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Major Forest Insect and Disease Conditions in the United States: 2013

Forest Service FS-1054 July 2015

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Compiled by Melissa L. Jenkins
Forest Health Protection

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Cover photo: *Balsam fir and white spruce defoliation and mortality caused by spruce budworm defoliation on the Superior National Forest. Photo by Marc Roberts, USDA Forest Service.*

Back cover photo: *Top: Spruce beetle damage in southern Colorado. Photo by Tom Eager, USDA Forest Service. Bottom: Pinyon ips infestation, Los Padres National Forest, California. Photo by Jeffrey Moore, USDA Forest Service.*

Preface

This report on the major insect and disease conditions of the Nation's forests represents the 63rd annual report prepared by the Forest Service, an agency of the U.S. Department of Agriculture (USDA). The report focuses on the 20 major insects and diseases that annually cause defoliation and mortality in forests of the United States. The 2007 report, *Major Forest Insect and Disease Conditions in the United States 2007* (http://www.fs.fed.us/foresthealth/publications.shtml#reports), provides background information on the 20 insects and diseases described in this report and should be referenced if more detailed information is desired. This 2013 update, with updated charts, tables, and maps, provides a national summary of the major changes and status of these 20 forest pests. Additional information on these and other pests is available at http://foresthealth.fs.usda.gov/portal/#.

The Forest Health Protection program of the Forest Service and its State partners provide the information in this report. 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 detecting and reporting insect and disease epidemics. State and USDA Forest Service program specialists regularly conduct 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.

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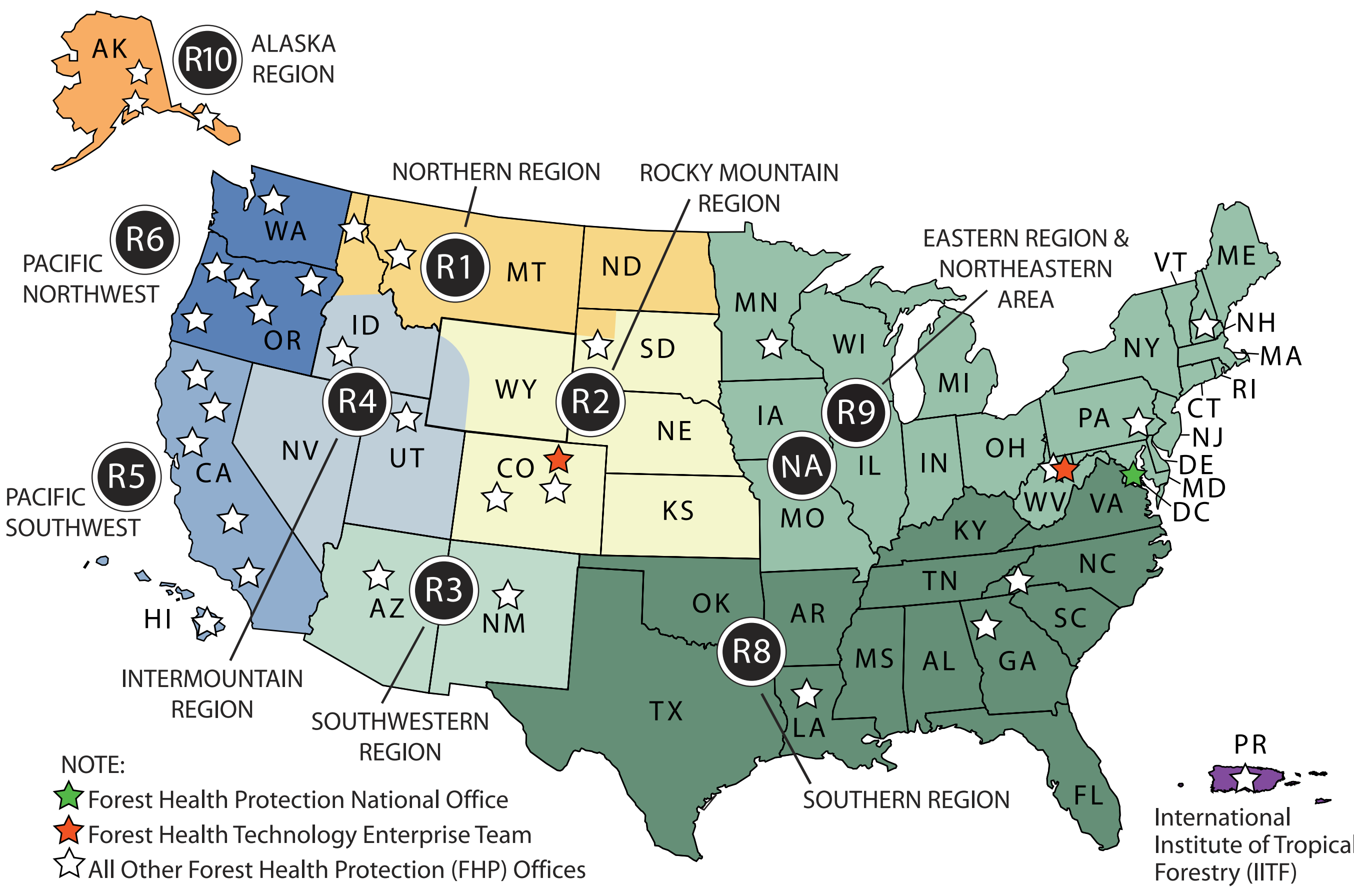
FOREST SERVICE REGIONS AND AREA



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This report is also available at http://www.fs.fed.us/foresthealth/current_conditions.shtml and at http://www.fs.fed.us/foresthealth/publications.shtml#reports.

Contents

Executive Summary/Introduction 1
Mountain Pine Beetle 2
Gypsy Moth 6
Southern Pine Beetle 8
Emerald Ash Borer 11
Sudden Oak Death 14
Spruce Beetle 15
Western Bark Beetles 18
Western Spruce Budworm 22
Hemlock Woolly Adelgid 25
Laurel Wilt Disease/Redbay Ambrosia Beetle 27
Spruce Budworm 29
Sirex Woodwasp 31
Dwarf Mistletoes 32
Asian Longhorned Beetle 34
White Pine Blister Rust 36
Oak Wilt 38
Fusiform Rust 40
Dogwood Anthracnose 41
Beech Bark Disease 42
Butternut Canker 44

Executive Summary/ Introduction

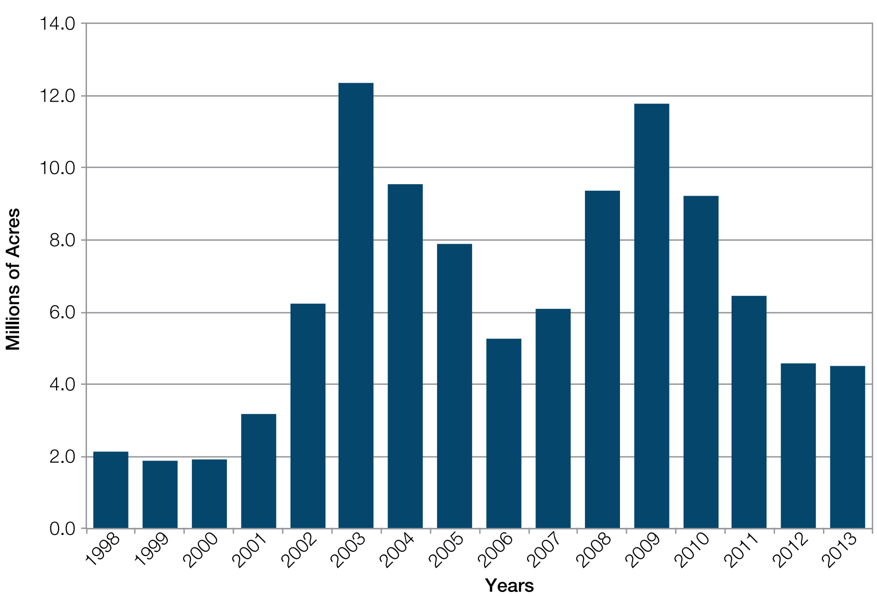
Many insects and diseases are valuable in providing benefits to maintaining and enhancing the health of forests. Insects are primary pollinators for many plants that humans rely on for food; both insects and diseases are the initial decomposers of organic matter that is essential for sanitary conditions and nutrient cycling; and insects and diseases are a critical food source for animals, such as birds, and sometimes even humans. These same insects and diseases can also cause epidemic outbreaks and forest loss. They can affect the more than 750 million acres of forest land and millions more acres of urban treed areas. Surveys help to determine the extent and intensity of insects and diseases and are an important tool to help prioritize future actions to be taken by Federal and State agencies and other stakeholders to ensure forests remain resilient and sustainable for generations.

The overall mortality that insects and diseases cause varies by year and by pest. The chart in figure 1 illustrates mortality variations during the past 16 years.

Acres of Tree Mortality Caused by Insects and Diseases

In 2013, mortality caused by insects and diseases was reported on nearly 4.5 million acres nationwide, a 0.1-million-acre decrease from 2012, when mortality was reported on 4.6 million acres. During the past 4 years, mortality has been reported on a declining number of acres, indicating a downward trend since 2009, when mortality was reported on 11.8 million acres. One pest caused slightly more than 35 percent of the mortality—the mountain pine beetle, a native insect found in forests of the Western United States.

Figure 1. Surveyed acres of mortality from 1998 through 2013.



Although mortality is represented in the chart, defoliation can also significantly affect our forests. The western spruce budworm caused nearly 1.7 million acres of defoliation damage in 2013, a 1.8-million-acre decrease from 2012. European gypsy moth defoliation was reported on nearly 574,000 acres in 2013, an increase from the 39,194 acres reported in 2012. A single defoliation event does not usually cause tree mortality; however, taken together with continued attacks or severe abiotic factors, such as weather and drought, trees can succumb to these defoliating insects.

Readers are advised to use caution when interpreting the maps in this document, because data are displayed at the county scale. If damage was reported at just one location in the county, the whole county is displayed as affected. This protocol is used because data for some pests are collected only at the county level. In addition, if the damage were reported at a finer pixel size, many areas would not be visible at the scale used in this publication. For example, numerous counties reported southern pine beetle mortality in 2013, but most individual infestations were small. When added together, the total area affected was only about 6,104 acres of mortality. The maps in this publication represent only what is reported as mortality or defoliation and not the total infestation of a pest. In any given year, some areas are not surveyed because of physical limitations, such as forest fires, weather events, or limited resources.

Every year, hundreds of native and non-native insects and diseases damage our Nation's forests. This report provides descriptions of 20 major insects and diseases that contribute to annual forest mortality and defoliation.

Mountain pine beetle

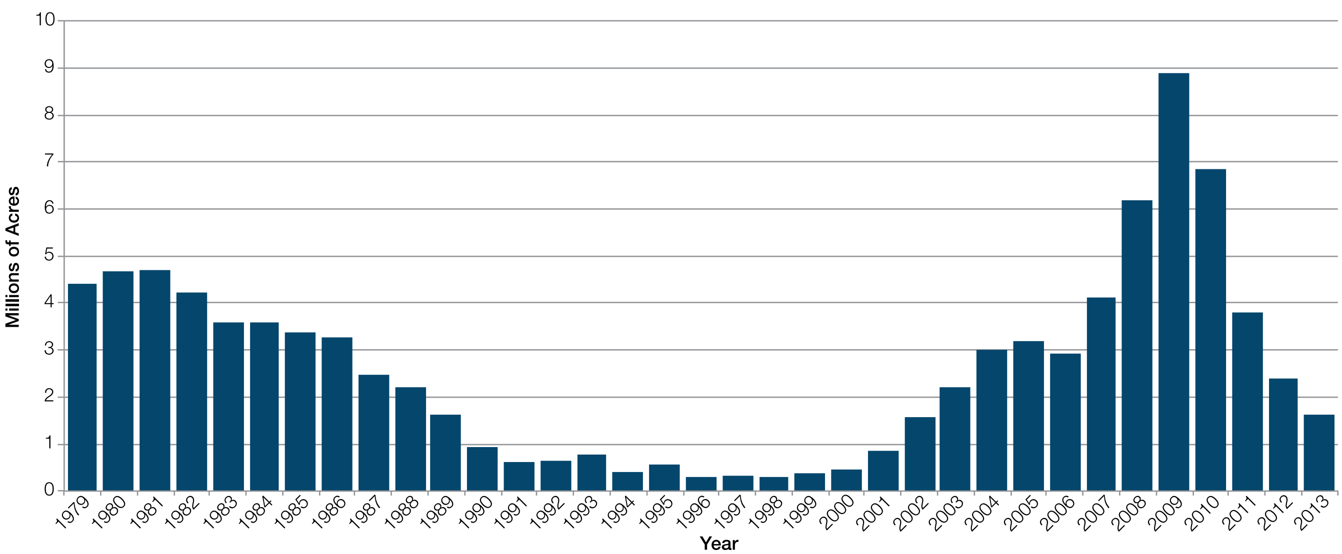
Dendroctonus ponderosae Hopkins

In 2013, surveys detected mountain pine beetle (MPB) mortality on approximately 1.6 million acres, a decrease of 800,000 acres from 2012 (fig. 1). Idaho, Montana, and Oregon continued to report high mortality levels (figs. 2 and 3).

In the Northern Region, surveys identified lower levels of MPB activity, a continued decrease from 2012. Although mortality may have been observed as scattered trees across a landscape with few remaining susceptible host trees, some pockets of high-intensity mortality did occur. Areas of high mortality levels were found on the Big Hole area of the Beaverhead-Deerlodge, southern Bitterroot, and Clearwater National Forests. A new outbreak also erupted throughout the Bear Creek drainage near Red Lodge, MT. High-elevation five-needle pines, such as whitebark and limber pine, were affected. Ponderosa pine mortality decreased in 2013. Portions of southern Gallatin National Forest and neighboring portions of Custer National Forest contained regions of white pine mortality. MPB in western white pine in Idaho continued to decrease to nearly half the levels detected in 2012. Because of the continued decrease in available susceptible hosts, it is likely the decline in MPB activity will continue across the region, with areas of high activity where pockets of susceptible pine hosts remain.

The level of MPB activity across much of the Rocky Mountain Region continues to decline; however, localized areas had steady or increasing activity. In the Black Hills of western South Dakota and northeastern Wyoming, epidemic levels of ponderosa pine mortality continued. Some localized areas, however, had static and even declining areas of MPB populations. Hotspots were found across the Black Hills, including the Northern Hills. The Black Elk Wilderness Area bordering

Figure 1. Mountain pine beetle activity decreased significantly in 2013 in much of the Western United States.



Custer State Park experienced near 100 percent mortality by 2012 because of MPB. The adjacent land in Custer State Park had much lower pine mortality. The trees were already stressed by white pine blister rust and white spruce encroachment. The additional stress of beetle attacks, even when unsuccessful, can result in significant tree mortality. Efforts to preserve these relic stands have been very successful, with the loss of about 3 percent of the trees to MPB, despite high losses of ponderosa pine in the immediate vicinity.

Figure 2. Mountain pine beetle mortality in 2013 by State.

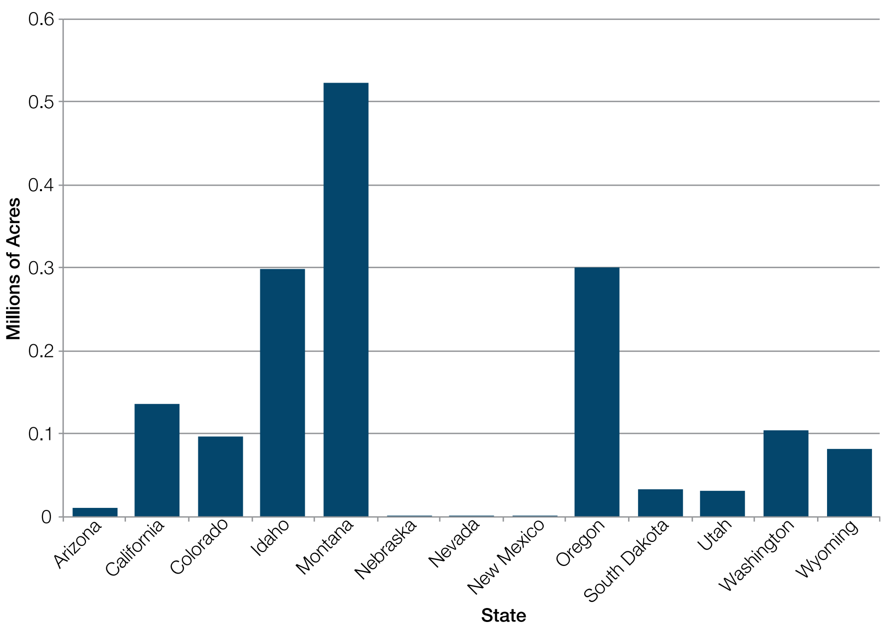
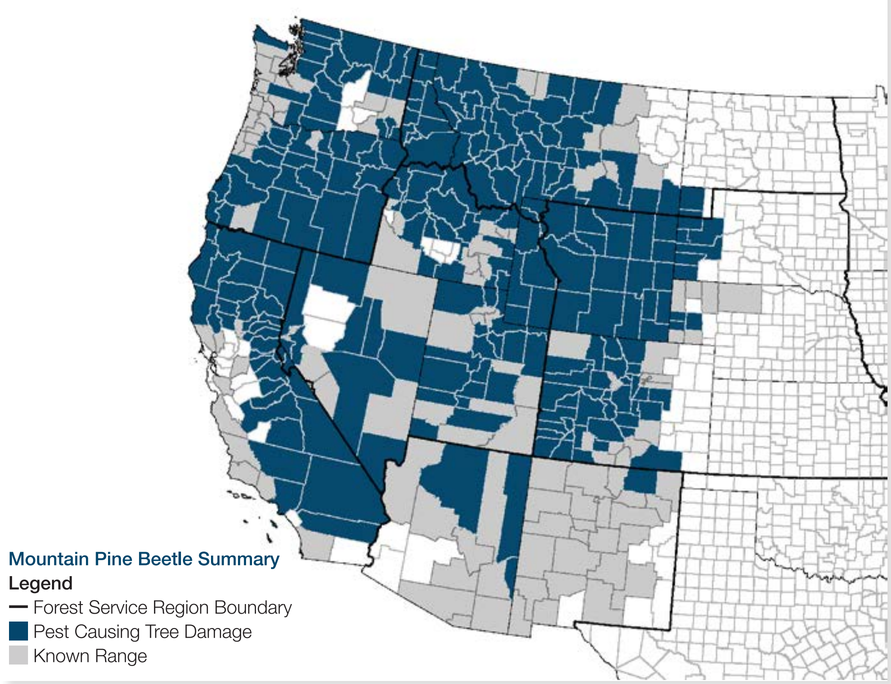


Figure 3. Counties that reported mountain pine beetle activity in 2013.



In Fremont, Hot Springs, and Park Counties of western Wyoming, in the Absaroka and Wind River Mountains, localized heavy mortality of lodgepole, whitebark, and limber pine occurred because of MPB. In heavily impacted stands, activity declined in many areas because of host depletion. Limber pine mortality was detected in Natrona County. Very low MPB activity was seen in the Pine Ridge area of Natrona and Converse Counties and the Miller Hills in Converse County. North Sweetwater County had low to medium MPB activity. Populations are down to endemic levels in Niobrara and Larimer Counties. Very low levels of MPB persist primarily in limber pine in Carbon County. In Albany County, low levels of ponderosa pine mortality were observed.

In Nebraska, surveys identified lower levels of MPB activity in 2013. No live adults or larvae (fig. 4) were found in ground surveys, and beetle populations in western Nebraska forests have returned to the low levels that existed before the 2009 outbreak.

MPB populations in northern and central Colorado have declined significantly within lodgepole pine stands within the area impacted during the past 15 years (fig. 5). Hundreds of thousands of acres of suitable hosts remain on the landscape south of the main epidemic area, yet the populations have not expanded in this direction. Populations have increased, however, within ponderosa pine stands in a number of counties in southern Colorado, most notably on the Uncompahgre Plateau in Montrose and San Miguel Counties. Jackson County had pockets of newly infested lodgepole pine; however, the overall tree mortality in the area is very high and beetle populations are declining. MPB activity was found in ponderosa pine across much of Jefferson County. Many forest stands of lodgepole and ponderosa pine that lost trees to MPB in recent years still contain a significant component of living trees, especially in the northern Front Range.

Figure 4. Mountain pine beetle larvae feeding at right angles to the egg gallery. Photo by G.D. Amman, USDA Forest Service.

Figure 5. Ponderosa pine and lodgepole pine mountain pine beetle damage on the Roosevelt National Forest in Colorado. Photo by Justin Backsen, USDA Forest Service.

In contrast to Colorado and other Rocky Mountain States, Arizona and New Mexico in the Southwestern Region had little MPB activity. In Arizona, post-fire MBP-caused tree mortality increased throughout the Wallow Fire and Shultz Fire areas. In the White Mountains, MPB killed trees in high-use recreation areas not burned by the Wallow Fire. In 2013, more acres were impacted by MPB in Arizona than in any previous year since the 1970s. In New Mexico, occasional individual ponderosa pine trees were observed with MPB, but no major recent outbreaks have occurred. Widespread bark beetle activity in ponderosa pine forests in New Mexico tended to be a combination of *Ips*, western, and roundheaded pine beetles.

The largest recorded MPB outbreak in the Intermountain Region is rapidly declining. Most of the preferred, susceptible host type has been killed in areas where the outbreak was occurring for many years. Most of the pine mortality occurred, historically, in southern Idaho and western Wyoming. In southern Idaho, the only increase in pine mortality occurred on the Sawtooth National Forest, but MPB remains at endemic levels. A 93-percent decrease occurred on the Salmon-Challis National Forest. In western Wyoming, pine mortality declined by 66 percent on the Bridger-Teton National Forest. Levels are approaching endemic levels on most forests in southern Idaho and western Wyoming.

MPB-caused pine mortality increased in Utah and Nevada after 2 years of declining mortality. In Utah, lodgepole pine mortality nearly doubled on the Uinta-Wasatch-Cache National Forest and remained high on the Ashley National Forest. A threefold increase in limber pine mortality occurred on the Manti-La Sal National Forest. In Nevada, pine mortality nearly tripled on the Humboldt-Toiyabe National Forest but remains at low levels.

In California, mortality from MPB decreased slightly in 2013. MPB was the primary cause of mature sugar pine mortality throughout its range in California, especially in the southern Sierra Range. Large areas of mortality of lodgepole and whitebark pine continued in areas of northeastern California and the eastern side of the Sierra Nevada Mountain Range.

Areas with mortality caused by MPB increased in Oregon and decreased in Washington compared with 2012 levels. In Oregon, the increase is attributed to high-intensity, localized damage in areas with remaining, highly susceptible lodgepole and five-needle pines. Concentrated tree mortality was most apparent in Klamath and Lake Counties on the Fremont-Winema National Forest and in Baker and Grant Counties at the southern end of the Blue Mountains in the Malheur and Umatilla National Forests. Mortality occurred where populations of MPB were active in northeast Oregon on the Malheur, Umatilla, and Wallowa-Whitman National Forests and on the Winema-Fremont National Forest in central Oregon (fig. 6).

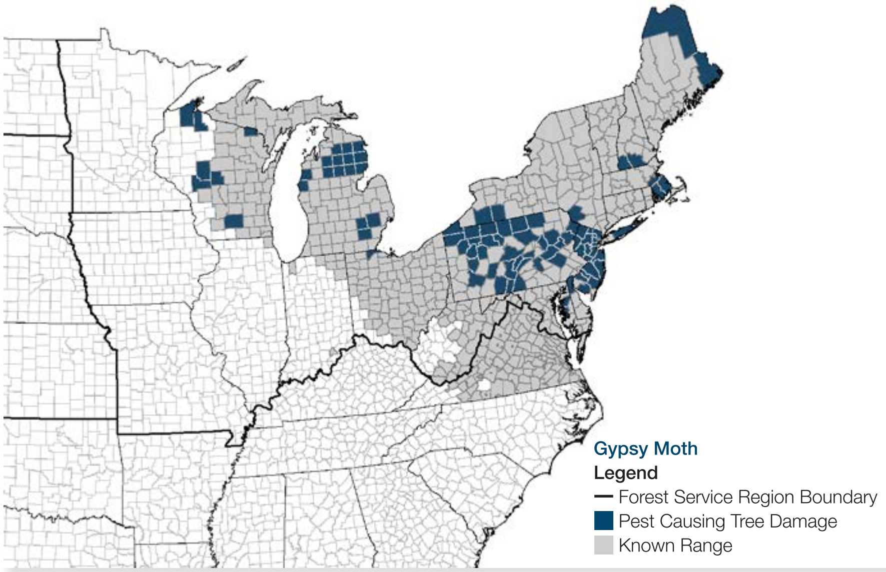
Figure 6. Lodgepole pine stand killed by mountain pine beetle near Ukiah, OR. Photo by Dave Powell, USDA Forest Service.

In Washington, an overall decline in mortality was recorded for all pine hosts, representing the lowest detection level in 10 years. Concentrated areas of mortality occurred, however, in Chelan and Okanogan Counties near Lake Chelan on the Okanogan-Wenatchee National Forest. Localized increases in mortality also were observed in Ferry County on the Colville National Forest and in the Simcoe Mountains near the southern border of the Yakama Indian Reservation. MPB mortality on whitebark pine decreased from 2012 levels. Past mortality in this host type was responsible, in part, for the lower number of acres mapped with mortality in 2013.

Gypsy moth

Lymantria dispar Linnaeus

Figure 1. Counties that reported gypsy moth damage in 2013.



Across the Northeast in 2013, defoliation caused by gypsy moth (GM) increased above 2012 levels (figs. 1 and 2). No defoliation was reported in 2013 in Rhode Island or Vermont. In Vermont, egg-mass counts were very low. New Hampshire reported very light defoliation in Cheshire and Hillsborough Counties.

Low levels of defoliation resulting from gypsy moth larval feeding were recorded in Aroostook and Washington Counties in Maine in 2013 (fig. 3). Moderate defoliation was reported in Bristol, Norfolk, and Plymouth Counties in Massachusetts (table 1).

Figure 2. Gypsy moth defoliation from 1924 through 2013.

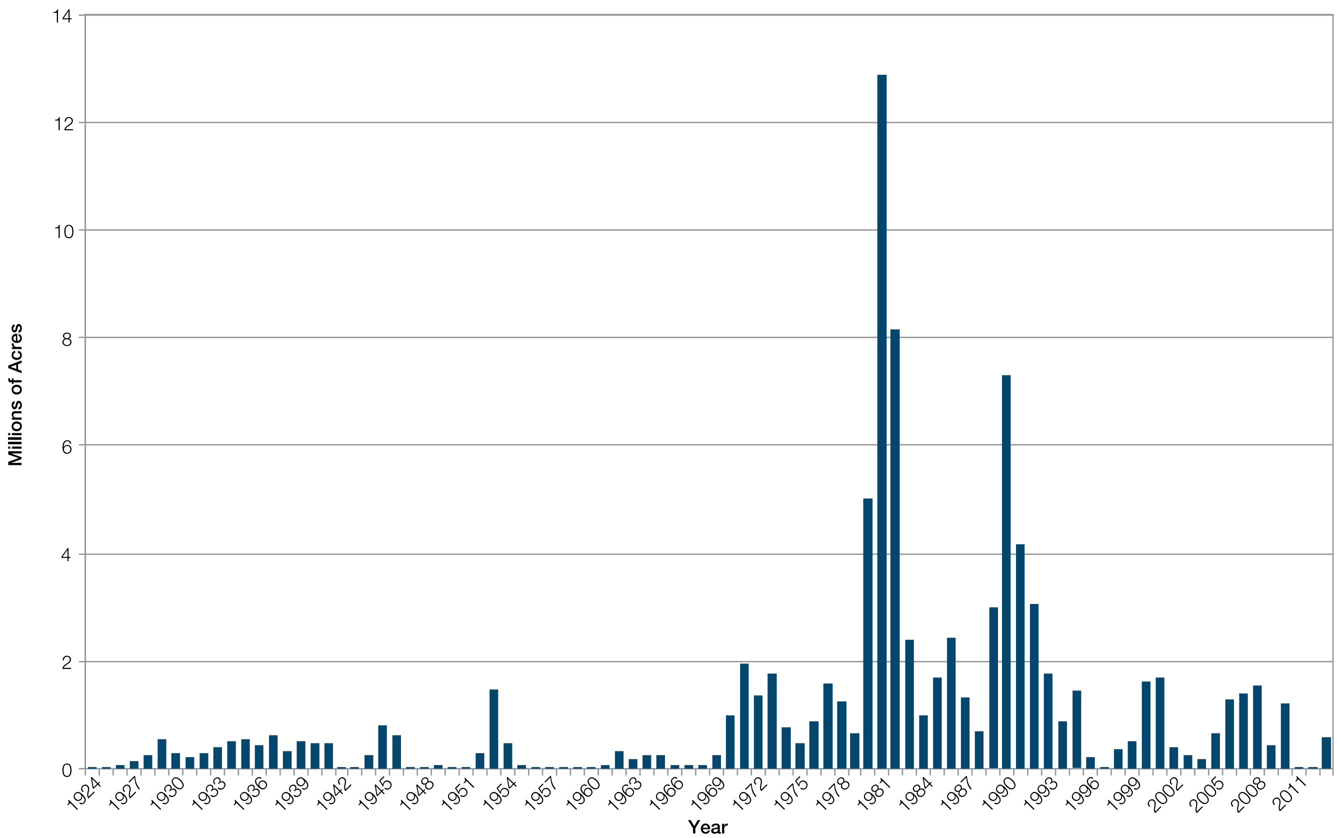


Figure 3. Gypsy moth larva. Photo by John H. Ghent, USDA Forest Service.

Table 1. Gypsy moth defoliation by State in 2013.

State	Acres Defoliated
Maine	16.8
Maryland	47.2
Massachusetts	2,020.3
Michigan	53,566.2
New Hampshire	1,904.12
New Jersey	2,884.8
New York	165,687.1
Pennsylvania	335,451.3
Wisconsin	12,248.9

Figure 4. Northern hardwood defoliation caused by gypsy moth on the Huron Manistee National Forest in Michigan. Photo by Marc Roberts, USDA Forest Service.

A significant rise in GM populations from 2012 was recorded in New York for 2013. The most severe defoliation was observed in Cattaraugus County. Defoliation was also observed in Allegany, Sullivan, and Suffolk Counties.

In Pennsylvania, populations of GM continue spreading across the Commonwealth. Considerable heavy to moderate defoliation was observed in Cameron, Clarion, Crawford, Elk, Forest, McKean, Potter, Tioga, Venango, and Warren Counties.

Maryland reported defoliation in Queen Anne's and Talbot Counties. GM defoliation in New Jersey remained low in 2013 but appears to be increasing compared with 2012 levels. Ohio reported trace areas of defoliation in 2013.

Light defoliation was detected in Bayfield and Ashland Counties in Wisconsin, decreasing by more than half compared with 2012 damages in Bayfield County. In Michigan, GM populations increased significantly from 2012 populations. Heavy defoliation was mapped in several counties in the north central Lower Peninsula (fig.4). In Minnesota, traps caught seven times more than the 2012 trap catches; however, no defoliation was detected.

In 2013, no major outbreaks from GM were reported in West Virginia, but populations appear to be increasing in Greenbrier, Pocahontas, Randolph, and Webster Counties. Expansion of GM populations from the north continued in North Carolina. The 2013 trapping season had a very low number of trap catches compared with the number of 2012 catches.

In Virginia, no defoliated acres from GM were detected during aerial surveys for the fourth year in a row, although 1 acre of light defoliation was reported from ground observations.

Southern pine beetle

Dendroctonus frontalis Zimmermann

Southern pine beetle (SPB) activity decreased in 2013, when approximately 6,104 acres with SPB-caused mortality were reported compared with 8,346 acres in 2012 (figs. 1 and 2). A total of 460 acres (286 SPB spots with infestations) of SPB-caused mortality were detected and mapped during 2013 (table 1) in the Southeastern United States (figs. 3 and 4). In the Southeast, most of the activity was in Mississippi, which reported 241 acres in 2013, a decrease from 1,471 affected acres in 2012. Of these acres, 146 spots had infestations and 107 of these spots were on the Tombigbee National Forest. Infestations continued to increase on the Tombigbee National Forest. Populations of SPB decreased to unexpectedly low levels on the Bienville and Homochitto National Forests. This reduced activity in Mississippi occurred 1 year after the 2012 SPB outbreak. SPB activity was also reported in Alabama, Florida, and Virginia.

In Delaware, surveys indicate very low levels of SPB. In January 2013, seven small SPB infestations were discovered at Assawoman State Wildlife Area in the southeastern corner of Delaware in Sussex County, in an unmanaged mature loblolly pine stand. No evidence of damage or

Figure 1. Counties that reported southern pine beetle infestations in 2013.

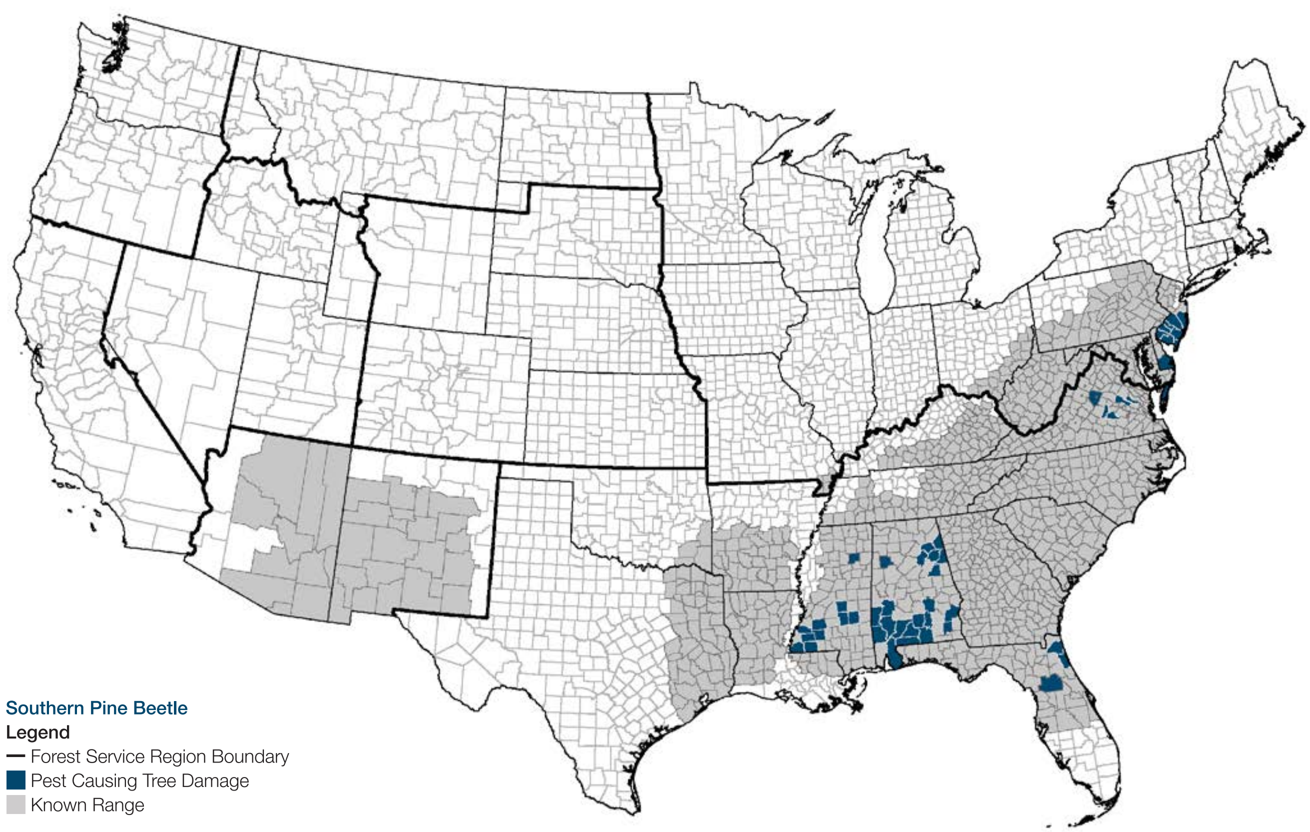
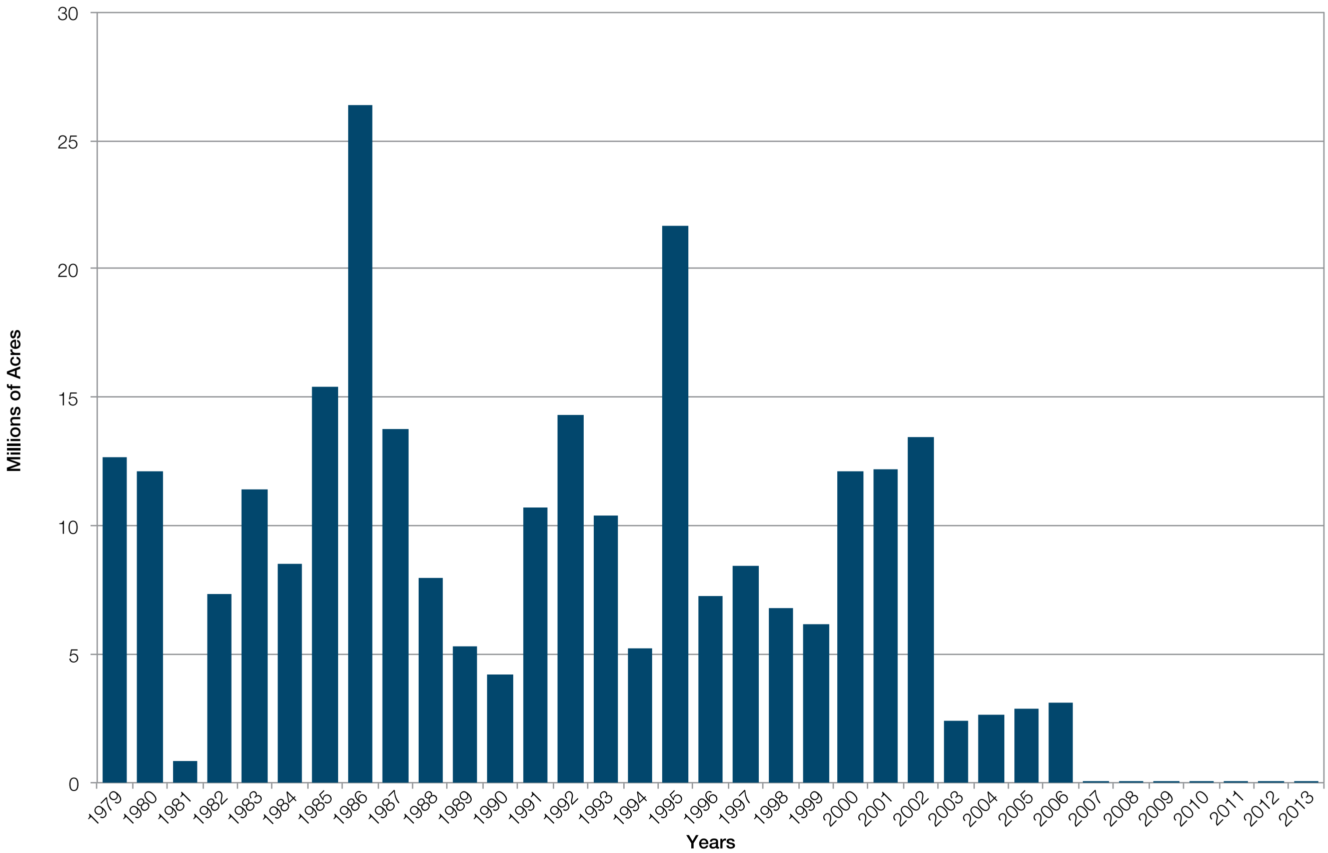


Figure 2. Southern pine beetle (SBP) outbreaks, 1979 to 2013.



Note: The surveys after 2007 counted the number of outbreak acres differently than in previous years. All acres in the county previously were counted if a single spot was positive for SPBs. The surveys after 2007 reflect the estimated number of areas affected by SPBs.

mortality was found from aerial surveys or ground inspections at Cape Henlopen.

In New Jersey, SPB mainly affected pitch pine, shortleaf pine, and Virginia pine, but it has been observed infesting Norway spruce and white pine. In 2013, approximately 600 fewer acres of damage were reported than in 2012. SPB is still mainly found in the southern counties of the State, including Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, and Salem Counties.

Table 1. Southern pine beetle activity by State in 2013.

State	Acres Infested	Number of Spots[1]
Alabama	3	81
Delaware	2	1
Florida	182	30
Mississippi	241	146
New Jersey	5642	1026
Virginia	34	29
Total	6104	1313

[1] Spot size and density vary, so the number of spots does not directly correlate to the number of infested acres.

[2] Infested acres include mostly lightly scattered mortality.

Figure 3. Southern pine beetle damage. Photo by Erich G. Vallery, USDA Forest Service.

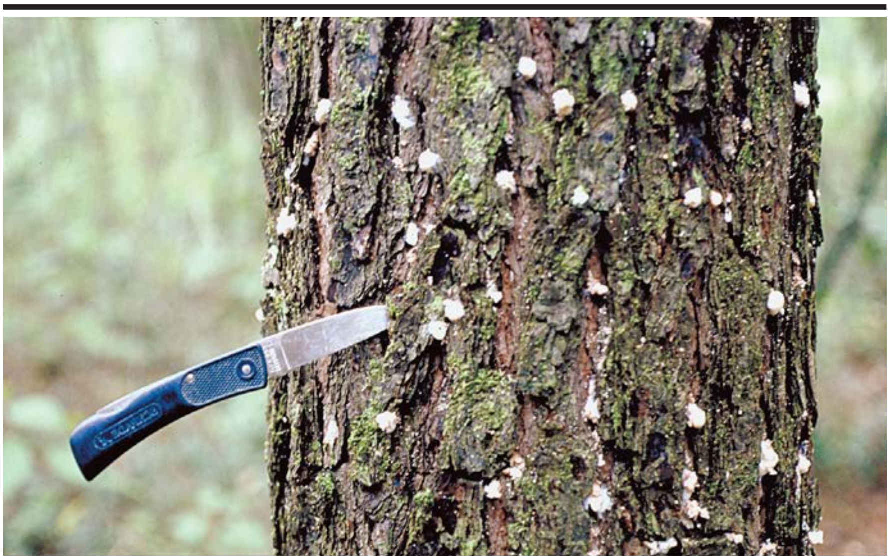


Figure 4. Pitch tube damage caused by southern pine beetle on loblolly pine. Photo by James R. Meeker, USDA Forest Service.

Emerald ash borer

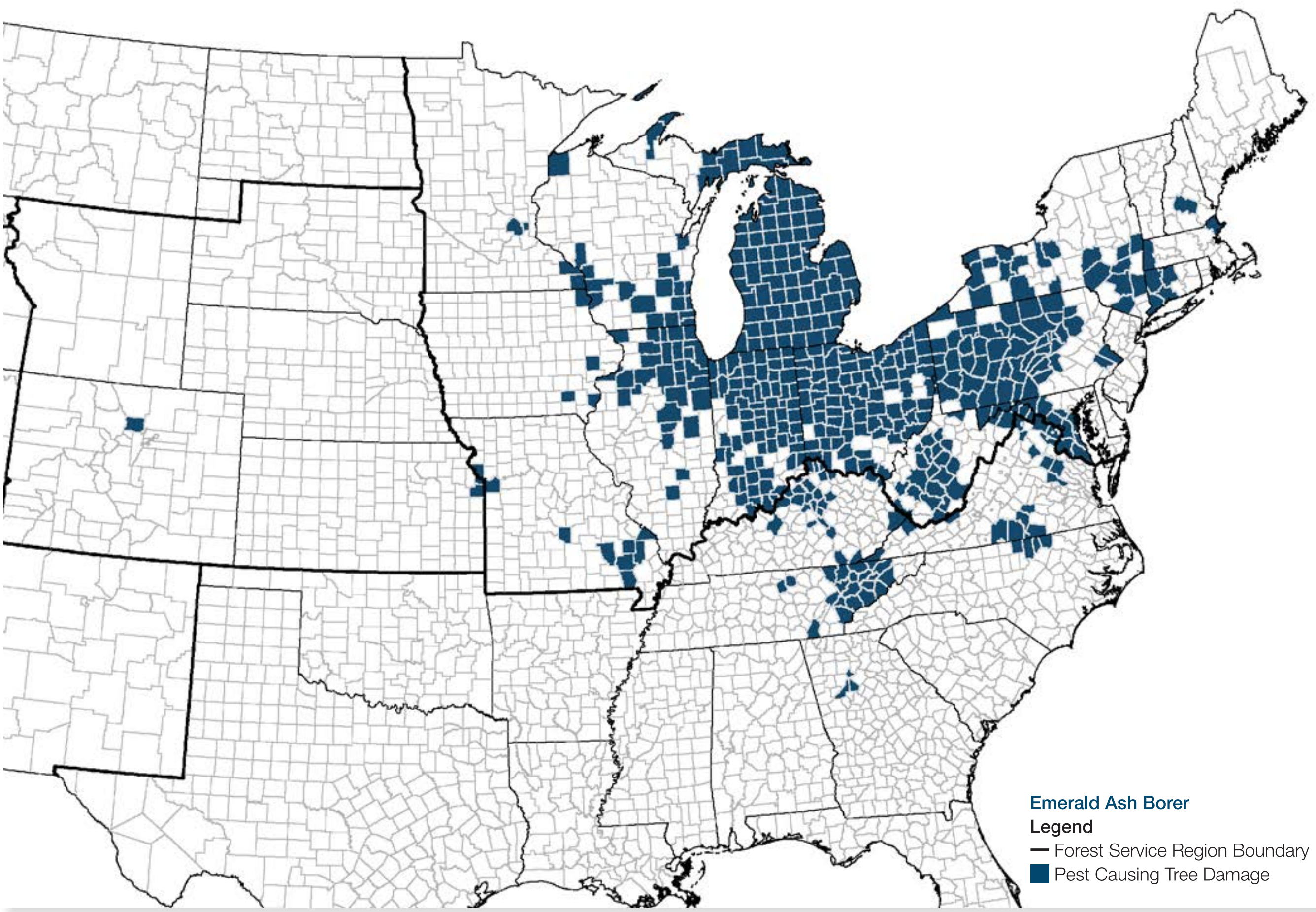
Agrilus planipennis Fairmaire

Emerald ash borer (EAB) activity was reported in 22 States and the District of Columbia by the end of 2013, an increase of 4 States from 2012. EAB was found for the first time in Colorado, Georgia, North Carolina, and New Hampshire in 2013 (fig.1).

In Connecticut, EAB was first found in New Haven County in July 2012. Since then, EAB has been found in Fairfield, Hartford, Litchfield, and New Haven Counties. In 2013, EAB was detected in the northeastern part of Massachusetts, in Essex County. Two counties now have EAB, including Berkshire County in the western part of the State, detected in 2012. In New Hampshire, EAB was detected for the first time in Merrimack County in 2013.

EAB was positively confirmed in six new counties in New York in 2013—Cayuga, Delaware, Onondaga, Ontario, Otsego, and Rensselaer. Pennsylvania added 16 counties to the infestation list in 2013—Blair, Bradford, Cambria, Cameron, Clearfield, Columbia, Dauphin, Elk, Erie, Fayette, Forest, Luzerne, Montgomery, Potter, Tioga, and Warren. EAB was found

Figure 1. Quarantined counties as a result of the emerald ash borer infestation as of 2013.



in 47 of 67 counties in Pennsylvania. Montour and Northumberland Counties were added in late 2012.

In 2013, Maryland added two new counties with EAB—Calvert and Frederick—for a total of 11 counties. Surveys in Delaware and New Jersey did not detect any EAB infestations.

In Virginia, although 2012 was a breakout year for EAB, with 13 additional counties reporting new records, 2013 was not the same case. In 2013, no new counties were added, but new infestations were discovered in and around the extensive area of infestation in south-central Virginia along with four new counties in adjacent North Carolina. In addition, Shenandoah National Park reported its first positive EAB trapping. In many counties where EAB was reported in 2012, no EAB-infested trees were confirmed in 2013.

EAB continued to spread in West Virginia and is now found in 28 counties. Four counties in West Virginia reported new activity in 2013—Boone, Doddridge, Jefferson, and Monongalia.

In Kentucky, EAB was confirmed in 28 counties (7 more than in 2012). Positive EAB detections have been found in adjacent or nearby counties of neighboring States on all sides of Kentucky. The north central region of Kentucky and two disjunct counties in the northeastern part of the Commonwealth are under quarantine. The Commonwealth continues to have a regional quarantine.

In Tennessee, 19 counties now have reports of EAB, compared with the 18 infested counties reported in 2012. The insect was much more widespread than previously known, and survey activities documented its presence in many new areas.

In Georgia, EAB was discovered in DeKalb and Fulton Counties in 2013.

In 2013, six Ohio counties reported new EAB infestations—Ashtabula, Fayette, Hocking, Holmes, Jefferson, and Tuscarawas. EAB continued to spread throughout the State, with increasing populations in new counties.

EAB did not spread to any new counties in Michigan in 2013 (figs. 2 and 3).

Indiana reported new county records in 16 counties in 2013. Following the 2013 survey, 79 counties are under State quarantine and 5 counties will be added

Figure 2. Emerald ash borer damage to ash tree in Lansing, MI. Photo by Leah Bauer, USDA Forest Service.

Figure 3. Ash trees killed by emerald ash borer in southeastern Michigan. Photo by Joseph O'Brien, USDA Forest Service.

to the quarantine area. EAB is present in 65 of 79 quarantined counties. Aerial surveys were conducted to map new locations and expansion of the mortality across and around the areas that have obvious and extensive ash mortality. In southern Indiana, mortality expanded in Floyd, Harrison, Lawrence, Orange, and Washington Counties.

In Illinois, EAB was found for the first time in Jo Daviess and Rock Island Counties in 2013. EAB continued to spread throughout the northern two-thirds of the State, particularly in the Chicago metropolitan areas. Rock Island County represents the western edge and Jo Daviess County represents the northwestern edge of EAB spread. Expansion of the EAB statewide quarantine expanded from Lake Michigan (Chicago area) to the Mississippi River and north to the Wisconsin border.

In Wisconsin, six new county records were reported in 2013 in Dane, Dodge, Douglas, Fond du Lac, Sauk, and Winnebago Counties.

No new county records were reported in Minnesota for 2013; however, populations intensified and spread within the quarantined counties.

EAB was found in Iowa in 2010, on Henderson Island in Allamakee County. In 2013, EAB was found in Cedar, Des Moines, and Jefferson Counties. EAB has been confirmed within 100 miles of the Nebraska border in western Iowa.

Missouri reported five new counties with EAB—Bollinger, Butler, Jackson, Perry, and Pulaski. Three of the five counties are adjacent to the large infested area in southeastern Missouri, while Pulaski County is isolated in south central Missouri. New statewide quarantines were established in 2013.

In Kansas, Johnson and Wyandotte Counties have confirmed EAB. Quarantines have been enacted, prohibiting the movement of ash material from those counties.

In Colorado, EAB was found in the city of Boulder in Boulder County.

SUDDEN OAK DEATH

Phytophthora ramorum Werres et al.

Sudden Oak Death (SOD) continued to be a problem in 2013 along coastal California and Oregon (figs. 1 and 2). In California, elevated infection levels and subsequent mortality resulted from mild, wet springs experienced from previous years. Tanoak mortality continued to be high, similar to 2012 levels (fig. 3). Aerial surveys for 2013 reported new, severe coast live oak mortality in the San Francisco Bay Area.

In 2013, 136 waterway sites distributed throughout coastal California were monitored for *Phytophthora ramorum*, leading to the discovery of the pathogen in multiple new watersheds in the northern extent of the disease. *P. ramorum* has been confirmed near the Six Rivers National Forest and in Trinity County, which is currently uninfested.

In Curry County in Oregon, SOD spread con-tinues throughout the affected area.

Figure 1. Counties that reported Sudden Oak Death in 2013.

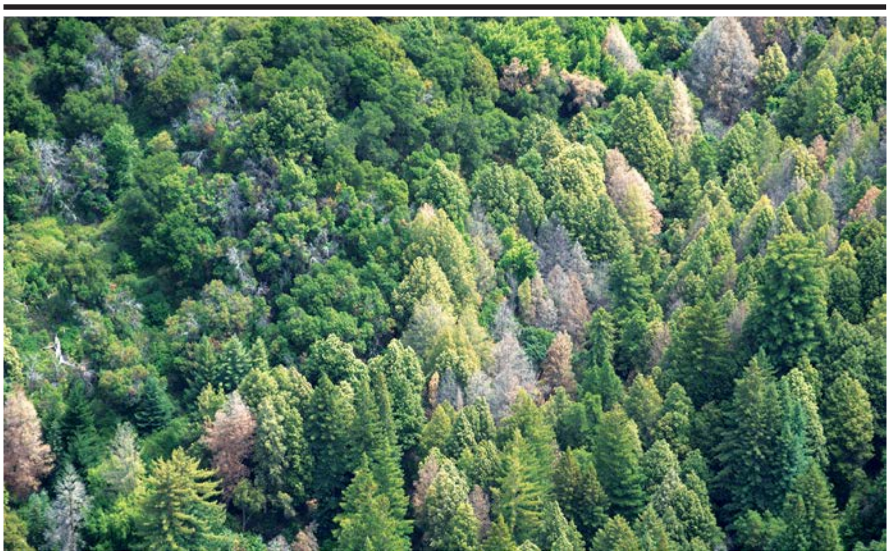


Figure 2. Sudden Oak Death killing tanoak near Monterey, CA. Photo by Zachary Heath, USDA Forest Service.

Figure 3. Symptoms of sudden oak death on tanoak seedling. Photo by Joseph O'Brien, USDA Forest Service.

Spruce beetle

Dendroctonus rufipennis Kirby

The spruce beetle (SB) epidemic continued to intensify in Colorado and Wyoming within the Rocky Mountain Region in 2013, leaving many areas with large, dead standing trees. The number of acres reported with SB mortality totaled more than 561,400 acres nationwide, higher than the 443,300 acres reported in 2012 (fig. 1).

In Colorado, the SB epidemic occurred primarily on the Grand Mesa-Uncompahgre-Gunnison, Rio Grande, San Isabel, and San Juan National Forests and on Bureau of Land Management and other surrounding lands in the southwest portion of the State (fig. 2). The SB outbreak, which began in the Weminuche Wilderness of the Rio Grande and San Juan National Forests in the early 2000s, continued to expand farther north, south, and eastward on both sides of the Continental Divide in 2013. Significant spruce mortality was evident from the Weminuche Wilderness, north to Monarch Pass. SB populations continued growing in Hinsdale County, in the Sangre de Cristo Mountains, and in the West Elk and Elk Mountains. In the most damaged areas, trees with less than a 4-inch diameter at breast height have been attacked. Beetles are also attacking large numbers of lodgepole pine in the proximity of Engelmann spruce. SB continued to have a relatively minor presence in northern Colorado. Areas of infestation continue to be small (less than 1 acre to individual trees); however, the occurrence is more widespread than in 2012.

In Wyoming, stand-converting mortality caused by SB attack continues in areas not already host depleted in the Absaroka Mountains. Mortality increased slightly in the Big Horn Mountains and Wind River Range. Ground observations in the Togwotee Pass area detected numerous 2013 mass attacks on remaining live spruce trees.

Figure 1. Spruce beetle-caused tree mortality detected in 2013 by aerial detection surveys.

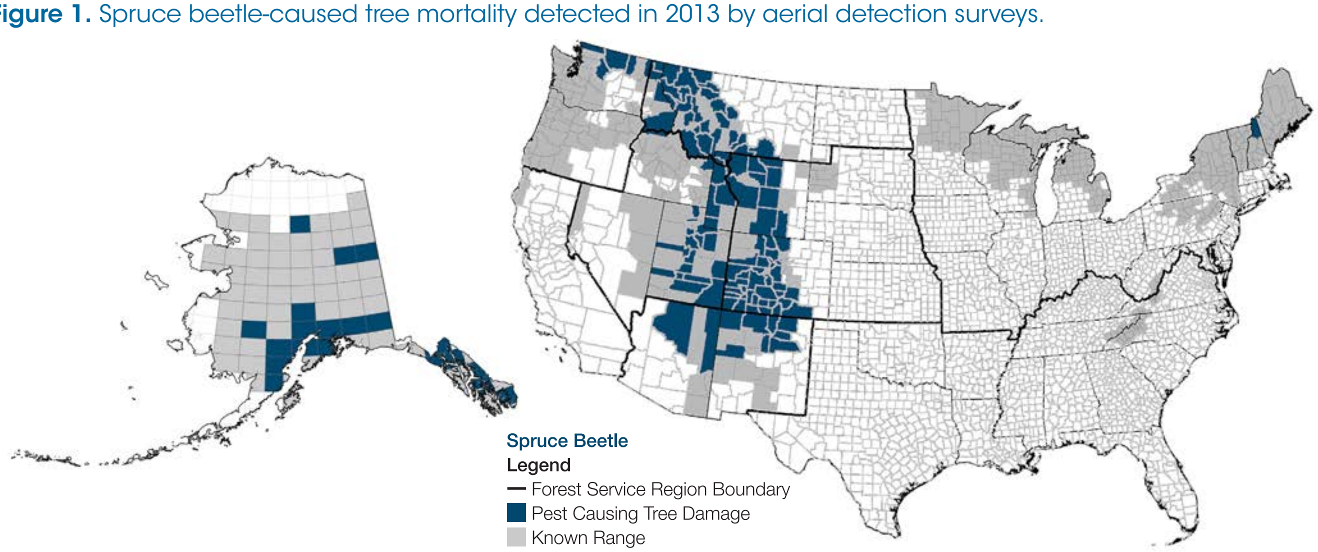


Figure 2. Spruce beetle damage in southern Colorado. Photo by Tom Eager, USDA Forest Service.

In the Intermountain Region, SB-caused tree mortality increased nearly sevenfold in 2013. Most of the spruce mortality occurred in Utah, where it was detected on all national forests. The Ashley, Fishlake, and Uinta-Wasatch-Cache National Forests had significant outbreaks. A ninefold increase in spruce mortality also occurred on private lands in Utah. In western Wyoming, spruce mortality was scattered throughout the Bridger-Teton National Forest. No SB-caused mortality was reported in southern Idaho or Nevada.

In the Northern Region, SB-caused mortality remained low, similar to the level in 2012. Beetle populations remained endemic throughout most of northern Idaho and Montana. Outbreaks of SB populations declined sharply to low levels in the locations that had elevated activity in recent years. Those locations include Beaverhead-Deerlodge and Custer National Forests and federally managed lands within the Gravelly Mountains.

Although not currently in a widespread outbreak status in the Southwestern Region, SB activity has been increasing. Increased activity was observed on the White and Chuska Mountains of eastern Arizona, mostly on tribal lands, and on the Apache-Sitgreaves National Forest. Some of the spruce mortality in the area may be the result of the blue spruce engraver beetle. The increase in mortality in the White Mountains is likely associated with the high level of fire-injured trees in the area impacted by the Wallow Fire in 2011.

In New Mexico, areas with SB activity were mapped from aerial detection surveys on the Carson and Santa Fe National Forests. The largest concentration of activity was in the Pecos Wilderness on the Santa Fe National Forest. A small stand of spruce trees was discovered to have an active SB population on the west side of the Carson National Forest near the New Mexico-Colorado border, adjacent to the extensive SB outbreak on the Rio Grande National Forest.

In the Pacific Northwest region, levels of SB mortality were similar to the 10-year average in Washington. Most of the mortality occurred in western Okanogan and eastern Whatcom Counties. The most significant damage detected in 2013 occurred within the Pasayten Wilderness in Okanogan County; SB has been active in that location since 1999.

SB activity in Alaska was slightly elevated in 2013 compared with the 2012 level, when the lowest recorded figure occurred since systematic, statewide aerial surveys began in the 1970s. Despite the relatively low number of infested acres, SB remained the leading cause of conifer mortality in southern Alaska. Although many areas exhibited declining intensity of SB activity, ongoing outbreaks continue to show signs of persistent, residual activity in 2013 (fig. 3). These areas include Katmai and Lake Clark National Parks in southwest Alaska and Chickaloon Bay and Skwentna/Puntilla Lake in south-central Alaska. The outbreaks in Katmai and Lake Clark National Parks increased in total acres, although the intensity of the outbreaks remained light to moderate. Southeast Alaska accounted for about 25 percent of the total statewide SB-caused mortality in 2013, similar to the accounting in 2012. The total number of acres mapped with SB activity increased significantly compared with affected acreage in 2012. The Kupreanof Island outbreak remained static in 2013. An area of significant SB activity was northwest of Haines, along the lower Klehini River and around Chilkat Lake. These areas were heavily impacted during previous SB outbreaks in the 1990s.

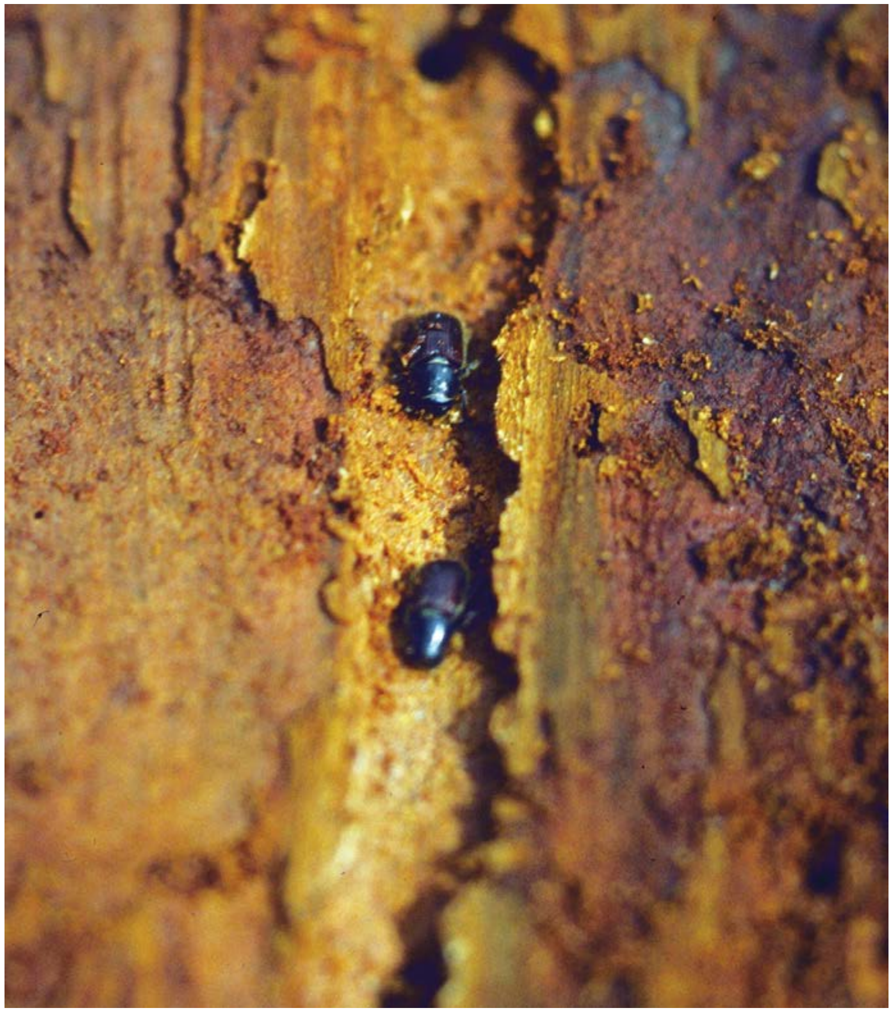


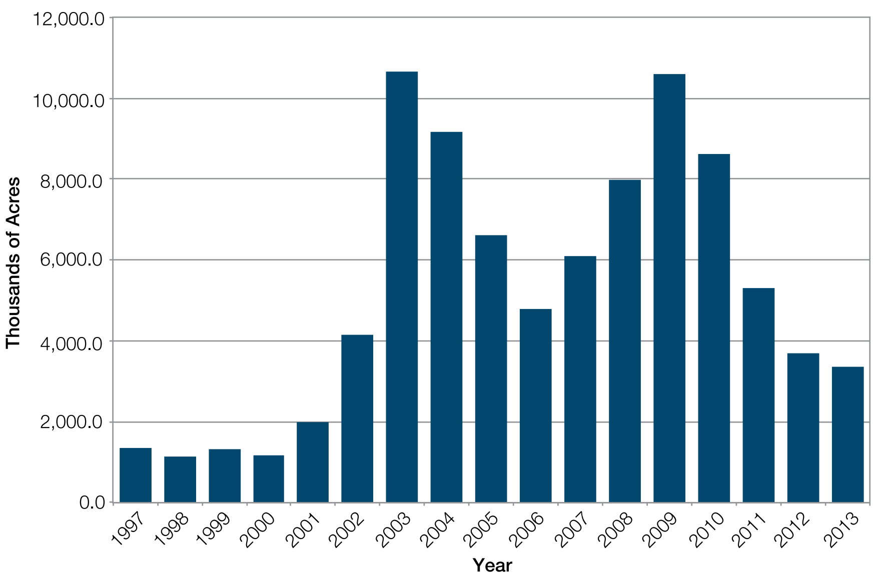
Figure 3. Spruce beetle adult. Photo by Jerald E. Dewey, USDA Forest Service.

Western Bark Beetles

Numerous Species

Western bark beetle (WBB) mortality in 2013 continued its downward trend that began 4 years ago. As in previous years, the primary reason for the decrease was fewer acres recorded with mountain pine beetle (MPB) mortality. In 2013, nearly 3.4 million acres of WBB-induced mortality were reported (fig. 1). The following sections describe the conditions of selected WBB reported for 2013 (table 1).

Figure 1. Western bark beetle outbreaks from 1997 to 2013.



Douglas-Fir Beetle

The number of recorded acres of Douglas-fir beetle (DFB)-caused mortality increased from 2012 to 2013, from 162,000 to 226,000 acres.

In Montana and northern Idaho, DFB-caused mortality increased sevenfold from 2012 to 2013. DFB-caused mortality was detected on all land ownerships, including Federal, State, tribal, and private lands. Tree mortality occurred in spatially isolated pockets scattered throughout the region. DFB outbreaks occurred in northern Idaho within Clearwater and Idaho Counties, with notable mortality occurring throughout private lands

Table 1. Trends for selected western bark beetles and infested acres detected in aerial surveys during 2013.

Bark Beetle(s)	Host(s)	Acres Detected With Bark Beetle Activity in 2013*
Mountain pine beetle, *Dendroctonus ponderosae* Hopkins	Ponderosa pine (*Pinus ponderosa* C. Lawson), lodgepole pine (P. *contorta* Douglas ex Louden), white pines and others (*Pinus* spp.)	1,575,128 acres
Spruce beetle, *Dendroctonus rufipennis* (Kirby)	Engelmann spruce (*Picea engelmannii* Parry ex Engelm.), white spruce (*P. glauca* [Moench] Voss), Sitka spruce (P. *sitchensis* [Bong.] Carr.)	561,351 acres
Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopkins	Douglas-fir (*Pseudotsuga menziesii*)	226,261 acres
Jeffrey pine beetle, *Dendroctonus jeffreyi* Hopkins	Jeffrey pine (*Pinus jeffreyi* Balf.)	43,657 acres
Western pine beetle, *Dendroctonus brevicomis* LeConte	Ponderosa pine, Coulter pine (*Pinus coulteri* D. Don)	232,396 acres
Western balsam bark beetle, *Dryocoetes confusus*, Swaine	Subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.)	14,696 acres
Fir engraver beetle, *Scolytus ventralis* LeConte	True firs (*Abies* spp.)	256,831 acres
Pine engraver, *Ips pini* (Say), Arizona five spined ips, *Ips lecontei* Swaine	Ponderosa pine	9,100 acres
Pinyon ips, *Ips confusus* (LeConte)	Pinyon pine (*Pinus edulis* Engelm.)Singleleaf pinyon (*Pinus monophylla* Torr. & Fen.)	96,832 acres

* The number of dead trees per acre varies.

near Orofino, ID. DFB activity was not associated with western spruce budworm (WSBW)-caused defoliation in these locations.

Scattered DFB activity in Montana was typically associated with previous WSBW-caused defoliation, as observed throughout the Gallatin and Bitterroot National Forests in ground surveys. Acres of DFB-caused mortality are anticipated to be underreported across Montana because of difficulties associated with assessing DFB-caused mortality in trees with previous WSBW defoliation.

In the Intermountain Region of southern Idaho, Nevada, and Utah, DFB-caused tree mortality decreased from widespread outbreak levels to localized outbreaks in 2013. Increased Douglas-fir mortality occurred in Nevada, Utah, and western Wyoming, and all of the decrease was recorded in southern Idaho. Mortality may be under-represented for 2013, however, because of difficulty accurately mapping the footprint by aerial survey.

DFB-caused mortality of Douglas-fir occurred at low levels in Wyoming. Small pockets of activity or single-tree attacks were noted from around the State.

In Colorado, increasing, widespread low-level mortality occurred across much of the susceptible cover type (fig. 2). Increased activity was noted along the U.S. Highway 550 corridor, north of Durango. Increased activity occurred in the San Miguel River Canyon, between Telluride and Placerville, and in the West Fork of Cimarron Valley. In central Colorado, DFB-caused mortality occurred in older trees in Chalk Creek drainage area between Salida and Buena Vista and in subdivisions and private lands in Gunnison County. Farther north, pockets of DFB-caused tree mortality were identified in South Turkey Creek Canyon. Pockets of DFB-caused tree mortality were located on the Pike National Forest, and small pockets of mortality occurred west of Boulder and in the Allenspark area.

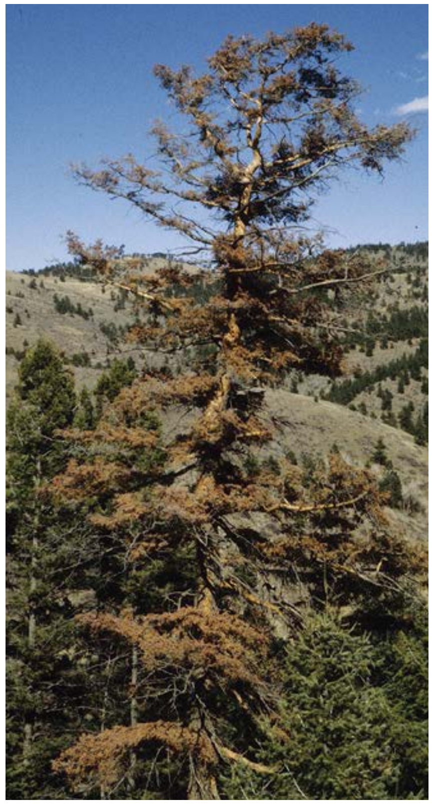


Figure 2. Douglas-fir beetle damage on Douglas-fir trees, Golden Gate Canyon State Park in Colorado. Photo by USDA Forest Service.

DFB continued to be active in a few isolated areas of Grand County, CO. Populations of DFB continue to be active in Steamboat Springs. In western Colorado, affected areas have been infested for the past 5 to 10 years, and patches of mortality continue to grow slowly. The areas most affected are the north slopes of the Roan Plateau east to Glenwood Springs, the Crystal River drainage, and the upper North Fork of the Gunnison River. Damage is apparent throughout the range of Douglas-fir.

In Arizona, activity was predominantly in mixed conifer forests recently affected by fire on the White Mountains, the San Francisco Peaks, and the Chiricahua Mountains. Approximately 72 percent of the acres identified with DFB-caused tree mortality were in areas burned by large wildfires during the past 3 years. Of the observed tree mortality in Arizona, 65 percent occurred in the White Mountains, which were burned by the Wallow Fire in 2011. DFB populations increased quickly following the Wallow Fire because of the large amount of susceptible (fire-injured large-diameter trees) host material. Many of these stands suffered severe mortality of Douglas-fir. DFB populations were elevated on the Coconino National Forest in northern Arizona following the Shultz Fire on the San Francisco Peaks.

Activity by DFB and overall mortality in the mixed conifer forests throughout New Mexico increased substantially in 2013, doubling from 2012 levels. Groups of Douglas-fir trees in the area affected by the Las Conchas Fire in the Jemez Mountains of the Santa Fe National Forest have been attacked and killed by DFB; however, most of the mortality in New Mexico may be related to the drought conditions and overall tree stress. DFB activity was observed throughout the State, particularly on the Carson, Lincoln, and Santa Fe National Forests.

DFB-caused mortality occurred in several pockets of large, mature Douglas-fir throughout northern California. The observed mortality increased dramatically in size and distribution from 2012. Many areas of mortality were observed in steep, north-facing drainages where Douglas-fir grows in relatively pure stands.

In Oregon and Washington, areas with mortality attributed to DFB declined in 2013 compared with 2012 mortality levels. Decreasing levels of defoliation caused by WSBW allowed for increased detection of beetle-caused tree mortality in heavily defoliated areas. In Oregon, DFB annually causes scattered mortality across northwest Oregon, often in association with blowdown from winter storms. Recent outbreaks have been most severe on the west slopes of the Cascade Mountain Range. Tree mortality was most apparent in 2013 in the vicinity of the Willamette National Forest and on the Umpqua National Forest. Some of the mortality was related to past fires on the Umpqua National Forest and in areas where other agents such as woodborers were present. Scattered mortality was also observed on the Umatilla and Wallowa-Whitman National Forests in northeastern Oregon.

In Washington, acres mapped with DFB decreased to their lowest levels in the past 10 years. Concentrated areas of mortality were detected in western Okanogan County on the Okanogan-Wenatchee National Forest and the Loomis State Forest and in southeast Washington on the Umatilla National Forest. In the Lake Wenatchee area of the central Washington Cascade Mountain Range, heavy wet snow and wind in December 2012 uprooted and damaged extensive forests on the Wenatchee River Ranger District. DFBs colonized this material in 2013. The full extent of the blowdown is not yet known.

Jeffrey Pine Beetle

In California, Jeffrey pine beetle-caused mortality increased in 2013. In northwestern California, where Jeffrey pine beetle is uncommon, Jeffrey pine beetle-caused mortality was found on small pockets of Jeffrey pine. In northeastern California, however, based on ground surveys, Jeffrey pine beetle declined. In some areas, dying Jeffrey pine were found to have high numbers of wood boring larvae, to the point where they may have limited Jeffrey pine beetle reproduction. In those areas, Jeffrey pine was also attacked by other woodborers. Only light Jeffrey pine beetle-caused mortality was reported elsewhere in its range in California.

In Nevada, Jeffrey pine beetle-caused mortality remained low. Most of the Jeffrey pine mortality occurred on the Bridgeport and Carson Ranger Districts of the Humboldt-Toiyabe National Forest.

Fir Engraver Beetle

Overall, reported fir engraver beetle (FEB) mortality increased slightly from 2012 to 2013, from 211,000 to almost 257,000 acres. FEB activity subsided throughout much of California in 2013, for the third year in a row. A slight increase in fir mortality was noted in localized areas of northern California. In the southern Sierra Mountain Range, only scattered fir mortality was observed and was often found in conjunction with other woodborers.

In the Intermountain Region, FEB-caused fir mortality remained low in 2013. Most of the damage occurred on national forest lands in Nevada and Utah. Fir mortality remained static in Nevada, occurring primarily on the Carson and Ely Districts of the Humboldt-Toiyabe National Forest. In Utah, tree mortality caused by FEB decreased 79 percent, with tree mortality occurring on the Dixie and Uinta-Wasatch-Cache National Forests and on private lands (fig. 3). In southern Idaho, FEB-caused mortality was minimal in 2013. Although populations remain relatively low, a slight increase in the FEB's presence in northern Idaho occurred mostly in Kootenai and Latah Counties. Impacts by FEB to forests in Montana remained at very low levels.

In Colorado, FEB-caused mortality of white fir increased in 2013, located within or adjacent to the Ouray area. In some areas, intermittent areas of Douglas-fir mortality were from DFB. Significant FEB activity was also found in Archuleta County. Mortality of white fir because of FEBs increased in southwestern Pueblo County, Custer County, the Wet Mountains, and the Sangre de Christo Mountain Range. In the Durango area, the number of white fir infested by FEB decreased in 2013.

In Oregon and Washington, acres with mortality attributed to FEB were at their lowest level since 2001, and tree mortality has remained at endemic levels for several years. As with DFB, the decreased levels of defoliation caused by WSBW allowed for better detection of beetle-caused tree mortality in recently defoliated areas. In Oregon, mortality attributed to FEB remained at low levels in most areas but increased in drought-prone areas of southwest Oregon, including Jackson, Klamath, and Lake Counties, and on the

Figure 3. Fir engraver infestation on white fir on the Uinta National Forest in Utah. Photo by USDA Forest Service.

Fremont-Winema National Forest. In Washington, the most heavily affected areas were in Ferry, Pend Oreille, and Stevens Counties.

In Arizona FEB-caused tree mortality increased significantly in 2013. Most of the mortality occurred in the White Mountains, which were burned by the Wallow Fire in 2011. Large stands of white fir and mixed conifer that burned in the Wallow Fire had large populations of FEB in 2013. Other areas with increased fir mortality from the FEB were incited by drought conditions, particularly in the northeastern portion of the State in the Chuska Mountains, on Navajo tribal lands, and in north-facing canyons at Canyon De Chelly National Monument.

In New Mexico, the overall mortality in mixed conifer forests increased in 2013; however, the amount attributed to FEB activity decreased slightly from 2012 levels. Fir engraver activity occurred throughout the State but, particularly, on the Santa Fe National Forest. High stand density and drought stress likely contributed to the mortality.

Pine Engraver Beetle

Pine engraver beetle (PEB) populations and associated tree mortality continued at low, endemic levels in 2013. Nearly all mortality occurred in ponderosa pine, scattered in small patches across Montana and Idaho, with the largest impacts east of the Continental Divide.

In South Dakota, PEB populations increased dramatically beginning in 2012. This increase resulted in ponderosa pine mortality in the Black Hills, primarily in the southern counties of Custer and Fall River in 2013. Populations increased in Shannon County in 2013. Although typically found in dying trees and slash piles, populations of PEBs have increased and become a significant cause of tree mortality. This increase may be because of the number of trees killed by the MPB, the aftermath of the 2011–2012 drought, and the use of chipping slash following thinning operations. An increase in pine mortality was observed where the fresh slash was chipped earlier in the year.

In Wyoming, PEB was found in Campbell County and in Garnet Hill in northwest Goshen County.

Western Pine Beetle

Western pine beetle (WPB) activity continued its upward trend in most locations, with the exception of California, where a decrease accounted for an overall national decrease in acres affected by WPB. In 2013, 232,000 acres with mortality were reported compared with 252,000 acres in 2012.

In California, pine mortality from WPB decreased slightly in 2013. WPB activity increased in the Southern Sierra Nevada Mountain Range, especially around the area affected by the Rim Fire. Elevated mortality of Coulter pine was also observed in southern California. In northern California, areas with black stain root disease had elevated mortality associated with WPB. WPB activity decreased in a few northeastern California locations, possibly because of an extreme cold spell in January 2013. Dead WPB larvae were observed within the bark of infested trees in cold air sink areas of the Lassen National Forest.

In southern Idaho, Nevada, and Utah, ponderosa pine mortality attributed to WPB increased nearly fourfold from 2012 levels. Most of the mortality occurred in southern Idaho on the Boise National Forest and on private land. Drought conditions and the wildfires of 2012 were likely responsible for this tree mortality. In central and southern Utah, ponderosa pine mortality attributed to WPB increased slightly. Endemic levels of activity were reported in Nevada and western Wyoming.

In northern Idaho and Montana, ponderosa pine mortality attributed to WPB doubled from 2012 but still remained at low levels. Most of the mortality occurred in Idaho, in Bonner and Boundary Counties, and in Flathead County in western Montana. The mortality was generally scattered. No significant WPB was detected in 2013 in southwestern Colorado.

In Oregon and Washington, mortality was similar to levels observed in 2012; however, a slight increase was observed in Washington. In Washington, the areas with the most significant activity include the Colville and Yakama Indian Reservations and areas south of Spokane. In Oregon, mortality was most extensive on the Malheur and Ochoco National Forests and the Warm Springs Indian Reservation.

Ponderosa pine mortality attributed to WPB in central and southern New Mexico increased substantially in 2013 from the already elevated levels in 2012. The Cibola, Gila, and Lincoln National Forests and the Mescalero Apache Indian Reservation were the most affected. Tree mortality resulted from the continued dry conditions and subsequent insect activity. WPB was one causal factor contributing to the ponderosa pine mortality, along with other agents and bark beetles, including *Ips*.

In Arizona, most of the WPB-caused tree mortality occurred in the Coconino, Kaibab, Prescott, and Tonto National Forests. Statewide, WPB activity has increased fourfold from 2012, partly because of an extremely dry and windy spring. In Arizona, 40 percent of WPB-caused tree mortality occurred on the Coconino National Forest in northern Arizona, generally near or within burn perimeters. Large areas of scattered WPB-caused tree mortality were found on the southwestern end of the San Carlos tribal lands.

WESTERN SPRUCE BUDWORM

Choristoneura occidentalis Freeman

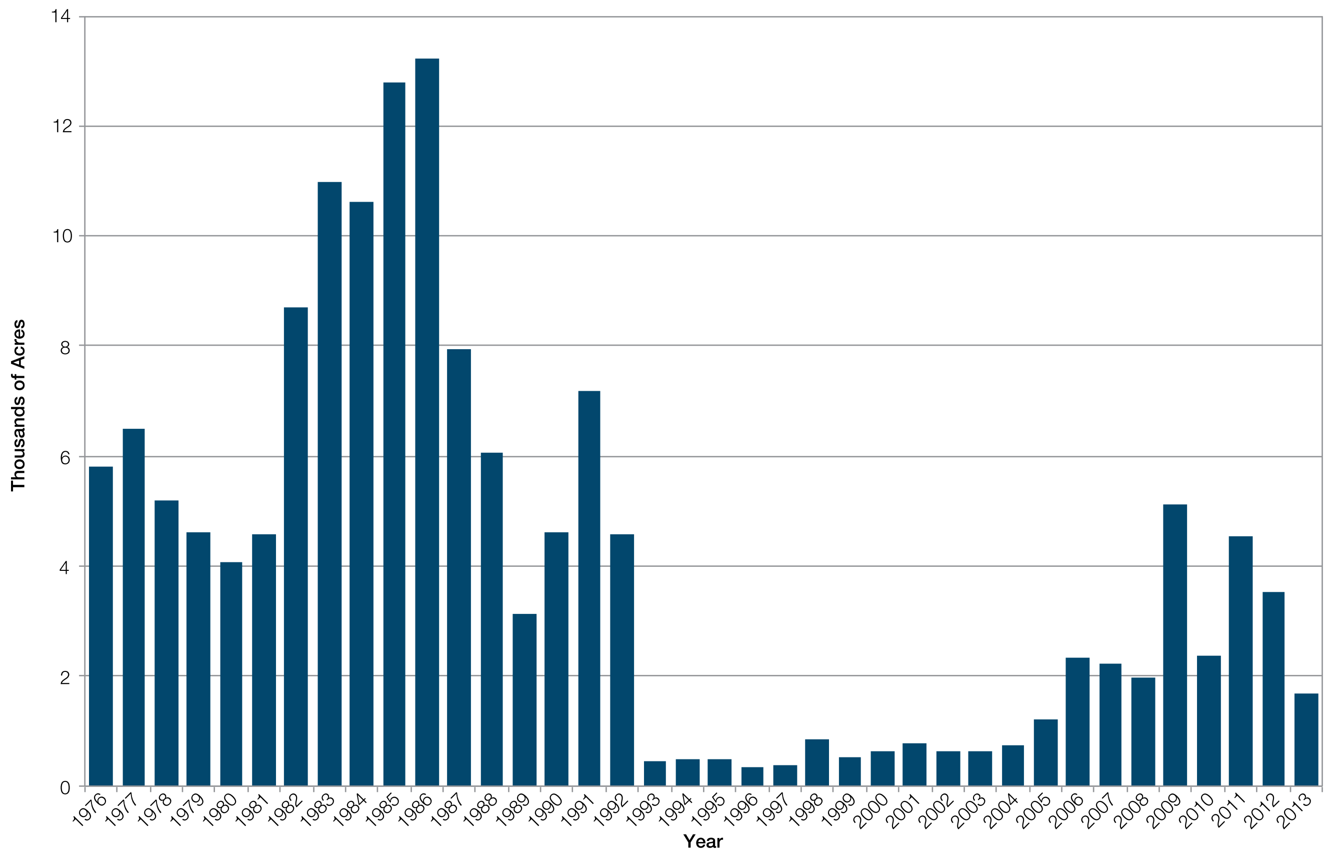
Western spruce budworm (WSBW) defoliation was reported on more than 1.6 million acres (figs. 1 and 2) in 2013, a decline of 1.9 million acres from 2012 (table 1).

Most of the WSBW activity in the Southwest was in New Mexico, which had a greater amount of susceptible host types. Defoliation continued to be widespread throughout northern New Mexico, but the number of acres with defoliation mapped from aerial detection surveys decreased considerably in 2013. This decrease was most likely because of the drought conditions experienced in the State. No observed damage was mapped in the southern portion of New Mexico in 2013.

In Arizona, acres affected by WSBW decreased statewide in 2013. Activity continued in the Chuska and White Mountains, and two-thirds of the mapped damage occurred in the White Mountains. Damage was observed on the San Francisco Peaks for the first time in decades.

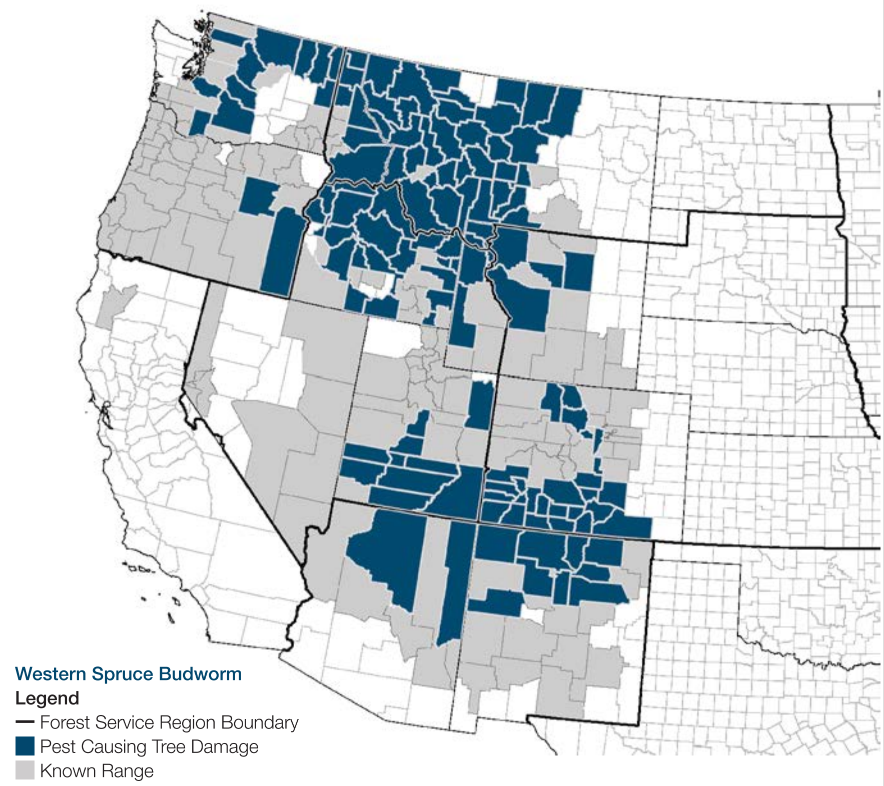
In the Intermountain Region, WSBW-caused tree defoliation decreased in area by nearly 50 percent in 2013 compared

Figure 1. Acres of western spruce budworm defoliation in 2013.



with affected areas in 2012. Nonetheless, south-central Idaho populations of this insect remained near outbreak levels for the 9th consecutive year. In southern Idaho, acres defoliated by WSBW remained high on the Boise and Payette National Forests, although a significant reduction in defoliation occurred on the Boise, Caribou-Targhee, and Salmon-Challis National Forests. In Utah, acres affected by WSBW defoliation increased threefold from acreage mapped in 2012, with the largest increase occurring on the Fishlake National Forest. In western Wyoming, defoliation decreased to endemic levels. No WSBW was mapped in Nevada.

Figure 2. Counties that reported western spruce budworm in 2013.



The number of acres defoliated by WSBW in Montana in 2013 declined by more than 50 percent, especially east of the Continental Divide. Defoliation from budworm was recorded in nearly every county. Little defoliation from budworm was recorded in Idaho. In 2013, defoliation intensity remained high in some areas, especially on forests east of the Continental Divide, where budworm has been recorded for several years. Areas with significant budworm defoliation were the Flathead, Helena, Lewis and Clark, and Lolo National Forests.

WSBW decreased significantly in Oregon and Washington in 2013. Although budworm remains present in some areas, it was obscured by a late flush of foliage in some areas. In Oregon, very few areas of WSBW defoliation were detected. This low detection represents a significant decline in the number of acres mapped relative to acreage in 2012 and was the lowest number of acres since 2005.

Table 1. Acres (in thousands) with western spruce budworm defoliation by State, 2002 to 2013.

State	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Arizona	11.30	24.00	10.70	11.20	2.50	4.80	1.70	1.27	0.39	3.50	1.66	1.10
California	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado	131.10	20.00	20.00	71.40	93.70	390.20	153.40	382.37	212.83	90.27	217.36	156.27
Idaho	22.60	204.10	64.10	75.30	254.30	360.50	366.20	1,030.56	865.99	1,887.47	717.14	367.57
Montana	52.40	66.00	177.30	453.70	1,142.20	497.20	577.80	2,576.15	326.34	1,200.78	1,490.94	596.01
Nevada	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00
New Mexico	198.80	143.20	238.20	183.80	142.50	452.20	360.40	559.29	317.42	500.54	476.95	298.02
Oregon	1.90	5.50	6.60	0.30	38.00	98.10	10.00	40.80	108.14	256.08	79.13	0.32
Utah	7.00	14.70	20.00	40.50	88.60	51.40	7.70	69.71	142.04	28.04	13.56	38.54
Washington	57.50	139.90	193.20	363.10	555.70	355.80	455.10	414.50	373.08	538.47	511.19	179.88
Wyoming	134.60	13.30	4.50	6.40	4.40	29.00	34.90	30.32	20.85	34.77	21.42	28.26
Total	617.20	630.70	734.60	1,205.70	2,321.90	2,239.90	1,967.20	5,104.97	2,367.09	4,539.93	3,529.36	1,665.97

Defoliation occurred in Malheur County near the Strawberry Mountains (fig. 3). In Washington, detected areas of WSBW defoliation were the lowest since 2003. Mid-elevation forests in Ferry, Kittitas, and Okanogan Counties were most heavily affected. New areas of defoliation were observed in Pend Oreille, Stevens, and Yakima Counties. WSBW damage was observed on the Colville National Forest and has been increasing during the past 3 years.

In Colorado, infestations continue on the Rio Grande, San Isabel, and San Juan National Forests and surrounding lands. WSBW significantly impacted white fir and Douglas-fir in Costilla County around La Veta Pass. Saguache County, toward Poncha Pass, had an increase in WSBW, while Conejos Canyon in Conejos County observed minor occurrences of the pest. WSBW decreased in Custer County along the Sangre de Cristo Mountain Range. In northern Colorado, heavy defoliation was observed on spruce and subalpine fir trees in southern Routt County. Patches of WSBW were also observed in southern Jefferson County.

In Wyoming, surveys show a continued increase of areas with visible heavy defoliation in the Clarks Fork of the Yellowstone River and the northern section of the Shoshone National Forest.

Figure 3. Western spruce budworm damage on grand fir on Malheur National Forest in Oregon. Photo by Dave Powell, USDA Forest Service.

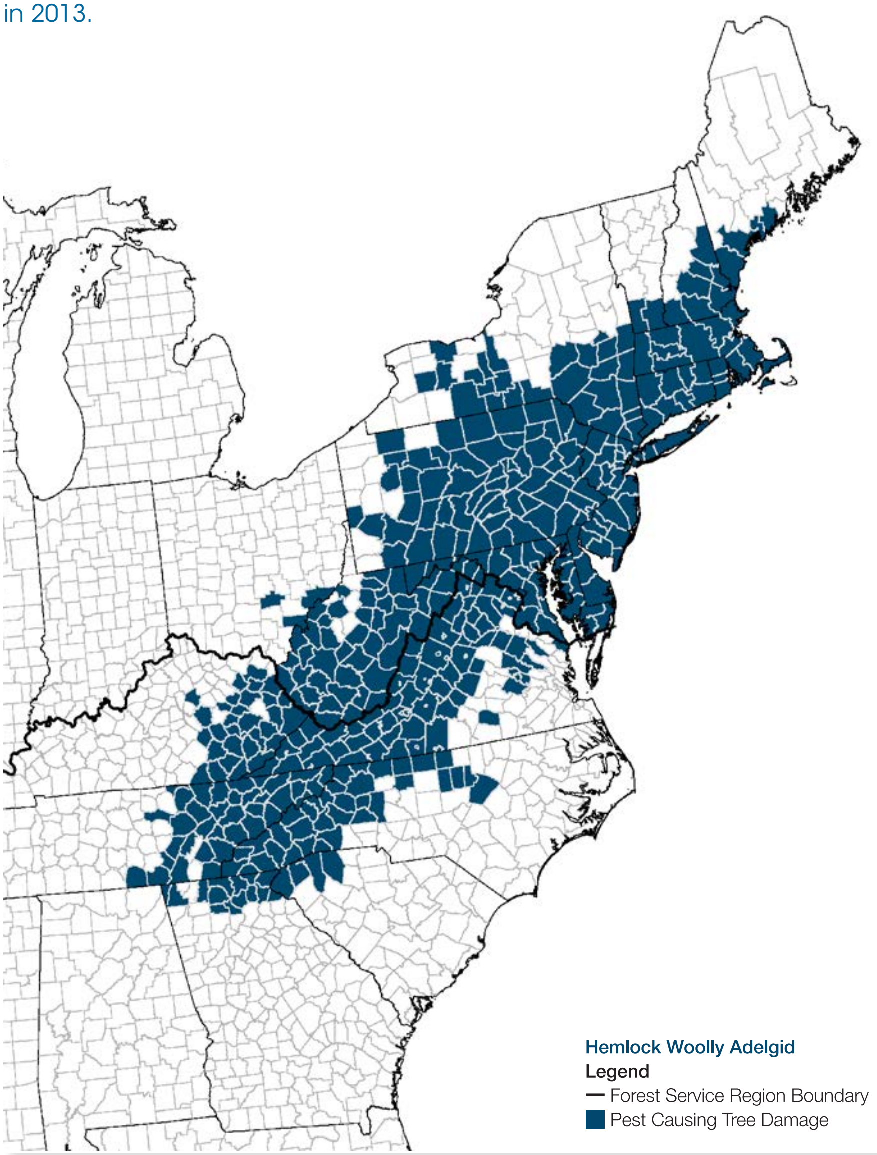
Hemlock woolly adelgid

Adelges tsugae Annand

Hemlock woolly adelgid (HWA) continued to expand its range and affect an increasing number of host trees—eastern and Carolina hemlock (figs. 1 and 2).

In Georgia, decline and mortality of eastern and Carolina hemlock continued. Surveys conducted in 2013 for the 10th year revealed the adelgid continued to spread. Many of the eastern stands are experiencing rapid decline and mortality. In total, Georgia had 14 infested counties, and HWA has affected the State's entire hemlock forest range.

Figure 1. Counties that reported hemlock wooly adelgid damage in 2013.



In Tennessee, HWA continued to cause damage to hemlocks in the mountainous eastern counties. One new county was determined to be positive in 2013, bringing the total number of infested counties to 36 of the 38 counties with hemlock populations. HWA continued to spread in infested counties.

In Kentucky, HWA infested 30 counties throughout the eastern part of the State, with 8 counties added in 2013. Infestations occurred on private nonindustrial, State, and Federal lands. Bell and Harlan Counties have areas with trees approaching mortality because of HWA. Hemlock woolly adelgid continues to spread throughout the hemlock range, and infestation levels quickly increased in 2013 (fig.3).

In North Carolina, all 35 counties within the native range of hemlock were affected by HWA. Infestations continued to spread within infested counties and intensified in the southern Appalachian Mountains. Mortality was apparent in infested counties, primarily in forested stands where control was difficult and cost prohibitive.

In South Carolina, decline and mortality of eastern and Carolina hemlock continued in four affected counties in the westernmost part of the State—Greenville, Oconee, Pickens, and Spartanburg.

In Virginia, significant decline continued in many areas, although, in some areas,

Figure 2. Hemlock woolly adelgid infestation. Photo by USDA Forest Service.

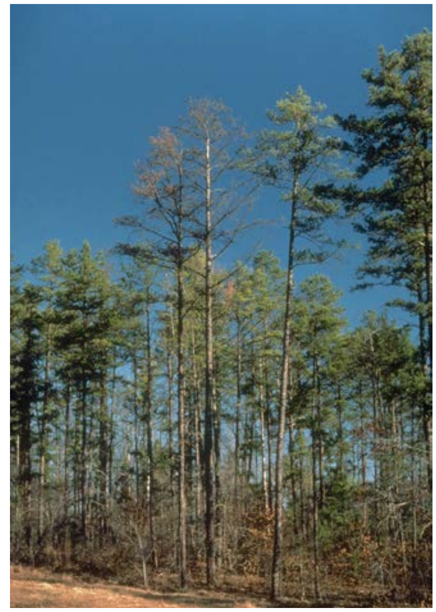


Figure 3. Hemlock woolly adelgid damage on hemlock needles. Photo by USDA Forest Service.

trees that had supported HWA infestations for many years were still alive. HWA continued to spread and has permeated the entire range of hemlock within Virginia. Hemlock mortality levels averaged about 22 percent in the southwest portion of the Commonwealth, from Bath and Rockbridge Counties, southwest to Lee County—a 2-percent increase from last year's mortality level estimate.

In Connecticut, discoloration from HWA was mapped by aerial survey throughout the State. The health of hemlock stands in Connecticut continued to show general recovery from HWA, with large areas of the northern half of the State showing excellent new growth.

Warm winter temperatures continued to cause an increase in new populations statewide in Massachusetts. A small amount of foliage discoloration was mapped from the aerial survey in Berkshire County. Counties impacted by HWA included Barnstable, Berkshire, Bristol, Dukes, Essex, Franklin, Hampden, Hampshire, Middlesex, Norfolk, Plymouth, Suffolk, and Worcester—every county in the Commonwealth except Nantucket.

In Maine, populations of HWA spread in 2013. Most known infestations were very close to the Atlantic coast or other significant bodies of water. Hemlock decline, due in part to HWA damage, was apparent in several coastal communities, although they were not yet detectable by aerial survey.

HWA continued to spread throughout New Hampshire. New infestations were found in seven towns in 2013. The new towns were Barrington, Fitzwilliam, Francestown, Londonderry, New Boston, Walpole, and Weare. HWA infestations were present in all five Rhode Island counties in 2013. In Vermont, crown symptoms were noticeable in 2013, and light overwintering mortality of the insect occurred.

Hemlock is not a significant component of Delaware's rural or urban forests; nevertheless, HWA has been confirmed in all three counties within the State. In Maryland, populations of HWA increased in 2013, especially in Garrett County. HWA was found in the District of Columbia in 2013.

Nearly all hemlocks in New Jersey were infested with HWA to some extent in 2013, as in 2012. In New York, HWA continued to cause damage and mortality to native forest and ornamental eastern hemlock trees. Three new counties (Otsego, Rensselaer, and Wyoming) were found to be HWA infested in 2013. Damage was most severe in areas that were infested for several years in the Catskill Mountains and the southern part of the State. Several infested stands within the Finger Lakes region, however, were also beginning to show hemlock mortality.

In Ohio, a new HWA infestation was discovered in Hocking State Park in Hocking County in 2013. In Pennsylvania, four additional counties were added to the infestation list in 2013—Clarion, Forest, Jefferson, and Warren. A countywide infestation of HWA was reported for each of the following counties—Bedford, Blair, Franklin, Fulton, and Lycoming. In general, HWA started to recover after winter population crash in 2009.

In West Virginia, new HWA detections were reported for Jackson, Mason, Putnam, and Ritchie Counties in 2013.

Laurel wilt disease/ redbay ambrosia beetle

Raffaelea lauricola T.C. Harr., Fraedrich and Aghayeva *Xyleborus glabratus Eichhoff*

Laurel wilt (LW) was reported in Mobile County, AL, infecting mainly sassafras trees. LW spread to new areas within Marengo County and into Greene County for the first time in 2013. The disease is spreading rapidly among scattered sassafras stands.

In Florida, LW continues to spread locally into new areas, causing heavy mortality in redbay and related species (fig. 1). Laurel wilt fungus is carried by the redbay ambrosia beetle. In forest stands where the disease has been established for several years, nearly all of the mature redbay trees

Figure 1. Redbay mortality caused by redbay ambrosia beetle and its associated fungus, laurel wilt disease, in Florida. Photo by Albert (Bud) Mayfield, USDA Forest Service.

have been killed. Six new counties—Broward, Hernando, Jackson, Manatee, Sarasota, and Taylor—confirmed LW in 2013, bringing the total number of affected counties to 40. In 2012, the first cases of LW affecting avocado trees in commercial groves were confirmed in Miami-Dade County, and many more cases followed.

In Georgia, one new LW-positive county—Warren—was detected in 2013. This addition brings the total number of affected counties in southeast Georgia to 40 (fig. 2). As the disease moves farther inland, hosts such as sassafras becomes predominant; thus, the spread and severity of the disease may change. The rate of spread inland from the initial coastal introduction has varied—from more than 17 miles per year in the southern coastal plain, where redbay trees are the primary host and the trees are abundant, to less than 9 miles per year farther inland, where redbay becomes less abundant and sassafras more abundant (fig. 3).

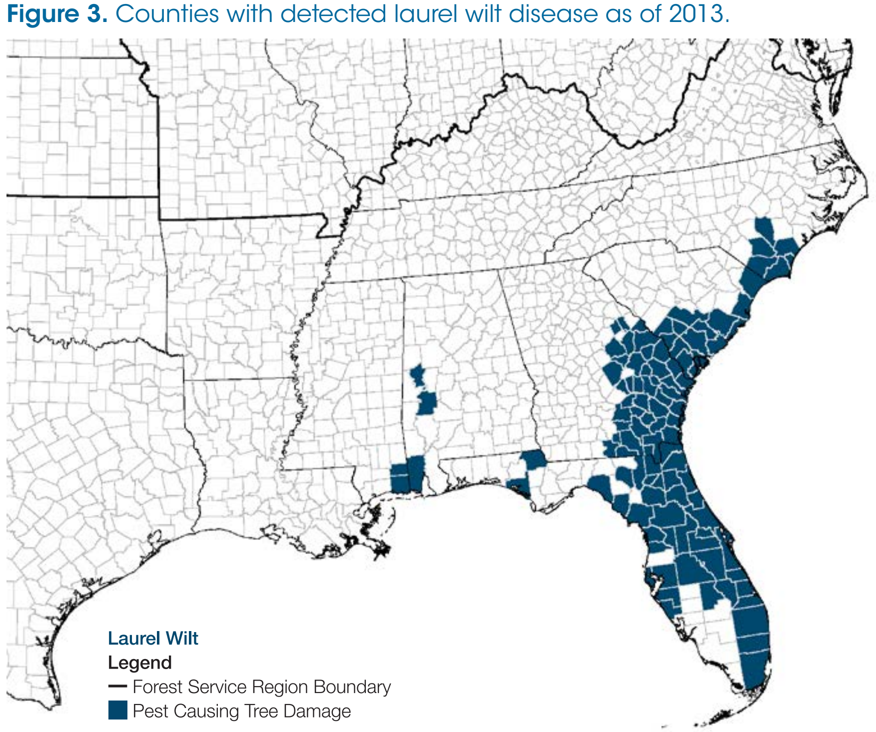
In Mississippi, mortality was severe, especially in and around the Pascagoula River basin in Jackson County, extending into newly confirmed George County in 2013.

In 2013, LW was confirmed in New Hanover County, NC, for the first time and was also found in additional areas within the previously affected counties. The mortality rate throughout the affected area did not appear to be as heavy as in States farther south.

In South Carolina, mortality of redbay and sassafras was known to occur in scattered locations in 13 counties. LW was found only on sassafras, however, in Beaufort County. Dieback and mortality are locally severe, and most redbays in an affected stand succumb to LW.

Figure 2. Redbay trunk with exposed sapwood showing typical black staining caused by laurel wilt disease on Jekyll Island, GA. Photo by USDA Forest Service.

Figure 3. Counties with detected laurel wilt disease as of 2013.



Spruce budworm

Choristoneura fumiferana Clemens

Maine reported a dramatic increase in spruce budworm (SB) catches in pheromone traps in 2013. Many locations showed a fourfold increase compared with catches in 2012 (fig. 1). The highest counts were in Aroostook County; however, larval feeding was still not reported. Vermont reported that moth catches from pheromone traps in 2013 decreased from 2012 and remained low.

A continuous outbreak of SB has occurred primarily in the northeast quarter of Minnesota since 1954. In 2013, both defoliation and mortality were reported in Lake and St. Louis Counties; however, the overall acreage trend is decreasing (fig. 2). New areas of defoliation are occurring near the North Shore of both Lake and St. Louis Counties.

In Michigan, populations nearly collapsed in the Upper Peninsula in 2013, with only small defoliating populations remaining in the western and central areas of the Upper Peninsula (fig. 3). In the Lower Peninsula, the scattered nature of the spruce cover type prevented large outbreaks of this insect. In Wisconsin, defoliation damage was much lower in the northeastern counties in 2013. Damage was detected in portions of northern Wisconsin for the past 4 years (in Ashland, Florence, Forest, Marinette, and Oconto Counties).

Figure 1. Counties that reported spruce budworm in 2013.

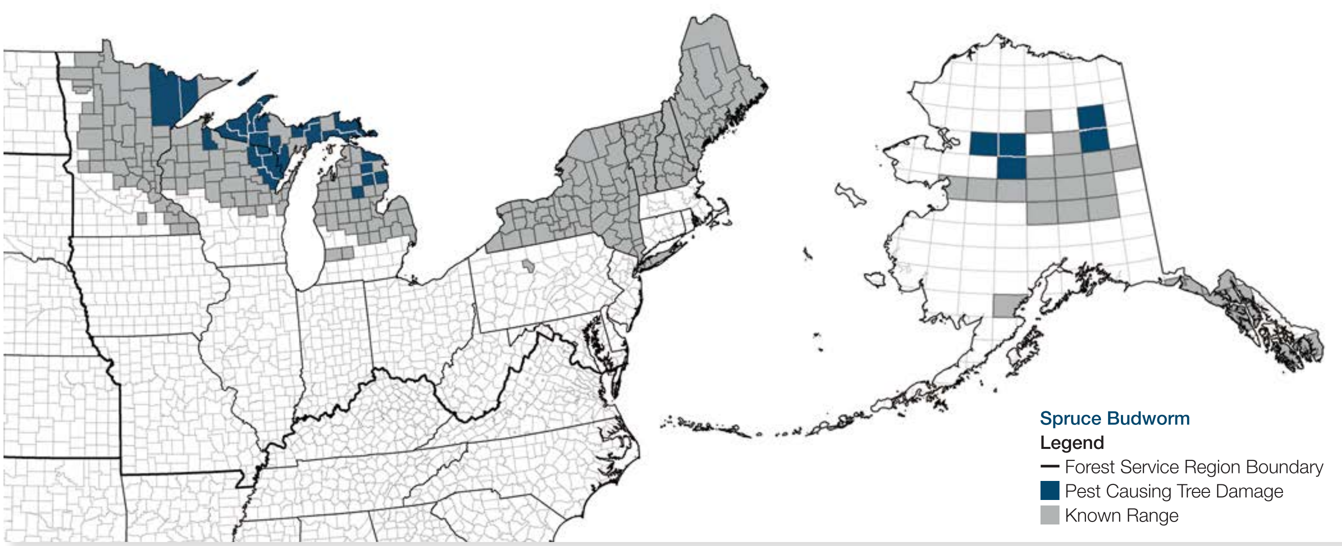


Figure 2. Balsam fir and white spruce defoliation and mortality caused by spruce budworm defoliation on the Superior National Forest in Minnesota. Photo by Marc Roberts, USDA Forest Service.

Figure 3. Spruce budworm defoliation and mortality on the Hiawatha National Forest in Michigan. Photo by Marc Roberts, USDA Forest Service.

Sirex woodwasp

Sirex noctilio Fabricius

In Pennsylvania, four new counties—Clarion, Indiana, Luzerne, and Lycoming—were added to the Sirex woodwasp infestation list in 2013. It is assumed that much of New York State is likely infested with Sirex woodwasp, although no new affected counties were detected in 2013. Within the known infestation, much of the damage was still found on pine plantations that were overstocked, overmature, or otherwise in declining health (fig. 1).

Trapping surveys conducted in Delaware, Maryland, and New Jersey did not detect any Sirex woodwasp in 2013.

Figure 1. Adult Sirex woodwasp on Scots pine. Photo by Kevin Dodds, USDA Forest Service.

Dwarf mistletoes

Arceuthobium spp.

Like decay diseases, dwarf mistletoe (DM) species are rarely detected in aerial surveys and do not change rapidly from year to year. Yet, they chronically affect trees and stands, slowly increasing over time, reducing growth, reducing tree longevity, increasing susceptibility to drought, and contributing to deterioration of stand conditions (fig. 1). The following paragraphs summarize the extent of DM in selected areas.

Douglas-fir DM is common in Douglas-fir in the Southwestern Region. It was even present in remote canyons in the Navajo National Monument. Ground surveys indicate that more than 50 percent

Figure 1. Mortality to whitebark pine from limber pine dwarf mistletoe and mountain pine beetle, Mount Shasta, CA. Photo by Pete Angwin, USDA Forest Service.

of mixed conifer stands with Douglas-fir are infected. Southwestern DM infests more than one-third of the ponderosa pine forest type in the Southwest. The distribution and intensity of southwestern DM infestations depend on location, and a few national forests in the Southwestern Region have more than 60 percent of its ponderosa pine acreage infested. Pinyon DM is widespread across the Southwest, but it occurs at fairly low levels. Widespread distribution of DM infection is found in two-needle pinyon (*Pinus edulis*), but only one known population of infected border pinyon was found in the Mule Mountains of southern New Mexico. Infested California single-leaf pinyon trees are found in central Arizona.

Figure 2. Dwarf mistletoe infestation on Jeffrey pine. Photo by USDA Forest Service.

Lodgepole pine DM occurs on approximately 2 million acres (28 percent) of the lodgepole pine type in the Northern Region (northern section of Idaho, Montana, and North Dakota). DM species remain the most widespread and frequently observed disease within the Intermountain Region (southern Idaho, Nevada, and Utah; fig. 2). In some stands, growth is completely stunted.

DM infections are the most serious and damaging disease problem in the Rocky Mountain Region. The different species of the parasitic plant occur on lodgepole pine, five-needle pine, pinyon pine, ponderosa pine, and Douglas-fir throughout the region. In Colorado, DM was widespread. In Oregon and Washington, hemlock DM occurs throughout the hemlock zone from the Cascade Mountain Range west to the Pacific Ocean. In north-central Washington, a moderate to heavy infection of western DM occurs in a multistoried ponderosa pine stand, with some mortality.

Asian longhorned beetle

Anoplophora glabripennis Motschulsky

Cooperative efforts continue to eradicate the Asian longhorned beetle (ALB) from the quarantined areas in New York City and Long Island, NY. In 2013, newly infested trees were found in Suffolk County, just outside of the central Long Island quarantine zone (fig. 1).

In Worcester, MA, 23,545 trees were identified as infested and a 110-square mile quarantine by U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), has continued to be in effect since 2012 (fig. 2). No infested trees were found in the Jamaica Plain suburb of Boston in 2013.

In Ohio, ALB surveys and removal efforts continued in Clermont County. The current APHIS quarantine area covers 61 square miles. By the end of 2013, of the 832,012 trees surveyed, 10,430 trees were infested with ALB (fig. 3).

In 2013, surveys for ALB were conducted in Delaware, Maryland, New Jersey, Pennsylvania, and West Virginia, but no detections were reported.

Figure 1. Counties that reported Asian longhorned beetle infestation in 2013.

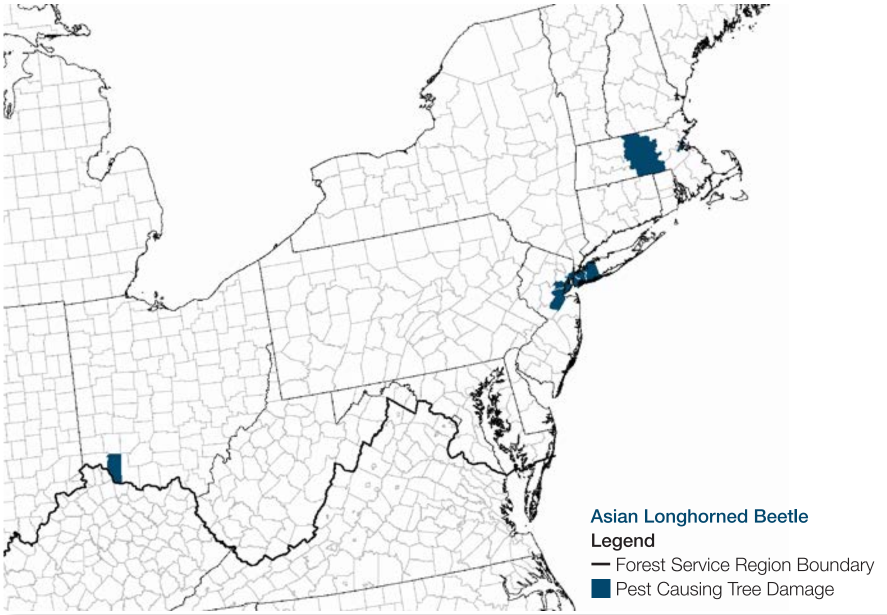


Figure 2. Asian longhorned beetle egg sites and exit holes on maple trees in Worcester, MA. Photo by Kenneth R. Law, USDA Animal and Plant Health Inspection Service, Plant Protection and Quarantine.

Figure 3. Adult Asian longhorned beetle emerging from tree. Photo by Michael Bohne, USDA Forest Service.

WHITE PINE BLISTER RUST

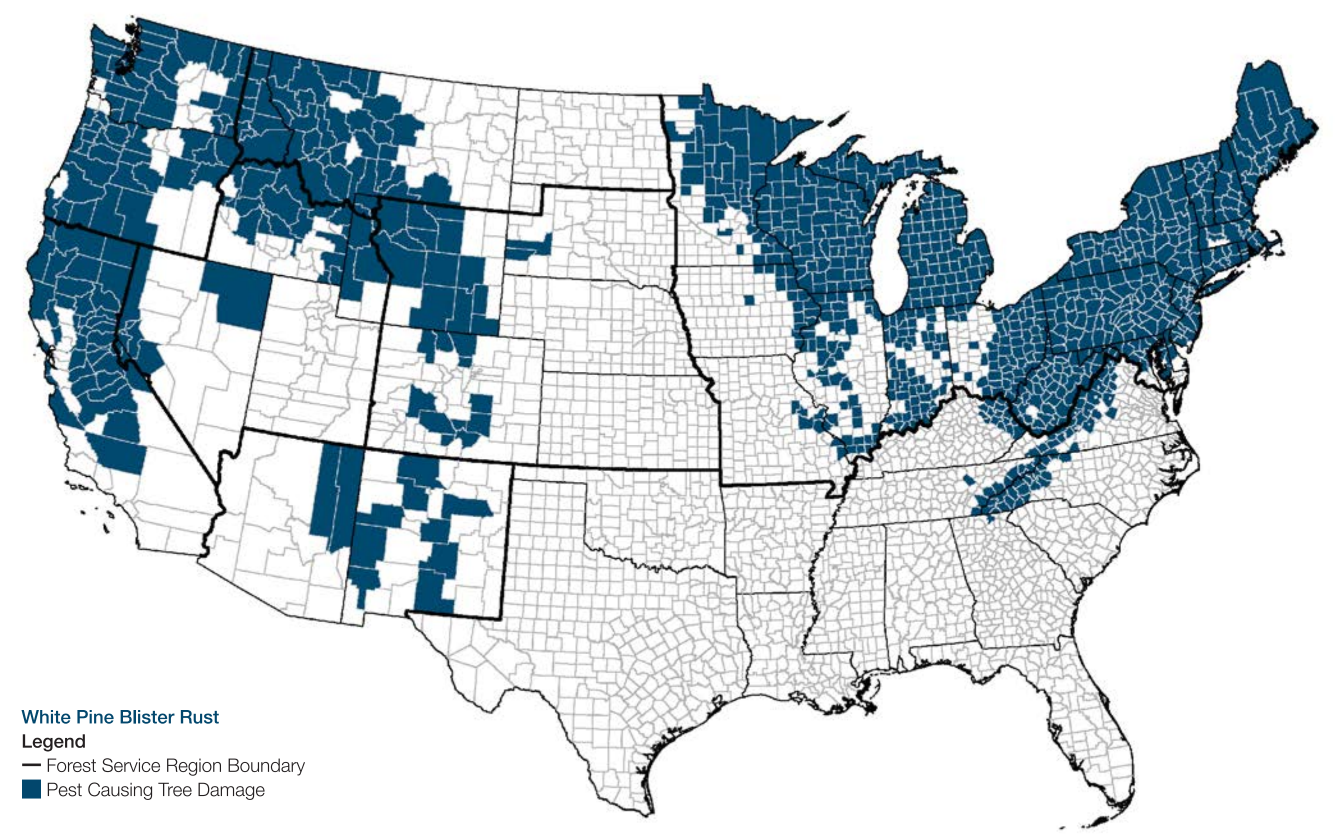
Cronartium ribicola J.C. Fisch. ex Rabenh

In 2013, Maine reported white pine blister rust (WPBR) in Aroostook, Hancock, Lincoln, Penobscot, Somerset, and Washington Counties. In Rhode Island, WPBR was found on white pine in Kent, Providence, and Washington Counties. WPBR was found in all 10 counties in New Hampshire. No new reports of WPBR occurred in West Virginia.

WPBR has spread throughout the range of western white pine in the inland northwest (fig. 1). Although western white pine can still be found at low densities on much of its original range, the acreage where it dominates has been dramatically reduced to around 5 percent of its historical range.

WPBR continues to spread and intensify throughout the range of limber and whitebark pine in the Rocky Mountain Region. The combined impacts of WPBR and mountain pine beetle (MPB) remain a concern for limber and whitebark pine populations in northern Colorado and throughout Wyoming. Decline and mortality continued to occur in limber and whitebark pine populations on the Arapaho-Roosevelt, Bighorn, Medicine Bow, Pike-San Isabel, Rio Grande, and Shoshone National Forests; on Bureau of Land Management lands in central Wyoming (on Green, Ferris, and Shirley Mountains and on Rattlesnake Hills); and within the Great Sand Dunes National

Figure 1. Counties where white pine blister rust was present in 2013.



Park and Preserve. Infected bristlecone pines have also been observed within the Great Sand Dunes National Park and Preserve.

In Wyoming, WPBR-caused mortality occurred on limber and whitebark pine trees statewide, and the disease continues to intensify. The incidence of WPBR was lowest in the Medicine Bow and Sierra Madres Mountain Ranges. A study in the Bighorn National Forest found that MPB incidence was positively correlated with WPBR branch canker severity and stem canker incidence. Whitebark pine on the Shoshone National Forest was predisposed by this rust disease and is succumbing to MPB attacks. In Custer State Park in South Dakota, a survey of the limber pines revealed only one new infection in 2013.

The Northern Region continued to survey and monitor WPBR spread and intensification on limber pine, western white pine, and whitebark pine. WPBR spread throughout the range of whitebark pine, including approximately 500,000 acres above 5,000 feet on the high mountaintops in Idaho and Montana from the Canadian border, south to Glacier and Yellowstone National Parks.

In the Southwest, WPBR caused widespread mortality on five-needle pines. In 2013, infections were detected in multiple trees on the Santa Fe National Forest, indicating that the disease continued to colonize new areas within New Mexico.

Since its introduction, WPBR has spread throughout the range of most western five-needle pines in the Intermountain West. In the Intermountain Region, WPBR was most frequently found on whitebark and limber pine. Western white and sugar pines, some of which are infected, are found only on the Humboldt-Toiyabe National Forest along the California-Nevada border.

In Oregon and Washington, WPBR spread in 2013 throughout the range of five-needle pines (figs. 2 and 3). Southern California white pine continues to remain free of WPBR.

Figure 2. Symptoms of white pine blister rust showing on bark of white pine on the Umpqua National Forest in Oregon. Photo by Richard Sniezko, USDA Forest Service.

Figure 3. Whitebark pine mortality from white pine blister rust in Washington State. Photo by Richard Sniezko, USDA Forest Service.

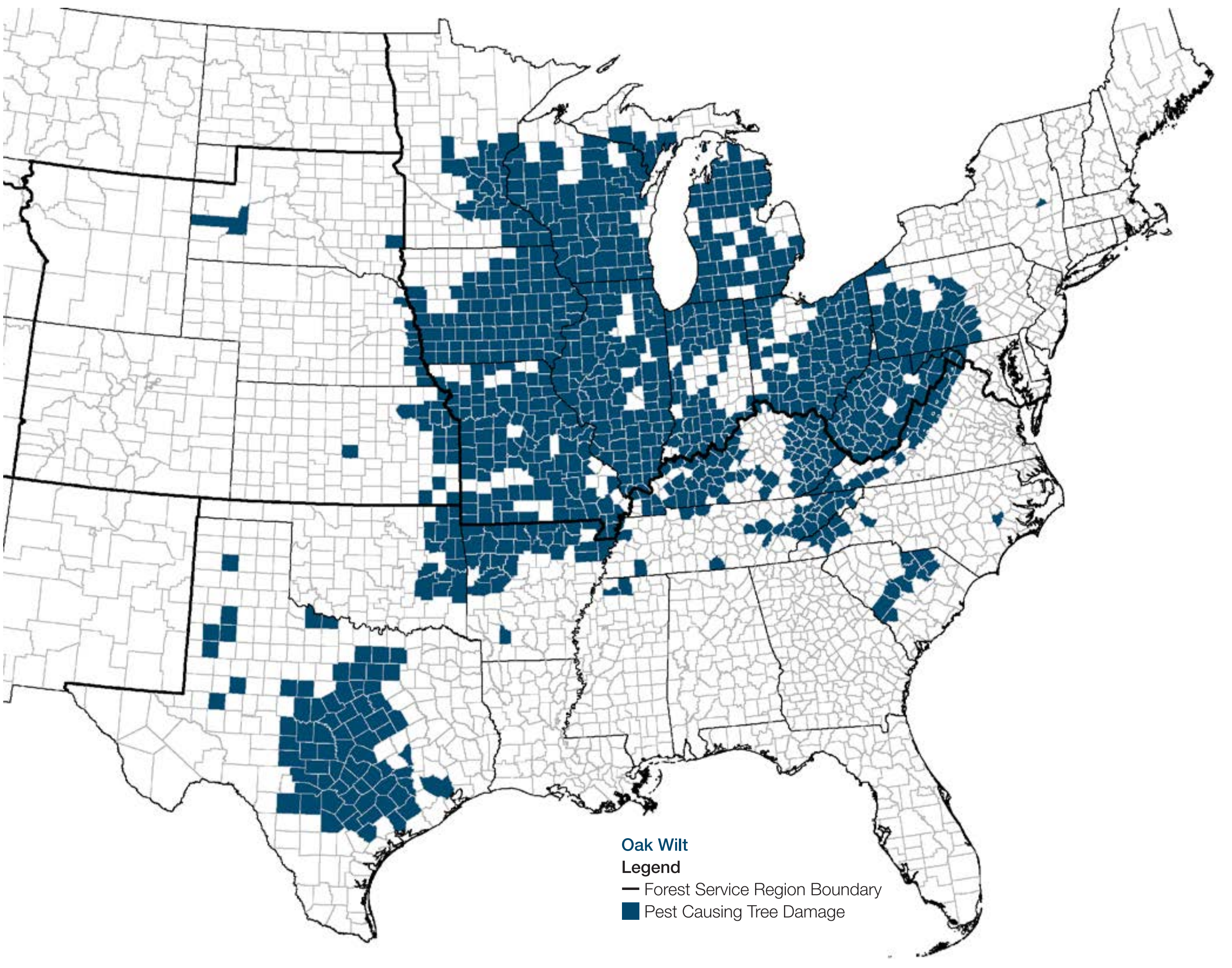
Oak Wilt

Ceratocystis fagacearum Bretz

Oak wilt (OW) disease continued to cause mortality across the Northeastern United States and the South (fig. 1). New York reported two trees having OW in Schenectady County. OW was reported in the Snaggy Mountain area of the Potomac-Garrett State Forest in Garret County, MD. In West Virginia, the disease is widespread throughout, except in Ohio and Webster Counties. No new county records were reported for West Virginia in 2013.

Michigan reported OW spread across its oak resource. New county records in Eaton and Iosco Counties were confirmed. In Wisconsin, new county records for

Figure 1. Counties where oak wilt disease was present in 2013.



OW were reported in Rusk County. No new county records were reported for Minnesota or Missouri in 2013 (fig. 2).

In 2013, no new county records were reported in Illinois, Indiana, and Iowa. In Illinois, OW was present in 90 percent of its counties, while in Indiana OW is known to occur in 63 counties. OW is common in the woodlots of northwestern Indiana in the Kankakee River basin. OW on white oak has not been detected in Indiana. In each incident, mortality occurs on red and black oak in small infection centers less than 1 acre in size.

OW disease conditions in nearly all Southern Region States have been static for a number of years, with no new positive counties recorded. Surveys for OW are no longer routinely performed in most States and serious or widespread damage is generally unknown, except in Texas. In Texas, widespread mortality of live oak and Texas red oak continues and a survey and suppression program is in full operation (fig. 3). No new detections were reported for any Southern State in 2013.

Figure 2. Oak wilt-caused mortality on northern pin oak in Ramsey County, MN. Photo by Steven Katovich, USDA Forest Service.

Figure 3. Leaf symptoms from oak wilt disease on live oak, Kerrville, TX. Photo by Paul A. Mistretta, USDA Forest Service.

Fusiform rust

Cronartium quercuum f. sp. *fusiforme* Hedg. and Hunt ex Cumm.

In the South, fusiform rust causes deformation and mortality region-wide on loblolly and slash pine hosts (fig. 1), particularly in young plantations, in 12 States with susceptible host pines (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia). Severity of damage is highly variable depending on location and annual weather-mediated pressure (fig. 2). No recent estimates of the number of affected acres are available, but past estimates from forest inventory data (circa 1987 to 1993) indicate 13.4 million acres of planted and natural loblolly and slash pine stands were affected with infection levels of 10 percent of the pines or greater (fig. 3).

Figure 1. Aecia on pine caused by fusiform rust. Photo by Robert L. Anderson, USDA Forest Service.

Figure 3. Counties where fusiform rust was present in 2013.

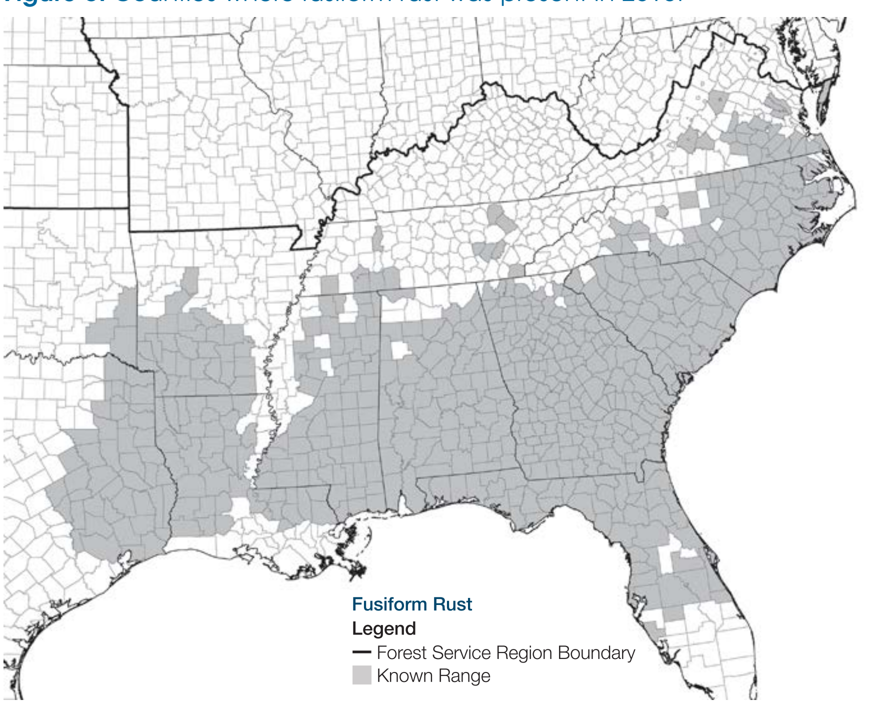


Figure 2. Stem gall caused by fusiform rust. Photo by USDA Forest Service.

Dogwood Anthracnose

Discula destructiva Redlin

In the Northeastern Area, dogwood anthracnose continued to occur across its historic range statewide in Delaware, Maryland, New Jersey, Ohio, Pennsylvania, and West Virginia, in 2013. Ohio detected new damage in Jefferson County, Pennsylvania detected new damage in Adams County, and Maryland detected new damage in Frederick County.

In the Southern Region, dogwood anthracnose disease has now spread to most of the cool, moist, high-elevation areas with dogwood host in Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and Virginia (fig. 1). Widespread dieback and mortality have resulted (fig. 2). In the hardest hit areas, the dogwood population has been reduced by as much as 90 percent. No new affected areas have been discovered in recent years, however, and the disease spread to new areas has attenuated.

Figure 1. Old dogwood anthracnose canker on dead stem, Bent Creek, NC. Photo by Robert L. Anderson, USDA Forest Service.

Figure 2. Dogwood anthracnose symptoms on flower bracts. Photo by Robert L. Anderson, USDA Forest Service.

Beech bark disease

Cryptococcus fagisuga Lindinger, *Neonectria ditissima* Tul. & C.Tul. Samuels & Rossman, *N. faginata Lohman*

Beech bark disease (BBD) has spread progressively into the Northeastern United States, and several discontinuous jumps have transported it as far as west as Michigan, as far south as central Virginia, and to isolated locations in eastern Tennessee and western North Carolina (fig. 1).

In North Carolina, 14 western counties were reported with BBD, but no new counties were reported in 2013. Intensification and spread to stands in some areas at elevations lower than 4,000 feet was reported. The disease is prevalent in the Great Smoky Mountains National Park and has been particularly damaging to beech gaps throughout the park and nearby mountains. In Tennessee, BBD has occurred in five eastern Tennessee counties. In Virginia, BBD has been known to occur in six counties in the western part of the Commonwealth. The disease was generally restricted to the border area in West Virginia and along the Shenandoah National Park. The Mount Rogers area in Virginia continues to have the only high-elevation beech stands known to be disease free in the South (fig. 2). BBD was reported in 12 counties in West Virginia.

In the Northeast in 2013, discolorations from BBD were mapped by aerial survey in St. Lawrence County, NY. Dieback and mortality were mapped by aerial survey statewide in Vermont. Although the disease remained throughout beech stands in Maine

Figure 1. Counties where beech bark disease was present in 2013.

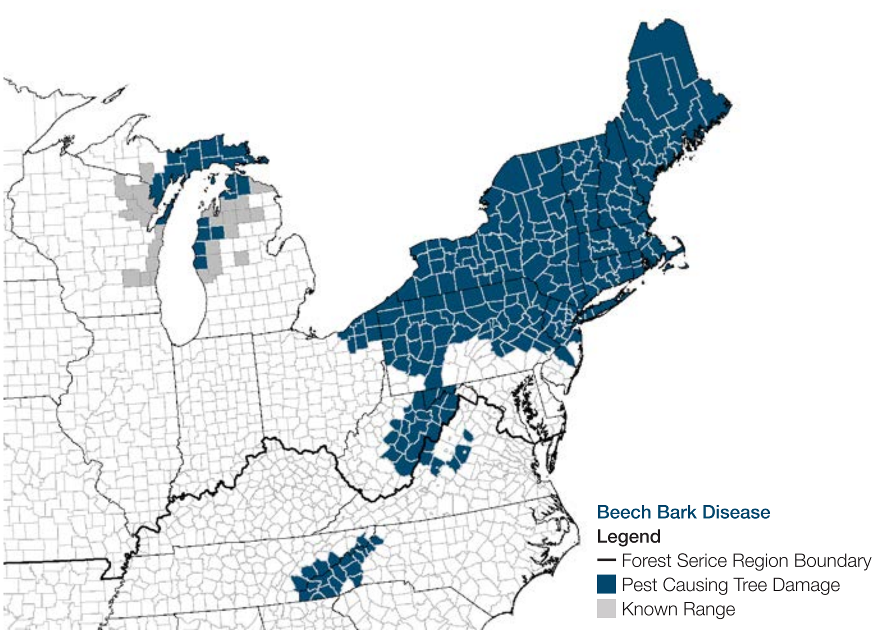


Figure 2. Beech bark disease symptoms on American beech. Photo by USDA Forest Service.

and New Hampshire, no significant activity was reported in 2013. In Massachusetts, discoloration from BBD was mapped by aerial survey in Hampshire County. In Connecticut, the disease was endemic statewide and caused mortality on stressed trees. Infestation of beech was limited throughout most of Rhode Island; most beech showed no sign of disease.

In Delaware, more than 100 trees at four sites in New Castle and Kent Counties were revisited and inspected for scale and dieback. No scales were found, indicating that BBD was not well established in the State. In 2013, Maryland reported increases of BBD in Garrett County. In New Jersey, most beech trees found in the northern counties have been infested and infected by both the scale and fungus, respectively. At this time, no BBD has been found in central or southern New Jersey. Small-scale populations have been identified in the central counties. In Pennsylvania, no surveys were conducted and no reports were received in 2013.

Although BBD and beech scale have been confirmed in northeastern Ohio for several years, the amount of beech scale encountered by researchers has reduced significantly from recent years.

In Michigan, no newly affected counties have been reported since 2011. The advancing front of BBD continued to move across the beech resource. Fragmentation of beech forests in the Lower Peninsula of Michigan slowed the spread eastward from the initial infestations in Mason and Oceana Counties. The killing front continued to expand toward the western extent of beech in the central part of the Upper Peninsula (fig. 3). Local killing fronts were beginning to appear in the extreme northern Lower Peninsula. In Wisconsin, BBD was first detected in Door County in 2009.

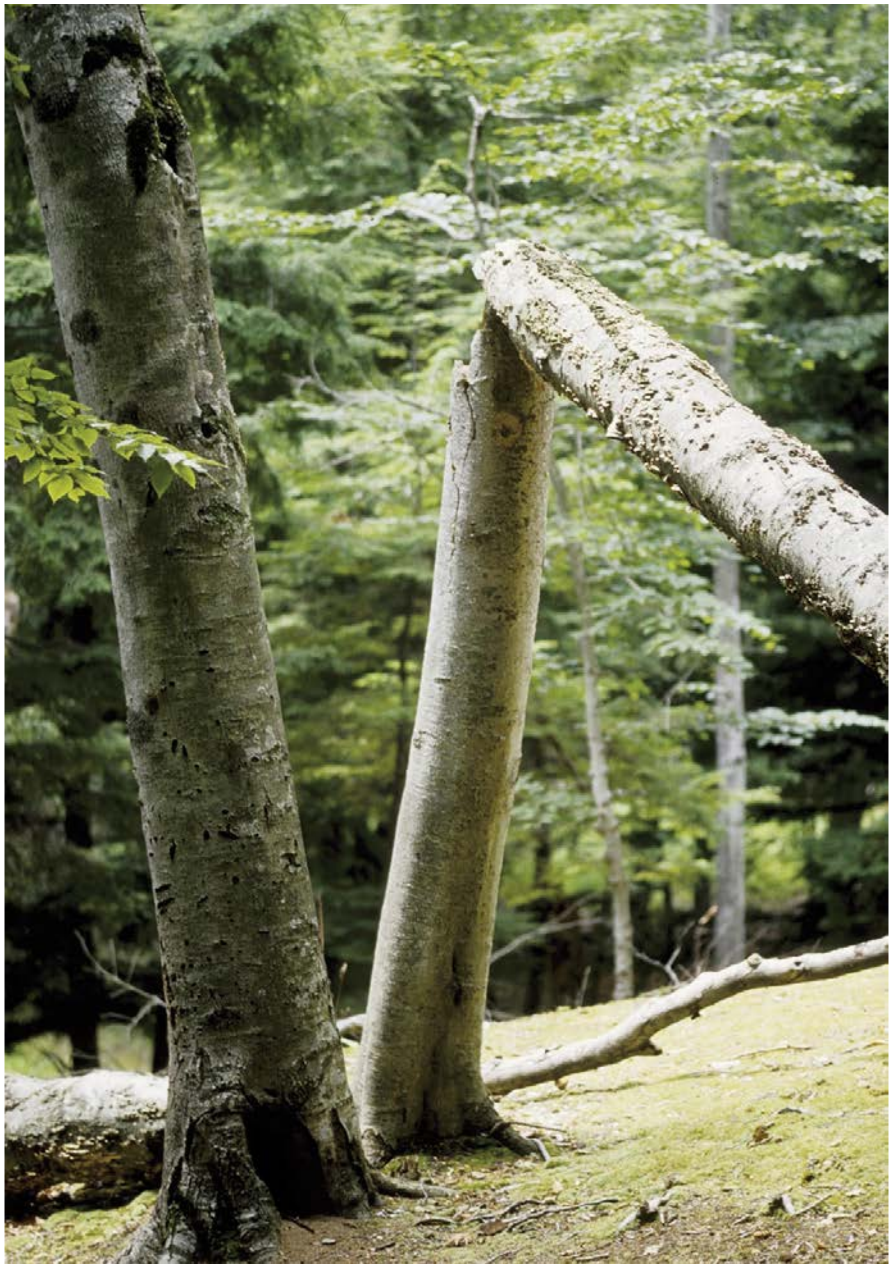


Figure 3. Beech snap in a stand affected with beech bark disease in Michigan. Photo by Joseph O'Brien, USDA Forest Service.

Butternut canker

Ophiognomonia clavigignenti-juglandacearum = Sirococcus clavigignenti-juglandacearum Nair, V.M.G.: Chuck Kostichka and J.E. Kuntz

Figure 1. Butternut canker symptoms. Photo by USDA Forest Service.

Butternut canker continued to have a damaging effect throughout the entire range of butternut (fig. 1). In the Northeastern Area, butternut canker continued to cause scattered dieback and mortality on butternut forests (fig. 2).

In the South, butternut canker severely affected butternut trees in seven States (Alabama, Arkansas, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia) and spread into most areas where butternut was present (fig. 3). Disease spread into new areas has slowed, and no new areas have been discovered in recent years.

No formal surveys have been conducted recently.

Figure 2. Butternut canker symptoms. Photo by USDA Forest Service.

Figure 3. Counties that reported butternut canker in 2013.