



2017 REPORT ON
**THE HEALTH OF
COLORADO'S FORESTS**



MEETING THE CHALLENGE OF DEAD AND AT-RISK TREES



Director's Message



Michael B. Lester, State Forester and Director. Photo: Society of American Foresters

Frequently being outdoors to enjoy Colorado's diverse and scenic environments is one of the reasons many of us call this state home. You don't have to drive, hike, pedal or paddle very far to appreciate the value that forests and trees bring to our lives, our communities and the natural world. Along your way, it may become apparent that many of our forests are overly dense and unhealthy; millions of acres of Colorado forestland also have been impacted by bark beetles in recent decades. But there's a silver lining to the problem of dead and dying trees in our forests: standing dead trees often continue to hold value for years, and currently are being utilized by wood products businesses in efforts that support forest management efforts.

The annual *Report on the Health of Colorado's Forests* provides an overview of current forest conditions, the forces that are shaping them and actions being taken to address challenges. This year, we hope you will find of particular interest the special section on dealing with dead trees and forests at risk of insect mortality.

In the Gunnison Basin, which has been hit harder by bark beetle outbreaks in the past few years than perhaps anywhere else in Colorado, communities and landowners are rallying together to suppress destructive insect activity and

take preventive measures. There and all around the state, industry professionals also continue to pursue effective methods of harvesting and marketing standing dead timber.

Working in parallel with these regional, on-the-ground efforts, others are coming together to raise public awareness, advise forestry policy changes and gain stakeholder perspectives on forest challenges and solutions. The state's Forest Health Advisory Council was created by Colorado House Bill 16-1255 to provide a collaborative forum to advise the State Forester on a range of issues, opportunities and threats with regard to Colorado's forests. This 21-member council from across the state convened for the first time in April 2017 and is actively working across organizational boundaries to identify barriers to, and opportunities for, improving Colorado's forest health. To learn more about this council's priorities and membership, visit www.csfs.colostate.edu/forest-health-advisory-council.

Within the Colorado State Forest Service (CSFS), we are proactively realigning our organization to address the evolving needs of our forests and constituents, and will continue with this implementation throughout 2018:

- Four management areas (Northwest, Northeast, Southwest and Southeast) will replace the current CSFS field structure of 15 separate districts. All existing CSFS field offices throughout the state will continue to serve the local needs of landowners and partners in each area.
- Within each of these areas, staff with specialized expertise will apply science and data to forestry programs and projects; plan and implement work on the ground; and provide outreach and community forestry services.
- A new CSFS Science and Data Division will support strategic and project-level planning based on current research and enhance the management and reporting of data.

This restructuring and reprioritization will increase the CSFS's impact and provide tactical definition to the agency's Five-Year Strategic Plan to foster healthy and resilient forests.

The natural and human-induced challenges facing our forests are complex. I encourage you to become aware of the issues, take personal responsibility for forested lands you may own and advocate for effective management of this shared natural resource. Enjoy your travels and experiences in the forest with a greater understanding of how the actions we take now, as citizens, land managers and legislators, will impact those experiences for generations to come.

Michael B. Lester
State Forester and Director
Colorado State Forest Service

Table of Contents

Executive Summary	2
Statewide Insect and Disease Update	4
Special Section: Meeting the Challenge of Dead and At-Risk Trees	13
Effective Forest Management: A Focus on Prevention	22

Front cover photos, clockwise from top left: CSFS Insect and Disease Technician Katelynn Martinez hanging an MCH packet that repels Douglas-fir beetle. Photo: Dan West, CSFS; Logging operations to improve forest health. Photo: CSFS; Adult spruce beetle. Photo: Dan West, CSFS; A view of the Gunnison Basin. Photo: Dan West, CSFS

The Role of the Colorado State Forest Service



CSFS State Lands Program Specialist Diana Selby working on a forest management project at the Colorado State University Mountain Campus in Larimer County. Photo: Nancy Klasky, CSFS

Since 1955, the Colorado State Forest Service (CSFS) has been committed to providing timely, relevant forestry information and education to the citizens of Colorado to achieve resilient forests and communities. The CSFS is a service and outreach agency of the Warner College of Natural Resources at Colorado State University. Headquartered in Fort Collins, the agency also provides staffing for the Division of Forestry within the Colorado Department of Natural Resources.

The CSFS was recently reorganized into four areas covering the quadrants of the state, and continues to serve the citizens of Colorado from 19 previously existing field offices.

Using applied science, the CSFS adapts its focus and approach in response to emerging forestry issues. Every year, the agency assists thousands of landowners and hundreds of communities to improve forest health. As the lead state agency providing forest stewardship

and wildfire mitigation assistance, the CSFS offers a variety of programs and services, including:

- Forest and timber management for forest health and increased resiliency
- Resources and projects to reduce wildfire risk
- Wood utilization and marketing assistance
- Insect and disease surveys and detection
- Urban and community forestry assistance
- Trees and shrubs for conservation, including advice on tree planting and care
- Workshops for forest landowners, communities and homeowner associations
- Outreach and education for adults and youth

CSFS funding is obtained from the U.S. Forest Service; the state general fund and state service-based revenues; self-generated and other revenues; and severance taxes.

Executive Summary

Each year, the Colorado State Forest Service (CSFS) prepares a report on the health of Colorado's forests to inform Colorado's General Assembly, citizens and other stakeholders. The report provides an overview of current forest conditions, the forces shaping them and some of the actions being taken to address related challenges. This year, the publication also offers a special section describing ways in which the state is dealing with millions of standing dead trees, as well as how it is managing those forests at continued risk of insect mortality.

Native forest insects and diseases are important to the ecology of all of Colorado's forests, often setting the stage for the replacement of older trees with younger, more vigorous ones. However, these same organisms can impact the benefits society derives from forests, including wildlife habitat, recreation, timber production and watershed protection. Regular monitoring for the damage caused by forest insects is a fundamental aspect of forest management, and in Colorado the primary source of this information is an annual aerial forest health survey conducted cooperatively by the CSFS and U.S. Forest Service (USFS), Rocky Mountain Region.

Based on the 2017 survey, spruce beetle was Colorado's most widespread and damaging forest insect pest for the sixth consecutive year. A total of 206,000 acres with active infestations of this bark beetle were observed in high-elevation Engelmann spruce forests, with nearly a third of these acres not previously infested. Counties most significantly impacted by spruce beetle in 2017 included Gunnison, Fremont, Hinsdale, Saguache and Chaffee. Mature Douglas-fir trees also continued to be attacked and killed by Douglas-fir beetle – another



Sam Pankratz, a CSFS Southwest Area forester, peels the bark off a tree to look for Douglas-fir beetles. Photo: Ryan Lockwood, CSFS

closely related bark beetle – impacting a total of 14,000 acres in many of the same counties, and several others in the central and southern portions of the state.

Besides the impacts of these bark beetles, in 2017 western spruce budworm defoliated 252,000 acres of Douglas-fir, white fir and spruce in Colorado, with the most heavily impacted areas including the Sawatch, Mosquito and Culebra ranges; Sangre

de Cristo Mountains; and the Tarryall Mountains in Park County. White fir continued to be attacked and killed by fir engraver beetle in Ouray and Archuleta counties, though tree mortality occurred on fewer acres than in 2016. And damage caused by a complex involving western balsam bark beetle and several species of root-decaying fungi continued to be ubiquitous, causing tree mortality on 50,000 acres of high-elevation



subalpine fir throughout the state.

Emerging, or currently more localized, insect and disease threats also exist in Colorado's forests. The exotic pest emerald ash borer (EAB), first detected in Colorado in 2013, continues to spread in the urban and community forests of Boulder County, and in 2017 was detected for the first time within the City of Lafayette. A needle cast fungi affecting lodgepole pine forests on Vail and

Monarch passes caused localized areas of premature needle drop, and a rapidly increasing outbreak of roundheaded pine beetle in Dolores County continues to affect more acres of ponderosa pine each year – with more than 10,000 cumulative acres impacted since 2012.

The Gunnison Basin has been dealing with the state's most serious bark beetle outbreaks, in part due to prolonged drought conditions. Several programs and methods currently are being employed to deal with this growing concern, including the Western Bark Beetle Program, the use of pheromone treatments to repel attacks on susceptible trees, and use of the Good Neighbor Authority to allow state contracting procedures to be used for management efforts on federally owned lands.

Nearly 3.4 million acres of Colorado's pine forests have been impacted by the mountain pine beetle since 1996, and another 1.78 million acres of Engelmann spruce have been affected by a similar forest insect, the spruce beetle. Together, these bark beetles have caused widespread tree mortality on roughly one-fifth of Colorado's forestland over the past two decades. But the problem of dead and dying trees in the state's forests also offers an opportunity: standing dead trees can hold value for years, and currently are being utilized by wood products businesses in efforts that support forest management efforts.

The CSFS and its partners are working with sawmills and forest products businesses statewide to seize this opportunity. Colorado has more than 100 sawmills, ranging in size from small mobile operations to large-scale permanent facilities, and an estimated one-third of these mills

use beetle-killed trees as part of their wood supply.

Several specific areas and programs related to meeting the challenges of dead trees are addressed in this year's report. More than a decade after the mountain pine beetle epidemic moved through Grand County, dead trees from over 30,000 acres of private and state land have been sustainably harvested and processed into valuable wood products. And cooperative efforts between the CSFS and its partners are providing opportunities to derive value from Colorado's standing dead trees, including research with Colorado State University to determine how long wood remains usable after being killed by beetles or fire. A primary focus of these efforts has been at the site of the 2013 Black Forest Fire.

In locations throughout Colorado, CSFS and USFS efforts also are providing access to capital to support the state's sawmills. These efforts not only help enable forest management, but create jobs in places like the San Luis Valley, where a new mill now employs almost 50 full-time workers from the surrounding area.

Besides the need to address dead trees on the landscape, the need to manage forests with a focus on healthy trees – especially those at higher risk for future insect and disease concerns – remains an ever-present priority. To better deal with ongoing forestry challenges, the CSFS is proactively realigning its organizational structure, with changes beginning in 2018. All CSFS field offices will remain open, and the agency restructure will provide enhanced opportunities to fulfill the CSFS Five-Year Strategic Plan to foster healthy and resilient forests.

Statewide Insect and Disease Update

Forest insects and diseases are important to the ecology of all of Colorado's forests. For example, outbreaks of tree-killing bark beetles can set the stage for the replacement of older trees with younger, more vigorous ones by targeting trees in mature, overly dense forests. However, altered forest conditions impact wildlife habitat, recreation, timber production, watershed protection and other forest values.

Regular monitoring for the damage caused by forest insects is a fundamental aspect of forest management. In Colorado, the primary source of information on forest pest conditions is the annual aerial forest health survey. Aerial detection surveys are conducted cooperatively by specialists from the U.S. Forest Service (USFS), Rocky Mountain Region, and the Colorado State Forest Service (CSFS). Trained observers representing both agencies fly in small aircraft over the state's native forests – covering all land ownerships – to map and classify the intensity of the current year's damage. Some areas flown during the aerial survey also are ground-checked to verify the agent responsible for the damage and the level of severity.

In 2017, aerial survey hardware and software were upgraded to keep up with technological advances, allowing greater precision for observers. While this represents an improvement in aerial survey methods, caution should be used when comparing this year's data to previous years due to slightly differing sampling tools.

Another key source of information for this report is field visits by CSFS foresters, who identify and assess forest pest activity while advising private forest landowners on how to manage their forests. These foresters also are directly responsible for the management of state-owned forest lands and conduct statewide forest inventories, allowing for further knowledge to inform the report. In addition, the CSFS cooperates



Spruce beetle-killed trees throughout the Rio Grande National Forest. Photo: Dan West, CSFS

with other agencies such as the Colorado Department of Agriculture, USDA Animal and Plant Health Inspection Service (APHIS) and USFS to design and conduct special surveys to ensure the early detection of exotic insect species that threaten both urban and native forests.

Highlights for 2017

Long- and short-term temperature and precipitation trends can affect forest insect populations. According to the Colorado Climate Center, the statewide annual temperature over the past two decades has been about two degrees Fahrenheit warmer than the pre-1990s period. This additional warming is one factor that has contributed to large-scale insect and disease impacts in recent years.

The statewide annual temperature during Colorado's water year (Oct. 1 to Sept. 30) was 3.2 degrees F higher than the base period average of 44.6 F in 2017 (average calculated from

1901-2000), continuing a trend of above-normal temperatures. Most of the state received average or above-average precipitation in 2017, with Colorado's water year total of 20.09 inches providing 1.99 inches more moisture than the average. The wettest areas occurred on the Eastern Plains in the southeast quadrant of the state, while the northeast and southwest quadrants received average precipitation. The largely forested northwest quadrant of the state received slightly below-average precipitation for the year. Also of note, a late-season, heavy snowfall occurred in the southeast portion of Colorado in the spring, which caused significant damage to some tree species while also killing many livestock.

These weather and climate-related factors influenced forest insect and disease activity in the state, including the following notable impacts:

- For the sixth consecutive year, Colorado's most widespread and damaging forest insect pest was the spruce beetle. A total of 206,000

acres with active infestations were observed in high-elevation Engelmann spruce forests throughout the state. Approximately 67,000 new acres were impacted in 2017, indicating a continued spread of spruce beetles into forests not previously infested. Expanding outbreaks in the northern and central portions of the state have the potential to affect susceptible new areas in the near future.

- Mature Douglas-fir continued to be attacked and killed by Douglas-fir beetle in the central and southern portions of the state. Garfield, Gunnison, Hinsdale and Saguache counties were heavily impacted in 2017. Approximately 14,000 acres were impacted statewide, with 11,000 acres being new.
- Western spruce budworm defoliated 252,000 acres of Douglas-fir, white fir and spruce in central and southern

Colorado. Custer, Fremont, Gunnison, Huerfano, Las Animas, Park, Rio Blanco and Saguache counties experienced heavy and widespread defoliation.

- White fir continued to be attacked and killed by fir engraver beetle in several areas of the state, particularly in Ouray and Archuleta counties. Tree mortality occurred on 2,500 acres statewide, compared to 6,300 acres in 2016. Fir mortality due to the pest near the community of Ouray declined significantly.
- Western balsam bark beetle and associated root disease fungi continued to be ubiquitous throughout Colorado's spruce-fir forests, causing tree mortality over 50,000 acres of high-elevation subalpine fir.
- Emerald ash borer, first detected in Colorado in 2013, was detected for the first time within the City of Lafayette.
- A needle cast fungi affecting lodgepole pine forests on Vail and Monarch passes caused localized areas of premature needle drop, and noticeable discoloration of needles.
- Roundheaded pine beetle continued to affect more acres of ponderosa pine in Dolores County, with nearly 11,000 acres impacted from 2012 through 2017.



Spruce beetle-caused mortality over Wolf Creek Pass, Mineral County. Photo: Dan West, CSFS

Indigenous Pests

Conifer Forests

Spruce Beetle

[Dendroctonus rufipennis]

Spruce beetles are native bark beetles that infest high-elevation Engelmann spruce and also occasionally Colorado blue spruce. The spruce beetle typically produces a new generation every two years, with larvae growing under the bark of spruce trees, most often at elevations above 9,000 feet. Adults fly to seek new hosts from late May through July, preferring large-diameter trees when they are present.



A spruce beetle and gallery in an Englemann spruce on Marshall Pass, Chaffee County. Photo: Dan West, CSFS

- As the spruce beetle moves through contiguous stands of Englemann spruce, the preferred trees are depleted. This is one reason for fewer actively infested acres than recorded in 2016.
- 67,000 previously uninfested acres were impacted statewide in 2017.
- Infestations continued expanding north in the Collegiate Peaks of the Sawatch Range, with 3,800 new acres recorded in Park County.
- Susceptible Englemann spruce forests exist between expanding outbreaks in the northern and central portions of the state, indicating that the spruce beetle has the potential to affect new areas in the near future.
- Notable counties affected by previously uninfested acres in 2017:

Colorado County	2016 Acres Affected	2017 Acres Affected	1996-2017 Cumulative Acres Affected	Previously Uninfested Acres
Gunnison	67,000	40,000	134,000	13,000
Freemont	6,900	9,000	20,000	6,000
Hinsdale	37,000	22,000	272,000	5,000
Saguache	39,000	18,000	217,000	4,000
Custer	18,000	11,000	34,000	4,000
Chaffee	14,000	12,000	33,000	4,000
Costilla	3,100	4,800	9,700	3,500
Archuleta	9,700	8,100	53,000	3,000

The spruce beetle was Colorado’s most widespread and damaging forest insect for the sixth consecutive year. Severe outbreaks continued in portions of the San Juan/La Garita Mountains, West Elk Mountains, Sawatch Range, Sangre de Cristo Range and Wet Mountains. Significant infestations also were mapped in portions of Grand and Larimer counties in north-central Colorado, and west of the Continental Divide in and around Rocky Mountain National Park.

- 1.78 million cumulative acres have been impacted by spruce beetle outbreaks in Colorado since 1996.
- 206,000 acres of high-elevation Englemann spruce were impacted in 2017, compared with 350,000 acres in 2016. This was the third consecutive year the state saw a decline in acres with active infestations of spruce beetle.

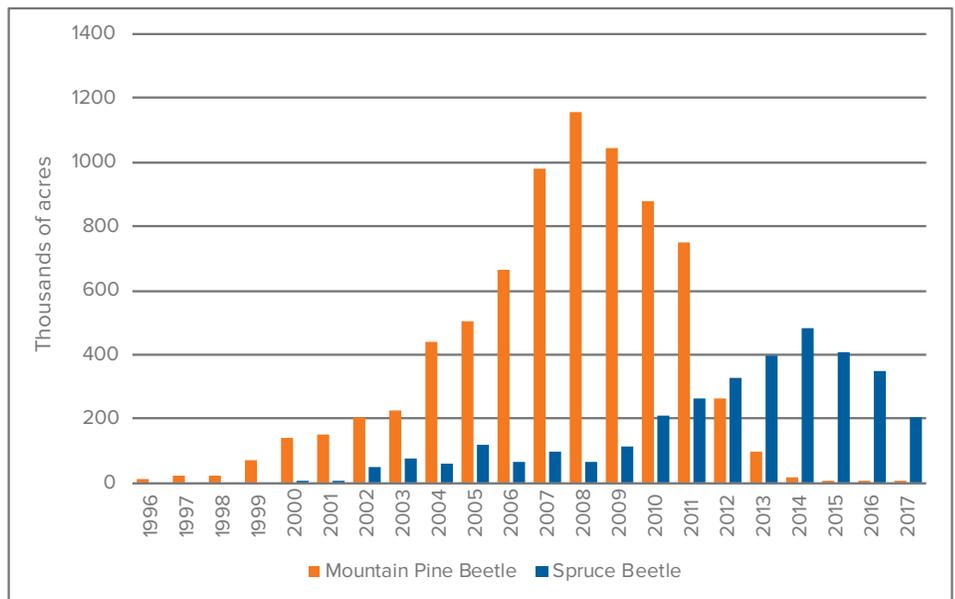
Mountain Pine Beetle (*Dendroctonus ponderosae*)

Mountain pine beetle (MPB) is a native bark beetle that infests all pine species native to Colorado. Populations reproduce once per year, requiring new green host trees to complete development. In Colorado, adults typically fly to new host trees from late June into early August.

MPB impacted nearly 3.4 million acres in the state from 1996 to 2014, but populations now remain at endemic, or background, levels statewide. Previous tree mortality is most concentrated in lodgepole pine forests in north-central Colorado, but scattered pockets of fading ponderosa and limber pines continue to be detected at moderate to low levels in the northern and central Sangre de Cristo Mountains. Localized “pocket” activity also occurred in ponderosa and lodgepole pines throughout the Front Range, although the causal agent for visible damage might include other native bark beetles.

- Less than 900 acres of native pine forest were affected by MPB in 2017, which is similar to the acreage impacted in 2016.

Mountain Pine Beetle and Spruce Beetle-Caused Mortality in Colorado



- 2017 represents the year with the lowest acreage impacted by MPB in more than two decades.
- Notable counties with MPB-caused mortality in 2017:

Colorado County	2016 Acres Affected	2017 Acres Affected	1996-2017 Cumulative Acres Affected
Douglas	6	270	35,000
Larimer	120	100	809,000
Park	50	130	138,000
Saguache	280	100	43,000

Douglas-fir Beetle [*Dendroctonus pseudotsugae*]

Douglas-fir beetle is another important native bark beetle, present in mature Douglas-fir forests across most of the West. Outbreaks tend to be associated with overly dense stands of mature Douglas-fir trees, coupled with periods of below-normal local precipitation. Adults seek new trees to attack from late spring through early fall.

In 2017, pocket activity occurred in portions of the Flat Tops Wilderness, Rampart Range and Sangre de Cristo Mountains. Most of the Douglas-fir forests surrounding the communities of Gunnison, Salida, Aspen, Ouray, Telluride and Eagle also were heavily impacted.

- 14,000 acres comprised of Douglas-fir were impacted in 2017, compared with 19,000 acres in 2016.
- 11,000 new, previously uninfested acres were impacted statewide, also a decrease compared to 2016.
- Notable counties with the most newly infested acres in 2017:

Colorado County	2016 Acres Affected	2017 Acres Affected	1996-2017 Cumulative Acres Affected	Previously Uninfested Acres
Saguache	1,700	2,500	39,000	2,000
Hinsdale	870	1,100	15,000	1,000
Gunnison	3,100	1,900	34,000	1,000
Garfield	3,400	2,200	35,000	1,000
Eagle	1,400	500	11,000	1,000
Pitkin	1,600	590	12,000	1,000

Western Balsam Bark Beetle/ Root Disease Complex

Damage caused by western balsam bark beetle (*Dryocoetes confusus*) and several species of fungi that cause root decay continued in high-elevation subalpine fir. Statewide acreage impacted by this bark beetle/root disease complex decreased in 2017 from the previous year. The area affected by this complex may vary from year to year, though the intensity of damage is typically relatively low except during extreme drought conditions.

Several areas with significant damage in 2017 occurred in the Flat Tops Wilderness and Mount Zirkel Wilderness in northwest Colorado; the Sawatch Range near the town of Aspen; forests surrounding the town of Gunnison; and the northern portion of the Front Range.

- 50,000 acres of high-elevation, mixed-conifer forests containing subalpine fir were affected in 2017, compared to 122,000 acres in 2016.
- Notable counties affected in 2017:

Colorado County	2016 Acres Affected	2017 Acres Affected
Pitkin	9,600	7,900
Gunnison	6,400	6,400
Eagle	5,200	4,600
Larimer	8,500	4,400
Grand	7,100	4,400
Garfield	9,000	3,100

Fir Engraver Beetle [*Scolytus ventralis*]

Fir engraver beetle is a native bark beetle that predominantly attacks white fir in Colorado. The adults typically fly to seek new trees in which to lay their eggs in the summer months, peaking in July and August. In 2017, notable tree mortality occurred only in southern Colorado, where white fir grows in mixed-species forests, often with Douglas-fir.

- 2,500 acres of white fir, all in southern Colorado, were impacted in 2017, compared to 6,300 acres in 2016.
- Localized areas affected in 2017 included the Sangre de Cristo

Mountains south to the northern portions of the Culebra Range. The eastern slopes of the Wet Mountains also continued to have mortality ranging from individual trees to pockets of 10 or more trees.

- Fir mortality near the mountain town of Ouray declined after more than five years of infestation. Fir engraver beetle is estimated to have killed more than 85 percent of the white firs in the Uncompahgre River Gorge around the community.
- Notable counties affected in 2017:

Colorado County	2016 Acres Affected	2017 Acres Affected
Ouray	3,200	1,600
Archuleta	1,400	400
Hinsdale	580	380



A ponderosa pine tree killed by the roundheaded pine beetle on The Glade, Dolores County. Photo: Dan West, CSFS

Roundheaded Pine Beetle [*Dendroctonus adjunctus*]

The roundheaded pine beetle is an indigenous bark beetle closely related to mountain pine beetle, spruce beetle and Douglas-fir beetle. Southern Colorado is

thought to be the northern-most portion of its native range, which extends as far south as Guatemala. Ponderosa pine is considered the primary North American host tree species, and trees are attacked late in the year, from August through November, with the beetle producing one new generation per year.

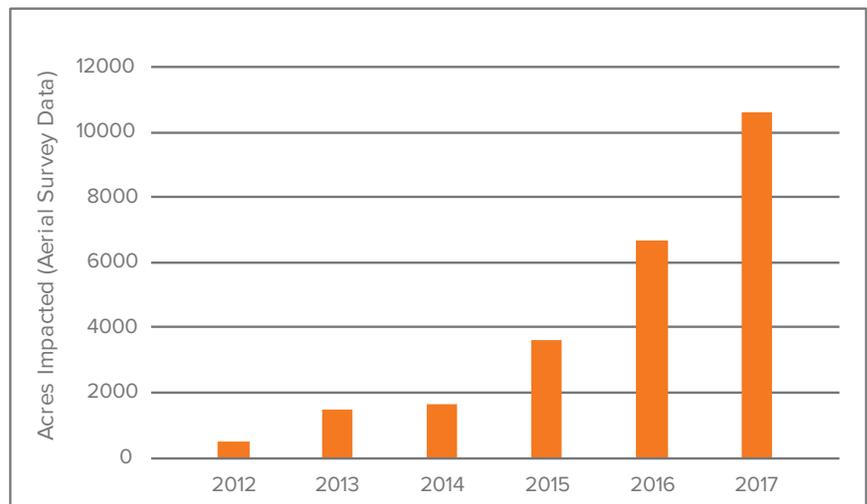
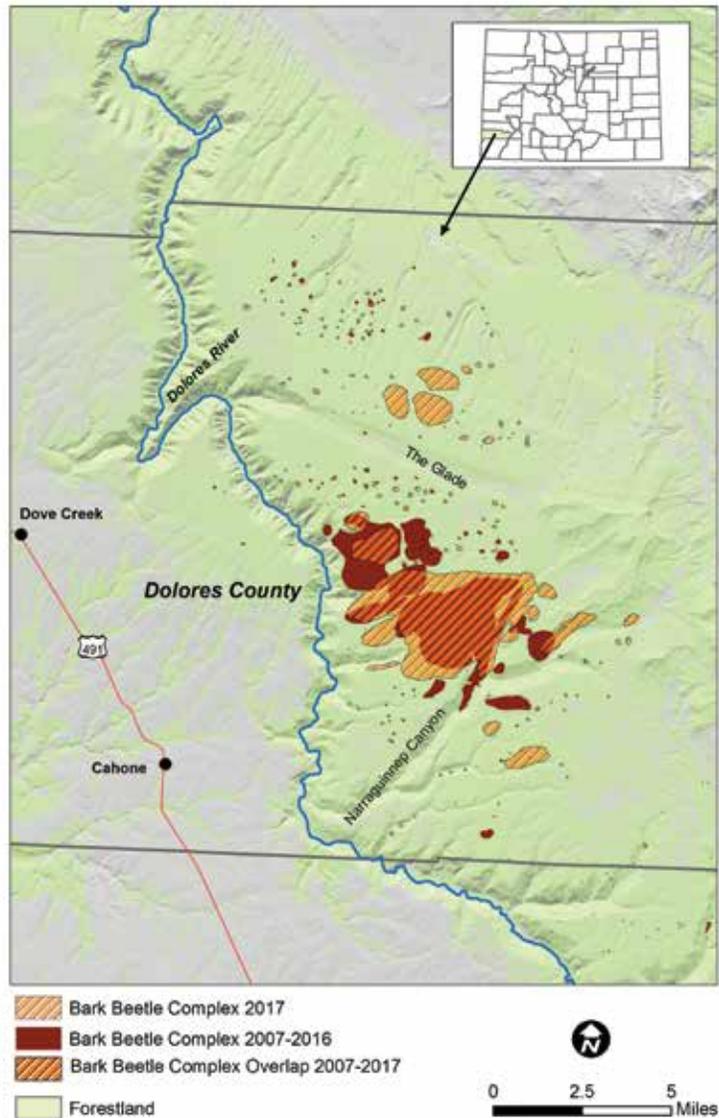
Roundheaded pine beetle attacks a wide range of tree ages and sizes, most commonly after a prolonged drought period. Outbreaks typically are short in duration, though contiguous ponderosa pine forests in Dolores County have sustained increased mortality for the sixth consecutive year. Roundheaded pine beetles may kill trees solely, or they may be associated with other species of bark beetles in the same tree – including western pine beetle, engraver beetles and mountain pine beetle – in a situation commonly referred to as a “bark beetle complex.”

Nearly 11,000 acres of ponderosa pine were affected in 2017, compared to over 6,000 acres in 2016. All of these observed acres were in Dolores County, in southwest Colorado.



Roundheaded pine beetle and associated native bark beetle-caused mortality in 2016, overlooking the Narraquinnep Canyon in Dolores County. Photo: Dan West, CSFS

Roundheaded Pine Beetle and Associated Bark Beetle-Caused Mortality in Colorado



Roundheaded pine beetle and associated native bark beetle-caused mortality has increased in intensity and area in the southwestern corner of Colorado from 2012 to 2017.



Douglas-fir trees affected by western spruce budworm in Chaffee County. Photo: Dan West, CSFS

Western Spruce Budworm [*Choristoneura freemani*]

Western spruce budworm larvae feed in the buds and on new needles of Douglas-fir, true firs (*Abies* spp.) and spruce, with adult moths most active later in the summer. Larval feeding causes a reddish-brown color in the needles and terminal ends of branches. For a number of consecutive years, this moth has been Colorado’s most damaging and widespread forest defoliator, with heavy damage occurring in Douglas-fir forests throughout the southern portions of the state.

- 252,000 acres of Douglas-fir, true firs and spruce were impacted statewide in 2017 – an increase from 226,000 acres in 2016.
- Areas significantly affected in 2017 include the Sawatch Range and West Elk Wilderness in central Colorado; the Culebra Range and much of the Sangre de Cristo Mountains;

the Mosquito Range and Tarryall Mountains in Park County; and along the southern portions of the Rampart Range and Front Range.

- Notable counties affected in 2017:

Colorado County	2016 Acres Affected	2017 Acres Affected
Saguache	27,000	75,000
Gunnison	15,000	42,000
Huerfano	17,000	13,000
Park	14,000	12,000
Rio Blanco	19,000	11,000
Las Animas	20,000	11,000
Fremont	11,000	11,000
Custer	14,000	11,000

Deciduous Forests

Defoliating Insects of Aspen

Western tent caterpillar (*Malacosoma californicum*) and large aspen tortrix (*Choristoneura conflictana*) are two insect species capable of significantly defoliating Colorado’s aspen forests when population levels are high in

the summer months. Western tent caterpillars produce protective silk tents, most often seen in the crowns of aspen and cottonwood trees. Mountain mahogany, chokecherry and plums also are sometimes affected. Large aspen tortrix feed on aspen leaves and also roll them into shelters in which they pupate.

- 38,000 acres of aspen forest were defoliated statewide in 2017, compared to 19,000 acres defoliated in 2016.
- Notable counties affected in 2017:

Colorado County	2016 Acres Affected	2017 Acres Affected
Gunnison	520	4,400
Garfield	470	3,900
Archuleta	1,900	3,400
Mesa	690	2,800
Conejos	1,700	2,300
Dolores	960	2,200



A newly emerged emerald ash borer adult on an ash tree leaf in Boulder County. Photo: Dan West, CSFS

Leaf Diseases of Aspen and Cottonwoods

Several species of leaf fungi are sometimes responsible for the thinning or discoloration of aspen and cottonwood foliage in Colorado, but their impacts were isolated in 2017. Discoloration of foliage caused by a combination of Marssonina blight and/or Septoria leaf blight (*Septoria* spp.) caused early leaf drop and diseased leaves primarily in the north-central and northwest mountains, where environmental conditions favorable to these fungal pathogens developed. A total of 40,000 acres of aspen forest were affected by foliar fungi statewide, with nearly half of these acres located in Routt County.

- Notable counties affected in 2017:

Colorado County	2016 Acres Affected	2017 Acres Affected
Routt	1,300	19,000
Rio Blanco	1,100	11,000
Moffat	-	3,600
Garfield	-	2,700
Grand	-	1,200
Eagle	-	1,100

Other Broadleaf Defoliators

Thousand Cankers Disease/
Walnut Twig Beetle
[Pityophthorus juglandis]

Thousand cankers disease is found in the Western United States and results from a species of tiny twig beetles (*Pityophthorus juglandis*), feeding primarily on black walnut trees, spreading a canker-causing fungi (*Geosmithia morbida*). Black walnut trees have been impacted in recent years along the Front Range and Eastern Plains of Colorado. The disease has spread especially quickly throughout Fort Morgan, with many symptomatic trees being observed each year from 2015 to 2017. An additional detection occurred in 2017 in the nearby community of Brush, also within Morgan County. No other new detections were located in 2017.

Exotic Pests

The introduction of exotic insects, fungi, plants and other organisms threatens not only Colorado's forests, but those around the world. Invasive species can cause severe damage in

their new habitats, as the newfound host trees that are unfamiliar with the introduced pest may have little or no natural resistance. Also, native predators and parasites may not be present in the new habitat to help keep populations of these exotic species in check. Once established, invasive forest pests can be spread over long distances via the human transport of firewood, nursery stock and other plant materials. Exotic insects and diseases pose a continual threat to Colorado's native and planted forests; of these, emerald ash borer is potentially the most destructive.

Emerald Ash Borer *[Agrilus planipennis]*

Emerald ash borer (EAB), an insect native to Asia, is considered the most destructive tree pest ever to be introduced into North America. EAB was initially introduced to the continent roughly two decades ago. First detected in Michigan in 2002, this insect has now killed millions of ash (*Fraxinus* spp.) trees in at least 31 states and two Canadian provinces.

Infestations were first detected in Colorado in 2013, in the City of Boulder, and since then detections have occurred throughout Boulder County. Approximately 15 percent of the trees in Colorado's urban and community forests are ash, making EAB a major threat statewide. Although early detection of this exotic pest remains challenging, an additional detection in the City of Lafayette was confirmed in 2017 – still within the known-infested County of Boulder. Positive detections have also previously occurred in Gunbarrel and Longmont, and in all these areas EAB populations continue to expand.

A collaborative interagency team has been organized to coordinate surveys and pest management activities to help limit the spread and reduce the impacts of this extremely destructive insect. Agencies and organizations represented on the Colorado EAB Response Team include the CSFS, Boulder County, City of Boulder, Colorado Department of

Agriculture, Colorado State University Extension, Colorado Tree Coalition, Green Industries of Colorado, University of Colorado, USDA Animal and Plant Health Inspection Service (APHIS) and multiple municipalities. Team members have been leading efforts in evaluating traps designed to attract adult beetles to seek early detection; the release of four species of parasitic wasps that prey on EAB; the establishment of a quarantine zone in Boulder County and surrounding areas; and providing current information on the pest's status and the most effective ways to protect ash trees.

Other Damaging Agents

Pine Needle Scale *[Chionaspis pinifoliae]*

Pine needle scale was the most significant damaging insect to private forestlands in Grand County for the third consecutive year. This insect feeds on the needles of most pine species, and also on Douglas-fir and spruce. During severe outbreaks, the tiny scales can settle over entire needles, robbing the tree of necessary nutrients. Heavy infestations also can cause premature needle drop, crown dieback, increased susceptibility to other insects or disease, and even tree death.

Pine needle scale has been active in many areas throughout the Fraser Valley for several years. This increase in activity likely is a result of heavy and sustained chemical spraying to prevent bark beetle infestation, which kills beneficial insects that feed on the scales. Lodgepole pines of every size, from small saplings to mature trees, are in some areas heavily infested with the scale, and foresters have observed tree mortality even without additional insect or disease impacts.

Assessments conducted in 2017 indicate the Fraser Valley infestation declined slightly in some areas. Yet communities along the I-70 corridor (including Empire, Vail, Breckenridge and Frisco) had severe to moderate impacts on both native and transplanted spruce.

Dwarf and True Mistletoe

Several species of dwarf mistletoe (*Arceuthobium* spp.) and one additional species of true mistletoe (*Phorodendron* spp.) are naturally present in Colorado. The only true mistletoe in the state, commonly known as the juniper mistletoe (*P. juniperinum*), occurs in the southwest corner of the state and affects several juniper varieties. This mistletoe is considered less aggressive than dwarf mistletoes, though is still

impactful in the harsh climates where many junipers occur.

Dwarf mistletoes are leafless parasitic plants that derive nutrients from their host trees by sinking their own roots through the bark of branches and stems. Within six years, developed shoots begin to produce flowers and seeds that allow for reproduction. All of Colorado's native pines and Douglas-fir trees are susceptible to mistletoe species.



Dwarf mistletoe infection on lodgepole pines is ubiquitous throughout Colorado. Photo: Dan West, CSFS



Needle cast fungi affecting a lodgepole pine near Vail Pass, Summit County. Photo: Dan West, CSFS

Dwarf mistletoes are harmful to host trees in that they cause branches to swell at the infection site, eventually forming large “witches brooms” of densely clumped twigs. Infection eventually causes trees to become stunted and deformed. Seeds of the parasite are ejected onto adjacent trees by the shoots, while long-range dispersal is possible via movement by wildlife.

Mistletoe continues to be a persistent problem for communities and native forests statewide. A range of infection severity regularly occurs across the state, from localized pocket and stand impacts to severe infections that impact entire drainages. Infection rates of the only true mistletoe vary and continue to be noticeable in the southwest corner of the state, mainly around Mancos and Dolores in Montezuma County.



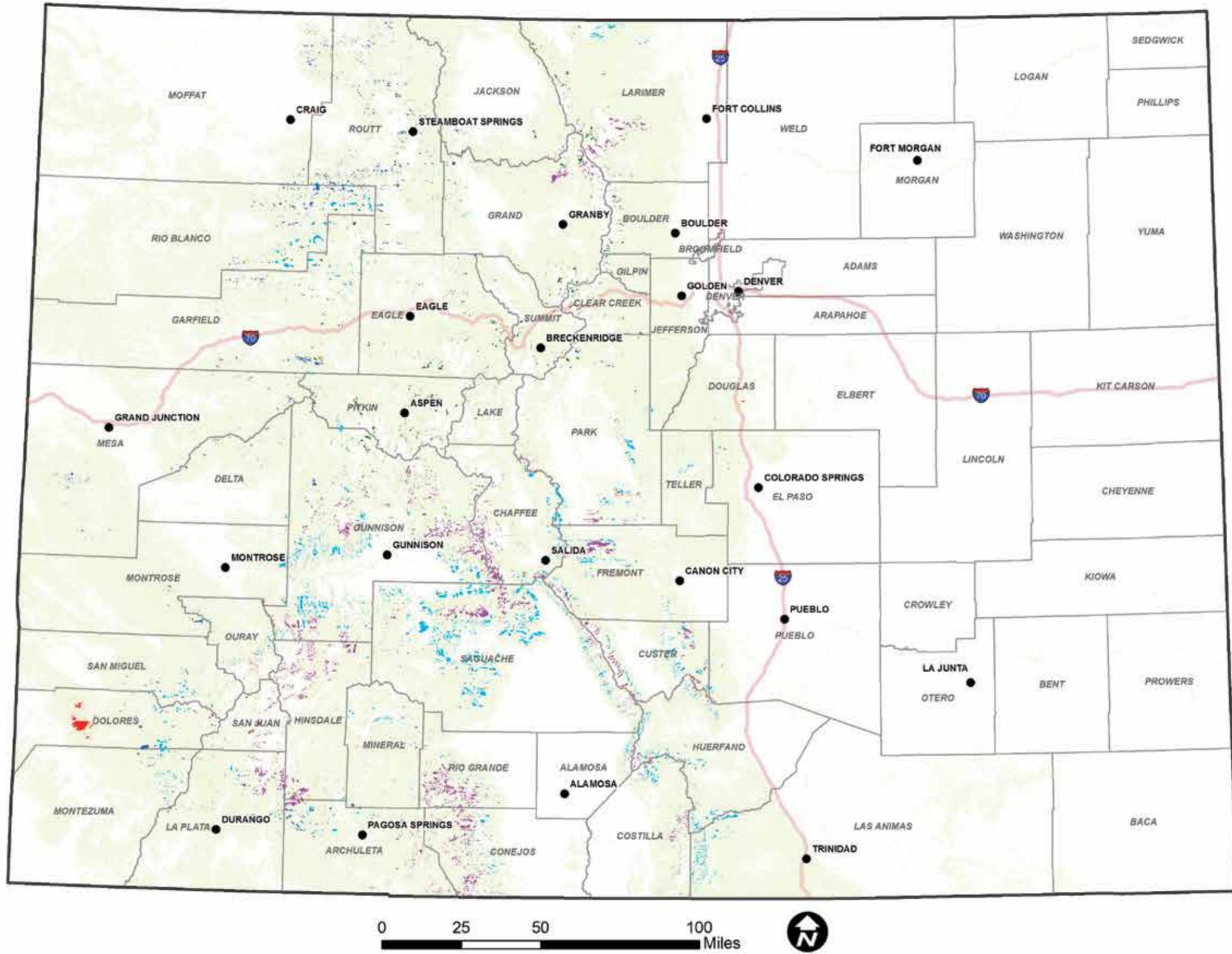
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Lodgepole Pine Needle Cast

Lodgepole pine forests along I-70 over Vail Pass, and on Monarch Pass in Saguache County, were discolored by a needle-cast disease in 2017. Premature needle drop of older needles and discoloration of both older and new needles was caused by two species of fungi of the genus *Lophodermella*, triggered by above-average precipitation in the spring. Environmental conditions favorable to the fungi, which require continually wet leaf surfaces, became widespread. The fungi are often seen near streams or areas that experienced a heavy snowpack and resultant greater humidity levels in the spring months.

2017 Insect and Disease Activity in Colorado Forests



 Forestland	 Spruce Beetle 205547 acres
 Western Spruce Budworm 252361 acres	 Western Balsam Bark Beetle 50080 acres
 Douglas-fir Beetle 14000 acres	 Bark Beetle Complex 12000 acres
 Fir Engraver 2496 acres	 Aspen Diseases and Defoliating Insects 78421 acres

Aerial Survey Data

Due to the nature of aerial surveys, the data on this map only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Some destructive diseases are not represented on the map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as an indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable, and not all trees in shaded areas are dead or defoliated.

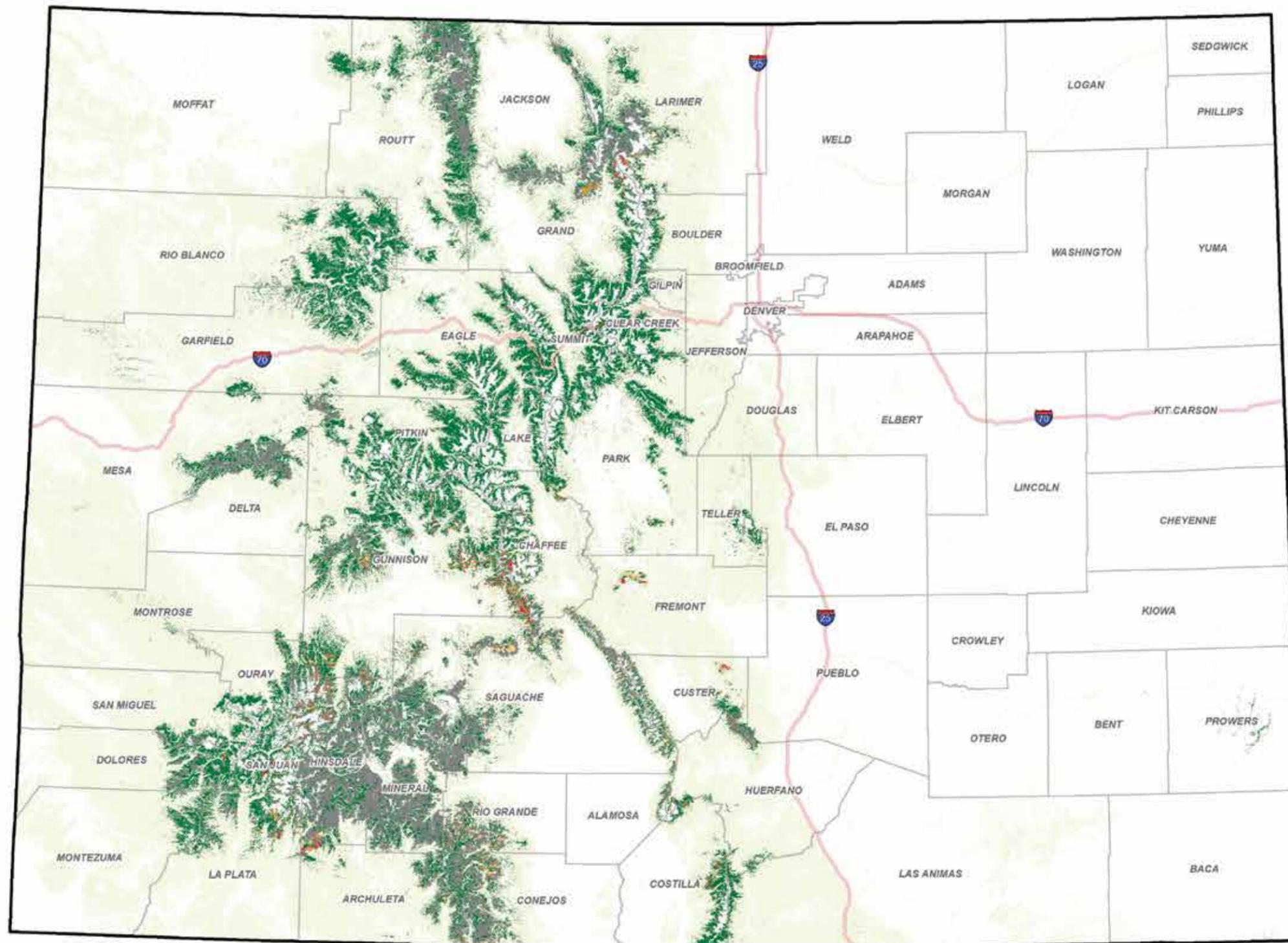
The insect and disease data represented on this map are available digitally from the USDA Forest Service, Region 2 Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this map for purposes other than those for which it was intended may yield inaccurate or misleading results.

In 2017, aerial survey hardware and software were upgraded to keep up with technology advances, allowing greater precision for observers. While this represents an improvement in aerial survey methods, caution should be used when comparing this year's data to previous years due to slightly differing sampling tools.

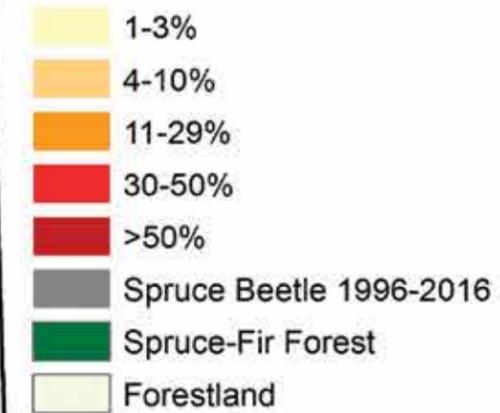
Map created December 2017
 For more information:
www.csfs.colostate.edu
 ©CSFS



Spruce Beetle Activity in Colorado Forests, 1996-2017



Spruce Beetle Intensity 2017



Spruce beetle intensity percent classes denote the number of dead trees relative to the total forested area within the polygon. Contiguous spruce forests susceptible to spruce beetle exist in the central part of the state, between the advancing fronts of separate ongoing outbreaks in the north and south.

Aerial Survey Data

Due to the nature of aerial surveys, the data on this map only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. The data presented on this map should only be used as an indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable, and not all trees in shaded areas are dead or defoliated.

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Spruce-fir type represents Engelmann and/or blue spruce occurrence with basal area >1 (based on basal area data FHAAS*).).



Map created December 2017
 For more information:
www.csfs.colostate.edu
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*Data Source: United States Department of Agriculture (USDA) Forest Health Assessment & Applied Sciences Team (FHAAS)

Special Section: Meeting the Challenge of Dead and At-Risk Trees

Colorado's forests contain millions of dead trees, in large part due to the impacts of bark beetles in recent decades. Nearly 3.4 million acres of predominantly lodgepole and ponderosa pine forest have been impacted by the mountain pine beetle since 1996, and another 1.78 million acres of Engelmann spruce have been affected by a similar forest insect, the spruce beetle. Together, these bark beetles have caused widespread tree mortality on roughly one-fifth of Colorado's forestland over the past two decades.

While the affects of bark beetles are a natural form of ecosystem disturbance, and all forests contain a number of dead trees – many of which provide important

wildlife habitat – an excessive degree of forest mortality can cause problems. Forests with higher percentages of tree mortality, and unhealthy forests in general, are more likely to fuel large, intense wildfires that threaten public safety, water supplies, wildlife and recreation. Broad-scale tree mortality that is followed by destructive wildfires also can have implications related to climate change, as dead and burned forests become sources of carbon moving into the atmosphere, rather than acting as sinks that absorb carbon from the atmosphere.

Besides the need to address dead trees on the landscape, the need to proactively manage forests with a focus on healthy trees – especially

those at high risk for future insect and disease concerns – remains an ever-present priority. Many agencies and organizations are taking actions to address not only the concern of millions of dead trees, but also forest stands at risk to current and future forest insect outbreaks. The Colorado State Forest Service (CSFS) works with numerous key partners to mitigate the potential impacts of bark beetle epidemics, which could lead to many more standing dead trees, and to address dead trees already in the forest from past outbreaks. The following segments cover some of the programs, partnerships and preventive strategies to deal with the growing problem of dead and vulnerable trees in Colorado's forests.

Working Together to Manage Bark Beetles in the Gunnison Basin

The Gunnison Basin encompasses more than 8,000 square miles of western Colorado in Delta, Gunnison, Hinsdale, Montrose, Ouray and Saguache counties. The region has dealt with some of the state's most serious bark beetle outbreaks over the past five years. Due to prolonged drought conditions from 2010 to 2015, outbreaks of multiple bark beetle species have occurred in pine, mixed-conifer and spruce-fir forests. This creates concerns for fuels management, watershed health, recreation, safety and wildlife habitat, and the need for effective partnerships and strategies to mitigate these impacts. Several programs and methods are currently being employed to deal with this ongoing concern and mitigate its impacts.

The Western Bark Beetle Program

Western Bark Beetle Program funds from the U.S. Forest Service are administered by the Colorado State Forest Service (CSFS) to implement forest management activities in areas that are threatened by or are currently infested with bark beetles. These projects aim to improve forest conditions at a landscape scale, emphasizing treatments of beetle-caused mortality on private lands. Landscapes are treated by removing or destroying bark beetle-infested trees and by reducing the risk of future beetle infestations through tree thinning and removal. The CSFS Southwest Area has administered the Western Bark Beetle Program for almost two years, and has seen early success in forests threatened by Douglas-fir beetle and spruce beetle.

Bark beetle activity has increased in central and southern Colorado, especially in the Gunnison Basin. Spruce beetle, a native insect of high-elevation Engelmann spruce, has caused widespread mortality. Also, stands containing Douglas-fir in the West Elk and La Garita mountains of the Gunnison National Forest have seen significant infestation levels from the Douglas-fir beetle. These latter native beetles prefer to attack the largest Douglas-fir trees first, resulting in "group kills" of 10 or more trees at a time. In general, susceptible Douglas-fir trees average 120 years in age and 14 inches in diameter, growing in dense stands. In the basin and throughout much of Colorado, Douglas-fir trees prefer to grow on north-facing slopes and in smaller stands adjacent to contiguous Douglas-fir forests at lower



Before (left) and after (right) a forest management treatment using Western Bark Beetle Program funds on the Double R Ranch. Photos: J.T. Shaver, CSFS

elevations. These forest stands are highly valued for watershed protection, recreational uses and wildlife habitat.

The CSFS mitigates bark beetle impacts to Douglas-fir and Engelmann spruce forests under the Western Bark Beetle Program by identifying infested stands in the Gunnison Basin, and then implementing related forest management activities. To improve stand resiliency to future bark beetle disturbance, management treatments remove currently infested trees and thin dense stands to improve individual tree growth. CSFS foresters also meet with private landowners to discuss possible projects and inform them about forest health issues on their properties. Not every site visit results in a completed project, but these visits allow the CSFS to inform the public on local forest health issues and discuss recent trends.

Since 2016, three Western Bark Beetle projects have been completed in Gunnison County. Two of the projects were focused on suppression of insect populations, with pockets of infested Douglas-fir trees removed. The third project focused on both direct suppression of infested trees and preventive tactics that included thinning

the forest to promote species diversity and increase the vigor of the residual forest. Overall, 44 high-priority acres were treated from 2015 to 2017 using Western Bark Beetle Program funding alone in Gunnison County.

The Double R Ranch is one of the locations where the program has been implemented. A project there improved forest health through the removal of infested Douglas-fir trees, and by thinning the forest to a manageable density to allow for the use of pheromone applications to deter bark beetle attacks. Ranch Manager Bill Bavin attributes much of the ranch's forest resiliency to the Western Bark Beetle Program.

"Working with the Colorado State Forest Service has been a very beneficial relationship for the ranch," Bavin said. "Through the Western Bark Beetle Program and the help of CSFS foresters, we were able to get a handle on the infestation of Douglas-fir beetle."

The acres treated thus far are just a start for the program in Gunnison County. There is a high demand within Gunnison and Hinsdale counties for these projects, due to the currently elevated populations of both spruce beetle and Douglas-fir beetle. The CSFS

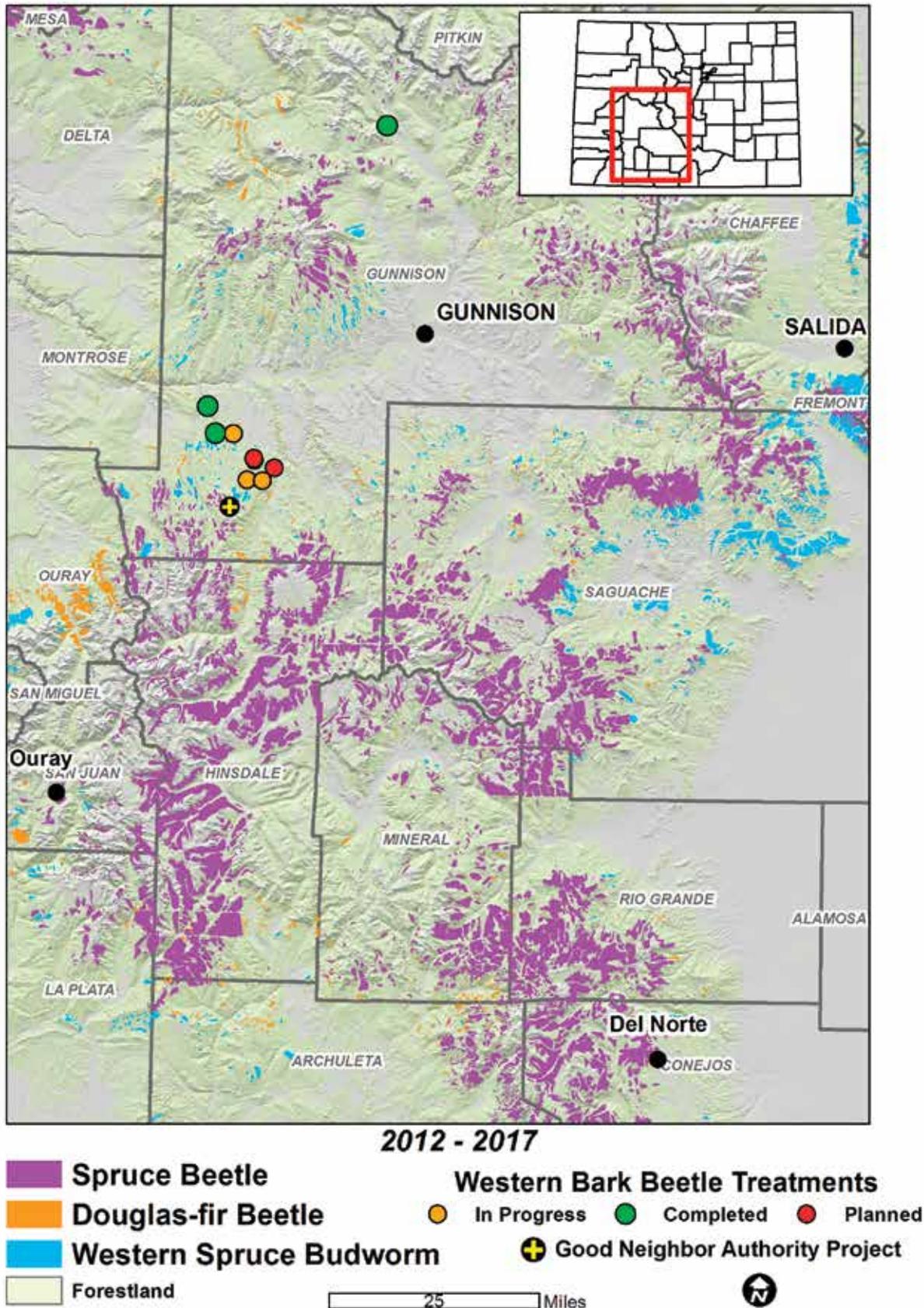
Southwest Area has three additional projects slated for completion in 2018 and another four projects anticipated to be completed in 2019.

Pheromone Treatments for Bark Beetles

Douglas-fir beetles are beneficial native insects of Western forests, normally found at low densities attacking trees that have been injured or predisposed to attack from temperature extremes, root diseases, lightning strikes or other stressors. Like other bark beetles, they communicate with one another via chemicals known as pheromones. Pheromones can either attract or repel other individual bark beetles. In the initial attack phase, female Douglas-fir beetles emit attractant, or "aggregation," pheromones to draw additional individuals in to focus on a targeted tree through mass attack. As more beetles arrive and mate, the concentration of aggregation pheromones declines and the anti-aggregation pheromone increases. This prevents overcrowding of offspring in the host tree.

The repellent, or anti-aggregation, pheromone for Douglas-fir beetle is commonly referred to as MCH. MCH

Insect Impacts and Forest Management Treatments in the Gunnison Basin



Douglas-fir beetle, spruce beetle and western spruce budworm-affected areas from 2012 to 2017 relative to state-managed areas for these insects.

was first isolated from the Douglas-fir beetle in 1971. Since then, several scientific studies have demonstrated the effectiveness of MCH in repelling attacks on susceptible trees under high beetle populations. In 1999, MCH was registered with the EPA to be used on individual trees through slow-release pouches.

MCH pouches have been successfully used by the CSFS in the Gunnison Basin since 2012. By 2015, the MCH program had grown immensely, with 76 landowners participating in the program each year. In the spring of 2017, the CSFS Southwest Area and

cooperators applied 3,424 MCH packets for private landowners. Many additional landowners applied their own MCH packets in 2017. Overall, more than 13,000 MCH packets were deployed that year, addressing 650 acres in both Gunnison and Hinsdale counties.

The program continues to be a success, due to the cost-effectiveness of the MCH packets – which at \$50 to \$75 per acre represent a lower-cost option than removing dead trees after a bark beetle outbreak. This benefit is coupled with the ease of application, providing many private landowners the ability to apply the MCH packets



A Douglas-fir beetle anti-aggregation MCH pheromone pouch. Photo: Dan West, CSFS



J.T. Shaver, a forester in the CSFS Southwest Area, applies MCH anti-aggregation pheromone to a Douglas-fir in Gunnison County. Photo: Dan West, CSFS

themselves. Due to the MCH program, entire subdivisions have successfully protected their trees even while the surrounding forest has sustained bark beetle-caused mortality.

The San Juan Ranch Estates, an 80-acre subdivision in Hinsdale County, has applied MCH for the past three years. Dennis Mourning, president of San Juan Ranch, credits the use of MCH in successfully protecting their forested resource.

“We have yet to lose a tree to the Douglas-fir beetle,” he said. “Faced with limited options, we are especially thankful to the Colorado State Forest Service for controlling Douglas-fir beetle within our subdivision. Our challenges included location and steep terrain, bordered by public property, and a high percentage of our trees being Douglas-fir. Spraying preventive insecticides was deemed not feasible nor cost effective.”

Pheromone treatments continue to offer a good short-term solution to bark beetle outbreaks in the Gunnison Basin, but they are not 100 percent effective and do not replace the need for ongoing forest management.

Good Neighbor Authority Leverages Local Resources to Improve Forest Health and Resiliency

A nationwide legislative authority granted through the 2014 Farm Bill, the Good Neighbor Authority (GNA) allows state resources and contracting procedures to be used on federally owned, U.S. Forest Service (USFS) and Bureau of Land Management-administered lands. Because wildfires and insect and disease outbreaks do not respect land ownership boundaries, some of the core operating procedures of the GNA program are to leverage other partnering agencies and organizations to be able to accomplish forest health and resilience treatments across ownership boundaries and cover large landscape-scale areas. The program also allows for greater contracting and staffing efficiencies to address project work, enabling more work to get done on the ground.

The authority is currently helping local Gunnison Basin forest resource managers address recent spruce beetle and aspen decline issues. Perhaps most importantly, it is allowing the USFS to leverage CSFS resources to plan and implement treatments on larger areas of forested land in the basin that have been affected by the spruce beetle.

After the CSFS signed a GNA Master Agreement with the USFS regional office in 2015, numerous Supplemental Project Agreements have been executed throughout Colorado at the more local forest level, between CSFS areas and USFS Forest Supervisor offices. The CSFS has continued building a strong relationship with the Grand Mesa, Uncompahgre and Gunnison National Forests (collectively referred to as “GMUG”) and the other resident partners associated with the Spruce Beetle Epidemic and Aspen Decline Management Response (SBEADMR) planning effort. The startup of the partnership’s new plan on the GMUG has been a huge local effort

with a diverse group of stakeholders that includes conservation and environmental organizations; hunting and recreation interests; local industry; and local, state and federal agencies.

As part of a GMUG East Zone project agreement, the Alpine Plateau GNA project will have three separate timber sale areas, potentially treating up to 3,000 acres over the next five years. These projected sale areas have been spatially laid out by the SBEADMR planning team to locate areas of operable ground and beetle activity. Federal funds will be leveraged with legislatively directed seed money funds from the state, per Colorado House Bill 16-1255, to accomplish management efforts.

This bill’s direction included the CSFS’s use of the GNA program, along with the USFS, “to implement forest management treatments that improve forest health and resilience and supply forest products to Colorado businesses.” In addition to the positive effects to

the general health and resilience of the Gunnison Basin’s forests, the local forest products industry infrastructure will also benefit through the resultant salvage timber sales.

Working in the Gunnison Basin on National Forest lands also has many benefits with regards to adjacent private and Bureau of Land Management lands. As an example, the Arrowhead Ranch subdivision is a privately owned community located to the north of the Alpine Plateau GNA project. This subdivision will benefit greatly through a reduction in the amount of dead standing timber in the forest near their mountain homes – which might otherwise serve as fuel for an approaching wildfire.

The CSFS and its federal partners are eager to increase use of the GNA throughout Colorado to increase the number of managed acres in areas affected by insects and disease, while increasing forest resilience on a landscape scale.



The removal of beetle-killed trees is often a preferred management option, as seen in this project that addressed mountain pine beetle impacts in Summit County. Photo: Kristin Garrison, CSFS

Finding Markets to Utilize Colorado's Dead Trees

Many forested areas in the state contain unusually high numbers of dead trees. And in some of these areas, despite the drastic changes to the landscape, forest management is not allowed or a feasible option. For example, some of these areas are designated wilderness – where natural processes are the desired sole driver and impacts from human activities are expected to be minimal – while other areas have steep, untreatable acres, poor access or timber of such low quality that management is not feasible.

However, many other forested areas with high levels of tree mortality can and should be treated. Throughout the state, the Colorado State Forest Service (CSFS) and its partners are working with sawmills and forest products businesses of all sizes to deal with the aftermath of major bark beetle epidemics – and the resultant high number of dead trees. Colorado has 102 sawmills statewide, ranging in size from small mobile operations to large-scale permanent facilities, and it is estimated that nearly one-third of these mills use beetle-killed trees as part of their wood supply.

One of the locations where the state's forest management priorities align with the needs of the forest products business community is the Alpine Plateau of the Gunnison Basin, which, as previously described, is facing large-scale bark beetle outbreaks. Other areas where dead trees are being utilized include northern Colorado communities previously impacted by mountain pine beetle, and mills in the Black Forest and San Luis Valley making use of the wood from trees killed by wildfire or insects.

Efforts in the Gunnison Basin

The Gunnison Basin produces some of Colorado's most valuable timber species for local wood products businesses. Recently, supply inconsistencies and the economic downturn contributed to an absence of wood products manufacturers to meet the area's forest management needs. Fortunately, new public-private forest management partnerships have the area's mill capacity returning and more profitably sourcing tree removals from forest management activities – including the removal of dead trees. The CSFS Southwest Area participates with the U.S. Forest Service in ongoing Good Neighbor Agreements, described in the previous section, and also with local landowners and homeowner associations that together work toward meeting the region's forest management needs.

“We've been able to successfully market the removals from our forest management projects to several of our local wood products businesses,” said Sam Pankratz, forester for the Southwest Area.

From traditional products like lumber to higher-value products for the log and residential home industries, this wood is finding a use across Colorado as well as in out-of-state markets. Good Neighbor agreements, along with the area's active private landowners and homeowner associations, are critical in the management of spruce forests to make them more resistant to spruce beetles, and also to recover value from trees that have already succumbed to the beetles.

“Add to that our active Douglas-fir management efforts, and we're able to offer our forest products business community a diverse range of tree species and a wood quality that allows



Beetle-killed logs in the log infeed at a sawmill in the San Luis Valley, Colorado. Photo: Edward Brian Perkins

them to be more responsive to their consumer wood product markets,” said Pankratz.

Colorado’s largest forest products manufacturer is located in Montrose County, at the edge of the Gunnison Basin, and remains a frequent destination for the wood harvested in the basin. Also, several other smaller businesses important to actively managing the area’s forests are profitably using some of the area’s most valuable timber species.

Utilizing Beetle-Killed Trees After Mountain Pine Beetle

Around the year 2000, northern Colorado began to experience large-scale mountain pine beetle activity and landscape-level tree mortality in its lodgepole pine forests. More than a decade later, the forest products industry and communities within Grand County take pride in how they’ve been able to continue to utilize the resultant wood.

“Over the past 15 years, trees from over 30,000 acres of mountain pine beetle mortality on private and state lands have been sustainably harvested, removed and processed into wood products,” said Ron Cousineau, CSFS Northwest Area manager.

Ninety percent of the wood from mountain pine beetle-killed trees on these managed state and private acres has been utilized by several local mills and made into wood shavings and pellets, posts and poles, house logs and products for bioenergy markets. This diverse group of forest products manufacturers supported, and was in turn supported by, the communities salvaging mortality from mountain pine beetle.

Although the focus of this past 15 years of work has been to remove dead and dying trees, Cousineau says that forest regeneration, protection of critical infrastructure and enhanced watershed

Creating Jobs in the San Luis Valley



An employee working at Blanca Forestry Products, a sawmill that employs almost 50 full-time staff in Costilla County. Photo: Edward Brian Perkins

When Blanca Forestry Products planned to open a new sawmill in the San Luis Valley, some in the community believed that they’d be facing a challenge finding the employees needed to run the mill. To overcome this challenge, the business took advantage of the resources available through the Colorado Office of Economic Development and International Trade and the Colorado Department of Employment.

“Our local workforce center helped us screen over 200 applicants, and in six months we were confident in the candidates we had available to us,” said Ty Ryland, president of Blanca Forestry Products.

Opening in early 2017, the mill employs almost 50 full-time

workers from Costilla County and the surrounding area in permanent, well-paying jobs.

“One of the things it’s been great to see is some of our kids that left the Valley for employment opportunities elsewhere are returning back due to the employment opportunities that we’re able to provide,” Ryland said.

To continue to address the challenges in developing specialized sawmill skills in local communities, the CSFS and Trinidad State College’s Valley Campus are currently exploring opportunities to link the educational and job-training role that the college offers with career opportunities at businesses like Blanca Forestry Products.

resilience have all been key priorities and objectives. Success in utilizing this dead wood also has led to continued investments by Northern Water and Denver Water in the properties these utilities manage in the region, in their larger efforts to maintain the long-term quality of drinking water supplies that millions of downstream residents rely on.

While a great deal of dead wood utilization has been achieved in northern Colorado, it is important to point out that the area is now reaching the point at which the dead trees can no longer be sustainably and economically harvested, to be made into consumable wood products. The trees killed many years ago are starting to fall at increasing rates, and once on the ground the wood becomes much more susceptible to the degrading actions of moisture, fungal attack, cracking and splitting.



The 2017 Colorado Outstanding Logger of the Year, Mike Jolovich of Windy Gap Logging, receives the award from CSFS Northwest Area Manager Ron Cousineau and forester Matt Schiltz. Photo: CSFS



Lumber being processed from trees killed in the 2013 Black Forest Fire. Photo: Evan Mackes, CSFS

“We’ve accomplished a lot on our landscapes and in our communities, in concert with the industry,” Cousineau said. “But our window for utilizing what remains of the mountain pine beetle mortality is probably no longer than three more years.”

Cooperative Efforts to Increase Wood Utilization

Getting the most value out of wood derived from Colorado’s standing dead trees is the purpose behind cooperative efforts among the CSFS, Colorado State University, the U.S. Forest Service (USFS), local community organizations and local sawmills.

“One area we are looking at is how long wood remains usable, and how much our wood deteriorates, after trees are killed by bark beetles or fire,” said Dr. Kurt Mackes, senior research scientist with the CSFS and assistant professor with the Department of Forest and Rangeland Stewardship at Colorado State University. “What we’re seeing is that some of the trees may be deteriorating faster than we expected, but it varies widely from the time since the trees were killed.”

Using a combination of mobile and stationary mill technology, projects located in Colorado’s Black Forest and the San Luis Valley are producing lumber from trees killed during the 2013 Black Forest Fire, and those killed in the current spruce beetle outbreak in southern Colorado.

“We’re finding through using a mobile sawmill technology that there are opportunities to profitably recover and make wood products from trees years after being killed in the Black Forest Fire,” said Mackes.

A sawmill in Ault, Colo., cooperating with Black Forest wood utilization efforts also is producing premium-width ponderosa pine panels from trees that likely otherwise would have been simply mulched on site following the fire. The outcome of these efforts is to

Job Training to Bolster Colorado’s Wood Products Industry

Evolving the conventional education model, transforming student lives and turning wood into value-added products is the mission of the Manufacturing Industry Learning Lab, a training center in Colorado Springs commonly referred to as “The MiLL.” The center boasts 46,000 square feet of classroom and manufacturing space, with more than \$3 million of advanced manufacturing equipment.

“All of our equipment is donated by the industry themselves because they see the return on this investment, in the form of an educated and trained pool of candidates to hire for the wood manufacturing industry,” said Dean Mattson, founder and director of The MiLL and Peyton Woods Manufacturing.

Graduates of the program receive national certification, and Mattson says many are immediately sought by industry.

“This is definitely not the typical wood-shop class many of us may remember from our high school days,” said Tim Reader, CSFS utilization and marketing program specialist. “The MiLL is a state-of-the-art center focused on wood manufacturing, cabinet finishing and wood construction.”

capture more usable wood volume and higher wood value, and to better inform local forest managers and the sawmill community on how best to anticipate and respond to getting the most value out of dead trees.

The state’s sawmills are critical to meeting forest management objectives. For example, Colorado’s aspen mills are few in number, but are critical to helping forest managers maintain the health and vigor of one of Colorado’s most visible and valuable forest types. To help ensure that mills that utilize exclusively aspen wood continue to be profitable, the CSFS is working with the USFS and local economic development communities to help diversify the products each aspen mill produces and to support the recovery of one of the

state’s most prominent aspen mills following a fire at their facility.

“Through a combination of our own CSFS lending program, the USFS Wood Innovations program, and resources available for our local business and economic development community, we’re able to provide access to capital to support a wider range of log qualities our aspen mills can take, and a more diverse array of products than can be currently made,” said Tim Reader, CSFS utilization and marketing program specialist.



Aspen trees in autumn. Photo: Bob West

Effective Forest Management: A Focus on Prevention

Benjamin Franklin once famously said that “an ounce of prevention is worth a pound of cure.” That principle is perhaps nowhere more true than in the management of forests.

This report on the health of Colorado’s forests offered a special focus on the millions of standing dead trees in the state, and some of the ways the Colorado State Forest Service (CSFS) and its partners are working to address this challenge. Throughout the state, sawmills and forest products businesses are helping land managers successfully deal with the mortality from major bark beetle epidemics. But it is far more effective to prevent the mass die-off of forestland than to respond to losses that have already occurred. From a longer-term perspective, the need to manage all forests – and not just those that have already succumbed to bark beetles or

other threats – remains the primary focus of foresters and land managers in Colorado.

Wildfires, native forest insects and diseases are all critical to the health of forest ecosystems. In fact, these forms of natural disturbance are some of the best means for the stand-level replacement of older, stagnant forests with healthy young trees. Insects in particular also provide an ideal means for the selective removal of individual trees that are less healthy or adaptable than their peers. But in the absence of landscape-level forest management, and in the face of a growing human presence on the landscape, these same forms of disturbance have in recent years demonstrated how they can also become threats. Besides the loss of aesthetic value, high numbers of dead trees in a forested landscape have implications for wildfire intensity

and suppression efforts, specifically, which could – should a fire occur – compromise the many values those forest ecosystems provide.

Everyone benefits from forests in some way, whether enjoying the scenery and wildlife they provide, or the clean air, fresh water and wood products derived from them. One of the best methods to ensure forest resiliency and reduce the risk of threats such as bark beetles or intense wildfires is the selective removal of trees, especially living ones competing with others for resources. Science-based, landscape-scale management by the CSFS and its partners on state, private, federal and other lands can help ensure that future generations benefit from healthier, more resilient forests. This legacy, focused on prevention rather than response, can only be realized if Colorado’s forests are properly managed today.

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CSFS Northwest Area forester John Twitchell guiding a visit to the Colorado State Forest during the 2017 Western Landowner Alliance Tour. Photo: Joe Duda, CSFS

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