United States Department of Agriculture

# 2015 Forest Health INDIANA highlights

## Forest Resource Summary

Reflecting the effect of past glaciations, forests exist in large consolidated blocks chiefly in the hilly southern part of the state. In the northern two-thirds of the state, forests generally occupy scattered woodlots, wetlands, and riparian corridors.

Currently, Indiana houses nearly 4.9 million acres of forest land (figure 1). Forested area has increased by about 3.5 percent (166,000 acres) since 2009. Timberland accounts for nearly 97 percent, while the remaining 3 percent of forest is reserved or unproductive (figure 2).

Eighty four (84) percent or over 4.1 million acres of forest land is privately owned. The state and local government owns 8.0 percent or 391 thousand acres while the federal government owns roughly 7.4 percent or 380 thousand acres. A little over 3 percent or 161 thousand acres of forest land is considered reserved.

Indiana has surprisingly diverse forests, encompassing northern maple/beech/birch types to southern bald cypress swamps, and dominated by oak-hickory type in south central Indiana. FIA survey identified 95 different tree species growing in Indiana forests. Hardwoods are the dominant species in Indiana. The oak/hickory group alone occupies 71 percent of forest land, the bulk of which resides in the white oak/red oak/hickory forest type with the remainder classified as softwoods or nonstocked.

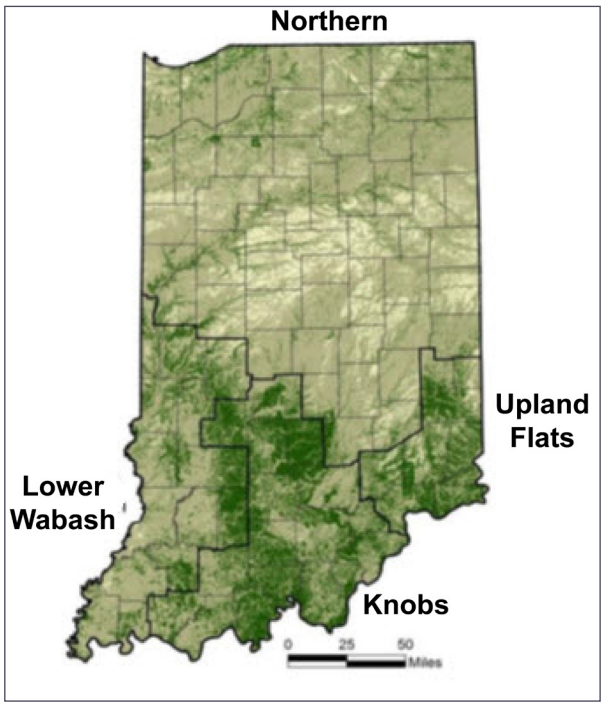



*Figure 1.—Indiana's forest cover map. Areas shaded in green are forested areas.*

Forest Service
Northeastern Area
State and Private Forestry

Indiana Department of Natural Resources

2015

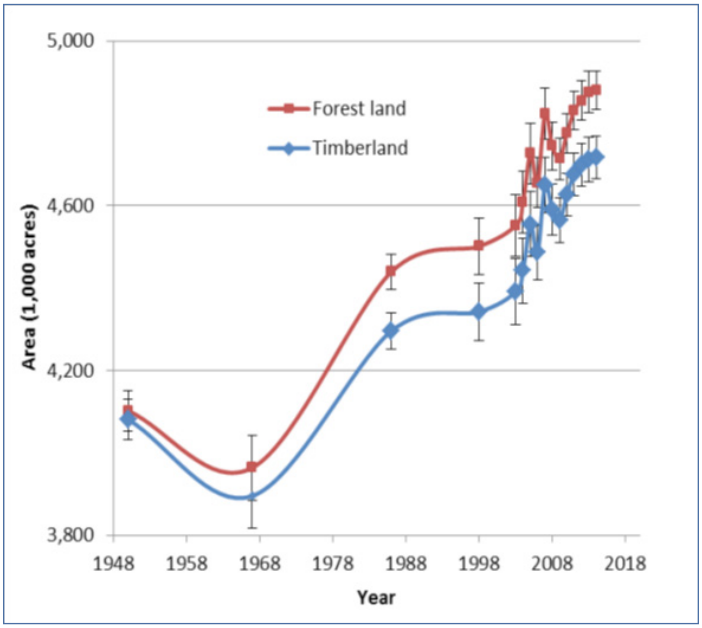



*Figure 2.—Acres of forest land and timber land in Indiana, by inventory year and dating from 1950 to 2014. Error bars represent 1 standard error or 67 percent confidence interval.*

Sugar maple (*Acer saccharum*) is by far the most numerous tree in Indiana with an estimated 360 million individuals; red maple (*Acer rubrum*) is second behind with an estimated 110 million trees in Indiana. Interestingly, the most numerous species, sugar maple, is not the most voluminous species in the state, that distinction belongs to the State tree, yellow-poplar, a.k.a. the tulip tree (*Liriodendron tulipifera*) with a net volume of nearly 1.24 billion cubic feet. These yellow-poplars also store approximately 23.5 million tons of woody biomass in their tissues.

Black oak followed by yellow-poplar, white ash, and sugar maple show the highest mortality in Indiana for the 2014 forest inventory. Annual mortality increased by 30.4 percent between 2009 and 2014 and in 2014 was 1.24 percent of net volume.

## Volume

Net volume (10.5 billion $ft^3$) experienced an increase of about 8.4 percent, which statewide in 2014, averages 2.1 thousand cubic feet per acre (statewide, about 26 cords per acre). Yellow Poplar and Sugar Maple were the top two individual tree species by volume estimates, each with over 1 billion cubic feet. White Oak, White Ash, and Black Oak rounded out the top five, all with over 500 million cubic feet each.

More information on Indiana Forests is available in 2014 FIA Annual Report located at http://www.in.gov/dnr/forestry/files/fo-2014_FIA_Annual_Report.pdf

## Forest Products

Indiana ranks 9th nationally in total lumber production and 3rd in hardwood lumber production. Indiana forests contribute over **$16 billion annually** to Indiana's economy. In 2008, Indiana's primary wood-using industry included 155 sawmills, 8 veneer mills, one handle plant, and 21 mills producing other products. Direct employment within the industry accounted for over 35,000 people and indirectly, the industry supports around 90,000 jobs. Forest-based manufacturing provided $2.4 billion in value-added, $7 billion in value of shipments, and a payroll of $1.2 billion to Indiana's economy in 2008. More than two-thirds of the 68.4 million cubic feet of industrial roundwood harvested in 2008 came from south-central and southwestern Indiana. Saw logs accounted for 90 percent of the total harvest, with other minor products—primarily veneer logs, pulpwood, handles, and cooperage—making up the rest.

Maple syrup is a product of Indiana's forests. In 2015, there are 138 maple syrup producers in 45 counties; most are found in northern half of the state. Of those, 84 responded to a survey with 67 indicating a total production of 11,829 gallons of maple syrup which was down from 14,729 gallons in 2015. A total of 57,734 taps produced 496,818 gallons of sugar water with an average 42 gallons to get 1 gallon of maple syrup. The 2015 retail prices for gallon, quart and pint are $41.70, $13.35 and $7.87, respectively. The estimated statewide income is estimated to range from $493,269 to over $615,000 when calculating sales plus give-away or owner consumption.

# State Forest Health Issues – An Overview

The **2015 growing season's major forest health problems** are the increased expansion and amount of ash mortality from Emerald Ash Borer and the confirmation of Walnut Twig Beetle trapped in a sawmill in Franklin County.

**The recurring forest health issues** are gypsy moth management, oak wilt, butternut canker, emerald ash borer mortality, white pine root decline (*Procera* root rot), mortality/ decline in aging pine plantations and aging hardwood forests.

**Future forest pests of concern** for Indiana in 2016 include the exotic pests –, Sudden Oak Death, Asian Longhorned Beetle, Hemlock Woolly Adelgid, Beech Bark Disease, Gold Spotted Oak Borer and other *Agrilus* spp., and Red Bay Wilt.

Also of concern are **Invasive plants** that have potential to affect and are affecting Indiana forest regeneration and biodiversity. Plants of concern are kudzu, *Pueraria montana*, tree of heaven, *Ailanthus altissima*, bush honeysuckle, *Lonicera spp*., Japanese stilt grass, *Microstegium vimineum* and others. The kudzu eradication program continued to eradicate locations in Indiana. As of 2015, there are 167 confirmed sites in 41 counties totaling 158.01 acres. The goal is to move kudzu to the Ohio River and eventually out of Indiana. To help manage and prevent aquatic invasive plants, 28 aquatic invasive plant species are prohibited from sale, barter, trade, distribute or transport in Indiana.

# Exotic Insect Pests of Indiana Forests

Two exotic major insects of concern - Gypsy moth and Emerald Ash Borer - continued to dominate the state resources for monitoring and management activities. Added to this in 2015 is Thousand Canker Disease of Walnut. In addition to these species, surveys for and awareness for other exotic invasive pests, – Asian Longhorned Beetle, Hemlock Woolly Adelgid and Sudden Oak Death, continue to the impact state resources.

## 1. Emerald Ash Borer - *Agrilus planipennis* Fairmaire

Emerald ash borer (EAB) was discovered in northeast Indiana in June of 2004.

The 2015 survey using the purple panel trap with manuka and phoebe oil lures was conducted in 3 southwestern counties (Gibson, Posey and Vanderburgh) following the national survey design by USDA APHIS and USDA Forest Service (FHTET). Traps were set at 24 grid points by 1 DNR staff. Three traps in Vanderburgh County detected suspect EAB, which were negative. All other traps were negative for EAB. Visual survey following removal of the traps detected EAB in 1 of the 3 counties – Posey. The detection was in a rest area on I-64 (east bound) and was 1 mile east of a 2015 trap.

**Counties with first EAB detection in 2015**

| County | Date detected/ Survey Method | | Quarantined prior to detection |
|---|---|---|---|
| | Panel trap | Visual | |
| Parke | | 4/2/2015 | Yes |
| Posey | | 12/1/2015 | No |

In 2015, EAB was detected for first time in Parke and Posey counties (figures 3 and 4). At the end of 2015, EAB had been detected in 84 of the 92 Indiana counties. Indiana's EAB quarantine is in the repeal process and expected to be repealed by summer 2016.

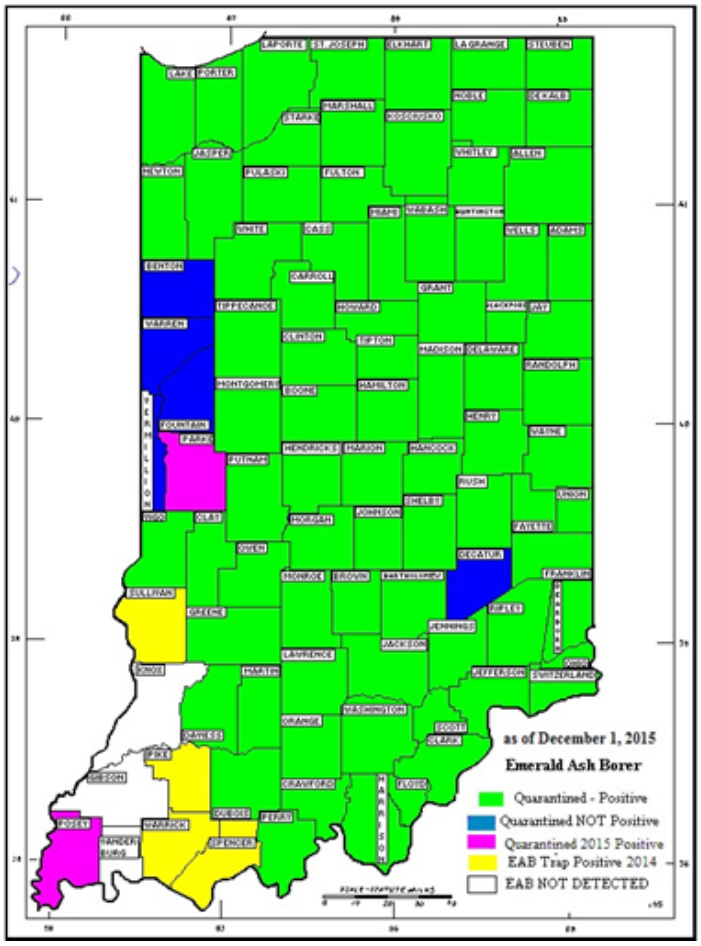



*Figure 3.—2015 EAB Quarantine Map.*

The aerial survey mapped new locations and expansion of the mortality over and around the areas that have obvious and extensive ash mortality in prior years. Figure 5 shows the extent of EAB mortality in 2015. The southern area (shaded yellow) saw an increase in EAB mortality detected both from the air and by visual reports from foresters and others. The mortality in this area is expected to increase in 2016.

The survey detected 28,953 forested acres with EAB mortality bringing the total forested acres with mortality to 131,422 since 2009.

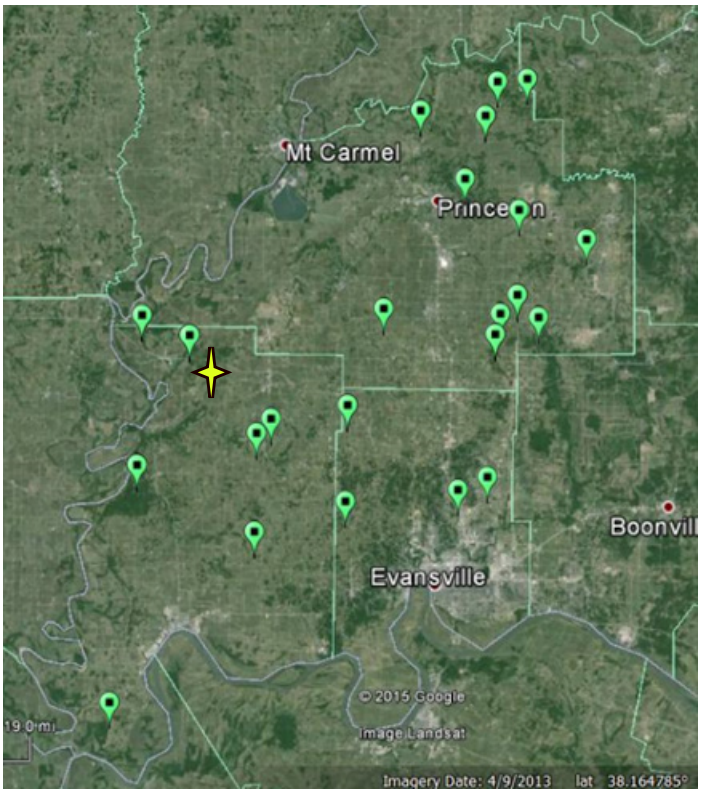



*Figure 4.—2015 EAB Tap Location Map*

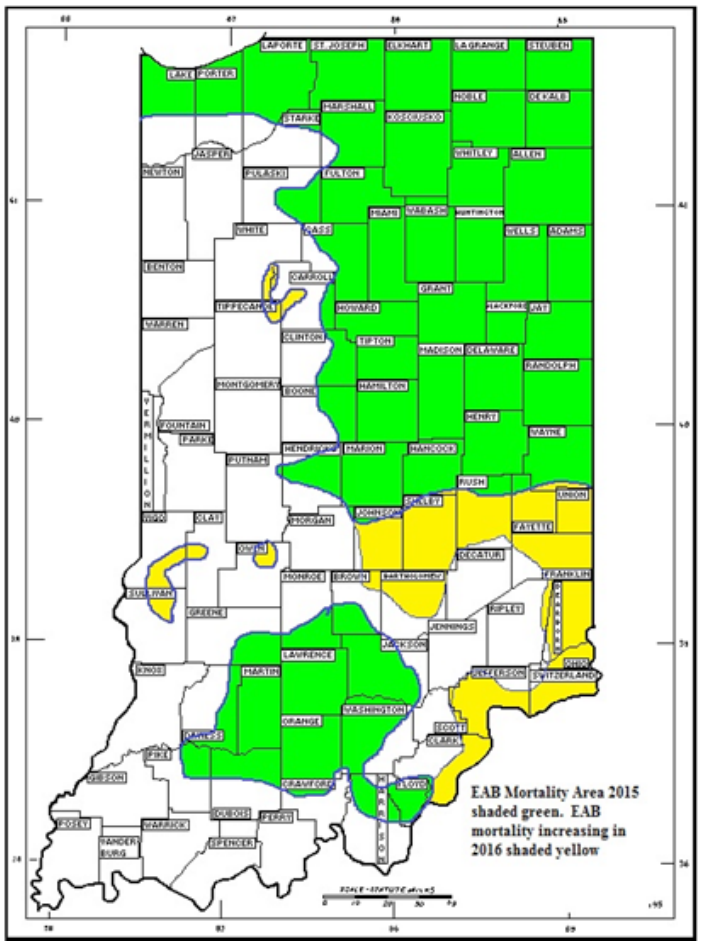



*Figure 5.—2015 EAB Mortality Map.*

## 2. Gypsy Moth – *Lymantria dispar*

The 2015 Cooperative Gypsy Moth Survey completed its 28th year of the statewide Survey. The survey is part of the Slow-The-Spread (STS) Program and uses the STS protocol for its' design and operation dividing the state into three zones - the STS Evaluation Zone, the STS Action Zone, and the State Area (figure 6). The survey design used fixed 5K, fixed 3K, and fixed 2K, for the three zones. Across all zones, the survey used 11,025 trap sites (traps set at 10,737 sites) all referenced by GPS. Four counties in the state area were not trapped this year, compared to eight counties not trapped in 2014, mostly for economic reasons, but also because of negative trap catches in previous years. There are plans to survey most of these counties in 2016.

The survey detected 15,293 moths from 40 counties ranging from 1 to 2,549 moths per county (figure 7). This year's moth catch is 7,582 less than last year's number of 22,875. Positive traps occurred in 40 counties; 31 in the STS zones and 9 in the State Area.

Since the survey began in 1972, 480,378 moths have been caught in 90 of the 92 counties. Gypsy moth has not been detected in Dubois and Sullivan Counties since surveys began in 1970.

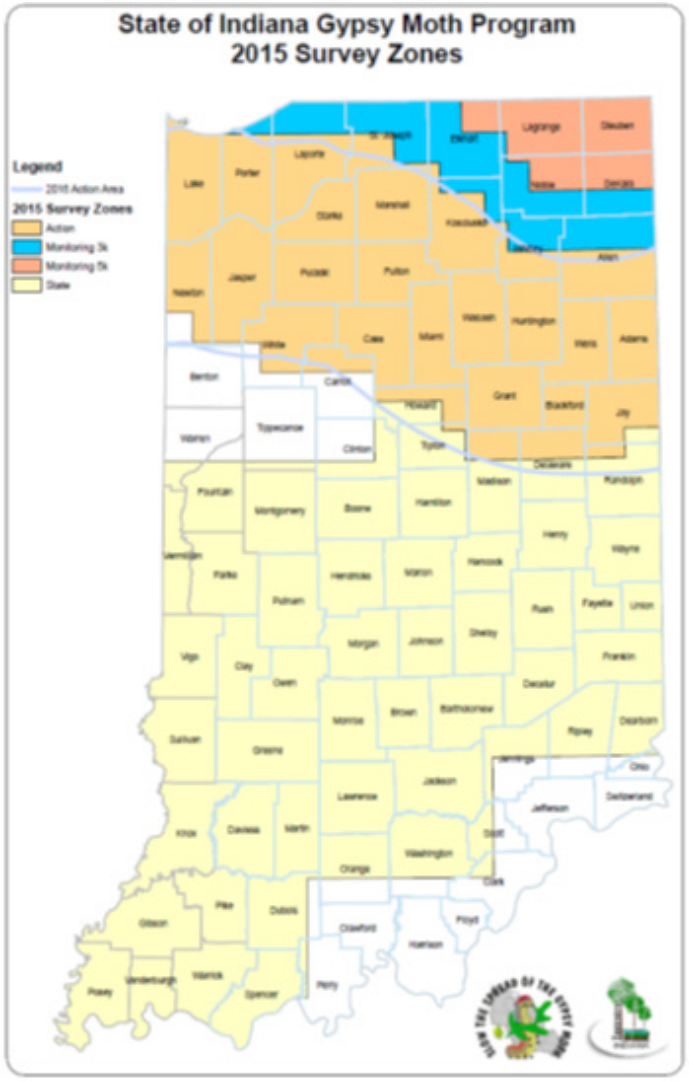



*Figure 6.—2015 Gypsy Moth Survey Zones.*

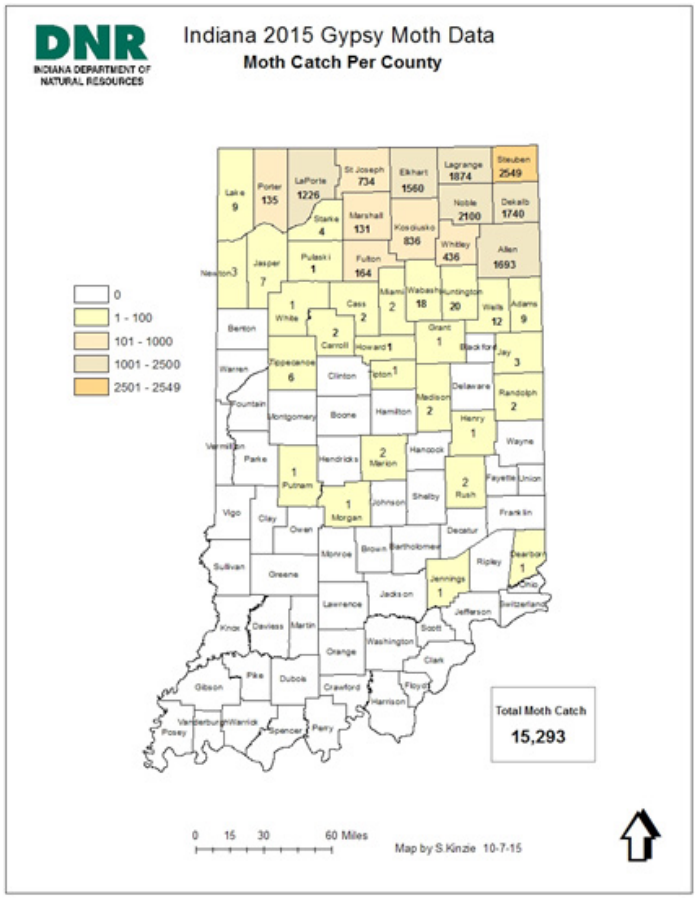



*Figure 7.—2015 Gypsy Moth Trap Catch Data.*

Btk (Bacillus thuringenisis kurstaki): Treatments to slow-the-spread and development of gypsy moth were conducted on five sites totaling 1,676 acres in three counties (figure 8). The sites were treated with Btk at 25 BIU with two applications at 4 sites and one application at 1 site, for a total of 2,205 treated acres.

Mating Disruption: five sites totaling 11,500 acres were treated with pheromone flakes (Disrupt II, Hercon): 6g/a = 9,750 acres 15g/a = 1,750 acres (figure 8).

Aerial surveys detected no noticeable defoliation from Gypsy Moth in 2015. The last time surveys detected defoliation from Gypsy Moth was in 2009 when 70 acres of defoliation occurred in 2 counties.

There are nine counties along the northern border under state and federal gypsy moth quarantine (figure 9).

## 3. Thousand Canker Disease - *Pityopthorus juglandis* and *Geosmithia morbida*

Walnut Twig Beetle (WTB), *Pityopthorus juglandis*, was confirmed at a sawmill in Franklin County in March 2015 from 2 beetles collected in the 2014 trapping survey. Investigation at the sawmill in March found walnut logs with numerous galleries. Insect samples as well as bark samples from the logs were sent to Purdue University for identification and rearing. The bark weevil *Stenomimus pallidus* in addition to walnut twig beetle were identified. At least 50 walnut twig beetles were reared out of the bark samples. By mid-April following the trap confirmation and detection in the walnut logs, all walnut logs were burned.

Thousand Canker Disease (TCD) trapping and windshield surveys were conducted in 2015 (figure 10). Two trapping surveys were conducted. The first survey consisted of 145 traps set near high risk sites.

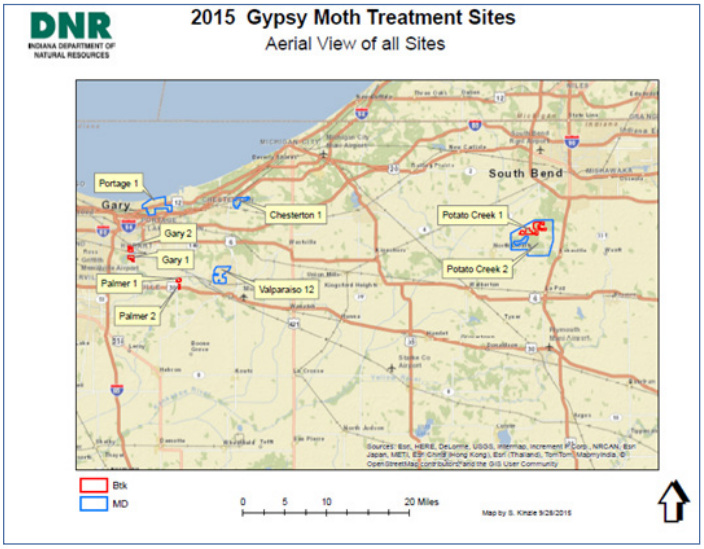



*Figure 8.—2015 Gypsy Moth Treatment Sites.*


*Figure 9.—2015 Gypsy Moth State and Federal Quarantine Map.*

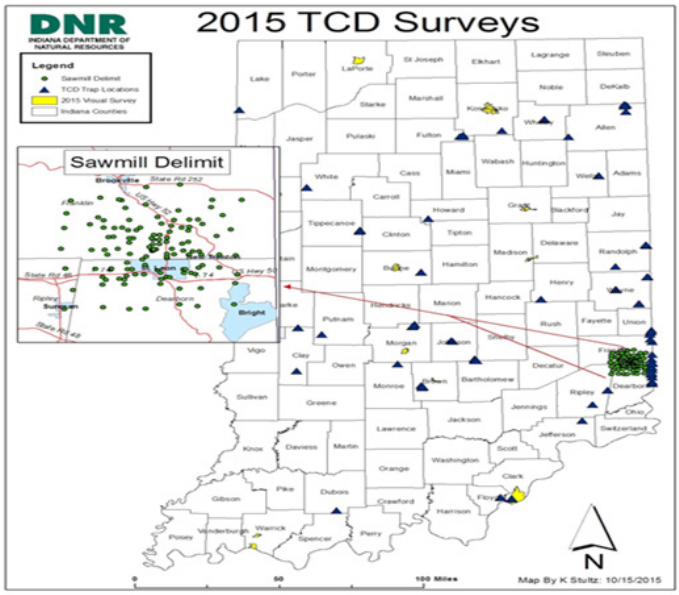



*Figure 10.—2015 Thousand Cankers Disease Survey Map*

There were 25 traps were placed along the Ohio border adjacent to Butler County. In late September, a consolidation yard in Union County was discovered that accepted material to make mulch. Some of the material was walnut from Ohio so three additional traps were set in and around this site to bring the total trapping locations to 148.

The second survey was a delimit survey around the Franklin County sawmill and the black walnut plantation at Yellowwood State Forest. The sawmill delimit contained 217 grid points made up of a 500M, a 1K, and a 3K grid. Of these points, 126 locations had a trap deployed. Additionally, walnut bolts were placed on 10 random traps within the 500M grid to detect the WTB and *Geosmithia morbida*. The bolts had a walnut twig beetle lure tacked to them and were hung from the conduit that supported the trap. WTB and the fungus were not recovered from the bolts. 18 traps were placed in and around the black walnut plantation.

In December, screening of the insects collected from 3 sawmill delimit traps detected 7 *Pityopthorus spp*. Identification by USDA confirmed WTB from all 3 traps and *P. lautus* from 1 trap. Two traps contained 1 WTB and the third trap contained 2 WTB. Two traps were on the sawmill site and the third trap was across the road from the sawmill at a black walnut tree along the county road. WTB has not been detected at the black walnut plantation.

In addition to the trapping surveys, windshield surveys were conducted in several cities throughout the state to evaluate walnut trees for TCD in urban areas. The cities were Brookville/St Leon, Chandler/Newburgh, Chesterfield/Daleville/Mounds State Park, Gas City/Jonesboro, Jeffersonville, LaPorte, Lebanon, Martinsville, Nashville and Warsaw. Trees were initially mapped in late winter and revisited during July and August to look for TCD symptoms. In all, 1431 trees were surveyed and six of those trees will be monitored over time. The windshield survey has been conducted for the last four years with data on a grand total of 3,569 trees in 42 cities.

The 2015 visual survey also included the gypsy moth trap tenders who viewed and reported 842 black walnut trees from across the state as they monitored gypsy moth traps. They identified 17 trees that had suspicious symptoms.

Jenny Juzwik, USFS Research Pathologist, and Matt Ginzel, Purdue Forest Entomologist, conducted a TCD study in the Yellowwood plantation. The study involves inoculating black walnut branches with *G. morbida* and other fungi cultured from black walnut branches in the 2014 study to understand the role of all fungi in canker development. And repeats the stressed tree study to determine what insects come to these trees and if they carry the fungus. Results will be available in 2016.

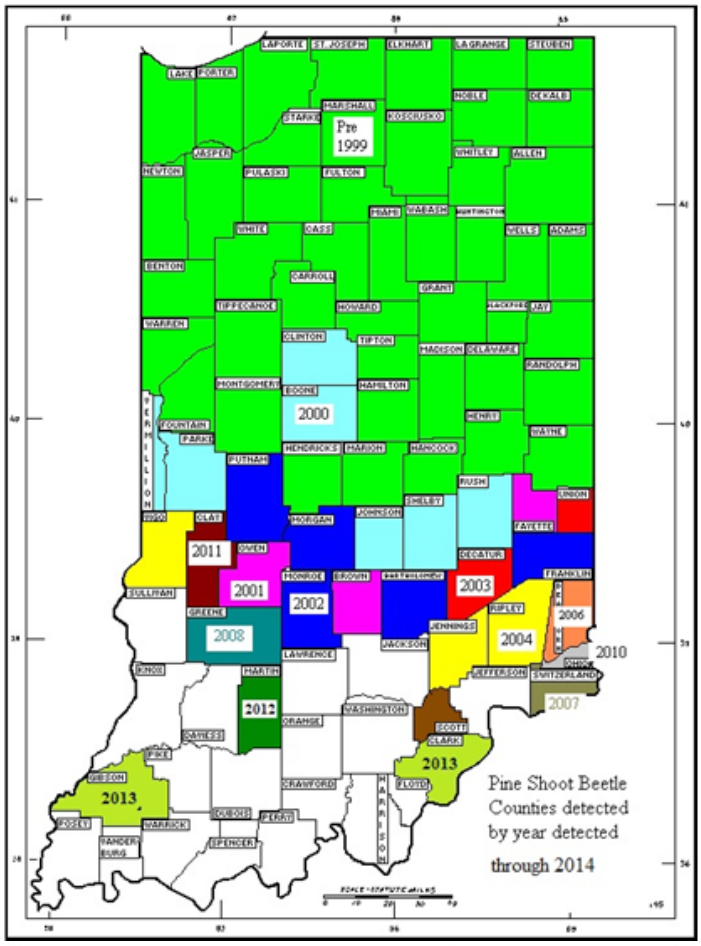
Current Indiana TCD facts.

- Walnut Twig Beetle has not been detected in or captured from a black walnut tree in Indiana.
- Walnut Twig Beetle has only been detected in traps and logs as the sawmill in Franklin County.
- *Geosmithia morbida* has not been cultured from a black walnut tree in Indiana.
- *Geosmithia morbida* has been cultured from a weevil, *Stenomimus pallidus*, from the black walnut plantation in Brown County.
- TCD complex has not been detected in a black walnut tree in Indiana.
- Only the black walnut plantation on Yellowwood State Forest in Brown County and the sawmill in Franklin county are quarantined. No counties are quarantined.
- Only study trees in the Yellowwood plantation have *G. morbida* in controlled inoculations.
- No black walnut tree in the Yellowwood plantation has TCD.

## 4. Secondary Exotic Insect Pests of Concern

a. **Pine Shoot Beetle** - *Tomicus piniperda* - Pine Shoot Beetle (PSB) was not detected in 2015. PSB occurs in 74 of the state's 92 counties (figure 11). Indiana's PSB quarantine received preliminary adoption to repeal and it is anticipated to be repealed by summer 2016. The entire state is federally quarantined for PSB.

b. **Exotic Bark Beetle**: **Early Detection Rapid Response (EDRR) Survey** - This survey was conducted in Indiana in 2015. The survey followed the EDRR survey protocols (2010). Twelve locations across Indiana (figure 12) were selected in rural/urban forests, primarily pine forests, relative to cities and other pathways for introduction and subsequent spread of exotic bark and ambrosia beetles.



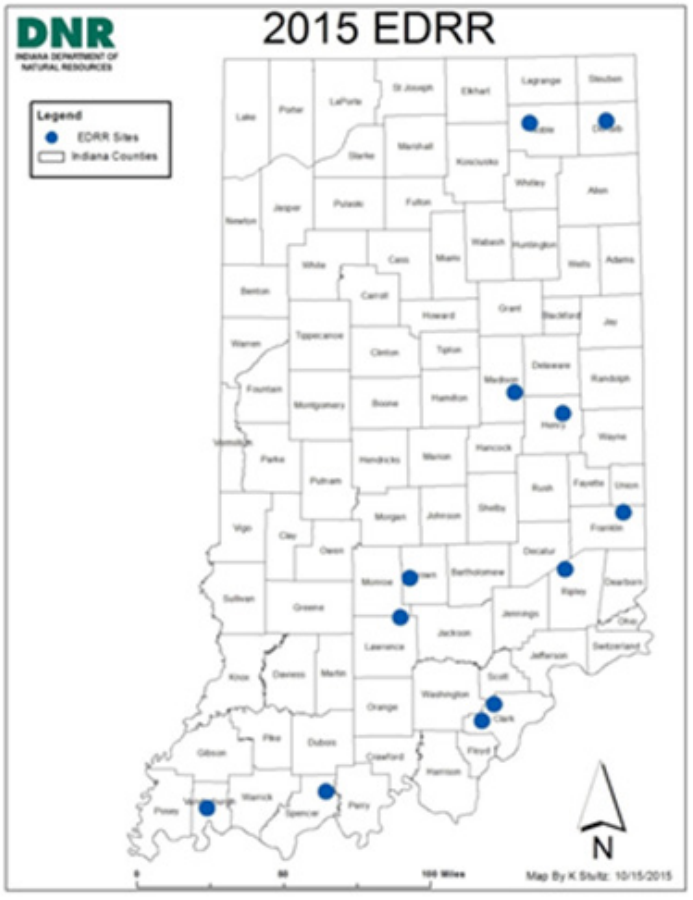




*Figure 11.—Top: Pine Shoot Beetle County Distribution Map.*

*Figure 12.—Bottom: 2015 Early Detection Rapid Response Survey Map.*

Three lindgren funnel traps were set at each location. One trap was baited with UHR ethanol; a second with UHR Alpha-pinene and ethanol; and the third with three component exotic *Ips* lure. Traps were set beginning in late May and monitored for 12 weeks.

Traps were monitored every two weeks and collected samples were cleaned of debris and shipped to Anthony Cognato at Michigan State for prescreening and final determination of species.

There were 935 unique sample records totaling 4,224 insects collected and 57 genus/species identified. No species of concern detected. Field data was entered into the Forest Service database.

c. **Hemlock Woolley Adelgid** - *Adelges tsugae* - Hemlock Woolly Adelgid (HWA) was detected in LaPorte County in 2012. Survey of the detection site and surrounding area in 2015 did not detect HWA.

e. **Asian Long-horned Beetle** - *Anoplophora glabripennis* – No organize trapping survey conducted in 2015. Through a Farm Bill Project – Forest Pest Outreach and Survey Project – continued to train volunteers to recognize and report ALB suspect trees. Did not receive reports from trained volunteers but received a few reports of suspect trees from landowners which were all negative. And received one report – exit hole in a maple tree - from the Fort Wayne City Forester in December, that was quickly investigated by Division of Entomology & Plant Pahtology, USDA Identifier and Purdue. This report was not ALB, but believed to be a carpenter bee exit hole and tunnel.

# 4. Non-Indigenous Plant Pathogens

## 1. Sudden Oak Death - *Phytophthora ramorum*

As part of IDNR-DEPP's annual Sudden Oak Death (SOD) survey, 23 separate locations were surveyed in 19 counties (figure 13). A total of 388 samples were collected with 105 of those testing positive for *Phytophthora spp*. None of those tested positive for *P. ramorum*. Seven trace forward sites were also surveyed and no symptoms of SOD detected. SOD has only been confirmed twice – a nursery in Lake County in 2006 and a garden center in St. Joseph County in 2012. SOD has not been detected at or around them since initial detection.

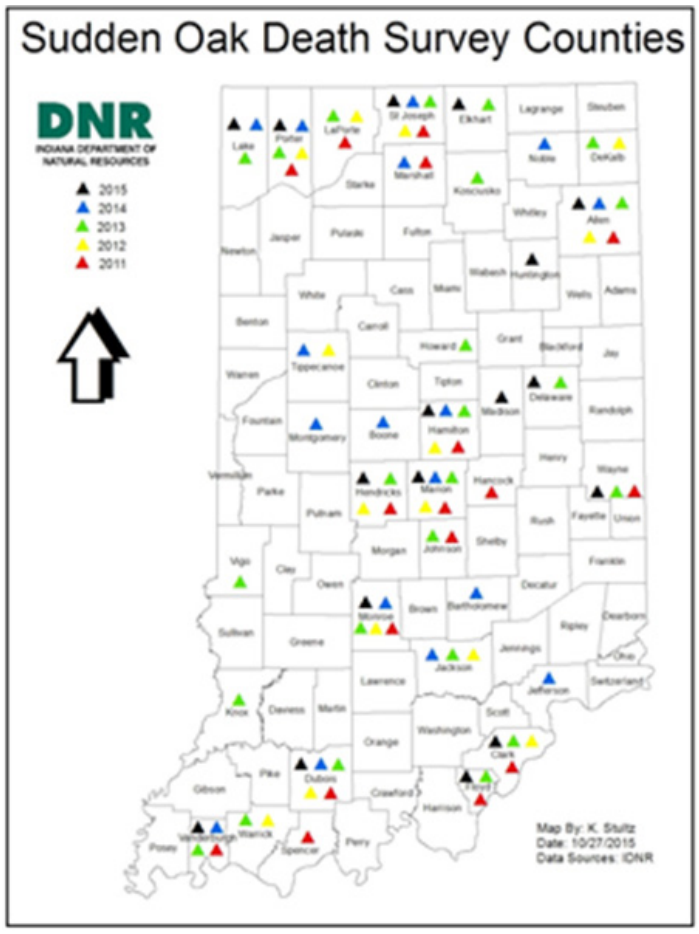



*Figure 13.—2015 Sudden Oak Death Survey Map.*

## 2. Dutch Elm Disease - *Ophiostoma ulmi (syn. Ceratocystis ulmi)*

This disease conitnued to kill American elm in the urban and rural forests. The amount of mortality has lessened across the state.

## 3. Oak Wilt - *Ceratocystis fagacearum*

No new county detections occurred in 2015. Oak wilt was reconfirmed by Purdue Plant Diagnostic Lab (culture confirmation) in three counties – Marion, Monroe (2nd year in a row to reconfirm) and St. Joseph. Oak wilt has been detected in 64 counties (figure14).

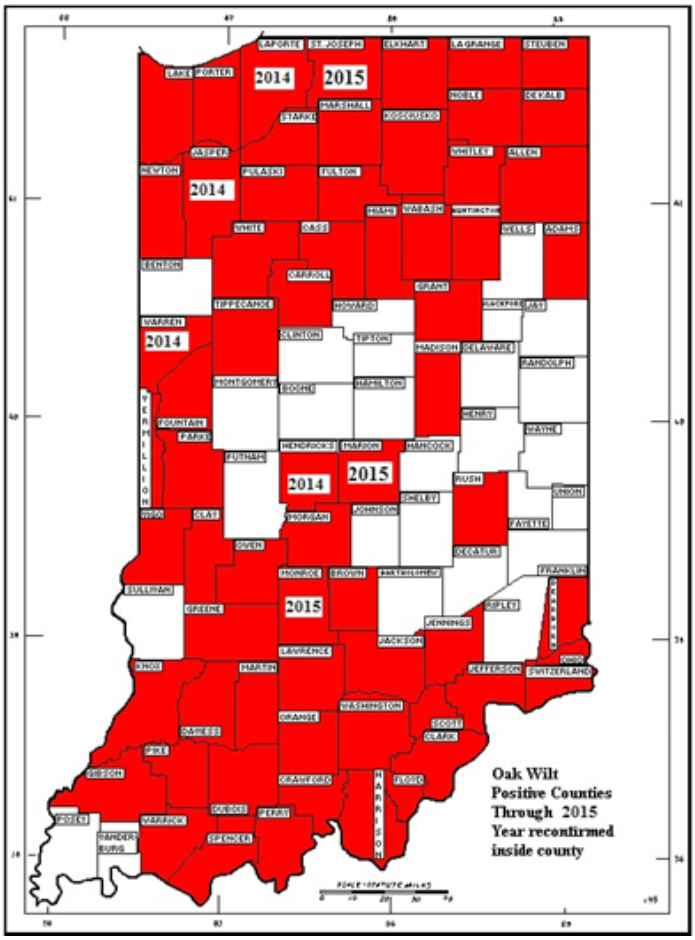



*Figure 14.—2015 Oak Wilt Distribution Map.*

The oak wilt confirmation in Monroe County is in the Bloomington urban area. With this repeat detection, there is concern that oak wilt could become a problem in this area. It the past, oak wilt has not been a problem, as most of the oak mortality is Oak Decline.

Oak wilt continues to be a problem in the woodlots of northwestern Indiana in the Kankakee River basin. A slight increase in requests from homeowners in this area for oak wilt management may indicate it is causing more mortality. However aerial surveys did not detect an increase in oak wilt symptoms or mortality.

## 4. Butternut Canker - *Sirococcus clavigignenti-juglandacearum*

As in prior years no surveys were conducted in 2015 as the disease is present throughout the state. The Hardwood Tree Improvement Cooperative at Purdue University continues to locate and collect plant material from butternut trees for a breeding program to save the species.

## 5. Beech Bark Disease – Disease complex of *Cryptococcus fagisuga* Lind and *Nectria coccinea* var. *faginata* Lohman

No surveys for this disease were conducted in 2015. No reports of trees with the scale or canker and no beech mortality were received. To date this disease is not present in Indiana and is expected to first occur in northern Indiana because of its presence along Lake Michigan in the Lower Peninsula of Michigan and in. The concern is the possibility that infected/infested material (firewood) is brought into Indiana.

## 6. Red Bay Wilt – *Raffaelea lauricola* and Redbay Ambrosia Beetle, *Xyleborus glabratus*

This forest pest complex is not known to be present in Indiana. No surveys were conducted in 2015 and no reports of dying sassafras or spicebush were received.

## 7. Dogwood Anthracnose – *Discula destructiva*

Surveys were not conducted in 2015 and no reports of the disease were received Dogwood anthracnose is present throughout the state and is common in southern Indiana forests.

### 8. Ailanthus Wilt – *Verticillium albo-atrum*

One report of Tree of Heaven, *Ailanthus altissima*, wilting in Noble County was received from a consulting forester. The symptoms of the dead trees and saplings indicated possible Ailanthus wilt. Discoloration (golden color) of sapwood surface also matched the color shown in the photo guide for this disease. However, the fungus could not be recovered from samples submitted to Purdue Plant Diagnostic Lab and also to Ohio Plant Diagnostic Lab working with a USDA Forest Service researcher. The location will be monitored and new samples collected in 2016.

## 5. Native Insect and Disease Concerns

### 1. Forest Tent Caterpillar – *Malacosoma disstria*

There was no report of forest tent caterpillar in 2015. The last report of forest tent caterpillar was the 2003-2006 epidemic in southeastern Indiana.

### 2. White Pine Root Decline - *Verticicladiella procera*

Procera Root Rot (White Pine Root Decline) is an annual killer of white pine windbreak, ornamental and Christmas trees. No survey was conducted in 2015 but mortality occurs in all areas of the state as landowners continue to call each year about their dying white pines.

### 3. Anthracnose – *Apiognomonia* spp.

There were no reports of sycamore anthracnose defoliation in 2015.

### 4. White Oak Mortality

There was one report of white oak mortality from Crawford County in 2015. The group of dead white oak, approximately 12 pole to saw timber size trees, covered ¼ acre. The majority of the trees had been dead for 2+ years. No evidence of current year mortality was observed. Evidence of Hypoxylon canker, Armillaria root rot and Two-lined Chestnut borer was observed.

### 5. Looper Complex – Linden *Looper Erannis tiliaria* and Half Winged Geometer *Phigalia titea*

Looper defoliation, Linden Looper *Erannis tiliaria* and Half Winged Geometer *Phigalia titea*, was reported in 2013 on Jackson Washington State Forest (Washington County primarily) and confirmed by female moth capture on sticky traps in fall to spring 2013/2014. Aerial survey in 2014 did not detect defoliation and there was not report of defoliation. Again in 2015, aerial did not detection defoliation nor was defoliation reported.

## 6. Weather-Related Issues in Indiana Forests

No weather related forest damage or impacts occurred in 2015.

## 7. Invasive Plant Species

**Kudzu** - *Pueraria lobata* - an Asian native invasive vine is located throughout Indiana but is predominately in southern Indiana (figure 15).

Currently there are 167 known sites totaling 158.01 acres in 41 counties. 66.0% of the sites are less than one acre. Four new sites were confirmed in 2015 totaling 0.66 acres.

Treatment of kudzu by IDNR-DEPP began in 2006 and has continued annually to remove kudzu from Indiana. In 2015, herbicide applications were conducted at 65 kudzu sites in 24 counties. A total of 63.4 acres were treated by IDNR-DEPP by October 15, 2015.

The average treatment cost is $1,127.79 per acre per applications. The average cost of erosion work is $2,803 per acre.

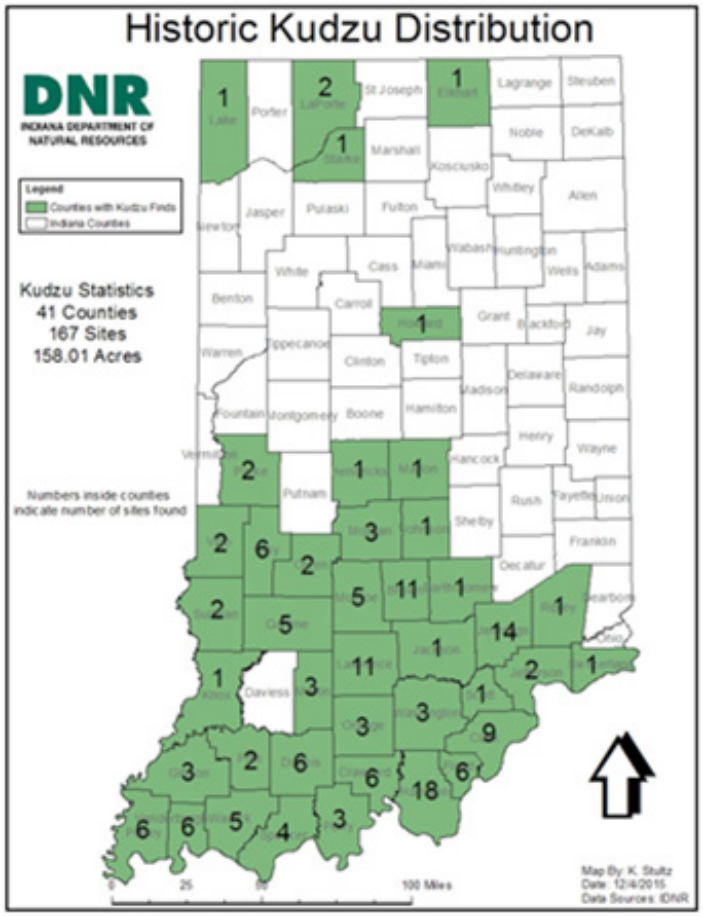



*Figure 15.—Historic Kudzu Distribution Map.*

REPORT PREPARED BY: Philip T. Marshall, Forest Health Specialist, Division of Forestry, State Entomologist, Division of Entomology & Plant Pathology

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## Forest Health Programs

State forestry agencies work in partnership with the U.S. Forest Service to monitor forest conditions and trends in their State and respond to pest outbreaks to protect the forest resource.U.S. Department of Agriculture Forest Service

Northeastern Area
State and Private Forestry
11 Campus Blvd., Suite 200
Newtown Square, PA 19073

http://www.na.fs.fed.us

Forest Health Protection
Northeastern Area
State and Private Forestry
1992 Folwell Avenue
St. Paul, MN 55108-1099
651–649–5180

Phil Marshall
Indiana Department of Natural Resources
Division of Forestry
402 West Washington Street, Room W290
Indianapolis, IN 46204
317–232–4189; fax: 312–232-2649
pmarshall@dnr.in.gov
http://www.in.gov/dnr/forestry

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