

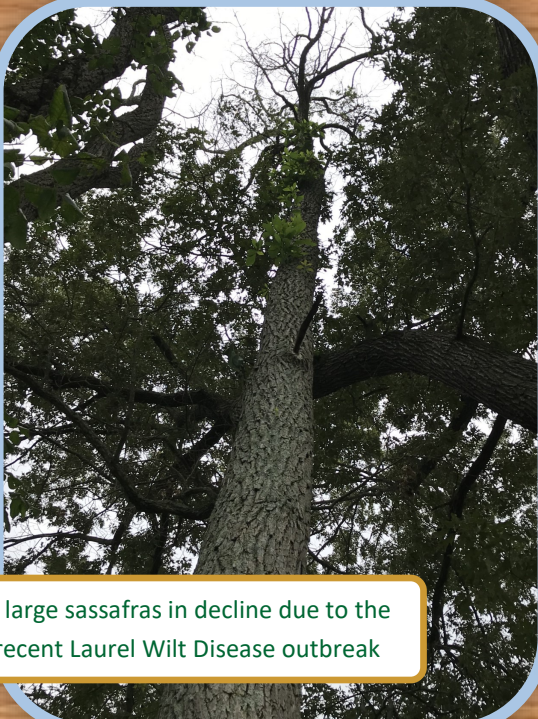
# 2019 FOREST HEALTH HIGHLIGHTS

from the Kentucky Division of Forestry

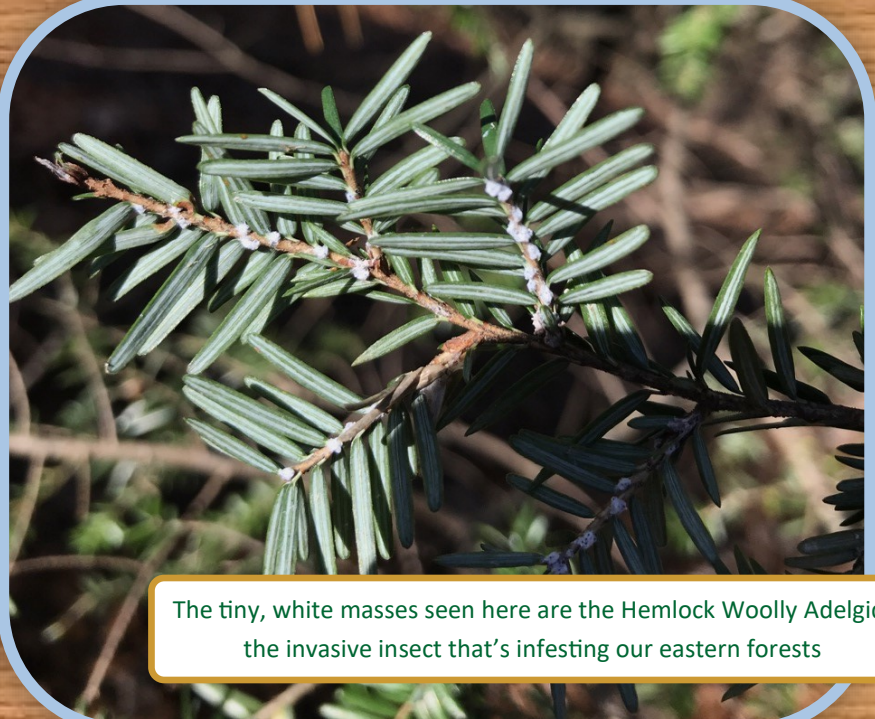


Aerial view of ash mortality due to the exotic pest, the Emerald Ash Borer

**Kentucky is home to nearly 13 million acres of some of the nation's most diverse woodlands. Yet, this valuable resource is under attack. The most severe threats to our forests are insects, diseases, invasive plants, and occasional bouts of extreme weather. This document touches on the most influential of these disturbances and provides an up-to-date review of their impacts within the Commonwealth over the past year.**



A large sassafras in decline due to the recent Laurel Wilt Disease outbreak



The tiny, white masses seen here are the Hemlock Woolly Adelgid, the invasive insect that's infesting our eastern forests



# EXOTIC INSECT PESTS

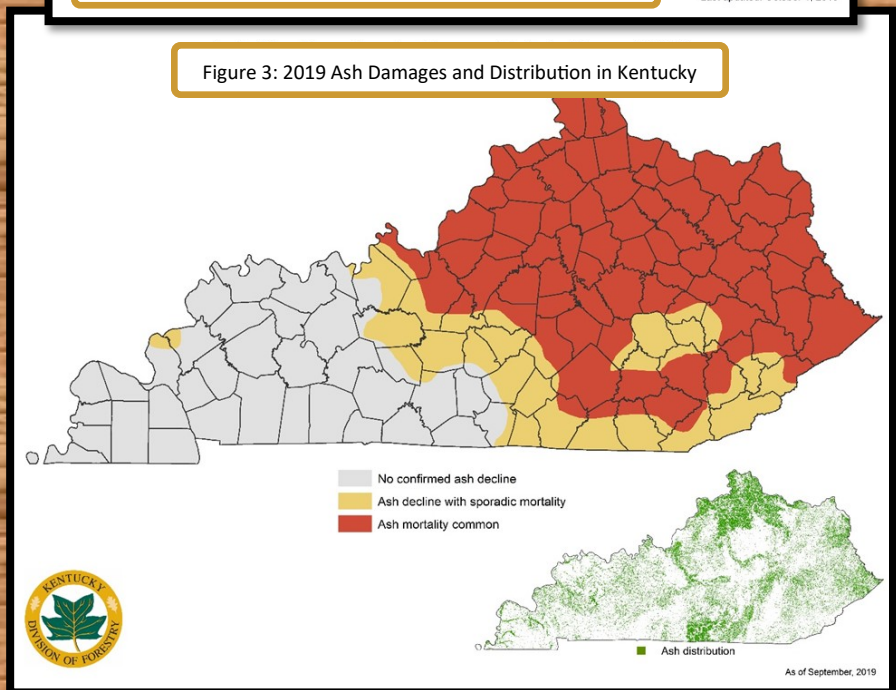
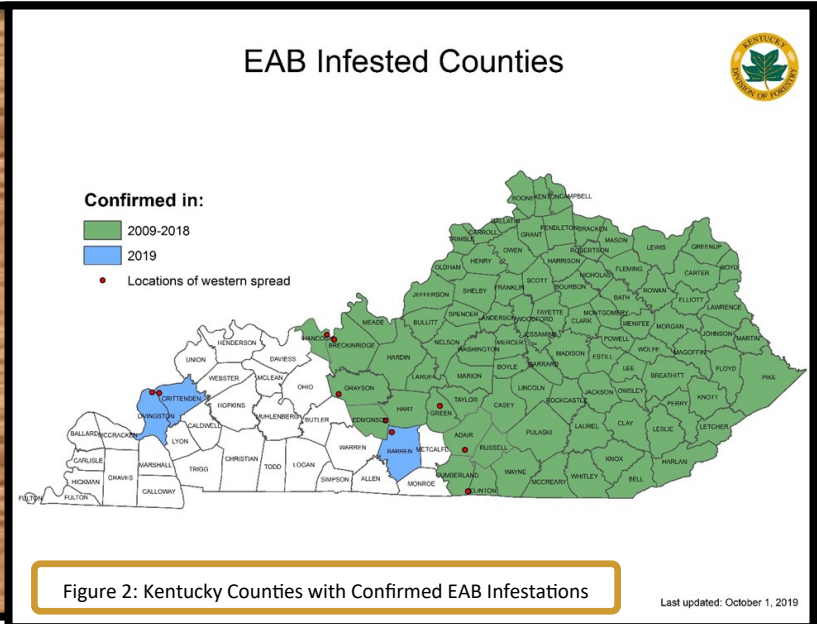
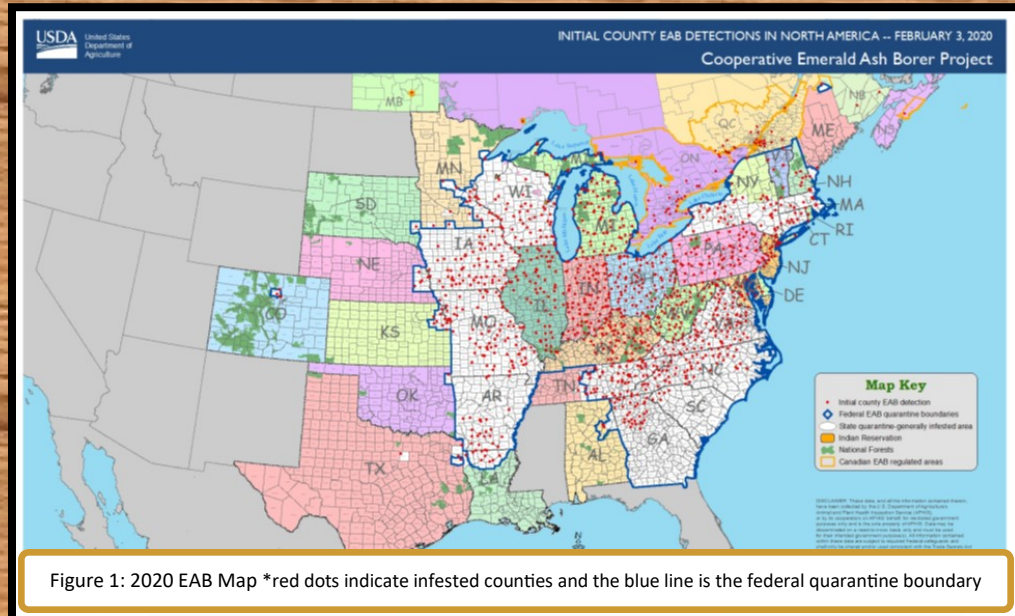
## EMERALD ASH BORER

Since its initial discovery within US borders in 2002, this exotic pest has continued to cover new ground throughout the country and can now be detected in 35 states (Figure 1). Indeed, it has made giant leaps across hundreds of miles to be found as far west as Texas and Colorado. Naturally this small beetle can only disperse a few miles per year on its own. Therefore, these expansions are often caused by human assists such as the movement of firewood or other infested material. This pattern is mirrored within the Commonwealth as this pest begins to pop up in western counties.

Infestations of the emerald ash borer (EAB) were first confirmed in Kentucky in 2009. A quarantine of 20 northern Kentucky counties, located in the region between Louisville and Lexington, was initially established. In the following years, additional EAB infestations were found in nearby counties and the state quarantine was expanded. In April of 2014, the county quarantine system was rescinded and the entire state was added to the USDA APHIS list of regulated areas. Currently, the EAB regulated region is the largest area under Plant Protection and Quarantine. As such, APHIS is proposing to remove the domestic quarantine and refocus their efforts on biological control of this exotic pest.

EAB has been confirmed in 92 Kentucky counties to date (Figure 2). Ever since its arrival, EAB activity had led to mass mortality throughout our northeastern counties and decline continues to spread westward (Figure 3). In 2019, EAB was confirmed in three new counties: Barren, Crittenden, and Livingston, and will eventually impact ash resources across the entire state as the infestation continues to spread into western Kentucky. Infestations in neighboring states of Indiana, Illinois, Missouri, and Tennessee can only aid this expansion within the coming years.

The Division of Forestry will continue to monitor this pest's progress in 2020.





# EXOTIC INSECT PESTS

## HEMLOCK WOOLLY ADELGID

The eastern hemlock is a foundation species within the riparian habitat in which it's found (Figure 4). However, this integral species is under attack from the hemlock woolly adelgid (HWA). This pest is an exotic species with origins from Japan and was first detected in the eastern United States during the 1950s. It wasn't until 2006 when this insect invader was first discovered in Kentucky. Approximately 98% of Kentucky's hemlocks are found in the eastern one-third of the state. In this region, infestations currently occur in 31 counties resulting in decline and mortality (Figure 5).

The Kentucky Division of Forestry (KDF) has a field crew responsible for treating hemlocks to prolong the survival of this ecologically significant tree. Chemical insecticide treatments are employed in order to suppress HWA populations (Figure 6). Treatments began in 2009 on Kentucky State Forests and has since expanded to include properties managed by Kentucky State Parks, Office of Kentucky Nature Preserves, KDFWR Wildlife Management Areas, and USFS Daniel Boone National Forest (DBNF). Since 2009, KDF has chemically treated over 180,000 hemlock trees.

Recently, KDF has also released two species of predatory beetles that feed especially on HWA within the DBNF in hopes of creating a future field insectary site (Figure 7). Although there has been no evidence of predatory beetle establishment within the release sites to date, upcoming releases will take place adjacent to past release sites to increase chances of establishment.

We will continue to improve upon this integrated pest management program in 2020 with further chemical and biological control of this invasive pest.

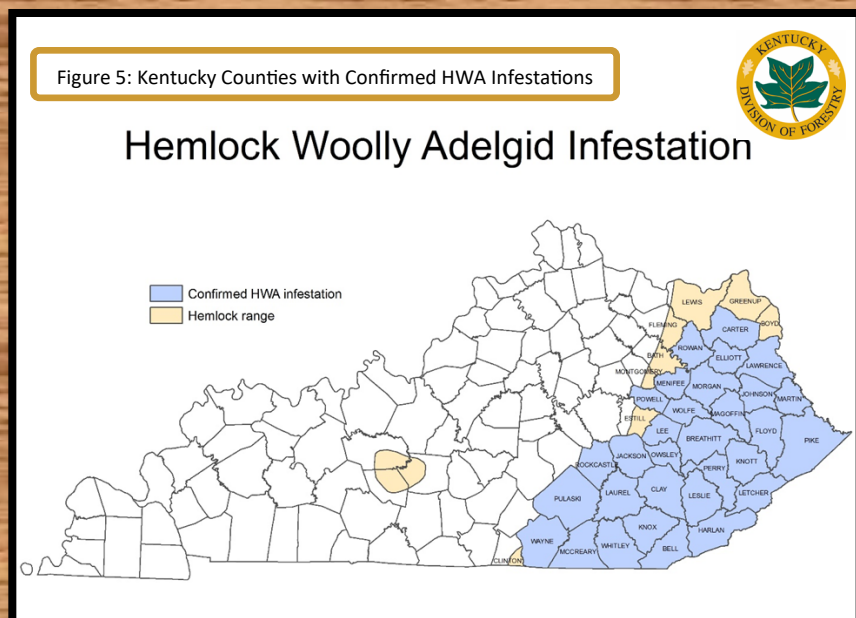
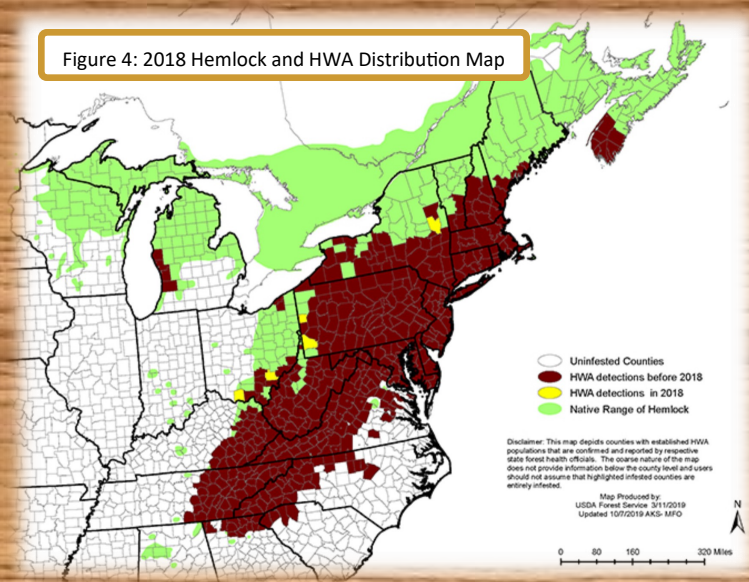


Figure 6: Chemical treatment of hemlock using a soil drench technique.



Figure 7: *Laricobius nigrinus*, a species of predatory beetle that specializes on HWA. Photo courtesy of KY Heartwood.



# NATIVE INSECT PESTS

Exotic pests aren't the only insects damaging our woodlands. There are also a number of native insect pests that locally impact our forests every year. Yet, the significance of these native pests fluctuates over time. While these native insects typically don't cause the same level of damage as their non-native counterparts, they can become an issue when coupled with additional stressors such as drought. KDF is constantly on the look-out for damages from such native pests.

## YELLOW-POPLAR WEEVIL

It is worth noting that much of eastern and central Kentucky experienced an outbreak of the yellow-poplar weevil this year (Figure 8). Generally, this native insect is considered a minor pest, but the weevil was reported at higher than normal levels over the past few years. Reports of browning yellow-poplar trees began in June of 2019 (Figure 9). After it became evident that many counties had infestations, ground surveys were conducted to confirm the general extent of damage from this pest. The surveys concluded that the majority of counties had either minor or intermediate levels of damage. In areas of heavy feeding, trees experienced partial defoliation (Figure 10). Yet, general observations indicate that many of the impacted trees had put on a new flush of leaves by August to replace those defoliated earlier in the season. As in 2015 and 2018, no major decline has been documented. However, periods of severe drought occurred in 2019, and that, in combination with the feeding damage could lead to possible localized decline.



Figure 8: Yellow-poplar Weevil Adult



Figure 9: Browning Yellow-Poplar



Figure 10: Yellow-poplar weevil feeding damage

## SCARLET OAK SAWFLY

Browning oak trees were reported in parts of eastern Kentucky again in 2019 (Figure 11). For the second year in a row, the scarlet oak sawfly had caused feeding damage on oaks (Figure 12). The majority of damage in 2019 was reported in Magoffin County. In the past, no long term damage had been expected from this periodic pest of oak trees. Yet, the long term effect of this year's infestation is yet to be determined as we experienced multiple extreme weather events, including a late season drought.

Figure 12: Scarlet Oak Sawfly Larvae and Feeding Damage

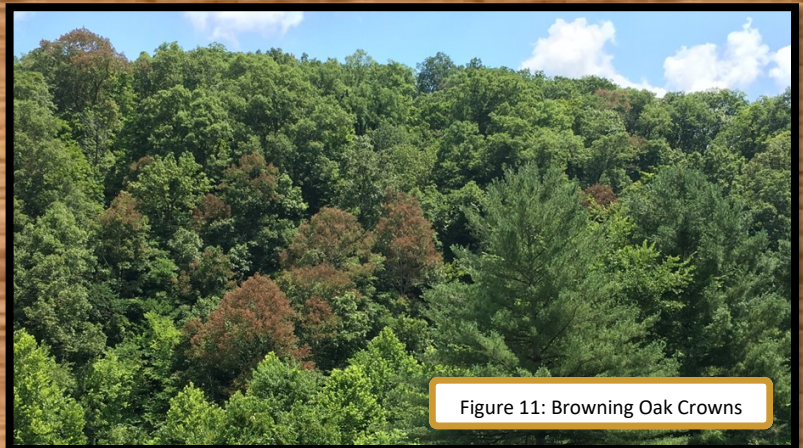


Figure 11: Browning Oak Crowns



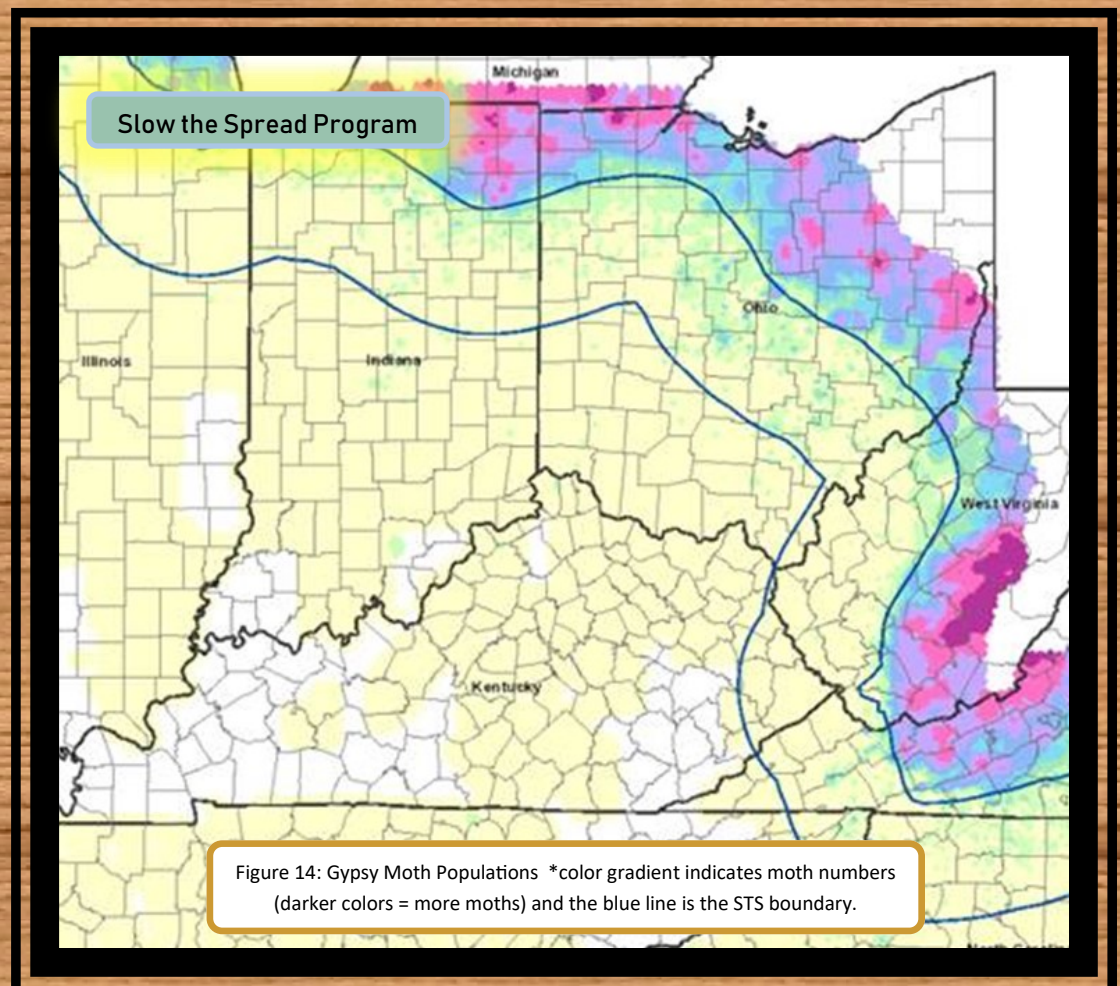
# INVADERS ON THE HORIZON

There is also a myriad of pests that have yet to make their way into Kentucky. These looming threats would cause extensive damage to our forests, which is why they demand our attention and awareness. These pests may never make it to Kentucky. It all depends on the quarantines put in place by the federal government and additional regulatory efforts by various state and private stakeholders. Even under these strict guidelines, we each must do our part to insure that we aren't moving infested material.

## EUROPEAN GYPSY MOTH

The European gypsy moth caterpillar is an aggressive defoliator that possesses a strong preference for oak species (Figure 13). This is unfortunate for our state since the predominant forest-type here is oak-hickory, which covers 76% of our woodlands. Gypsy moth surveys have been conducted since 2005 through various agencies and programs. Thankfully this pest is not yet established in Kentucky, although it has been detected every year since the surveys began. Kentucky's Office of the State Entomologist annually traps for gypsy moth using detection surveys through USDA APHIS and Slow the Spread (STS) programs. In 2019, traps were placed in 78 counties across the state. Three positive traps were found across two counties with a total of three moths captured. Counties with positive traps include Boone and Henry, which are located within northern Kentucky. Positive trap catches were down from 4 moths in 2018, 12 moths in 2017, 68 moths in 2016, and 171 moths in 2015. This is an excellent example of a successful early detection and rapid response system. The efforts of the STS program have kept this pest at bay and the pressure off Kentucky (Figure 14).

Figure 13: Gypsy Moth Caterpillar





# INVADERS ON THE HORIZON

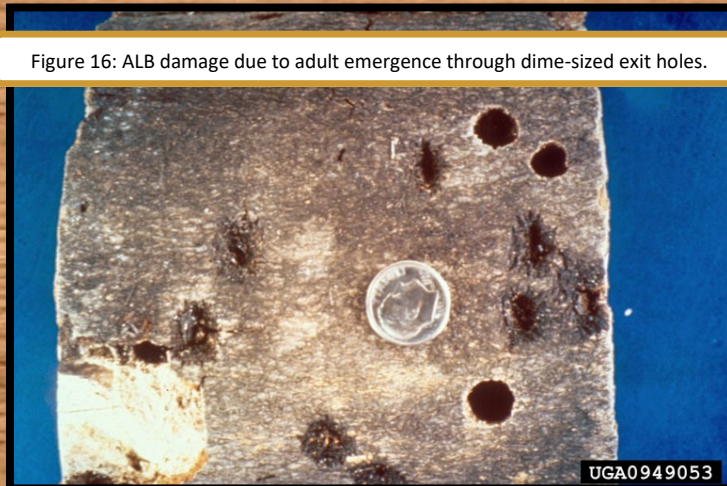
## ASIAN LONGHORNED BEETLE

The Asian longhorned beetle (ALB) continues to be a potential pest of concern for Kentucky (Figure 15). Although ALB has not been found within the Commonwealth, in 2011 it was discovered in Clermont County, Ohio, a mere 10 miles from our northern border. This fact should spur vigilance; here are the common signs of ALB activity. The females chew oviposition pits on host trees, most commonly maple, and lay a single egg beneath the bark. Then the larvae hatch and feed on the sapwood for a short period of time before moving into the heartwood. When adults emerge, they create noticeably round exit holes that can be as large as a dime (Figure 16). KDF works with various agencies to educate the public on ALB identification and signs of infestation.

Figure 15: Asian Longhorned Beetle Adult



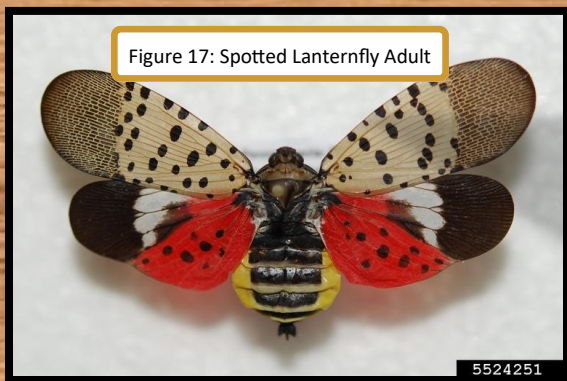
Figure 16: ALB damage due to adult emergence through dime-sized exit holes.



## SPOTTED LANTERNFLY

The spotted lanternfly (SLF) is a relatively new invasive insect to the US with origins from Asia. It was only first discovered in Pennsylvania in 2014. It can be described as beautiful, but it is also dangerous (Figure 17). Don't be fooled by its name, this insect isn't a fly at all. It is actually a hemipteran which uses its characteristic, piercing and sucking mouthparts to steal nutrients right out of its host. It is thought that tree of heaven is their primary host species, but they also show preference towards red maple, black walnut, and various other fruiting trees and vines. Damage from this insect's aggregate feeding behavior can weaken the host, leaving it susceptible to other stress agents. Although the SLF hasn't been found in Kentucky, it was recently discovered in West Virginia in October of 2019. Currently, there is no federal quarantine in place for this pest. Yet, some states have taken it upon themselves to provide regulations for their infested areas (Figure 18).

Figure 17: Spotted Lanternfly Adult



Spotted Lanternfly Known Distribution  
Updated January 10, 2020

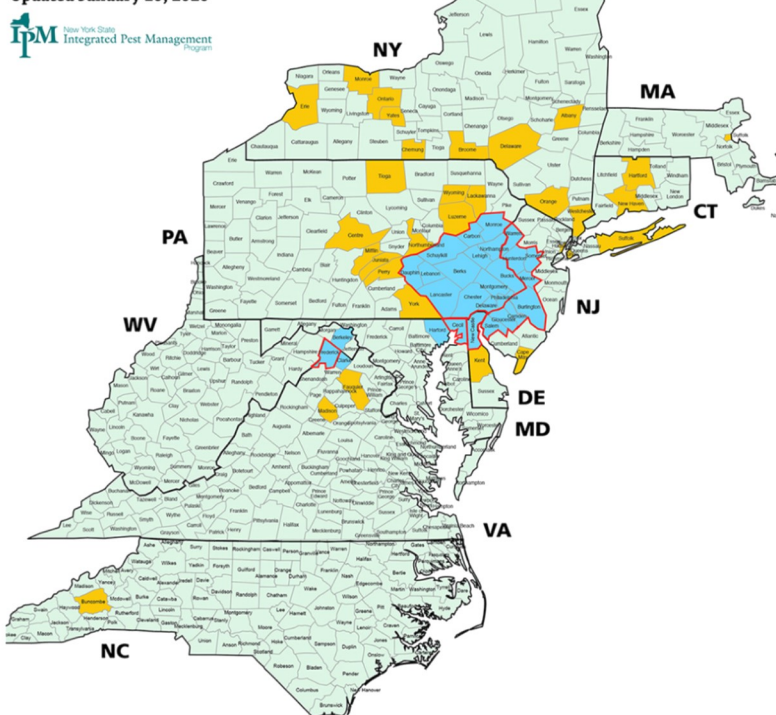


Figure 18: SLF Distribution Map \*blue areas indicate infestation, yellow areas are locations where SLF have been found, and the red line shows the state quarantine areas.



# DISEASES

## LAUREL WILT DISEASE

In 2019, laurel wilt disease (LWD) was first documented in Kentucky in Christian, Todd, and Logan counties (Figure 19). LWD was initially discovered inside the Fort Campbell Army Base in Christian county, Kentucky. After this primary detection, ground surveys were used to learn the extent of the outbreak. Samples from Todd and Logan counties came back positive for LWD as well. These counties are all along the Tennessee border, where this disease has also been reported.



Figure 21: Sapwood Staining

The redbay ambrosia beetle vectors this disease by boring into trees and transmitting the pathogen within the wood. A single beetle can transmit enough spores of the lethal fungal pathogen, *Raffaellea lauricola*, to kill a tree. The fungus infects the xylem, blocking off the vascular system, causing wilting and eventual mortality. Death can occur within weeks to months after being infected. Yet, there is evidence to suggest that sassafras can surpass the initial infection and survive for an extra year or two before succumbing to the disease. Signs of beetle activity include very small circular holes in the bark, occasionally accompanied by thin sawdust toothpicks of waste. Other symptoms to look for include early fall coloration or wilting of leaves on suspect trees that may remain attached for months (Figure 20). In most infected trees and shrubs the fungus causes distinctive, dark staining within the sapwood (Figure 21).

This disease complex is specific to plants within the Laurel Family. Sassafras and spicebush are the only two species found in Kentucky that LWD is known to attack. As of now, we only know of impacts to sassafras; no observations of infection in spicebush have been documented to date in Kentucky.

Next year, a pilot study in cooperation the USFS Southern Research Station will investigate the efficacy of a fungicide treatment as a method to combat this disease in municipal sassafras trees. The Commonwealth could need this more than we know as the national champion, and possibly, the world's largest sassafras tree is located in Owensboro, Kentucky.

### Laurel Wilt in Kentucky



Figure 20: Foliar Symptoms of LWD

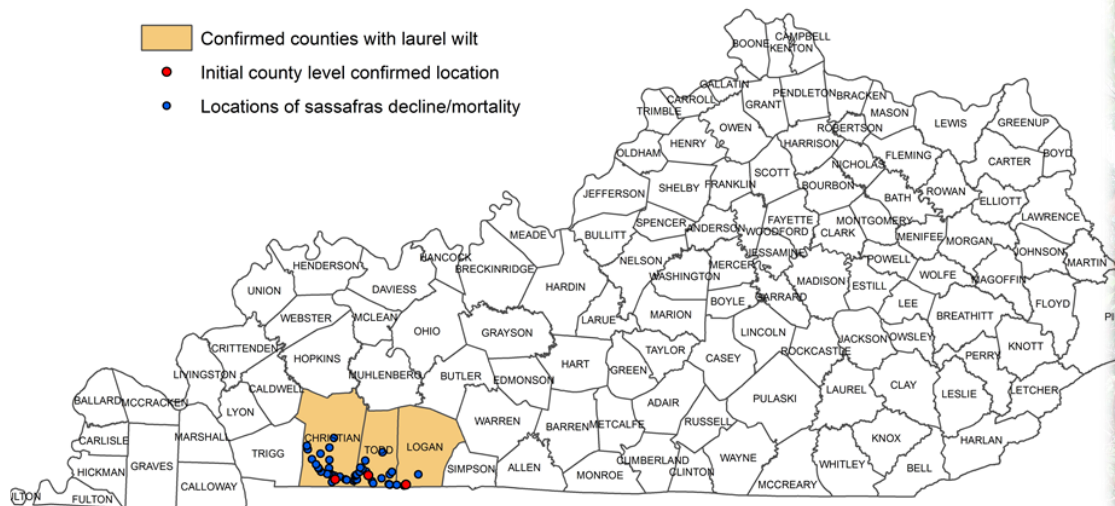


Figure 19: Laurel Wilt Map

Last updated: August 14, 2019



# DISEASES

## THOUSAND CANKERS DISEASE

Thousand cankers disease (TCD) of eastern black walnut is caused by the fungal pathogen, *Geosmithia morbida* and its insect vector, the walnut twig beetle. It was first recorded in the eastern United States in 2010. Yet, neither the pathogen nor the vector of TCD have been confirmed in Kentucky even though there have been confirmed cases in the neighboring states of Indiana, Ohio, and Tennessee (Figure 22). A monitoring program has been conducted within the Commonwealth for many years, and thus far, no beetles have been found. In 2019, KDF placed 9 funnel traps in seven north central counties, including Franklin, Owen, Carroll, Gallatin, Boone, Grant, and Fleming, to monitor for the walnut twig beetle (Figure 23). This program will continue in 2020.

Figure 22: Distribution of Thousand Cankers Disease

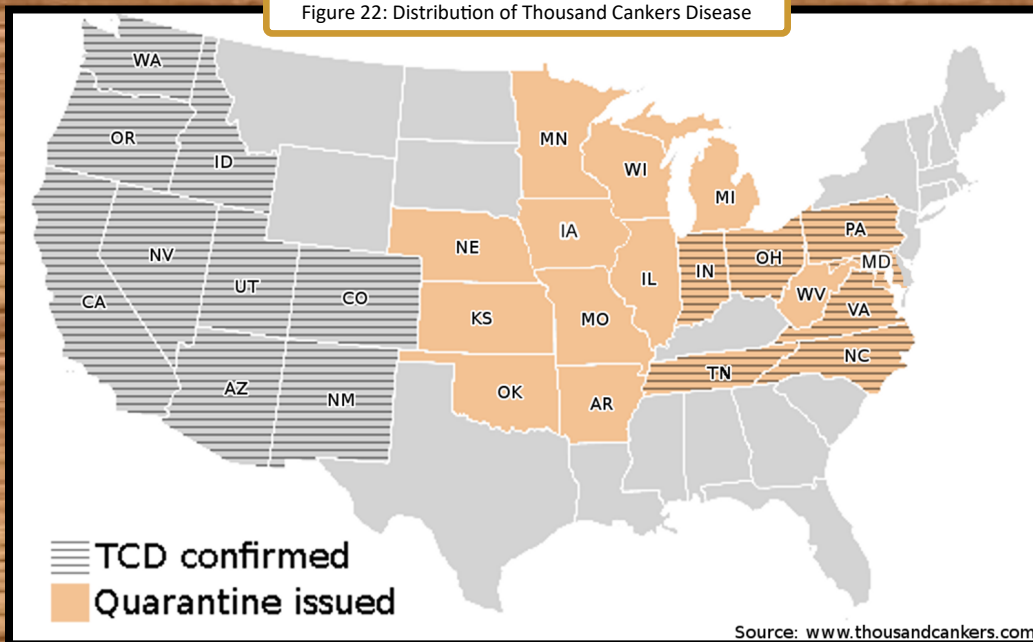
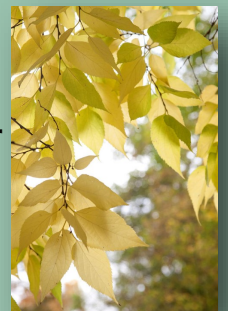


Figure 23: Funnel Trap in a Black Walnut

## "THE MYSTERIOUS DECLINE OF SUGARBERRY IN THE SOUTH"

It all started back in the summer of 2009. Reports began coming in from sporadic locations within the southeastern US pertaining to sugarberry decline. These places were all experiencing the same problem; sugarberry trees were yellowing, dropping their leaves, and gradually dying. Initially, experts thought that this epidemic could be stemming from a combination of factors such as poor site quality, damaged root systems, invasive issues, and of course, insect pressures. Yet, none of these stressors were the primary cause of mortality. Further research and investigation resulted in the discovery of phloem discoloration within all the symptomatic trees. The phloem damage exhibited was eventually linked to phytoplasma, a bacterial agent that infects plant tissue by means of an insect vector or root graft. While this bacteria seems to be the culprit, only one tree has tested positive for this disease to date. Thus, more examination is needed. The Kentucky Division of Forestry will be implementing detection surveys for this mysterious decline next field season as we have a substantial population of sugarberry in the southwestern portion of the state.





# EXTREME WEATHER

We came into 2019 very moist; following the wettest year ever recorded in Commonwealth history! The precipitation didn't stop there either. It continued on into the first half of the year. Then, someone decided to turn off the faucet and things took a very dry turn.

Indeed, temperatures increased across the state during the early summer. After the initial warm-up, temperatures oscillated throughout the summer until we hit record highs. By the end of July, the state began to dry out. Throughout the entire month of August, the state as a whole was abnormally dry. By mid-September, much of the state was experiencing moderate or severe drought with sky-rocketing temperatures throughout the region. September saw the first record high in the upper nineties, with some parts of the state breaking triple digits. That's when severe drought set in for the first time since 2016. The month of September ended up being the hottest and driest month on record in Louisville and Lexington. Indeed, it was the first time in recorded history that parts of the Commonwealth received no measurable rainfall for an entire calendar month! This intense heat-wave continued throughout the late season into October (Figure 24). Then, someone decided to turn the faucet back on and we finally received some much needed rain.

Flash-droughts, like the one we experienced in 2019 have lasting effects on individual trees as well as whole forests. Water stress is a key concern and can become a challenge when other stressors are present. Especially, given the fact that we just came out of the wettest year on record and countless trees put on additional growth that they may not be able to maintain in the future. Yet, our woodlands are resilient. Many trees are capable of bouncing back to health, while others may begin on the path to decline. Only time can tell.

## U.S. Drought Monitor Kentucky

October 15, 2019

(Released Thursday, Oct. 17, 2019)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	8.06	91.94	56.18	17.98	4.03	0.00
Last Week 10-08-2019	3.16	96.84	66.23	16.82	1.08	0.00
3 Months Ago 07-16-2019	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 01-01-2019	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 10-01-2018	0.00	100.00	91.66	58.25	4.00	0.00
One Year Ago 10-16-2018	100.00	0.00	0.00	0.00	0.00	0.00

### Intensity

None	D2 Severe Drought
D0 Abnormally Dry	D3 Extreme Drought
D1 Moderate Drought	D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

### Author:

Richard Heim  
NCEI/NOAA



droughtmonitor.unl.edu

Figure 24: Kentucky's Severe Drought



# FOREST HEALTH ASSISTANCE IN KENTUCKY

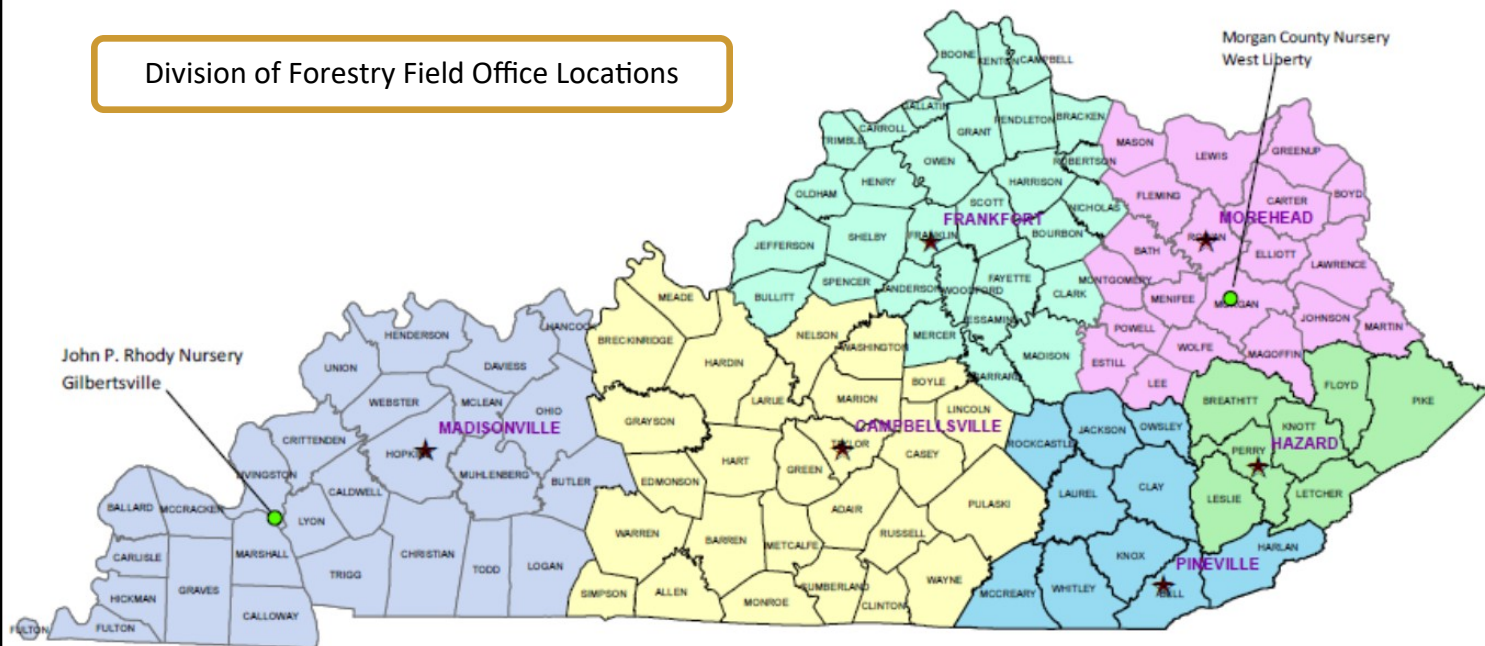
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## Division of Forestry Field Office Locations



### Field Office Contact Information

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Campbellsville, KY 42718	Frankfort, KY 40602	Morehead, KY 40351	Hazard, KY 41701	Madisonville, KY 42431	Pineville, KY 40977
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### References:

- USDA APHIS provided the Federal Quarantine Maps
- Photos with image numbers are courtesy of Bugwood.org