



2017 Indiana Forest Health Highlights

1. State Forest Health Issues – An Overview

The **2017 growing season's forest health problems and concerns** included March windstorms that downed trees across several southern Indiana counties, increased ash mortality from emerald ash borer, the confirmation of the second detection of walnut twig beetle from a 2016 trap at a veneer mill in Johnson County, the detection of additional areas of chestnut oak mortality in the Knobs area of Indiana, and the first occurrences of shingle oak defoliation and bur oak blight.

The recurring forest health issues included gypsy moth management, oak wilt, butternut canker, emerald ash borer and mortality/decline in aging hardwood forests.

Future forest pests of concern and not present in Indiana for 2017 included the exotic pests—sudden oak death, Asian longhorned beetle, hemlock woolly adelgid, beech bark disease, gold spotted oak borer and other *Agrilus* spp., spotted lantern fly and red bay wilt.

Also of concern is thousand cankers disease of black walnut. The components of the disease—walnut twig beetle and *Geosmithia morbida*—have been detected in Indiana through trapping survey and research work. However, the disease has not been detected in or killed a black walnut tree in Indiana.

Invasive plants that have potential to affect and are affecting Indiana forest regeneration and biodiversity are also of concern. Plants of concern are kudzu, *Pueraria montana*, tree of heaven, *Ailanthus altissima*, bush honeysuckle, *Lonicera* spp., Japanese stilt grass, *Microstegium vimineum* garlic mustard, *Alliaria petiolate*, and others. The kudzu eradication program continued to eradicate locations in Indiana. Through 2017, there are 182 confirmed kudzu sites in 43 counties totaling 186.94 acres. The goal is to move kudzu to the Ohio River and eventually out of Indiana.

To help manage and prevent invasive plants, 28 aquatic invasive plant species are prohibited from sale, barter, trade, distribution or transport in Indiana, and the Division of Entomology & Plant Pathology (DEPP) is developing a rule to prohibit or restrict 44 terrestrial invasive plant species.

2. Exotic Insect Pests of Indiana

Two exotic major insects of concern—gypsy moth and emerald ash borer—continued to dominate the state resources for monitoring and management activities in 2017. Added in 2016 to these pests was thousand cankers disease of walnut. Other species that affected survey work and awareness efforts in 2017 were Asian longhorned beetle, hemlock woolly adelgid and sudden oak death, spotted lantern fly, and laurel wilt.

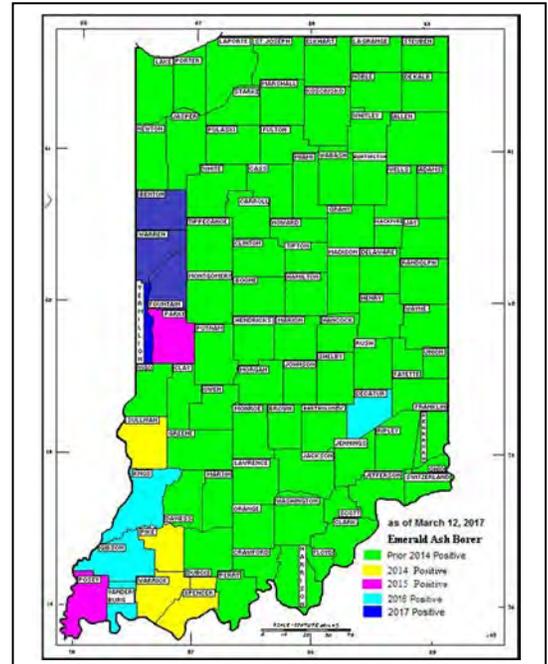
Emerald Ash Borer (EAB) - *Agrilus planipennis* Fairmaire

EAB was discovered in northeast Indiana in June of 2004. In 2017, the last of Indiana’s 92 counties had EAB detected in those counties—Vermillion, Fountain, Warren and Benton.

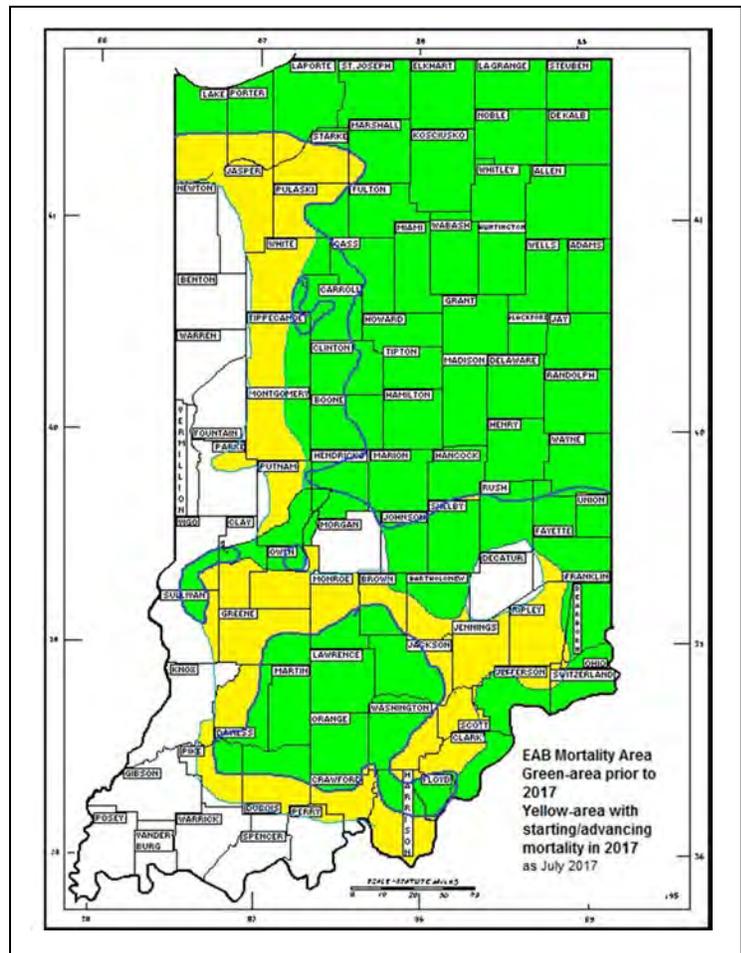
Map 1 shows the counties confirmed positive since 2014.

Although first confirmed in 2004 and likely in Indiana between 2000 and 2004, EAB took 14-plus years to spread from Steuben/LaGrange counties through Indiana.

Aerial survey found the western edge of ash mortality is almost to the Illinois border in northwestern Indiana and to the Illinois border in central Indiana (Map 2). In southwestern Indiana, EAB is in the early years of killing ash, and it is expected that the killing wave will be through southwestern Indiana by 2022.



Map 1: Positive EAB counties from 2004 through 2017 showing counties detected from 2014 to 2017.



Map 2: EAB mortality from 2004 to 2016 is shaded green. Dark line inside green-shaded area indicates extent of mortality in 2015. Yellow shaded area is mortality just becoming noticeable through survey in 2017.

A total of 3,391 forested acres of EAB mortality was detected in 2017, bringing the total forested acres with mortality to 155,676 since 2009. This information is only through aerial survey—the acreage would be much more, as the survey does not record all acres, just the acres “farthest” from the prior-year survey. It could be said that mortality will occur on more than 4 million acres of Indiana rural forest and all of the urban forest acres.

Indiana’s EAB quarantine was repealed in October 2016.

Emerald Ash Borer Parasitoid Release Program

The DEPP initiated release of 4 EAB parasitoids in 2016 and continued releases in 2017. The egg parasitoid *Oobius agrili* and 3 larval parasitoids, *Tetrastichus planipennis*, *Spathius galinae* and *S. agrili* (Photos 1, 2, 3) were received from the USDA Lab at Brighton, Michigan.

Release began in late April and continued for 22 weeks through the end of September 2017. Between 2,200 and 12,200 insects were released weekly. Over 138,985 *Tetrastichus*, over 34,900 *Oobius* and almost 6,950 *Spathius* were released during the course of the summer. Release occurred at the same 2016 locations for a total of 13 sites in 5 locations in southeast Indiana— Brookville Lake (5), Crosley Fish & Wildlife Area (1), Hardy Lake State Recreation Area (2), Austin Bottoms (4) and Atterbury Fish & Wildlife Area (1). Counties with release sites were Franklin, Union, Jennings, Scott, Jackson, Washington and Johnson counties (Map 3).

For the two years, a total of 314,835 parasitoids were released. In 2019, surveys will be conducted to recapture any of the parasitoids to determine if they have established.

| Number of Emerald Ash Borer parasitoids released in 2016 & 2017 by species/genus | | | | |
|--|----------------------|---------------------------------|-----------------|---------|
| Year | <i>Oobius agrili</i> | <i>Tetrastichus planipennis</i> | <i>Spathius</i> | Total |
| 2016 | 52,000 | 77,000 | 5,000 | 134,000 |
| 2017 | 34,900 | 138,985 | 6,950 | 180,835 |
| Total | 86,900 | 215,985 | 11,950 | 314,835 |

(Compiled from 2016 and 2017 Division of Entomology & Plant Pathology Annual Reports, Emerald Ash Borer Parasitoid Release Program report by Jared Spokowsky)

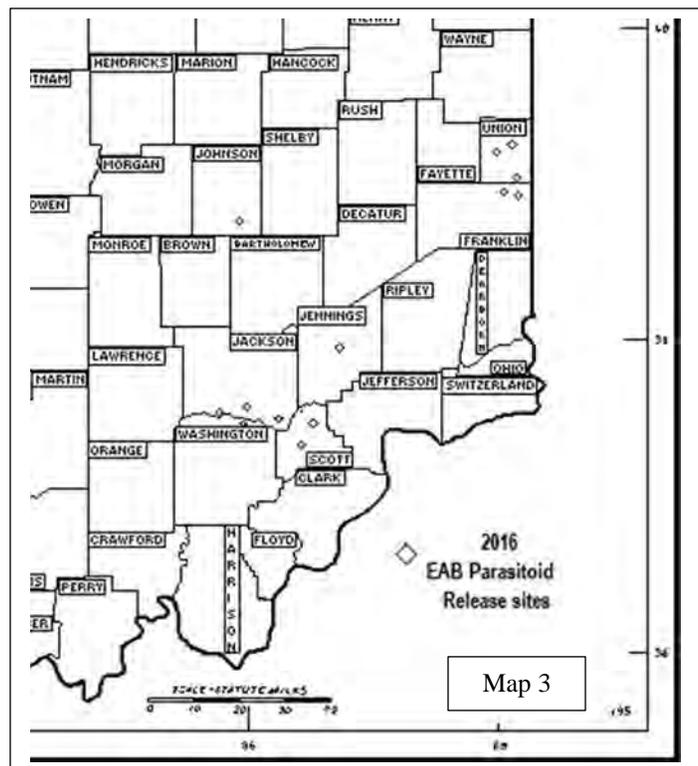
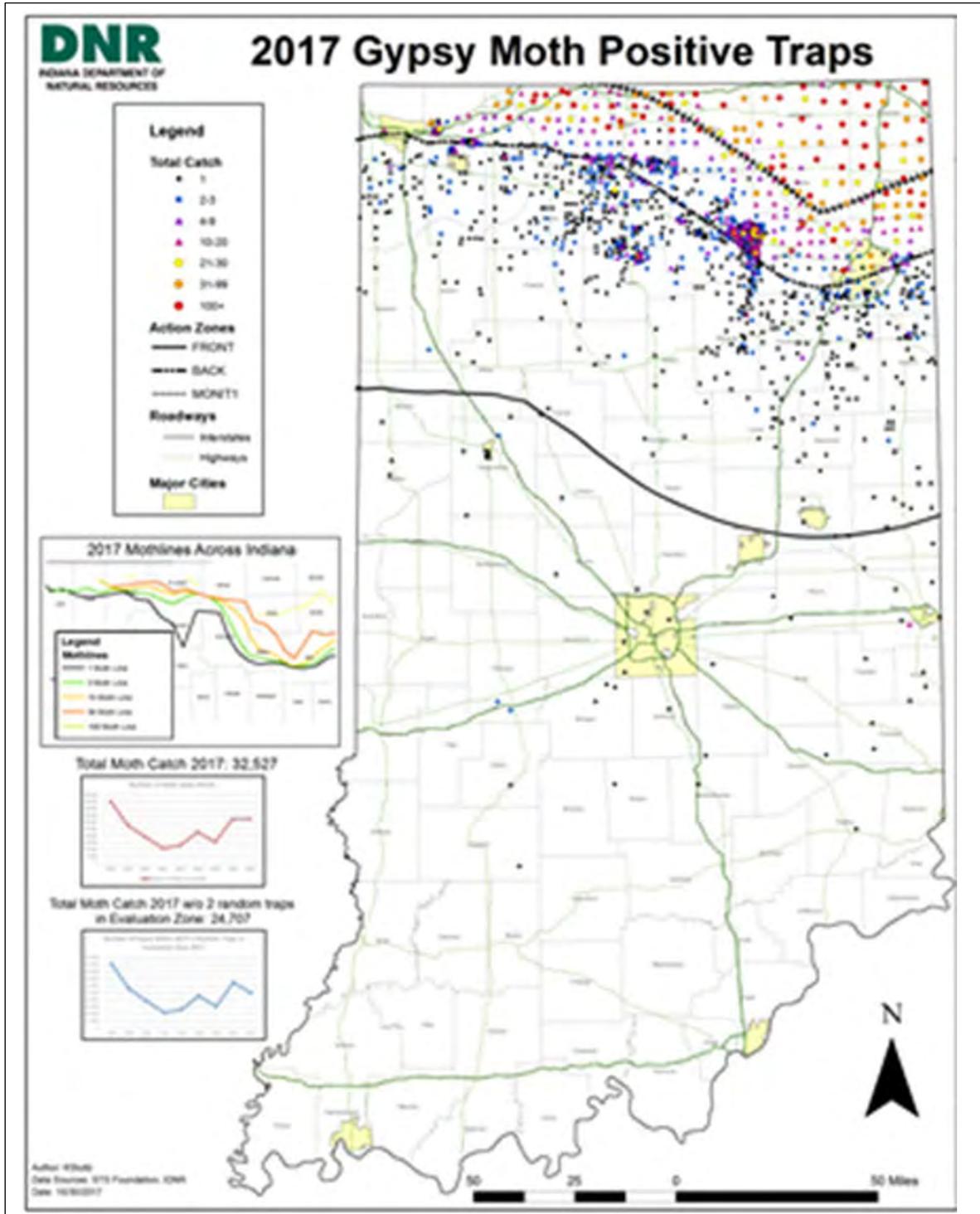


Photo 1 (top) – *Oobius agrili* (Houping Lui Michigan State)
 Photo 2 (middle) – *Spathius* spp. (David Cappaert)
 Photo 3 (bottom) – *Tetrastichus planipennis* (David Cappaert)

Positive traps occurred across the 32 counties of the STS zones and scattered across 23 central and southern counties in the State Area (Map 6). The survey found the majority of the moth catch—83% of the moths (26,955 of 32,527)—in the Evaluation Zone, which includes the 9 quarantined counties of Steuben, LaGrange, Elkhart, Noble, St. Joseph, Porter, Allen, LaPorte and DeKalb (Map 8). The Action Zone, which is below the Evaluation Zone detected 16% of the moths (5,252 of 32,527). The majority of the Action Zone moth catch occurred in the northern and eastern parts,

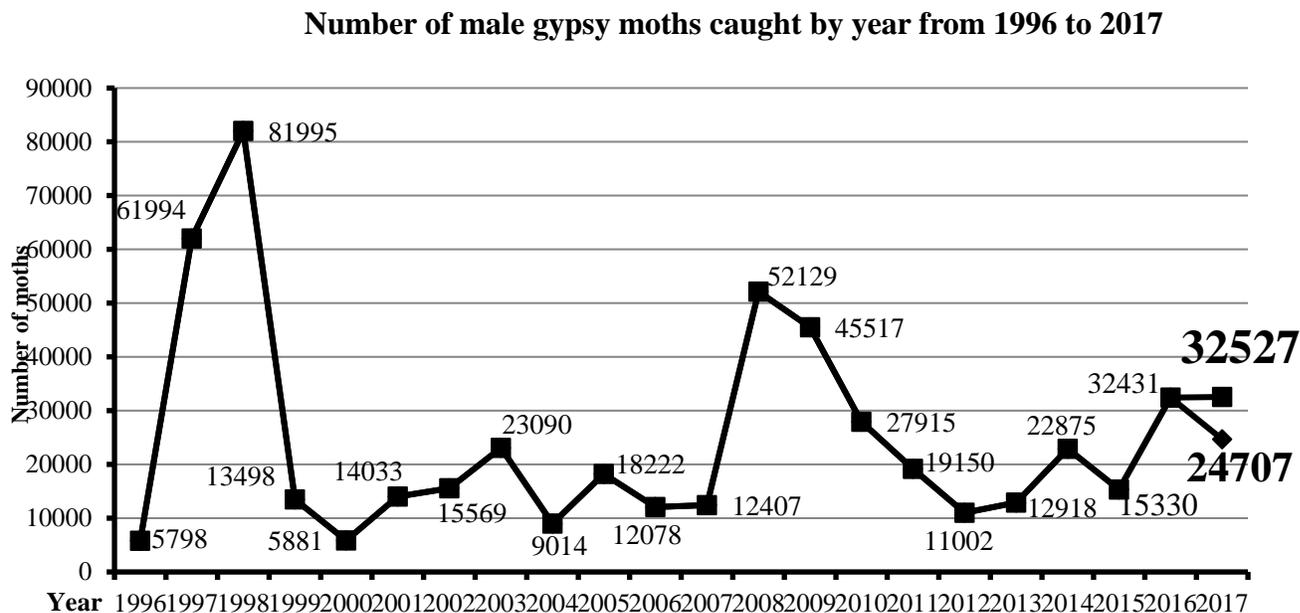


Map 6: 2017 Gypsy Moth positive trap locations by range of moth catch in each trap.

which are next to the Evaluation Zone. The State Area detected 1% of the moths (320 of 32,527).

Graph 1: Number of male gypsy moths caught by year, from 1996 to 2017.

Note: For 2017, 32,527 includes the 2 random traps in evaluation area that were used to monitor moth flight, which increased total moth catch by 7,820 moths. Graph shows total catch with and without the 2 traps.



Since the survey began in 1972, a total of 545,336 moths have been caught in 90 of the 92 counties. Gypsy moth has not been detected in Dubois or Sullivan county since surveys began in 1972.

Btk (*Bacillus thuringiensis kurstaki*): Treatments to slow-the-spread and development of gypsy moth were conducted on nine sites totaling 2,363 acres in five counties (Table 1 and Map 7). One site in Tippecanoe County was treated with Btk at 36 BIU. The other sites were treated with Btk at 25 BIU, with either a single or two applications. For all sites and applications, a total of 3,048 acres were treated. The Purdue site was treated on May 7. Four sites received one application on May 12. Four sites received two applications on May 12 and 16. Purdue application cost was \$42.53/acre and the other site’s application cost was \$34.41/acre/application.

Mating Disruption: Two sites totaling 7,578 acres were treated with SPLAT GM-Organic at a rate of 6 grams per acre. (Table 2 and Map 7).

In 2014, an eradication treatment began on the campus of Purdue University. Treatment occurred in 2014 and 2017. In 2015, there were only five moths caught on the campus, but in 2016 that number jumped to 46, prompting treatment again in the spring of 2017. This year, after one application of Btk at 36 BIU/acre, 21 moths were caught in six separate traps. For 2018, the site will not be treated and a delimit survey will be used to determine eradication because no new egg masses were found during ground survey.

Table 1: 2017 STS and Eradication Btk Treatment Sites.

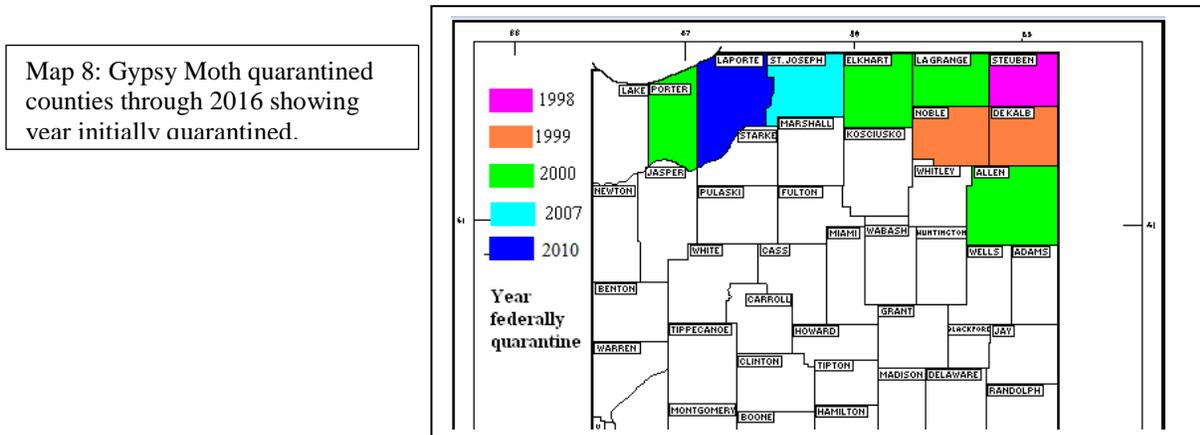
| | COUNTY | SITE NAME | TREATMENT | | | EA ACRES | Treat Acres | Total Acres treated all applications |
|-------|--------------|---------------------|------------|--------|--------|----------|-------------|--------------------------------------|
| | | | MATERIAL | Appl # | METHOD | | | |
| 1 | Fulton | Disko Core 17 | Btk 25 BIU | 1 | Aerial | 957 | 315 | 315 |
| 2 | Kosciusko | Harrison TWP 17 | Btk 25 BIU | 2 | Aerial | 976 | 47 | 94 |
| 3 | Kosciusko | Rosella 17 | Btk 25 BIU | 2 | Aerial | 167 | 96 | 192 |
| 4 | Kosciusko | Pierceton West 17 | Btk 25 BIU | 2 | Aerial | 24,898 | 471 | 942 |
| 5 | Marshall | Green TWP 17 | Btk 25 BIU | 1 | Aerial | 2,052 | 60 | 60 |
| 6 | Porter | Tanglewood 17 | Btk 25 BIU | 1 | Aerial | 563 | 87 | 87 |
| 7 | Porter | Portage 17 | Btk 25 BIU | 1 | Aerial | 513 | 416 | 416 |
| 8 | Porter | Valparaiso South 17 | Btk 25 BIU | 2 | Aerial | 949 | 71 | 142 |
| 9 | Tippecanoe * | West Lafayette 17 | Btk 36 BIU | 1 | Aerial | 1,040 | 800 | 800 |
| Total | | | | | | 32,115 | 2,363 | 3,048 |

Table 2: 2017 STS Mating Disruption Treatment Sites.

| | COUNTY | SITE NAME | TREATMENT | | | EA ACRES | Treat Acres | Total Acres treated all applications |
|-------|------------------------------------|---------------------|----------------------|--------|--------|----------|-------------|--------------------------------------|
| | | | MATERIAL | Appl # | METHOD | | | |
| 1 | Fulton, Kosciusko Miami, Wabash | Disko MD 17 | SPLAT GM-O @ 6 grams | 1 | Aerial | 12,301 | 4,000 | 4,578 |
| 2 | Porter | Valparaiso South 17 | SPLAT GM-O @ 6 grams | 1 | Aerial | 3,155 | 3,000 | 3,000 |
| Total | | | | | | 15,456 | 7,000 | 7,578 |

Potential Problem Areas from 2017 survey were evaluated in November. Four sites were proposed for treatment in 2018—one in Fulton County with Btk and three in Marshall County with mating disruption.

Aerial surveys detected no noticeable defoliation in 2017. There were reports of defoliation in Allen, LaPorte, Porter and Whitley counties in 2017, but none was detectable through aerial survey. Aerial survey did detect 96 acres of defoliation in 2016 in Porter County. Prior to 2016, the last time aerial survey detected defoliation was in 2009, when 70 acres of defoliation occurred in 2 counties.





Map 7: 2017 Gypsy Moth Treatment locations. Red outline is Btk treatment and Blue outline is Mating Disruption treatment.

Thousand Cankers Disease - *Pityophthorus juglandis* and *Geosmithia morbida*



Figure 15: Walnut twig beetle collected during 2014 survey. Photos by Bobby Brown USDA APHIS PPQ.

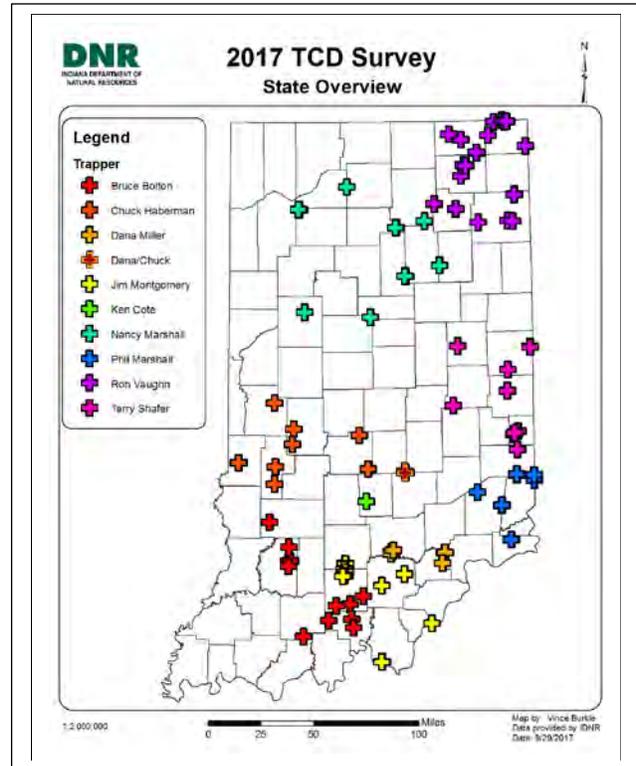
The 2017 walnut twig beetle (WTB) consisted of 148 Lindgren funnel traps placed at high-risk sites throughout the state. Traps were deployed in mid- to late April and were removed during late September through early October.

There were 1,819 samples collected, and 72% of the samples had been screened through December. From screened samples, 133 samples containing 262 insects were submitted for identification with 25 identified, and none were WTB.

The Farm Bill & USDA Forest Service funded 2016 WTB surveys that collected 130 samples consisting of 318 insects and 20 samples consisting of 29 insects, respectively. WTB was not identified from the Farm Bill survey; however, one WTB was identified March 15, 2017, from a 2016 dry cup trap at the same sawmill in Franklin County where WTB was previously collected in 2015. The 2016 trap was also in the same location as the 2015 trap. The beetle was sent to test and culture for *Geosmithia*, which was

not found. *Stenomimus pallidus* was frequently collected in 2016, and is widespread throughout the state.

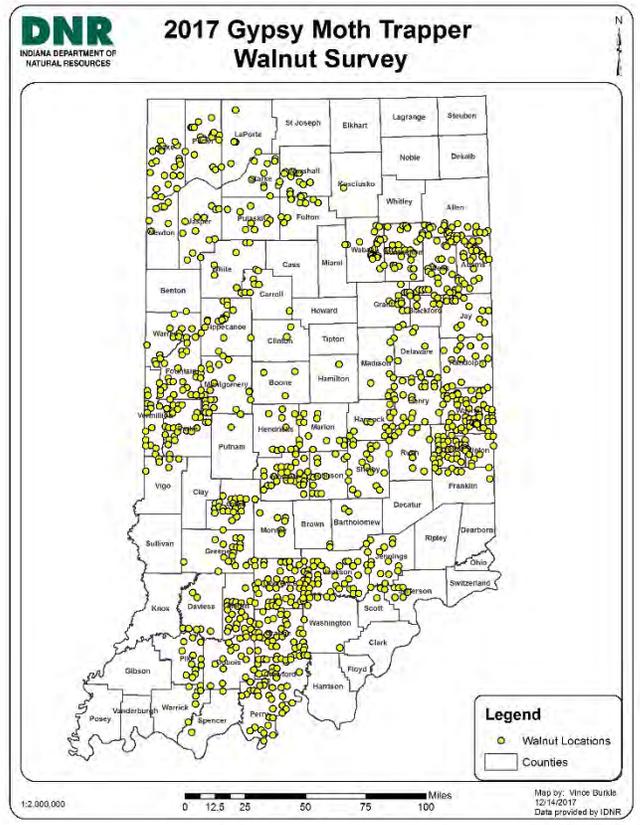
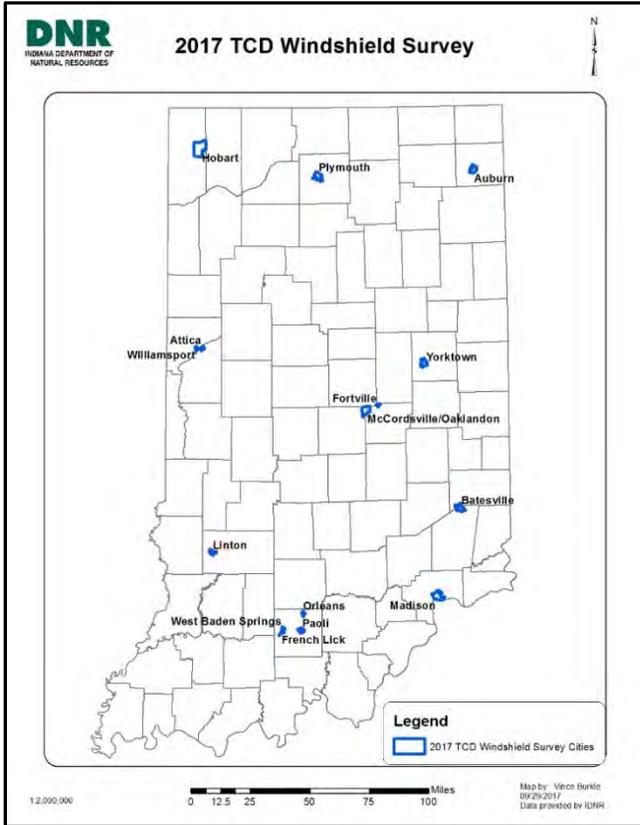
Walnut twig beetle (WTB), *Pityophthorus juglandis*, was confirmed at a sawmill in Franklin County, March 2015, from 2 beetles collected in the 2014 trapping survey. The 2015 delimit survey of the sawmill location detected 4 WTB from 2 traps. One trap on the sawmill detected 1 WTB on August 13, 2015, and 2 WTB on September 1, 2015. The second trap was across the road from the sawmill and detected 1 WTB on May 13, 2015. All were confirmed by USDA on December 9, 2015, and all tested negative for *G. morbida*. The trap across the road was located next to a black walnut tree that was cut down in 2016 and taken to Purdue for rearing and isolation. WTB and *G. morbida* were not collected and isolated from the tree. The 2017 delimit survey at the sawmill and adjoining woods set 13 traps and did not detect WTB.



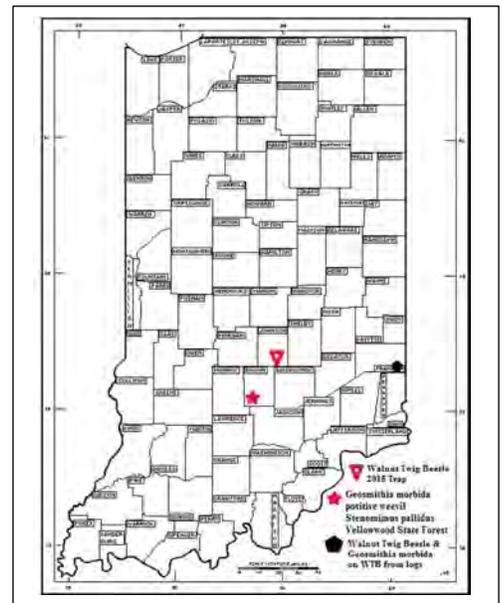
The Windshield Survey added 16 new locations in 2017. The purpose of this survey is to locate walnut trees in urban areas and evaluate them for symptoms consistent with TCD. The 2017 survey was conducted in Attica, Williamsport, Auburn, Batesville, Fortville, McCordsville, Oaklandon, French Lick, West Baden, Orleans, Paoli, Hobart (northern half), Linton, Madison, Plymouth and Yorktown. A total of 1,855 trees were surveyed, with 36 listed as suspect, which will be evaluated over time. Since this survey began in 2012, a total of 6,943 trees has been evaluated in 76 municipalities. Arc Collector was used to gather the data for this survey, which made it easier to relocate trees on later visits.

Gypsy moth trap tenders also collected data on the location and condition of walnut trees near gypsy moth traps. They identified 1,038 trees and indicated 4 trees with dieback or decline. Since 2011, trap tenders have collected data on 7,343 walnut trees.

After the 2017 surveys, thousand cankers disease of black walnut (TCD) has not been detected and confirmed from a walnut tree in Indiana. There is no mortality of black walnut trees from TCD occurring in Indiana



Location of Indiana sites (above and right) trapping WTB and or detecting *Geosmithia morbida*. Map above shows Ohio positive location of TCD.



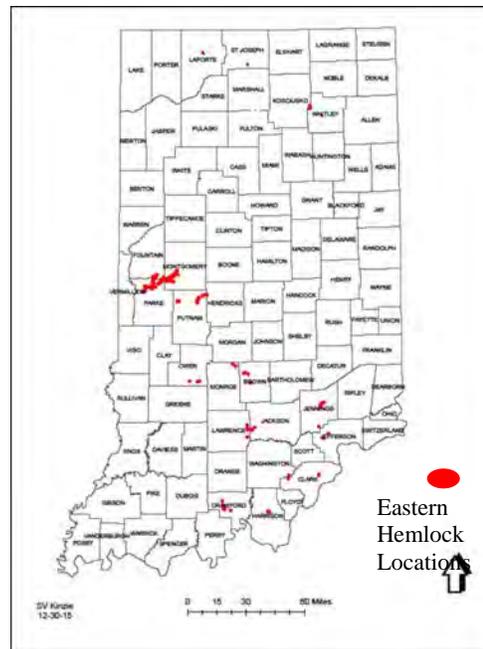
Other Exotic Insect Pests of Concern

Hemlock Woolley Adelgid - *Adelges tsugae* -

Hemlock woolly adelgid (HWA) was detected in one site in LaPorte County in 2012. Survey of that detection site and surrounding area in 2017 did not detect HWA. Survey of Eastern hemlock locations scattered across Indiana (see map) is ongoing each year. HWA has not been detected in those locations and has not been detected in any landscape setting or any nursery and retail locations selling Eastern hemlock.

Asian Longhorned Beetle (ALB) - *Anoplophora glabripennis* –

No trapping survey conducted in 2017. Resource personnel and the public were trained to recognize and report ALB suspect trees through the Farm Bill-funded Forest Pest Outreach and Survey Project. No reports were received from the public or from trained volunteers. ALB does not occur in Indiana.



3. Plant Pathogens of Concern

Chestnut Oak Mortality – *Armillaria mellea*, *Agrilus bilineatus*, *Hypoxylon Canker* (*Biscogniauxia atropunctata*), *Phytophthora cinnamomi* and possibly 2012 drought.

The chestnut oak mortality reported for the first time in 2016 at Patoka Lake (Dubois County) was aerial and ground surveyed in 2017. The surveys identified a 28-acre area of mortality. The decision was made to initiate a forest health management plan to salvage mortality, suppress further mortality, regenerate the forest and implement wildlife management on the area.

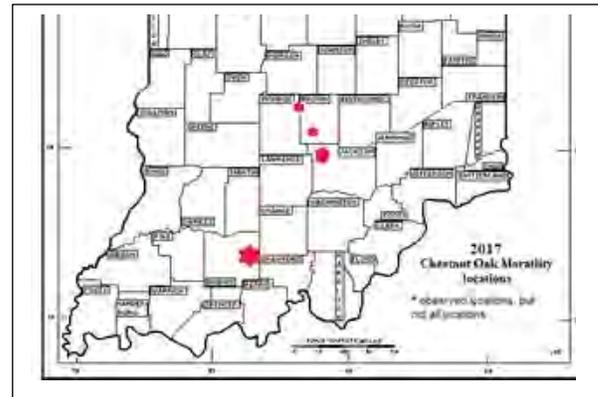
Besides identifying the extent of mortality at the Patoka Lake site, aerial survey identified continuing and expanding mortality at the Jackson County 2016 site and at sites on Yellowwood State Forest, Morgan-Monroe State Forest, Brown County State Park and Hoosier National Forest that surround Monroe Lake.

The additional sites are similar to the Patoka Lake site in that the chestnut oak mortality occurs on mid- and lower slopes and only to chestnut oak. As found in 2016, symptoms develop in late July and continue through September and appear similar to oak wilt, which has not been detected from sampled trees in 2016 and 2017.



Red top symptomatic trees were cut down at Yellowwood State Forest. The annual rings of each tree found that the incremental growth (ring width) decreased in 2012 and remained consistent at the narrow ring width through 2017.

Based on reduced ring width and estimated time of death starting in 2012/2013 at Patoka Lake (based on only large-diameter branches remaining on trees in the center of the site when examined in 2016), this indicates the mortality initiated after the 2012 drought. But with continued mortality occurring in 2016 and 2017, other pathogens are assumed to be involved such as *Phytophthora cinnamomi*, Armillaria root rot, Hypoxylon canker and two-lined chestnut borer.



2017 Chestnut Oak Mortality Locations

This may be typical oak decline, but brings up the concern of why just chestnut oak (and not the associated red oak group trees and white oak) is dying.

Second concern is that seedling and sapling chestnut oak among the dead chestnut oak are not symptomatic and dying.

Third concern, the rapid progression of symptoms in one year (2016 and also 2017) after the problem has been there for 3-4 years, makes one question the oak decline cause and raises the question of the role of *Phytophthora cinnamomi* in rapid disease progression in one growing season.

Fourth concern, Armillaria root rot and two-lined chestnut borer do not appear to have a major role in the rapid progression of symptoms or dying, but that still needs further study.

Fifth concern, the chestnut oak mortality is similar to rapid white oak mortality in Missouri based on symptoms, site conditions and occurrence of *P. cinnamomi* on white oak.

Thus, what is the role of *P. cinnamomi*. Is it a “new” disease situation/complex?

The 2016 Pest Condition Report provides more background information on this disease situation.

Additional evaluation of the mortality is planned for 2018 using aerial and ground survey, monitoring of the forest health management at the Patoka Lake location, and analysis of FIA/FHM data to determine if those data show an increase in chestnut oak mortality over the past 5-10 years.

Oak Wilt - *Ceratocystis fagacearum*

Oak wilt was confirmed for the first time in Boone County in 2017 by the Purdue Plant Diagnostic Lab (culture confirmation) from a red oak yard tree at a rural home.

Oak wilt was reconfirmed in Starke and Tippecanoe counties in 2017.

In Tippecanoe County, it was confirmed from a Northern pin oak, *Quercus ellipsoidalis*. That may be the first time oak wilt was confirmed from that tree species in Indiana. In Starke County, it was confirmed in a red oak tree.

Prior to Boone County, the last counties to record first-time confirmed oak wilt were Hendricks and Warren in 2014. Prior to that it was Jennings County in 2007, then Grant County in 2001 and again in 2011—in the same urban forest both years.

Oak wilt has been detected in 65 counties.

Oak wilt continues to be a problem in the woodlots of northwestern Indiana in the Kankakee River basin. Mortality of black and red oak continued in 2017. There were fewer inquiries in 2017 and no widespread occurrence detected during aerial survey.

Usually in southern Indiana, oak mortality is not oak wilt but oak decline—two-lined chestnut borer, Hypoxylon canker and Armillaria root rot.

Oak wilt in white oak has not been detected.

Dogwood Anthracnose – *Discula destructiva*

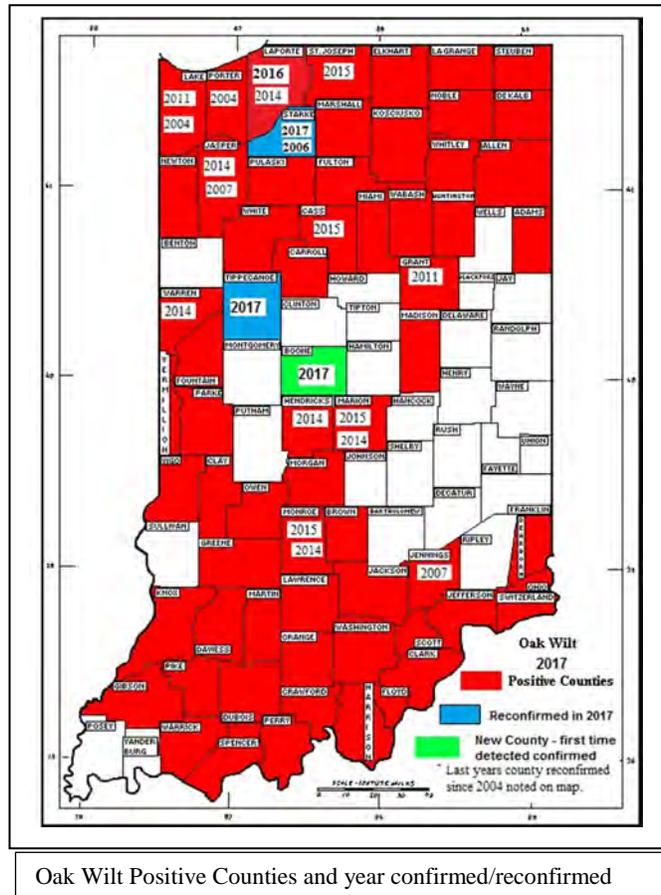
Surveys were not conducted in 2017. This disease is of less concern now because of its slow removal of trees. There were no reports of dogwood dying, even though the disease is present in the state.

However, dogwood may have been slowly removed from the forest by dogwood anthracnose, if Continuous Forest Inventory plot data on State Forests is an indication. The survey period 2008-2012 estimated 73,768 dogwoods between 5 and 9 inches DBH (live + dead). The 2012-2016 survey estimated 60,176 dogwoods between 5 and 9 inches DBH (live + dead). This is a reduction of 13,592 dogwoods, and an 18.4% reduction in total number of dogwoods. Over these 2 survey periods, dogwoods <5 inches DBH decreased by 934,267 (2,602,712 to 1,668,445). The reason for tree death is not indicated in the data. Dogwood anthracnose and the 2012 drought are the likely cause of tree death.

(Source: Continuous Forest Inventory Property Reports 2008-2012; 2009-2013; 2010-2014; 2011-2015; 2012-2016 - <http://www.in.gov/dnr/forestry/3605.htm>)

Ailanthus Wilt – *Verticillium nonalfalfae*

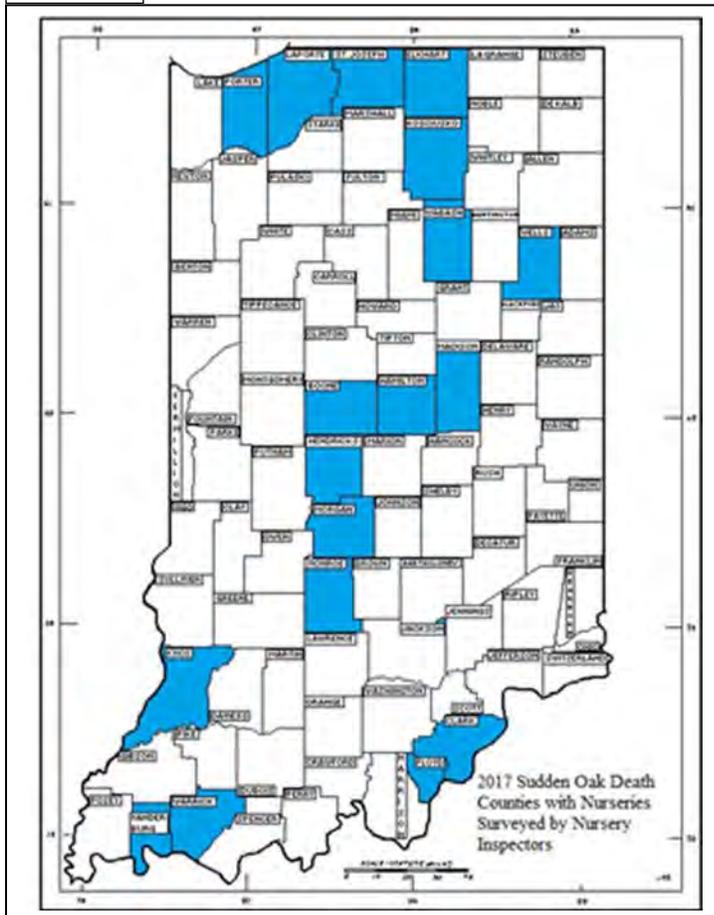
No report of tree of heaven, *Ailanthus altissima*, wilting was received in 2017. Prior sites in Noble and Fayette counties tested for the wilt fungus did not have any wilting trees in 2017. A wilting tree with this fungus will have a golden color to the sapwood surface. Wilting is likely to be seen in mid- to late July, and trees need to be sampled quickly when the tree is wilting to culture the fungus. The fungus has the possibility of being a bio-control.



Sudden Oak Death - *Phytophthora ramorum*

The DEPP continued the annual sudden oak death (SOD) survey. In 2017, 31 separate locations were surveyed in 19 counties (Map 11). A total of 401 samples were collected, with 108 of those testing positive for *Phytophthora spp.* None of those tested positive for *P. ramorum*. No trace-forward survey occurred. No forest survey or water source survey was conducted.

Map 11



Through 14 years of survey, SOD has been confirmed only twice—at a nursery in Lake County in 2006 and at a garden center in St. Joseph County in 2012. SOD has not been detected at or around those sites since initial detection.

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

As in recent years, the occurrence of this disease was low across the urban and rural forests. Although symptomatic trees were not common, dead trees with bark falling off or completely removed were evident.

7. Butternut Canker - *Sirococcus clavigignenti-juglandacearum*

As in prior years, no surveys were conducted in 2017 because 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.

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

No survey for this disease was conducted in 2017. Late in the 2017 one landowner in Marshall County reported beech dying. Emailed photos did not show signs of the scale or fruiting bodies of the fungus. Cankered or wound areas shown in the photos may be from another cause. This location will be examined in 2018.

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. The concern is the possibility that infected/infested material (firewood) might be brought into Indiana.

Red Bay (Laurel) 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 2017. One report of sassafras mortality in Crane Naval Weapon Support Center in Martin County was received in 2017. This report will be checked in 2018. No other reports of dying sassafras or spicebush were received.

4. Native Insect and Disease Concerns

Jumping Oak Gall - *Neuroterus* spp.

Jumping oak gall is a small wasp that creates tiny round galls on the underside of white oak trees. When the leaf is heavily galled, the leaf turns a brown color starting in May and June.

The discoloration is similar to a defoliation as it interferes with the leaves' ability to produce food for the tree, which can result in tree stress.

No brown discoloration of white oak occurred in 2017 in Harrison, Crawford, and Perry counties, as occurred in 2016. (Map 12)

The first occurrence of jumping oak gall and the discoloration of white oak occurred in 1999 in these same counties, again in 2012 and in 2016, in the area shown on 2012 map. (Map 13)

In 1999, the discoloration occurred over a larger area of south-central Indiana, encompassing 10 or more counties.

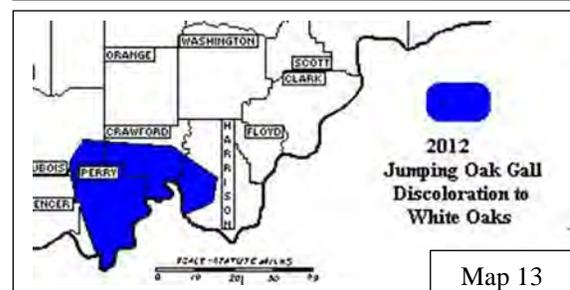
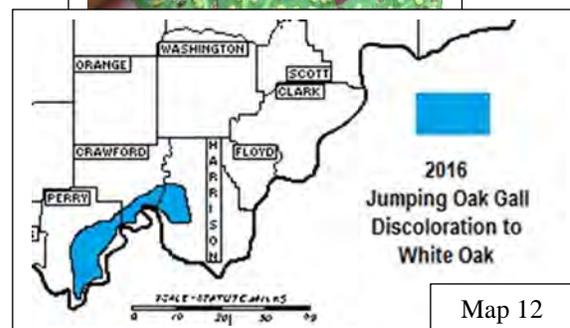
Forest Tent Caterpillar – *Malacosoma disstria*

There was no report of forest tent caterpillar in 2017. The last epidemic occurred in southeastern Indiana between 2002 and 2006 (Dearborn, Jefferson, Ohio & Switzerland counties). Prior to that, the only other recorded epidemic in the state was in the mid- to late 1970s in mid-south central Indiana (Greene, Lawrence, Martin & Monroe counties).

Eastern Tent Caterpillar – *Malacosoma americanum*

There was very light defoliation to black cherry, primarily in fencerow trees, in 2017. We did not see noticeable defoliation in 2017 in Lawrence, Monroe and Morgan counties, which had defoliation in 2015 and 2016. The 2015-2016 epidemic has disappeared from the state. The last time Eastern tent caterpillar was at epidemic levels in the state was 2000 and 2001, in the same area of south-central Indiana.

Looper Complex – Linden looper *Erannis tiliaria* and half-winged geometer *Phigalia titea*



Defoliation by this looper complex did not occur in 2017. The last occurrence was 2013, with very light defoliation in Washington County on Jackson-Washington State Forest. Aerial survey in 2014 did not detect any defoliation in the same area, and there were no other reports of looper defoliation that year or in 2015 and 2016.

The other defoliating event occurred over 3-4 years in the late 1970s and early 1980s, across south-central Indiana, then again in 2001-2004, defoliating 89,252 acres in Clark, Crawford, Harrison, Jackson, Perry, Scott and Washington counties in 2003; 131,943 acres in Brown, Bartholomew, Clark, Jackson, Monroe, Scott and Washington counties in 2004, and ending in 2005.

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 2017, but mortality occurs in all areas of the state as landowners continue to call each year about their dying white pines.

Anthracnose – *Apiognomonia* spp.

There were no reports of sycamore anthracnose defoliation in 2017.

White Oak Mortality

There was one report of white oak mortality late in 2017. The mortality is in a white oak progeny text plantation on Harrison-Crawford State Forest. The trees will be examined in 2018. Two-lined chestnut borer is one possible cause, as swamp chestnut oak in a 25- to 30-year-old plantation have been killed by this beetle in the past.

5. Weather-Related Issues in Indiana

March Windstorm

On March 2, 2017, several windstorms that included tornadoes in some local areas damaged forests in several southern Indiana counties—Brown, Bartholomew, Lawrence, Monroe, Orange, Scott, and Washington. The majority of the areas damaged had uprooted trees that could be salvaged. The tornado areas had trees snapped off and twisted laying in multiple directions. Hardy Lake State Recreation Area, Brown County State Park and Yellowwood State Forest had areas with uprooted trees.

