Central States
Forest Health Watch

Current forest health information for land managers in Illinois, Indiana, Iowa and Missouri

August 24, 2012

This collaborative effort of the USDA Forest Service Northeastern Area, Missouri Department of Conservation, and Indiana, Iowa and Illinois Departments of Natural Resources provides technical updates twice a year on forest health issues of regional interest. Useful information can also be found in previous editions, which are available on the www at http://na.fs.fed.us/fhp/fhw/.

Contents:

Important Regional Forest Health Issues

Nonnative insects and pathogens continue to be highly significant forest health issues in our region. In this edition you will find updates on Emerald Ash Borer, Gypsy Moth, Asian Longhorned Beetle, and Thousand Cankers Disease.

Emerald Ash Borer (EAB)

EAB emergence was earlier this year. According to the degree-day model, emergence started in early May in Missouri, and peaked in mid-May. For Iowa, Illinois, & Indiana, peak emergence was in early June, with declining activity by late June. Panel traps are being processed, and results should be available soon.

The distribution of EAB is difficult to define, because the insect has often been established in an area for some length of time before it is detected. Thus caution should be taken with moving firewood and forest products, even from areas where established infestations are not known to occur. The status of EAB in each of the Central States is briefly discussed below.

Illinois: EAB continues to be found within quarantine areas, but there have been no new finds outside the quarantine boundary. Extensive trapping, using the green, 12-unit Lindgren funnel trap, was conducted statewide in about 30 state parks, conservation areas and state forests.

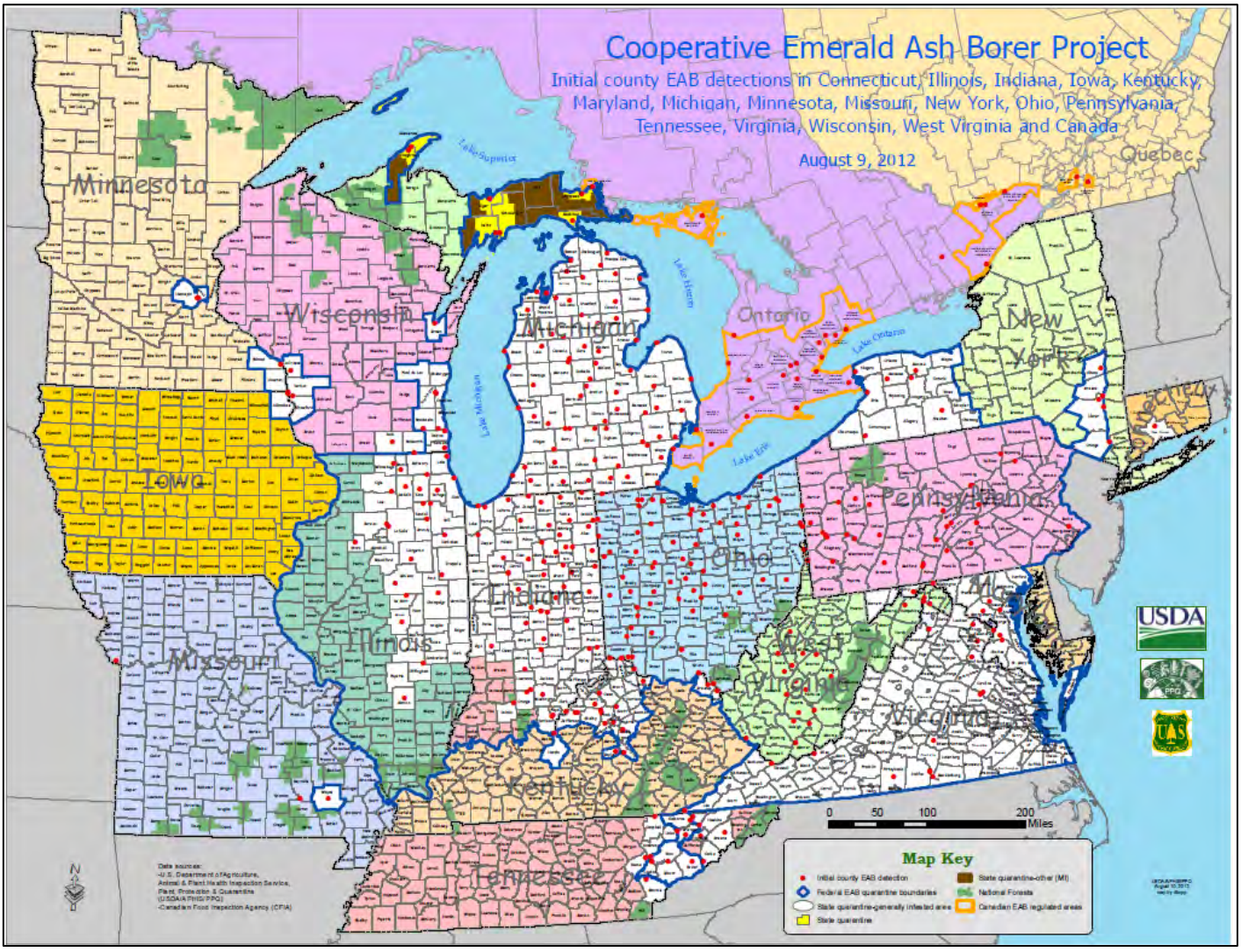
Indiana: One new county (Henry) has been found to be infested during 2012. Currently, 12 counties in the very southwest corner of the state are considered to be non-infested and are outside of the state quarantine.

Iowa: The far northeast corner of Allamakee County continues to be the only confirmed location with EAB in Iowa. Most of the purple traps have been taken down, and so far only two in Allamakee County have been positive for EAB. Out of many suspect beetles submitted for identification, none were EAB. In 2011, Iowa established 416 “sentinel trees” across 158 sites which will be cut down and evaluated for the presence of EAB at the end of 2012. Additional investigation is currently being done in areas where ash mortality has been observed. Monitoring is ongoing, and communities continue their “preparedness” activities, as they are able.

Missouri: EAB was discovered in July by an attentive arborist near Kansas City. Early reports indicate that at least one tree had already died and extensive boring damage is visible, so this infestation has most likely been present for some time (years). Surveys are currently underway to determine how widespread the insect might

be. In addition, EAB adult beetles were found on purple panel traps in Reynolds and Madison Counties in southeast Missouri, which are immediately west and north, respectively, of the known infestation in Wayne County. A new quarantine county map for Missouri will soon be available on the Missouri EAB website at http://extension.missouri.edu/emeraldashborer/. This link to an article by Missouri Extension provides good advice for homeowners:
http://extension.missouri.edu/emeraldashborer/kansascity.aspx#.UB04IZ19UaE.twitter

APHIS modified the Federal Quarantine effective July 1, 2012. The Federal Quarantine that regulated interstate movement between EAB-infested areas has been removed. Now regulated articles can freely move across state boundaries **within** the new Federal Quarantine (except for the non-infested counties denoted in Illinois and Indiana). According to APHIS, "These changes will allow for the best use of available resources by maximizing the protection APHIS provides to non-infested areas, while reducing the complexity of the requirements for affected stakeholders."

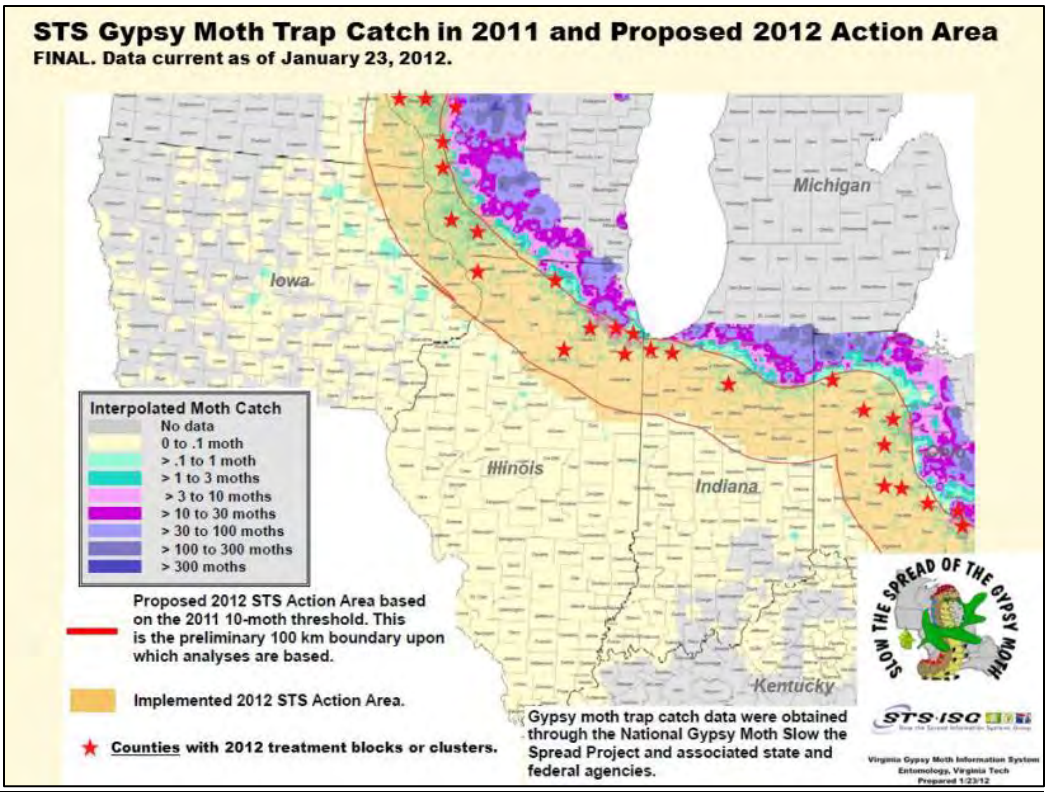


Gypsy Moth (GM) Activities – Spring 2012

In the transition zone of GM, treatments were applied to reduce populations and "slow the spread" of the advancing front. Through the Slow the Spread (STS) program, the historical spread rate of 13 miles/year has been dramatically reduced to about 3 miles per year. Iowa joined the Slow the Spread (STS) program in 2010, and four sites were treated during 2011. However, no treatments were done in Iowa during 2012. Missouri had four single catches of GM in pheromone traps in 2011, but is still considered to be without established

populations. The map to the right shows the results of GM STS trapping in 2011. The map also includes counties with the treatment sites (red stars).

No eradication projects were undertaken in the Central States in 2012.



States without established populations:		
	Treatment Activities	Trapping Activities
Iowa	None in 2012.	Iowa began to participate in the STS program in 2009. In 2011, 2,817 traps were placed in northeastern Iowa as part of the STS grid. An additional 2,900 gypsy moth detection traps were placed across the remainder of the state in a joint effort of IA DNR Bureau of Forestry, USDA APHIS, and IDALS.
Missouri	None	MO Dept. of Conservation, USDA APHIS, U.S. Dept. of Defense and MO National Guard cooperated to set out an estimated 6,000 detection traps in Missouri. Delimit trapping is being conducted in 4 counties where gypsy moths were captured last year (Calloway, Jefferson, Lewis, and St. Louis).
States with established populations:		
	Treatment Activities	Trapping Activities
Illinois	Aerial application of Btk on 11 sites (approx. 2300 acres) and mating disruption on 4 sites (approx. 17,200 acres) was planned in Cook, Kane, Jo Davies, Kendall, LaSalle, Will, and Winnebago Counties. The intent of these treatments is to slow the spread of gypsy moth by eliminating reproducing populations in the treatment sites. Some private GM suppression occurs in the greater Chicago area, but this is not reported to or monitored by the Forest Service or State.	The Illinois Department of Agriculture organizes detection trapping in the portion of the state not covered by the STS program.
Indiana	For 2012, gypsy moth treatments (14,272 acres) were much less than 2011 treatments (94,461 acres). Btk was applied to one site, totaling 668 acres, in Porter County. Mating disruption was applied to 13,604 acres in 5 sites in 2 counties (Fulton & Lake) in northern Indiana. The 10-moth line has only advanced at an average of 2.3 miles/year over the last 4 years.	The gypsy moth survey set 4,497 traps in the STS area of northern Indiana. A total of 5,046 traps (880 delimit traps and 4,166 detection traps) were set in the remainder of the State.

Asian Longhorned Beetle

Asian Longhorned Beetle (ALB) continues to be a concern for the Central States, even though the infestation in Chicago was declared eradicated in 2008. Recent detections of infestations in Massachusetts and Ohio have made it clear that ALB could be established in other places, and that it can go undetected for long periods of time. Early detection is very important to increase the chance of eradication and minimize eradiation costs. Arborists and others involved in pruning and removal of declining trees have the valuable opportunity to look at the canopy of high risk trees, and can provide early detection of ALB or other non-native pests. An aware

general public is also extremely valuable in detection. A recent Vermont article suggests using pool filters as a detection tool (http://vtinvasives.org/news/check-your-pool-filter-asian-longhorned-beetle).

Further information about ALB identification, host species, and life cycle can be found at:
http://www.na.fs.fed.us/pubs/palerts/alb/alb_pa.pdf
http://www.uvm.edu/albeetle/identification/index.html
http://www.beetlebusters.info/

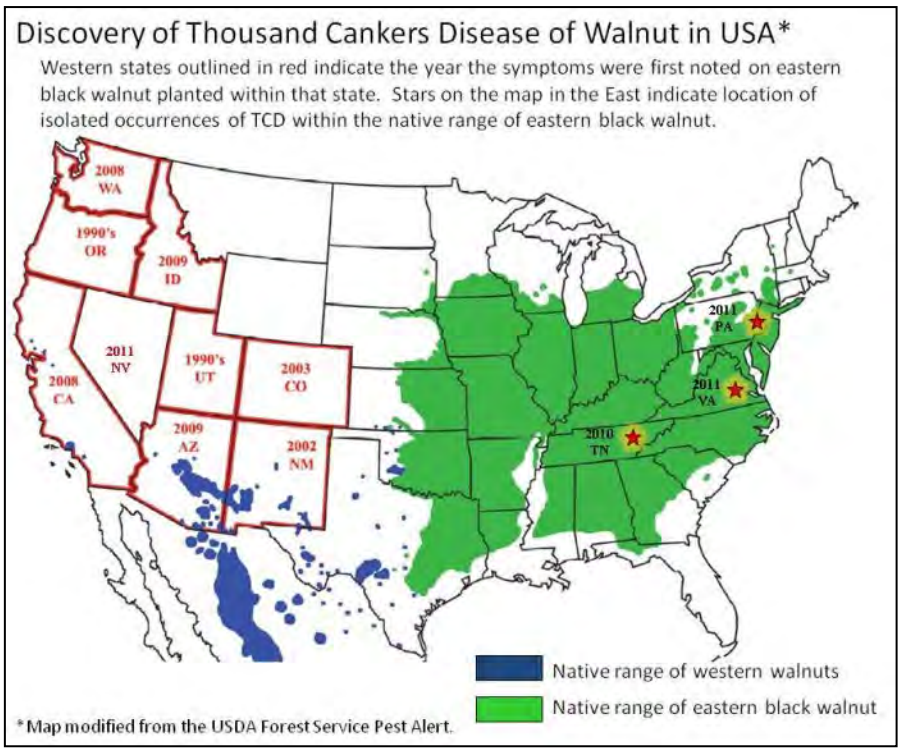
Here is the synopsis of the known ALB infestations to date:

	Year Detected	Status	# trees detected	comments
New York	1996	Active	6,224	Last infested tree found in 2010
Illinois – Chicago	1998	Eradicated (2008)	1,551	
New Jersey – Jersey City	2002	Eradicated (2008)	113	
New Jersey – Carteret	2004	Active	616	Last infested tree found 2006
Massachusetts – Worcester	2008	Active	21,200	
Ohio – Bethel	2011	Active	8,767	

Iowa recently completed an ALB visual survey of 166 declining maple trees across Iowa. The trees were identified during the 2010 and 2011 community inventory grant. No evidence of ALB was found on any of the suspect trees.

Thousand Cankers Disease of Black Walnut

Thousand Cankers Disease (TCD) of black walnut has not yet been identified in any of the Central States. As of August 2012, the only known locations of TCD within the natural range of eastern black walnut are limited areas in Tennessee, Virginia, and Pennsylvania. TCD is caused by a tiny bark beetle, *Pityophthorus juglandis*, and associated cankers caused by the fungus *Geosmithia morbida*. A survey protocol that uses a pheromone to attract the bark beetle became available in 2012. The pheromone is used as bait in a 4-unit Lindgren funnel trap. Seventeen States in the East are using this trapping protocol, including Iowa, Illinois, Missouri, Indiana, Minnesota, Wisconsin, Michigan, New York, Ohio, West Virginia, Pennsylvania, Maryland and New Jersey, Virginia, North Carolina, Tennessee, and Kentucky.



Results of the 2012 surveys are not yet in; however it has been reported that many traps are also catching *Pityopththorus lautus*, a tiny beetle that is common in the twigs of sumac and a variety of other hosts. It has been noted by researchers that at least 9 other species of fungi have been found associated with the walnut twig beetle (P. juglandis). In some cases, staining can be observed in walnut wood without the presence of the

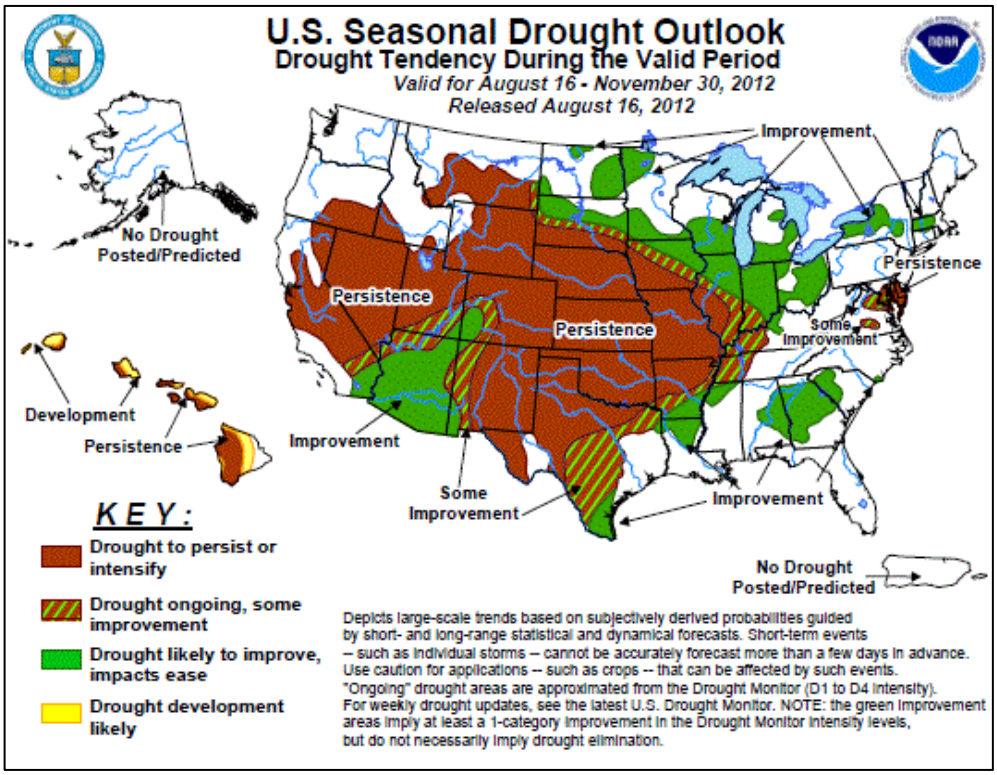
walnut twig beetle, and the fungus associated with the staining is not always Geosmithia. Clearly this is more complicated than it may initially seem: not all walnut damage is caused by TCD, and it takes a bit of sleuthing to figure out what is really going on in declining trees.

The TCD pest alert is available online at http://www.na.fs.fed.us/pubs/detail.cfm?id=5225 Additional information on TCD is also available at http://www.thousandcankers.com . If you observe declining black walnut trees, report them to your State's forest health specialist.

Weather Overview

The Midwest experienced a mild winter followed by an early spring. All four of the Central States reported extreme high temperatures during 3 weeks in March, putting many places as much as 4 weeks ahead of normal phenological schedule by the end of March. Record heat was also reported 1 week each in April and May, and two weeks in June.

The warm spring followed by the hot, dry summer has resulted in ALL of the Central States area being under some level of drought by the beginning of August. NOAA forecasts little relief through most of the fall. See our feature topic in this edition for more discussion of the expected and observed drought impacts on our forests.



What else is being reported across the Region

Intercepted Exotics

We are always on the lookout for the known exotics that could arrive to damage our forests, but a couple of recent incidents remind us of the need to watch out for the unknown exotics. In July, store employees in an Iowa discount store discovered a dead "ALB look-alike" in a box of fabric goods received from overseas. The insect was identified as *Batocera lineolata* (white striped longhorn beetle), a pest of chestnuts, pears, figs, and other trees in its native Japan. It is not known to be established in the USA.

In a separate incident, a pest control technician treating a commercial facility in Pennsylvania was given a specimen of a yellow spotted longhorned beetle (*Psacothea hilaris*) that had been intercepted in the building. This insect damages ficus and mulberry trees in its native Southeast Asia, but has not been reported in the USA.

When suspect exotic insects are found, contact your State Plant Regulatory Official. Contact information is available on the National Plant Board webpage at: http://www.nationalplantboard.org/member/index.html

White Oak Mortality

Contributed by Missouri Department of Conservation, with additional regional notes added.

Beginning in August 2011 and continuing into summer 2012, Missouri has received many reports of rapid white oak decline and mortality. Reports have been received from across the state, however a majority of the unusual reports came from central, east, and southeast Missouri. This syndrome has occurred on lower, wetter sites and north slopes in forested areas with good soils, as well as on ridges and with open-grown trees in managed landscapes. Most reports fit one of two patterns:

In the first observed pattern, many affected trees are large, spreading, mature white oaks on upland sites in lawns and other open areas. Affected trees often show little evidence of decline prior to rapid browning of large sections of the canopy. Some trees rapidly advance to browning and death of the entire canopy, while in other cases trees still had some live branches at the end of summer 2011, with complete mortality often observed in 2012.

In the second observed pattern, rapid decline and mortality occurs in pockets of variable age to mature white oak on lower slopes and bottomland in natural forested areas with good soils and adequate moisture. In some locations white oak decline is more random with respect to slope and aspect. Other oak species nearby typically appear healthy or are less affected.

With most affected white oak, brown leaves appear to hang on the tree after death. Extensive Hypoxylon canker is frequently observed soon after death, with bark falling from the trunk and large branches. Examination of some trees indicates some evidence of decay in the root flare but evidence is not present in many trees. Borer activity has been noticed under the bark, in some cases consistent with 2-lined chestnut borer. Other native borers have been collected from wood placed in emergence chambers. A very few trees have had evidence of *Armillaria* associated with the root flares or fruiting around the tree.

In some of these areas, white oaks were stressed in late spring 2010 by significant leaf browning and leaf drop caused by jumping oak gall. However, severe jumping oak gall infestation was not present in all areas with white oak decline and mortality. White oak has been impacted by various weather events in Missouri including a severe state-wide late freeze in spring 2007, additional frost damage in some low-lying areas in spring 2012, ice storms, windstorms, excessive moisture in some areas from 2008-spring 2011 and a rapid transition to drought during summer 2011-2012. Affected white oak in managed landscapes typically had few herbicide applications nearby and impacted forested areas were often far from crop fields where herbicides may have been applied. These white oak issues are being investigated by state Forest Health staff who hope to have additional information in the future.

A high level of white oak decline and mortality has also been observed recently in Iowa, particularly in the southeast quadrant of the State. In 2012, white oaks are dying quickly (within one season), and an unexpectedly high level of the samples tested (68% of 483) have been positive for the oak wilt fungus. It is typical for oak wilt disease to cause rapid death of red oaks, but unusual for it to rapidly kill white oaks. One hypothesis is that a series of spring storms (during the high risk period for oak wilt transmission) 10 to 12 years ago may have resulted in high numbers of new infections through wounds, and that the drought may have intensified development of disease in trees, leading to high mortality. Two lined chestnut borer has also been observed at high levels in the dying oaks.

In Illinois, white oak decline has not been observed to spread to as great of an extent as it did in 2011, despite the drought.

Of interest as well are recent studies on the possible role of *Phytophthora* sp. in decline of white oak in Ohio. Researchers discovered *P. cinnamomi* at significantly greater densities in declining trees than healthy trees,

and less fine roots on infested trees than healthy trees. These results indicate that *Phytophthora* root disease could be contributing to white oak decline, at least on that study site. For more information, the following journal article should be accessible on the internet: Balci, Y., et al. 2010. Involvement of *Phytophthora* species in white oak (*Quercus alba*) decline in southern Ohio. Forest Pathology 40 (2010):430-442.

Horned and Gouty Oak Galls in Illinois

By Fredric Miller, IDNR Forest Health Specialist

Normally, we do not worry too much about galls on trees, but in recent years there has been a fairly widespread outbreak of Horned and Gouty oak galls in central and southern Illinois.

Visual surveys the last several field seasons have revealed extensive galling of trees along roadsides, in windbreaks, and landscape plantings. Galling appears to build over a period of years with some trees only having a few galls to others that have heavy galling throughout the tree.

The culprits are the horned and gouty oak galls which are caused by two closely related species of galling wasps. These galls are found on the woody stem galls of pin oak and other tree species. The biology of the galling wasps is rather complicated and includes an "alternating generations" biology (Starbuck and Barrett 2012). In other words, in early spring, the wasps emerge from the woody stem galls, females lay eggs in the swelling buds of host trees and eggs hatch within 1-2 weeks. Small galls form along leaf veins and 2-3 months later, females emerge from the "leaf generation". Females from this "leaf generation" lay eggs in the young shoots and may take 2-3 years to complete their development. Normally, galling causes minor to moderate dieback of twigs and branches, but in heavy infestations, tree decline may result. Observations in Illinois have included tree death after multiple years of galling. Pin oak is prone to galling, but other oak species have also been affected.

Management of these galls is limited. Doing nothing is an option, pruning out infested limbs, or canopy sprays with an insecticide may be warranted for specimen or landscape trees (Starbuck and Barrett 2012).

Research conducted by E.A. Eliason (1999) at the University of Kentucky, showed that spraying susceptible hosts in early spring with various insecticides did reduce the number of leaf galls, but did not significantly reduce the number of stem galls. In addition, Eliason injected several insecticides into the tree to hopefully control larvae developing in the young leaves. None of the products reduced the number of leaf galls or stem galls. Foliar applications of several systemic insecticides also failed to control larvae. Bottom line, insecticide treatments do not appear to be a viable option.

In conclusion, galled trees will eventually decline and even die in areas where galling is heavy, insecticide treatments are neither practical nor effective, and pruning out infested limbs is not practical on a large scale. Landowners and homeowners should be prepared to replace affected windbreak trees, and specimen or landscape trees. Practicing good plant health care (i.e. watering, fertilizing, mulching, and pruning) may help in prolonging the life of the tree.

References:

Starbuck, C. and B. Barrett. 2012. Biology and control of horned and gouty oaks galls. University of Missouri, Division of Plant Sciences. 2 pp.

Eliason, Eileen. 1999. Ecology, Host Plant Relationships, and Management of the Horned Oak Gall Wasp, *Callirhytis Cornigea* (Osten Sacken) University of Kentucky. 274 pp.

Bur Oak Blight

Contributed by Jill Pokorny, US Forest Service pathologist

Bur Oak Blight (BOB), a leaf blight disease that causes late season browning of leaves, has continued to be found in new locations. Symptoms of BOB have been observed only on *Quercus macrocarpa var. oliviformis*, a variety of bur oak that produces smaller acorns. The pathogen has now been confirmed to be present in 75

counties in Iowa, 26 counties in Minnesota, 3 counties in Illinois, 10 counties in northern Missouri, and 9 counties in Wisconsin. BOB is also present in northeastern Kansas and eastern Nebraska. To date, it has not been detected in Indiana or Michigan. Surveys to detect the presence of BOB are currently underway in South Dakota and North Dakota.

With the intense drought across the Central States, it may be difficult to determine whether the leaf browning is caused by early host senescence, or by disease. One interesting development this year in Minnesota is the occurrence of symptoms that are atypical of BOB. In some cases, instead of the typical large wedged-shaped lesions, we are seeing very small black leafspots that produce a "freckle-like" appearance to infected leaves and leaf petioles. Often these freckled leaves turn totally brown and fall off the tree. We suspect the very hot and dry weather produced environmental conditions that were unfavorable for the growth and development of the leafspots, and so they have remained very small in size. We will have more information and images to share on this phenomenon later this fall.

Doug McNew, Iowa State University, is willing to run DNA sequencing on suspect BOB samples that represent a **new county or state record.** As part of our Forest Service grant, Doug and Tom Harrington are developing a BOB distribution map and are interested in receiving samples from **DNR Forest Health Specialists** in all of the SPFO 7-State Service Area (Illinois, Iowa, Missouri, Indiana, Wisconsin, Minnesota, and Michigan). This is a great opportunity for you to help determine if BOB is present in your State and/or determine BOB's distribution within your State. This is the final year of the grant, so let's work closely with Tom and Doug to collect and process as many **new county/state record** samples as possible.

When collecting and submitting samples, here are a few tips:

1. Collect branch twigs with symptomatic leaves attached (not just leaves). It is critical to examine leaf petioles for the presence of the *Tubakia* fungal structures. So, look for branches exhibiting brown leaves or leaves with the wedge-shaped or freckle-like lesions **and** petioles with the black pustules present. See the Pest Alert for diagnostic leaf and petiole symptoms.
2. Collect twig samples from 2-3 locations on the tree. Include some acorns, if possible.
3. Wrap the samples in dry paper toweling (no plastic bags, please), place in box or insulated envelope, and ship to:

   Doug McNew/Tom Harrington
   Iowa State University
   Dept. of Plant Pathology
   351 Bessey Hall
   Ames, IA 50011
4. Include information on where the tree is located (city and county), how much of the crown is exhibiting leaf symptoms, presence and amount of any branch dieback, and when symptoms first appeared.
5. Include your contact information. Samples may take a few weeks to be processed.

A Pest Alert on Bur Oak Blight provides photographs of symptoms, information for identification of symptoms and submission of samples, and current status of management recommendations. The electronic version is available at http://www.na.fs.fed.us/pubs/detail.cfm?id=5248. Hard copies can be requested from the US Forest Service or Iowa State University. The publication number is NA-PR-02-11.

Scorch

In Illinois, most of the maples are showing extensive abiotic leaf scorch due to the drought. The laboratory at the Morton Arboretum will be receiving samples to test for Bacterial Leaf Scorch in the next few weeks.

Dutch Elm Disease

Interest has continued in the potential use of Dutch elm disease (DED) tolerant American elms for restoration of bottomlands and replacement of ash. A handful of verified DED tolerant cultivars of American elm are

available on the open market for planting in urban areas. There is evidence that some level of DED tolerance may be heritable, but there are not yet nearly enough known DED tolerant cultivars to serve as the foundation for a breeding program. US Forest Service researchers at the Northern Research Station (NRS), however, are taking what steps they can to overcome this problem.

One step is the establishment of a "Survivor elm database". The public is invited to go to a Forest Service website and report locations and background information on large diameter American elms that have been exposed to Dutch elm disease and continued to survive without chemical protection. The website for this database is http://nrs.fs.fed.us/disturbance/invasive_species/ded/survivor_elms/ . NRS is particularly interested in elms in natural habitats. As they continue to accumulate a list of promising elms, they are also developing rapid screening methods to use in the future to determine which elms are most likely to truly be DED tolerant. They are also refining grafting methods to be able to clonally propagate difficult-to-root elms.

In 2012, NRS was able to collect open pollenated American elm seed from DED-tolerant elms in a planting near Delaware, Ohio. The trees from this seed putatively carry a higher level of tolerance to DED than the overall American elm population. With this seed, we have begun a study to compare trees from this "enriched" seed to trees from locally collected seed, and also a series of operational trials to better understand how to successfully propagate and restore elm into bottomland forests.

Japanese Beetles

Japanese beetle damage is particularly annoying in the landscape, because the adults feed for such a long period of time (~ 2 months). The adults feed on many species of trees, including birch, linden and apple, and also on many popular garden plants, like roses, raspberries, and grapes. The adults lay their eggs in the soil, and the larvae feed on the roots of turf. High levels of beetle larvae in the soil can cause extensive damage to turf. Many insecticide and biological control options are targeted at the larvae that feed on the roots of turf. Japanese Beetles are generally an urban problem, in places where trees grow intermixed with turf. Generally the amount of impact lessens after the insect has been present in an area for a few years, but localized impacts do continue. Your university extension service should have the latest information on most effective treatments for your area.

In Illinois, heavy defoliation of lindens and crabapples was common statewide. In Missouri this year, the impact was variable, with particularly high populations in Central Missouri.

In a small portion of the SW corner of Iowa, basswood has been suffering a 2nd or 3rd year of defoliation which may be due to Japanese beetle, The extensive feeding damage observed is typical of Japanese beetle, although basswood leaf miner may also be involved. If Japanese Beetle is involved, this would be a situation where the insect is affecting forest trees, and not just urban plantings.

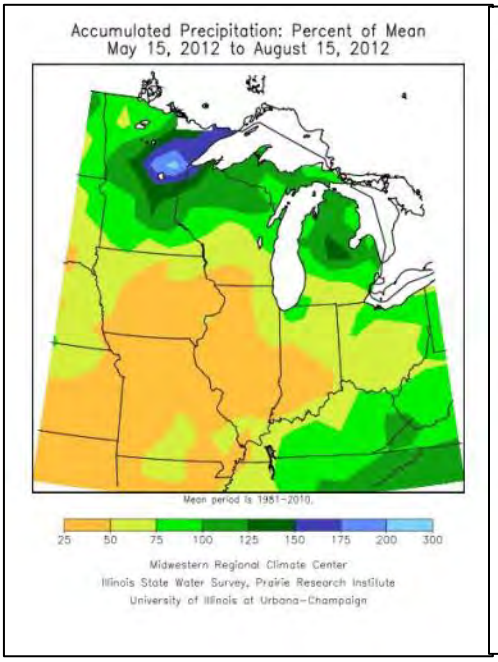
Other Resources and Sources of Information

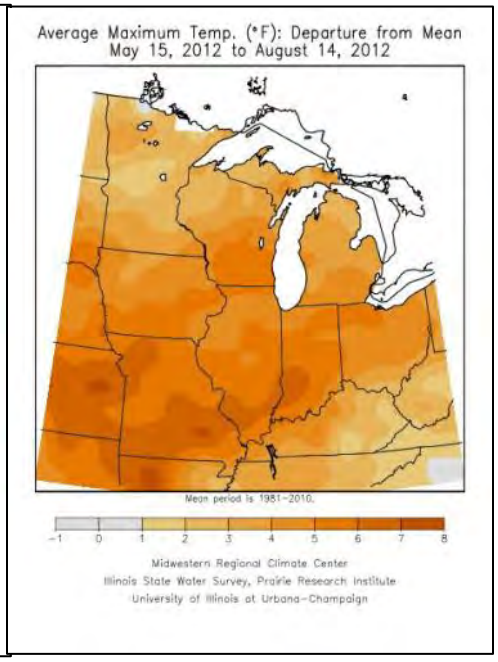
Extension Plant Clinics are also a diagnostic resource in your state. Websites for the respective clinics are:
Iowa State University Plant and Insect Diagnostic Clinic: http://www.ent.iastate.edu/pidc/
University of Missouri Plant Diagnostic Clinic: http://plantclinic.missouri.edu/ (the Missouri Clinic is currently closed)
Purdue University Plant and Pest Diagnostic Lab: http://www.ppdl.purdue.edu/PPDL/
University of Illinois Plant Clinic: http://web.extension.illinois.edu/plantclinic/
Within Illinois, the Morton Arboretum also provides Diagnostic Lab Services on the same fee schedule as the University of Illinois: http://www.mortonarb.org/plant-clinic.html

Feature Topic: Deepening drought affects forests, fish, and wildlife

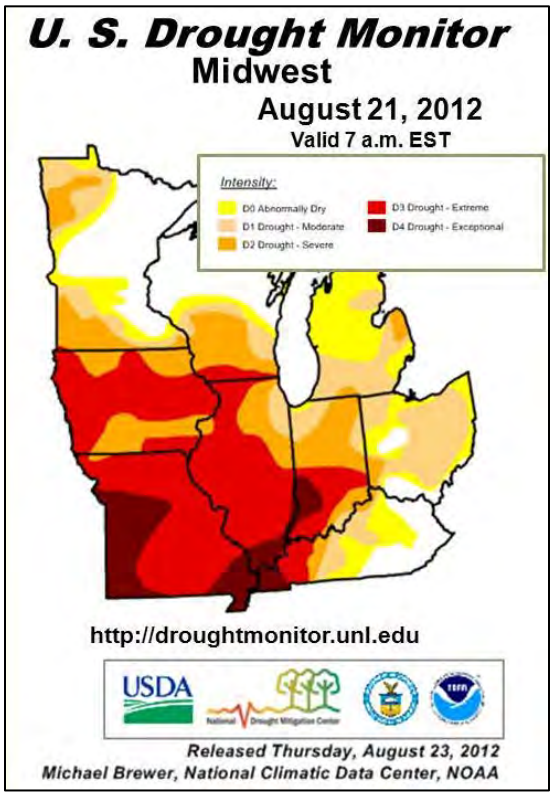
Modified from an article prepared by Jim Low, Missouri Department of Conservation.

Missouri Department of Conservation (MDC) developed an extensive press release on drought effects on citizens, forest, fish and wildlife. Drought effects extend throughout the Central States, and MDC gave permission to adapt information from their recent press release for this feature article.





Everything from trees to fish are feeling the pinch of heat and drought. The period from January through June was the hottest on record nationally. A look at the 90-day regional maps for deviation from normal maximum temperature average and precipitation reveals that "hot and dry" extend across the region (see maps). Much of the region is now under severe to extreme drought, with some areas even experiencing exceptional drought (see map). The National Weather Service's long-range forecast is for drought conditions to persist or intensify across Missouri. No significant increase in precipitation is anticipated before October.



Extreme heat, wind and unusually low humidity have sapped what little moisture once existed in the region's soil. Read on for information on how this this affecting the region's forests, wildlife and fish.

FORESTS

Even prior to the drought, portions of Central States forests were stressed by several factors. In Missouri, most of the state suffered a severe, late freeze in 2007, killing flower and leaf buds on many trees. Missouri and other States have endured severe storms with damaging winds and uneven distribution of rainfall over the past several years. In addition to weather events, pest outbreaks such as the periodical cicada, jumping oak gall, and various defoliators have stressed trees in various localities. Thus many trees entered this drought in a stressed condition.

The drought is expected to cause a reduction in acorn and nut production, which could in turn reduce mast for wildlife. Another impact is that many trees are dropping their leaves early to reduce the amount of water lost through evaporation, helping them survive. However some trees will succumb

to drought. Drought is hardest on old trees and those already weakened by disease or insect damage. Trees growing on west- and south-facing slopes will face greater drought challenges, as will trees that are crowded or poorly adapted to the sites where they are growing. The drought underscores the importance of proper forest management and working with a professional forester to properly manage forests.

On the other end of the spectrum from the old trees are the very young trees. New plantings in urban landscapes that were watered may survive even if they did not thrive through the drought. However, very high mortality should be expected in new plantings in forest settings and plantations that did not receive supplemental watering.

The ongoing drought also has heightened wildfire danger. Unlike western states, the primary wildfire season in the Central States is late winter. In most years, once trees leaf out, the shade they provide causes humidity levels on the forest floor to increase, reducing fire danger. This year is an exception. Compared to a normal year, total burned acreage in Missouri has tripled. Burn bans are in effect across much of the area.

WILDLIFE

Native wildlife is well-adapted to the range of conditions that can occur in the Central States. However, animals may have to alter normal behavior patterns to meet their needs for food, water and shelter. With scarcity of water, wild animals are attracted to water features in yards as well as to watered lawns and gardens. Squirrels may be eating garden tomatoes and frogs and turtles may be moving into backyard ponds and fountains. Cool basements may attract animals trying to escape the heat.

Deer are traveling farther than usual for this time of year and moving during times of day when they ordinarily would be inactive. Aquatic turtles must move or die when ponds or streams where they live dry up. On the other hand, smaller, less mobile animals, such as frogs, often take the opposite approach, hunkering down to wait out the heat.

Hummingbirds go where there is food, and this summer that means forests, especially around permanent bodies of water, where flowering plants remain available. As a result, fewer hummingbirds are visiting nectar feeders in dry upland areas, causing some people to wonder what has become of the little birds. On the other hand, larger birds whose primary foods are seeds and insects are crowding to well-stocked feeding stations. Putting out black-oil sunflower seeds, seed mixes and suet blocks almost guarantees that mobs of birds will visit your feeder.

Likewise, people are reporting seeing more herons this year, not because there are more of the birds, but because they are concentrated around limited water. Keeping wetland areas wet enough for ducks could be a problem if the drought continues. Low water levels in streams and wells have raised concerns about the availability of water later in the fall at managed wetland areas. On the other hand, low water levels allow maintenance work on boat ramps and other areas that normally are too wet. Lack of moisture also permits habitat work in areas where soil normally remains saturated throughout the summer and provides opportunities to control invasive plants.

The drought is not expected to have big impacts on deer numbers. Although fawn survival can be affected by drought, the mild winter and early spring green-up allowed the deer population to enter the summer in excellent body condition. Epizootic hemorrhagic disease and blue tongue (another hemorrhagic disease) always are concerns in drought years, because deer have more opportunity to transmit diseases when they are crowded around limited water supplies. Hemorrhagic diseases are

different and unrelated to chronic wasting disease, or CWD. In Missouri, there have been some reports of dead deer around water, which is typical of hemorrhagic diseases; test results are not yet in to confirm the cause. Such outbreaks are difficult to document, since affected deer typically die quickly and are immediately consumed by scavengers.

Due to reduced availability of other natural foods, deer are causing larger-than-normal amount of damage to crops. At this time of year, deer normally are browsing on plant leaves, buds and fruits. As deer travel longer distances to find food and water, they could be active throughout the day, rather than just from dusk to dawn, as they normally are. The mild winter and early spring allowed deer to store nutrients and enter the summer in great body condition, so there is unlikely to be an effect on antler size. For the same reason, deer don't need supplemental feeding.

Warm, dry weather early in the nesting season gave wild turkeys, quail, pheasant and other upland birds a much needed break from the wet, cold weather that has plagued them in recent years. Quail should have no trouble finding food because grasshoppers – one of their staple foods – are abundant. Quail can tolerate periods of dry weather well, as they get their water from dew and food.

FISH

The most dramatic effects of the current drought on fish and other aquatic life are occurring in ponds, small lakes and streams. Fisheries biologists across the state report increased incidence of fish kills in small impoundments. Although the number of fish kills is up, such events are normal occurrences in Missouri. In most cases, fish die because they can't get enough oxygen. Warm water holds less oxygen than cool water, so hot weather is naturally more stressful. Fish usually can cope with this unless other factors come into play. Some of the other factors include increased fertility that promotes algal growth. Cloudy weather turns algae from oxygen producers into oxygen consumers, so a couple of overcast days can have disastrous results. Fish gulping air at the surface of a pond is an early warning of an impending kill.

Fish in large lakes are not immune to drought and heat. Most of Missouri's large reservoirs still have reasonably good water levels, but temperatures are climbing and dissolved-oxygen levels are declining. Fish grow sluggish as water warms and oxygen grows scarce, and this makes for poor fishing. Fish also are more susceptible to diseases and parasites in tepid lakes. The longer such conditions continue, the greater the likelihood that fish will die.

Fish in streams also feel the effects of heat and drought. Streams with healthy watersheds (including good soil-conservation practices, vegetated stream-side buffer zones and trees that provide shade) generally have good water quality and avoid fish kills. But even fish in healthy streams can experience stress in extreme droughts. Trout in small spring-fed streams are at risk because reduced flow from springs has raised their water temperatures.

CONCLUSION

Good news related to the drought is scarce, but there are a few silver linings. One is that ticks and mosquitoes are not as troublesome this summer as they have been in recent years. Invasive zebra mussels can't tolerate warm water well and apparently were devastated by high water temperatures at Lake of the Ozarks last year. This year's more extreme conditions could help contain the destructive mussels.

While individual animals and local populations may suffer, experts agree that forests, fish and wildlife overall will bounce back from the current drought and heat.

Many MDC staff specialists were quoted as sources in the original article, including: Nick Kuhn, Ben Webster, Jeff Briggler, Brad Jacobs, Emily Flinn, Beth Emmerich, and Rex Martensen.

This newsletter is also available on the WWW at:

http://na.fs.fed.us/fhp/fhw/

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