tested positive for phytoplasma on *Juglans* (Figure 10). Three sites had phytoplasma confirmed from black walnut, and phytoplasma was confirmed on butternut at one site in Jefferson County. In addition, three sites had samples of walnut scale (an insect) tested for phytoplasma, to determine if they could be a vector of the pathogen. All scale samples were negative for phytoplasma.

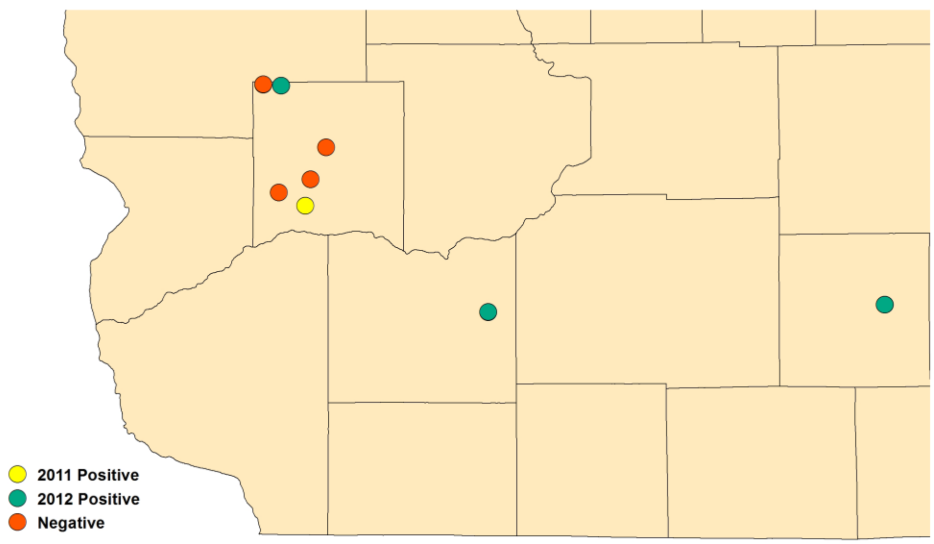


Figure 10. Locations of 2012 phytoplasma testing on black walnut and butternut.

Sapsucker Injury and Associated Cankers to Walnut

During surveys for thousand cankers disease in 2012, surveyors encountered several sites in Lafayette and Richland Counties that had sapsucker and associated canker injury to black walnut (Figure 11), which was causing dieback in the canopy. Prolific epicormic branching formed just below the sapsucker feeding holes at one site, making it difficult to see the damage from the ground (Figure 12). *Botryosphaeria* spp. is suspected as the main canker pathogen but *Fusarium* spp. may also be playing a role.

Figure 11. Cankers under sapsucker feeding sites.

Figure 12. Profuse epicormic sprouting below sapsucker injury.

Conifer Health Issues

Testing Red Pine Seedlings for Asymptomatic Infection by *Diplodia pinea*

Over the past seven years, the state nurseries have implemented an aggressive management plan to monitor and control Diplodia shoot blight and canker, caused by the fungus, *Diplodia pinea*. Some evidence suggests the presence of this fungus, coupled with increased seedling stress, could lead to seedling mortality. Recent research revealed that the fungus could persist in or on red pine seedlings without showing symptoms, and become active once a tree is stressed (i.e. moisture deficit). To limit seedling exposure to the fungus and subsequent infection, nursery and pathology staff devised a series of management actions: Removal of all mature red pine found in and around the state nurseries, increased applications of fungicides, and annual testing of nursery stock. These measures have helped to reduce the infection rate of red pine seedlings.

Since 2006, the state nurseries and Forest Health staff have tested asymptomatic red pine seedlings for Diplodia infection (details can be found in the 2007 Annual Report). In 2012, the forest health lab processed 395 asymptomatic, healthy 2-0 and 3-0 red pine seedlings for the presence of *D. pinea*. Samples were collected from all three state nurseries (Table 1).

A 10% infection tolerance level has been set for management purposes. Between 2007 and 2011 the overall asymptomatic infection rate had been consistently lower than 10%. Although the overall infection rate in 2012 (Table 1) was still relatively low (less than 20%), the state nursery program took the sampling results seriously and made management decisions to ensure the quality of their red pine stock. No red pine seedlings from Hayward Nursery will be sold in 2013. At Griffith Nursery, the only red pine seedlings that will be sold will be lifted from

Nursery	Total number of seedlings tested 2012	Total positive for Diplodia infection 2012	% positive for Diplodia infection 2012	% positive for Diplodia infection 2011
Hayward	190	34	17.9%	9.1%
Griffith	70	9	12.9%	6.9%
Wilson	135	2	1.5%	0%

Table 1. Diplodia infection rates among asymptomatic 2-0 and 3-0 red pine seedlings from Wisconsin state nurseries.

planting blocks where the infection rate was less than 10%. An investigation of the increased infection rates in 2012 is in progress.

Eastern Larch Beetle

Aerial surveys found that 970 acres of tamarack forest (Figure 1) were found to have significant mortality from eastern larch beetle, *Dendroctonus simplex*. It appeared that damaging populations had been present in eastern Price County and western Langlade County for several years. A total of 108 infested tamarack stands were mapped, but the majority of those had infestations less than 10 acres in size. Only seven infestations were larger than 40 acres, and they were located in western Langlade, eastern Taylor, eastern Price and southern Oneida Counties. Not all areas with tamarack were surveyed in northern Wisconsin. Land managers have been advised to closely monitor the infestation, or salvage and regenerate tamarack stands if appropriate.

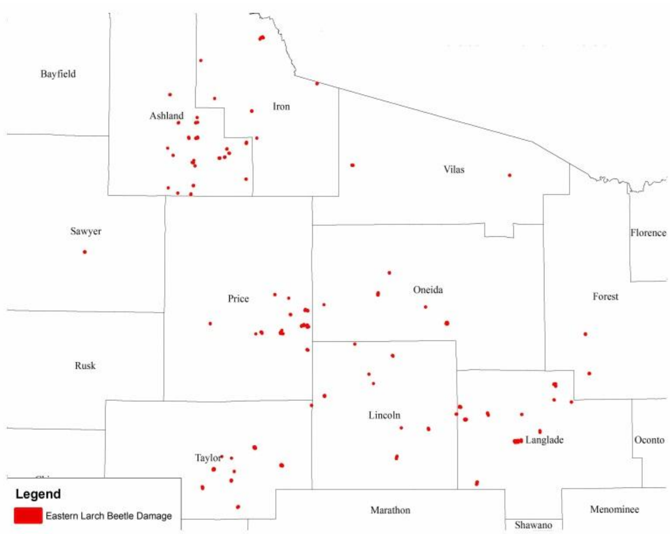


Figure 1. Eastern larch beetle damage detected in tamarack stands in north central Wisconsin.

Jack Pine Budworm

Jackson County was the only county in west central Wisconsin where jack pine budworm (*Choristoneura pinus*) activity was evident this year. Moderate to heavy defoliation of jack pine was seen in the southern portion of the Town of Manchester in the area of Old Hwy I. There was some top dieback and mortality of jack pine in this area, but no egg masses were found. Very light defoliation was seen in the Town of Brockway, and one egg mass was found in this area. Based on egg mass counts, there should not be any major jack pine budworm activity in 2013 in any of the counties surveyed (Dunn, Eau Claire, Jackson, Monroe, Pierce and St. Croix Counties).

Moderate to high populations of budworm larvae were found this year in Adams, Juneau, Portage and Wood Counties in both jack and red pine, but egg mass counts were surprisingly low.

Aerial surveys of the Bayfield Peninsula detected 173 acres of scattered jack pine budworm defoliation in western Bayview Township. The jack pine resource in the peninsula was not thoroughly assessed for defoliation, so this damaged acreage is likely an under-representation of the total. Late larval surveys in western Bayview Township found 1.2 larvae per 15 inch branch sample, which suggested that heavy defoliation would not occur (3 stands sampled).

No larvae were found in surveys in Nokomis and Minocqua Townships in western Oneida County (5 stands sampled). Larval populations in Oneida County have been nearly non-existent since 2008.

Early larval surveys in Vilas County (Cloverland, Conover, Plum Lake and St. Germain Townships) suggested that defoliation would not be noticeable (13 stands sampled). Larval populations increased slightly from 2011 in Vilas County, though they were still nearly non-existent. The highest plot total for early larval surveys in Vilas County was three infested shoots out of 30 examined. Twenty shoots or more out of 30 need to be infested before moderate or heavy defoliation is predicted. Defoliation surveys were not done in Florence, Oneida or Vilas Counties, but no defoliation was reported from land managers.

Jack Pine Gall Rust Surveys in Wisconsin State Nurseries

In the Wisconsin state nurseries, stem and branch galls are occasionally detected on jack pine seedlings at the time of lifting. Surveys to evaluate the incidence of gall rusts on jack pine seedlings were initiated in 2008 and continued in 2012.

One thousand jack pine seedlings per nursery were randomly collected at the time of spring lifting between late March and mid-April 2012. At Hayward and Wilson Nurseries, both 1-0 and 2-0 seedlings were included in the study, while at Griffith Nursery only 1-0 seedlings were lifted. Each seedling was thoroughly examined for the presence of galls. A summary of five years of results is shown in Table 2.

Nursery	Seedling age	2008 Galls	2009 Galls	2010 Galls	2011 Galls	2012 Galls
Hayward	2-0	0.7%	-	3.4%	0.7%	0.0%
Hayward	1-0	-	0.0%	0.0%	0.1%	0.0%
Griffith	2-0	7.3%	-	32.6%	18.5%	-
Griffith	1-0	-	4.2%	2.4%	-	7.2%
Wilson	1-0	-	0.0%	0.5%	0.4%	0.2%
Wilson	2-0	-	-	-	-	1.4%

Table 2. Incidence of visible galls on jack pine seedlings at the time of lifting from Wisconsin state nurseries.

All of the seedlings with visible gall formation had only one gall per seedling, and they were found only on the main stems. During the five year study period, there was a wide year-to-year fluctuation in the infection rate. Late spring frosts and dry weather during aeciospore dissemination appear to be the major factors that limit the spread of spores (Nighswander and Patton 1965). Incidence of galls was consistently less than 5% at Hayward and Wilson Nurseries, but not at Griffith Nursery (Table 2).

In addition to the assessment of gall incidence at the time of lifting, asymptomatic seedlings with no visible galls or swelling were examined later in the season in order to evaluate the rate of gall formation after the seedlings were sold and planted (Table 3). Apparently healthy seedlings were randomly collected from lifted stock at all three nurseries in the spring of 2012, and potted in late April. Fifty 1-0 seedlings from Griffith Nursery and 50 each of 1-0 and 2-0 seedlings from Hayward and Wilson Nurseries were planted in a plastic pot and placed in the greenhouse to limit additional inoculum exposure. The number of galls per seedling and the locations of galls were recorded in July and October.

Nursery	Seedling age	Number of galled seedlings (%) on 7/30/2012	Number of galled seedlings (%) on 10/15/2012	Total number of galled seedlings (%)
Hayward	1-0	0 (0%)	0 (0%)	0 (0%)
Hayward	2-0	0 (0%)	0 (0%)	0 (0%)
Griffith	1-0	11 (22%)	2 (4%)	13 (26%)
Wilson	1-0	0 (0%)	0 (0%)	0 (0%)
Wilson	2-0	0 (0%)	0 (0%)	0 (0%)

Table 3. Number of asymptomatic jack pine seedlings that developed a gall following lifting and potting.

No seedlings from Hayward or Wilson Nurseries produced a gall over the summer. However, 26% of the apparently healthy 1-0 seedlings from Griffith Nursery produced at least one gall by October. One of the 13 seedlings that exhibited gall formation had two galls on the main stem. Three seedlings had a gall only on a branch. Eighty-five percent of seedlings that produced a gall did so within three months of being potted. Since there was no gall formation on any of the seedlings from Hayward or Wilson Nurseries, it is believed that the seedlings that later exhibited a gall in the greenhouse had been infected prior to lifting. It is believed that the higher gall incidence at Griffith Nursery is due to a high component of jack pine and oak adjacent to the nursery property.

In order to address high gall incidence that has been occasionally observed at Griffith Nursery, a small-scale fungicide study was initiated in 2012. The routine fungicide application protocol at this nursery has been to apply a fungicide five weeks after germination, and then five additional biweekly applications. This summer, however, 75% of the 1-0 jack pine seedlings were treated with eight biweekly applications instead of five, in order to evaluate the effect of additional fungicide on gall incidence. Seedlings from the standard treatment and the test treatment will be examined for the presence of galls in the spring of 2013.

In the spring of 2012, galled seedlings that were potted annually between 2008 and 2011 were examined for the production of spores (pycnia and aecia, Figure 2). Twenty-seven out of 122 galled seedlings had sporulated in the spring of 2012 (Table 4). The status of pycnia and aecia formation was recorded in early May. None of the seedlings that were potted in 2011 developed aecia. More than half of the seedlings that were potted in 2008 or 2009 had galls that formed either pycnia or aecia.

Figure 2. Sporulation of a jack pine gall.

Nursery	Year potted	Seedling age at the time of potting	Number of non-sporulating seedlings	Number of seedlings with aecia	Number of seedlings with pycnia only	Total number of seedlings
Hayward	2009	1-0	3	0	0	3
Hayward	2010	2-0	7	2	2	11
Hayward	2011	1-0	1	0	0	1
Hayward	2011	2-0	9	0	0	9
Griffith	2008	2-0	14	14	5	33
Griffith	2009	1-0	7	7	3	17
Griffith	2010	1-0	7	3	5	15
Griffith	2010	2-0	8	0	1	9
Griffith	2011	1-0	8	0	3	11
Wilson	2008	1-0	2	0	0	2
Wilson	2009	1-0	0	1	0	1
Wilson	2010	1-0	3	0	1	4
Wilson	2011	1-0	6	0	0	6

Table 4. Number of potted, galled jack pine seedlings that sporulated in 2012.

Microscopic examination of germ tubes to distinguish *Cronartium quercuum* (eastern gall rust) from *Peridermium harknessii* (western gall rust) was conducted on 13 of the 27 galled seedlings that had sporulated (Anderson and French 1964). Eleven seedlings from Griffith Nursery and two seedlings from Hayward Nursery were tested. Aeciospore germination rate varied from 5% to more than 90% per seedling. Thirty germ tubes were randomly selected from each galled seedling and the length of each germ tube was recorded after 24 hours of incubation at 18.5^{o}C. Average germ tube lengths for all tested seedlings were approximately within the range of *C. quercuum*, and much longer than the range of *P. harknessii*.

For the detailed results of the jack pine gall rust study between 2008 and 2011, please refer to the Forest Health Annual Reports from these years.

References:
Anderson, G.W. and French, D.W. 1964. Differentiation of *Cronartium quercuum* and *Cronartium coleosporioides* on the basis of aeciospore germ tubes. *Phytopathology* 55: 171-73.

Nighswander, J.E. and Patton, R.F. 1965. The Epidemiology of the Jack Pine - Oak Gall Rust (*Cronartium Quercuum*) in Wisconsin. *Canadian Journal of Botany* 43: 1561-80.

Spruce Budworm

Aerial and ground surveys on non-federal lands in northern Wisconsin were done to map spruce budworm (*Choristoneura fumiferana*) defoliation in balsam fir and spruce stands in 2012. This native pest has reached damaging levels in portions of northern Wisconsin for the last three years. Michigan DNR first reported spruce budworm defoliation in adjacent areas of Michigan in 2009.

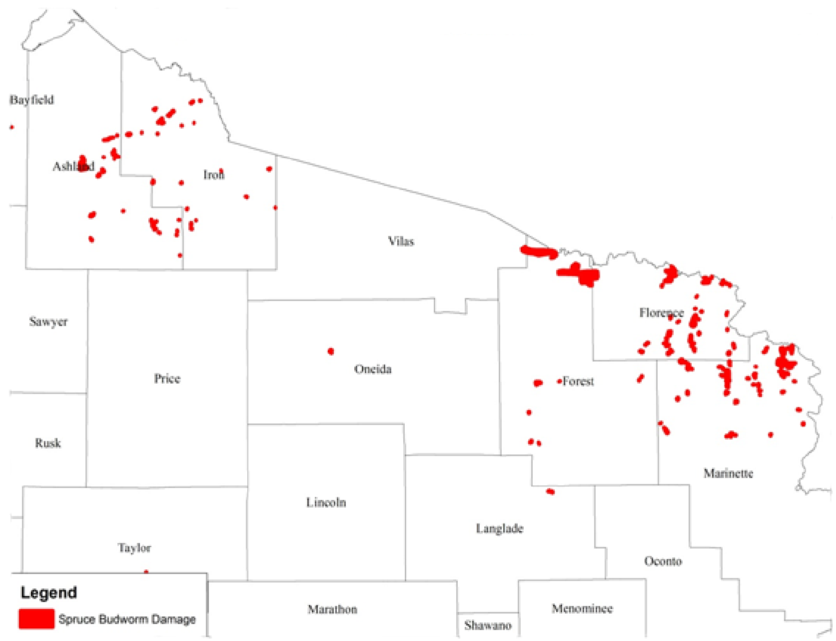


Figure 3. Recorded spruce budworm defoliation in northern Wisconsin in 2012.

About 27,000 acres of defoliated spruce-fir forest was mapped (Figure 3), although not all areas with spruce-fir forests were surveyed. Roughly 20% of this acreage was heavily defoliated (>75% defoliation of current-year needles), primarily in northern Marinette, eastern Florence, and central Ashland Counties. Significant defoliation also occurred in northern Forest County. Land managers have been advised to track the number of years their spruce-fir stands have been heavily defoliated by spruce budworm, and after 3 consecutive years, managers should consider regenerating the stand.

Survey results suggest that defoliation will occur in the Town of Niagara (northern Marinette County) in 2013. Wisconsin DNR's Forest Health team plans to continue surveying in 2013.

Abiotic Issues

Drought

Drought was the major weather event of 2012 in Wisconsin. All or parts of 12 counties were in extreme drought by early October (Figure 1). Even the northern tier of counties, which experienced flooding in June, were considered abnormally dry by October. The hardest hit parts of the state were as much as 12-16 inches below their average yearly precipitation totals.

Conditions were made worse by extreme heat across the state, especially in March and July (Figure 2). Wisconsin experienced 9 straight months of above normal temperatures that hastened soil drying.

Precipitation in October, November and December eased drought conditions. By the end of December 2012 there were no parts of Wisconsin considered to be in Extreme or Exceptional Drought situations (Figure 1).

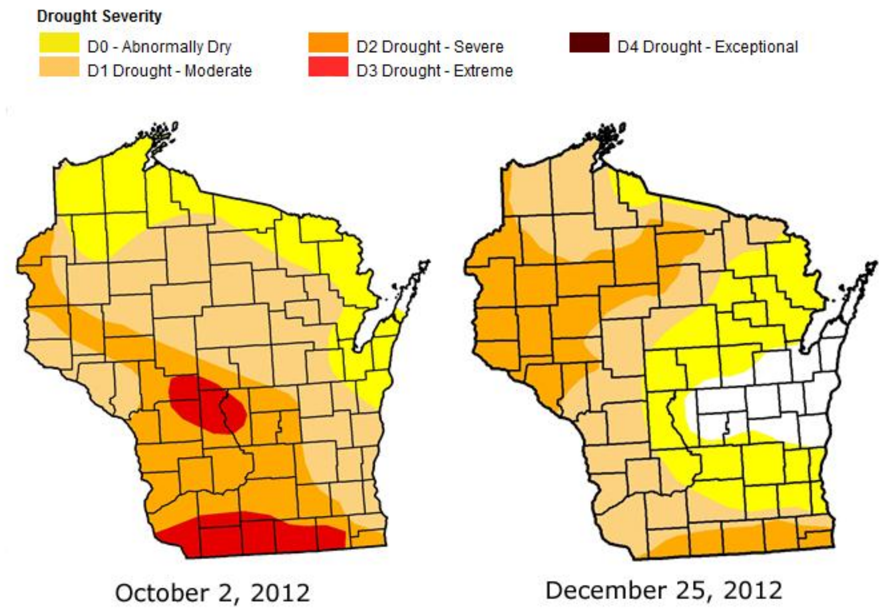


Figure 1. Drought conditions in Wisconsin as of October 2 and December 25, 2012. Source: U.S. Drought Monitor http://droughtmonitor.unl.edu/.

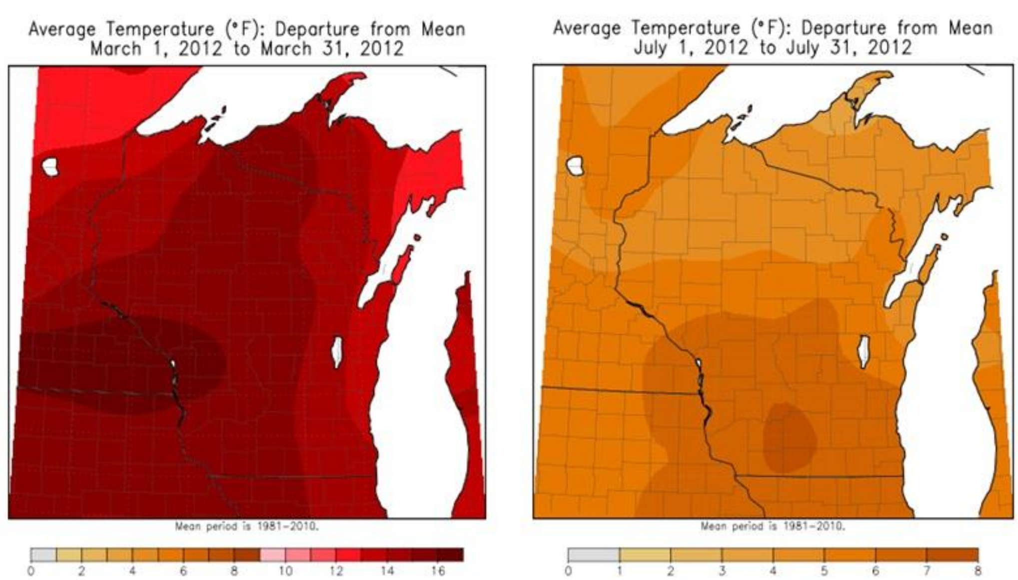


Figure 2. Average departure from mean temperature (°F) for March and July 2012. Source: Wisconsin State Climatology Office (http://www.aos.wisc.edu/~sco/clim-watch/index.html#30day).

Hot and dry conditions caused many forest health issues in 2012, particularly with young trees. Forest Health staff reported numerous cases of winter desiccation of conifers early in the year. An April cold snap following the extreme heat in March caused extensive frost damage, which exacerbated drought issues during the summer. Many landowners will need to replant large numbers of trees due to heavy plantation losses.

Drought effects on large trees became more visible later in the summer, but it is expected that most of the damage will not be noticed until 2013 or even 2014. Populations of bark beetles, buprestids and fungal pathogens such as *Armillaria* will be on the rise and will likely cause considerable damage in 2013 if drought conditions continue into winter.

Minor Issues Table

(Pest, Hosts, Damage, Noted Locations)

Abiotic Injury

Herbicide damage	Oak, spruce, pine, maple	Exaggerated growth, needle chlorosis, tree mortality	Dane and Rock Counties
Winter desiccation/ drought	Oak, hickory, maple, ash, pine, balsam fir	Browned foliage	Southern third of Wisconsin; red and white pine in Grant County; balsam fir in northwest counties
Frost damage	Red oak, aspen	New shoot mortality, leaf damage	Grant County; northern third of Wisconsin (notable in Ashland, Iron, Price and Vilas Counties)
Hail damage	Red pine	Severe shoot damage	Crandon area in Forest County

Alder

Alder flea beetle *(Macrohaltica ambiens*, formerly *Altica ambiens)*	Alder	Defoliation	Scattered areas in north central counties
Fall webworm *(Hyphantria cunea)*	Alder	Defoliation	Lincoln and Oneida Counties

Ash

Ash bark beetles *(Hylesinus spp.)*	Ash	Mortality	Dane County

Aspen

Blotch miner *(Phyllonorycter spp.)*	Aspen	Leaf mining, crown discoloration	Scattered heavy defoliation in northern third of Wisconsin

Basswood

Introduced basswood thrips *(Thrips calcaratus)*	Basswood	Defoliation	No defoliation seen in northern Wisconsin

Butternut

Butternut canker (pathogen: *Sirococcus clavigignenti-juglandacearum)*	Butternut	Stem cankers and mortality	Jefferson County

Cherry

Peach bark beetle *(Phloeotribus liminaris)*	Cherry	Infestation on large saplings	Suspected at Riveredge Nature Center (Ozaukee County)
Cherry scallop shell moth *(Hydria prunivorata)*	Cherry	Light to heavy defoliation, nuisance moths	Southeast Wood County
Fall webworm *(Hyphantria cunea)*	Cherry	Defoliation	Lincoln and Oneida Counties

Chestnut

Chestnut blight *(pathogen: Cryphonectria parasitica,* formerly *Endothia parasitica)*	American chestnut	Dieback, mortality	Grant County

Elm

European elm flea weevil *(Orchestes alni)*	Elm	Defoliation	Suspected in Iowa County

Hickory

Hickory bark beetle *(Scolytus quadrispinosus)*	Hickory	Crown dieback leading to tree mortality	Dane, Iowa and Sauk Counties; high levels of mortality in Sawyer and Taylor Counties
Phomopsis gall *(pathogen: Phomopsis spp.)*	Hickory	Galls on branches causing some branch dieback	Sauk County

Linden

Japanese beetle *(Popillia japonica)*	Linden	Defoliation	Dane County

Maple

Tar spot *(pathogen: Rhytisma acerinum)*	Norway maple	Leaf damage	Dane County

Miscellaneous Pests

Brown marmorated stink bug *(Halyomorpha halys)*	N/A	No damage found in Wisconsin to date	Overwintering specimens found in Green Bay, Middleton and Fort Atkinson; light trapped in Madison; found in a vehicle in Jefferson County; found in a Lake Geneva home (may have been imported from Pennsylvania)

Oak

Botryosphaeria canker (pathogen: *Botryosphaeria dothidea)*	Red and northern pin oak	Branch tip death	Common in southern Wisconsin; severe dieback along roads in some areas of north central Wisconsin; Vilas County
Columbian timber beetle *(Corthylus columbianus)*	Red oak	Wood boring and minor lumber defect	Suspected in Sheboygan County
Kermes scale *(Kermes spp.)*	Oak	Twig dieback	Severe dieback along roads in some areas of north central Wisconsin

Oak (continued)

Oak tatters *(Cause unknown)*	White and bur oak	Severely tattered leaves and defoliation	Rock County
Oak wilt *(Ceratocystis fagacearum)*	Red oak	Mortality	Richland and Sauk Counties
Twolined chestnut borer *(Agrilus bilineatus)*	Oak	Girdling and tree mortality	Sauk County
Oak slug sawfly *(Caliroa quercuscoccinae)*	Oak	Window-paning and leaf skeletonizing	Scattered northern red oaks in Lincoln and Oneida Counties
Pip gall wasp (*Callirhytis operator*)	Red oak	Acorn pip galls and aborted acorns	Forest County; possible reports from Oneida, Price and Washburn Counties
Cylindrosporium leaf spot *(Cylindrosporium spp.)*	Oak	Leaf disease, spotting	Oneida and Vilas Counties, lower incidence and severity than in 2011 on northern red oak; Pelican Lake in Oneida County
June beetles *(Phyllophaga spp.)*	Oak	Defoliation	Grant County

Pine

Chestnet brown bark beetle *(Pityogenes hopkinsi)*	White pine	Tree mortality	Racine County
Diplodia shoot blight *(Diplodia pinea)*	Jack and red pine	New shoot death with shepherd's crook and/or entire branch mortality	Polk and Washburn Counties in some low-lying areas; severe blight in plantations near Crandon after hail damage
Eastern pine shoot borer *(Eucosma gloriola)*	White pine	Shoot mortality	Jefferson and Waukesha Counties
European bark beetle (*Hylastes opacus*)	White pine	Stem feeding damage	Sheboygan County
Ips bark beetles *(Ips spp.)*	Pine	Tree mortality	Dane, Dodge, Jefferson and Sauk Counties; outbreak on 1.5 acres around a logging business in Aurora (Florence County)
Orthotomicus bark beetle (*Orthotomicus caelatus)*	White pine	Stem feeding damage	Sheboygan County
Red turpentine beetle *(Dendroctonus valens)*	Red pine	Stem infestation and possible tree mortality	Jefferson County
White pine blister rust (pathogen: *Cronartium ribicola)*	White pine	Trunk and branch cankers, tree and branch mortality.	Dodge and Waukesha Counties
Weevils (*Pissodes* spp.)	White pine seedlings	Pitch cocoon and feeding damage to stem	Sheboygan County
White pine weevil *(Pissodes strobi)*	Jack, Scotch, white Pine	Terminal leader killed on open-grown saplings	Florence and Vilas Counties on jack pine

Pine (continued)

Sirococcus shoot blight *(pathogen: Sirococcus* spp.*)*	Red pine	Severe shoot blight	Vilas County (Plum Lake Township)
Saratoga spittlebug *(Aphrophora saratogensis)*	Red pine	Shoot blight	Severely infested 2 acre plantation in the Town of Stella (Oneida County)

Spruce

Eastern spruce gall adelgid *(Adelges abietis)*	White spruce	Branch galls	Dodge County
Rhizosphaera needlecast *(Rhizosphaera kalkhoffii)*	Colorado blue and white spruce	Needle discoloration, needle loss	Dodge, Sheboygan and Washington Counties

Tamarack

Diplodia blight (pathogen:*Diplodia* spp.)	Tamarack	Branch canker, mortality	Dane County