

# 2014 Colorado Forest Insect and Disease Update

*A supplement to the 2014 Report  
on the Health of Colorado's Forests*



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Front and back cover photo: William M. Ciesla

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▲ Meg Halford, CSFS Franktown District assistant district forester, talks with landowners about the results of an aerial survey to map pine sawfly defoliation.

## Introduction

Forest insects and diseases represent an integral part of the dynamics of Rocky Mountain ecosystems. Bark beetle outbreaks, for example, can beneficially eliminate most of the older host trees over extensive areas of mature forests, which sets the stage for the development of young, more vigorous forests. However, large-scale outbreaks also can devastate forests critical for timber production, wildlife habitat, recreation and clean water supplies.

Monitoring forests to assess the status of damaging insects, diseases and other pests is an integral part of forest management. In Colorado, the primary source of data on current pest conditions is the annual aerial forest health survey – a cooperative program involving personnel from the USDA Forest Service and the Colorado State Forest Service (CSFS).

Aerial forest health surveys provide information on location and intensity of damage that forest landowners can use to manage forest pests. Trained observers fly in small aircraft (e.g., Cessna 206 and/or Cessna 210) and map the location of the current year's forest damage. Data are recorded on touch-screen computers containing mapping software. An interface with a GPS displays the location and track of the survey aircraft. Resulting data are transmitted daily to a central location, where a geographic information system (GIS) specialist analyzes and summarizes the data. Some areas detected during the aerial survey are later ground-checked to verify the agent responsible for the damage and the level of severity.

Other sources of information on the status of the state's forests are field visits made by CSFS foresters. These visits help foresters identify forest pest activity while advising private landowners in the management of their forests, managing state-owned forestlands and conducting forest inventories. In addition, the CSFS, in cooperation with the Colorado Department of Agriculture, USDA Animal and Plant Health Inspection Service (APHIS), USDA Forest Service and other groups, conducts special surveys to ensure early detection of invasive species.

The CSFS also produces an annual report on the health of Colorado's forests, which provides information to the Colorado General Assembly and citizens about emerging and ongoing forest health issues, as well as actions the agency is taking to reduce their impacts. This report is a supplement to the 2014 Report on the Health of Colorado's Forests, which is available online at [www.csfs.colostate.edu](http://www.csfs.colostate.edu).

## Forest Insect and Disease Highlights

- For the third successive year, Colorado's most widespread and damaging forest insect pest was spruce beetle. A total of 485,000 acres with active infestation were observed in high-elevation Engelmann spruce forests throughout the state.
- Mountain pine beetle infestations continued to decline following a massive outbreak that impacted nearly 3.4 million acres of Colorado forests between 1996 and 2013. In 2014, only 15,000 acres with active infestation were mapped. Most of the damage occurred in Larimer County.
- Stands of mature Douglas-fir continued to be attacked and killed by Douglas-fir beetle in the southern portions of the state. Approximately 34,000 acres were affected in 2014.
- Western balsam bark beetle and root disease fungi, which are responsible for a complex known as "subalpine fir decline," continued to cause tree mortality in high-elevation subalpine fir forests. Approximately 173,000 impacted acres were mapped.
- White fir continued to be attacked and killed by the fir engraver beetle. Damage was mapped on 43,000 acres in 2014.
- Western spruce budworm defoliated 178,000 acres of Douglas-fir, white fir and spruce forests in southern Colorado. Damage was seen as far north as portions of the Rampart Range.
- Douglas-fir tussock moth reached epidemic levels on the slopes of Cheyenne Mountain and in the Rampart Range. Ornamental blue spruce trees also were defoliated in several Front Range communities, and large numbers of this pest's larvae were seen in a forested community west of Boulder.
- A species of pine sawfly caused severe defoliation of ponderosa pine on 7,400 acres in Elbert and northern El Paso counties.
- Western tent caterpillar and large aspen tortrix caused defoliation of a combined 78,000 acres of aspen forests.
- Thousand cankers disease, transmitted by the walnut twig beetle, continued to kill ornamental black walnuts in many Colorado communities. In 2014, this disease was detected as far east as Fort Morgan.

## Exotic Pest Highlights

- Emerald ash borer (EAB), an insect native to Asia that has killed millions of North American ash trees, was detected in the City of Boulder in 2013. A special survey, designed to delimit the area of infestation, confirmed the pest in 10 contiguous square miles in Boulder. Surveys in portions of several other Front Range communities in 2014 did not confirm the presence of EAB.
- No gypsy moths were trapped in a statewide trapping effort for the pest, a defoliator of primarily broadleaf trees.
- Several limber pines infected with white pine blister rust were detected in the vicinity of Allenspark, extending the known northern distribution of this disease in Colorado.

## Status of Forest Insects, Diseases and Other Damaging Agents

### Indigenous Pests

#### Conifer Forests

#### Spruce Beetle

*(Dendroctonus rufipennis)*

Spruce beetle outbreaks continued across Colorado's high-elevation Engelmann spruce forests in 2014. The beetle was the state's most widespread forest pest for the third successive year. Infestations occurred on 485,000 acres in 2014 – an increase of 87,000 acres compared to 2013. Outbreaks typically develop following windthrow events, which provide breeding sites in downed trees that allow the insect population to build to large numbers.

Areas severely impacted by spruce beetle in 2014 include:

- Cochetopa Hills – Severe levels of tree mortality occurred in most high-elevation forests from North Pass northeast to Poncha Pass, and south to the old mining community of Bonanza.

- Grand Mesa – Infestations continue in mature spruce forests throughout the area.
- Mount Zirkel/Rabbit Ears Range – Infestations here, which are the result of a 1997 blowdown event in the Mount Zirkel Wilderness Area, continue in the Rabbit Ears Range west of Rocky Mountain National Park.
- Sangre de Cristo Range – Infestations intensified significantly over much of the range in 2014. Most high-elevation Engelmann spruce forests here now exhibit moderate to severe levels of damage.
- San Juan/La Garita Mountains – Infestations intensified significantly in the Henson Creek Basin and in the mountains surrounding Lake San Cristobal and the upper Lake Fork of the Gunnison River near Lake City. This is now part of the northern front of an outbreak that was first detected in the Weminuche Wilderness in 2003. Large areas with moderate to severe damage were mapped here. Small groups of dead trees also were detected in spruce forests in several tributaries of the Little Cimarron and Cimarron River basins. Localized activity has been seen in these areas since 2012, and appears to be intensifying.

Infestations are continuing at moderate to severe levels in the extreme western portions of the Rio Grande Basin, near the headwaters of the Rio Grande River. However, most of the spruce forests in the upper basin have been decimated by previous years of the spruce beetle outbreak. These stands generally have either no current activity, or only a trace of new attacks on trees of the intermediate crown class. Previously affected forests have now taken on a gray cast that can be seen for miles.

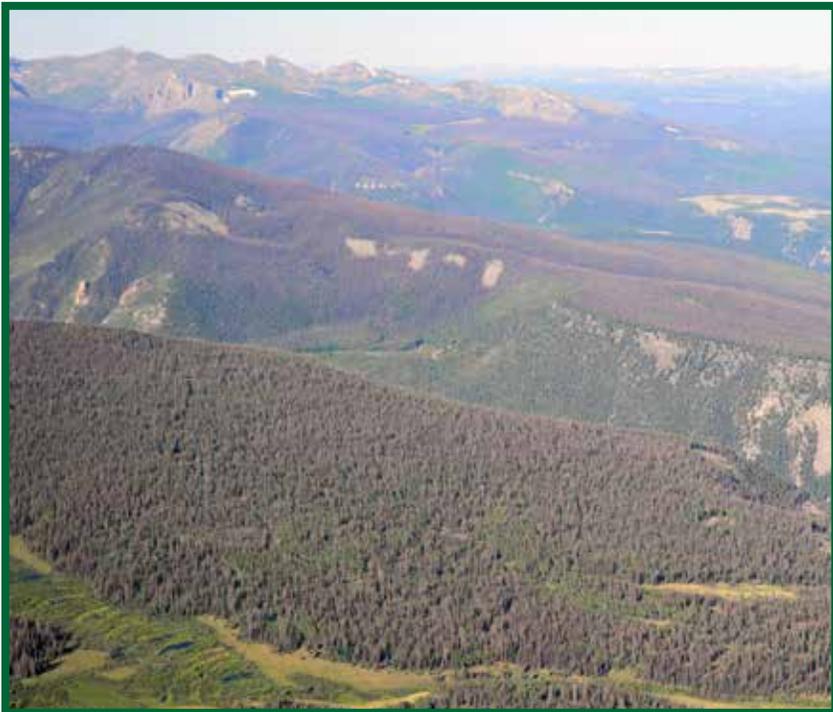
- Wet Mountains – Tree mortality is continuing in the Greenhorn Peak area of the Wet Mountains, where populations have been building up since a windthrow event in 2007.



▲ Before: This Engelmann spruce forest, located in Slumgullion Pass near Lake City, was healthy and vigorous in 2006.



▲ After: By 2014, most of the trees have been killed by spruce beetle in the same Engelmann spruce forest.



▲ Spruce tree mortality from spruce beetles in the Rio Grande Basin.

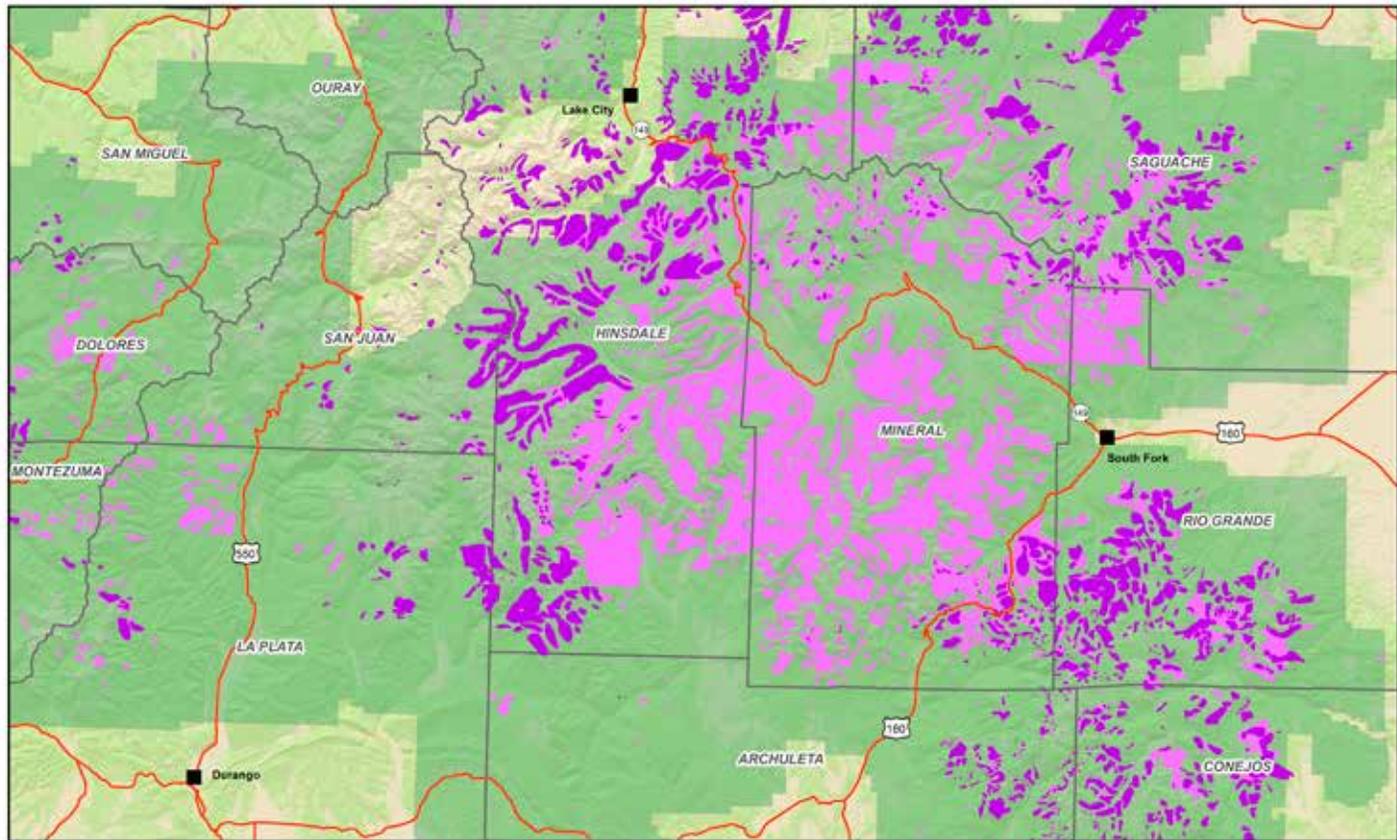


▲ Spruce beetle larva.



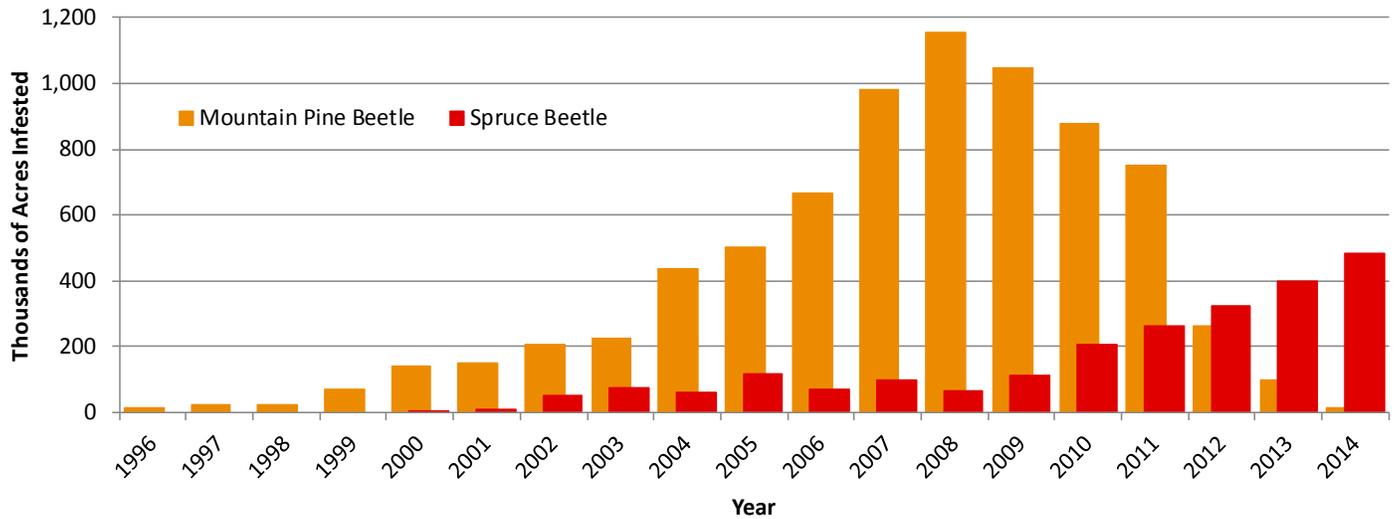
▲ Galleries or tunnels developed by spruce beetles under the bark.

### Spruce Beetle in Southwestern Colorado, 1996-2014



▲ Spruce beetle outbreaks occurred in many areas of Colorado, but the southwestern region is experiencing the largest ongoing outbreak in the state.

## Acres Impacted by Spruce Beetle and Mountain Pine Beetle, 1996-2014



▲ While the mountain pine beetle epidemic continued to slow dramatically, the spruce beetle outbreak has continued to grow.

### Mountain Pine Beetle

(*Dendroctonus ponderosae*)

In 2014, the area affected by mountain pine beetle declined to its lowest level since 1996. A total area of 15,000 acres with active infestation were mapped during the annual aerial forest health survey. Most of these acres (approximately 10,000) were in Larimer County, in the vicinity of Red Feather Lakes. Infestations also continued along the eastern slope of the Sangre de Cristo Range and on Miller Mesa near Ridgway. The decline in area with active infestation is primarily due to the death of suitable host trees during previous years of the outbreak. Since 1996, almost 3.4 million acres of lodgepole, ponderosa and five-needle pines have been affected by this bark beetle.



▲ Damage to subalpine fir caused by a combination of western balsam bark beetle and root disease.

### Western Balsam Bark Beetle/Root Disease Complex

Tree mortality of subalpine fir, caused by a combination of at least two root disease fungi (*Armellaria* spp. and *Heterobasidium parviporum*) and western balsam bark beetle (*Dryocoetes confusus*) continued at chronic levels during 2014. Approximately 173,000 acres of tree mortality were mapped in 2014, compared with 178,000 acres in 2013. Damage occurred in most of Colorado's high-elevation forests where subalpine fir is a component. Tree mortality was especially noticeable throughout the Elk Mountains between McClure and Independence passes. Most other infested areas were classified as having light damage.



▲ Limber and ponderosa pine trees killed by mountain pine beetle on the eastern slope of the Sangre de Cristo Range.

## Douglas-fir Beetle

(*Dendroctonus pseudotsugae*)

Douglas-fir beetle continued to kill groups of mature Douglas-fir trees in several areas of the state. Factors that favor development of outbreaks include periods of below-normal precipitation, fresh windthrow and outbreaks of defoliating insects. In 2014, tree mortality attributed to this beetle was mapped on 34,000 acres, compared to 43,000 acres in 2013.

Areas with concentrated tree mortality from Douglas-fir beetle include:

- Elk Mountains – Mortality continued at moderate levels in portions of the Crystal River Basin, from the community of Marble east to Mount Sopris.
- Rampart Range – Beetle activity continued in portions of the northern Rampart Range, in the vicinity of areas defoliated by Douglas-fir tussock moth in 2007-2008.
- Sangre de Cristo Range – Group kills of up to 100 trees continued to occur on the western slope of the range. The heaviest damage was observed in stands adjacent or in close proximity to the 2010 Medano Fire burn area, west of Great Sand Dunes National Park and Preserve.
- San Juan Mountains – Infestations consisting of groups of 10 to 50 trees each were detected in the upper San Miguel River Basin in the vicinity of Telluride. Activity also continued in portions of the Lake Fork of the Gunnison River Basin, with numerous centers of tree mortality detected from Elk Creek south to Lake City, and at the lower elevations of the Henson Creek Basin. Moderate to severe levels of damage continued in the upper Uncompahgre River Basin, from upper Dallas Creek east to Cow Creek and its tributaries, from Ridgway south to Ouray. Similar levels of tree mortality have been mapped in this area since at least 2011. Additionally, tree mortality continued in mature Douglas-fir stands north of Pagosa Springs.



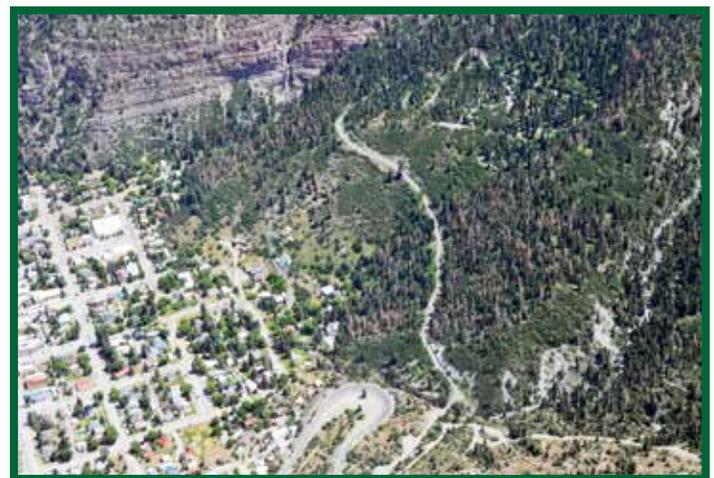
▲ Douglas-fir beetle infestations near Pagosa Springs.

## Fir Engraver Beetle

(*Scolytus ventralis*)

Fir engraver beetle is a pest of true firs throughout the West, and outbreaks often develop following periods of below-normal precipitation. In southern Colorado, white fir is the preferred host. In 2014, infestations occurred on 43,000 acres, compared to 37,000 acres in 2013 and only 4,700 acres in 2012. Areas of significant damage occurred in:

- Culebra Range/Spanish Peaks – Infestations continued to occur in low-elevation mixed conifer forests along the eastern slopes of the Culebra Range, north and west of La Veta. Damage also was detected along the eastern slopes of the Culebra Range, south of Cucharas Pass.
- Pike's Peak Area – Fir engraver beetle reached epidemic proportions from Chipita Park east to Manitou Springs and south along the lower slopes of Cheyenne Mountain. Infestations declined, however, in the Four Mile and Eight Mile (Phantom Canyon) basins.
- Sangre de Cristo Range – Moderate to severe infestations were detected in white fir stands on the eastern slopes of the range, north of the Taylor Creek Basin. In a number of areas, white fir mortality due to fir engraver beetle was accompanied by defoliation by western spruce budworm.
- San Juan Mountains – An outbreak of fir engraver beetle erupted into moderate and severe levels in white fir stands from the community of Portland (near Ridgway) south to Ouray. Low levels of damage also were detected in this area during ground checks made in 2013.
- Wet Mountains – Tree mortality due to fir engraver beetle increased significantly in low-elevation mixed conifer forests along the eastern slope of the Wet Mountains. Most areas of infestation were classified as “light,” but a few stands suffered severe damage.



▲ Severe tree mortality caused by fir engraver beetle in Ouray, Colo.

## Roundheaded Pine Beetle

(*Dendroctonus adjunctus*)

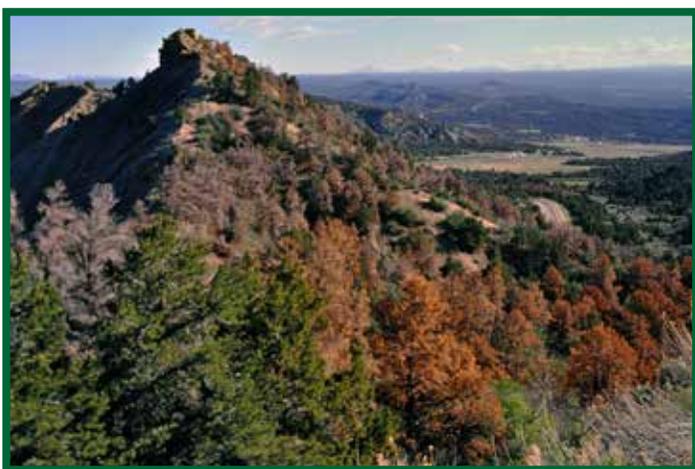
An outbreak of roundheaded pine beetle, another bark beetle pest affecting ponderosa pines, was first detected in the plateau above and east of Dolores Canyon in 2013. Damage continued in 2014, with approximately 1,400 acres affected. Both mountain pine beetle and ips engraver beetles (*Ips* spp.) also have been detected in this area.



▲ An outbreak of roundheaded pine beetle in ponderosa pine, upper Dolores Canyon. Photo: Brian Howell, USDA Forest Service, Rocky Mountain Region

## Insects of Piñon Pine

Moderate to heavy levels of tree mortality in piñon pine, caused by a complex of insects – piñon ips (*Ips confusus*), twig beetles (*Pityophthorus* spp.) and, in some cases, a shoot borer (*Dioryctria albiovittella*) – occurred along the I-25 corridor near Walsenburg and Trinidad and in piñon-juniper woodlands near Cañon City in 2013. The level of activity declined significantly in 2014, and the only notable damage detected was a small area of tree mortality at the mouth of Chicora Canyon near Ludlow.



▲ Piñon ips near Mesa Verde National Park.

## Western Spruce Budworm

(*Choristoneura freemani* [=occidentalis])

Larvae of western spruce budworm feed on buds and current-year foliage of Douglas-fir, true firs and spruce. Outbreaks have been underway across portions of southern Colorado since about 1998. In 2014, approximately 178,000 acres of aerially visible defoliation were mapped, compared with 156,000 acres in 2013, 217,000 acres in 2012 and 155,000 acres in 2011. Infestations and resultant defoliation have been gradually spreading northward.

Areas of significant western spruce budworm defoliation in 2014 include:

- Cochetopa Hills – Extensive defoliation was detected from Poncha Pass south to Bonanza and in the lower elevations of the Cochetopa Hills.
- Culebra Range/Spanish Peaks – Western spruce budworm continued to cause aerially visible defoliation in the Culebra Range and the Spanish Peaks. The most extensive and severe defoliation occurred on the east- and south-facing slopes of the Spanish Peaks, and in the Culebra Range from Cucharas Pass south to the New Mexico border.
- Pike's Peak Area – Defoliation occurred on the slopes of Raspberry Mountain near Divide and in several neighboring drainages. Defoliation also was detected in Douglas-fir stands from Chipita Park east to Manitou Springs, and south from Cheyenne Mountain to Turkey Creek.
- Rampart Range – Infestations were mapped in the southern portions of the Rampart Range, northeast of Woodland Park.
- Sangre de Cristo Range – Defoliation continued in most low-elevation Douglas-fir stands on both the eastern and western slopes of the Sangre de Cristo Range. The most extensive and severe defoliation occurred from Mount Zwischen south toward Blanca Peak, on the north-facing slopes of Mount Maestas, in the Big and Little Sheep mountains and on Silver Mountain.
- San Juan Range – Defoliation was mapped in the upper Dolores and San Miguel river basins and in the vicinity of Mount Sneffels.
- Waugh Mountain – Areas of localized defoliation occurred on the north-facing slopes of Waugh Mountain, located west of Cañon City, and in several drainages to the south.
- Wet Mountains – The outbreak in the Wet Mountains continued to expand northward, and defoliation was mapped in the northernmost areas of host type. Heaviest damage occurred from Hardscrabble Creek to the south. Several areas of defoliation were detected in the Wet Valley, and an area of defoliation also was mapped on Horseshoe Mountain and South Webster Park, south of the Royal Gorge.



▲ Mature western spruce budworm larvae on an Engelmann spruce tree.



▲ Defoliation of Douglas-fir by western spruce budworm near Poncha Pass.

## Pine sawfly

(*Neodiprion autumnalis*)

A species of pine sawfly has been present at low to moderate levels in portions of Elbert and El Paso counties, along the eastern fringes of Colorado's ponderosa pine forests, for many years. In 2014, a major outbreak developed in this area, causing nearly 100 percent defoliation of ponderosa pine over extensive areas. Numbers of sawfly larvae were so high that they stripped host trees of their foliage long before their feeding cycle was completed. This resulted in large numbers of immature larvae migrating to the bases of their host trees in search of food, and ultimately dying of starvation. A total area of 7,400 acres with heavy defoliation was mapped during the aerial forest health survey. Because local landowners are concerned about the level of damage that may occur in 2015, an egg survey is underway to try to predict defoliation levels in future years.



▲ Pine sawfly larvae on a ponderosa pine tree.



▲ Pine sawfly defoliation in Elbert County.

## Douglas-fir Tussock Moth

(*Orgyia pseudotsugata*)

Larvae of Douglas-fir tussock moth defoliate Douglas-firs and true firs. Outbreaks can cause complete stripping of the foliage of host trees in a single season and are cyclic, occurring at seven- to 10-year intervals. The last outbreak in Colorado occurred from 2004 to 2008 near Aspen Park and in the northern Rampart Range.

In 2014, five areas with severe defoliation were detected on the slopes of Cheyenne Mountain south of Colorado Springs. Another area of defoliation occurred in the northern Rampart Range, making the total area defoliated 530 acres. In addition, isolated defoliation of Colorado blue spruce occurred in urban areas in Colorado Springs, Denver and Fort Collins, and in several forested subdivisions west of Boulder.



▲ A pupal case and an adult male Douglas-fir tussock moth.



▲ Defoliation of Douglas-fir by western spruce budworm near Poncha Pass.

## Deciduous Forests

### Sudden Aspen Decline

Sudden aspen decline (SAD) refers to the dieback and death of aspen forests that has been a concern in Colorado and adjoining states since 2005. The condition is believed to be the result of successive years of below-normal precipitation. The peak year for SAD was 2008, when about 17 percent of Colorado's aspen forests were affected. However, relatively few areas with SAD have been detected during the annual aerial forest health survey in the last few years. In 2014, approximately 1,200 acres were mapped, mostly in Mesa, Montrose and Ouray counties. In many areas, the death of larger overstory aspens has resulted in a release of younger aspen regeneration and recovery of the stands.

### Defoliating Insects of Aspen

Western tent caterpillar (*Malacosoma californicum*) and large aspen tortrix (*Choristoneura conflictana*), the larval stage of which is a leaf roller, defoliate aspen forests in Colorado. Both species have caused defoliation of aspen forests in southern Colorado since 2004, and from above the damage from either of these species is indistinguishable from the other. In 2014, approximately 78,000 acres with aerially visible defoliation from these pests were mapped, compared with 54,000 acres in 2013 and 29,000 acres in 2012.

Areas of significant defoliation occurred in several locations across the southern portions of the state:

- Cochetopa Hills – Areas of heavy defoliation occurred from Poncha Pass south to Bonanza and west into the Cochetopa Hills. Ground checks indicated that western tent caterpillar was the primary defoliator here, as has been the case in past years. A local resident reported occurrence of mass migrations of western tent caterpillar larvae, which even used the outside of his home as a site for pupation.
- Culebra Range/Spanish Peaks – Extensive defoliation in the upper North Fork Purgatoire River basin, caused by western tent caterpillar and which has occurred since at least 2006, continued in 2014, but at slightly lower levels of intensity. An area of aspen defoliation on the eastern slope of East Spanish Peak, first detected in 2013, expanded in area in 2014. Localized areas of defoliation also occurred in the foothills south of the Spanish Peaks.
- Sangre de Cristo Range – Localized defoliation continued to occur in the range, but at lower levels than in previous years. However, a relatively large area of defoliation was mapped in upper Medano Creek.
- Wet Mountains – Defoliation continued in several locations in the Wet Mountains. Ground checks indicated this outbreak was largely caused by large aspen tortrix. However, an area of heavy defoliation north of Lake San Isabel was due to an outbreak of western tent caterpillar.

- Elk Mountains – Small pockets of defoliation occurred in several locations in the Crystal River Basin and south of Aspen. An area of defoliation in the Roaring Judy Basin, north of Almont and which was also present in 2013, was caused by large aspen tortrix.



▲ A colony of western tent caterpillar.



▲ Large aspen tortrix larva.



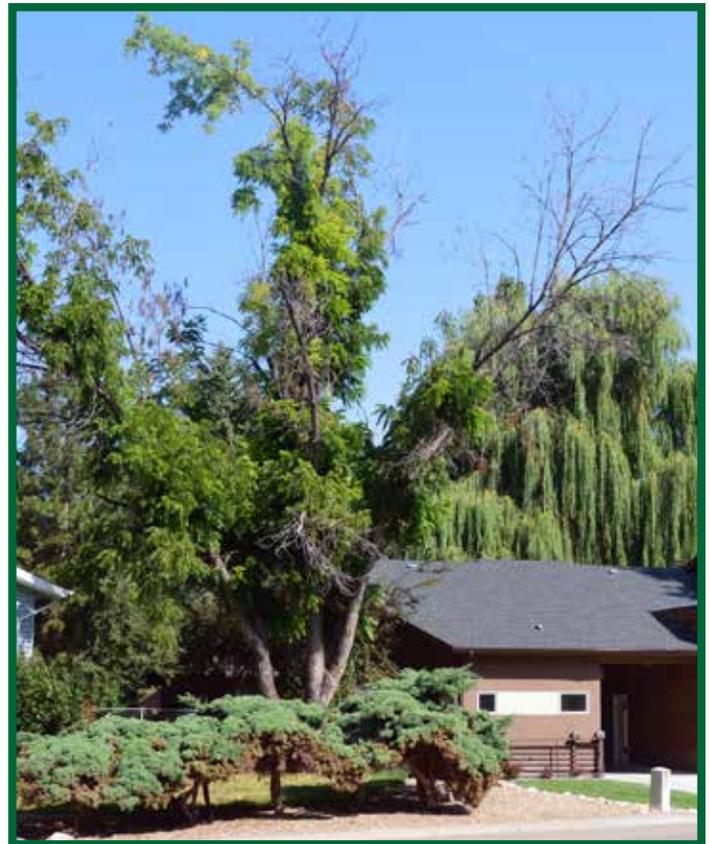
▲ Heavy defoliation of aspen forests by western tent caterpillar, near Bonanza.

### Other Broadleaf Defoliators

Defoliation and discoloration of New Mexico locust trees, caused by a leaf webbing caterpillar (*Agonopterix* spp.) and first observed south of La Veta in 2013, declined significantly in 2014. A single area of aerially visible defoliation was mapped at the mouth of Chaparral Creek on the north slope of West Spanish Peak.

### Thousand Cankers Disease/Walnut Twig Beetle

Thousand cankers disease, caused by a fungus (*Geosmithia morbida*) and transmitted from tree to tree by the walnut twig beetle (*Pityophthorus juglandis*), has been killing black walnut trees in Colorado's urban forests for a number of years. A cooperative survey conducted in 2014 by the CSFS in cooperation with Colorado State University (CSU) Extension, the CSU Plant Diagnostics Clinic and the City of Fort Morgan led to the detection of this disease in Fort Morgan. This is the easternmost location where this disease has been found in Colorado. Decline and death of ornamental walnuts continued in urban areas from Cañon City north to Fort Collins. Also, the walnut twig beetle was confirmed for the first time near the Kansas border in Kiowa County.



▲ This black walnut tree, beside a Fort Collins home, is infested with thousand cankers disease.

## Exotic Pests

The accidental introduction and establishment of exotic insects, fungi, plants and other organisms, primarily via international trade, threatens forests worldwide. Non-native species can cause severe damage in their new habitats, because their new host plants may have little or no resistance to the introduced pest. Moreover, natural enemies may not be present in the new habitat to help keep populations in check. Once established, many introduced pests can be further dispersed via long-distance transport of firewood and nursery stock. Several introduced pests, described below, pose a threat to Colorado's forests.

### Emerald Ash Borer

(*Agrilus planipennis*)

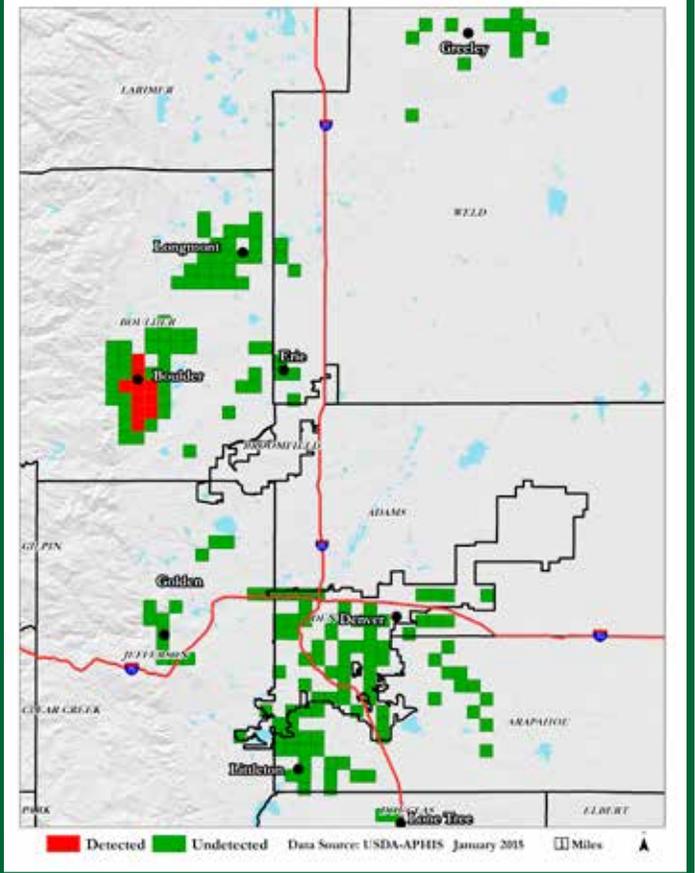
Emerald ash borer (EAB) is native to eastern Asia. The beetle most likely arrived in the U.S. in the 1990s, hidden in wood-packing materials used for shipping, and it soon became established in southeastern Michigan. EAB larvae feed under the bark of ash trees and construct winding, S-shaped galleries. Infested branches and, ultimately, entire trees die following several years of attack. Since its establishment in Michigan, EAB has spread to 24 U.S. states and two Canadian provinces, and has killed millions of ash trees. In September 2013, an EAB infestation was detected in Colorado for the first time, in the City of Boulder.

With the exception of single-leaf ash (*Fraxinus anomala*) which occurs on the Western Slope, ash trees are not native to Colorado. However, species native to the eastern U.S. have been widely planted here and are now important shade and ornamental trees in many Colorado communities. Ash trees are relatively fast-growing and hearty, and several cultivars of green and white ash also offer spectacular fall coloring. In some Colorado communities, 25 percent or more of the street trees are ash, and the Denver Metro area is estimated to have about 1.45 million ash trees. Consequently, the establishment of EAB in Colorado could have devastating impacts in many communities.

An initial delimitation survey was completed early in 2014, which established that the known area of EAB infestation was confined to five contiguous square miles in Boulder. By January 2015, additional detections increased that number to 10 square miles of the surveyed grid within the city. Surveys in portions of the Metro Denver area, Longmont, Erie and other communities along the Front Range have not confirmed the presence of EAB, and it has not been detected outside the City of Boulder.



## Emerald Ash Borer Detection and Monitoring



▲ Since the fall of 2013, many Front Range communities have worked with the Colorado EAB Response Team to conduct branch sampling or other detection efforts for EAB. (Data as of Jan. 16, 2015.)



▲ A CSFS forester and Colorado State University Extension specialist assess the branch of an ash tree to determine if it is infested with EAB. Photo: Ryan Lockwood, CSFS

◀ EAB can be difficult to detect. S-shaped galleries under the bark can be an indicator. Photo: Ryan Lockwood, CSFS

## Gypsy Moth

(*Lymantria dispar*)

Gypsy moth is a defoliator, primarily of broadleaf trees, that is native to Eurasia. This insect is widely established over much of the eastern U.S. and could easily become established in Colorado and other Western states. The Colorado Department of Agriculture, in cooperation with the USDA Animal and Plant Health Inspection Service (APHIS), again conducted a statewide survey in 2014 using traps baited with the female moth's sexual attractant to ensure early detection of infestations. No male moths were trapped.

## White Pine Blister Rust

(*Cronartium ribicola*)

White pine blister rust, a disease of five-needle pines, is native to Asia but has spread to Europe and North America via infected pine nursery stock. The disease first appeared in the West during the 1920s and caused devastating losses in portions of California, the Pacific Northwest and the northern Rocky Mountains. It was first discovered in northern Colorado in 1998, and has since been detected in several locations in both limber and bristlecone pines. In 2014, several limber pines infected with white pine blister rust were detected in the vicinity of Allenspark, thus extending the distribution of this disease in Colorado.

## Conclusion

Both native and exotic insects, fungi and other agents damaged Colorado's wildland and urban forests in 2014. As in recent years, the most destructive forest pests were several species of bark beetles that attack and kill conifers. Spruce beetle, found in high-elevation Engelmann spruce forests, was Colorado's most damaging insect pest for the third successive year. Other insect pests that caused significant damage in 2014 included Douglas-fir beetle, fir engraver beetle, western spruce budworm, Douglas-fir tussock moth, a pine sawfly and two species of caterpillars that defoliate aspen.

Unhealthy forests, including those that are over-mature or overstocked, provide host material for several species of bark beetles. The long-term absence of wildfire can result in increased numbers of trees per acre, buildups of forest fuels and changes in species composition, which can favor development of forest pest outbreaks or result in wildfires of increased severity. Moreover, climatic events such as extended drought and severe storms resulting in windthrow, can favor certain pest species.

Forest management can create conditions that are less favorable for the development of large-scale pest outbreaks, and provide many other long-term benefits. Forest management actions that can help create unfavorable conditions for pest outbreaks include timely harvesting of mature trees, forest thinning, favoring tree species that are less susceptible to pest outbreaks and, where possible, promoting species diversity. Foresters with the Colorado State Forest Service can provide assistance to private forest landowners to improve the condition of their forests.

## References and Further Reading

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▲ Extensive tree mortality in high-elevation Engelmann spruce forests in the Rio Grande Basin, caused by spruce beetle.



▲ Defoliation of aspen stands in the upper North Purgatoire River Basin. This area has suffered annual defoliation by western tent caterpillar since 2006.



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