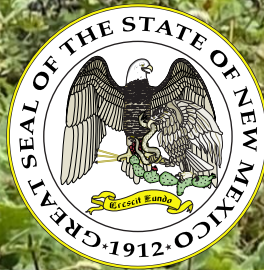


New Mexico Forest Health Conditions 2023

Energy, Minerals and Natural Resources Department
Forestry Division

2023



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Acknowledgment: Funding for this publication is supported by the USDA – Forest Service. Cover Photo: Victor Lucero, NMFJ

Caveat

ACRES WITH
mortality or defoliation stated throughout this report describes an amount of acreage with some percentage of damaged trees, i.e. not every tree in every reported acre is killed or defoliated.

2023 FOREST HEALTH SUMMARY

The number of acres of forest and woodlands mapped with insect, disease, and drought-stress damage significantly *decreased* by 363,000 acres, or 50%, across all land ownership types in New Mexico since 2022. Damage mapped on state and privately-owned forest and woodlands *decreased* by 75,000 acres (43%) from 2022 levels. Mortality by all species of bark beetles *decreased* in 2023. Piñon mortality in 2023 was 1,900 acres compared to 188,000 acres in 2022, a *decrease* of 99%. Bark beetle mortality near burn scars was observed in 2023 and may continue to increase for the next few years. Improved drought conditions in late 2022 and early 2023 may have been the primary factor contributing to the ability of piñon and other conifers to produce sustained pitch flow resulting in unsuccessful bark beetle colonization and low mortality. Statewide defoliation *decreased* by 10% overall in 2023. However, state and private lands experienced a 25% *increase* in defoliation due to western spruce budworm populations in northern New Mexico. Defoliation of Douglas-fir, spruce, and true firs from western spruce budworm in 2023 *increased* by 26,000 acres from 2022.

Pinyon needle scale contributed to 8,500 acres of defoliation in 2023. Caterpillars of the Douglas-fir tussock moth defoliated 2,600 acres of mixed conifer forest lands primarily in the Cibola National Forest.

2023 FOREST HEALTH CONDITIONS AT A GLANCE

Acres with Bark Beetle-Killed Trees	Climate	Acres with Defoliation
State and Private Lands 4,800	Mean Temperature 55.4 F=7th Warmest on Record	State and Private Lands 89,000
National Forest Lands 27,000	Mean Precipitation 10.75"=18th Driest on Record	National Forest Lands 135,000
Tribal Lands 1,700		Tribal Lands 13,000

AERIAL DETECTION SURVEY

Most of the information and data within this report were collected via aerial detection surveys. Aerial detection surveys (ADS) have been the most efficient and cost-effective method for collecting annual forest health data in New Mexico. In fact, the cost of ADS has been about a penny per acre. In New Mexico, the Forestry Division's Forest Health Specialist works with U.S. Forest Service, Forest Health Protection, New Mexico Zone personnel to aerially survey the state's forests and woodlands. Approximately 13 million acres of forest and woodlands are surveyed in New Mexico each year. Ground surveys are conducted post-ADS to check unknown or anomalous conditions observed from the air. The information within this report is not a complete picture of forest health in New Mexico, especially on state and private lands, because not every acre of forest and woodland in the state is surveyed. However, the area surveyed each year is approximately the same and data among years can be analyzed for trends.



1920s

first reports of aerially mapping forest insect damage in the U.S.



DROUGHT AND WARMING

Drought conditions in New Mexico worsened during 2023. For example, 51% of the state was abnormally dry (D0 drought category) at the beginning of January. By the end of December 2023, 41% of the state had progressed to severe drought (D2), and 35% of the state was in extreme drought (D3) (Fig. 1). Mean Temperature in NM during 2023 was 55.4°F, the 7th warmest on record. Mean Precipitation in NM during 2023 was 10.75", making it the 18th driest year on record. Overall, New Mexico was warmer and drier in 2023 compared to 2022. If conditions continue in this direction, increased drought stress may predispose trees to bark beetle attack or mortality in New Mexico forests and woodlands in 2024.

1992
the last year it was cooler than normal in New Mexico

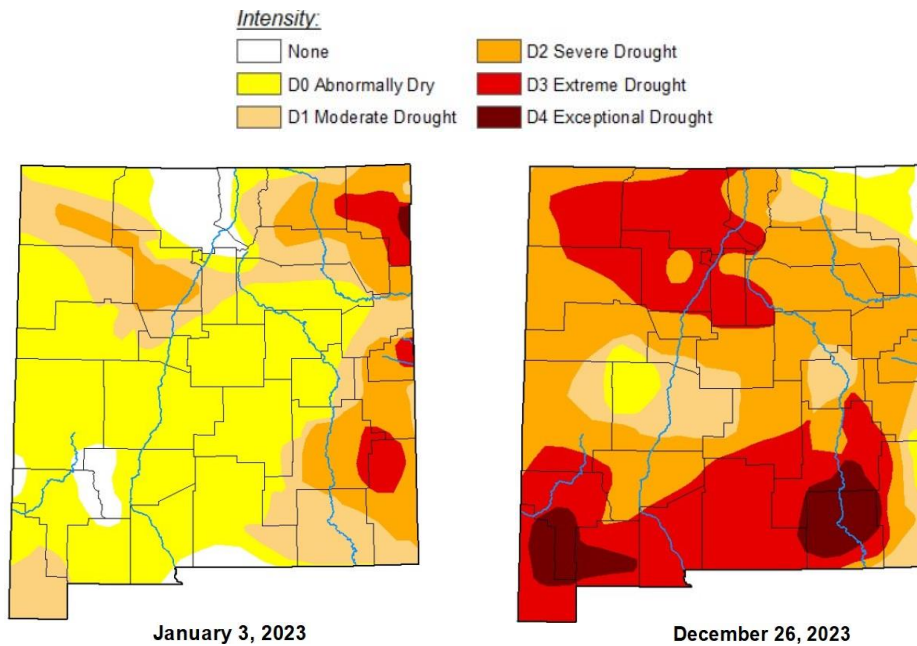
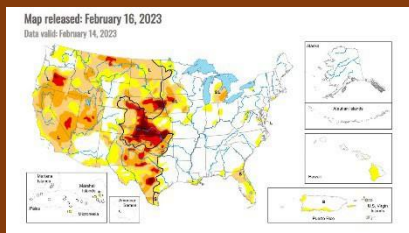


Figure 1. Comparison of drought at the beginning (L) and at the end of 2023 (R) in New Mexico.



View the current U.S. Drought Monitor map by clicking [here](#).



PEST HIGHLIGHTS

The following sections highlight the major pests that caused damage to New Mexico’s forest and woodlands in 2023.

MORTALITY AGENTS

Insects have killed more trees in the United States than any other biotic or abiotic agent, including wildfire (Raffa et al. 2008). Approximately 90% of tree mortality in New Mexico each year has been due to native bark beetles. Bark beetle-caused tree mortality can have substantial negative impacts on ecological processes, such as altering the carbon uptake of forests. The negative effects can be especially profound when bark beetles kill large areas of forest or woodlands (Kurz

et al. 2008). However, bark beetles do play a beneficial role in ecosystem function by killing stressed, over-mature, overstocked, or otherwise unhealthy trees. Bark beetle-killed trees are eventually replaced by juvenile trees that resist disturbance, recover more quickly, and maintain structure and function better than forest stands with old trees. Furthermore, canopy structure disturbance from bark beetle-caused tree mortality can increase the amount of sunlight reaching the forest floor and increase the number of snags and

1.6M
acres mapped with bark beetle-killed trees over the last decade

woody debris. This, in turn, can increase the species richness of flora and fauna in an area. In 2023 there was a substantial statewide decrease in mortality from bark beetles compared to 2022 (Fig. 2), most likely due to improved drought conditions in late 2022 and early 2023 resulting in healthier trees and their ability to withstand damage causing agents. 2023 had the lowest recorded tree mortality since 2010.

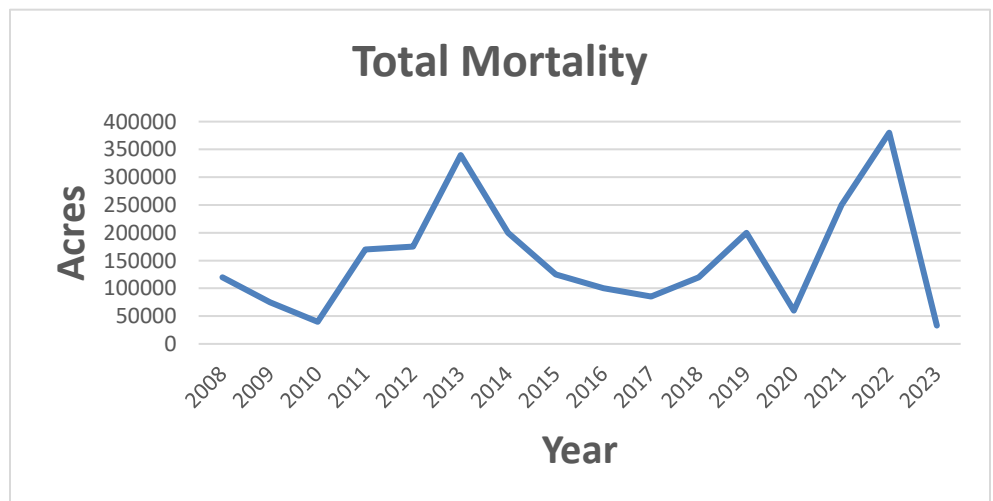


Figure 2. Trend of statewide forest mortality mapped on all land types in New Mexico from 2008 to 2023.

Spruce Beetle

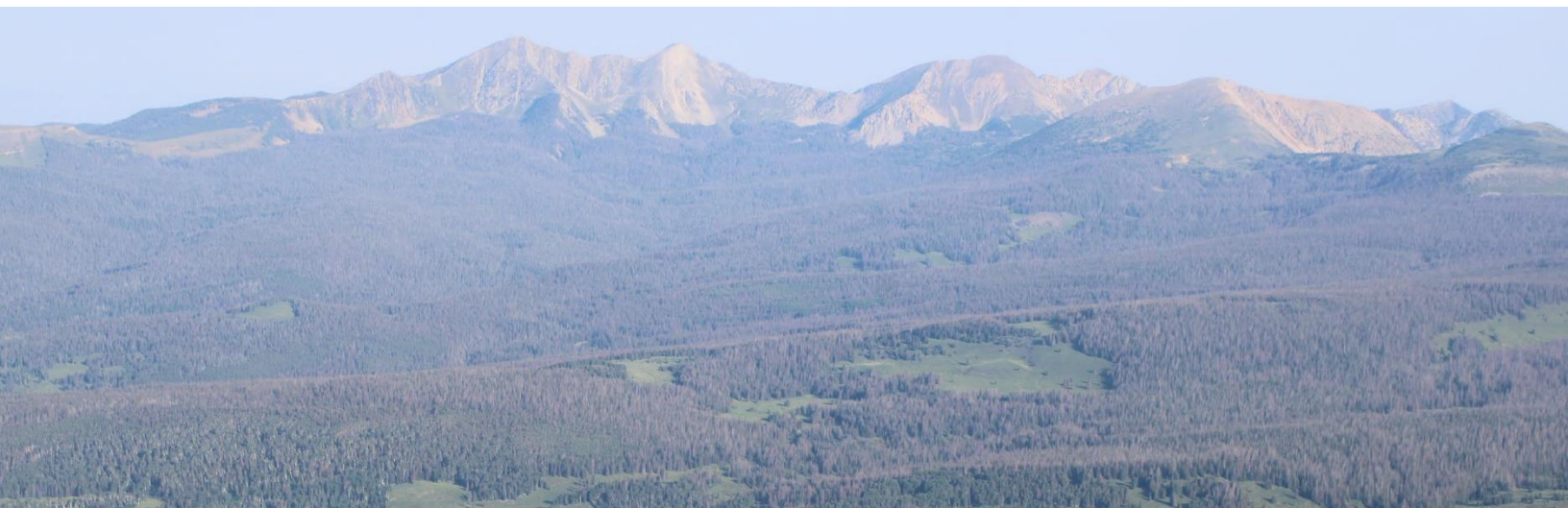
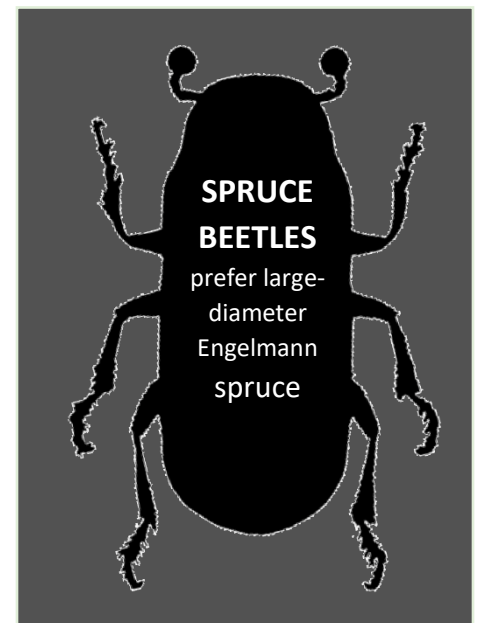
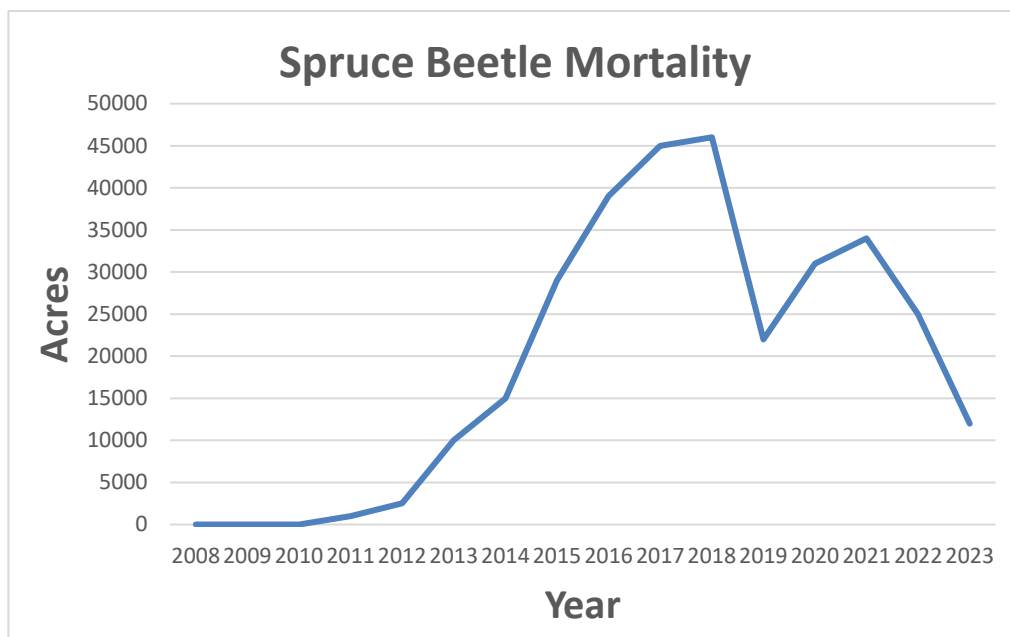
(Dendroctonus rufipennis)

298,000

acres mapped with spruce beetle-killed trees over the last decade

Approximately 12,500 acres of high-elevation Engelmann spruce forests in the state were mapped with spruce beetle-related tree mortality in 2023 (Fig. 3) resulting in a 50% decrease in acres mapped with spruce beetle activity compared to 2022 (24,000 acres). Most of the spruce mortality occurred on the Santa Fe and Carson National Forests (2,500 and 9,700 acres, respectively). Spruce mortality on private lands increased to 240 acres in 2023 compared to 2022 (180 acres) with most of the mortality detected on private land in Rio Arriba County. Spruce mortality was not detected on tribal lands in 2023.

Figure 3. Trend of statewide spruce mortality mapped on all land types in New Mexico from 2008-2023.



Ponderosa Pine Bark Beetles

(southwestern pine beetle; *Dendroctonus barberi*)
 (roundheaded pine beetle; *D. adjunctus*)
 (red turpentine beetle; *D. valens*)
 (pine engraver; *Ips pini*)

500,000
 acres mapped with bark beetle-killed ponderosa over the last decade

Approximately 5,500 acres of forests in the state were mapped with ponderosa mortality caused by this complex of bark beetle species, a significant decrease from 2022 levels of 130,000 acres (Fig. 4). The large number of acres in the Gila National Forest mapped with mortality in 2022 (83,000 acres) decreased by 97% in 2023 (1,800 acres). The Cibola National Forest had 220 acres mapped with mortality in 2023, a 98% decrease from 2022 (13,000 acres).

The other National Forests in the state (i.e., Santa Fe, Carson, Lincoln) collectively had ponderosa mortality on 1,400 acres. Mapped acres with ponderosa mortality on state and private lands decreased by 82% compared to 2022, with most of the mortality occurring in Mora County and Lincoln Counties.

Ponderosa mortality on tribal lands decreased by 99% substantially since 2022. Both Mescalero and Navajo Nation tribal lands each had 40 acres mapped with mortality in 2023 compared to 4,000 acres and 1,600 acres respectively, in 2022.

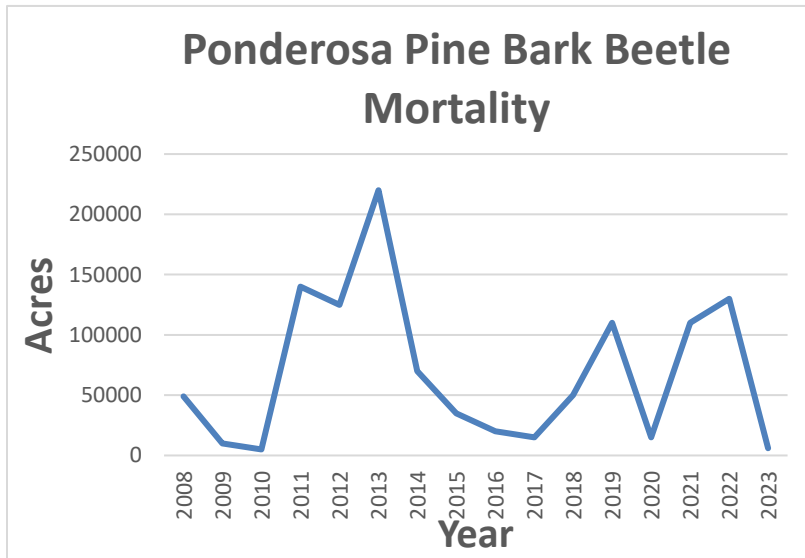


Figure 4. Trend of statewide bark beetle-induced ponderosa mortality on all land types in New Mexico from 2008-2023.



Mixed Conifer Bark Beetles

(Douglas-fir beetle; *Dendroctonus pseudotsugae*)
 (fir engraver; *Scolytus ventralis*)

307,000
 acres mapped with bark beetle-killed mixed conifer trees over the last decade

Approximately, 11,000 acres of mixed conifer forests throughout the state were mapped with mortality caused by Douglas-fir beetle and fir engraver beetle, a decrease of 20,000 acres or 64% from 2022. Mixed conifer mortality decreased on state / private lands by 61% and decreased on tribal lands by 53% in 2023 compared to 2022 levels. Acres mapped with mortality in mixed conifer forests on all National Forests decreased by 63%. The fir engraver beetle (host: white fir) was mapped on 4,000 acres with mortality and Douglas-fir beetle (host: Douglas-fir) was mapped on 7,000 acres with mortality. Areas near burn scars will be of particular interest to monitor for Douglas-fir bark beetle activity.

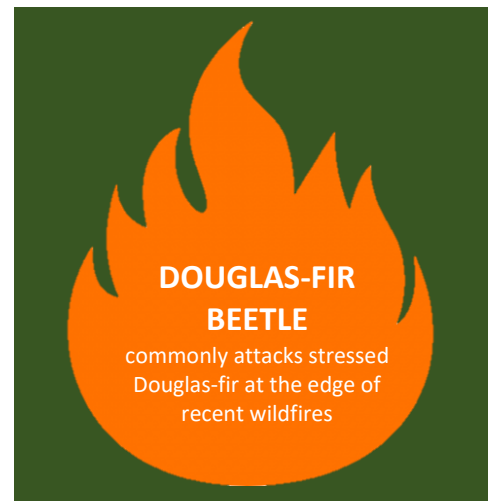


Figure 5. Trend of statewide bark beetle-induced mixed conifer mortality on all land types in New Mexico from 2008-2023.

Below: White fir mortality due to fir engraver beetle and the characteristic horizontal egg galleries.



Piñon Ips
(Ips confusus)

357,000
acres mapped with bark beetle-killed piñon trees over the last decade

Piñon Ips has been the most significant mortality agent of piñon in New Mexico and outbreaks of this species have been driven by prolonged drought conditions. However, in 2023, approximately 2,000 acres were mapped with bark beetle-killed piñon in the state, a substantial decrease of 99% compared to the 188,000 acres mapped in 2022. Mortality on state / private lands was 870 acres, National Forests 715 acres, and Tribal lands 440 acres. Areas mapped with piñon mortality were primarily single digit counts, consistent with endemic populations of Piñon Ips. Healthy trees are able produce a sustained pitch (sap) flow to physically repel or prevent Piñon Ips from colonizing trees, and timely precipitation events in late 2022 and early 2023 most likely improved health conditions of piñon trees on a landscape scale, resulting in the decrease in acreage mapped with mortality.

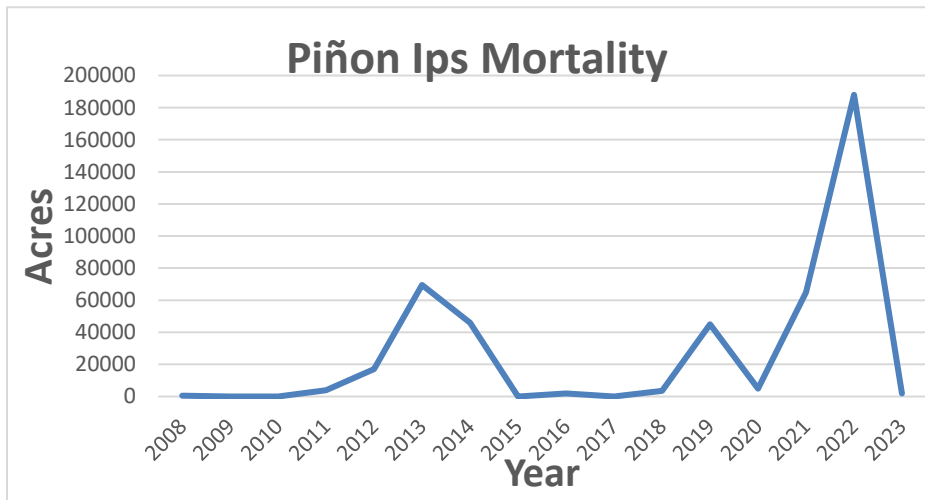


Figure 6. Trend of statewide bark beetle-induced piñon mortality on all land types in New Mexico from 2008-2023.





DEFOLIATION AGENTS

Defoliation agents, such as western spruce budworm or western tent caterpillar, have damaged approximately 4 million acres of forest and woodlands in New Mexico over the last decade. Defoliating agents rarely kill trees in a single season, but prolonged multi-year defoliation activity can result in growth loss, crown dieback, and in some instances, tree death. Defoliation also weakens

trees and can predispose them to attack by bark beetles or pathogens. In general, deciduous trees (e.g. aspen) can withstand defoliation activity better than evergreen species (e.g. pine, fir), although some exceptions do occur. Statewide defoliation decreased by 10% in 2023 (Fig. 7), which was due to a decrease in aspen defoliators and ponderosa needleminer

3.3M
acres of trees mapped with defoliation over the last decade

defoliation activity. Defoliation on state and private lands in 2023 increased by 25% from 2022 levels, due to increases in western spruce budworm activity. Douglas-fir tussock moth caterpillars were responsible for 2,600 acres of defoliation in 2023.

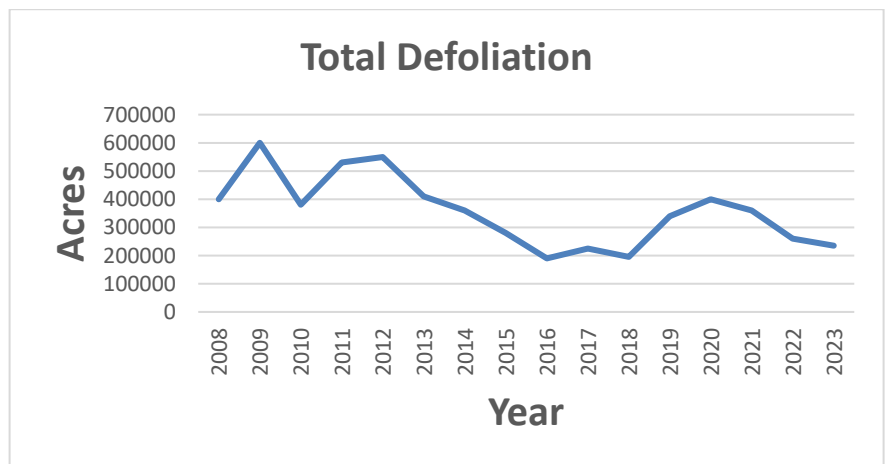


Figure 7. Trend of statewide forest defoliation mapped on all land types in New Mexico from 2008 to 2023.

Western Spruce Budworm

(Choristoneura freemani)

Caterpillars of the western spruce budworm (WSBW) moth feed on Douglas-fir, true firs (e.g. white fir), and spruce. In 2023, WSBW feeding was detected on approximately 199,000 acres of forests statewide and continues to be the most damaging defoliation agent in New Mexico. The number of acres on all land types with WSBW activity increased by 15% between 2022 and 2023 (Fig. 8). WSBW feeding activity on state and private lands increased by 70% between 2022 and 2023. WSBW feeding activity mapped on tribal forests decreased by 43% and occurred on the Taos Pueblo and Mescalero Apache lands. WSBW defoliation on all national forests was approximately 135,000 acres, a 20% decrease from 2022. The majority of WSBW defoliation in the state occurred on the Carson and Santa Fe National Forests and on state and private lands near these national forests. Western spruce budworm usually is the most destructive defoliator in the western U.S. and New Mexico is no exception. The overstocked mixed conifer forests of New Mexico have led to sustained

high populations of WSBW for several decades. The chronic feeding of this species can severely stress mature trees or cause mortality of small understory trees. Furthermore, mature trees that have been stressed by this insect’s defoliation activity generally are more susceptible to bark beetle attack.

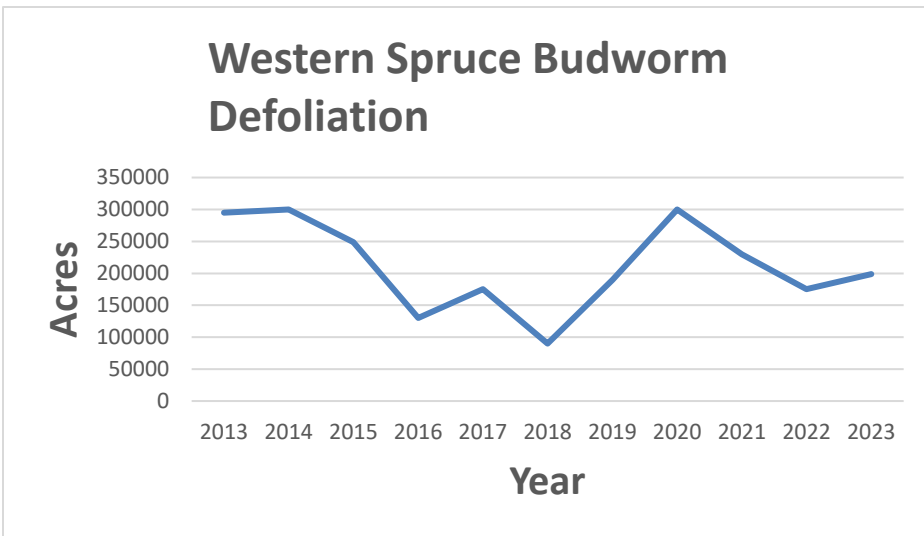


Figure 8. Trend of statewide spruce budworm activity on all land types in New Mexico from 2013- 2023.



Ponderosa Needleminer
(*Coleotechnites ponderosae*)

The tiny caterpillar of this species feeds within needles of ponderosa pine and has caused dramatic visual change over large areas (bottom image below). Feeding damage caused by this insect does not normally lead to tree death, but the damage can stress trees and make them more susceptible to bark beetle attack. Approximately 11,000 acres were mapped in 2023 with ponderosa needleminer damage, a 62% decrease from 2022. Most of the ponderosa needleminer activity continues to be located on and around the Vermejo Park Ranch near Raton and the Carson National Forest. Large-scale outbreaks are uncommon in New Mexico; however, there were reports of large outbreaks occurring in the northeastern part of the state in the 1980s and 1990s.

1989

52,000 acres were mapped in San Miguel County with needleminer defoliation damage



Above: Ponderosa needleminer caterpillar extracted from its feeding location within a needle sheath. Below: Large-scale defoliation damage (yellow crowns) on Vermejo Park Ranch caused by the ponderosa needleminer.



Aspen Defoliators

(western tent caterpillar; *Malacosoma californicum*)
(large aspen tortrix; *Choristoneura conflictana*)

The western tent caterpillar and large aspen tortrix have been the main defoliating agents of aspen in New Mexico and large-scale, chronic outbreaks of these species have been common. Large-scale aspen foliar disease (e.g. black ink spot) outbreaks were recorded in 1980's and 1990's. However, because of recent below average annual precipitation rates and above average temperatures, these disease events have been rare in New Mexico. In 2023, approximately 7000 acres of aspen were defoliated across the state, the majority of which occurred on the Santa Fe National Forest. Overall acres impacted by these defoliators decreased 62% in 2023 compared to 2022. Aspen defoliation on state and private lands decreased by 72% with most activity mapped in Rio Arriba, Taos, and Colfax counties. Aspen defoliation activity on tribal lands decreased substantially from 2022 to 2023 from 950 acres in 2022 to 80 acres in 2023; a decrease of 92%. After several years, a large-scale outbreak of western tent caterpillar around the Aspen Vista area of the Santa Fe National Forest finally ended, and vibrant fall colors returned. This outbreak had been present since 2015 and despite the prolonged defoliation activity, little to no aspen mortality has been observed in the area.

7 years

of a western tent caterpillar outbreak in the Aspen Vista area of the Santa Fe National Forest ended in 2023

Fall color near Aspen Vista area of the Santa Fe National Forest 2023.



ABIOTIC DISTURBANCE

Drought and Heat

Approximately 20,000 acres of ponderosa forests were mapped statewide with discoloration caused by drought- and heat-related stress, a 74% decrease from 2022. Ponderosa pine naturally sheds old needles every year; however, needles on affected trees are turning yellow months before they do normally. This symptom was a strong indicator of continued drought- and heat-related stress. Most discoloration was mapped on National Forests (15,000 acres) and state / private lands (4,000 acres). The symptomatic discoloration of ponderosa forests experiencing drought stress was concentrated in Rio Arriba, Sandoval, and Mora counties. Unfortunately, these visually drought-stressed ponderosa forests may experience increased twig beetle activity or bark beetle-induced mortality over the next few years.



Drought- and heat- stressed (yellow-orange crowns) ponderosa pines near Gallinas Peak on the Cibola National Forest.

CONCLUSIONS

The health of forests and woodlands in New Mexico are strongly influenced by temperature and precipitation. For example, warmer temperatures can increase insect activity and drier conditions can reduce the ability of trees to fight off pests, as exemplified by the large-scale piñon mortality event during the early 2000's. According to the National Weather Service, climatic conditions in New Mexico worsened for forests between 2022 and 2023; with a slight increase in annual mean temperature of 0.8°F and a decrease in annual mean precipitation of 3.44". Despite the 2023 conditions, overall damage to New Mexico's forests from biotic and abiotic factors decreased by 50% from the previous year, possibly due to residual soil moisture conditions from late 2022 and early 2023 that supported forest health in the spring and early to mid-summer months of 2023.



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Division

Special thanks to Randall Fowler – Forestry Data
Analyst NMFD for GIS support



APPENDIX

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