

2022

REPORT ON THE HEALTH OF COLORADO'S FORESTS



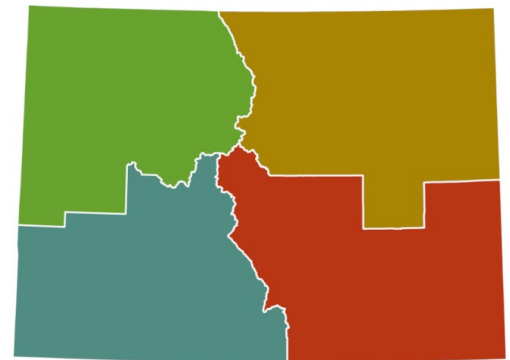
Each year, forest health reports provide information to the Colorado General Assembly and the general public about the health and condition of forests across Colorado, as well as the progress the Colorado State Forest Service is making in addressing critical forest health issues in our state.

Statewide Forest Health Issues



Forest Health Issues by Region of Colorado

Across Colorado, the Colorado State Forest Service is working with residents, communities and partners to improve forest health on a local level.



Reforestation Critical for Colorado's Future

Demand is rapidly growing for nursery-grown seedling trees and shrubs. Colorado needs seedling trees to reforest burned areas, store carbon and build climate-resilient watersheds and forests.

The [Colorado State Forest Service Nursery](#) is the state's leader in producing low-cost, Colorado-grown seedling trees and shrubs for conservation. Last year, the CSFS Nursery started upgrades to its facilities to ramp up production, thanks to funding from the Colorado Legislature.



Stay the Course to Make Fundamental Change in Forests, Communities

Challenges persist for Colorado's forests. This report highlights how ongoing drought, an indicator of a warming climate, continues to stress our forests, setting the stage for insect and disease outbreaks and large, destructive wildfires. We know people continue to move into wildfire-prone areas as Colorado's population grows and more homes are built in the wildland-urban interface. These challenges are enormous, but the state is on the right path to bringing about fundamental changes in the landscape that protect water quality, reduce fuels and sustain our outdoor recreation economy.



The Colorado State Forest Service and its partners have put the pedal down over the last few years on forest management thanks to historic investments by Governor Polis and the Colorado General Assembly. Our local and federal partners have followed suit.

Together, we are doing the groundwork necessary to build our capacity and impact to equal the scale of the problem. It took many decades for Colorado's forests to get to an unhealthy state – and it will take a sustained effort to bring about the change we know is necessary. I encourage you to read this report and join the CSFS on the road to healthier forests, wildfire ready communities and protected watersheds. Working together, we can leave things better than we found them, securing a better quality of life for all Coloradans.

– **Matthew M. McCombs, State Forester and Colorado State Forest Service Director**

Shared Stewardship Essential to Protect Colorado's Natural Resources

Year after year, Colorado proves to be a leader in promoting forest health, reducing wildfire risk and protecting watersheds. Since the 2021 Colorado legislative session, the Colorado Department of Natural Resources and Colorado State Forest Service have seen a monumental increase in funding to support ongoing and new initiatives, utilizing the best science and tools. I am proud of the work completed and look forward to what we accomplish in the years to come.



Shared stewardship is growing and collaboration among all levels of government and private landowners is essential to protecting Colorado's natural resources. DNR is committed to working with the CSFS and other partners to ensure forest management projects are done in the right places, at the right scale, and using all our available tools for active management.

The CSFS annual forest health report highlights the importance of working together to strengthen our collective mission on forest restoration.

– **Dan Gibbs, Colorado Department of Natural Resources Executive Director**

Insects and Diseases

Western Balsam Bark Beetle Overtakes Spruce Beetle for Most Forested Acres Affected

Spruce beetle is no longer the most prolific bark beetle in Colorado after a decade at the top of the list. Last year, western balsam bark beetle impacted more acres of forests statewide than spruce beetle, according to aerial survey data collected by the Colorado State Forest Service and U.S. Forest Service Rocky Mountain Region.

The aerial survey data also showed that western spruce budworm is once again the most widespread forest pest in Colorado, affecting 112,000 acres statewide in 2022. This insect partially eats the needles of trees. It can directly kill a tree after numerous years of defoliation. More often, however, Douglas-fir beetles finish the job and kill the tree weakened by western spruce budworm. Despite the budworm impacting many more acres across Colorado, bark beetles kill more trees.

Eyes in the Skies for Forest Health

Since the 1950s, forest managers have taken to the skies to detect and monitor disturbances to forests from insects and diseases, collecting data that provide an annual look at forest health in Colorado. With this information, managers can see how and where bark beetles and other pests are moving across the landscape and proactively manage these forests to lessen their impacts.



Flying over forests allows managers to detect disturbances from insects and diseases, such as this roundheaded pine beetle infestation in a ponderosa pine forest in the San Juan National Forest in Dolores County. Photo: Dan West, CSFS

Last year, trained aerial observers with the CSFS and USFS flew over 29.9 million acres of forests in small aircraft. Some of the areas spotted during flights were then ground-checked to verify the insect or disease responsible and the severity of the damage.

Aerial observations and on-the-ground assessments showed that, overall, bark beetles and other forest pests remain on the move in Colorado's forests, expanding into new areas as susceptible host trees are killed and new stands offer drought-stressed trees ripe for attack.

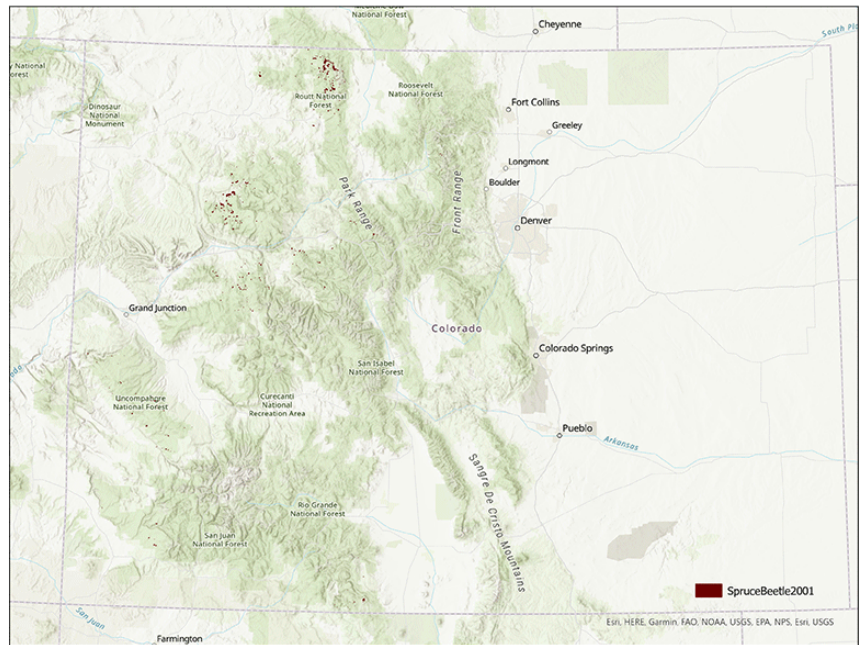
Small Infestations, Large Impact

Prolonged drought and warm temperatures in Colorado’s high-elevation forests have left subalpine fir trees susceptible to attack by western balsam bark beetle. Infestations of this beetle are patchy within a stand of trees – dead trees with a reddish hue intermingle with live green trees. When all of these small patches of infested trees are added up across forests statewide, the impact of this native bark beetle is more apparent. Western balsam bark beetle affected 35,000 acres statewide in 2022.

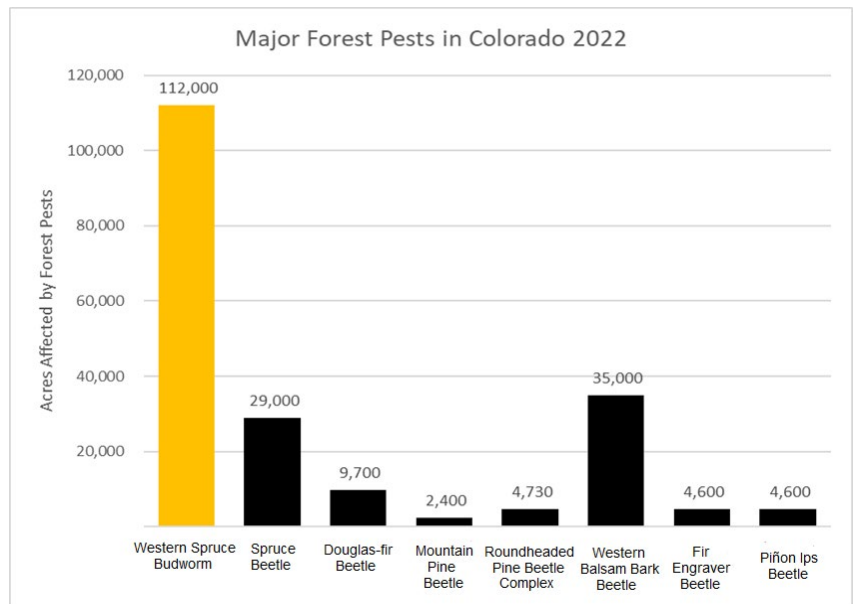
While no longer holding the top spot among bark beetles, [spruce beetle](#) remains impactful despite its overall decline statewide. This native bark beetle affected more than 8,000 new acres across Colorado in 2022 and has the potential to kill a large number of trees weakened by drought in areas experiencing outbreaks, leaving hillsides that may appear much more gray than green over time.

Other bark beetles such as [Douglas-fir](#), [piñon Ips](#) and the native bark beetle complex associated with [roundheaded pine beetle](#) are all expanding into new forests in Colorado as well, as a result of drought and warmer temperatures linked to climate change.

[Western spruce budworm](#), which is a small moth that partially consumes the needles of Douglas-fir trees during its caterpillar stage, continues to be the most widespread forest pest in Colorado. The number of acres impacted statewide is more than the acres impacted by the seven most prolific bark beetles combined.



This progression of maps shows the spruce beetle’s spread across forests in Colorado from 2001 to 2022. The maroon areas show locations where it was active that year, while the gray areas show where it had already affected trees. Since 2000, spruce beetle has affected at least 1.9 million cumulative acres in Colorado, a little more than 40 percent of the state’s spruce-fir forests. Maps: Dan West, CSFS. Graphic: Brian Sathe, CSFS

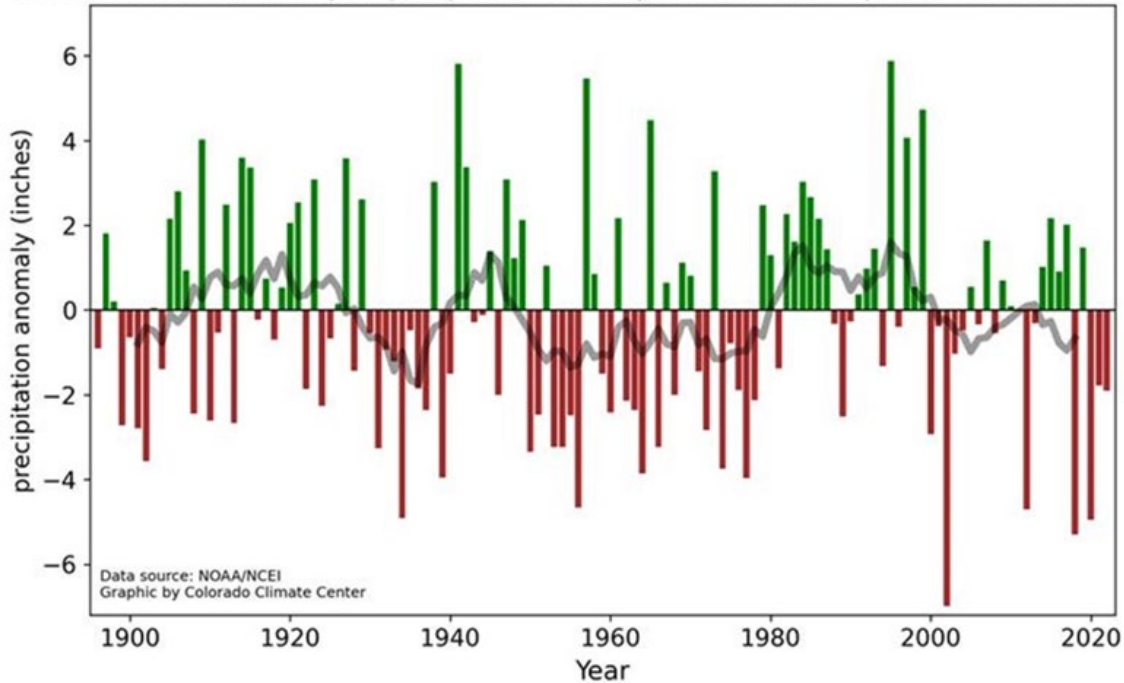


Western spruce budworm is the most widespread forest pest in Colorado. This insect affected more acres statewide in 2022 than the seven most prolific bark beetles combined. Graph: Dan West, CSFS

Warm, Dry Weather Continues to Stress Trees

Warm temperatures and below-average precipitation continue to leave trees susceptible to bark beetle attacks and other forest health issues. During periods of drought, trees are not able to produce enough resin to ward off insects trying to enter through the bark. Despite monsoonal rains arriving last year in parts of Colorado, which relieved some of the drought, several years of adequate precipitation will be necessary for trees to recover their defenses.

Colorado statewide water year precipitation anomaly (inches), with respect to 1901-2000 average



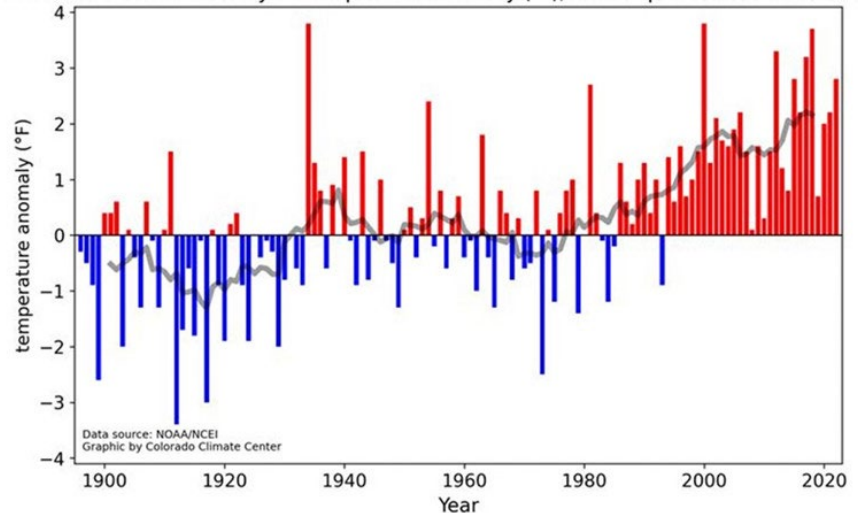
The water year for Colorado for 2022 (Oct. 1, 2021, to Sept. 30, 2022) was the 35th driest on records dating back to 1895. Graph: Colorado Climate Center, Colorado State University. Data: National Oceanic and Atmospheric Administration

Leading into the winter of 2021-22, October to December 2021 was the record warmest, according to the National Oceanic and Atmospheric Administration. The snow season started late but was active through mid-winter. Although 2022 snowpack led to the most runoff in Colorado since 2019, it was still below historical averages. May snowfall ended the season later than usual, causing frost damage on trees throughout areas of the Front Range and Palmer Divide.

The summer of 2022 was warm and dry for most of the state. A heat wave in early July broke records for a 10-day period and again in September, according to NOAA. Record heat last year added to stress on trees already weakened by prolonged drought.

The water year for Colorado for 2022 (Oct. 1, 2021, to Sept. 30, 2022) was the 6th warmest on records dating back to 1895. Graph: Colorado Climate Center, Colorado State University. Data: National Oceanic and Atmospheric Administration

Colorado statewide water year temperature anomaly (°F), with respect to 1901-2000 average



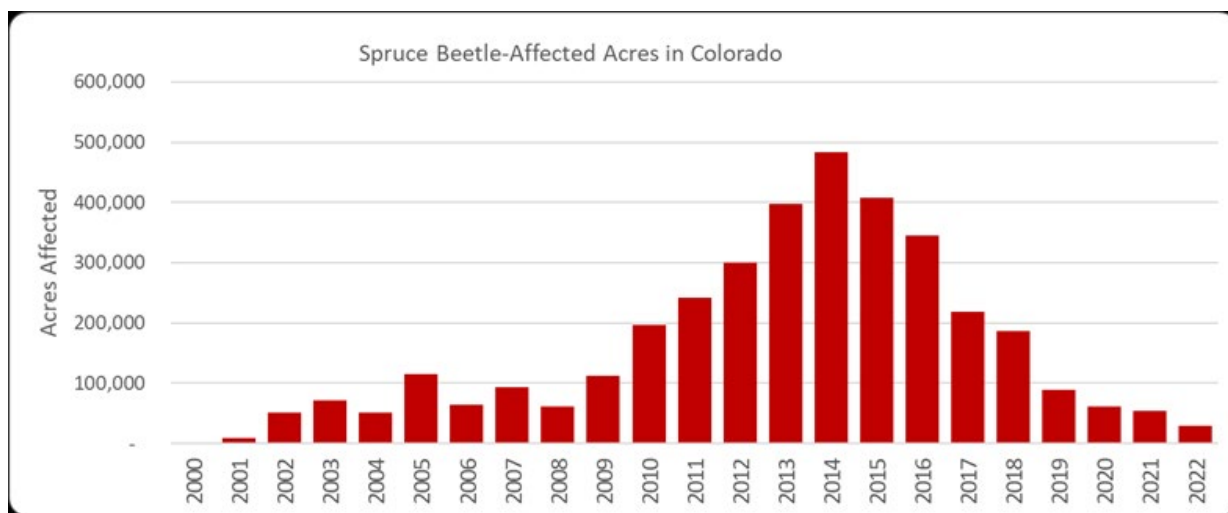
Notable Forest Pests in Colorado

Spruce Beetle

Acres affected statewide in 2022: 29,000

[Spruce beetle](#) (*Dendroctonus rufipennis*) remains in decline overall statewide. This bark beetle affected 53,400 acres in 2021 but only 29,000 acres in 2022. While the number of trees to infest is declining in high-elevation Engelmann spruce forests with outbreaks, the spruce beetle is moving into new areas:

- The Sawatch and Mosquito ranges, primarily in Gunnison, Chaffee and Park counties, continue to experience new infestations.
- Forests in the Needles and San Juan Mountains within Hinsdale, La Plata and San Juan counties also have new acres affected, indicating the expansion of beetle populations.
- The intensity of spruce beetle infestation in Grand and Gunnison counties has progressively declined as fewer large-diameter Engelmann spruce remain in the forest. However, new acres were recorded in Grand County as the beetle's footprint continues to spread.
- Spruce beetle continues to kill trees in Rocky Mountain National Park, particularly around the headwaters of the Colorado River in the Kawuneeche Valley, and along the southern park boundary, on the west side of the Continental Divide. Despite infesting new areas, the spruce beetle has declined in intensity overall in and around the national park for the second year in a row.



Since 2000, spruce beetle has affected at least 1.9 million cumulative acres in Colorado, a little more than 40 percent of the spruce-fir forests in the state. Graph: Dan West, CSFS

Douglas-fir Beetle

Acres affected statewide in 2022: 9,700

[Douglas-fir beetle](#) (*Dendroctonus pseudotsugae*) remains ever-present in most stands with Douglas-fir trees, despite having killed many of the largest, most susceptible trees over the past decade. This bark beetle is especially active in Colorado's central and southern conifer forests. Custer, Eagle, Fremont, Garfield, Gunnison, Hinsdale, Huerfano, La Plata, Mesa, Pitkin and Saguache counties continue to see severely affected Douglas-fir stands.

Notable Forest Pests in Colorado

Western Spruce Budworm

Acres affected statewide in 2022: 112,000

[Western spruce budworm](#) (*Choristoneura freemani*) continues to infest forests with Douglas-fir, white fir, and Engelmann and blue spruce, especially in the south-central forests of Colorado. Delta, Saguache, Gunnison, Chaffee, Mesa, Mineral, Park, Pitkin, Teller and Fremont counties were most affected by budworm in 2022. Tree mortality resulting from numerous years of defoliation is becoming more frequent throughout the southern half of the state. Trees damaged by the budworm for numerous years are at high risk of attack from the deadly Douglas-fir beetle.

Piñon Ips

Acres affected statewide in 2022: 4,600

The [piñon ips beetle](#) (*Ips confusus*) is increasing populations in lowland piñon-juniper forests spurred by prolonged drought conditions. Delta, Garfield, La Plata, Montrose, Mesa and Pitkin counties have significant infestations through 2022 of this Ips beetle, with piñon-juniper forests in other parts of Colorado experiencing pockets of mortality that have progressively increased in recent years.

Western Balsam Bark Beetle

Acres affected statewide in 2022: 35,000

Over the last several years, western balsam bark beetle (*Dryocetes confusus*) and associated root diseases have increased in occurrence and intensity across subalpine fir trees. This beetle usually persists at normal levels in high-elevation forests in balance with associated fungi, but has built populations as drought has left subalpine fir vulnerable to attack. Clear Creek, Boulder, Eagle, Garfield, Grand, Gunnison, Jackson, Mesa, Moffat, Rio Blanco, Routt and Summit counties are experiencing the highest levels of subalpine fir decline.

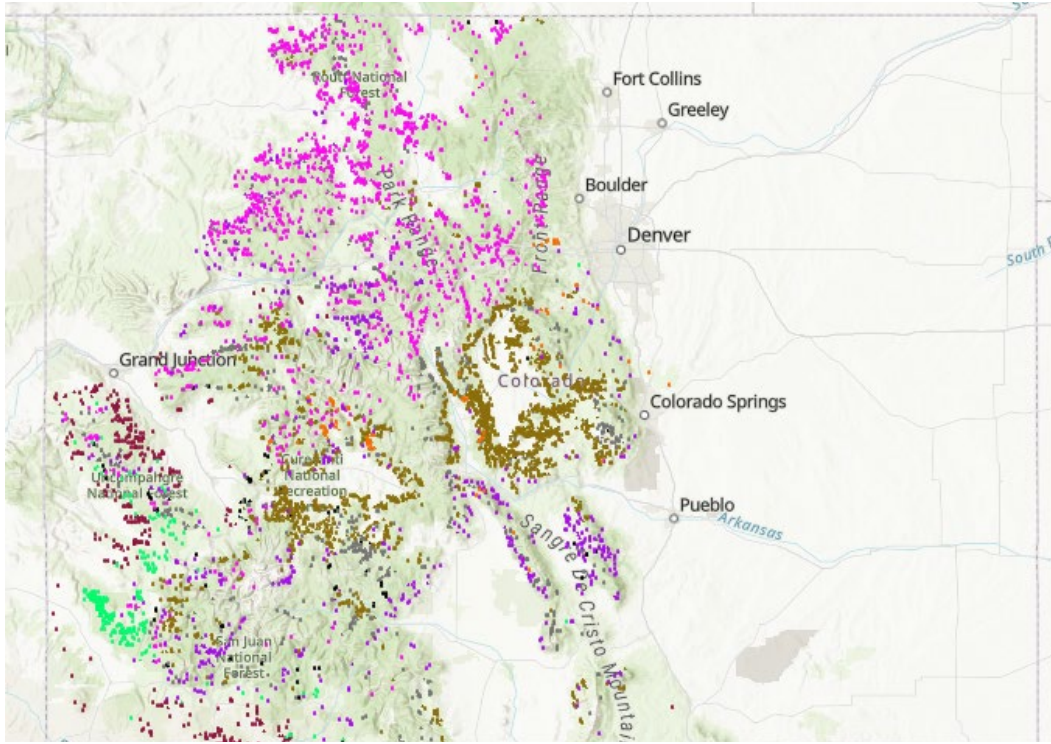
Mountain Pine Beetle

Acres affected statewide in 2022: 2,400

[Mountain pine beetle](#) (*Dendroctonus ponderosae*) persists in pockets of pine trees in areas of Colorado. Localized infestations in ponderosa, limber and bristlecone pines in Chaffee County and in lodgepole pines in Gunnison County continue to expand. Localized activity in the Black Forest in El Paso County persists as well. A developing population of mountain pine beetle in Gilpin County continues to grow in scale and intensity.

2022 Insect and Disease Activity in Colorado

Aerial Detection Survey - Colorado 2022 - All Major Pests



Regular monitoring for damage caused by forest pests is a key component of forest management. In Colorado, the annual aerial forest health survey is the primary source of information on forest pest conditions. This is a cooperative program of the U.S. Forest Service Rocky Mountain Region and the Colorado State Forest Service, in which trained aerial observers representing both agencies fly over the state's forests in small aircraft to map and classify the intensity of the current year's damage. Some areas detected during the aerial survey also are ground-checked to verify the insect or disease responsible for the damage and level of severity.

Resources



Forest Health Issues by Region of Colorado

- [Northeast Colorado](#)
- [Southeast Colorado](#)
- [Southwest Colorado](#)
- [Northwest Colorado](#)

[2022 Forest Health Highlights: Colorado](#)

Living With Wildfire

Preparation Key to Reduce Wildfire Risk

Over the past few years, residents in the wildland-urban interface (WUI) have been adapting to a new normal for wildfire. This new normal encompasses a year-round threat of wildfire, including dangerous, fast-moving grassfires, and requires all homeowners living in the WUI to be prepared. The Marshall Fire at the end of 2021 was a heartbreaking demonstration of how quickly wildfire can destroy homes and properties under the right conditions. The most destructive wildfire in Colorado history in terms of insured losses underscored the fact that taking steps to protect homes and other structures from wildfire must happen before extreme winds develop and embers fly.

The Marshall Fire also identified a gap in preparing for wildfire: Grassfires historically haven't received as much attention or focus as fires in forested landscapes. While the CSFS is a "forest" service, the agency has wildfire mitigation specialists and foresters who support communities in grasslands and shrublands as well.



Landowners can reduce their risk of wildfire by removing flammable materials, such as dead and dying trees or dense woody material, near their homes and other structures. Photo: CSFS

Techniques to reduce wildfire risk are similar, whether in a forest or a grassland, and the CSFS is committed to working with partners such as [CSU Extension](#) and the [Natural Resources Conservation Service](#), as well as other local resources such as county, non-profit and fire agency specialists, to assist all residents living in the WUI reduce their wildfire risk.

Weather and Wildfire

Wildfire has to have fuel to spread. Trees dried out due to drought or infested with [insects or diseases](#) provide fuel for wildfire. At the end of 2022, 42 percent of the state was in drought, and 31 percent was experiencing severe drought conditions or worse, according to the CSU Colorado Climate Center, which maintains Colorado's climate data. The period from Oct. 1, 2021, to Sept. 30, 2022, was the 6th warmest on records for Colorado dating back to 1895, according to the National Oceanic and Atmospheric Administration.

These climate change impacts of drought and warmer temperatures are out of our control, but there are steps Coloradans, especially those living in the WUI, can take to reduce their risk of wildfire. Community Wildfire Protection Plans (CWPPs) and individual advanced planning are two of the best ways to effectively prepare for wildfire.

Community Wildfire Protection Plans (CWPPs)

Preparation at a community level has greater impact than sporadic household or individual property mitigation efforts. CWPPs guide fuel treatment priorities within a focused area like a neighborhood and ensure residents and partners are working from the same plan, on the same priorities. Some CWPPs develop evacuation protocols that inform residents of routes to take, safe locations to travel to and what to take with them.

Living With Wildfire

Community Wildfire Protection Plans (CWPPs)

CWPPs require input from various participants, including local officials, fire authorities, CSFS staff and residents. Legislative action in 2021 made funding available to help communities develop or update existing CWPPs, and in 2022, the CSFS updated the [minimum standards for developing Community Wildfire Protection Plans](#).



Using a chipper to turn downed trees and thinned branches into mulch is one way to create more defensible space around a home or building. Photo: Mercedes Siegle-Gaither, CSFS

Individual Planning for Wildfire

As an outreach agency, the CSFS invests substantial time, money and effort into educating Colorado residents on how to [protect their homes and properties from wildfire](#). The agency works with partners across the state to reach homeowners and communities to help residents take action to reduce the risk of damage from wildfires.

Wildfire Awareness Month each May raises awareness about wildfire mitigation at the individual level. The Colorado General Assembly dedicated funding in 2022 to a wildfire awareness campaign that will launch in May 2023 during Wildfire Awareness Month. This campaign will provide Colorado residents with clear, concise information about their responsibility to prepare their home and property for wildfire and how to do it. It will also share information on home hardening and creating defensible spaces around buildings.

Wildfire Mitigation Must Be Second Nature

The number and intensity of wildfires in Colorado in 2022 were less than previous years. It is critical to remember that the continued drought and warmer temperatures leave large swaths of Colorado vulnerable to uncharacteristic wildfire that can cause significant damage to public and private property, loss of life and degradation of air and water quality across the state. Thinning dense, overgrown forests adjacent to communities and preparing homes and property for wildfire must continue to be second nature for all Coloradans to protect our homes, water supplies, air quality, recreation areas and our way of life.

Help with Creating or Updating a Community Wildfire Protection Plan

CWPPs are one of the most effective ways communities can prepare for wildfire in advance. These plans help guide local action by getting residents and officials together to determine how best to address local wildfire risk, defensible space around homes, reduction of structure ignitability and vegetation management on nearby lands.

CSFS foresters in [17 field offices](#) across Colorado can advise on developing and updating CWPPs. [Colorado residents can view CWPPs](#) from towns, cities, counties and neighborhoods across the state.

Watershed Protection

Providing Clean Water for Colorado and Beyond

Colorado's forests and regional water supplies are inextricably linked. Trees capture pollutants before they enter rivers, streams and reservoirs. Effectively managed forests have a lower risk of uncharacteristic wildfire that may scorch the earth and lead to mudslides and floods, damaging municipal water infrastructure, such as reservoirs and pipelines.

Colorado is a headwaters state. Mountain snow provides water for four major rivers in the region: the Colorado, Arkansas, Rio Grande and South Platte. Colorado's high-country watersheds provide water to Colorado and 18 other states; the need for effective forested watershed management cannot be overstated. The Colorado State Forest Service works with partners all over the state and region on projects to protect these vital resources.



The Powderhorn Wilderness Area in the southern Rocky Mountains is home to part of the Gunnison River watershed. Photo: Bob Wick, BLM

Stressors on Colorado's Watersheds

Forests have a critical impact on water quality. In addition to removing pollutants, forests keep sediment out of water supplies, regulate stream flows, reduce flood damage and store water. They also provide habitat for wildlife and increase biodiversity, which improves the resiliency of the entire forest.

Unfortunately, Colorado's forests are vulnerable to increasing stressors:

- **Uncharacteristic wildfire** can trigger cascading effects. Areas that burn completely tend to have slower regeneration of trees and other plants, resulting in changes in snowmelt timing and a higher potential for flooding and debris flows that harm water infrastructure.
- **Population increases** in the wildland-urban interface (WUI) put more pressure on wildfire mitigation resources, heighten demand for water-intensive agricultural products and inflate the number of people recreating in Colorado's forests.
- **Insects and diseases** can cause a slow but steady change in forests, frequently making wildfire in areas dense with beetle-killed trees more intense and more difficult to suppress.
- **Climate change** affects snowpack levels and the timing of precipitation. For example, the [Colorado Water Center](#) at Colorado State University describes how the timing of peak snow runoff historically occurred in June. Recently, runoff has occurred in pulses that disrupt water storage systems and some runoff may not be captured.

These stressors already affect watersheds across Colorado, threatening water quality and availability for millions of Americans. Future water security requires direct and immediate action.

Watershed Protection

How the Colorado State Forest Service Protects Watersheds

As a headwaters state, actions taken in Colorado affect water security in other states. The CSFS addresses forested watershed protection in many ways, and it's important to remember that the success of this work depends on effective collaboration and constant work with contractors, landowners and partners, whether they're federal, local, private or non-governmental.

Identify Priority Watersheds

The [Colorado Water Plan](#) is the framework developed to meet the state's water needs, and it describes a shared stewardship ethic to protect the health of watersheds. As part of this shared stewardship, staff at the CSFS consults with partners and other entities to identify priority areas for watershed protection projects. The CSFS' [2020 Colorado Forest Action Plan](#) identifies key watersheds that affect agriculture, downstream communities, recreation and ecosystem function.

The CSFS is uniquely positioned to lead cross-boundary, watershed-level projects that have large impacts on communities and individuals. Some examples of the agency's partnerships include the [Forests to Faucets](#) program and the Forest and Land Management Services Agreement with Denver Water, which has supported healthy forest practices in Boulder, Clear Creek, Douglas, Eagle, Grand, Jefferson, Park and Summit counties since the mid-1980s.

Manage Forests

CSFS staff regularly completes and oversees on-the-ground work in forests across Colorado. When insects or diseases have left swaths of standing dead trees, foresters take on fuels reduction to remove trees that increase the risk of uncharacteristic wildfire. This also happens in areas that have experienced decades of fire suppression and consequently have dense undergrowth that raises the risk of a high-intensity crown fire.

After disturbances such as wildfire, insect infestation or flooding, forests may require some management to improve the speed and quality of regeneration. These management techniques may include reseeding, planting seedlings, removing slash or spreading mulch to prevent landslides or flooding. All management activities require monitoring and adaptive management to ensure success over time.

High Priority Watershed: The Colorado River

The Colorado River originates from the high-elevation snowfields in Rocky Mountain National Park and supplies water to 40 million people downstream.

Decades of drought combined with higher demands on the water from growing populations have dramatically decreased the amount of water in the river, as well as the reservoirs it feeds. The Glen Canyon Dam, filled by the Colorado River, produces power for 5 million people in seven states. The dam holds back Colorado River water to create Lake Powell. [KUNC](#) reported that in 2022 the lake held less than 25 percent of its capacity.

Concerns about water availability are not hypothetical; shortages are already being felt and observed. As soon as June 2023, the Glen Canyon Dam may no longer produce electricity due to continuing low water levels in Lake Powell. The effects will not just be downstream. Front Range agriculture and municipal water consumption may be affected.

Watershed Protection

Assist Communities

The CSFS is a forestry and outreach agency, dedicated to educating and assisting communities and individuals across Colorado with forest management, especially how it relates to watershed protection. For example, each May the CSFS works with partners to promote Wildfire Awareness Month and provide information to homeowners about steps they can take to reduce the risk of wildfire to their homes and properties.



A volunteer helps thin an area of lodgepole regrowth in northern Colorado. Photo: CSFS

Community groups, local governments and landowners can apply for several grant programs throughout the year. In 2022, legislation made it possible to provide approximately \$15 million in grants to communities and groups through the [Forest Restoration and Wildfire Risk Mitigation](#) grant program. Two other programs include the [Wildfire Mitigation Incentives for Local Government](#) and [Wildfire Mitigation Resources & Best Practices](#).

CSFS foresters in 17 field offices across Colorado provide direct assistance to landowners in their areas. They create forest management plans and advise on development of Community Wildfire Protection Plans (CWPPs). By working so closely with community groups, foresters can include watershed protection expertise when planning projects.

Support Timber Industry

Reduction and removal of hazardous, flammable materials is an important aspect of managing forests for watershed protection. Ideally, these materials can be used by the timber industry in some manner, whether it's for firewood, building materials or furniture. Profitable Colorado wood products help offset the costs of forest management that protects our forested watersheds.

It's impossible to separate watershed protection from other forest management goals and objectives. Activities that help reduce the risk of uncharacteristic wildfire often reduce the risk of damage to municipal water infrastructure. Reforestation goals also promote watershed health by growing trees that remove pollutants from waterways. Protecting the forested watersheds that are the source of water for millions of Colorado residents, as well as residents of other states, is an immense responsibility and a guiding priority of the work of the CSFS.