



2013 Colorado Forest Insect and Disease Update

A Supplement to the *2013 Report on the Health of Colorado's Forests*



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Introduction

Information on the status of damaging forest insects, diseases and other agents in Colorado's forests is derived from several sources, including the annual aerial forest health survey, on-the-ground detection by Colorado State Forest Service (CSFS) foresters and special surveys.

The annual aerial forest health survey is a cooperative program of the USDA Forest Service (USFS) and the CSFS to conduct an assessment of Colorado's forests. This data is supplemented with ground-checks conducted by aerial surveyors, and information on occurrence and severity of forest damage observed by CSFS foresters during their day-to-day activities. CSFS foresters identify damaging forest pest activity while advising and assisting private forest landowners in the management of their forests, while managing state-owned forestlands, and conducting forest inventories and other related activities. In addition, the CSFS, USFS, USDA Animal and Plant Health Inspection Service (APHIS) and the Colorado Department of Agriculture conduct special surveys to help detect various pests. In 2013, special surveys were conducted for thousand cankers disease, Douglas-fir tussock moth, emerald ash borer and gypsy moth.

The CSFS 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 we are taking to reduce their impacts. This report is a supplement to the *2013 Report on the Health of Colorado's Forests*, which is available online at <http://csfs.colostate.edu/pdfs/2013ForestHealthReport.pdf>.

Insect and Disease Highlights

- For the second successive year, spruce beetle was the most damaging native forest insect pest, infesting a total of 398,000 acres of high-elevation spruce forests across Colorado.
- The mountain pine beetle outbreak in northern Colorado continued to decline in 2013, with a total area of 98,000 acres of active infestation detected.
- Douglas-fir beetle impacted mature Douglas-fir trees on 43,000 acres across portions of southern Colorado.
- Subalpine-fir decline caused scattered tree mortality of subalpine fir in many high-elevation spruce-fir forests.
- Western spruce budworm defoliated a total of 156,000 acres of spruce-fir forests in southern Colorado.

- Fir engraver was at epidemic levels over much of the natural range of white fir in southern Colorado.
- A complex of twig beetles, a shoot-boring moth and the piñon ips bark beetle damaged 15,000 acres of piñon pine.
- Western tent caterpillar and large aspen tortrix defoliated 54,000 acres of aspen forests in southern Colorado, almost twice the area mapped in 2012.
- Thousand cankers disease of black walnut continued to impact trees in Colorado communities.

Exotic Pests

- Emerald ash borer was discovered in Boulder in late September 2013.
- A new area of white pine blister rust was found on limber pines in the Rampart Range.

Status of Forest Insects, Diseases and Other Damaging Agents

Catastrophic wildfires in spring and early summer, a massive flood in September and the discovery of emerald ash borer in Boulder captured headlines in 2013. In 2013, as in past years, Colorado's forests suffered damage from a wide range of insects, diseases and other agents, both indigenous (Table 1) and exotic (Table 2).

The state's ongoing forest health concerns are due to a combination of factors that impact forest health, including poor stand conditions, long-term drought and warmer temperatures. In addition, many of our mountain forests have become unhealthy and overly dense, setting the stage for future insect and disease outbreaks, potentially devastating wildfires and the dangerous floods that often follow. These risks present both challenges and opportunities.



▲ Active mountain pine beetle infestations persisted in mixed lodgepole/ponderosa pine forests in several areas of the northern Front Range, including the Buckhorn Creek Basin in Larimer County.

Table 1. Important indigenous pests of Colorado's forests in 2013

Pest	Host trees	Factors favoring outbreaks	Area infested in 2013 (acres)
Spruce beetle	Engelmann spruce	Fresh windthrow, mature/overmature stands, mild winter temperatures and drought	398,000
Mountain pine beetle	Lodgepole, limber, ponderosa and bristlecone pines	Mature/overmature stands (lodgepole/limber pines), overstocked stands (ponderosa pines), mild winter temperatures and drought	98,000
Douglas-fir beetle	Douglas-fir	Mature/overmature stands, below-normal precipitation, outbreaks of defoliating insects	43,000
Subalpine fir decline	Subalpine fir	Root disease fungi that predispose trees to bark beetles	178,000
Fir engraver beetle	White fir	Below-normal precipitation	37,000
Piñon pine insects (insect complex)	Piñon pine	Below-normal precipitation	15,000
Western spruce budworm	Douglas-fir, white fir, Engelmann spruce	Mature/overmature stands, below-normal precipitation	156,000
Defoliating insects of quaking aspen (western tent caterpillar, large aspen tortrix)	Quaking aspen	Unknown	54,000
Thousand cankers disease	Black walnut	Unknown	No new infestations detected; established infestations intensified in Denver, Fort Collins and Pueblo

Table 2. Important exotic pests of Colorado's forests in 2013

Pest	Host trees	Origin	Status in 2013
Emerald ash borer	Ash (all species)	East Asia	Discovered in Colorado for the first time, in Boulder, where multiple areas of infestation have been detected
White pine blister rust	White or five-needle pines	Asia	New outbreak discovered on the Rampart Range

Indigenous Pests

Conifer Forests

Spruce Beetle

(Dendroctonus rufipennis)

For the second consecutive year, spruce beetle was the most widespread insect pest of Colorado's forests. In 2013, active spruce beetle infestations were found on 398,000 acres of spruce forests, compared to 326,000 acres in 2012.¹ Currently, outbreaks are occurring in five areas of the state, including portions of northern Colorado, the Grand Mesa, the Sangre de Cristo Range, the San Juan and La Garita mountains, and Wet Mountains.

Areas of significant spruce beetle impact include:

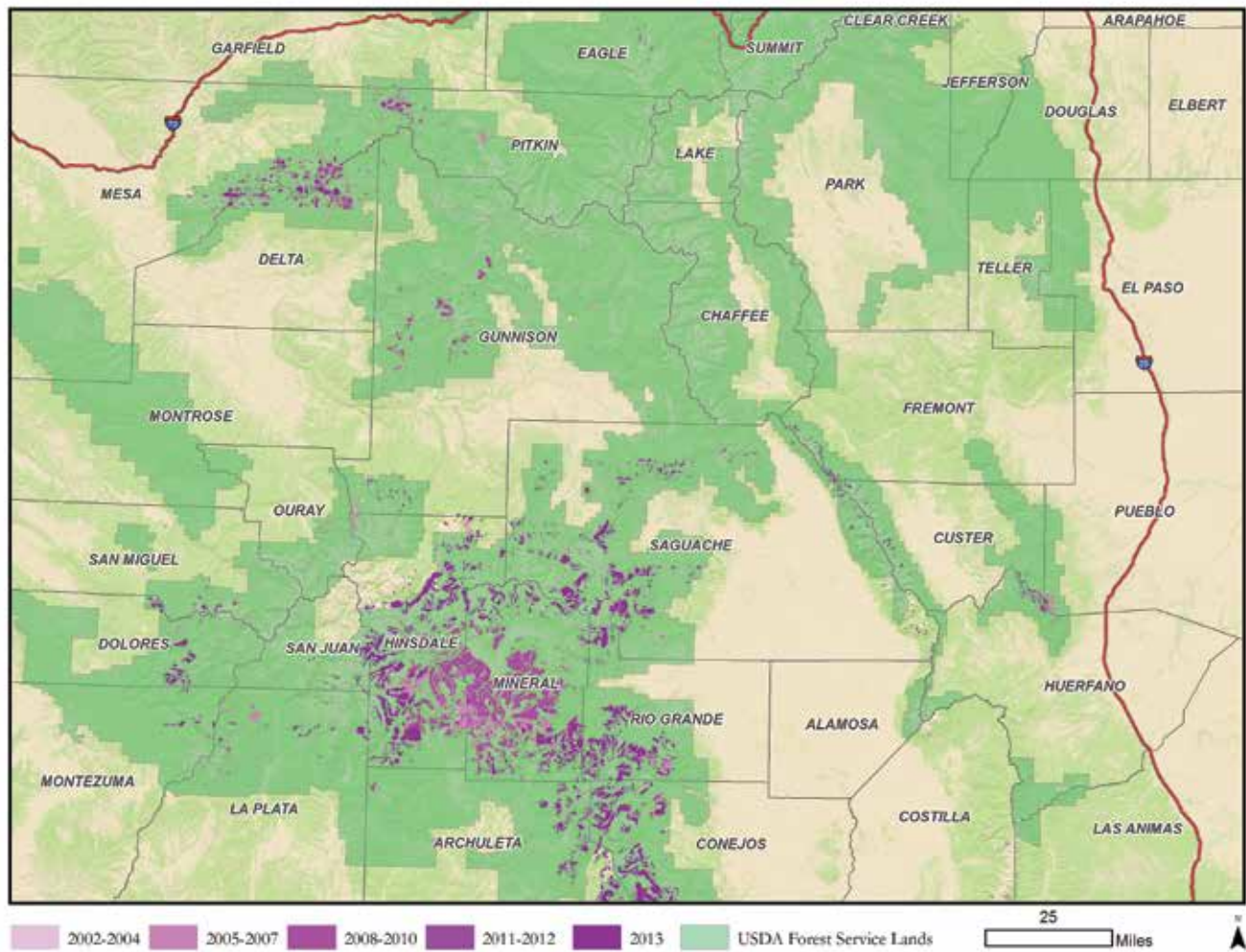
- San Juan/La Garita mountains – the Weminuche Wilderness, the upper Rio Grande Basin, Monarch Pass, Slumgullion Pass and the Slumgullion Slide near Lake City, Rambouillet Park and the Lake Fork Gunnison River Basin above Lake San Cristobal
- Grand Mesa

- Mt. Zirkel Range/Rabbit Ears Range – Upper Cache La Poudre River Basin, Laramie River Basin, upper Big Thompson River Basin, Buckhorn Creek Basins, Cameron Pass and Willow Creek Pass
- Wet Mountains – Ophir Pass south to Greenhorn Peak
- Sangre de Cristo Range – Mt. Zwischen north to Hayden Pass on the western slopes of the range, and from Methodist Mountain south to Mt. Zwischen on the eastern slopes

A substantial volume of windthrow occurred in spruce-fir and mixed conifer forests due to a severe winter storm in November 2011. The 2012 aerial forest health survey detected 117 areas of blowdown, affecting a total of 4,100 acres. In 2013, ground observations indicated that spruce beetles were attacking the windthrown spruce, thus increasing the potential for spruce beetle activity in areas where the insect currently is not present. This could lead to dramatic increases in spruce beetle activity over the next several years.

¹ The 2012 figure for spruce beetle infestation was revised after the initial release of the aerial survey data.

Spruce Beetle Progression in Southwestern Colorado, 2002-2013

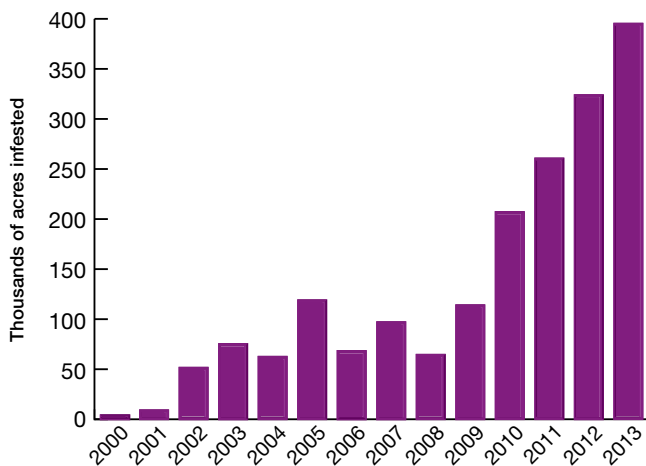


▲ Spruce beetle infestation on Spring Creek Pass in the San Juan Mountains.

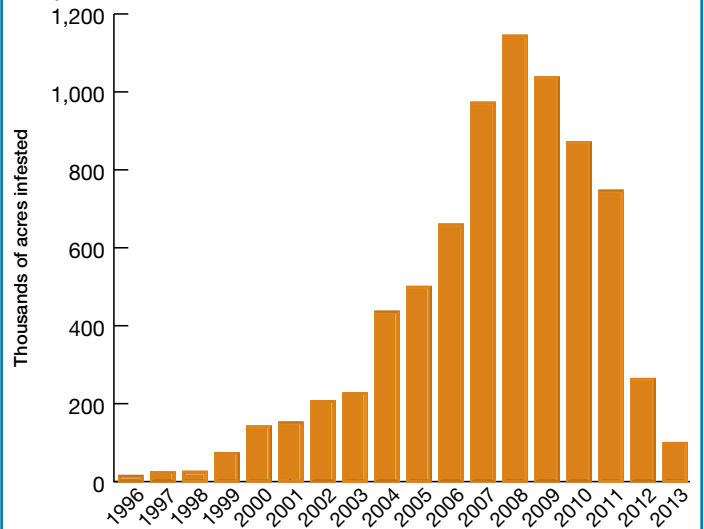


▲ Adult spruce beetles are approximately 1/4-inch in length.

Acres in Colorado Affected by Spruce Beetle



Acres in Colorado Affected by Mountain Pine Beetle



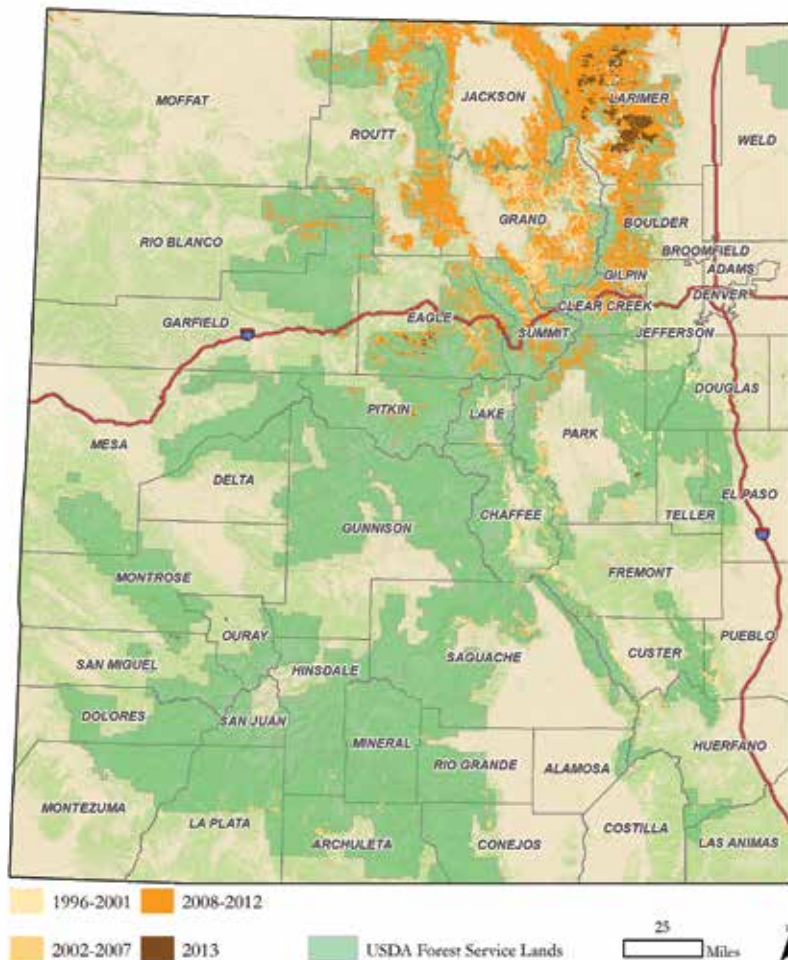
Mountain Pine Beetle

(Dendroctonus ponderosae)

The area of active mountain pine beetle infestation, which was Colorado's most destructive forest pest for several years, continued to decline in 2013. The number of acres of limber, lodgepole and ponderosa pine forests with active infestations was 98,000 acres in 2013, compared to 264,000 acres in 2012 and 752,000 acres in 2011. Approximately 3.4 million acres of forest have been damaged by this outbreak since it was first detected in 1996.

MPB infestations declined again throughout much of Colorado's pine forests. In many areas, the infestation has declined as the result of the depletion of susceptible hosts. In lodgepole pine forests in and around the Aspen/Snowmass ski area and the slopes of Smugglers Mountain, management activities have helped reduce the loss of trees to MPB. However, in some areas along the Front Range, from Rocky Mountain National Park south to the I-70 corridor, the Geneva Creek Basin and portions of South Park, a substantial population of pine suitable for attack and brood development remains.

Mountain Pine Beetle Progression in Colorado, 1996-2013





▲ Mountain pine beetle has infested and killed the majority of this limber pine stand in Larimer County.

Areas of significant mountain pine beetle impact include:

- 85,000 acres of MPB activity in Larimer County, representing 87 percent of all MPB activity in the state in 2013;
- the lower Big Thompson Canyon, portions of the Buckhorn Creek Basin, Pingree Park and Red Feather Lakes;
- limber pine mortality in the Sangre de Cristo Range; and
- ponderosa pine mortality on Miller Mesa, south of Ridgeway.

Other Bark Beetles in Ponderosa Pine

A complex of several species of bark beetles, including western pine beetle (*Dendroctonus brevicomis*), roundheaded pine beetle (*Dendroctonus adjunctus*), mountain pine beetle and ips engraver beetles (*Ips spp.*) attacked and killed ponderosa pines on portions of the southern slopes of the San Juan Range.

Douglas-fir Beetle

(*Dendroctonus pseudotsugae*)

Douglas-fir beetle is a major pest of mature/overmature Douglas-fir forests, especially following periods of below-normal precipitation or outbreaks of defoliating insects. In 2013, approximately 43,000 acres of active Douglas-fir beetle infestations were detected over portions of southern Colorado and on the Western Slope, compared to 27,000 acres in 2012.

Significant Douglas-fir beetle impacts were detected in the following areas:

- near Ouray where group-kills of up to 1,000 trees were seen on both sides of the upper Uncompahgre River;
- several tributaries of the Lake Fork of the Gunnison River and the Cimarron and Little Cimarron River basins between Gunnison and Montrose;
- the Crystal River Basin, from Marble north and east to Bulldog Creek, and the north-facing slopes of Mt. Sophris near Aspen; and
- portions of the northern Rampart Range.



▲ A stand of Douglas-fir trees was killed by the Douglas-fir beetle near Ouray.

Subalpine-fir Decline

Subalpine-fir decline was again seen in many high-elevation spruce-fir forests across the state, impacting a total of 178,000 acres. The mortality is the result of the western balsam bark beetle (*Dryocoetes confusus*) and two species of fungi (*Armillaria spp.* and *Heterobasidion parviporum*) that attack the root systems of subalpine fir.

Areas of significant subalpine-fir decline include the Upper San Miguel River Basin near Telluride, including the Telluride Ski Basin; the Elk Mountains south of Aspen; the Mosquito Range; and the Front Range.



▲ Subalpine fir decline near the Wet Mountains.

Fir Engraver Beetle

(*Scolytus ventralis*)

Fir engraver beetle is a pest of white fir, a tree that is found in mixed conifer forests, including the Douglas-fir and ponderosa pine forests in portions of southern Colorado. During years of below-normal precipitation, this bark beetle can reach epidemic proportions, killing large numbers of mature or nearly mature white fir. Significant increases in levels of white fir mortality, caused by the fir engraver beetle, occurred in several areas of the state, resulting in a total of 37,000 acres, compared to 4,700 acres in 2012.

Areas of significant fir engraver beetle impact include the eastern slopes of the Wet Mountains; the Sangre de Cristo and Culebra ranges; and portions of the Four Mile and Eight Mile (Phantom Canyon) Creek basins.



▲ White fir mortality near the Four Mile Creek Basin.

Insects of Piñon Pine

A complex of three insects caused severe damage to piñon pine in several areas of Colorado. The insects involved are piñon ips (*Ips confusus*), a tree-killing bark beetle; a complex of twig-infesting beetles (*Pityophthorus spp.*) that bore into and kill twigs and branches; and a shoot-boring moth (*Dioryctria albovittella*) that also attacks and kills branches. In 2013, piñon pine damage was mapped on approximately 15,000 acres of the state's piñon-juniper woodlands, compared to 1,900 acres in 2012. Several years of below normal precipitation likely is a contributing factor in this outbreak.

Significant piñon pine damage occurred in the following areas:

- the I-25 corridor, from Walsenburg south to the New Mexico border, with the heaviest damage in the vicinity of Ludlow;
- north of Cañon City in Four Mile and Eight Mile Creek (Phantom Canyon) basins, and the Royal Gorge; and
- the Wet Mountains and piñon-juniper woodlands, east to the Pueblo Reservoir and north toward Colorado Springs.



▲ The larval stage of the shoot-boring moth that attacks and kills branches of piñon pine trees.



▲ Piñon ips beetles under the bark of a piñon pine.



▲ Piñon twig beetle damage near Ludlow.

Western Spruce Budworm

(*Choristoneura freemani* [=occidentalis])

Widespread damage from western spruce budworm in mature Douglas-fir, white fir and Engelmann spruce forests continued over portions of southern Colorado during 2013. Approximately 156,000 acres of aerially visible defoliation were mapped during the 2013 aerial forest health survey, compared to 217,000 acres in 2012 and 155,000 acres in 2011.

Areas of significant western spruce budworm impact include:

- portions of the Culebra, Sangre de Cristo and San Juan/San Miguel ranges;
- the Spanish Peaks;
- the Wet Mountains as far north as the Hardscrabble and South Hardscrabble Creek basins;
- the vicinity of Mt. Maestas, Big and Little Sheep mountains, and Silver Mountain, north of La Veta Pass; and
- the Wet Valley near Antelope Mountain.



▲ Defoliation of Douglas-fir and white fir near Lake San Isabel in the Wet Mountains.



▲ Western spruce budworm defoliates Douglas-fir, white fir and Engelmann spruce trees.



▲ Western spruce budworm adult moths emerge in mid-summer and lay eggs on the underside of conifer needles.

Douglas-fir Tussock Moth

(*Orgyia pseudotsugata*)

Douglas-fir tussock moth is a defoliating insect of Douglas-fir and some other firs that reaches outbreak levels at seven-to-10-year intervals. The last outbreak in Colorado occurred between 2004 and 2008 in Douglas-fir stands near Aspen Park and the northern Rampart Range. In 2013, localized areas of light defoliation occurred on portions of the northern Rampart Range. Trapping conducted by the USFS in 2013 on portions of the Rampart Range captured several moths, which could indicate that an outbreak is imminent.



▲ Larval stage of the Douglas-fir tussock moth.

Other Damaging Agents of Conifers

Several other insects, diseases and abiotic factors impacted conifers in Colorado in 2013, including:

- pine sawfly (*Neodiprion* sp.) defoliation of ponderosa pine in portions of Elbert County that have not been seen since 2009;
- pine needle scale (*Chionaspis pinifoliae*) on ornamental blue spruce in Rustic, a residential area in Larimer County, and on lodgepole pine in Grand County;
- 9,300 acres of visible discoloration of ponderosa pine in several areas west of Walsenburg and Trinidad, and in the vicinity of Wetmore, Beulah and Colorado City;
- frost damage to ponderosa pine and Gambel oak near Mancos;
- drought-related injury in junipers, resulting in foliage discoloration south of Walsenburg; and
- branch die-back and discoloration near the Spanish Peaks and in the West Mountains caused by rodent-feeding.



▲ Discoloration of ponderosa pine trees west of Walsenburg is believed to be caused by severe drought.



▲ Pine sawfly larvae feeding on ponderosa pine needles.



▲ Pine needle scale on a blue spruce tree near Rustic.

Deciduous Forests

Sudden Aspen Decline

Sudden aspen decline (SAD), which is the dieback and death of aspen stands, has been a concern in Colorado since 2005. Peak damage occurred in 2008 when roughly 17 percent of the state's aspen forests were affected. The condition is believed to be drought-related. Aspen stands that exceed 60 years in age, occurring at lower elevations, were most severely affected. Weakened trees were attacked and killed by several secondary insects and fungi.

In 2013, approximately 1,200 acres of sudden aspen decline were mapped in Colorado's aspen forests. In many areas, death of the aspen overstory is being followed by a release of understory aspen regeneration, resulting in "recovery" of the affected stands.

Defoliating Insects of Aspen

Two insects, western tent caterpillar (*Malacosoma californicum*) and large aspen tortrix (*Choristoneura conflictana*), are known to defoliate aspen forests in Colorado. Both species were at outbreak levels in 2013, and aerially visible defoliation increased to 54,000 acres in 2013, compared to 29,000 acres in 2012 and 22,000 acres in 2011.



▲ Aspen defoliation in the Culebra Range.



▲ Damage by large aspen tortrix in the Roaring Judy Basin.



▲ Western tent caterpillar near Bonanza in the La Garita Range.

Following are areas where significant aspen defoliation was visible during the aerial survey:

Western tent caterpillar

- The Spanish Peaks, the Sangre de Cristo Range and the San Juan/San Miguel ranges
- Portions of the Culebra Range, including the North Fork Purgatory River Basin
- Near Bonanza in the La Garita Range

Large aspen tortrix

- The Wet Mountains
- The Roaring Judy Basin near Almont

Thousand Cankers Disease

(*Geosmithia morbida*)

Thousand cankers disease, caused by the fungus *Geosmithia morbida*, which is spread by the walnut twig beetle (*Pityophthorus juglandis*), has killed thousands of ornamental black walnut trees in many Colorado communities. In 2013, the CSFS conducted a special survey in 47 eastern Colorado communities to assess the condition of black walnut trees and aid future monitoring and detection of thousand cankers disease. The CSFS will evaluate the data to determine where future testing is necessary.

No new locations of thousand cankers disease were detected in Colorado in 2013. However, damage intensified in several communities, including Fort Collins, Denver and Pueblo. Extensive damage also continued in Cañon City. The disease appears to have subsided in Boulder, a community where heavy damage occurred in past years.



▲ A black walnut tree infested with thousand cankers disease in Cañon City.

Other Damaging Agents of Deciduous Trees

A number of other insects, diseases and abiotic factors impacted deciduous trees in Colorado, including:

- fall cankerworm (*Alsophila pometaria*) on Gambel oak near Castle Rock and Franktown;
- concealer moths (*Agonopterix spp.*) of New Mexico locust (*Robinia neomexicana*), east of the Culebra Range in Huerfano County, and east of La Veta;
- drought-related decline and mortality of cottonwoods near the Great Sand Dunes National Park and Preserve Visitor Center, lower Sand Creek, lower Phantom Canyon, north of Florence, and Four Mile Creek Basin, north of Cañon City; and
- extensive frost damage in late April and early May that impacted numerous aspen stands and deciduous trees in urban areas.

Exotic Pests

Accidental introduction of exotic insects, fungi and plants via international trade poses a continuing threat to forests worldwide. Once established in a new environment, in the absence of their natural enemies, they can cause massive damage, often to new host plants that have little or no resistance to the introduced pest. Potentially damaging pests can be introduced via imported live plant materials, logs, lumber, wooden crates and pallets. Once established, these pests can be easily spread by human activities, such as the transport of infested plant material and firewood. Several exotic forest insects and diseases currently pose a threat to Colorado's forests.



▲ EAB is responsible for the death or decline of tens of millions of ash trees in more than 20 states. Photo: Howard Russell, Michigan State University, www.forestryimages.org

Emerald Ash Borer

(*Agrilus planipennis*)

Emerald ash borer (EAB) attacks and kills ash trees, and all ash species native to North America are susceptible to attack. Since its arrival in North America, EAB has killed millions of ash trees and has spread across large areas of the midwestern and eastern U.S., and adjoining portions of Canada. On Sept. 23, 2013, EAB was detected in the City of Boulder.

Ash trees, especially green and white ash, are popular shade trees in many Colorado communities. Boulder has an estimated 98,000 ash trees and the Denver Metro area has approximately 1.45 million ash trees. Surveys are being conducted to determine the current extent of EAB in Boulder and surrounding areas. In response to the presence of EAB, a federally regulated pest, the Colorado Department of Agriculture (CDA) established a quarantine in Boulder County, the City of Erie and the Republic Landfill in Jefferson County.



▲ Vertical splits in the bark of ash trees can be a sign that EAB has infested the tree. Photo: Joseph O'Brien, International Society of Arboriculture, www.forestryimages.org



▲ D-shaped exit holes can indicate that the tree has been infested. Photo: Ryan Lockwood, CSFS



▲ New sprouts grow on the lower branches of an ash tree infested with EAB. Photo: James W. Smith, USDA APHIS PPQ, www.forestryimages.org



▲ EAB larvae create tunnels or galleries under the bark of ash trees. Photo: William M. Ciesla



▲ EAB poses a serious threat to ash trees in Colorado. Photo: David Cappaert, Michigan State University, www.forestryimages.org



▲ EAB larvae feed on the inner bark of ash trees, girdling the tree and disrupting the transportation of water and nutrients. Photo: David Cappaert, Michigan State University, www.forestryimages.org

Gypsy Moth

(*Lymantria dispar*)

Gypsy moth, which is native to Eurasia, was introduced in the eastern U.S. around 1869. Gypsy moth larvae feed on the foliage of many species of broadleaf trees, and also can feed on the foliage of conifers. Colorado is at high risk to the introduction of gypsy moth, particularly as people move into the state from infested areas, including much of the northeastern and north-central U.S. In 2013, the CDA and USDA Animal and Plant Health Inspection Service (APHIS) continued to monitor for the presence of gypsy moth in Colorado.



▲ Gypsy moth traps are placed around Colorado each year to determine the presence of the moths in the state.

White Pine Blister Rust

(*Cronartium ribicola*)

White pine blister rust was detected in one new location in 2013; the Eagle Lake Scout Camp in the Rampart Range. White pine blister rust is a disease of white or five-needle pines caused by the fungus, *Cronartium ribicola*. It produces cankers that kill branches and, ultimately, can kill entire trees. Native to Asia, this fungus was introduced in North America via infected nursery stock during the early part of the 20th century. White pine blister rust was first detected in Colorado in 1998, in Larimer County, and has since been found in several Colorado locations, causing damage to both limber pine and bristlecone pine.

Other Exotic Forest Pests Active in Colorado

- Elm leaf beetle (*Xanthogalereuca luteola*) was detected on ornamental elms in Cañon City, Wellington and Windsor.
- Poplar blackmine beetle (*Zeugophora scutellaris*) was detected on narrowleaf cottonwood in riparian forests along the Cache la Poudre River and lower Big Thompson Canyon.

Conclusion

A number of native and exotic pests caused damage to natural and urban forests in Colorado during 2013. The most destructive pests were the bark beetles that attack and kill conifers, including spruce beetle, mountain pine beetle, Douglas-fir beetle, fir engraver beetle,



▲ Elm leaf beetle was detected in Cañon City, Wellington and Windsor.



▲ Poplar black mine beetle was detected on narrowleaf cottonwood in Larimer County.

a complex of insects on piñon pine and two species of caterpillars that feed on aspen foliage. The discovery of the highly invasive emerald ash borer in Colorado will change the composition of our urban and community forests.

Poor forest condition often favors development of damaging levels of indigenous insects and diseases in Colorado's forests. Large areas of mature and overmature forests, often of a single species, provide favorable host material for several species of bark beetles, including mountain pine beetle, spruce beetle and Douglas fir beetle. Fire exclusion, drought and other weather-related events (i.e. frosts, high wind events and floods) also can impact forest condition, and the resiliency of forests to insects and diseases. For example, windthrow events in high-elevation spruce forests provide host material for the development of spruce beetle, which can lead to extensive outbreaks of this insect in adjacent spruce forests.

Forest management can create conditions that discourage the development of pest outbreaks and provide long-term benefits. Timely harvesting of mature lodgepole pine forests can help create a mosaic of different age classes of stands over the landscape, many of which are too young to sustain mountain pine beetle outbreaks. Removal of over-mature or windthrown Engelmann spruce can reduce losses from spruce beetle. Thinning of overstocked ponderosa pine forests can reduce their susceptibility to mountain pine beetle outbreaks.

Implementation of forest management can be constrained by access, special land-use classifications and opposition to timber harvesting on public forestlands. Forest ecosystems are constantly changing, despite the fact that for long periods of a forest life-cycle, the change may seem imperceptible to humans. As forests age and become dense, they also are more susceptible to insects, diseases and wildfire. It is during this phase of a forest that change is visibly dramatic.

We have the opportunity to affect these changes by applying forest management on available forestlands. Forest management creates an array of markets for traditional forest products, such as lumber and paneling, as well as wood for energy, including heat and electricity, and emerging technologies, such as biofuels. It also helps reduce treatment costs, supports local economies and reduces our dependence on imported wood.

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