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Major Forest Insect and Disease Conditions in the United States: 2017

Forest Service FS–1138 November 2019

Cover photos:

Dead gypsy moth caterpillar infected by *Entomophaga maimaiga* fungus. Photo by Karla Salp, Washington State Department of Agriculture.

Sampling frass of ambrosia beetles for *Ceratocystis lukuohia* on the Big Island, HI. Photo by Mark Hughes, College of Tropical Agriculture and Human Resources.

Emerald ash borer damage and symptoms occurring on green ash. Photo by David Cappaert, Environmental Sciences Magnet School, Hartford, CT, Bugwood.org.

Southern pine beetle spot detected in Chester County, PA. Photo by Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry.

United States Department of Agriculture

Major Forest Insect and Disease Conditions in the United States: 2017

COMPILED BY HELEN CORTÉS AND BRUCE MOLTZAN
FOREST HEALTH PROTECTION

Forest Service FS–1138 November 2019

Preface

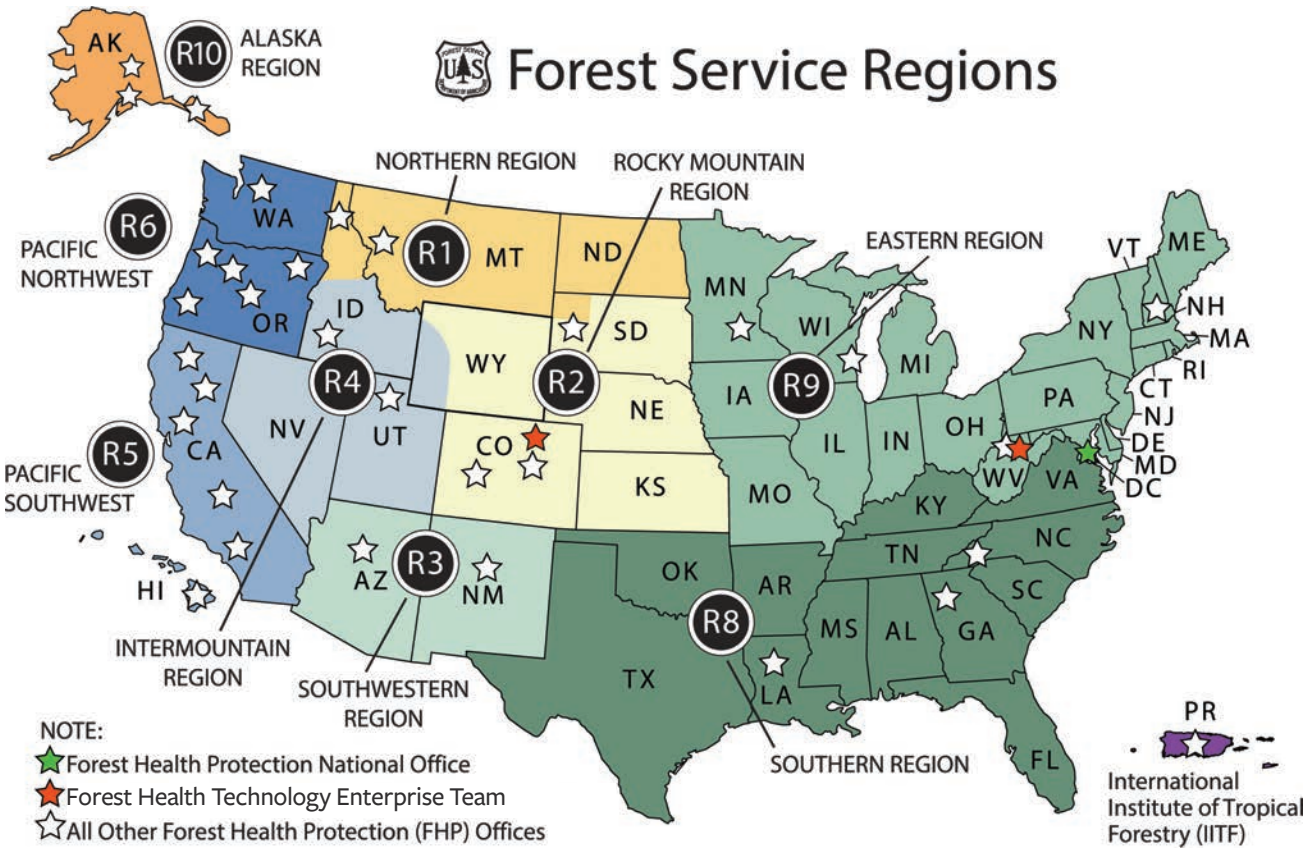
This report on the major insect and disease conditions of the Nation's forests represents the 67th annual report prepared by the U.S. Department of Agriculture, Forest Service. The report focuses on 10 major insects and diseases that annually impact our Nation's forests. This 2017 update provides a national summary of the major changes and status of major forest pests with updated charts, tables, and maps. Additional information on these and other pests is available at: https://www.fs.fed.us/foresthealth/.

The information in this report is provided by the Forest Health Protection program of the Forest Service and its State partners. This program serves all Federal lands, including National Forest System lands, lands administered by the U.S. Departments of Defense and the Interior, and Tribal lands. The program also provides assistance to private landowners through State foresters and other State agencies. Key elements of the program are administered by Forest Service and State program specialists to detect and report insect and disease epidemics through annual detection and monitoring surveys.

For additional information about conditions, contact a Forest Service office listed on the next page (see map for office coverage) or your State forester.

Contents

Forest Service Regions



Copies of this report are available from:

Forest Service, U.S. Department of Agriculture
Attn: Forest Health Protection

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Stop Code 1110
Washington, DC 20250–1110

Phone: 703–605–5344
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This report is also available on the Internet at:
https://www.fs.fed.us/foresthealth/publications/ConditionsReport_2017.pdf

Forest Health Protection Offices

USDA FOREST SERVICE, WASHINGTON OFFICE
Stop Code 1110
1400 Independence Avenue, SW
Washington, DC 20250–1110
703–605–5344

USDA FOREST SERVICE
NORTHERN REGION (R1)
Federal Building
200 East Broadway
P.O. Box 7669
Missoula, MT 59807–7669
406–329–3308

USDA FOREST SERVICE
ROCKY MOUNTAIN REGION (R2)
740 Simms Street
Golden, CO 80401
303–275–5026

USDA FOREST SERVICE
SOUTHWESTERN REGION (R3)
333 Broadway Boulevard, SE
Albuquerque, NM 87102
505–842–3247

USDA FOREST SERVICE
INTERMOUNTAIN REGION (R4)
324 25th Street
Ogden, UT 84401
801–625–5759

USDA FOREST SERVICE
PACIFIC SOUTHWEST REGION (R5)
1323 Club Drive
Vallejo, CA 94592
707–562–8921

USDA FOREST SERVICE
PACIFIC NORTHWEST REGION (R6)
1220 SW 3rd Avenue
Portland, OR 97204-3440
503–808–2913

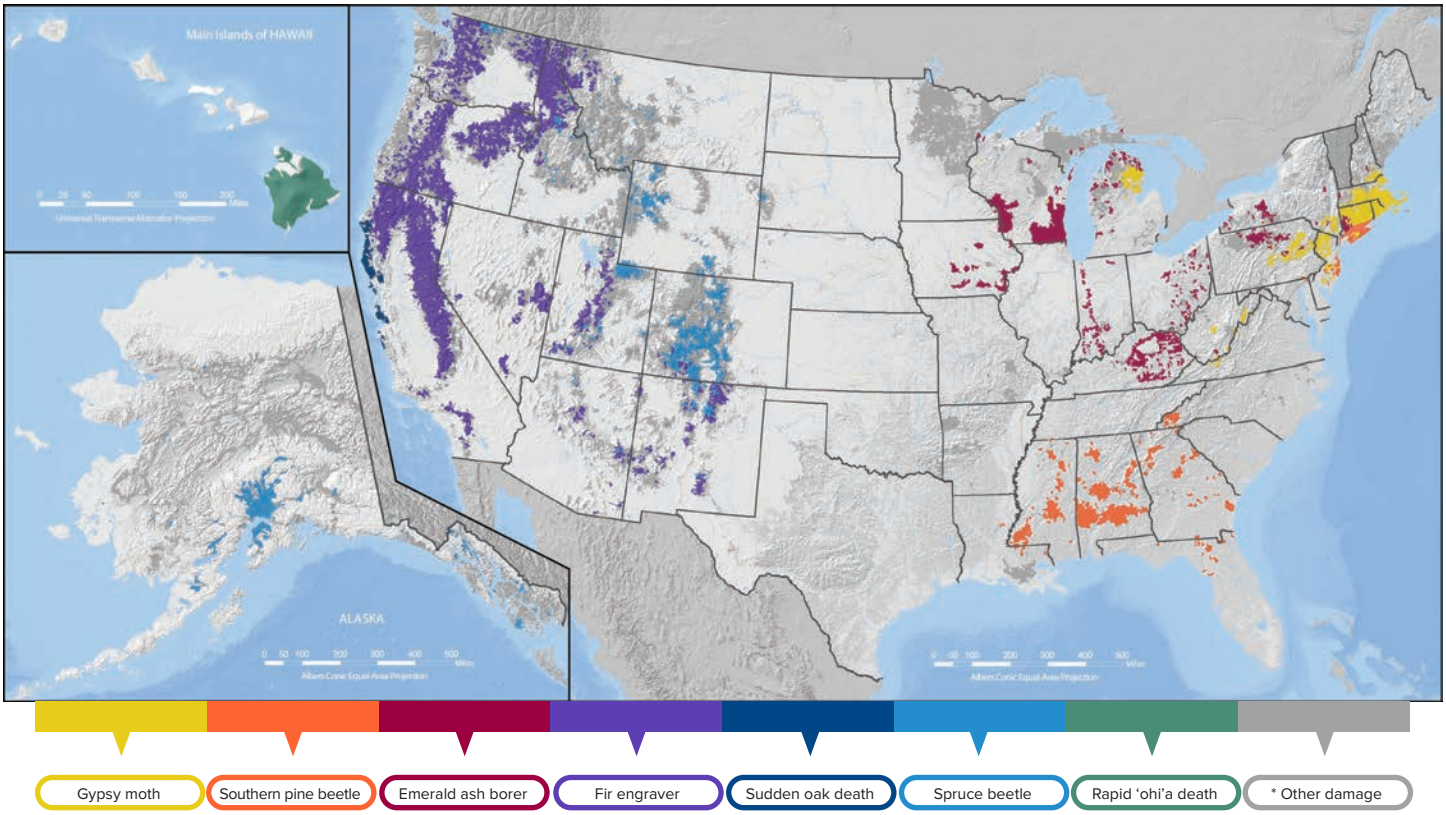
USDA FOREST SERVICE
SOUTHERN REGION (R8)
1720 Peachtree Road, NW
Atlanta, GA 30309
404–347–3540

USDA FOREST SERVICE
EASTERN REGION (R9)
626 East Wisconsin Avenue
Milwaukee, WI 53202
414-297-3600

USDA FOREST SERVICE
ALASKA REGION (R10)
3301 C Street, Suite 202
Anchorage, AK 99503–3956
907–743–9455

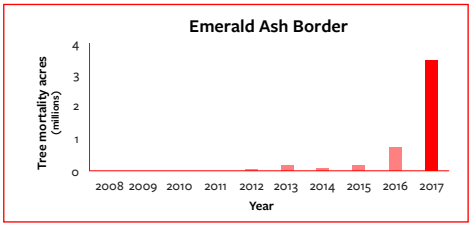
USDA FOREST SERVICE
INTERNATIONAL INSTITUTE OF TROPICAL FORESTRY
Jardín Botánico Sur, 1201 Calle Ceiba
San Juan, Puerto Rico 00926
787–766–5335

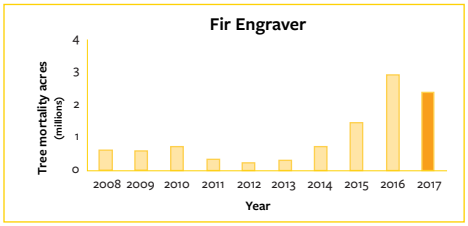
2017 Insect and Disease Survey
Subwatersheds with Tree Damage

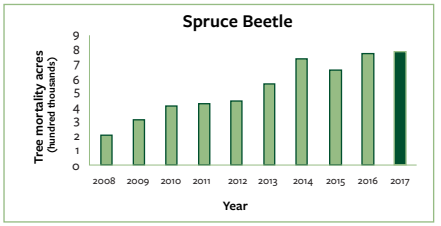


*Includes damage from forest tent caterpillar, western pine beetle, Mounta pine beetle, Swiss needle cast, spruce budworm, and many other less significant pests.

Top Mortality Agent and Survey Trends: 2008–2017





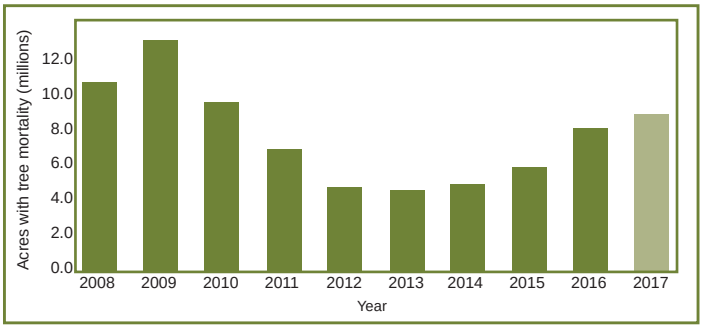


Executive Summary/Introduction

Insects and diseases play critical roles in maintaining healthy, resilient ecosystems. They also can be among the most serious economic and environmental threats to the forests and urban landscapes in America. Trees respond to environmental cues and may be positively or negatively impacted by these changes, altering ecosystem services derived from forested lands, including timber, recreation, clean water, energy, wildlife habitat, and jobs. To understand how conditions are changing and to protect species, forests are surveyed for insect and disease extent and intensity so that Federal and State agencies and other stakeholders can prioritize management to ensure forests remain resilient and sustainable into the future. The overall mortality caused by insects and diseases varies by year and by pest.

TREE MORTALITY

In 2017, more than **8.6 million acres** with mortality caused by insects and diseases was reported in the United States, which is roughly 700,000 acres greater than 2016 observations. In forests across the Western United States, tree damage by fir engraver has been increasing since 2015, causing approximately 2.4 million acres of mortality to white, red, and grand fir in 2017. Southern pine beetle, sudden oak death, and gypsy moth were also important sources of tree mortality throughout our Nation's forests in 2017.



ALL TREE MORTALITY
8.6 MILLION ACRES
IN 2017

Surveyed acres with tree mortality, 2008–2017.

Every year, hundreds of native and nonnative insects and diseases damage our Nation's forests. This report provides descriptions of 10 major insects and diseases that contribute to annual forest mortality and defoliation. Additionally, our Emerging Pest of Concern section describes pests that have the potential to become major threats and which the Forest Service and its partners are closely monitoring. **For more information on all the tree mortality and damage agents, please visit:** https://www.fs.fed.us/foresthealth/.

In addition to mortality, defoliating pests can damage trees by eating leaves or needles, causing significant losses of foliage and altering forest health. A single defoliation event does not usually cause tree mortality; taken together with repeated attacks or severe abiotic factors, such as weather and drought, trees can succumb to these defoliating insects. In 2017, surveys recorded 8.1 million acres of defoliation and other damage agents.

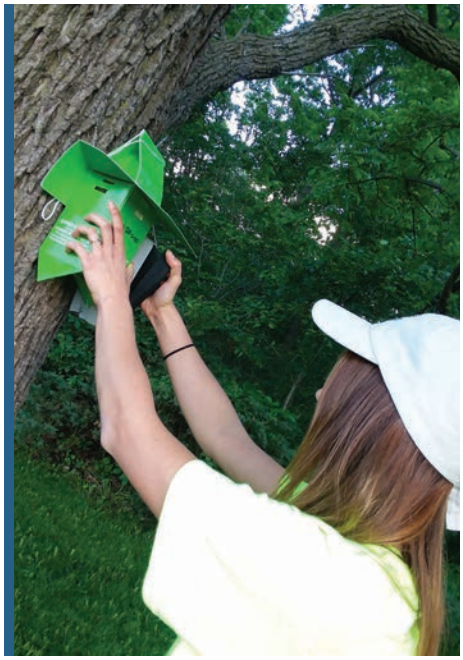
IMPORTANT: When interpreting maps throughout this document, note that data are displayed at the county scale only. For example, if damage was reported at just one location in the county, the entire county is displayed as affected. This standard convention is used because data for most pests are collected only at the county level. If the damage were reported at finer scales, many areas would not be visible at the scale used in this publication. The maps represent only what is reported as mortality or defoliation and not the total infestation of a particular pest. In any given year, some areas are not surveyed due to physical limitations, such as forest fires, weather events, or limited resources. Data collected from ground and aerial surveys used in this report represent a single snapshot in time for a given year. More frequent surveys are conducted in specific areas on a case-by-case basis. By combining these surveys over time, this report captures general trends and conditions of the 10 selected insects and diseases across multiple years.

Gypsy Moth

In 2017, surveys found that gypsy moth damage was on the rise in New Hampshire, while southeastern New York saw a 35-percent decrease. Gypsy moth feeding caused large areas of heavy defoliation across the eastern two-thirds of Massachusetts. Cold and wet spring conditions in the State allowed for virus and *Entomophaga maimaiga* fungus infections to cause significant gypsy moth mortality, with some locations experiencing as high as 95 percent caterpillar mortality. Rhode Island defoliation acres more than doubled that reported in 2016.

In Pennsylvania, although the number of acres damaged by gypsy moth declined compared to 2016, considerable defoliation was detected in the northeast portion of the State. Delaware reported forests had very few egg masses and gypsy moth populations throughout the State. In Maryland, egg mass surveys showed a stable population across the State; little defoliation was observed as spring conditions favored *E. maimaiga* infection.

In some areas of West Virginia, gypsy moth population collapse has been observed, but treatable egg mass counts continue to be located. The remainder of the counties in West Virginia had low population levels in 2017. Gypsy moth is present in Virginia, where populations have periodically peaked and crashed over the last three decades. Large defoliation events are most common in mountainous areas along ridgetops with high concentrations of oak. Early warm weather in the spring of 2017 likely influenced the early emergence of gypsy moth larvae and early defoliation of trees, but rain later in the season restricted the outbreak and limited the amount of damage.



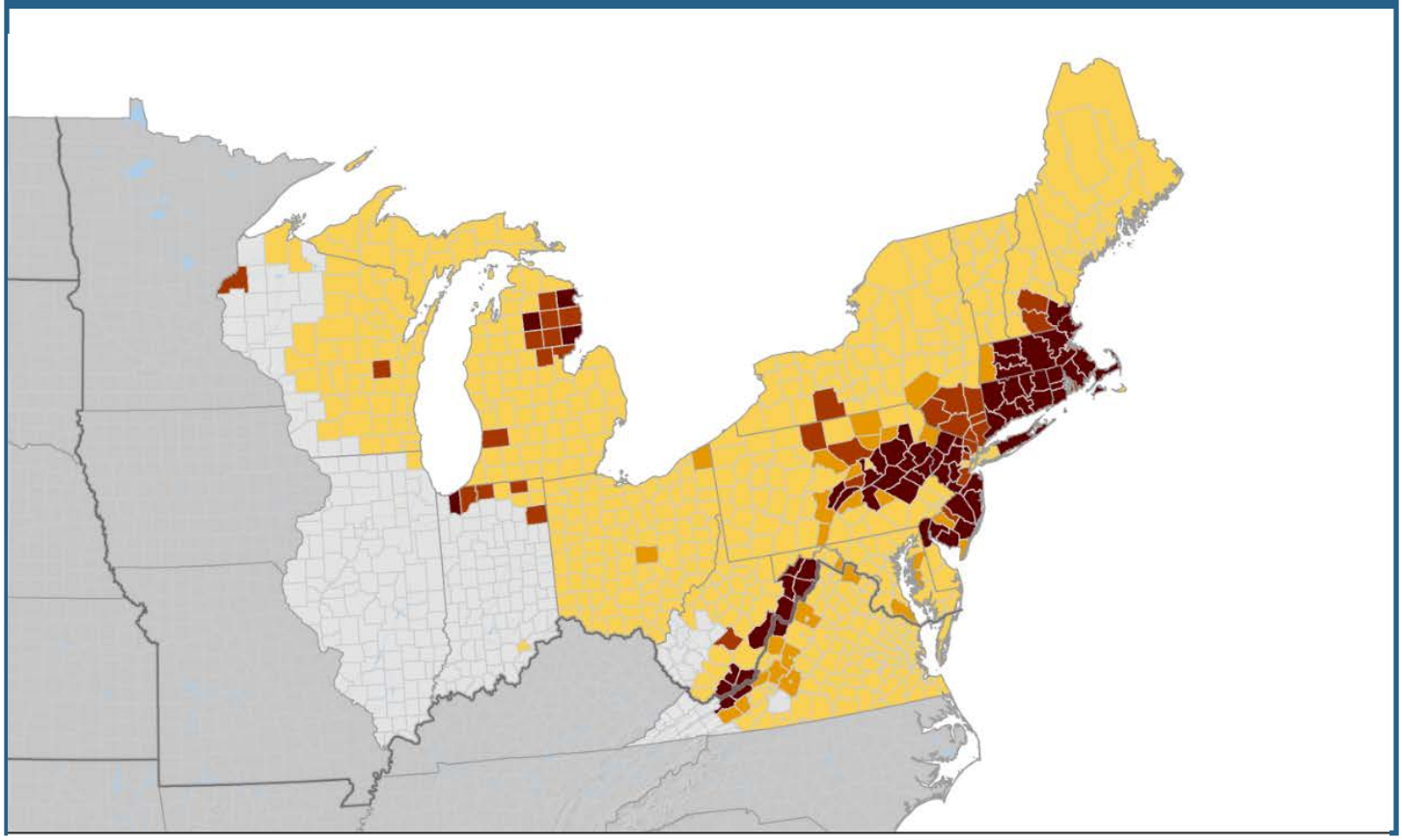
Placing gypsy moth traps in Ohio. ***Photo by Amy Stone****, Ohio State University Extension.*

Gypsy moth populations increased in the northeastern Lower Peninsula of Michigan in 2017. Indiana surveys were conducted in nine northern quarantined counties in prior-year treatment locations and showed no defoliation in 2017. Population increases are often of short duration, lasting only 1 to 2 years, as natural enemies such as the *Entomophaga* fungus and virus respond to quickly return moth populations to normal levels. In Wisconsin, 50 of the 82 counties are now reported infested by gypsy moth.

Dead gypsy moth caterpillar infected by Entomophaga maimaiga fungus. ***Photo by Karla Salp****, Washington State Department of Agriculture.*

OVERALL ACRES WITH GYPSY MOTH-CAUSED TREE MORTALITY DROPPED APPROXIMATELY *7,000 ACRES* COMPARED TO 2016

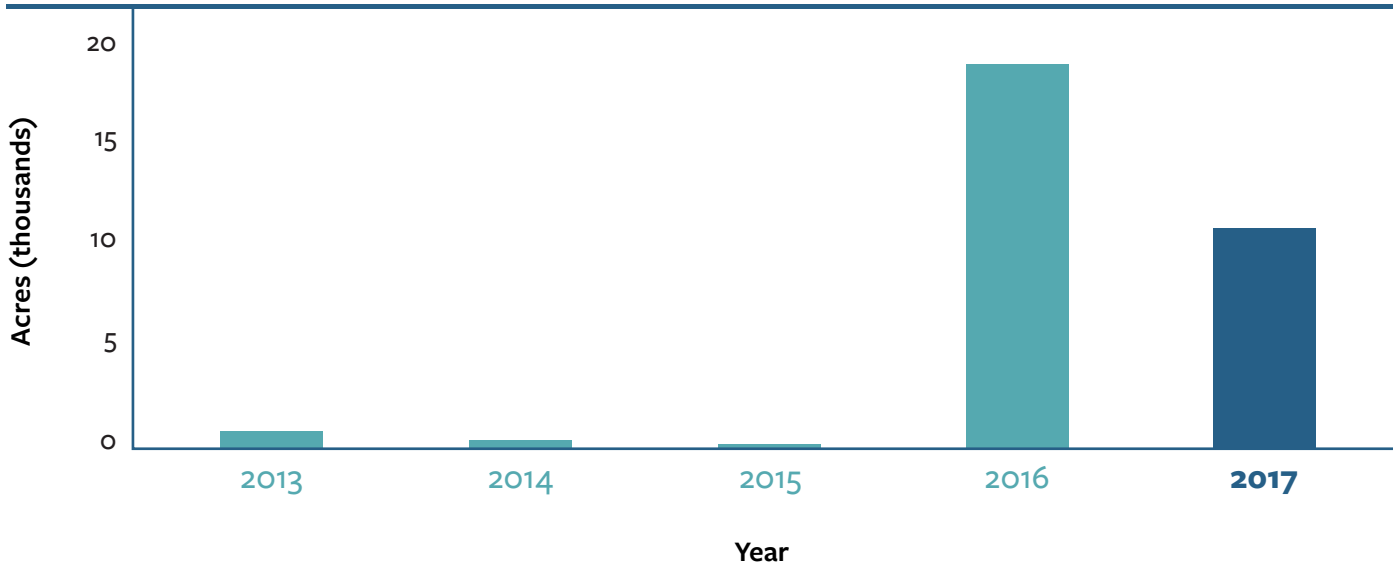
Gypsy Moth



Pest Damage and Range: 2016 & 2017 Damage | 2017 Damage | 2016 Damage | Biological Range & Previous Damage | Affected State | Pest Not Yet Detected | Forest Service Region

FOREST HEALTH ASSESSMENT AND APPLIED SCIENCES TEAM

Gypsy Moth Tree Mortality



Emerald Ash Borer

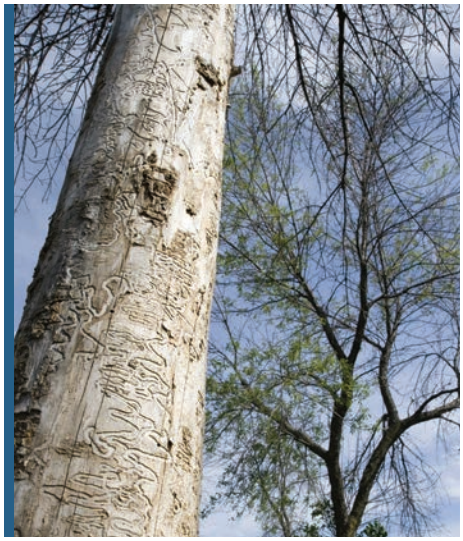
In 2017, emerald ash borer (EAB) was found for the first time in South Carolina and is now found in 32 States and the District of Columbia.

Emerald ash borer was found in three additional counties in New Hampshire, bringing the entire State under Federal EAB quarantine in 2017. In Massachusetts, EAB mortality acres were reported for the first time in Berkshire County. This pest continued to cause significant mortality in New York, where five new counties were declared infested in 2017. Considerable tree mortality acres were reported in urban areas of Connecticut.

Two new counties were added to Maryland's list of positive counties in 2017. The emerald ash borer continues to move through Virginia in 8 new counties, bringing the total number of infested counties to 55.

Seven new counties in Wisconsin were reported for EAB, bringing total infested counties to 47. In Minnesota, two new county records were reported in 2017, where the spread across the State has been slower than that of other infested States.

In Indiana, EAB is now confirmed in all 92 counties; the western edge of mortality is near the Illinois border in northwestern Indiana. Thirteen new EAB county records were reported in Iowa, bringing the total confirmed to 53 counties in 2017. EAB was detected in 10 new counties in Missouri during 2017, bringing the total to 41 counties.



Emerald ash borer damage and symptoms occurring on green ash. ***Photo by David Cappaert****, Environmental Sciences Magnet School, Hartford, CT, Bugwood.org.*

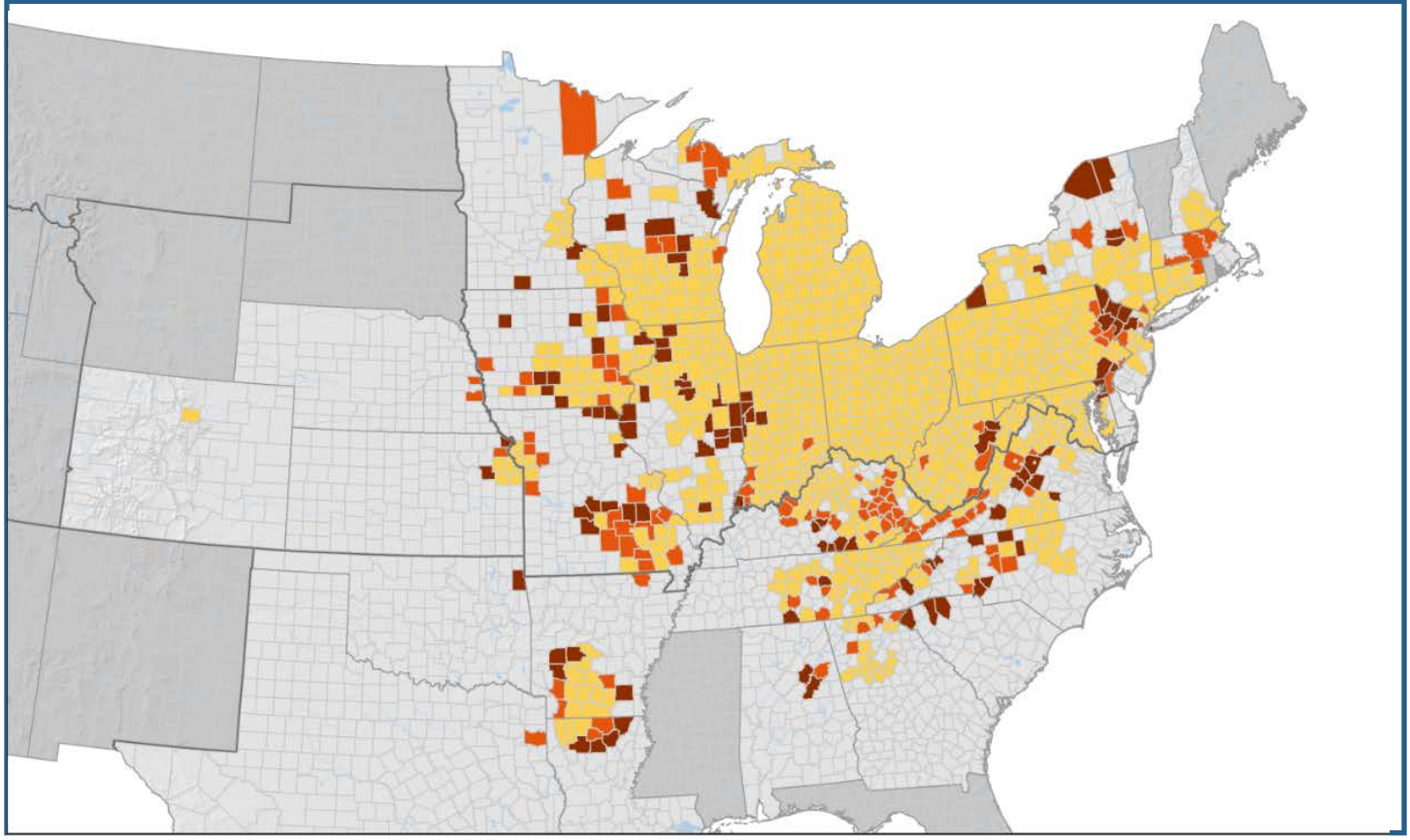
Adult pilose checkered beetle feeding on an adult emerald ash borer. ***Photo by David Cappaert****, Environmental Sciences Magnet School, Hartford, CT, Bugwood.org.*

In Kansas, the quarantined area consists of eight contiguous counties in northeast portion of the State. Mortality due to emerald ash borer has become apparent throughout the infested counties.

In Kentucky, five new county-level infestations were confirmed in 2017, as the borer slowly spread into the western part of the State. Ash mortality has only been observed in southern Arkansas along waterways where ash is common, such as Ouachita River and Little Missouri River. Emerald ash borer was first confirmed in Webster Parish, LA, in February 2015. Since then, it has been confirmed in eight more parishes and an official quarantine is in effect for all nine parishes.

In 2017, EAB was confirmed in nine additional North Carolina counties, bringing the statewide total to 33 positive counties. The beetle was detected for the first time in South Carolina in 2017. Georgia instituted a regional quarantine to cover 63 of 159 counties known to have emerald ash borer in 2017. In the South, only Florida and Mississippi lack confirmed infestations or trap catches of this beetle.

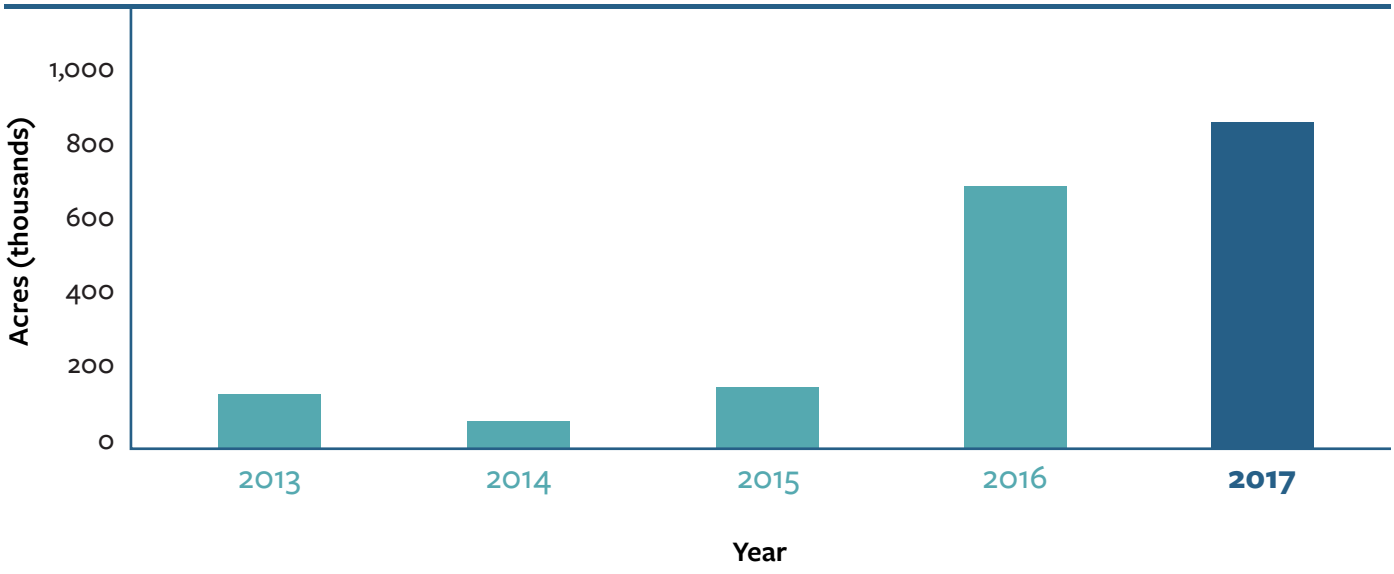
Emerald Ash Borer



Pest Damage and Range: New Damage in 2017 | New Damage in 2016 | Biological Range & Previous Damage | Affected State | Pest Not Yet Detected | Forest Service Region

FOREST HEALTH ASSESSMENT AND APPLIED SCIENCES TEAM

Emerald Ash Borer Tree Mortality



Southern Pine Beetle

In 2017, southern pine beetle (SPB) activity across the South was the highest recorded since 2003, with 18 counties reporting epidemic status. Severe SPB outbreaks occurred across Alabama, Georgia, and Mississippi; with scattered to lighter activity across northern Florida and western North Carolina, Connecticut, Delaware, Maryland, New Jersey, New York, and Pennsylvania. A majority of this activity occurred on national forest lands, most notably the Bankhead, Oakmulgee, and Talladega National Forests in Alabama, the Oconee National Forest in Georgia, and the Homochitto, Bienville, and Tombigbee National Forests in Mississippi.

In Alabama, after the devastating drought of 2016, 465 beetle spots were detected in January 2017; by June 2017, surveys detected 2,322 spots of various sizes caused by SPB. Georgia reported numerous beetle spots on State and private lands, with the majority of spots less than 5 acres in size. These SPB spots started the previous winter (2016) due to mild weather, allowing an early start in 2017 and rapid spread of SPB. In Mississippi, 331 SPB spots were detected on non-Forest Service lands in 2017. Most of these were in close proximity to national forest lands.

In 2017, 54 SPB spots were detected on State and private lands in North Carolina. The topography in infested areas will likely minimize the capability of individual spots to spread. Southern pine beetle has been at historical lows for more than a decade in South Carolina, but spring trapping and aerial surveys reveal that populations are increasing. Spots were only detected in Oconee County by a late summer aerial survey. Spots were less than 20 acres of impacted forest. These were found all on Forest Service lands, all having attributes that increase the risk of SPB infestation, especially in overstocked stands.

Southern pine beetle exit holes on loblolly pine. ***Photo by Chuck Bargeron****, University of Georgia, Bugwood.org.*

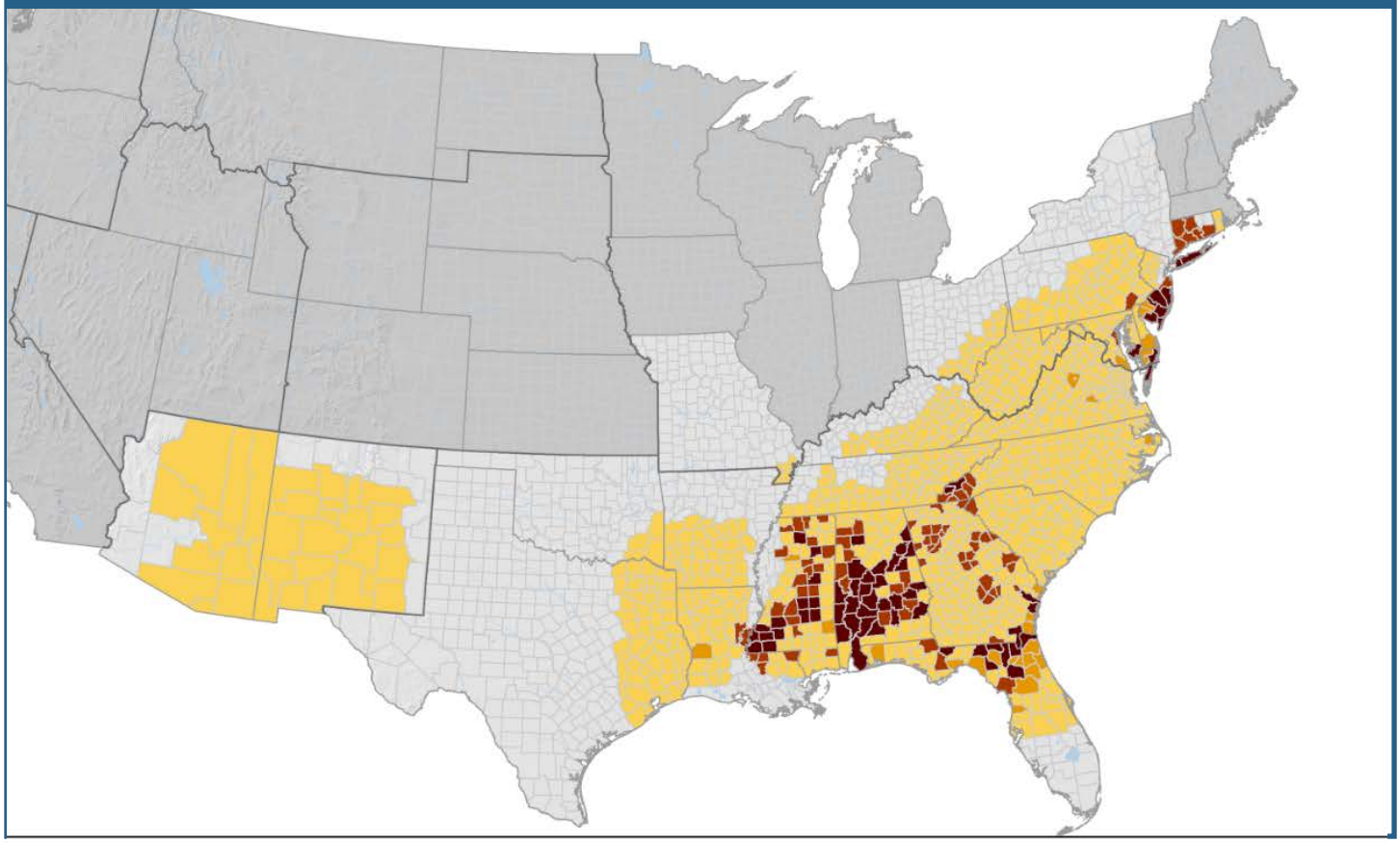
In Florida in 2017, SPB activity was lower than predicted in most areas. A total of 60 spots were detected. Numbers remain low across Louisiana, based on the spring trapping survey results. Several SPB spots were recorded and ground checked; there has not been an outbreak of SPB in Louisiana in 20 years.

In 2017, SPB was found in one new county in New Jersey and in four new counties in Pennsylvania. Trap catch of SPB was low across Maryland, with no populations measuring above low/declining status in the State. On Long Island, NY, SPB continues to cause widespread mortality of pitch pine on the eastern and western fronts of the Long Island Pine Barrens, a globally rare ecosystem under severe threat from the beetle. In Virginia, observations indicate that SPB infestations persist at low static levels. Southern pine beetle activity was observed in two counties across the Commonwealth but only in small, isolated spots. Chincoteague Island on the eastern shore of Virginia has been the only source of SPB activity over the last 5 years.

Southern pine beetle spots detected in Chester County, PA. ***Photo by Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry.***

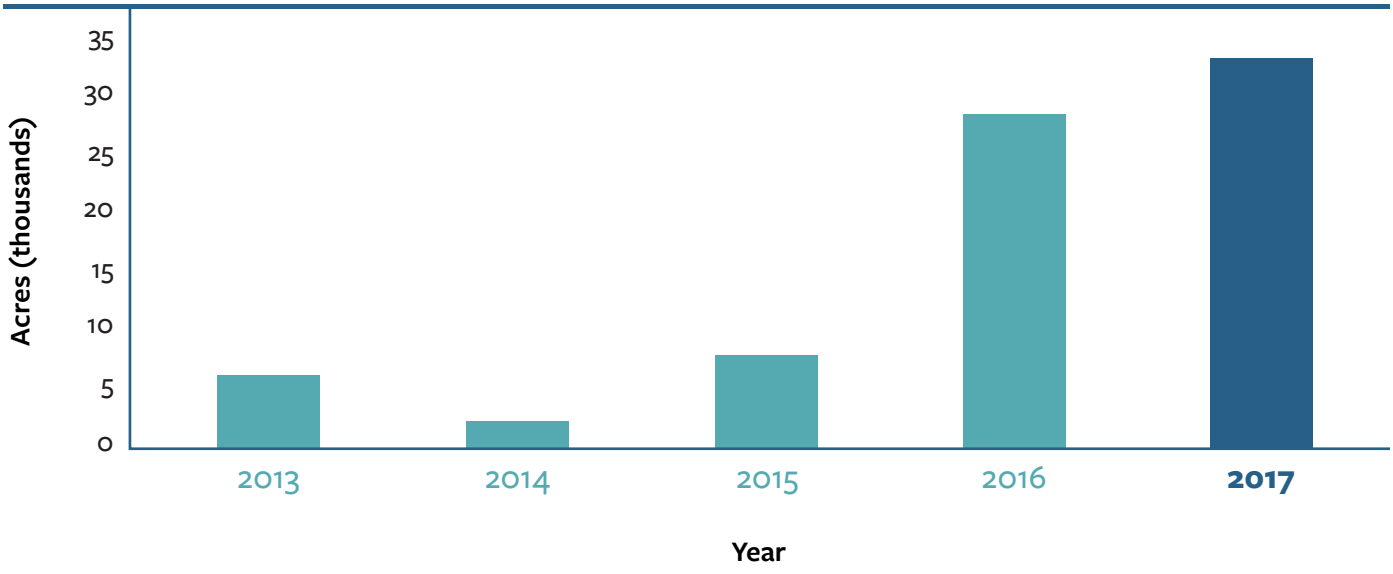
SOUTHERN PINE BEETLE MORTALITY WAS *34,069 ACRES* IN 2017

Southern Pine Beetle



Pest Damage and Range: 2016 & 2017 Damage | 2017 Damage | 2016 Damage | Biological Range & Previous Damage | Affected State | Pest Not Yet Detected | Forest Service Region

Southern Pine Beetle Tree Mortality



Hemlock Woolly Adelgid

In Maine, hemlock woolly adelgid (HWA) was detected in Camden Hills State Park in Knox County in 2017. HWA-infested trees in high-risk areas in Frye Island were treated to slow the spread of the adelgid in this outlier infestation. Vermont reported small pockets of decline due to hemlock woolly adelgid, and no new infestations were found in 2017. Crown discoloration was mapped in Windham County. In Vermont, HWA surveys for 2017 were performed in 29 towns that border the northernmost infested area. Holderness was the first detection in Grafton County. Hemlock woolly adelgid, along with elongate hemlock scale, continued to cause patchy damage and decline among the remaining population of hemlocks in Connecticut.

Eastern hemlocks stands across Massachusetts continued to have high-density HWA populations. The Massachusetts Department of Conservation and Recreation finished its winter mortality study in early 2017 and found low levels of typical HWA mortality. Hemlock woolly adelgid infestations remained present in all five counties in Rhode Island in 2017. In New York, HWA was found for the first time in the Adirondack Park, at Prospect Mountain in Warren County, near Lake George. It was also confirmed for the first time in Cortland County in several locations. Damage was most severe in areas infested the longest, such as much of the Catskills and Finger Lakes regions. In New Jersey, nearly all hemlock (approximately 25,000 acres) is known to be infested with HWA. Eastern hemlock is designated as a priority forest resource in the New Jersey Statewide Forest Resource Assessment and Strategies.

In 2017, two additional counties were added to the infestation list in Pennsylvania, bringing the total to 62 out of 67 counties. In Ohio, sampling of HWA from two sites in early 2017 showed winter mortality of 8 percent, compared to 28 percent in winter 2015–16. In Michigan, HWA was found in four counties along Lake Michigan. Two of these counties were new records in 2017. An internal quarantine has been established to regulate the movement of hemlock from these four counties.

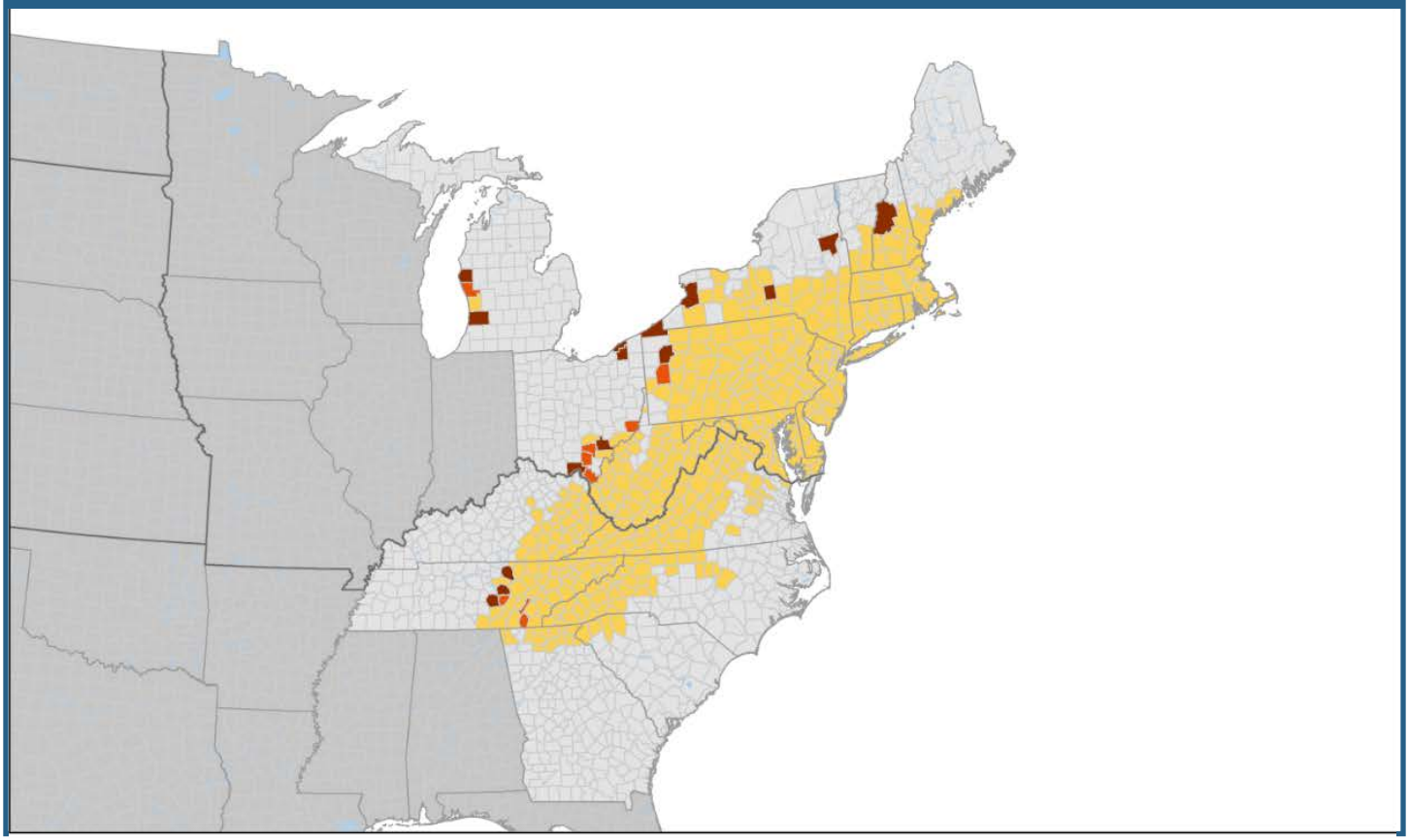
Hemlock woolly adelgid is now found in 48 West Virginia counties. It remains a pervasive pest around Virginia, where hemlock mortality increased slightly in 2017 (31 percent) compared to that of 2016 (30 percent). Changes in HWA populations and tree mortality are attributed to the mild winter temperatures in 2016, which favored HWA survival and reproduction. Across the South, no new HWA-infested counties were added in Virginia, North Carolina, South Carolina, or Georgia in 2017. Three new counties were reported in Tennessee.

Hemlock woolly adelgid mortality in the Nantahala National Forest, NC. ***Photo by William M. Ciesla****, USDA Forest Service, Bugwood.org.*

Biological control beetle release to control hemlock woolly adelgid in Pennsylvania. ***Photo by Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry****, Bugwood.org.*

IN NEW YORK, HEMLOCK WOOLLY ADELGID WAS FOUND FOR THE FIRST TIME IN THE *ADIRONDACK PARK* NEAR LAKE GEORGE IN WARREN COUNTY

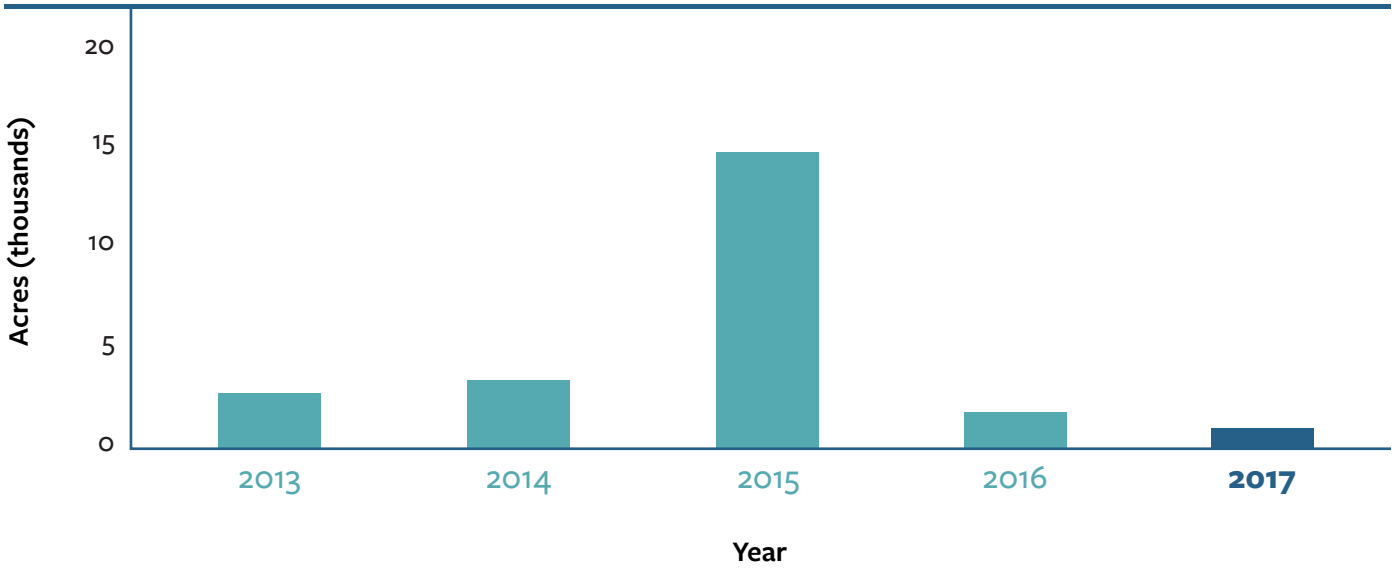
Hemlock Woolly Adelgid



Pest Damage and Range: New Damage in 2017 | New Damage in 2016 | Biological Range & Previous Damage | Affected State | Pest Not Yet Detected | Forest Service Region

FOREST HEALTH ASSESSMENT AND APPLIED SCIENCES TEAM

Hemlock Woolly Adelgid Tree Mortality



Fir Engraver

Western Bark Beetles

Fir engraver continues to be detected in all northern Idaho counties. Affected acreage increased 24 percent over 2016 levels. In southern Idaho, fir engraver tree mortality remained at low levels in 2017, with concentrations of mortality occurring on the Payette National Forest. Western spruce budworm-caused defoliation may have masked some tree mortality. In Northern Idaho, several areas of fir engraver-infested areas were recorded to have up to 50 percent mortality. Fir engraver was recorded across five counties in western Montana, resulting in an overall 19 percent decrease in activity compared to 2016. Fir engraver has been killing large-diameter white fir in increasing numbers for several years in Colorado.

The amount of new white fir mortality observed in the mixed conifer forests across the Southwest continued to decline in 2017. In Arizona, the number of acres with white fir mortality began approaching endemic levels after a significant peak in activity during 2013–2014. The damage mapped in 2017 was observed in eastern Arizona around Mount Baldy on both White Mountain Apache Tribal lands and on the Apache-Sitgreaves National Forest. In New Mexico, white fir mortality declined slightly in 2017 when compared with 2016. The Carson National Forest, and particularly the Questa Ranger District, had the most area affected across the State. The activity in the Cibola National Forest continued in 2017, but at lower levels than observed in prior years.

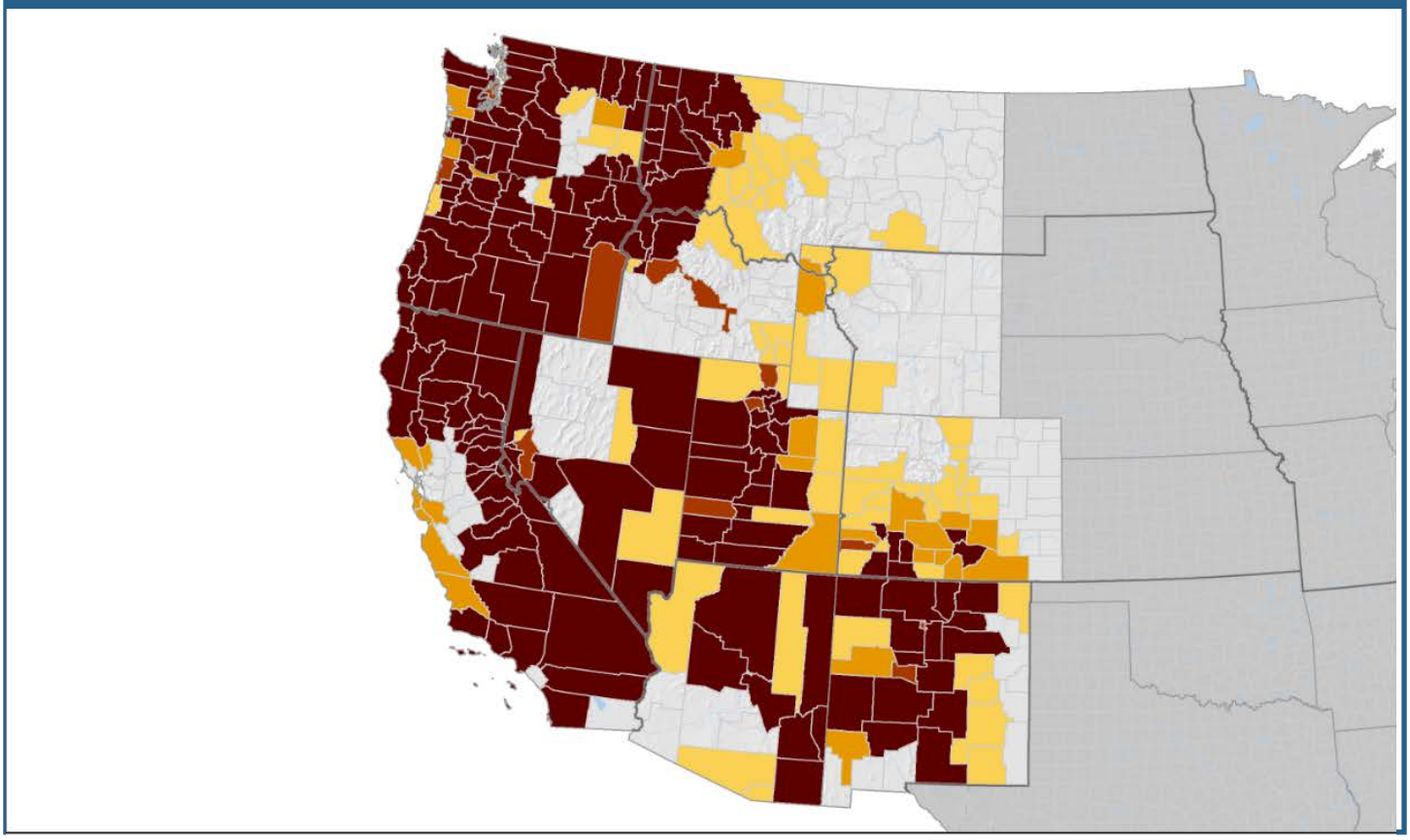
Fir mortality caused by the fir engraver on the Modoc National Forest in California. ***Photo by Jeffrey Moore,*** *USDA Forest Service.*

Bark removed showing fir engraver gallery. ***Photo by Scott Tunnock****, USDA Forest Service, Bugwood.org.*

In Nevada, the most fir engraver-caused tree mortality occurred in white fir on the Humboldt-Toiyabe National Forest and throughout all national forests in Utah.

Increasing levels of red and white fir mortality attributed to drought and fir engraver beetle were observed in many areas throughout California. The majority of the 2017 fir mortality was in white and California red fir. California red fir was considerably impacted, especially in the southern Sierra Nevada range. In northwestern California, fir engraver beetle caused scattered mortality in low- to mid-elevation white fir. Mortality was significant in the Klamath and Shasta-Trinity National Forests. In 2017, fir engraver-caused mortality in the southern Sierras approached 2016 mortality levels. Inyo County also experienced large numbers of dying white and red fir as a result of drought and fir engraver beetle. Light to moderate fir engraver beetle activity (fewer than 10 trees per acre) was observed on the Angeles National Forest. In the San Bernardino National Forest, white fir mortality was estimated to be 10 trees per acre as a result of fir engraver.

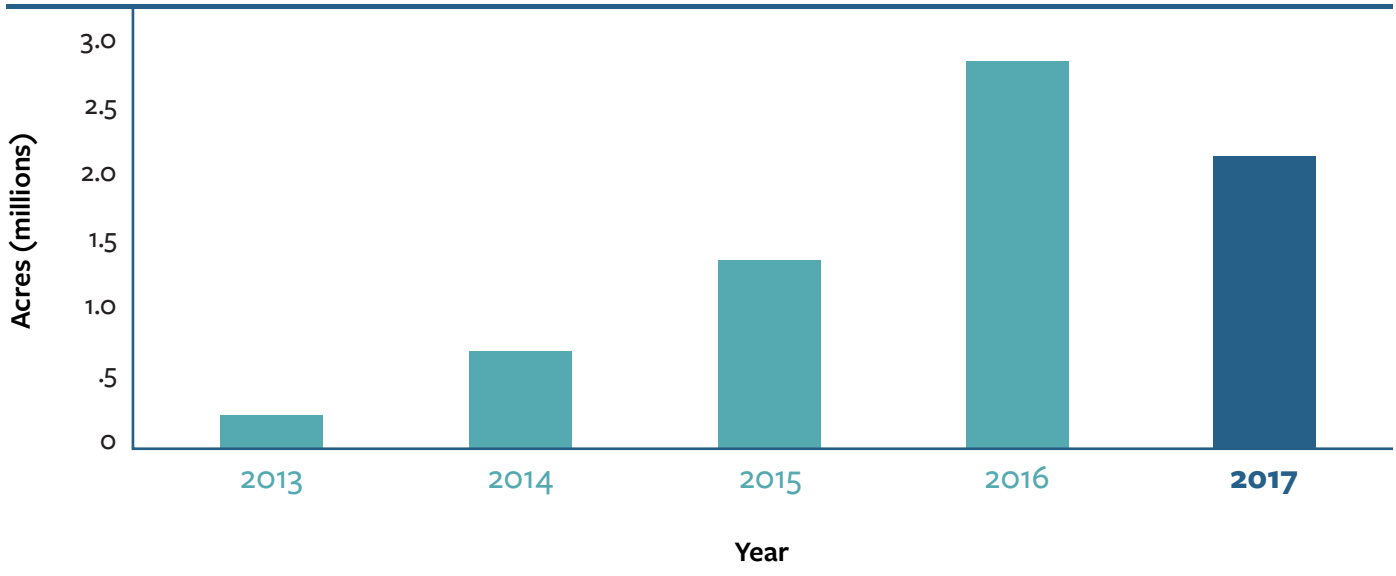
TOTAL FIR ENGRAVER MORTALITY REMAINS *HIGH* ACROSS THE WESTERN UNITED STATES



Pest Damage and Range: 2016 & 2017 Damage | 2017 Damage | 2016 Damage | Biological Range & Previous Damage | Affected State | Pest Not Yet Detected | Forest Service Region

FOREST HEALTH ASSESSMENT AND APPLIED SCIENCES TEAM

Fir Engraver Tree Mortality



Spruce Beetle

Western Bark Beetles

In 2017, spruce beetle activity in Alaska increased significantly in 2016. This represents the most damage recorded for spruce beetle since 1997, when the last major outbreak occurred. The majority of the damage was located in the Susitna Valley and adjacent drainages. Spruce beetle activity continued to build in the northwestern portion of the Kenai Peninsula in the area of Kenai, Soldotna, and Kasilof.

In Arizona, limited and scattered spruce beetle-caused tree mortality was observed during the 2017 aerial detection surveys. The spruce mortality was limited to the White Mountains of eastern Arizona. During the summer of 2017, crews debarked and cut trees into short lengths to eliminate the food source for beetle larvae. Ground surveys in the fall of 2017 did not find any evidence of active beetle infestations in the standing trees. Spruce beetle continued to kill Engelmann spruce, primarily in northern New Mexico on the Carson and Santa Fe National Forests in 2017. Stands that have experienced several years of the bark beetle have recorded greater-than-90-percent spruce mortality in the most heavily affected sites.

Across the Intermountain West, spruce beetle-caused tree mortality remained active, with approximately 100,000 acres impacted in 2017. Since 1996, more than 700,000 acres have been affected by spruce beetle, leaving many areas of large dead standing spruce in higher elevations. This is the first year of decreased activity following six consecutive years of increased spruce mortality.

Spruce beetle mortality on the Kenai Peninsula, AK. ***Photo by Bruce Moltzan****, USDA Forest Service.*

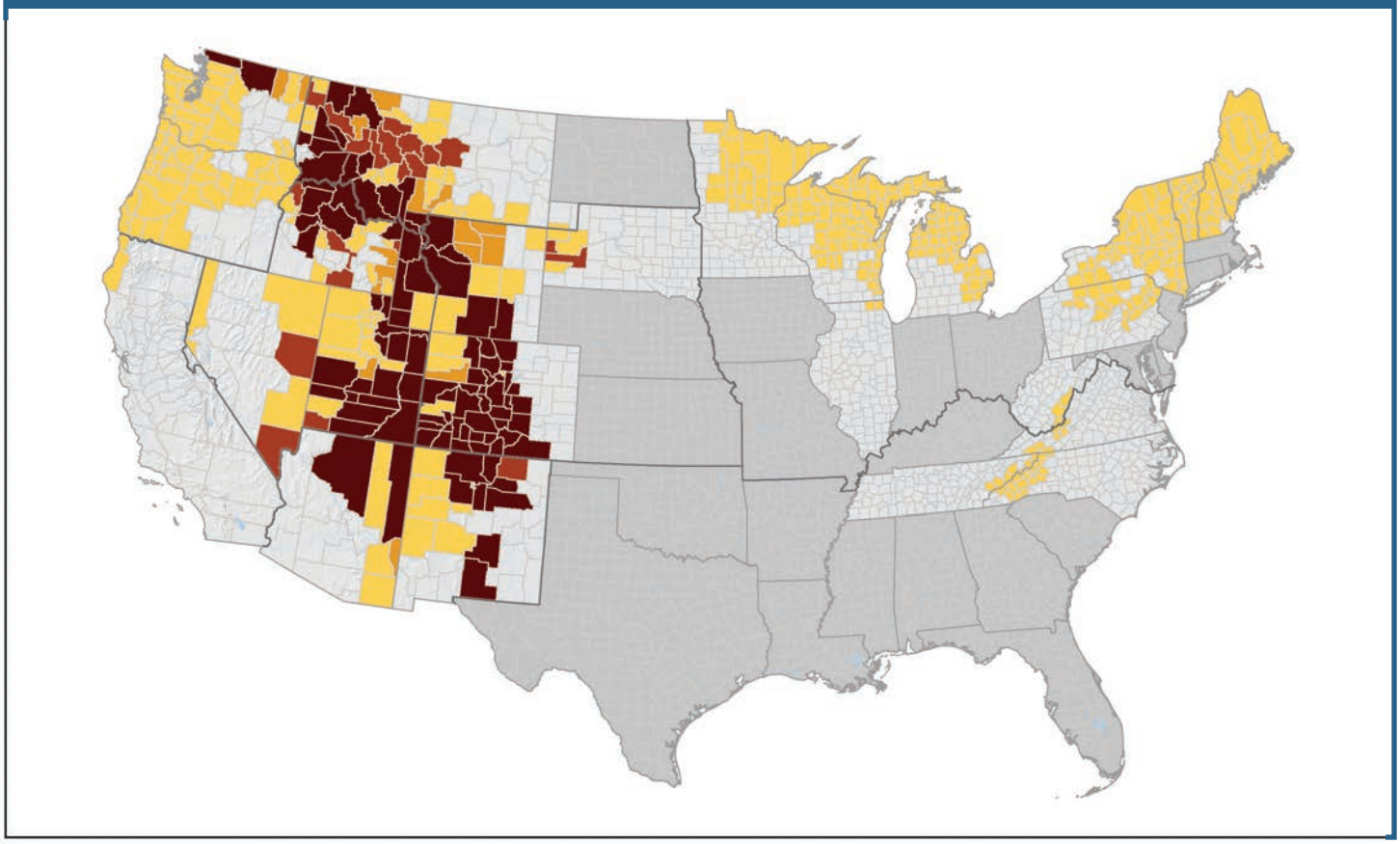
Adult Spruce beetles. ***Photo by Steve Munson****, USDA Forest Service, Bugwood.org.*

In Utah, most spruce beetle mortality acres occurred on national forests. The Uinta-Wasatch-Cache and Ashley National Forests continue to have significant outbreaks.

Spruce beetle mortality acres were reported at low levels on all national forests in Idaho, with most mortality occurring in riparian areas on the Caribou-Targhee National Forest. A significant outbreak did erupt in 2017 on the Nez Perce-Clearwater National Forest in northern Idaho. Most of new tree mortality in western Wyoming occurred in already heavily impacted stands, leaving behind few surviving mature spruce. In the Northern Rockies, estimates for spruce beetle-caused mortality increased three-fold in 2017 relative to damage detected in 2016. Beetle populations remained endemic throughout the majority of northern Idaho and Montana.

In 2017, spruce beetle activity was detected in areas not previously reported, as the epidemic continues to expand in Colorado. In south central Colorado, spruce beetle epidemics expanded on the San Juan, Rio Grande, Gunnison, and San Isabel National Forests. In northern Colorado, spruce beetle-caused new mortality in and adjacent to Rocky Mountain National Park.

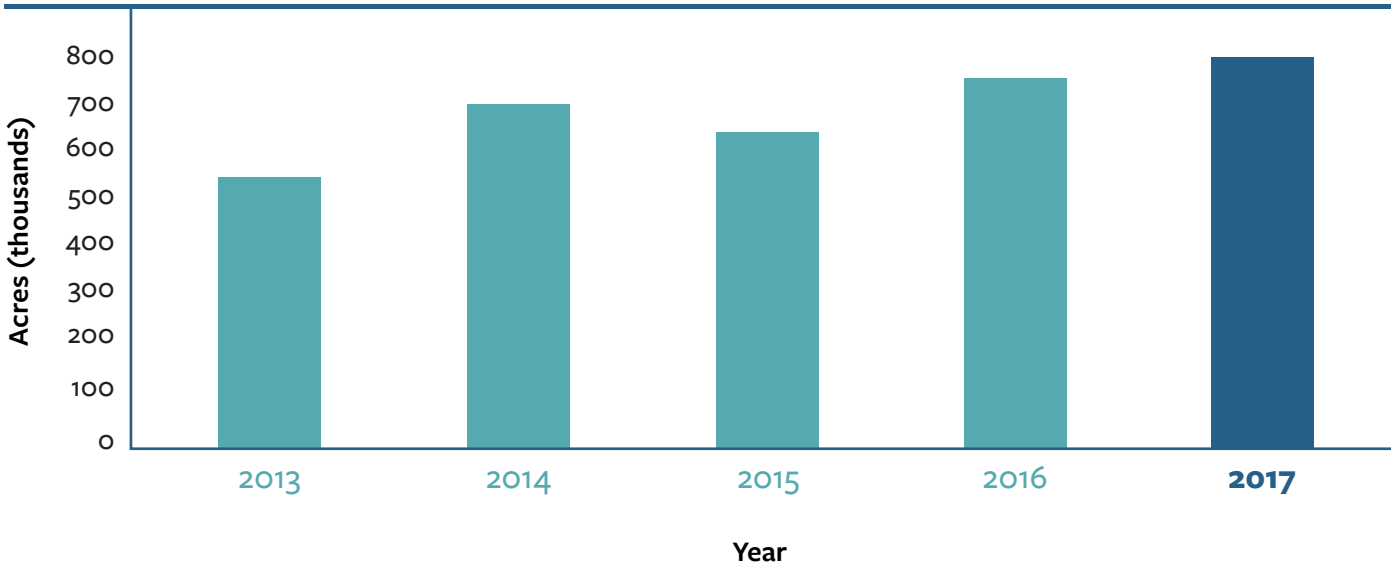
OVERALL SPRUCE BEETLE MORTALITY WAS UP *20,000 ACRES* FROM 2016



Pest Damage and Range: 2016 & 2017 Damage | 2017 Damage | 2016 Damage | Biological Range & Previous Damage | Affected State | Pest Not Yet Detected | Forest Service Region

FOREST HEALTH ASSESSMENT AND APPLIED SCIENCES TEAM

Spruce Beetle Tree Mortality



Mountain Pine Beetle

Western Bark Beetles

In Arizona, mountain pine beetle (MPB) activity was recorded at localized levels during 2016–2017, following an upswing in activity from 2013 to 2015. In 2017, only a few scattered individual pockets were observed on the San Francisco Peaks and Coconino National Forests.

Generally in Intermountain West, mountain pine beetle mortality acres continue to decrease. Surveys for 2017 recorded the lowest level of acres of pine mortality since before the massive mountain pine beetle outbreak of the early 2000s. Most tree mortality occurred in five-needle pines in Nevada following years of drought in the area.

In Idaho and Montana, mortality of pine species continued to decline across in 2017. The great majority of mortality (90 percent) continued to be in lodgepole pine, with limited amounts in ponderosa pine, five-needle pines, and western white pine. Ninety percent of the area affected occurred on national forest lands, with some scattered on other Federal, State, and private ownerships. Counties that have had MPB activity in the past continue to have small numbers of trees killed, with no areas of significantly increased activity noted. Pine mortality from mountain pine beetle is less than 0.5 trees per acre over the Black Hills of South Dakota. The epidemic has ended in Colorado; the MPB-affected area in the State did not expand in 2017.

Mountain pine beetle outbreaks across Wyoming occurred at much lower levels

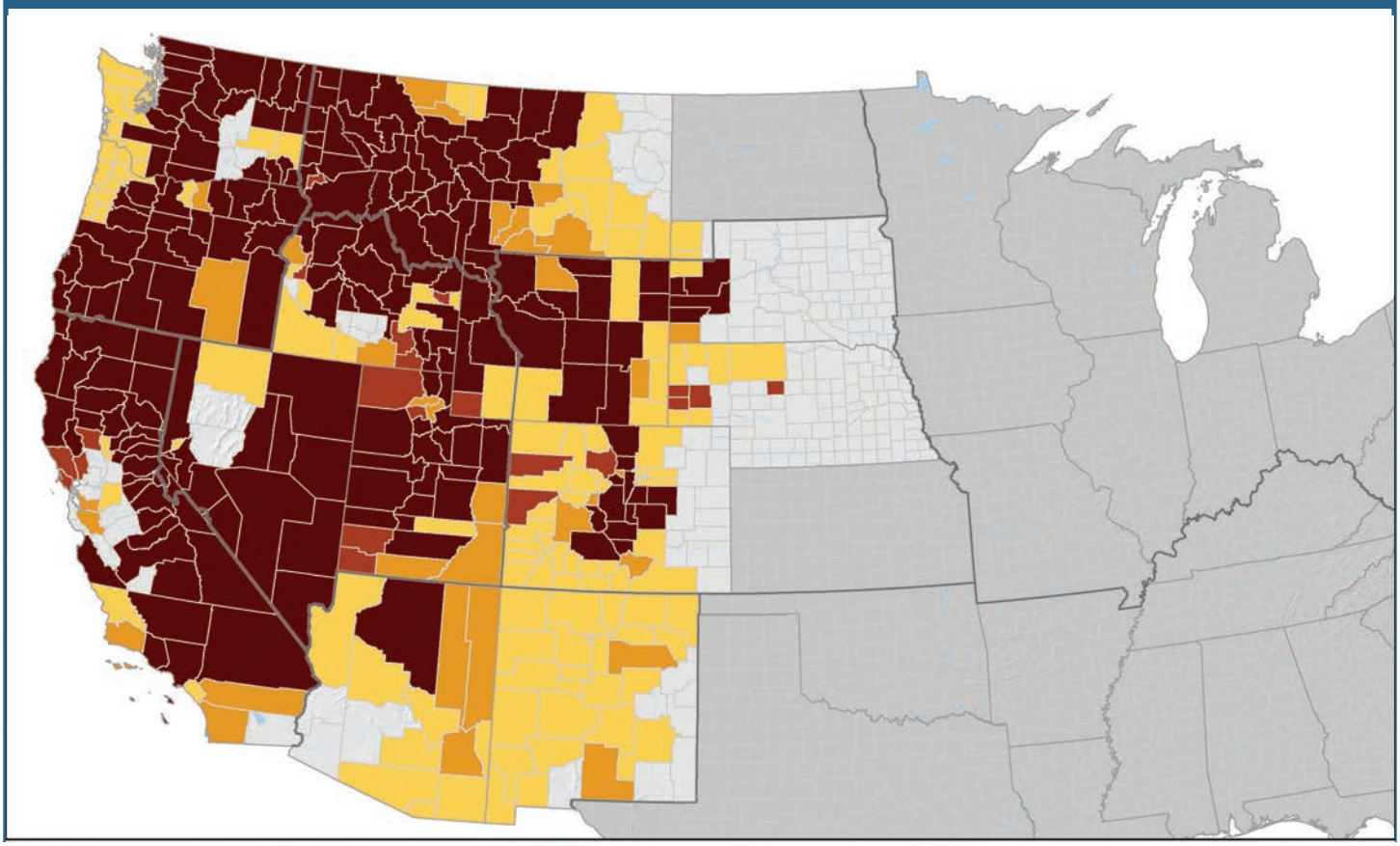
Mountain pine beetle mortality occurring on Whistlers Mountain in Jasper Park, Canada. ***Photo by Janet French****, Postmedia.*

affected in 2017. Dead standing trees are common throughout and little activity was observed in lodgepole or ponderosa pines. Trees affected were primarily high-elevation, five-needle pines. In many areas, much of the mature five-needle pines have been killed. In the northern portion of Wyoming, large areas still remain generally unaffected by mountain pine beetle, despite being susceptible.

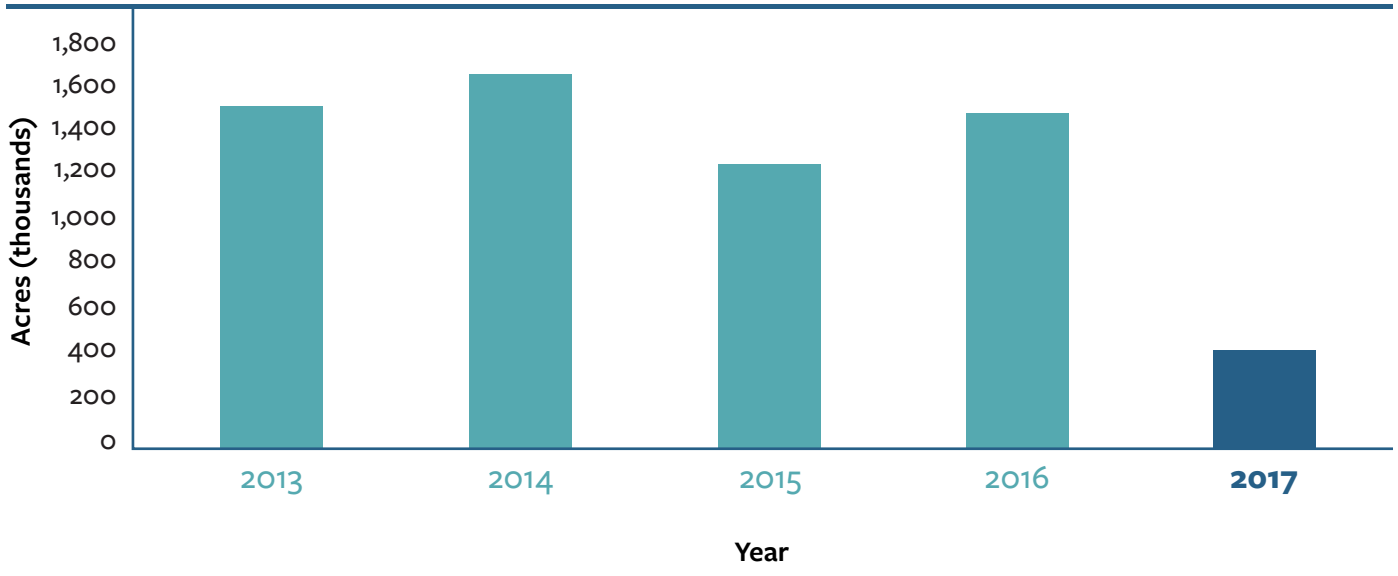
In California, MPB activity was lower in 2017 compared to 2016 levels. Successful mountain pine beetle attacks were noted on lodgepole, sugar, and ponderosa pine in northeastern California. Individual and small groups (2–4 trees) of attacked trees were noted on the Lassen National Forest. Individual large-diameter sugar pines (greater than 30 inches) and trees in small groups continued to die in southern Sierra Nevada forests on the Eldorado National Forest. Groups of dead lodgepole pine (5–15 trees) were detected on the Inyo National Forest. On the Sierra National Forest, large groups (20–50 trees) of dead lodgepole pine were observed, and mountain pine beetle activity appeared to be increasing in these areas. Significant sugar pine mortality also occurred in San Bernardino County.

Pheromone baiting as part of an integrated approach to management of mountain pine beetle. ***Photo by Jerald E. Dewey****, USDA Forest Service.*

MOUNTAIN PINE BEETLE MORTALITY CONTINUES TO *DECLINE* ACROSS THE WEST



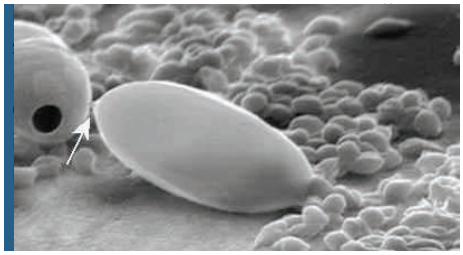
Mountain Pine Beetle Tree Mortality



Sudden Oak Death

In 2017, there were 39 new infestations of sudden oak death (SOD) detected at the boundary of the generally infested area, all occurring within the federally quarantine in Curry County, OR. The EU1 lineage (European form) was detected for a third straight year in the Pistol River area of Curry County. The Oregon Department of Forestry continues to prioritize all EU1 infestations for slowing-the-spread treatments because of the aggressiveness of this lineage and potential threat to the State's conifers. Ground surveys detected 119 trees with the EU1 lineage, including saplings of Douglas-fir and grand fir. One new infestation of the virulent strain occurred 2.5 miles from the last known EU1 infestations; as a result, the containment buffer size was increased to 600 feet around the infested area. No new sudden oak death finds were reported for Washington.

In California, above-average precipitation (2016–2017) improved environmental conditions favorable for SOD. Based on 2017 observations, lag times of 2 to 3 years between inoculum buildup and landscape-scale mortality of oak and tanoak are expected in 2018. For the first time, multiple areas tested positive in the San Francisco Presidio



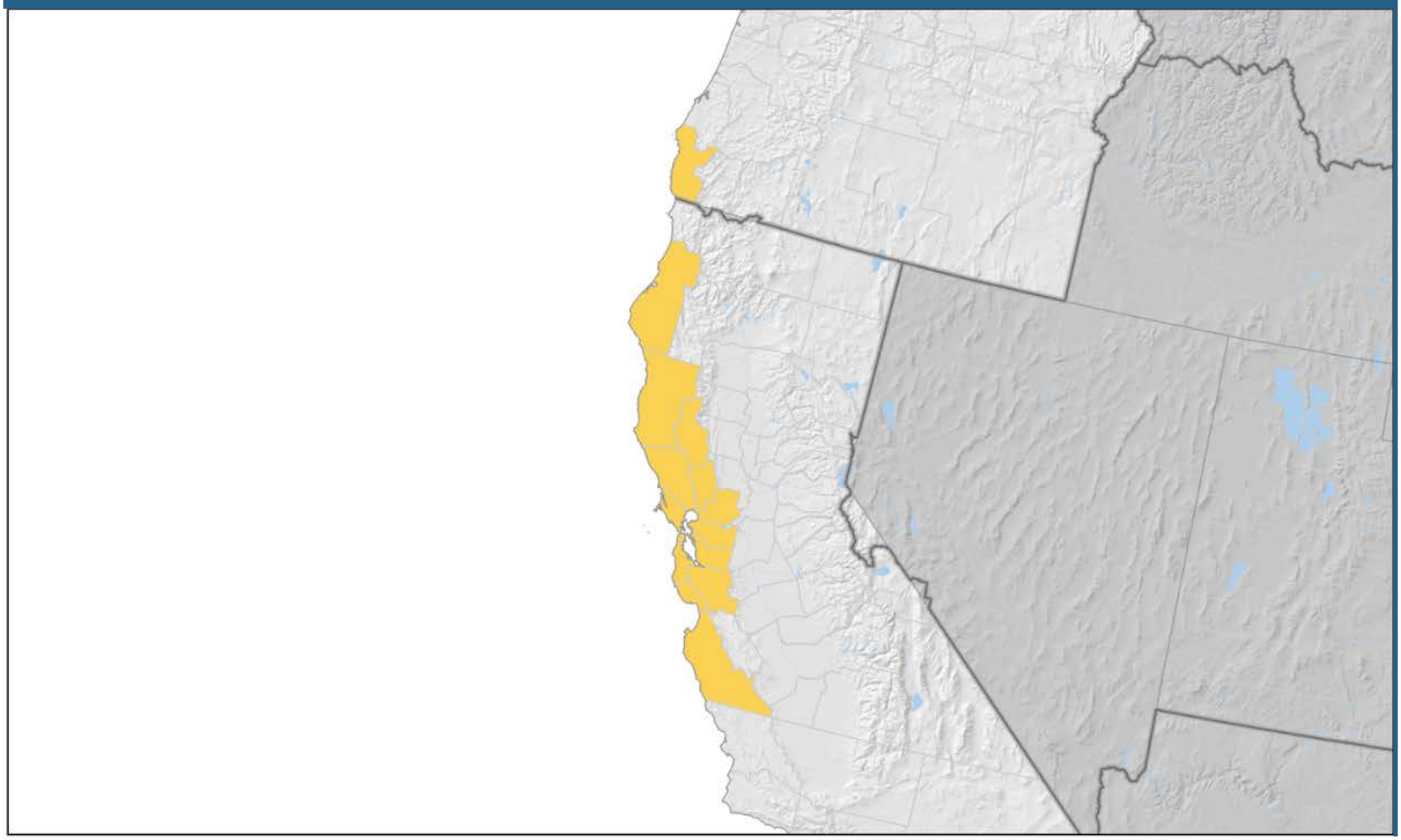
Phytophthora ramorum *zoosporangia releasing zoospores.* ***Photo by Edwin R. Florance (emeritis)****, Lewis & Clark College of Arts & Sciences*

of the coast live oaks in the plots were symptomatic for sudden oak death. Moderate increases in California black oak and tanoak mortality throughout most of the North Coast region were observed. Sudden oak death infection in Sonoma County increased, re-emerging near Cloverdale and recovered at high levels east of Healdsburg, Santa Rosa, and Glen Ellen. New symptoms were observed on coast live oaks in Sugarloaf Ridge State Park in Sonoma County. Sudden oak death was confirmed near the Hoopa Valley Tribal lands in Humboldt County in 2017. Redwood National Park and State parks in Humboldt County now intend to implement a monitoring and research program to complement their strategic management actions and assess risk to highly valued oak/tanoak trees within park boundaries.

Bleeding symptoms on a California Coast live oak caused by Phytophthora ramorum. ***Photo by Bruce Moltzan****, USDA Forests Service, Bugwood.org.*

SUDDEN OAK DEATH MORTALITY ***INCREASED*** FROM 2016

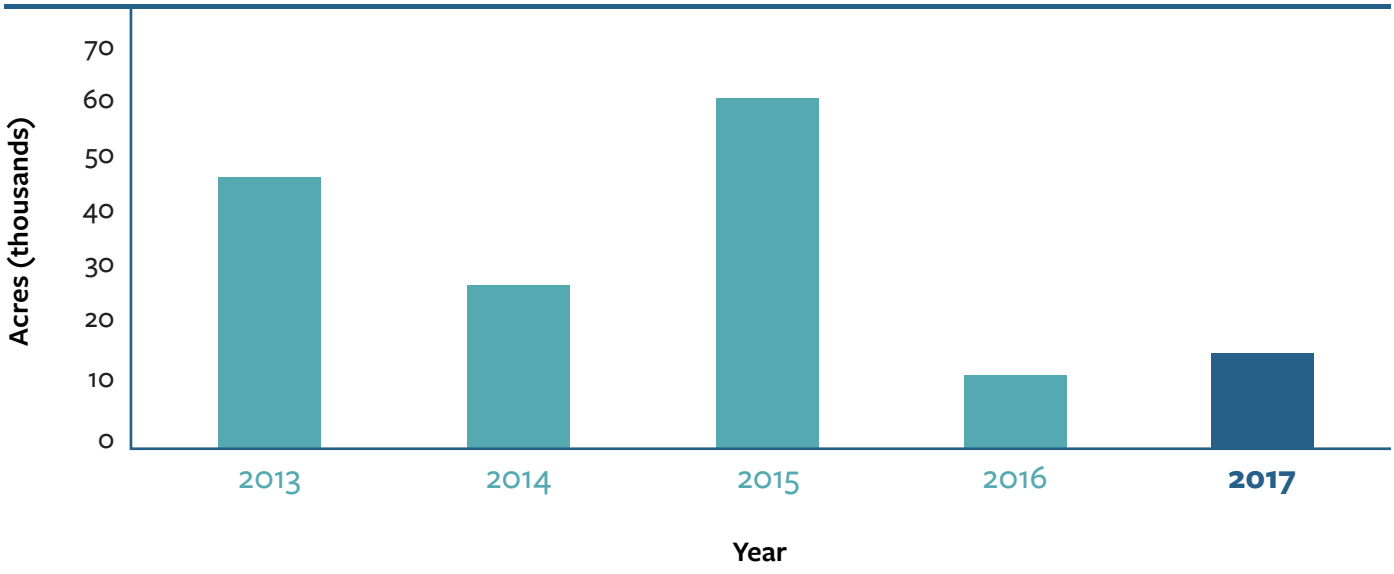
Sudden Oak Death



Pest Damage and Range: Biological Range & Previous Damage
Affected State Pest Not Yet Detected Forest Service Region

FOREST HEALTH ASSESSMENT AND APPLIED SCIENCES TEAM

Sudden Oak Death Tree Mortality



Laurel Wilt

In 2017, laurel wilt was confirmed in 55 Georgia counties. Forest Health Protection staff together with State partners identified new infections in seven new counties on red bay and sassafras. In Florida, laurel wilt was first confirmed in 2005 and is currently causing heavy losses of swamp bay on sensitive tree islands in the Everglades and impacting commercial avocado groves in Miami-Dade County. From November 2016 to October 2017, new county records of laurel wilt were confirmed in Santa Rosa, Okaloosa, and Gulf Counties, meaning that laurel wilt has now been confirmed present in every county in the State.

In South Carolina, redbay continues to die as a result of infection from laurel wilt fungus transmitted by the non-native ambrosia beetle *Xyleborus glabratus*. No new infested counties were reported in 2017. In North Carolina, laurel wilt disease was initially confirmed in 2011. In 2017 surveys, the disease was detected in new areas within already-infested counties. However, laurel wilt was not confirmed in any new counties.

In Alabama, areas of Covington County with the State's only known stands of pondberry (an endangered plant species) were surveyed. Stem samples from symptomatic sassafras were collected in four counties and sent to the lab for confirmation. As a result, Washington and Perry Counties were added to the national map. In Mississippi, mortality of redbay, swampbay, camphor, and sassafras

Sawdust tube produced by redbay ambrosia beetle and its associated fungus. ***Photo by Bud Mayfield****, USDA Forest Service, Bugwood.org.*

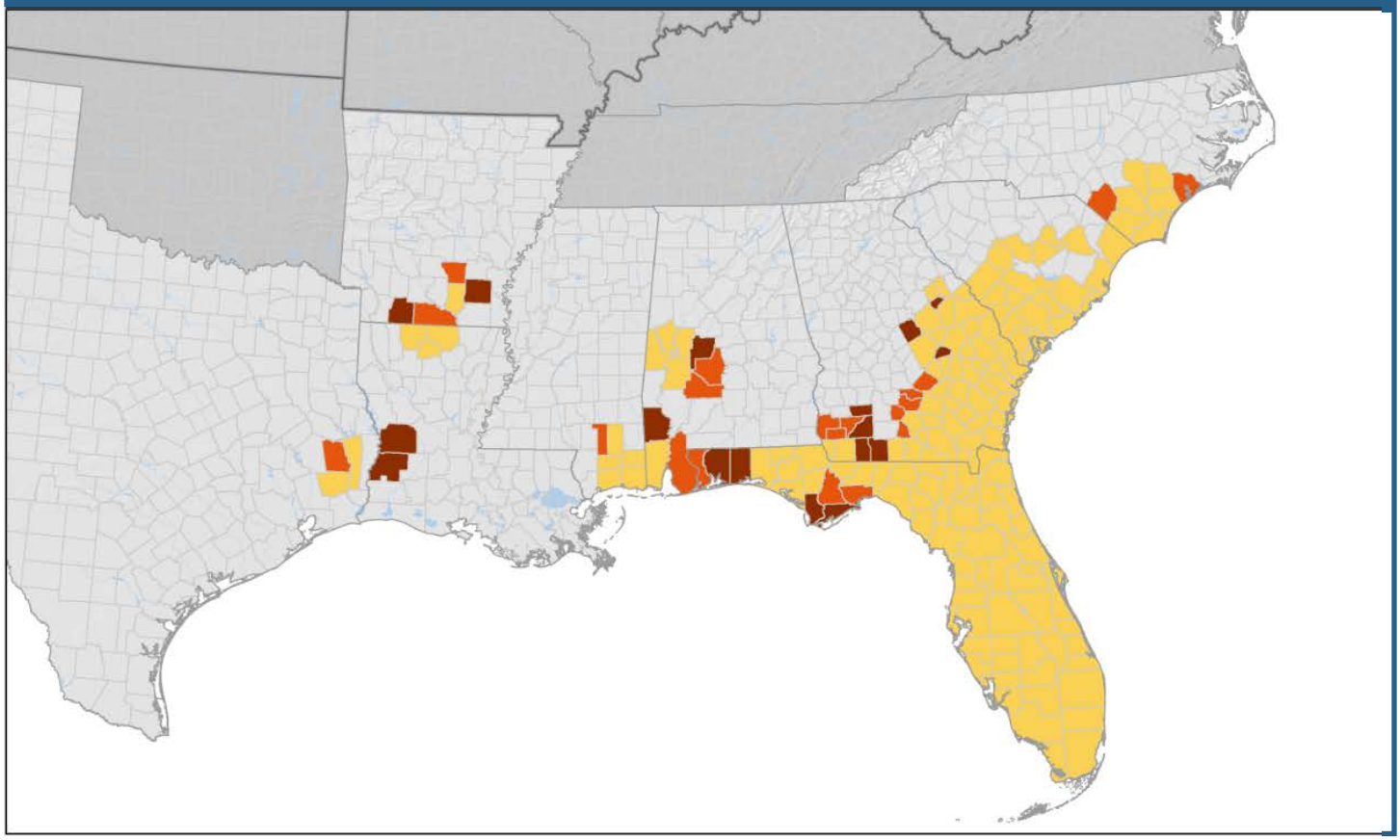
severe in and around the Pascagoula River Basin. The range continues to expand northward and is entering the northern boundary of the Coastal Plain and range of redbay/swampbay. No new counties were added in 2017.

In Louisiana, two new parishes were added as positive for laurel wilt, bringing the total for the State to five. Foresters continue to survey for decline in sassafras and redbay trees caused by laurel wilt. No new infested counties were added for Texas. In Arkansas, laurel wilt continued to spread across southern portions of the State with two new counties added in 2017.

Laurel wilt caused by Raffaelea lauricola *causes black streaks in redbay wood; ambrosia beetle galleries are seen in the upper right.* ***Photo by Tom Harrington****, Iowa State University.*

THERE WERE *17 NEW COUNTIES* WITH LAUREL WILT ADDED IN 2017

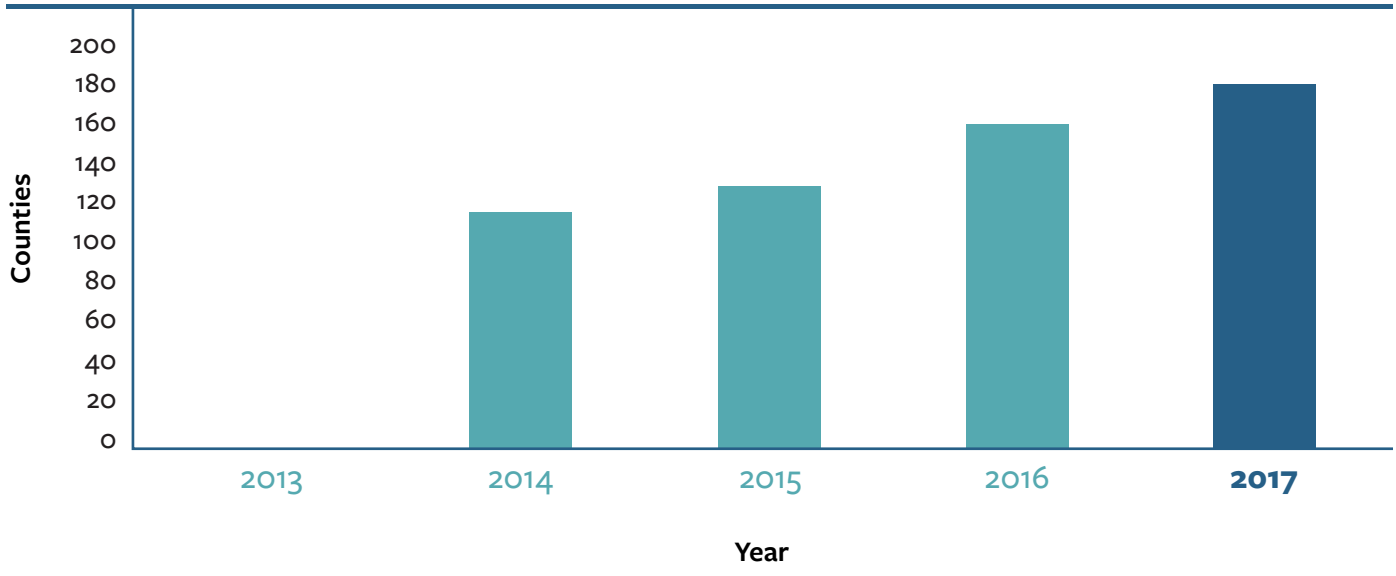
Laurel Wilt



Pest Damage and Range: New Damage in 2017 | New Damage in 2016 | Biological Range & Previous Damage | Affected State | Pest Not Yet Detected | Forest Service Region

FOREST HEALTH ASSESSMENT AND APPLIED SCIENCES TEAM

Laurel Wilt Total Counties Infected



Oak Wilt

In the Northeast, oak wilt was confirmed in two new locations in New York in 2017. Survey in the Schenectady County area revealed two sites, confirmed by Cornell Diagnostic Lab. Long Island submitted several samples—all found negative. Extensive outreach efforts will continue, along with survey, into 2018 to delimit the extent of the disease. Oak wilt has been found widely distributed in Pennsylvania, Ohio, and West Virginia. States with new oak wilt county records in 2017 included Indiana, Maryland, Michigan, Minnesota, Mississippi, and Wisconsin. Kansas had one case of oak wilt confirmed on pin oak in Osage County in 2017.

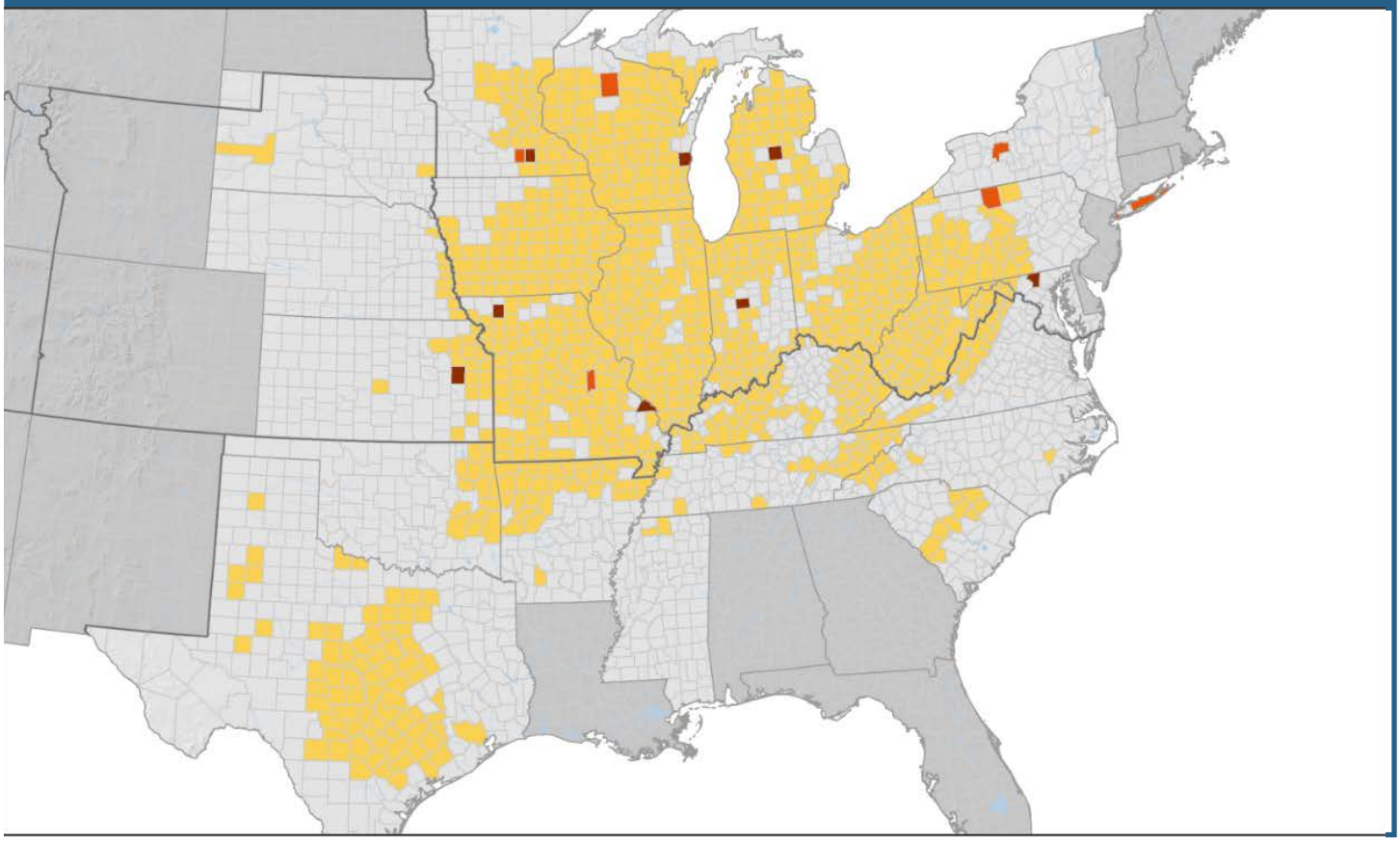
Oak wilt continues to occur in 73 documented counties in Texas. Texas A&M University personnel contribute technical assistance to landowners to help minimize the impact and spread of this disease. In 2017, there were 51 new trenches with a combined length of 46,565 feet (8.8 miles) installed to slow the spread of oak wilt through the Cooperative Oak Wilt Suppression Project. Oak wilt conditions across much of the Southern States have been static for a number of years with no new positive counties recorded. Surveys for oak wilt are no longer routinely performed in most States and serious or widespread damage is generally unknown.

Sap feeding nitidulid beetles that transmit oak wilt fungus. ***Photo by George Hudler****, Cornell University.*

Trees dying from oak wilt, translocation through root grafts causing tree to tree mortality near Grand Rapids, MI. ***Photo by Dave Roberts****, Michigan State University.*

TOTAL REPORTED OAK WILT MORTALITY ACRES *DECLINED* FROM 2016

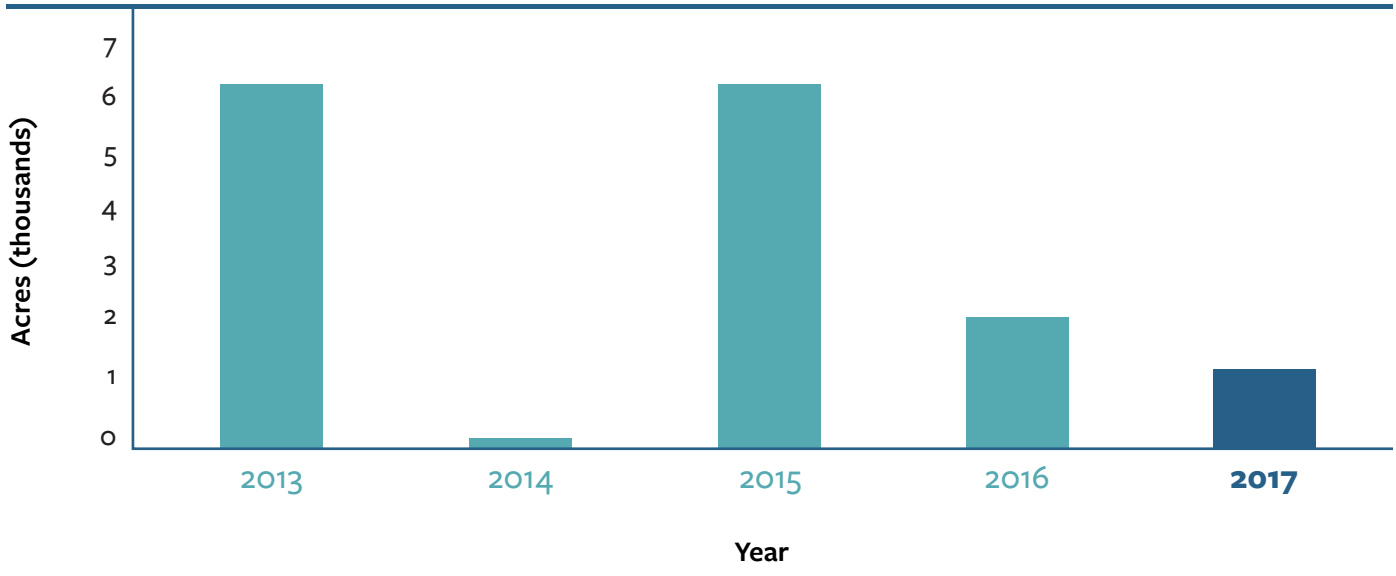
Oak Wilt



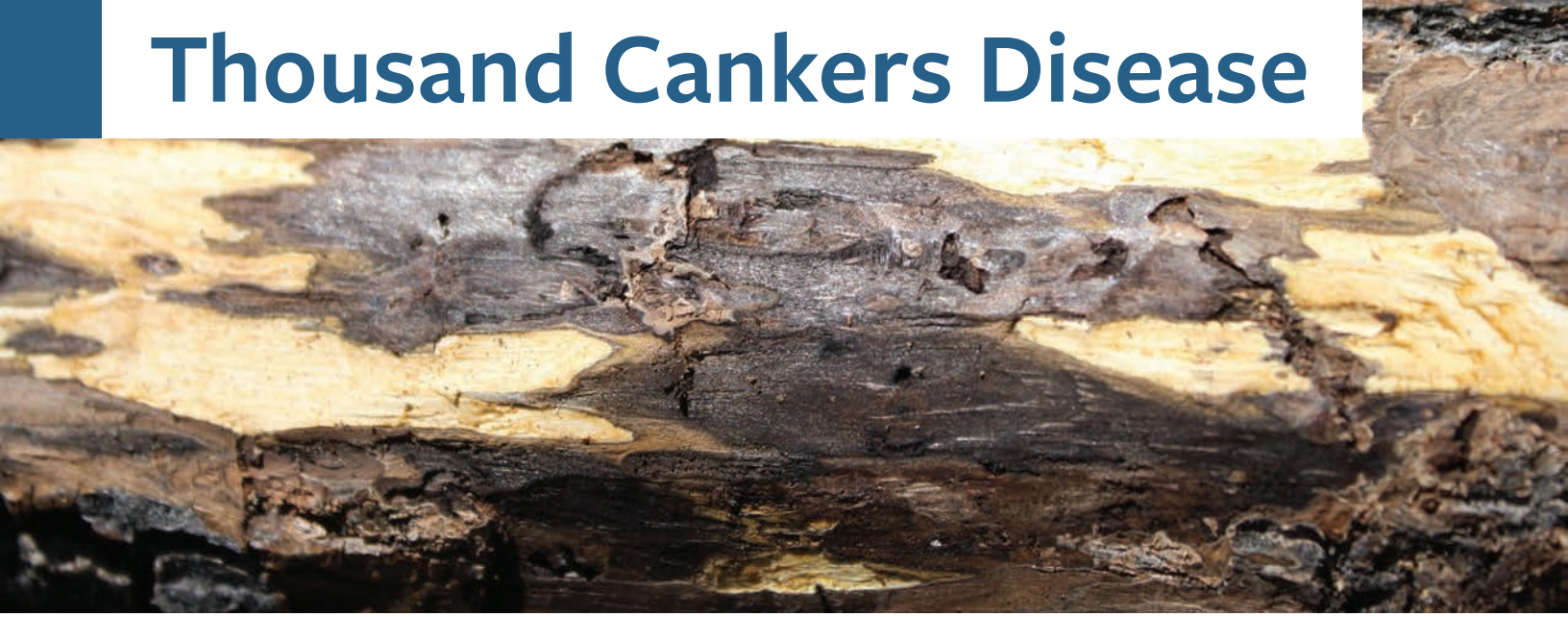
Pest Damage and Range: New Damage in 2017 | New Damage in 2016 | Biological Range & Previous Damage | Affected State | Pest Not Yet Detected | Forest Service Region

FOREST HEALTH ASSESSMENT AND APPLIED SCIENCES TEAM

Oak Wilt Tree Mortality



Thousand Cankers Disease



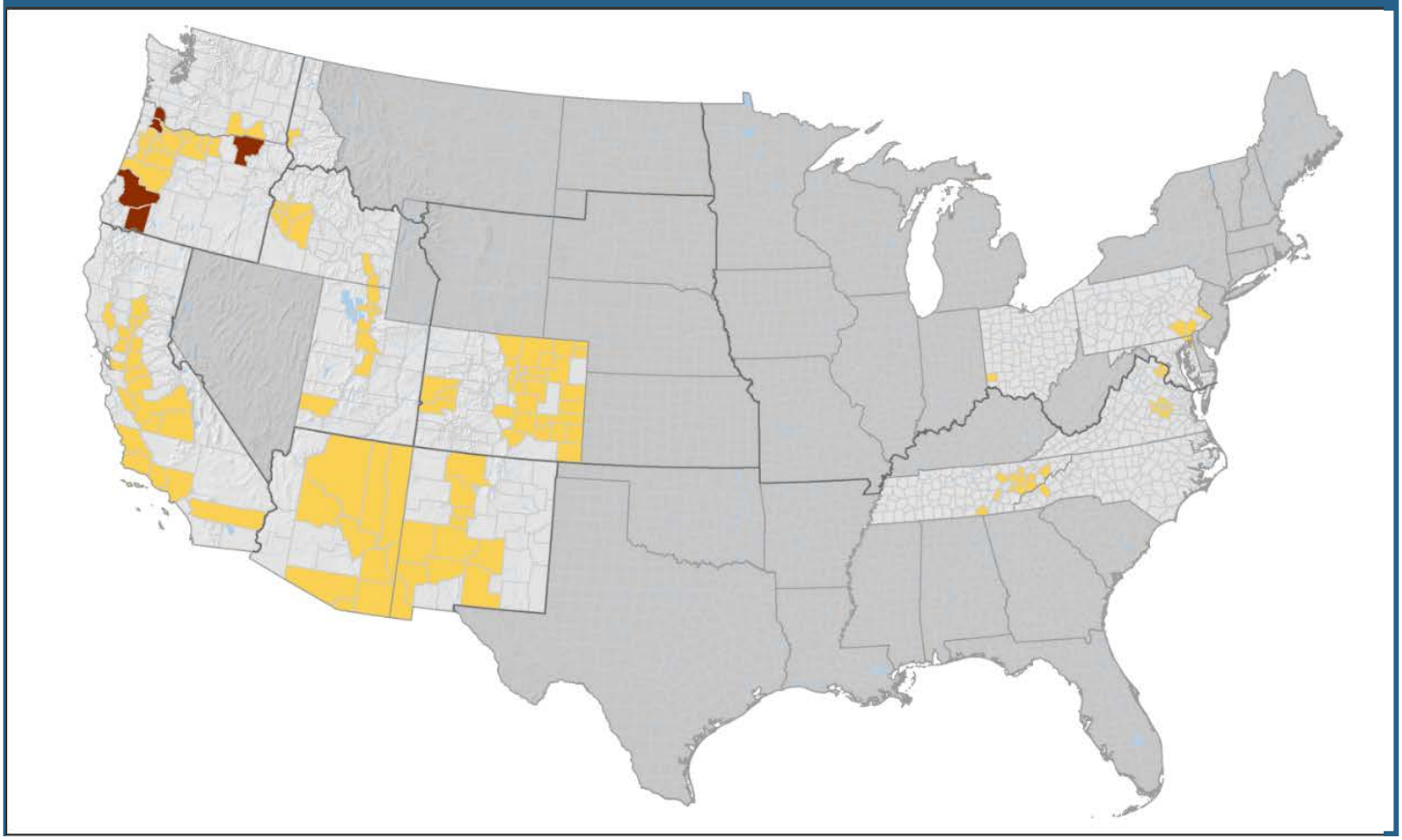
Thousand cankers disease (TCD) and associated walnut twig beetle were confirmed in small plantations and specimen trees of black walnut on agricultural and urban lands near Walla Walla, WA. Washington State University Plant Diagnostics Clinic provided confirmation of TCD. In Oregon, TCD has been confirmed in western counties of the Willamette Valley, and in one county in northeastern Oregon. In the Eastern States, no new counties were added in Maryland, North Carolina, Ohio, Pennsylvania, Tennessee, and Virginia in 2017. The USDA Forest Service, together with the USDA Animal and Plant Health Inspection Service, continue to provide funding to support TCD surveys.

Currently TCD has been confirmed in nine Western States: Arizona, California, Colorado, Idaho, New Mexico, Nevada, Oregon, Utah, and Washington. None of these States have phytosanitary regulations in place restricting movement of black walnut into or out of their State lines. In the East, six States have both confirmed TCD and phytosanitary regulations in place: Ohio, Maryland, Pennsylvania, North Carolina, Tennessee, and Virginia. Eleven States with large numbers of black walnut in both agroforestry plantings and forest have determined to control the movement of walnut through regulation: Arkansas, Iowa, Illinois, Indiana, Minnesota, Kansas, Michigan, Missouri, Nebraska, Oklahoma, and Wisconsin.

Lightly scraping bark back to expose thousand cankers disease. ***Photo by Simeon Wright****, Missouri Department of Conservation.*

Mortality on black walnuts killed by thousand cankers disease. ***Photo by Curtis Utley****, Colorado State University Extension, Bugwood.org.*

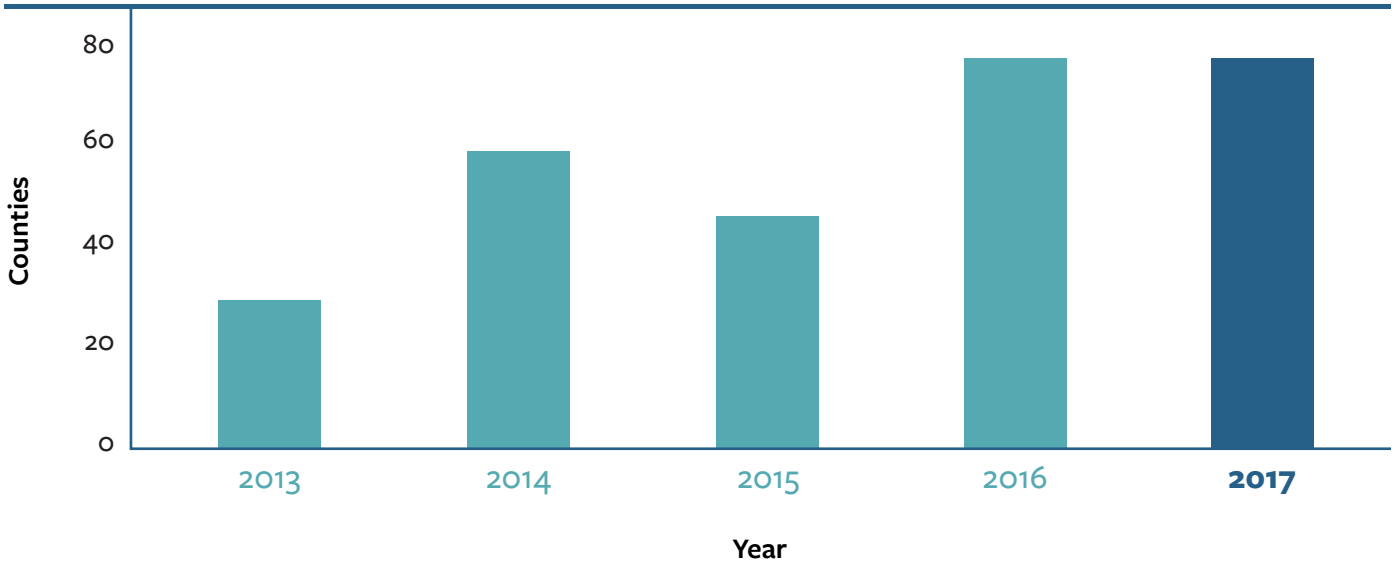
NO NEW COUNTIES **FOR THOUSAND CANKERS DISEASE WERE ADDED IN 2017**



Pest Damage and Range: New Damage in 2016 | Biological Range & Previous Damage | Affected State | Pest Not Yet Detected | Forest Service Region

FOREST HEALTH ASSESSMENT AND APPLIED SCIENCES TEAM

Thousand Cankers Disease Total Counties Infected



Rapid ʻŌhiʻa Death

Big Island of Hawaii

ʻOhiʻa (*Metrosideros polymorpha*) is the most common tree species in Hawaii's native forests, growing from sea level to nearly 8,000 feet and in dry, mesic, and wet forests. ʻOhiʻa-dominated forests cover 141,640 acres statewide, with 101,171 acres occurring on Hawaii Island, and ʻOhiʻa trees account for 50 percent of all forest trees in the State. This abundant tree provides habitat to much of the native flora and fauna and also has significant cultural importance. The name ʻOhiʻa means "to gather" in the Hawaiian language, referring to the tree's ability to collect water from the rain and mist, feeding the aquifers that sustain life on this remote archipelago.

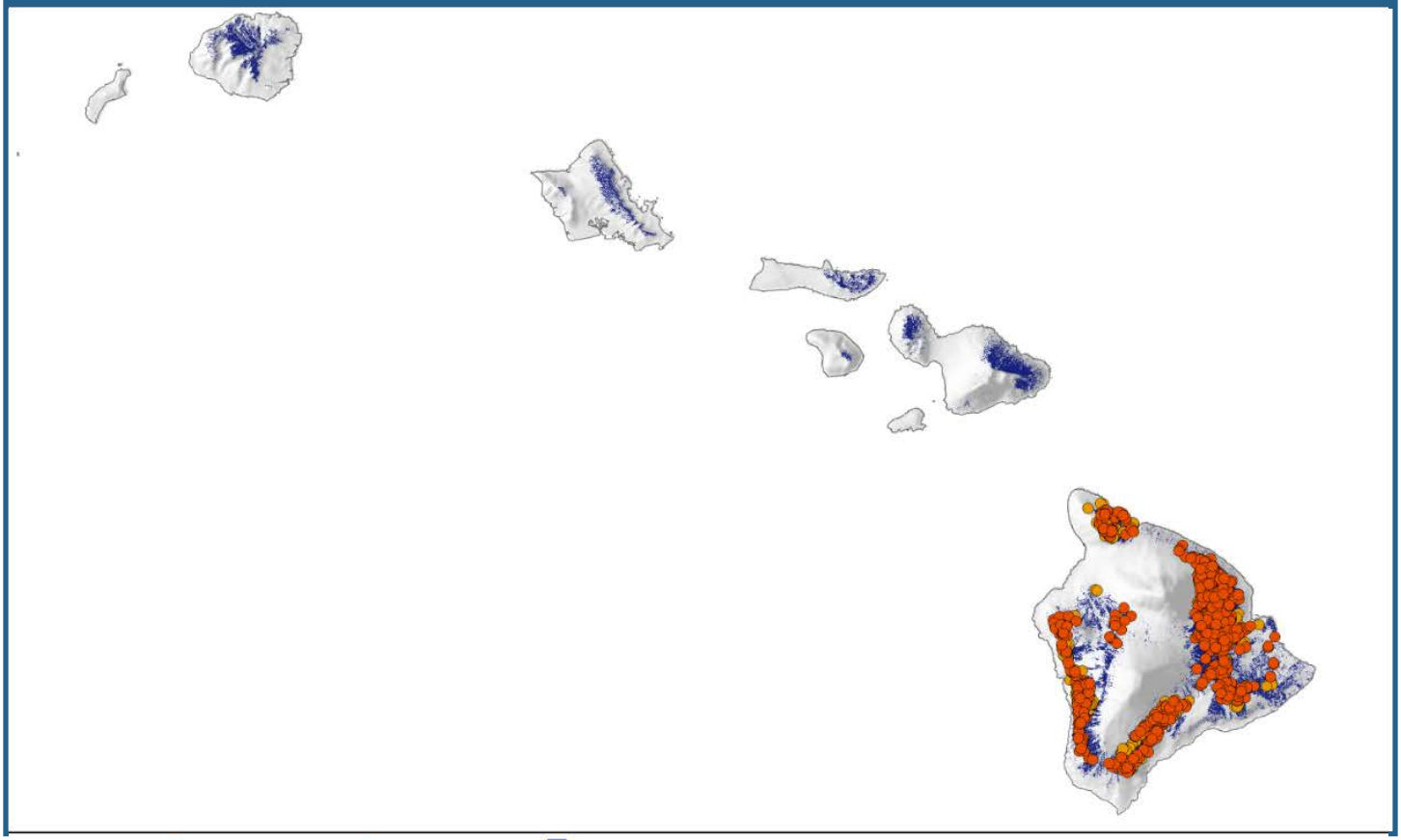
In 2017, rapid ʻOhiʻa death (ROD) continued its alarming spread on Hawaii Island, with positive detections in North Kohala on the northern tip of the island. These latest detections put ROD within 50 miles of healthy forest across the channel on Maui Island. Aerial surveys using Digital Mobile Sketch Mapping mapped approximately 135,000 acres on Hawaii Island showing ROD symptoms. Within these areas, mortality varies from 1 to 90 percent. The surveys were carried out statewide, and ground crews have collected samples from the mapped area for laboratory analysis. So far, in 2017, no samples from other islands have tested positive. The USDA Agricultural Research Service has developed molecular tools for rapid detection and samples from the forest are processed in their laboratory to confirm disease presence.

Further surveys resulted in identification of two distinct species of Ceratocystis which are currently being taxonomically described and characterized.

Recently killed ʻŌhiʻa tree showing the black staining in the wood caused by Ceratocystis lukuohia *due to wilting and desiccation.* ***Photo by J.B. Friday****, University of Hawaii.*

Sampling frass of ambrosia beetles for Ceratocystis lukuohia *on the Big Island, HI.* ***Photo by Mark Hughes****, College of Tropical Agriculture and Human Resources.*

ACRES OF RAPID ʻOHIʻA DEATH INCREASED BY *~40,000 ACRES* FROM 2016 TO 2017



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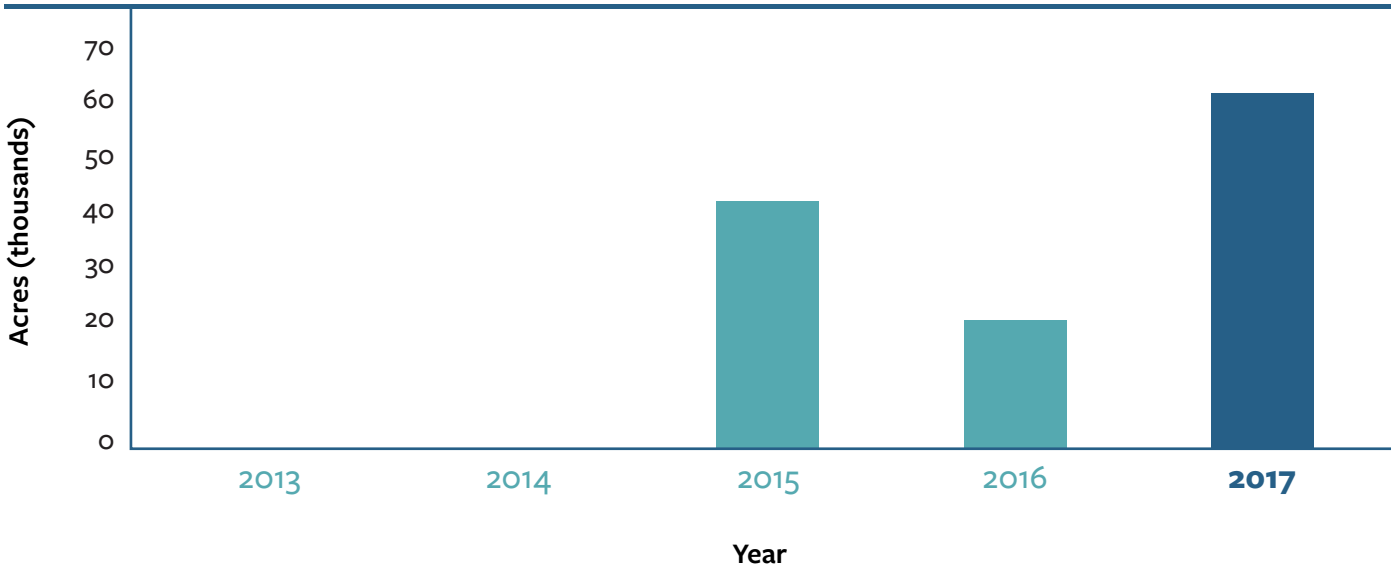
Rapid ʻŌhiʻa Death Tree Mortality



Beech Leaf Disease

Emerging Pest of Concern

Since 2012, a new disease of beech trees (Fagus spp.) called beech leaf disease (BLD) has increasingly been observed in North America. The disease mainly affects *F. grandifolia* (American beech) but also several other beech species including *F. sylvatica* (European beech), *F. orientalis* (Oriental beech). It could possibly affect *F. engleriana* (Chinese beech) and *F. crenata* (Korean beech). Early symptoms include dark striped bands between lateral veins of leaves and reduced leaf size. As symptoms progress, aborted buds, reduced leaf production, and premature leaf drop lead to an overall reduction in canopy cover, ultimately resulting in death of sapling-sized trees within 2 to 5 years. In areas where the disease is established, the proportion of symptomatic trees can reach more than 90 percent.

Beech leaf disease was first observed in the United States in Ohio (Lake County) in 2012 on *F. grandifolia*. The disease appears to be spreading rapidly, as it has subsequently been found in other counties in Ohio, in northwestern Pennsylvania and southwestern New York; as well as in Canada, along the north shore of Lake Erie in Ontario. In some infested areas (such as Ohio and Pennsylvania), citizens are invited to report diseased beech trees, and landowners are urged to avoid moving beech trees or tree parts to prevent disease spread. So far, the etiology of BLD remains unknown. Research looking at the DNA of diseased trees for bacteria, viruses, and phytoplasmas has not been able to identify a possible cause. More recently, attention has been focused on the possible role of nematodes, as a previously undescribed nematode species (*Litylenchus* sp.) has been observed in association with diseased beech leaves. Research to identify the causal agent(s) document the impact of BLD and develop management strategies continues.

Healthy looking beech leaves in Maryland. ***Photo by Bruce Moltzan****, USDA Forest Service.*

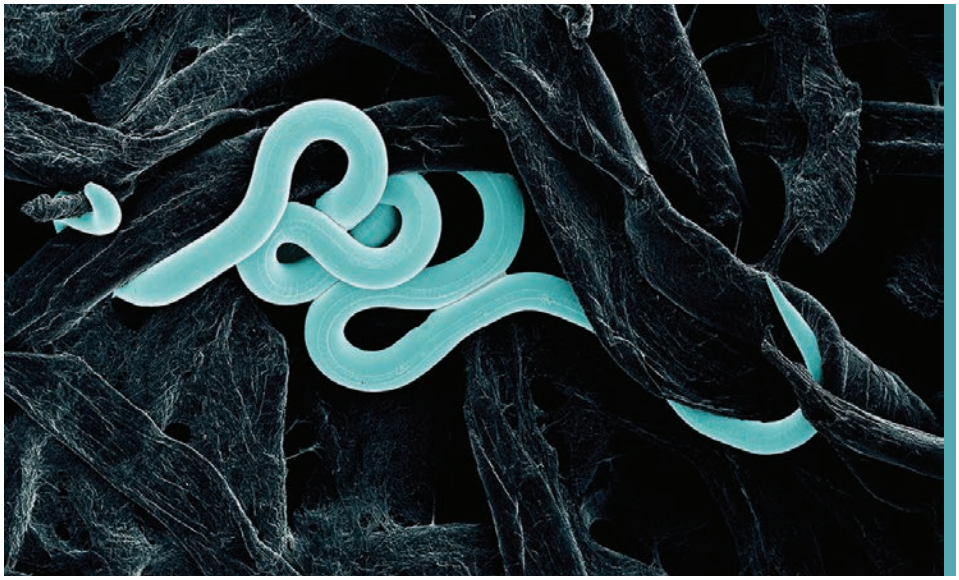
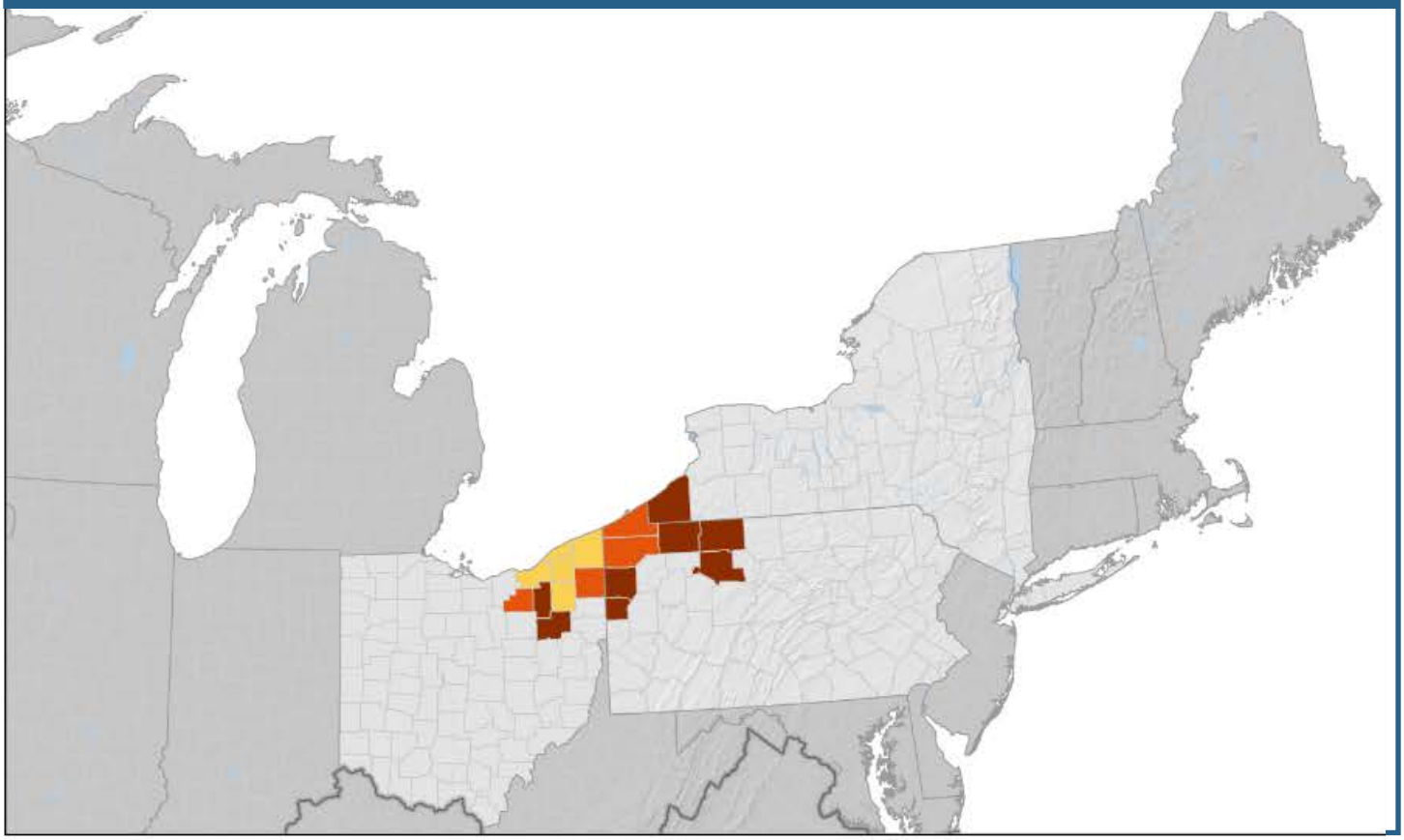


Photo of male Litylenchus crenatae *from Ohio.* ***Photo by Lynn Carta****, USDA Agricultural Research Service, and Gary Bauchan, USDA Agricultural Research Service, Electron and Confocal Microscopy Unit.*

THE CAUSE OF BEECH LEAF DISEASE REMAINS ***UNKNOWN***

Beech Leaf Disease



Pest Damage and Range: New Presence in 2017 | New Presence in 2016 | Biological Range & Previous Presence | Affected State | Pest Not Yet Detected | Forest Service Region

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PAGE 26 – BEECH LEAF DISEASE SHOWING RAISED INTERVEINAL SYMPTOMS ON BEECH IN OHIO. PHOTO BY JIM CHATFIELD, BUCKEYE YARD AND GARDEN ONLINE.