



## Aerial Detection Survey

A crucial part of forest management is regularly monitoring for damage caused by forest pests. The primary source of information on forest pest conditions in Colorado is an annual Aerial Detection Forest Health Survey. This is a cooperative program led by the U.S. Forest Service (USFS) with Colorado State Forest Service (CSFS) participation. Trained aerial observers from both agencies typically fly over most of the state's 24 million acres of native forests in small fixed-wing aircraft to map and classify the intensity of the current year's damage. When necessary, some areas flown also are ground-checked to verify the agent (i.e., abiotic, insect, diseases) responsible for the damage and/or the severity of the damage.

## Forested Acres Surveyed

The 2022 Aerial Detection Survey monitored approximately 29.9M forested acres compared to 29.2M acres in 2021 and 16.3M in 2020. \*Caution should be exercised when comparing 2020 and any other year acreages.

Due to COVID-19 pandemic safety protocols in 2020, trained aerial observers from both the CSFS and USFS flew over designated priority areas. Forested areas across Colorado were designated as having a "high," "moderate," or "low" likelihood of widespread, destructive forest disturbance (tree mortality). Areas identified as "high" priority were flown first, followed by "moderate" priority areas. As a result, fewer acres were surveyed in 2020.

## Drought Conditions Persist

Temperatures were well above average again in Colorado in 2022. This was the sixth warmest on record, dating back to 1895 (Oct-Sept.) Precipitation was, again, below average for the third straight year. Four of the last five years have been dry, causing tree susceptibility to insect infestations.

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

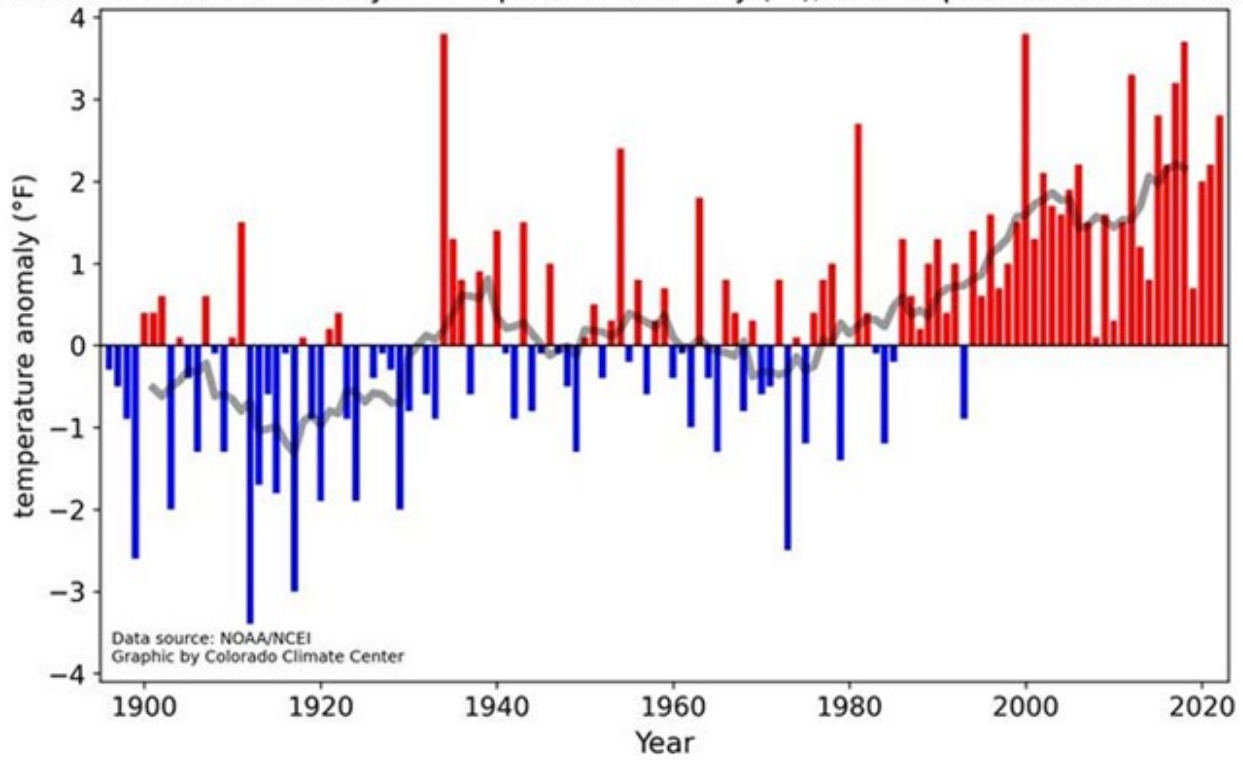


Figure 1. Temperature departure from the 100-year average – 2022 was the 6th warmest on record, keeping the trend with previous years. Graph: Colorado Climate Center, Colorado State University. Data: National Oceanic and Atmospheric Administration

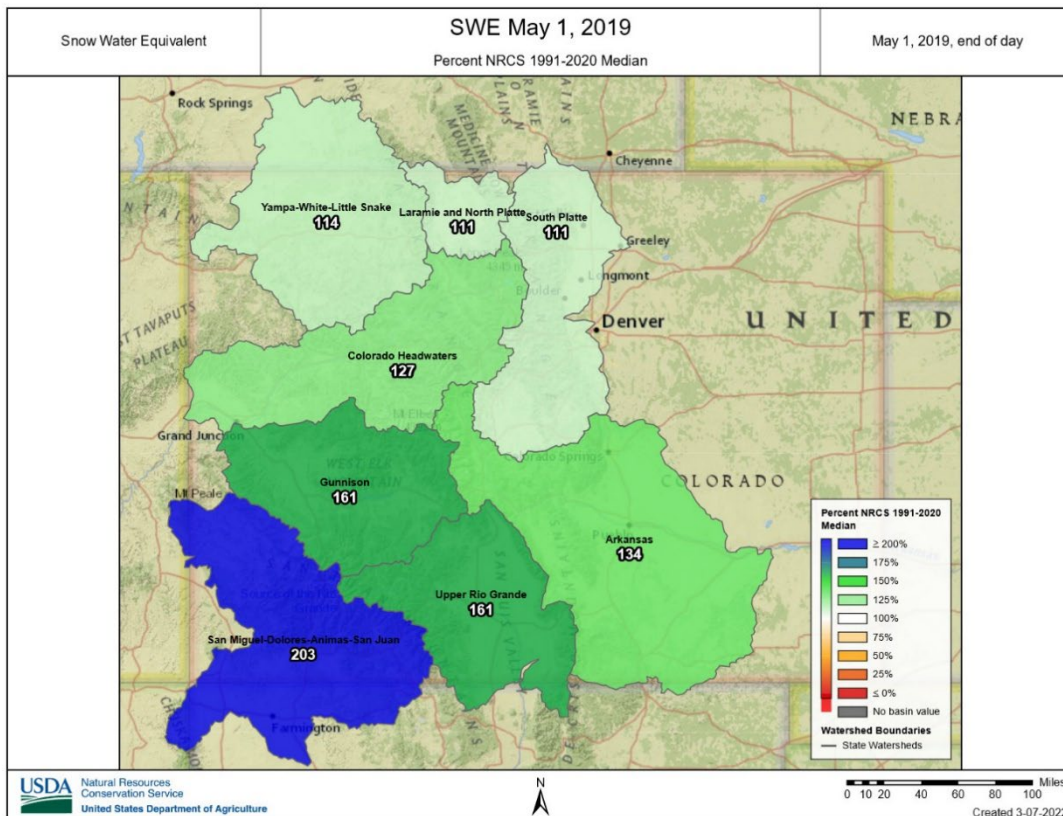


Figure 2. Snowpack at the end of the winter, 2019. Map: National Water and Climate Center, Natural Resources Conservation Service

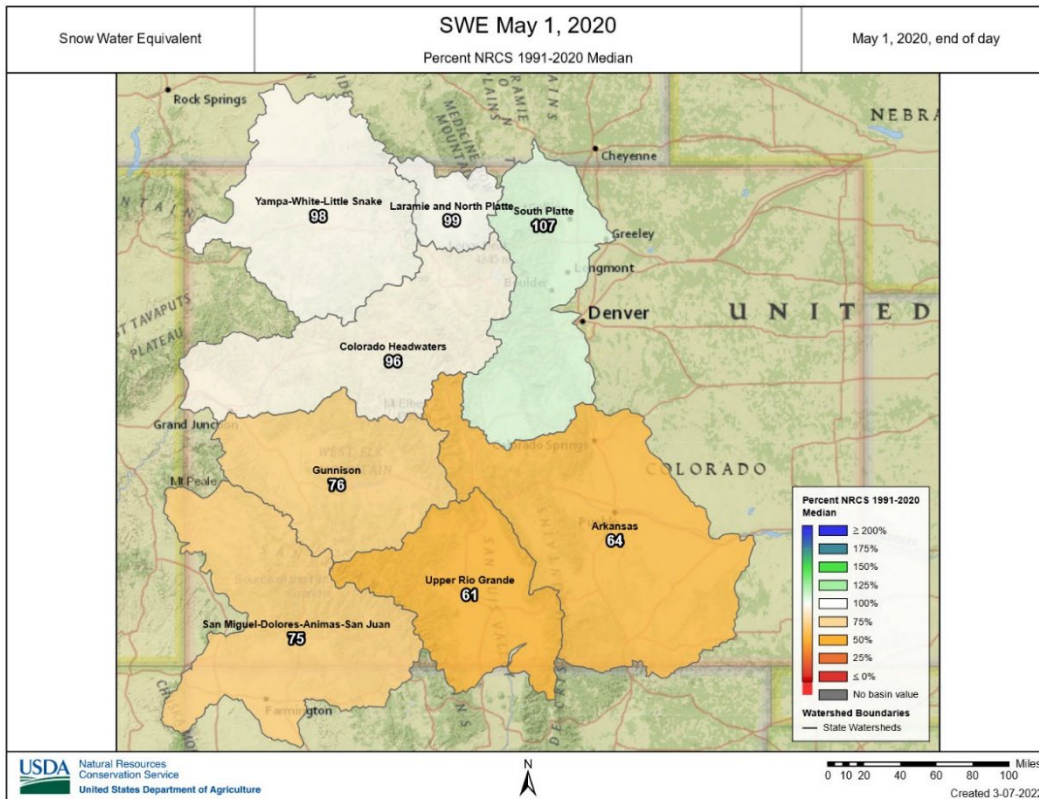


Figure 3. Snowpack at the end of the winter, 2020. Map: National Water and Climate Center, Natural Resources Conservation Service

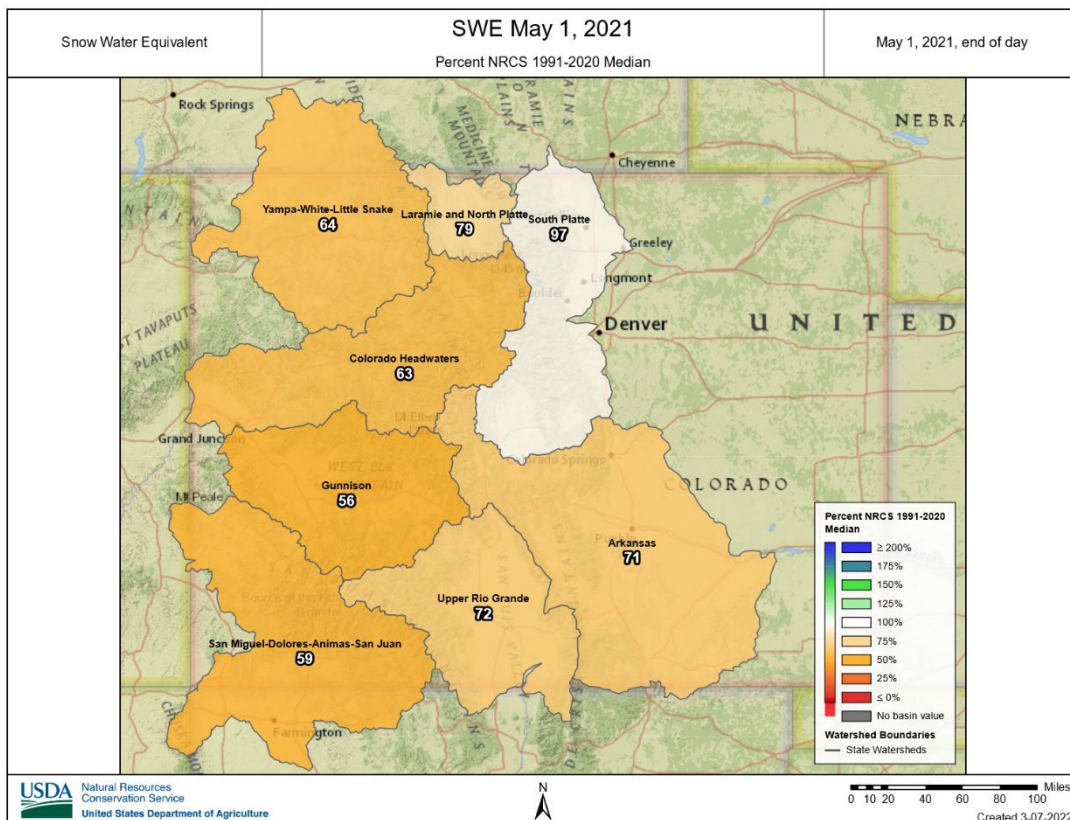


Figure 4. Snowpack at the end of the winter, 2021. Map: National Water and Climate Center, Natural Resources Conservation Service

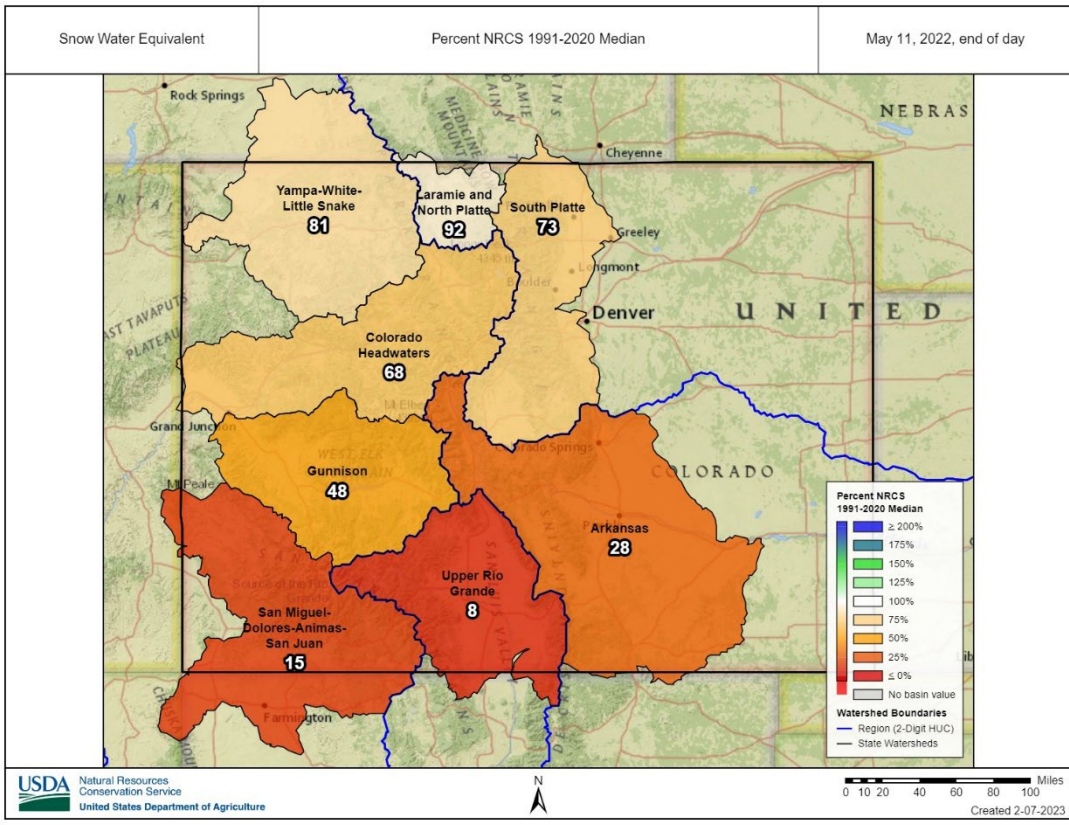


Figure 5. Snowpack at the end of winter, 2022. Map: National Water and Climate Center, Natural Resources Conservation Service

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

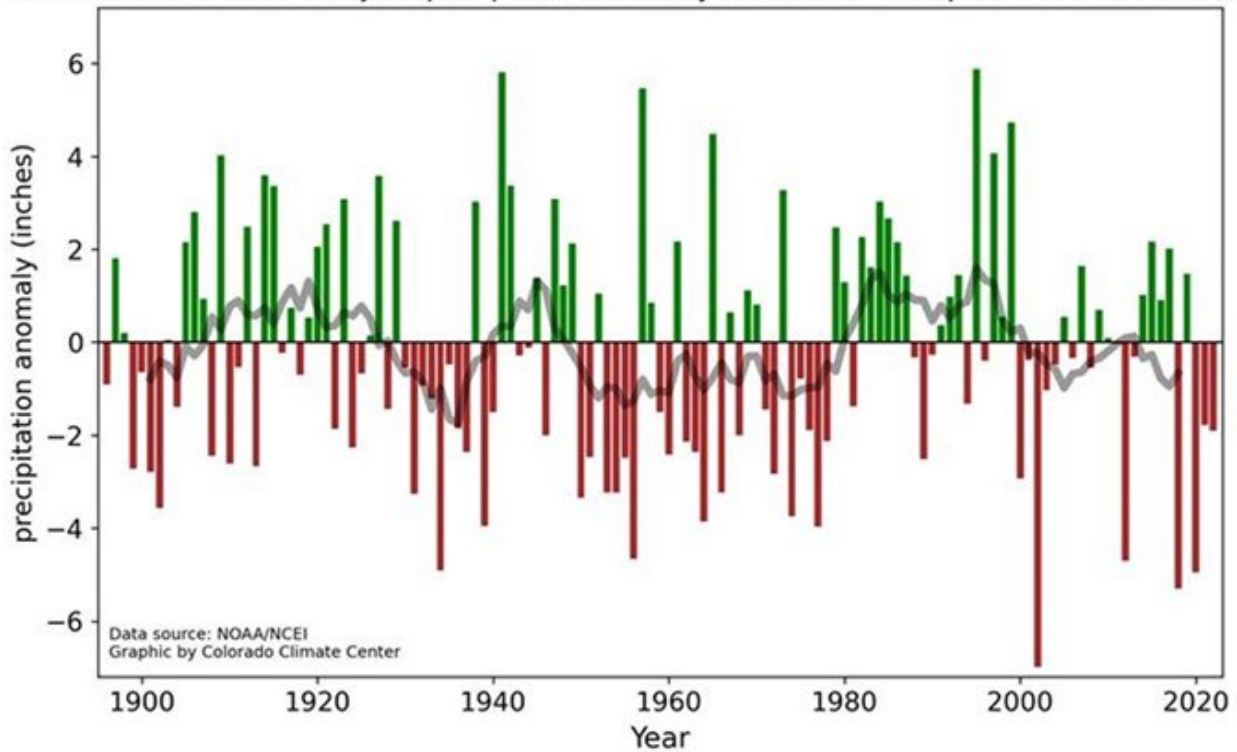


Figure 6. Precipitation in Colorado (1895-2022) – four of the last five years have been well below average. Graph: Colorado Climate Center, Colorado State University. Data: National Oceanic and Atmospheric Administration

# Spruce Beetle

Acreage affected in 2021: 53,400

Acreage affected in 2022: 29,000

Spruce beetle continues to infest high-elevation Engelmann spruce throughout much of Colorado. Since 2000, this small, native bark beetle has affected at least 1.9 million cumulative acres of forest. Newly infested forests within eastern Gunnison and western Chaffee counties in the Collegiate Peaks continue to experience severe, intense infestations. Infestations straddling Park and Chaffee counties in the Mosquito Range have intensified. However, spruce beetle populations within and near Rocky Mountain National Park appear to have declined in intensity for the second year running. Spruce beetle outbreaks in the San Juan Mountains, in Dolores, La Plata, Ouray, and San Juan counties continue to expand, though the intensity has slowed.

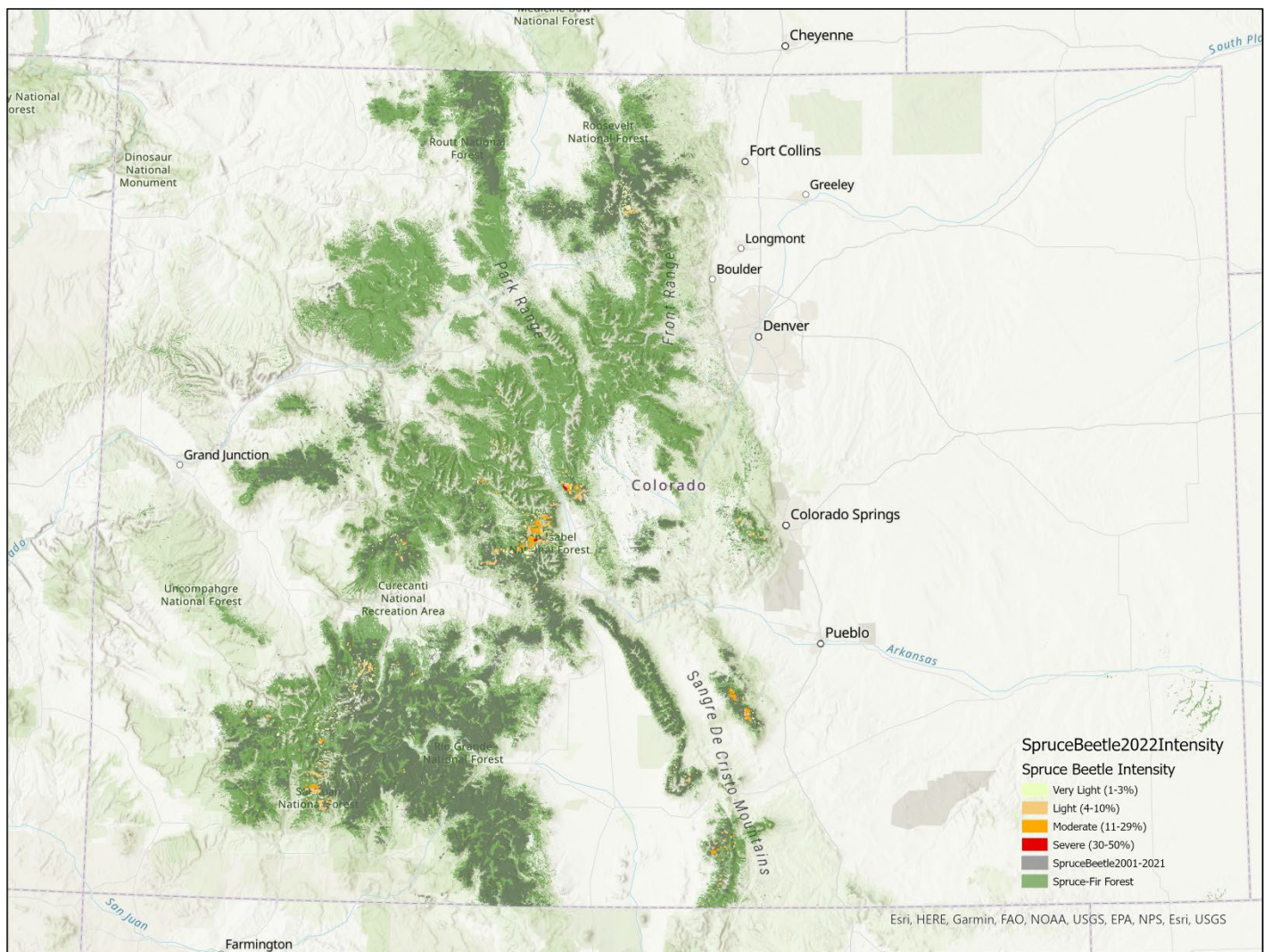


Figure 7 Current spruce beetle affected acreage with historic areas infested and high-elevation Engelmann spruce-fir forests

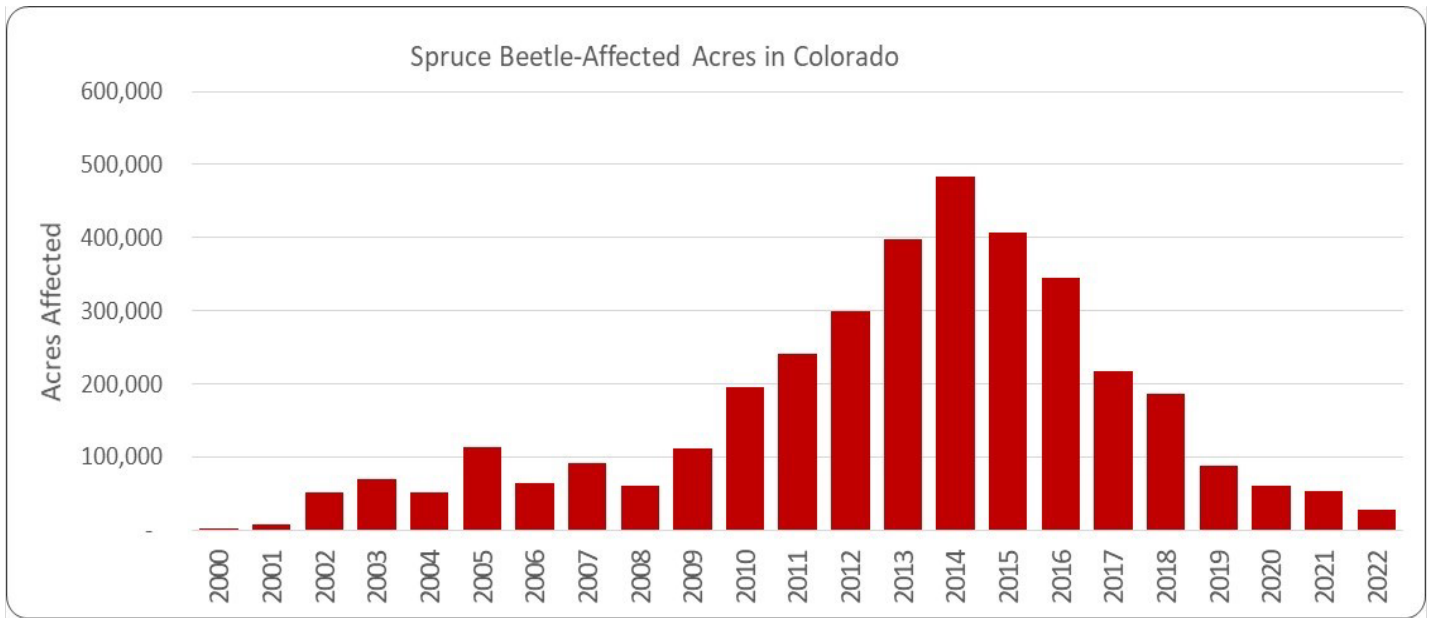


Figure 8. Histogram of affected acres in Colorado from 2000-2022



Figure 9. Spruce beetle-caused mortality typical of high-elevation spruce-fir forests in Colorado. Image: Dan West Ph.D; 2022

# Douglas-fir Beetle

Acreage affected in 2021: 8,000

Acreage affected in 2022: 9,700

Douglas-fir beetle continues to cause significant Douglas-fir tree mortality, predominately in the central and southern forests of Colorado, having depleted many of the largest trees in these forests over the past decade. Custer, Eagle, Fremont, Garfield, Gunnison, Hinsdale, Huerfano, La Plata, Mesa, Pitkin, and Saguache counties continue to see severely affected Douglas-fir stands.

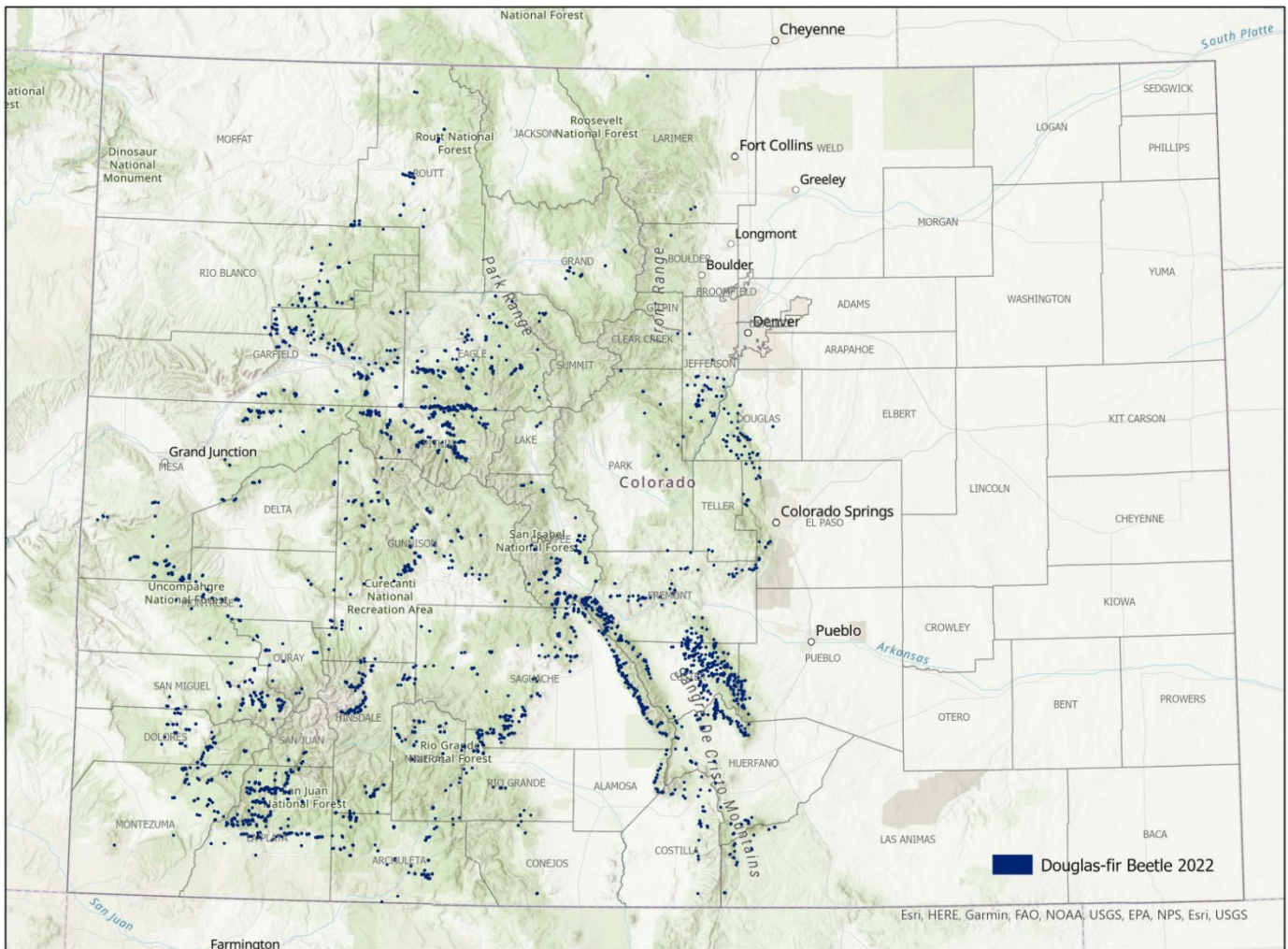


Figure 10. Douglas-fir beetle affected acres in Colorado in 2022



Figure 11. Groups of Douglas-fir beetle-caused mortality from several recent years. Image: Dan West Ph.D; Archuleta County, 2022

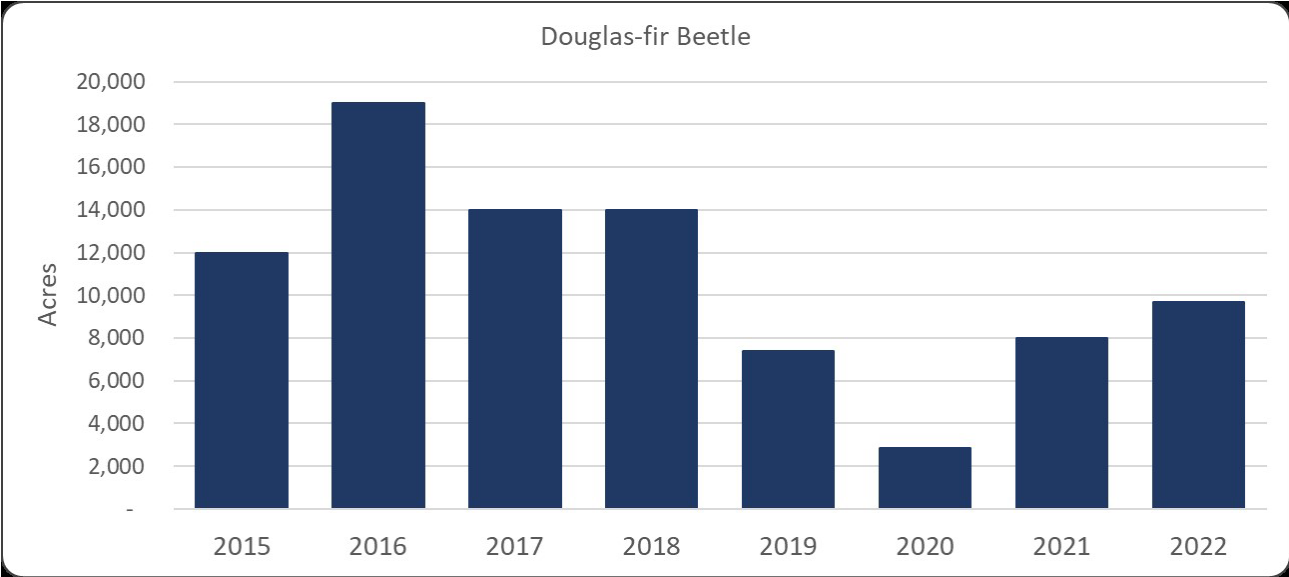


Figure 2 Affected acres histogram of Douglas-fir beetle from 2015-2022



# Roundheaded Pine Beetle and associated native bark beetles

Acreage affected in 2021: 7,300

Acreage affected in 2022: 4,730



*Figure 12. Roundheaded pine bark beetle-caused mortality in The Glade, San Juan National Forest, Dolores County. Image: Dan West Ph.D; July, 2022*

Roundheaded pine bark beetle (*D. adjunctus*) and associated native bark beetles (western pine beetle, mountain pine beetle, Ips engraver beetles) continued to increase their footprint, spreading into areas adjacent to infestations, attacking previously uninfested stands, and killing groups of 5-10 trees within ponderosa pine forests in Dolores and San Miguel counties. The intensity of beetle activity continues to remain high in localized areas of the San Juan National Forest. To the northeast of Dolores County, affected areas within San Miguel County, just to the south of Norwood, are seeing pockets of affected trees expanding from 2020-21, though incidence and intensity remains low.



*Figure 13. Roundheaded pine bark beetle and native associated bark beetle-caused mortality in The Glade, San Juan National Forest, Dolores County. Image: Dan West Ph.D; 2022*



*Figure 14. Roundheaded pine bark beetle and native associated bark beetle-caused mortality in the Glade, San Juan National Forest. Image: Dan West Ph.D; 2022*

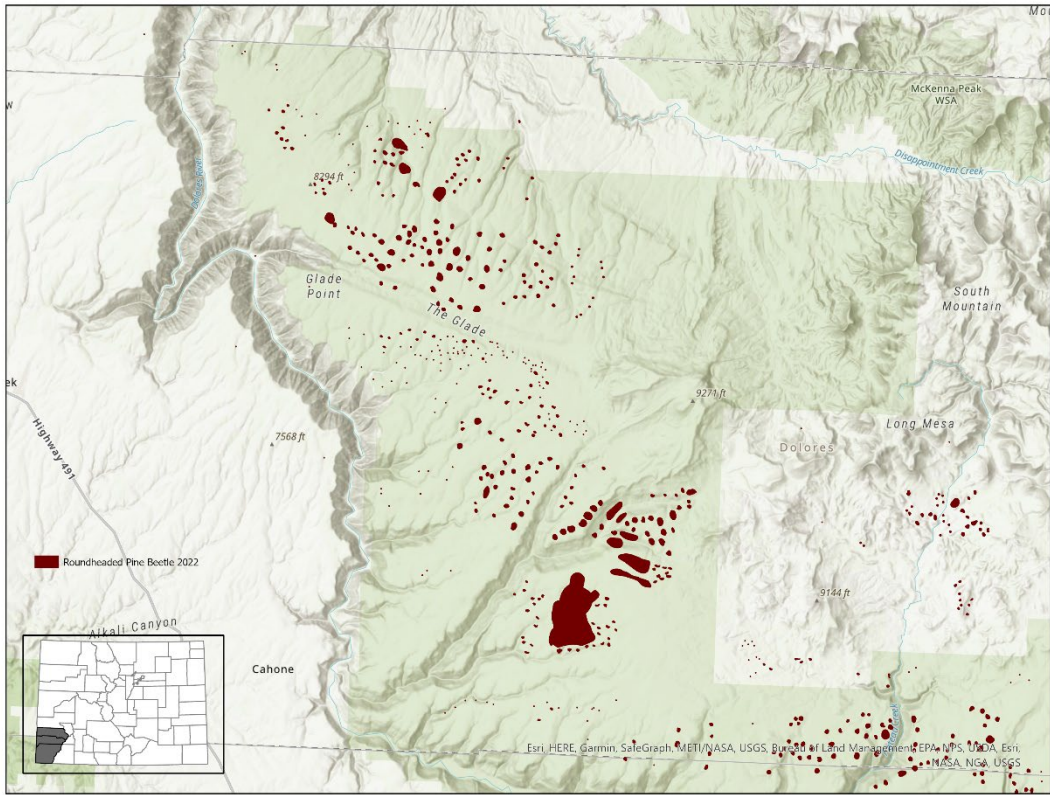


Figure 15. Roundheaded pine bark beetle detected acreage in 2022 in the southwest corner of Colorado

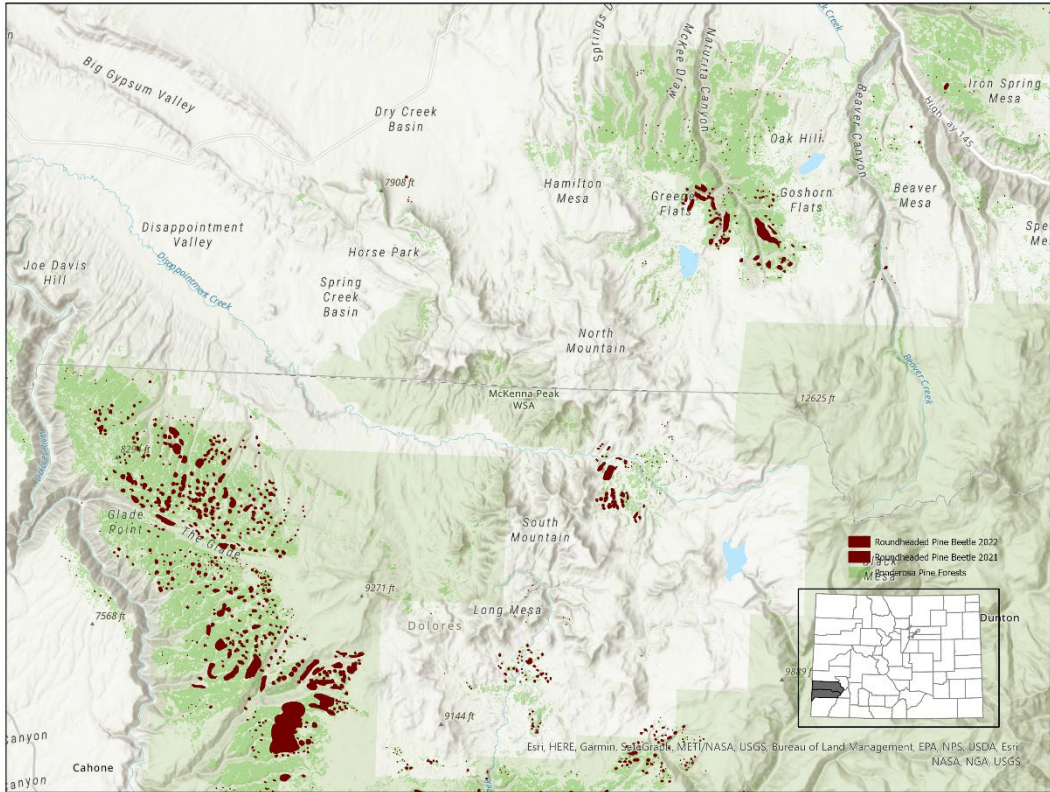


Figure 16. Bark beetles in ponderosa pine in Dolores and San Miguel counties detected from the Aerial Survey in 2021-2022

# Mountain Pine Beetle

Acreage affected in 2021: 1,500

Acreage affected in 2022: 2,400

## Mountain pine beetle making a comeback

Mountain pine beetle affected approximately 80% of the pine forests in Colorado from 1996-2014. Although not every tree was affected in every acre of pine forest, many of the largest, most susceptible ponderosa and lodgepole pines were depleted in this outbreak event. Mountain pine beetle is a native bark beetle that persists in weakened trees, particularly from drought in recent years. An outbreak started several years ago in mature lodgepole pine forests northeast of Gunnison, Co. These forests escaped infestation early in the 2000's, and are susceptible from the dearth of precipitation in recent years. Active beetle populations in Gunnison County continue to kill lodgepole pine forests in the Taylor River drainage, Ohio Creek drainage, and around the town of Crested Butte.



*Figure 17. Mountain pine beetle-caused limber pine mortality in Park County. Image: Dan West Ph.D.; 2022*

Of note approximately 200 acres of five-needle pines were detected in 2021 in the Mosquito Range, east of Buena Vista, CO. More than 400 acres of newly infested limber pines were mapped in the same area. As below-average precipitation persists, coupled with warmer temperatures through 2022, beetle populations are expected to proliferate in the coming

months. More than one year of adequate or above-average precipitation is required to stem the susceptibility of drought-stressed forests.

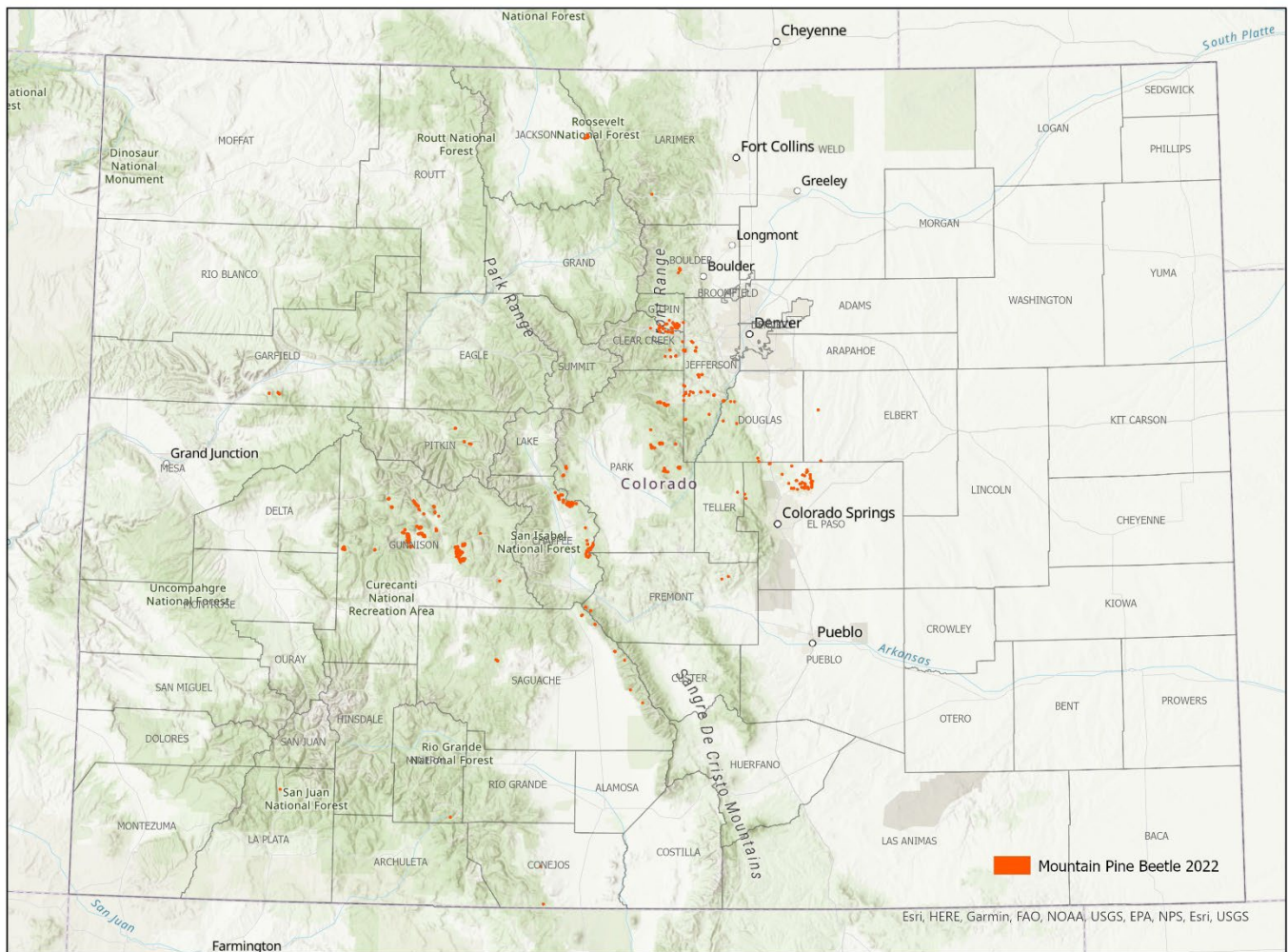


Figure 18. Mountain pine beetle-caused mortality detected from the aerial survey in 2022.

## Western Balsam Bark Beetle

Acreage affected in 2021: 28,400

Acreage affected in 2022: 35,000

Root disease and western balsam bark beetle historically co-exist in the high-elevation forests of Colorado. These areas, along with drought-stressed forests comprising subalpine fir, have recently become havens for populations of bark beetles. Populations of the beetles have grown in recent years due to water stress and warmer temps, and now infest otherwise healthy trees with lower defenses from poor precipitation. Eagle, Garfield, Grand, Gunnison, Jackson, Mesa, Moffat, Rio Blanco, Routt, and Summit counties were some of the areas most affected.



Figure 19. Western balsam bark beetle-caused mortality in Pitkin County. Image: Dan West Ph.D; 2022

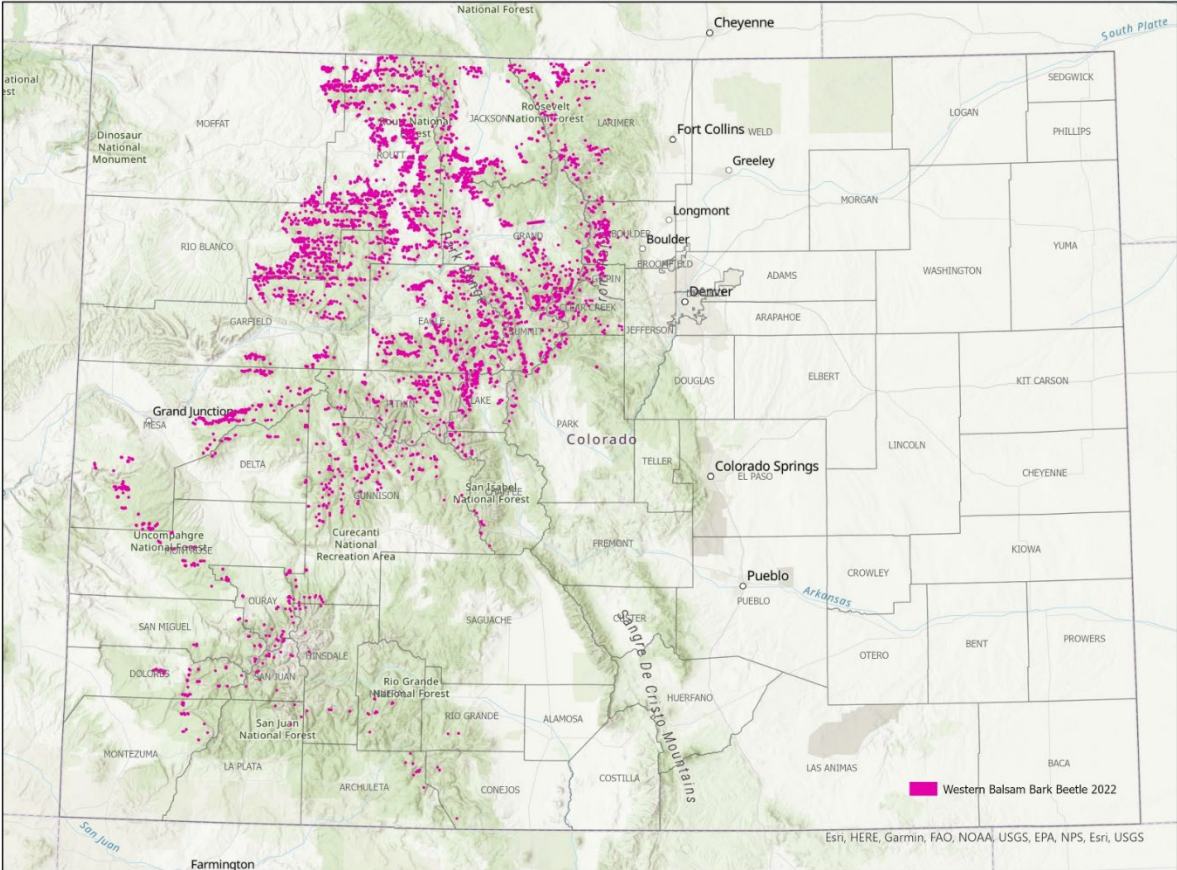


Figure 20. Western balsam bark beetle-caused mortality detected in 2022 in Colorado

# Piñon Ips and Juniper Mortality

Acreage affected in 2021: 17,600

Acreage affected in 2022: 4,600

Piñon Ips beetle has caused considerable die-off of piñon pines in parts of western and southeastern Colorado in recent years, spurred by persistent drought conditions. Populations of this native bark beetle are so high in some piñon-juniper forests, such as in the Glade Park and Gateway Canyon areas of Mesa county, that these forests are losing a significant number of their mature piñon trees.

The piñon Ips beetle is also spreading in Delta County, Garfield, and Pitkin counties. The Roaring Fork Valley has had substantial overstory mortality of mature piñon pines for the last six years. The southwest corner of Colorado, in Montezuma County, continues to lose mature piñon pines due to prolonged severe and exceptional drought conditions. As these mature pines are depleted and drought conditions persist, younger trees suffer and become increasingly susceptible.

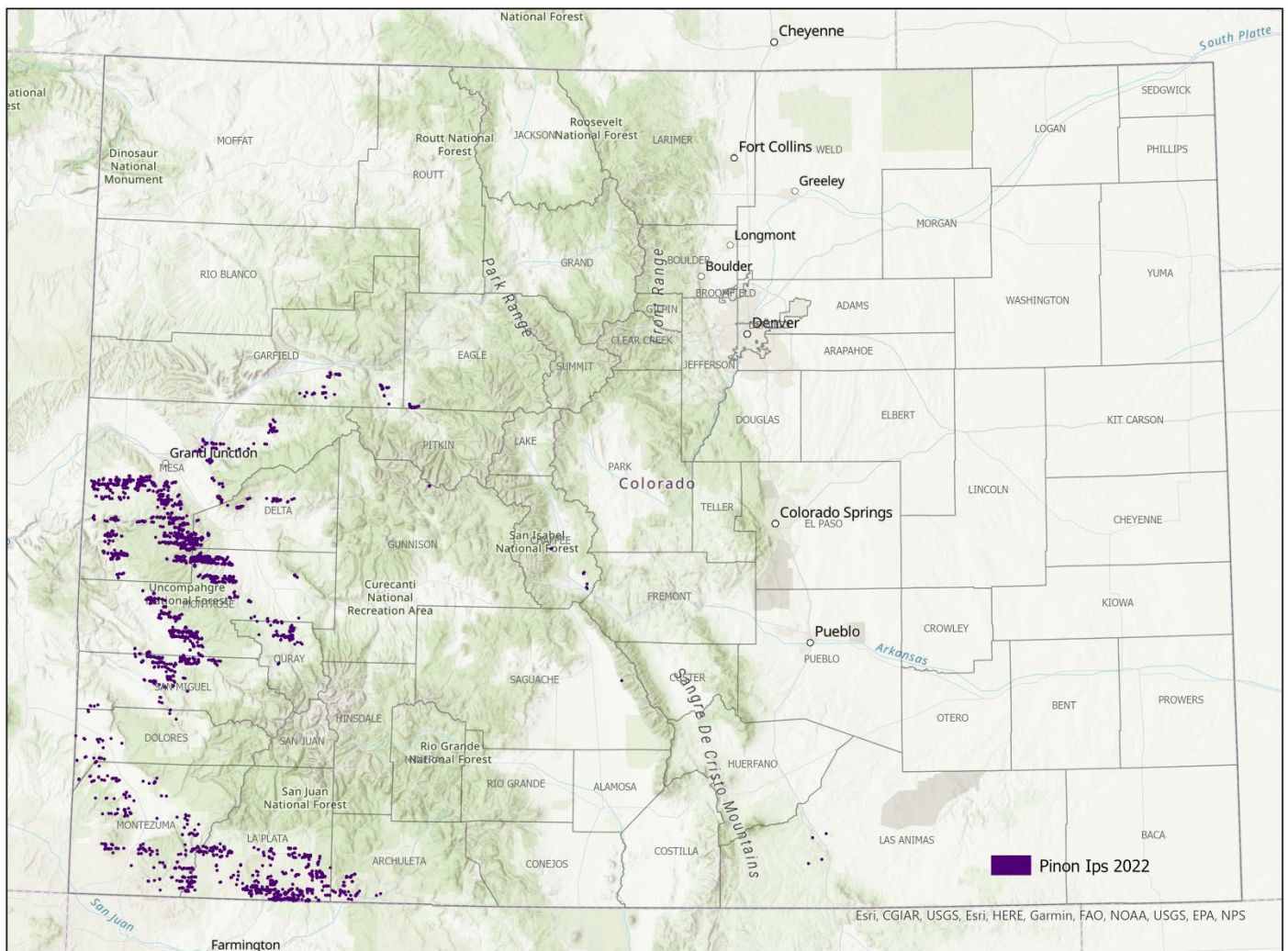


Figure 21. Piñon Ips beetle-caused mortality and juniper dieback detected in 2022 in Colorado

## Western Spruce Budworm

Acreage affected in 2021: 91,500

Acreage affected in 2022: 112,000

### Caterpillars of the Western Spruce Budworm continue to weaken and kill mature Douglas-fir and Engelmann spruce

The western spruce budworm is a native forest pest, primarily affecting Douglas-fir, true fir and Engelmann spruce trees. This defoliator is widespread throughout low-elevation mixed-conifer forests and spruce-fir forests in southern Colorado. A cooler, wet May in 2021 and an active monsoon in 2022 may have stunted its activity in 2022, but forest conditions have not changed appreciably and consecutive years of budworm defoliation continue to leave drought-stressed trees susceptible to attack by Douglas-fir and other bark beetles. This insect is causing significant damage and tree death to forests in the Mosquito Range, West Elk mountains, much of Gunnison and Saguache counties, and parts of the Front Range and the Sawatch Range. Chaffee, Fremont, Gunnison, Mineral, Park, and Saguache counties were heavily affected in 2022.



*Figure 22. Multiple years of caterpillar feeding has caused tree mortality and tree health decline throughout much of southern Colorado. Infested stands in Park County show Douglas-fir trees affected by the pest. Image: Dan West Ph.D; 2022*



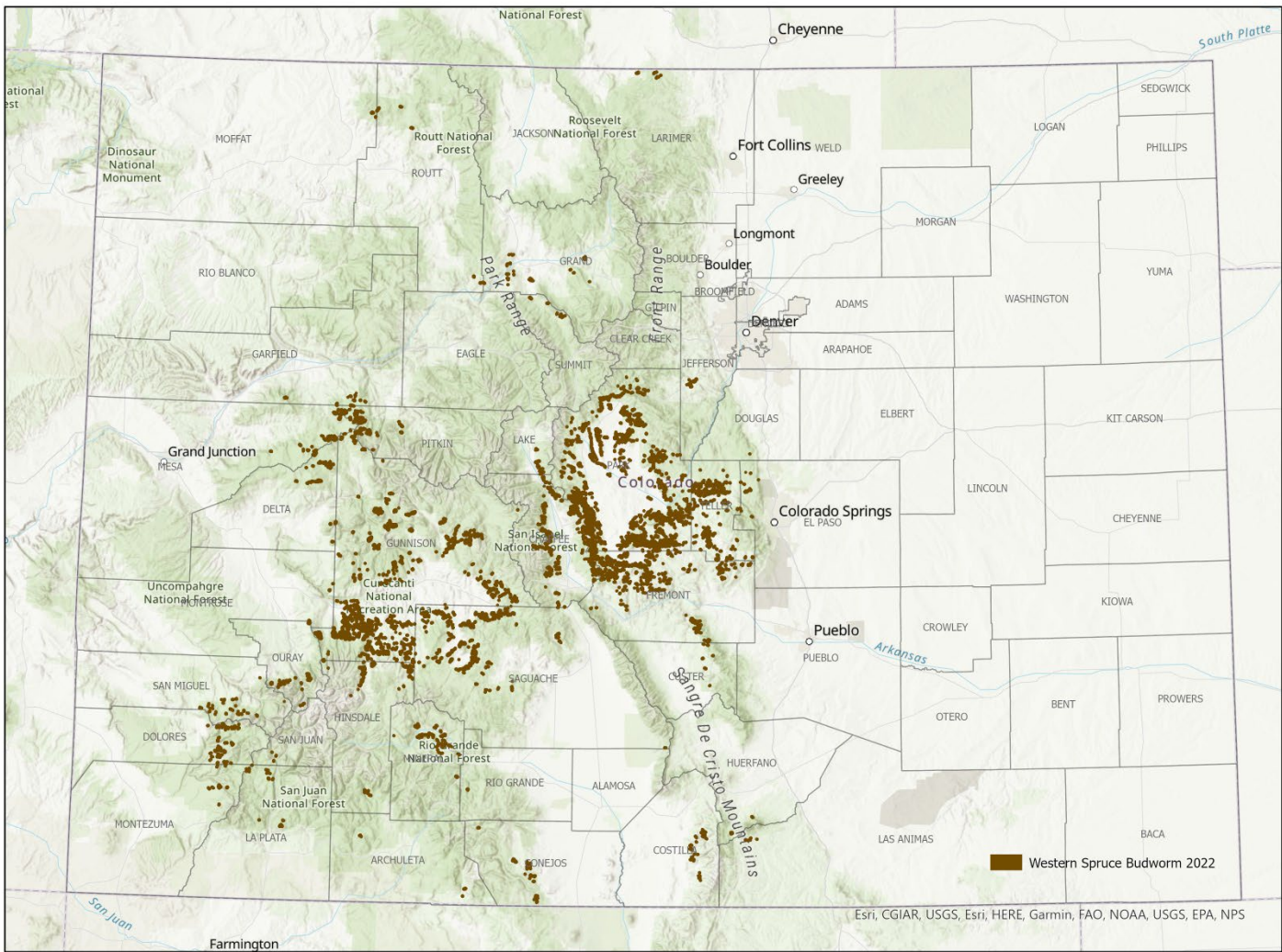


Figure 23. Western spruce budworm defoliation in 2022

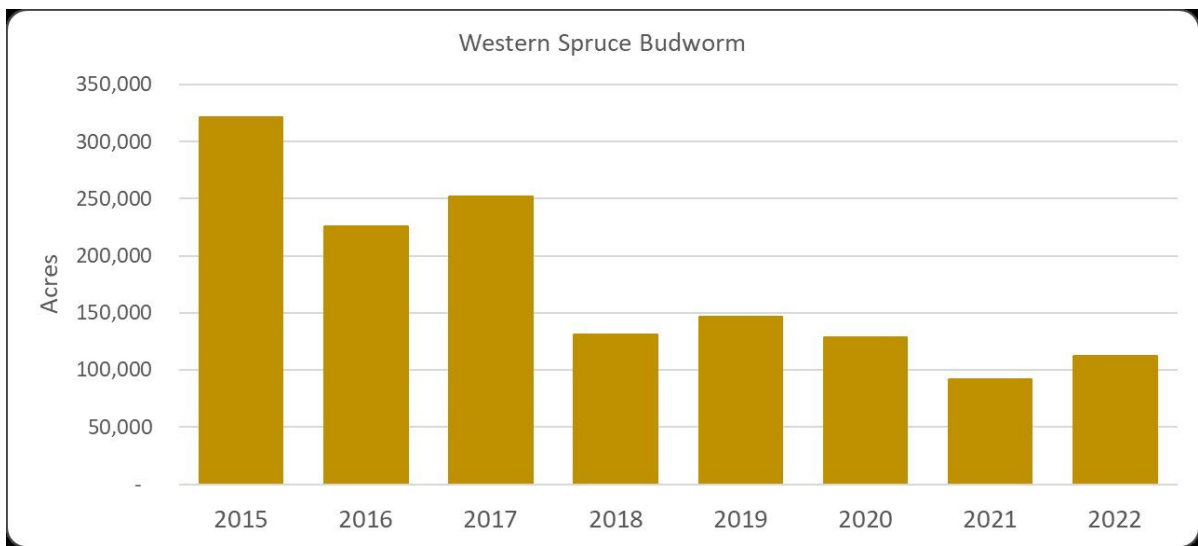


Figure 3 Western Spruce Budworm affected acres from 2015-2022

# Aspen Issues

Acreage affected in 2021: 19,000

Acreage affected in 2022: 31,500

Late snow kills newly emerged leaves in parts of Colorado, while others continue to see significant impacts from drought.

With moderate, severe, and extreme drought conditions across much of the state, there were minimal fungal issues in aspen stands. Aspen stands in Clear Creek, Jefferson, and Park counties had discolored and stunted growth due to late snow in May, freezing newly emerged leaves. By mid-June, many stands had attempted to push out new leaves. Defoliation from Aspen Leaf Beetle and Large Aspen Tortrix was evident in Park County. Much of the defoliation across the remainder of the state was from western tent caterpillars and large aspen tortrix. Gunnison, Mesa, Mineral, Montrose, Park, Routt, and Saguache counties were heavily affected.

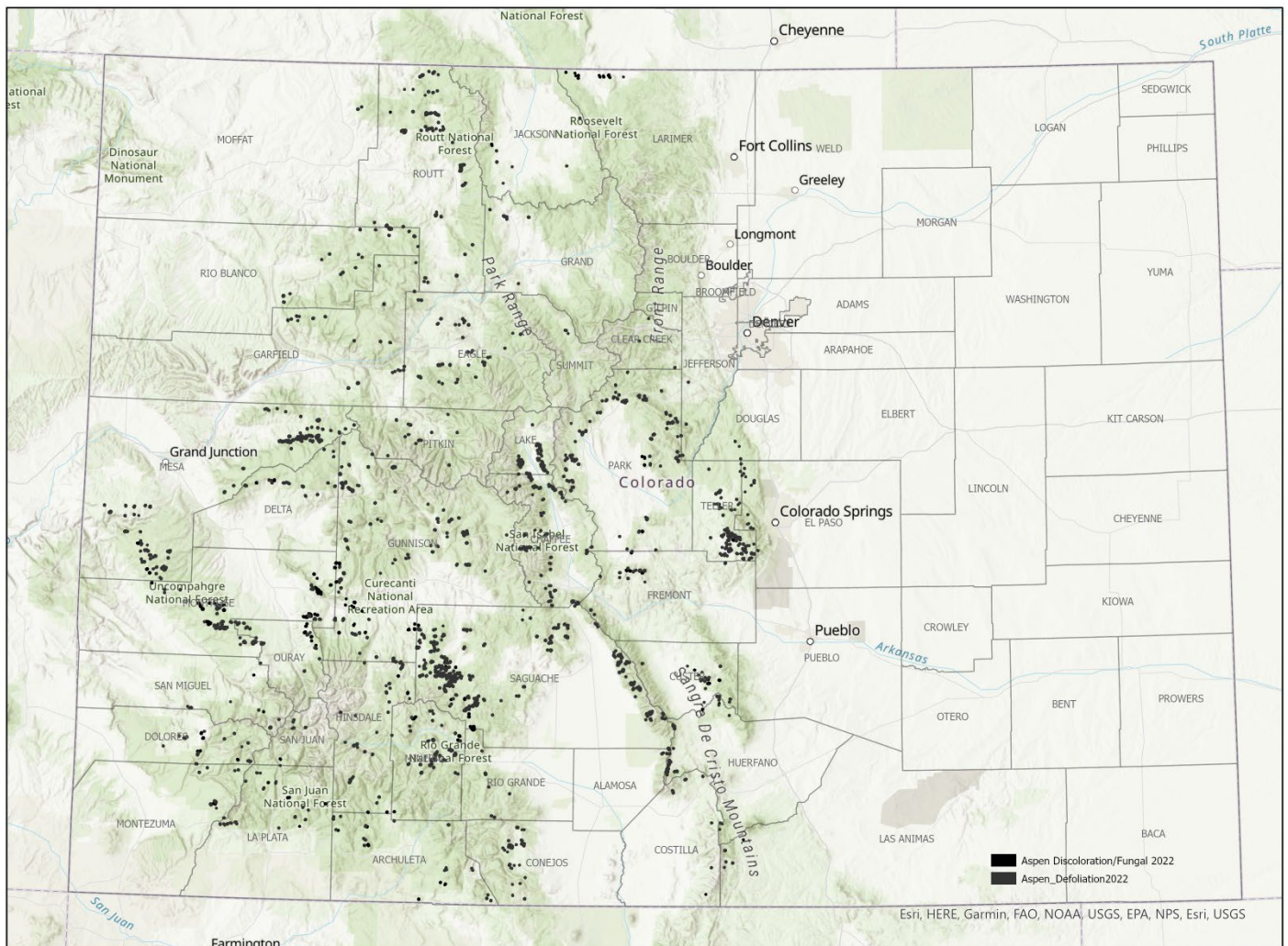


Figure 25. Aspen-related issues detected in 2022 in Colorado



*Figure 26. Aspen leaves killed by a late May freeze with newly flushed leaves in June 2022 in Park County. Image: Dan West Ph.D*



*Figure 27. Aspen defoliation by Aspen Leaf Beetle in Park County, 2022. Image: Dan West Ph.D*

For more information, contact any Colorado State Forest Service field office or Dr. Dan West.

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