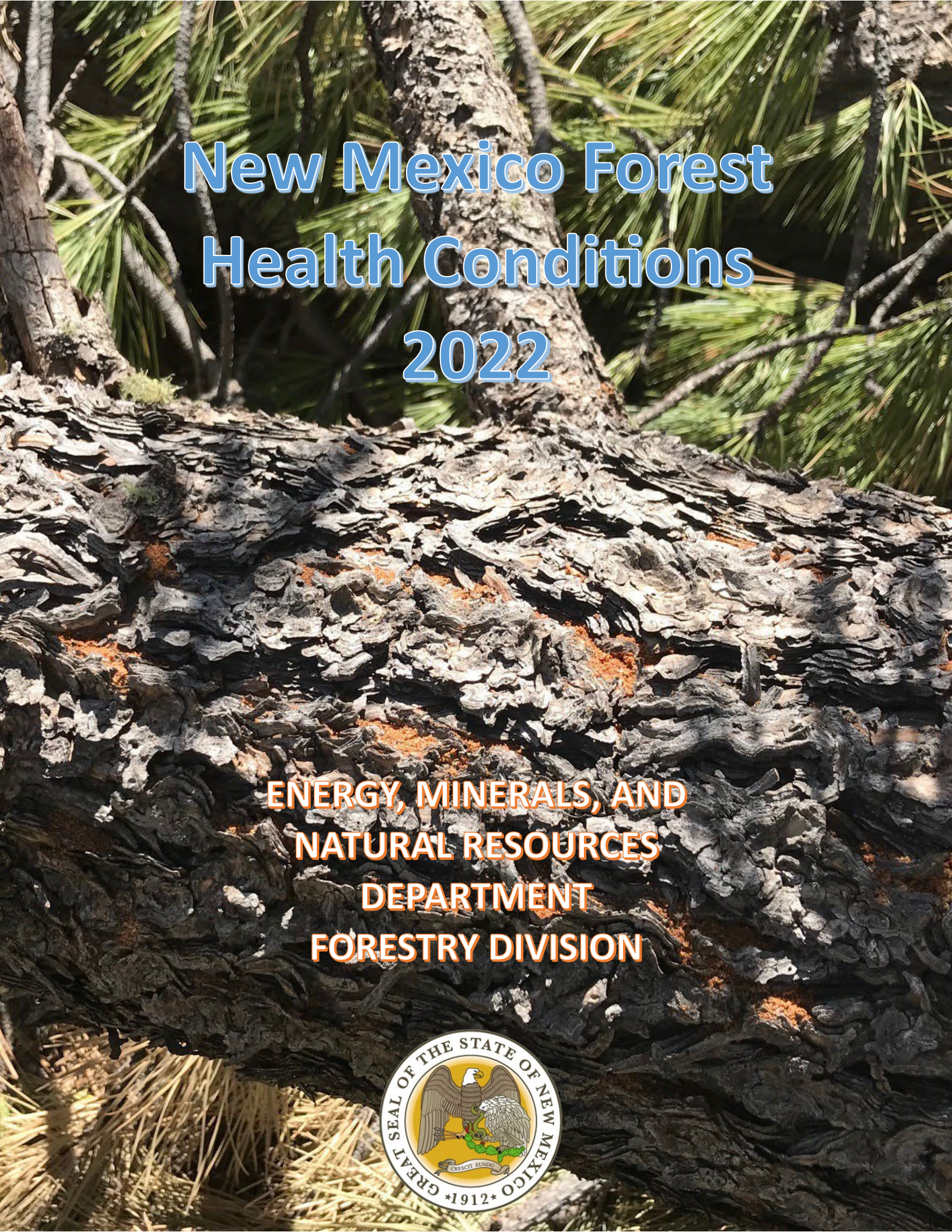


New Mexico Forest Health Conditions 2022

ENERGY, MINERALS, AND NATURAL RESOURCES DEPARTMENT

FORESTRY DIVISION

CONTENTS

Acknowledgment: Funding for this publication is supported by the USDA – Forest Service. Cover Photo: John Formby, US Forest Service

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.

2022 FOREST HEALTH SUMMARY

The number of acres of forest and woodlands mapped with insect, disease, and drought-stress damage decreased by 30,000 acres across all land ownership types in New Mexico since 2021. There were increases however in subcategories of damage between 2021 and 2022; with the largest increases represented in Piñon Ips mortality and drought impacts across all land ownership types. Damage mapped on state- and privately-owned forest and woodlands decreased by 94,000 acres or 35% from 2021 levels. Overall, most of the forest and woodland damage mapped in the state in 2022 occurred north of I-40. The Forestry Division's Forest Health Specialist continued to observe increased bark beetle-induced piñon mortality around Santa Fe, Cuba, and within the communities of the East Mountains (e.g. Edgewood). Examinations of the bark beetle-killed piñon trees in these areas found them to be unable to produce adequate pitch (i.e. sap) to repel bark beetle colonization. Consequently, it can be concluded that trees remain severely drought-stressed even though drought conditions improved in the state during 2022. Drought- and bark beetle-related tree mortality may continue to increase throughout the state in 2023 unless drought conditions continue to improve.

2022 FOREST HEALTH CONDITIONS *AT A GLANCE*		
Acres with Bark Beetle-Killed Trees	**Climate**	**Acres with Defoliation**
State and Private Lands 81,900	**Mean Temperature** 54.6°F = 17th Warmest on Record	**State and Private Lands** 72,000
National Forest Lands 195,000	**Mean Precipitation** 14.19" = 55th Wettest on Record	**National Forest Lands** 168,000
Tribal Lands 80,000		**Tribal Lands** 19,000

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

1992

the last year it was cooler than normal in New Mexico

Drought conditions in New Mexico improved during 2022. For example, 55% of the state was in the D2 or severe drought category in January; but by December 2022, 50% of the state had moved into the D0 or abnormally dry drought classification (Fig. 1). Mean Temperature in NM during 2022 was 54.6°F, making it the 17th warmest on record. Mean precipitation in NM during 2022 was 14.19", making it the 55th wettest year on record. These results yield a slightly cooler and slightly wetter year for 2022 than in 2021. If cooler and wetter conditions continue into 2023 then overall forest health conditions may improve as suggested by Allen et al. 2010.

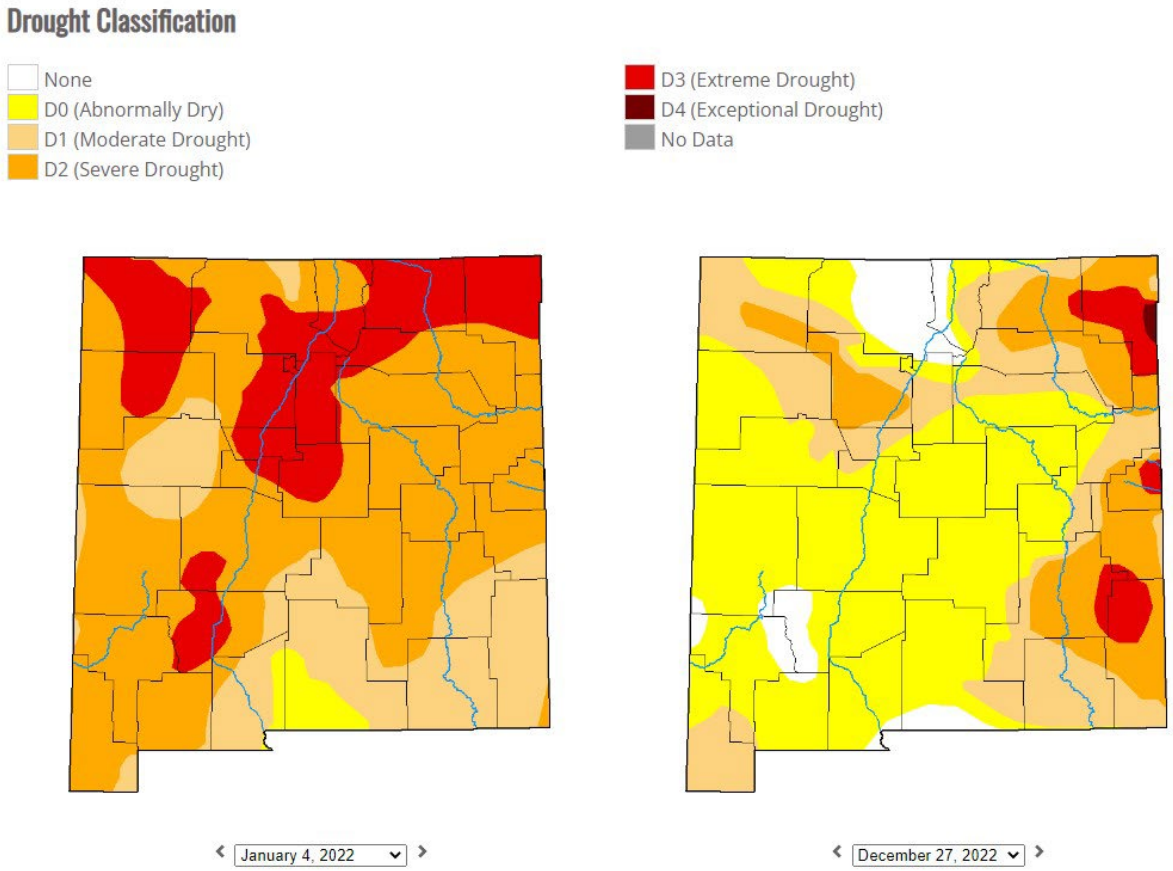
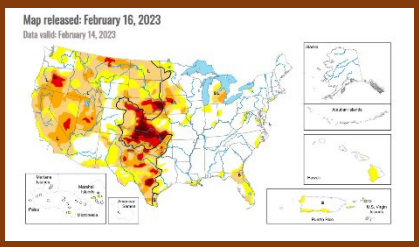


Figure 1. Comparison of drought at the beginning (L) and at the end of 2022 (R) in New Mexico.



View the current U.S. Drought Monitor map by clicking the graphic to the left.

PEST HIGHLIGHTS

The following sections highlight the major pests that caused damage to New Mexico's forest and woodlands in 2022.

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 woody debris. This, in turn, can increase the species richness of flora and fauna in an area. Overall, there was a substantial statewide increase in mortality from bark beetles from 2021 to 2022 (Fig. 2), most likely due to continuing drought conditions and above average temperatures throughout the state.

2.2M

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

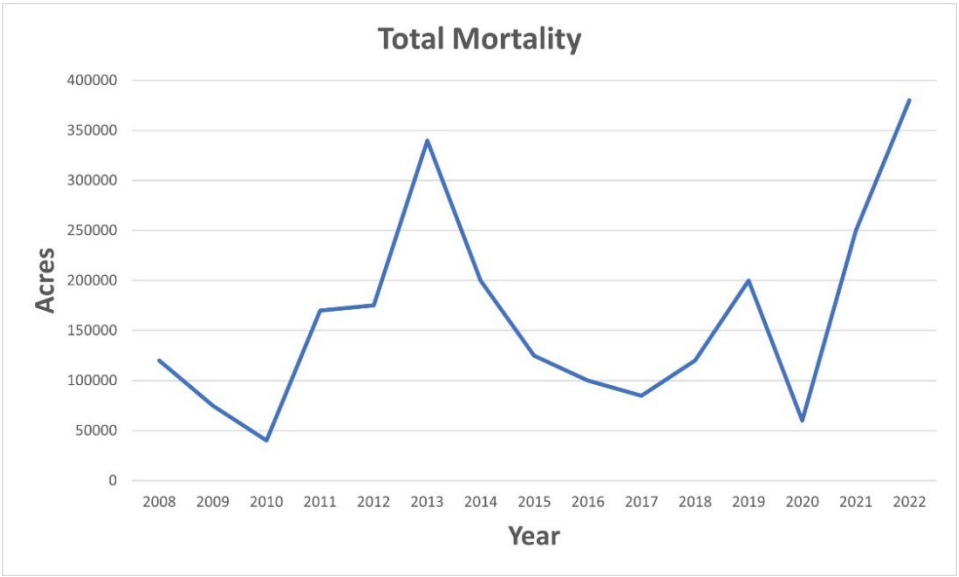


Figure 2. Trend of statewide forest mortality mapped on all land types in New Mexico from 2008 to 2022.

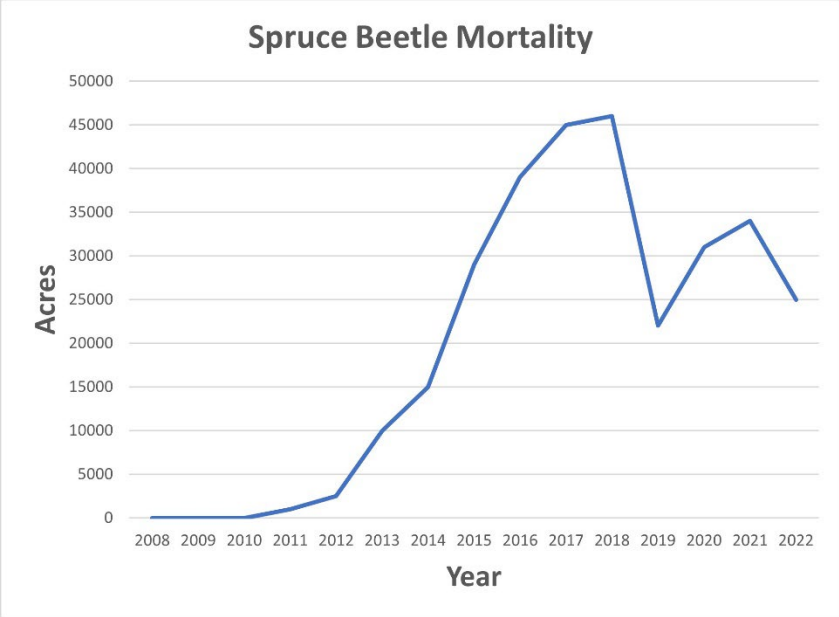
Spruce Beetle

(*Dendroctonus rufipennis*)

300,000

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

Approximately 24,000 acres of high-elevation Engelmann spruce forests in the state were mapped with spruce beetle-related tree mortality in 2022 (Fig. 3). This was a 28% decrease in acres mapped with spruce beetle activity since 2021. Most of the spruce mortality occurred on the Santa Fe and Carson National Forests (8,300 and 16,000 acres, respectively). Spruce mortality on private lands substantially decreased since 2021 with most of the mortality detected on private land in Rio Arriba County. Spruce mortality on tribal lands totaled 70 acres with much of that acreage mapped on the Navajo Nation. The spruce beetle outbreak that had subsided on the Mescalero Apache and Lincoln National Forest in 2021 remains absent in 2022.



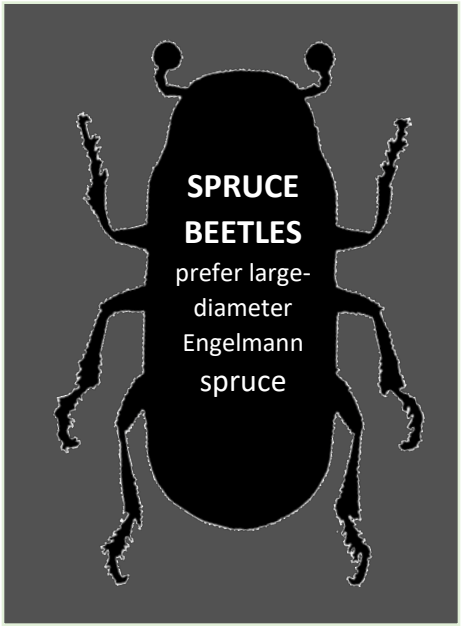
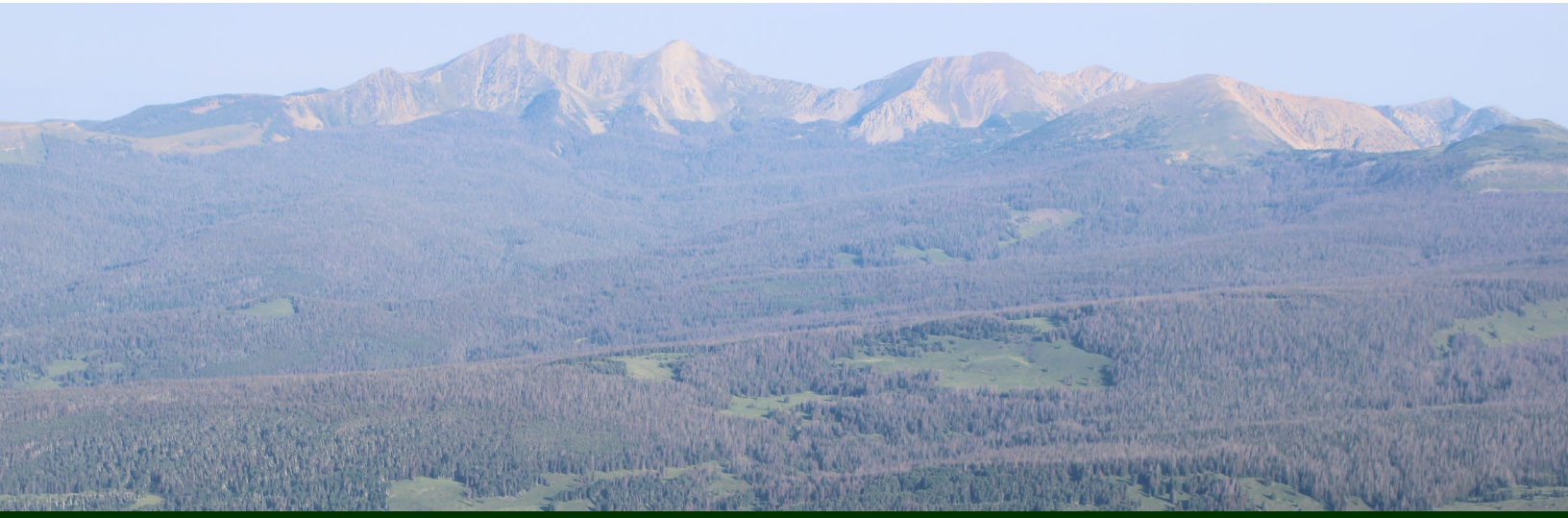


Figure 3. Trend of statewide spruce mortality mapped on all land types in New Mexico from 2008-2022.



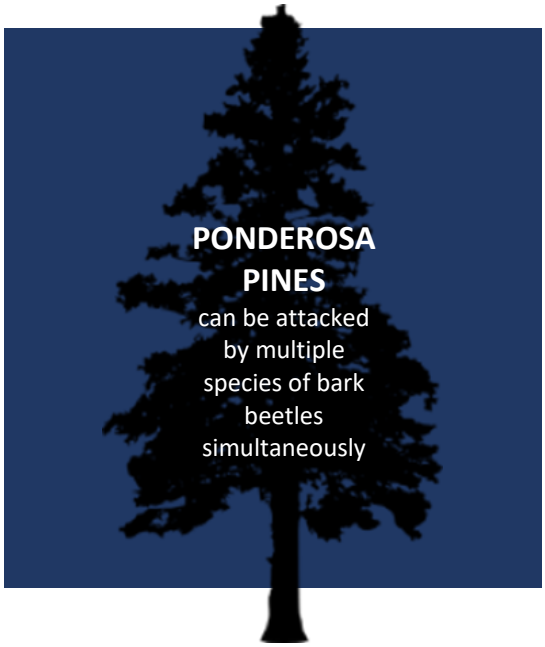
Ponderosa Pine Bark Beetles

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

1.0M
acres mapped with bark beetle-killed ponderosa over the last decade

Approximately 130,000 acres of forests in the state were mapped with ponderosa mortality caused by this complex of bark beetle species, which was a modest increase from 2021 levels (Fig. 4). Most of the acres mapped with mortality occurred on the Gila National Forest (83,000 acres), which remained consistent with previous aerial survey findings. The Cibola National Forest contained the second highest amount of mapped ponderosa mortality with 13,000 acres. The other National Forests in the state (i.e., Santa Fe, Carson, Lincoln) had mapped acreages that ranged from 800 to 5,500 acres. Mapped acres with ponderosa mortality on state and private lands increased slightly by 4% since 2021, with most of the mortality occurring in Mora County and Lincoln Counties.

Ponderosa mortality on tribal lands increased substantially since 2021 with most of the acres mapped on the Mescalero (4,000 acres) and Navajo Nation (1,600 acres) tribal lands. Bark beetle-induced ponderosa mortality throughout the state may continue to increase in 2023 due to on-going drought conditions and above average temperatures.



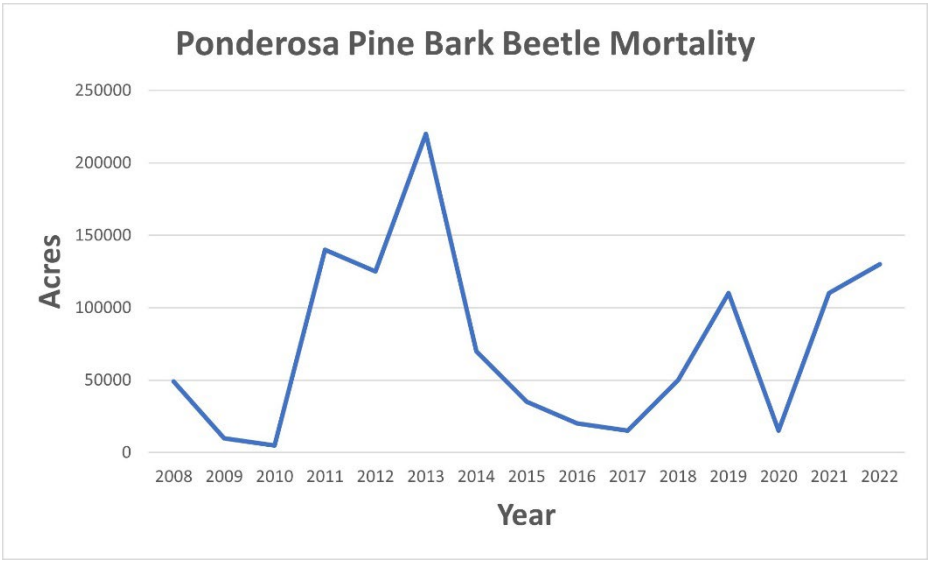


Figure 4. Trend of statewide bark beetle-induced ponderosa mortality on all land types in New Mexico from 2008-2022.

Mixed Conifer Bark Beetles

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

396,000
acres mapped with bark beetle-killed mixed conifer trees over the last decade

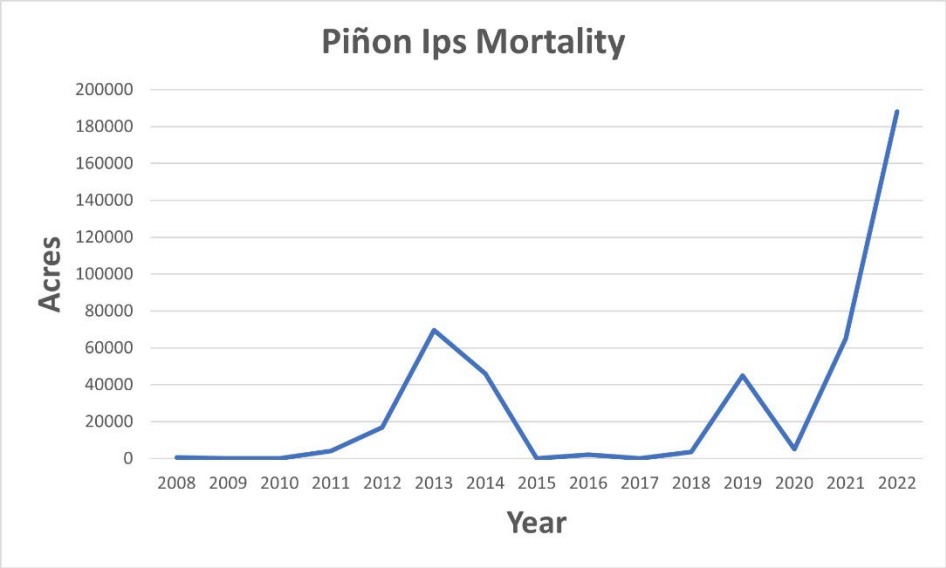
Douglas-fir beetle and fir engraver attack New Mexico's mid-elevation conifer species, Douglas-fir and white fir, respectively. Approximately, 32,000 acres of mixed conifer forests throughout the state were mapped with mortality caused by these two species of bark beetles, which is a slight increase in acres from 2021 levels. Mixed conifer mortality increased on state / private lands by 29% and decreased on tribal lands by 7% in 2022; compared to 2021 levels. The fir engraver beetle was more active in 2022 than 2021; with 21% of the acres mapped with mortality in mixed conifer forests caused by this species. The number of acres killed by mixed conifer bark beetles has decreased annually since 2014, but acres mapped with mortality have increased during 2021 and 2022 (Fig. 5). Large-scale outbreaks of these bark beetles have been rare in the southwest; however, increased Douglas-fir beetle activity can be observed in drought-stressed forests or those immediately surrounding recent fire scars.

Figure 5. Trend of statewide bark beetle-induced mixed conifer mortality on all land types in New Mexico from 2008-2022.

445,000
acres mapped with bark beetle-killed piñon trees over the last decade

Piñon Ips
(*Ips confusus*)

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. In 2022, approximately 188,000 acres with bark beetle-killed piñon were mapped in the state, which was a substantial increase in acres since 2021 and the most mapped since 2013 (Fig. 6). This increase was most likely influenced by the on-going drought conditions. Most of the 2022 acreage was mapped on tribal lands in the Zuni Reservation and Navajo Nation and on private / state lands; predominantly in Cibola, Catron and Mckinley counties. There were also to a lesser extent Piñon ips mortality on private lands in Rio Arriba, Santa Fe and Bernalillo counties. Most of the remaining mortality was mapped on National Forest and state / private lands south of 1-40. If drought conditions don't improve piñon mortality may continue to increase over the next few years.



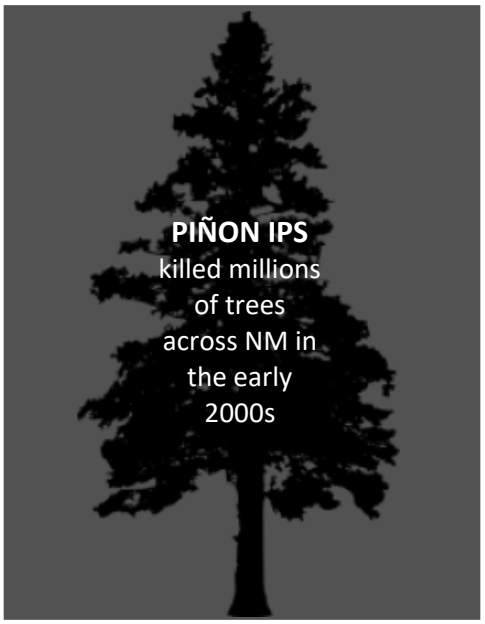


Figure 6. Trend of statewide bark beetle-induced piñon mortality on all land types in New Mexico from 2008-2022.

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 26% from 2021 to 2022 (Fig. 7), which was due to a decrease in western spruce budworm and western tent caterpillar defoliation activity. Defoliation on state and private lands in 2022 decreased substantially by 61% from 2021 levels, which were also due to decreases in western spruce budworm activity.

4.0M

acres of trees mapped with defoliation over the last decade

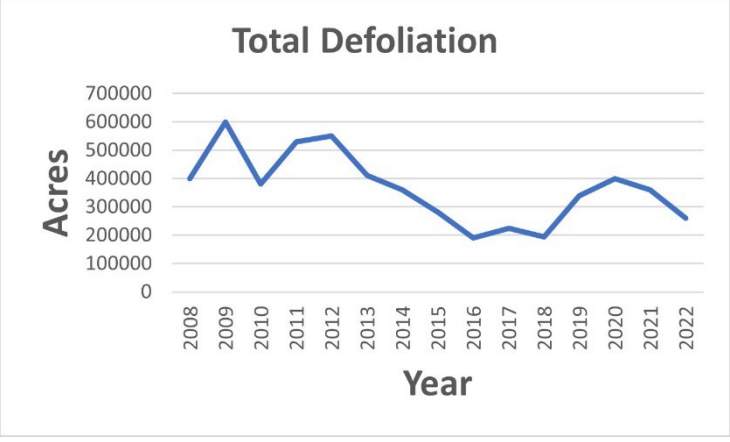


Figure 7. Trend of statewide forest defoliation mapped on all land types in New Mexico from 2008 to 2022.

Western Spruce Budworm

(*Choristoneura freemani*)

Caterpillars of this moth feed on Douglas-fir, true firs (e.g. white fir), and spruce. In 2022, western spruce budworm (WSBW) feeding was detected on 173,000 acres of forests statewide and was, once again, the most damaging defoliation agent in New Mexico. The number of acres on all land types with WSBW activity decreased 22% between 2021 and 2022 (Fig. 8), possibly due to decreased defoliation severity. Similarly, WSBW feeding activity on state and private lands decreased substantially by 43% between 2021 and 2022. Most of the WSBW feeding activity mapped on tribal forests occurred on the Taos Pueblo (5,600 acres) and Mescalero Apache (5,000 acres) lands. 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. Collectively, these areas accounted for 79% of the total acres impacted by WSBW. 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 and 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.

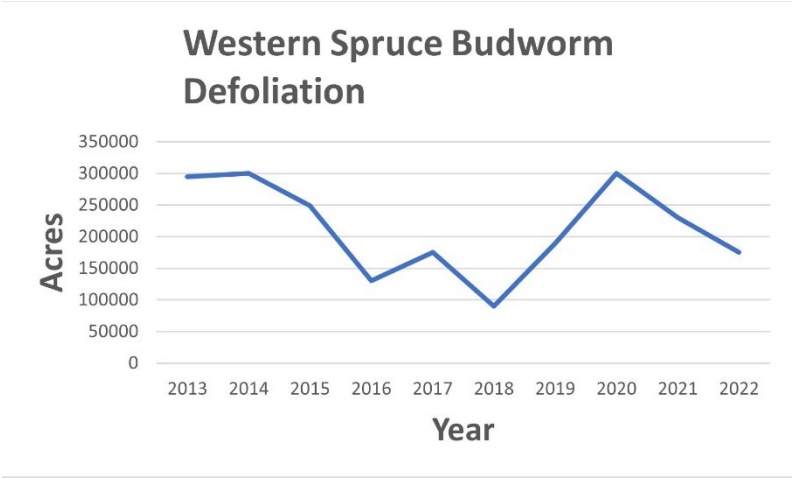


Figure 8. Trend of statewide spruce budworm activity on all land types in New Mexico from 2008-2022.

Ponderosa Needleminer

(*Coleotechnites ponderosae*)

1989

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

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. This was the fifth year of a large-scale outbreak of this moth species on and around the Vermejo Park Ranch near Raton. There was also continued a presence of needleminer activity in Carson National Forest. Acres affected by the species decreased to 30,000 acres or 69% between 2021 and 2022. 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.

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.

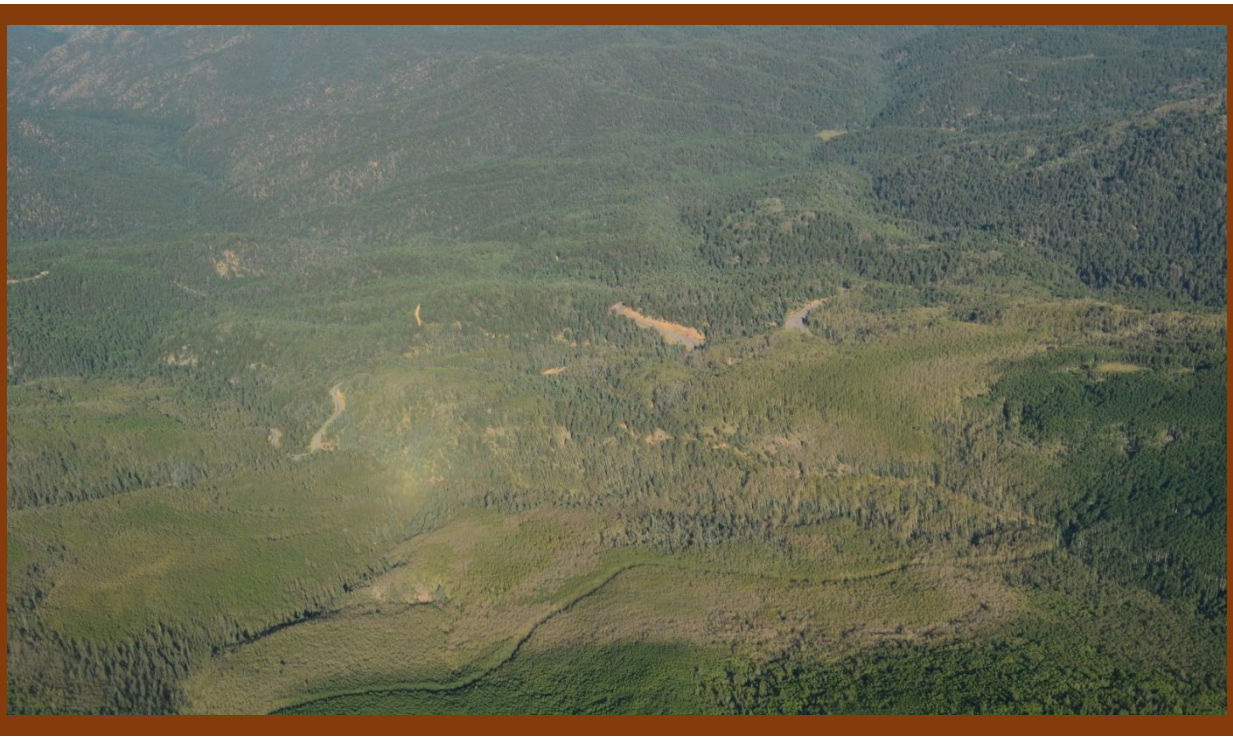
Aspen Defoliators

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

7 years
of a western tent caterpillar outbreak in the Aspen Vista area of the Santa Fe National Forest

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 below average annual precipitation rates and above average temperatures, these disease events recently have been rare in New Mexico. In 2022, approximately 18,600 acres of aspen were defoliated across the state, the majority of which occurred on the Santa Fe National Forests. Overall acres impacted by these defoliators increased 32% between 2021 and 2022. Aspen defoliation on state and private lands increased by 18% with most activity mapped in Rio Arriba, Taos, and Colfax counties. Aspen defoliation activity on tribal lands increased substantially from 2021 to 2022 from 150 acres in 2021 to 950 acres in 2022; an increase of 84%. The large-scale outbreak of western tent caterpillar around the Aspen Vista area of the Santa Fe National Forest remained on-going. This outbreak has been present since 2015 and as a result, has negatively impacted the vibrant fall color of aspen in the area. Despite the prolonged defoliation activity, little to no aspen mortality has been observed in the infested area and these epidemic western tent caterpillar populations may crash eventually over the next few years.

Aspen defoliation caused by the western tent caterpillar around the Aspen Vista area of the Santa Fe National Forest.



ABIOTIC DISTURBANCE

Drought and Heat

Approximately 76,000 acres of ponderosa forests were mapped statewide this year with discoloration caused by drought- and heat-related stress. 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 (53,000 acres) and state / private lands (17,000 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 improved for forests between 2021 and 2022; with a slight decrease in annual mean temperature of 0.8°F and a slight increase in annual mean precipitation of 1.75". These conditions were more favorable to forest health with an observed slight (e.g. 4%) reduction in overall damage to New Mexico's forest from biotic and abiotic factors.

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APPENDIX

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