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# Forest Health Conditions in Arizona & New Mexico, 2025



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**Cover photo: Aerial photo of heavy recent mortality in pinyon pine, ponderosa pine, and Douglas-fir on Church Mountain of the Smokey Bear Ranger District, Lincoln National Forest (top-left); and drought-associated dieback and mortality of juniper, pinyon, and oak on the Huachuca Mountains, Coronado National Forest (bottom-right).**

**Forest Health Conditions in Arizona & New Mexico, 2025**  
**Southwestern Region**  
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# Introduction

This document summarizes aerial and ground-based observations of forest damage caused by insects, diseases, and abiotic events across the Southwestern Region in 2025. These data are collected annually by the Forest Health Protection (FHP) team; the Arizona Department of Forestry and Fire Management; and the New Mexico Energy, Minerals, and Natural Resources Department. The information is provided to internal and external partners and is accessible to the public. Information is provided to track annual trends and to help guide land management decisions. The report also helps to fulfill a congressional mandate (The Cooperative Forestry Assistance Act of 1978, as amended) that requires survey, monitoring, and annual reporting of the health of forests in the U.S. Forest Health Protection staff are available to answer questions, and contact information can be found at the end of this document.

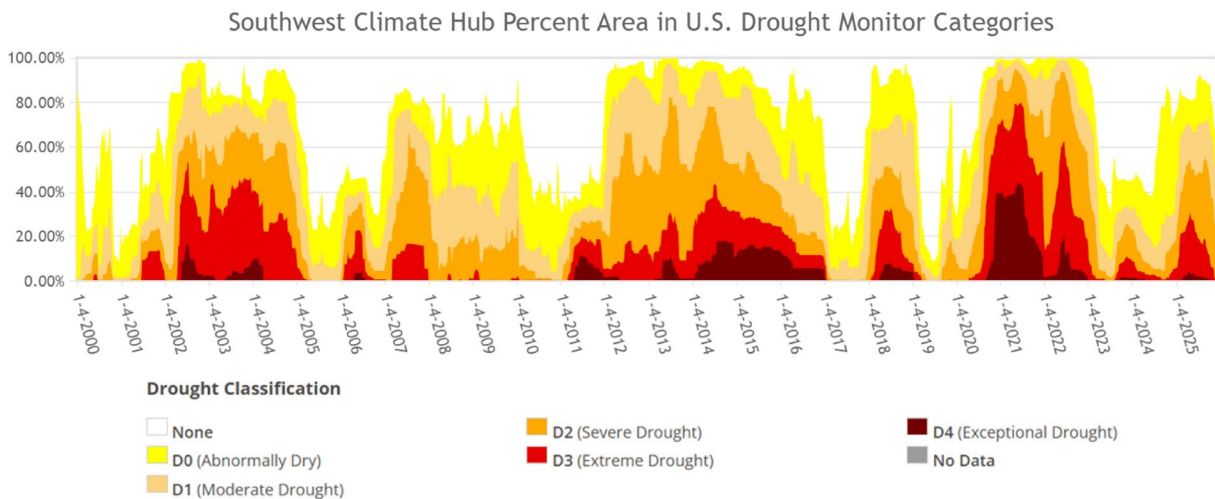
Please visit the FHP website for additional information and other publications and resources:

<https://www.fs.usda.gov/r03/natural-resources/forest-health>.

## Weather Conditions in Brief

### Drought

Over the last 25 years, the southwestern U.S. has experienced multiple extended droughts with recovery periods that are relatively short (Figure 1). Snowpack in the region coming out of the 2024-2025 winter was extremely low, the lowest on record in New Mexico. This low snowpack combined with warmer than average temperatures leading to rapid spring melt-off contributed to the majority of the Southwestern Region being under moderate to exceptional drought conditions by spring 2025 (Figure 2). Monsoon season somewhat alleviated these drought conditions, but most of the region remained under moderate to extreme drought in the fall. The hot and dry conditions continued through the end of 2025. Temperatures over the course of the year were above average across the region, and record warmest annual temperatures were recorded in northern Arizona and northwestern and southwestern New Mexico.



**Figure 1. Percent of the southwestern U.S. in various drought monitor categories from 2000-2025. Source: <https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx>.**

**Drought Classification**

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
- No Data

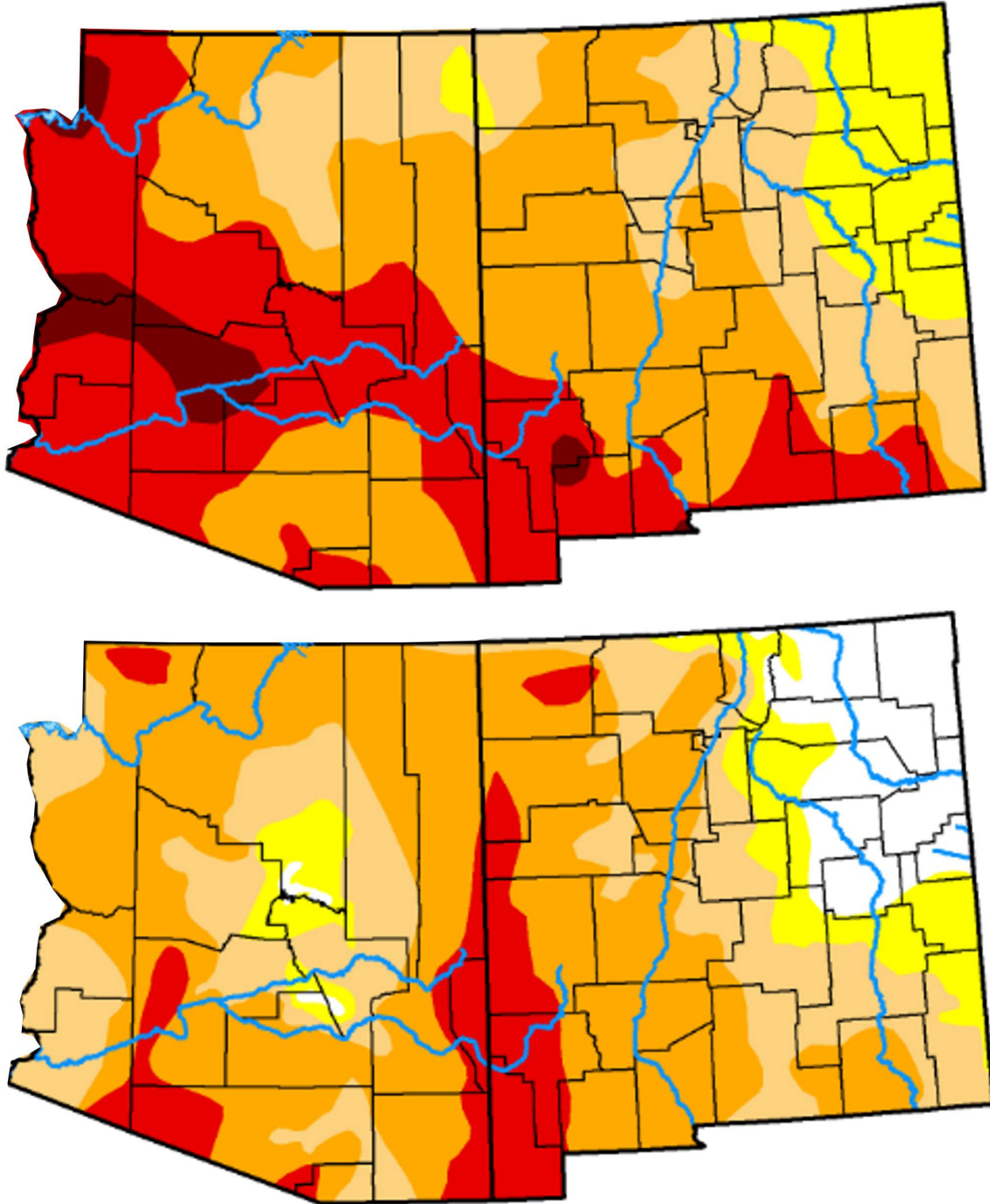
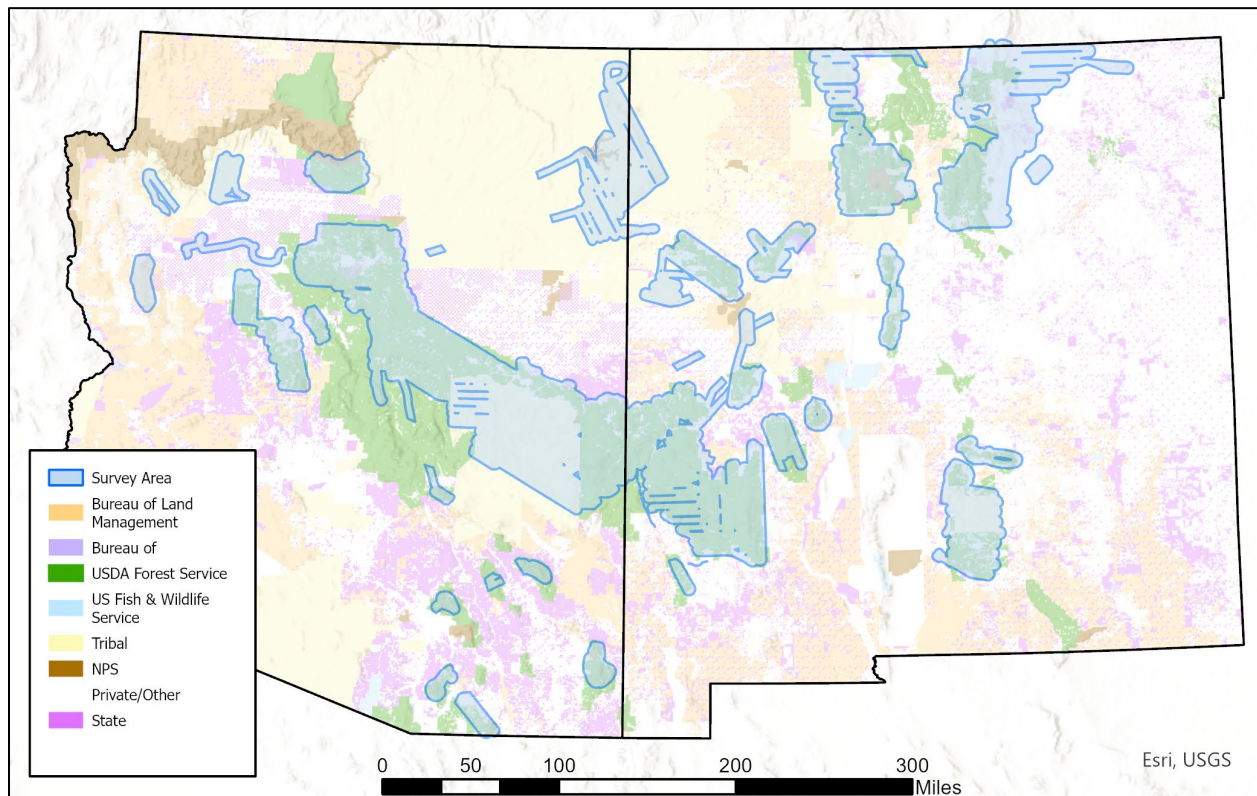


Figure 2. U.S. Drought Monitor comparison map of the Southwestern Region showing drought conditions between 18 March (above) and 21 October 2025 (below). Source: <https://droughtmonitor.unl.edu/Maps/CompareTwoWeeks.aspx>.

# Regional Forest Insect and Disease Summary

## Aerial Survey Summary

In 2025, aerial detection surveys (ADS) covered approximately 18.8 million acres of the Southwestern Region (Table 1, Figure 3), approximately 20% less than our 10-year average. Coverage was reduced due to capacity, budget, and local fires limiting aviation access in northern Arizona. Aerial surveys predominantly covered national forest (NF) land (55% of the area surveyed), followed by tribal (24%), state and private (18%), and other federal lands (3%). Ground-based monitoring data also contributed to the insect and disease data in 2025. Data can be downloaded so land managers can focus on damage in specific areas via the following link: <https://www.fs.usda.gov/science-technology/data-tools-products/fhp-mapping-reporting/detection-surveys>.



**Figure 3. Areas of the Southwestern Region surveyed (blue polygons) during 2025 aerial detection survey flights.**

**Table 1. Aerial detection survey acres flown in 2025 in the Southwestern Region.<sup>1</sup>**

Owner	State	Forested <sup>2</sup>	Riparian <sup>2</sup>	Woodland <sup>2</sup>	Total <sup>2</sup>
National Forest Lands	AZ	2,729,300	54,800	1,975,800	4,759,900
Bureau of Land Management	AZ	6,900	200	43,300	50,400
Department of Defense	AZ	28,900	300	19,900	49,100
National Park Service	AZ	23,500	1,200	94,900	119,500
Tribal	AZ	1,360,100	7,900	1,827,800	3,195,700
State and Private	AZ	193,400	15,600	387,000	596,000
<b>Arizona Total</b>		<b>4,342,000</b>	<b>80,000</b>	<b>4,348,600</b>	<b>8,770,600</b>
National Forest Lands	NM	3,749,500	65,600	1,884,600	5,699,600
Bureau of Land Management	NM	32,600	400	158,000	191,000
Bureau of Reclamation	NM	1,600		*	1,600
Department of Defense	NM		*	500	500
Department of Energy	NM	9,000	100	10,900	20,000
National Park Service	NM	85,400	1,000	15,500	101,900
Tribal	NM	797,100	3,000	567,200	1,367,300
State and Private	NM	1,703,500	51,400	975,100	2,730,000
<b>New Mexico Total</b>		<b>6,378,600</b>	<b>121,600</b>	<b>3,611,900</b>	<b>10,112,100</b>
<b>Grand Total</b>		<b>10,720,600</b>	<b>201,500</b>	<b>7,960,500</b>	<b>18,882,700</b>

\*Indicates less than 50 acres of land ownership and vegetation type surveyed.

<sup>1</sup> Values rounded to the nearest hundred, sum of individual numbers may differ from totals due to rounding.

<sup>2</sup> Vegetation type is based on USFS R3 Ecological Response Unit data,

## Bark Beetle Summary

Tree mortality attributed to bark beetles was mapped on 326,390 acres in 2025, with damage more than tripling from the 102,286 acres reported in 2024 (Table 2). Although this acreage is still considerably lower than in 2021-2022 when 700,000+ acres were mapped with mortality each year, this nevertheless represents a dramatic rise in activity. Regionwide, the complex of bark beetle species causing mortality of ponderosa pine (and similar hosts like Apache, Arizona, and Chihuahua pines) contributed to the most acres with mortality for any forest type. Acres with ponderosa pine mortality increased across the region from 62,093 acres mapped in 2024 to 262,882 acres in 2025. Pinyon ips bark beetles causing mortality in pinyon pine represent the second most prevalent agent with 45,942 acres mapped with mortality in 2025, up from 1,072 acres in 2024; most of the activity was mapped in the southern part of the region. Douglas-fir beetle-caused mortality accounted for the third highest acreage in the Southwestern Region in 2025 with 10,142 acres mapped with mortality, down from 14,772 acres in 2024.

In Arizona, pine bark beetles were the most prevalent mortality agent mapped for the fifth year in a row, with 105,477 acres recorded with damage in 2025, increasing from 29,148 acres in 2024. Pinyon pine mortality associated with pinyon ips activity in Arizona was mapped on 12,704 acres in 2025 and was the second most frequently recorded mortality agent, up from 109 acres in 2024. Fir engraver activity in Arizona was mapped on 935 acres in 2025, down from 2,305 acres with activity in 2024. Douglas-fir beetle activity was also down in 2025, with 329 acres recorded with damage compared to 636 acres mapped in 2024. Some of this reduction in mixed conifer mortality may be due to lack of survey coverage north of the Grand Canyon in Arizona. Western balsam bark beetle-caused mortality continued to decline from 262 acres mapped in 2024 to 159 acres in 2025. Spruce beetle levels in Arizona remained low with four acres mapped in 2025, down from 35 acres in 2024.

Ponderosa pine bark beetles were again the most active mortality agent in New Mexico in 2025, with 157,405 acres with mortality mapped, an increase from 32,945 acres in 2024 (Figure 4). Pinyon pine mortality associated with pinyon ips activity increased significantly in 2025 to 33,238 acres, up from 963 acres in 2024. Douglas-fir beetle activity was recorded on 9,813 acres in 2025, down from 14,136 acres mapped in 2024. Spruce beetle activity declined slightly from 9,981 acres mapped in 2024 to 8,509 acres in 2025. Fir engraver activity in New Mexico also declined in 2025 to 2,074 acres, down from 5,374 acres mapped in 2024. Western balsam bark beetle damage in New Mexico remained low, declining from 292 acres mapped in 2024 to 18 acres in 2025.



**Figure 4. Widespread and severe ponderosa pine mortality (brown trees) was occurring across the Gila National Forest in 2025 due to ongoing drought conditions, with the forest accounting for nearly half of all ponderosa pine mortality in the region.**

**Table 2. Bark beetle<sup>1</sup> incidence (acres) by ownership from aerial detection surveys in 2025 in Arizona and New Mexico<sup>2</sup>.**

Owner <sup>3</sup>	Pine bark beetles <sup>4</sup>	Pinyon ips	Douglas-fir beetle	Fir engraver	Spruce beetle	Western balsam bark beetle
Apache-Sitgreaves National Forest	36,346	2,486	154	366	2	2
Coconino National Forest	9,384	21	148	58		1
Coronado National Forest	13,542	6,105	1	98		1
Kaibab National Forest	3,845	90		3		
Prescott National Forest	2,526	316		3		
Tonto National Forest	4,282	107		19		
Bureau of Land Management	118	0		0		
Department of Defense	3,422	2,567				
Canyon De Chelly National Monument	2	2				
Chiricahua National Monument	2		0			
Grand Canyon National Park	4	0				
Sunset Crater National Monument	1					
Walnut Canyon National Monument	1	1				
Hopi Tribal						
Hualapai Tribal	23	3				
Kaibab Tribal						
Navajo Tribal	1,652	648	13	1	1	
San Carlos Tribal	16,482	44		0		
White Mountain Apache Tribal	13,466	294	12	406	2	156
Other Tribal	1					
State & Private	3,859	434				
<b>Arizona Total</b>	<b>105,477</b>	<b>12,704</b>	<b>329</b>	<b>953</b>	<b>4</b>	<b>159</b>
Carson National Forest	188	2	3,283	307	4,789	9
Cibola National Forest	6,443	6,356	74	106		5
Gila National Forest	124,304	10,851	223	2		
Lincoln National Forest	19,869	7,519	962	92		
Santa Fe National Forest	401	2	3,501	698	3,401	1
Bureau of Land Management	369	679	1			
Department of Energy	5		0			
Bandelier National Monument	3					
El Malpais National Monument	339					
Valles Caldera National Preserve	2		1	1		
Acoma Pueblo	14	10				
Isleta Pueblo	4	536		1		
Jemez Pueblo	1					
Jicarilla Apache Tribal	5	1	7	1		
Laguna Pueblo	3	0	0			
Mescalero Apache Tribal	4,342	1,112	190	1	1	
Navajo Nation	20	24	3	0		0
Picuris Pueblo	1	1	0	1		
Ramah Tribal	0	1				
Santa Clara Pueblo	2		0			
Taos Pueblo	0		5		201	
Zuni Pueblo	152	1,844	0			
State & Private	6,532	8,006	2,268	1,172	117	2
<b>New Mexico Total</b>	<b>157,405</b>	<b>33,238</b>	<b>9,813</b>	<b>2,074</b>	<b>8,509</b>	<b>18</b>
<b>Grand Total</b>	<b>262,882</b>	<b>45,942</b>	<b>10,142</b>	<b>3,028</b>	<b>8,512</b>	<b>177</b>

<sup>1</sup>Only major bark beetle and mortality agents shown. Agents detected with lesser activity may not be represented in the table.

<sup>2</sup>Values rounded to the nearest acre, sum of individual values may differ from totals due to rounding and multiple agents occurring in the same location; a blank cell indicates no damage was observed.

<sup>3</sup>Values based on landownership, thus any inholdings are summarized with their ownership category.

<sup>4</sup>Ponderosa pine bark beetle attributed mortality may include acreage from similar hosts such as Apache, Arizona, and Chihuahua pines.

## Defoliation and Sap Sucker Damage Summary

Defoliation from insects and diseases (including agents not listed in Table 3) decreased across the region from 365,386 acres in 2024 to 170,977 acres in 2025 (Table 3). Most notable was a reduction in acres with western spruce budworm activity in northern New Mexico to the lowest acreage observed in ten years. Damage was mapped on 55,411 acres in 2025, down from 248,823 acres in 2024. Despite this reduction, most of the acres with defoliation by western spruce budworm continue to be detected in New Mexico (93%). Typically the dominant defoliating agent in New Mexico, it accounted for about 35% of the damage in the state in 2025, while pinyon needle scale and Douglas-fir tussock moth were both major contributors as well (26% and 25% of the damage, respectively). Pinyon needle scale, a native sap sucking insect, was the second most common defoliator detected regionwide in 2025. A total of 48,385 acres were mapped compared to 44,581 acres in 2024 across the Southwestern Region. More pinyon needle scale damage was recorded in New Mexico (81%) than in Arizona. Douglas-fir tussock moth was the third most widespread defoliator mapped in the region in 2025 with 42,104 acres recorded (again entirely in New Mexico), up from 18,082 acres in 2024 (Figure 5). Aspen damage recorded during aerial surveys includes defoliation and mortality. Aspen damage declined regionwide from 28,002 acres in 2024 to 7,852 acres in 2025 with damage primarily recorded in New Mexico (91%).

In Arizona, pinyon needle scale was the most prevalent defoliating agent, and observable damage was mapped on 9,225 acres in 2025, down significantly from 28,338 acres recorded in 2024. Pinyon needle scale damage is chronic across woodlands, but because pinyon pine does not regrow lost needles many affected stands look grey which makes it difficult to discern if needle scale is still active when mapping from the air. The Prescott scale, also a native sap sucking insect, was active across Arizona and contributed to ponderosa pine branch and tip dieback along with twig beetles and the fungal disease *Diplodia* shoot blight and canker on 6,714 acres (reported in Table 4). Drought is the likely driver of irruptive secondary agents documented in Arizona in 2025. Pine tip moths continue to cause severe damage in parts of eastern Arizona, where invasive Nantucket pine tip moth and native ponderosa pine tip moths were mapped impacting reforestation projects across 23 acres in 2025.

In New Mexico, additional noteworthy defoliation events included activity from ponderosa pine needleminers, sawflies, and various defoliators contributing to oak damage. Ponderosa pine defoliation attributed to pine needleminer was mapped on 2,248 acres in 2025, declining from the 13,781 acres recorded in 2024. Defoliation by sawflies of ponderosa pine was also mapped on 5,537 acres in 2025, down from 7,074 acres recorded in 2024. Oak defoliation activity in New Mexico was elevated in 2025 with 8,591 acres impacted, up from 3,201 acres in 2024.



**Figure 5. Defoliation by Douglas-fir tussock moth on the Jemez Mountains (landscape, left; stand, right).**

**Table 3. Defoliation<sup>1</sup> and aspen damage incidence (acres) by ownership from aerial detection surveys in 2025 in Arizona and New Mexico<sup>2</sup>.**

Owner <sup>3</sup>	Western spruce budworm	Aspen damage <sup>4</sup>	Ponderosa pine needleminer	Sawfly in ponderosa pine	Pinyon needle scale	Douglas-fir tussock moth
Apache-Sitgreaves National Forests		201			363	
Coconino National Forest		84				
Coronado National Forest					2,879	
Kaibab National Forest					1,291	
Prescott National Forest					691	
Tonto National Forest					2,322	
Bureau of Land Management						
Department of Defense						
Bureau of Reclamation						
Canyon De Chelly National Monument						
Grand Canyon National Park						
Saguaro National Park						
Walnut Canyon National Monument						
Hopi Tribal						
Hualapai Tribal						
Kaibab Tribal						
Navajo Tribal		61			509	
San Carlos Tribal					28	
White Mountain Apache Tribal		328			793	
Other Tribal						
State & Private					697	
<b>Arizona Total</b>		<b>674</b>			<b>9,225</b>	
Carson National Forest	26,676	1,362	243			1,161
Cibola National Forest	690	554	184	5,536	2,891	1,881
Gila National Forest				1	662	
Lincoln National Forest	2,322	217			20,160	
Santa Fe National Forest	3,740	3,419	596		105	37,379
Bureau of Land Management	252				811	
Department of Energy						
Bandelier National Monument		0				
El Malpais National Monument						
Valles Caldera National Preserve	380	64				136
Acoma Pueblo						
Isleta Pueblo						27
Jemez Pueblo					13	900
Jicarilla Apache Tribal	166	11			134	
Laguna Pueblo						
Mescalero Apache Tribal	691	117			11,646	
Navajo Nation	150	44				
Picuris Pueblo		12				
Ramah Tribal						
Santa Clara Pueblo		57				
Taos Pueblo	721	19				
Zuni Pueblo						
State & Private	20,263	1,303	1,224		5,084	1,908
<b>New Mexico Total</b>	<b>55,411</b>	<b>7,179</b>	<b>2,248</b>	<b>5,537</b>	<b>39,160</b>	<b>42,104</b>
<b>Grand Total</b>	<b>55,411</b>	<b>7,852</b>	<b>2,248</b>	<b>5,537</b>	<b>48,385</b>	<b>42,104</b>

<sup>1</sup>Only major defoliator agents shown. Less commonly detected agents or those detected with lesser activity may not be represented in the table.

<sup>2</sup>Values rounded to the nearest acre, sum of individual values may differ from totals due to rounding and multiple agents occurring in the same location; a blank cell indicates no damage was observed.

<sup>3</sup>Values based on landownership, thus any inholdings are summarized with their ownership category.

<sup>4</sup>Aspen damage includes a combination of insect defoliation and other biotic and abiotic factors causing decline, dieback, and mortality.

## Disease Summary

Dwarf mistletoe is the most common and widespread pathogen in the Southwest. Aerial detection surveys do not allow for identification of dwarf mistletoe infestations, and yearly ground estimates are limited; therefore, overall estimated acreage affected does not change from year to year. Current estimates (Arizona 1,873,000 acres and New Mexico 2,073,000 acres across all ownerships) are based on historical records, which indicate that over one-third of ponderosa pine acreage and about one-half of mixed conifer acreage have some level of infection. Recent roadside surveys showed a similar affected area in ponderosa pine compared with these historical records.

Root diseases are also widely distributed across the region (219,000 acres and 860,000 acres across all ownerships for Arizona and New Mexico, respectively) but poorly documented. The most prominent root diseases in the region are caused by *Armillaria* spp. and *Heterobasidion occidentale*, and these diseases often interact with bark beetles, drought, and other tree stressors to cause tree mortality. Foliar diseases generally occur sporadically based on environmental conditions but can be a chronic issue in areas conducive to infection. Canker-causing fungi have become increasingly common across the Southwest. Diplodia shoot blight and canker of pines was observed causing branch flagging in various locations in 2025, including the Philmont Scout Ranch and 115 acres mapped via ADS on the Quemado Ranger District (RD) of the Gila NF as well as distributed across the Bradshaw (Prescott NF), Payson (Tonto NF), and Williams (Kaibab NF) RDs in Arizona. Charcoal canker caused by *Biscogniauxia mediterranea* was also prevalent in southern Arizona, particularly on the Huachuca Mountains where the disease is closely associated with thousands of acres of oak damage.

White pine blister rust, a disease caused by the introduced fungus *Cronartium ribicola*, continues to injure and kill southwestern white and limber pine in the Southwest. Tree mortality from this disease is most prevalent on the Sacramento Mountains of southern New Mexico, but the disease can now be found in many parts of the Southwest, including eastern Arizona and parts of northern New Mexico.

## Abiotic Summary

Abnormally dry conditions and moderate to extreme drought continued to occur across the Southwestern Region in 2025, and abiotic damage associated with these conditions was elevated compared to 2024 (Table 4). Impacts were primarily documented in woodlands in Arizona and ponderosa pine in both Arizona and New Mexico and commonly associated with secondary, drought-driven pathogens and insects. Drought-induced discoloration was mapped in several species (though primarily ponderosa pine) on 49,180 acres regionwide in 2025, increasing from 15,225 acres recorded in 2024. Oak damage, which includes dieback, defoliation, and drought-induced discoloration, was observed on 9,964 acres in 2025; however, over a third of the 19,357 acres of drought discoloration in mixed species mapped regionwide was mapped in southern Arizona on the Huachuca Mountains and included a significant oak component. Drought-associated oak mortality was also observed during ground surveys on Coronado NF. Drought-induced dieback in juniper increased dramatically from 1,203 acres in 2024 to 53,354 acres in 2025, primarily in Arizona on the Coronado and Prescott NFs and on state and private lands. Branch flagging in ponderosa pine was recorded on 6,989 acres in 2025, increasing from 2,046 acres recorded in 2024. Branch flagging may be caused by twig beetles, Prescott scale, or the fungal disease Diplodia shoot blight and canker but is often tied closely to drought conditions. Red belt winter injury was not observed after being recorded on the Valle Vidal unit of Carson NF with 1,005 acres affected in 2024. Hail damage was not observed in 2025 after being mapped on 211 acres of New Mexico State Game & Fish Lands in 2024. Salt damage of ponderosa pine along roadways was mapped on about 158 acres regionwide in 2025, up from 97 acres in 2024.

**Table 4. Abiotic and other damage<sup>1</sup> incidence (acres) by ownership from aerial detection surveys in 2025 in Arizona and New Mexico<sup>2</sup>.**

Owner <sup>3</sup>	Juniper drought dieback	Oak damage <sup>4</sup>	Ponderosa drought discoloration	Drought discoloration mixed spp.	Ponderosa branch flagging <sup>5</sup>	Ponderosa pine road salt damage
Apache-Sitgreaves National Forests	1,872		4,682	847	1,727	
Coconino National Forest	146		5,437	1,034	2,595	24
Coronado National Forest	14,478	1,164		3,399		
Kaibab National Forest	105		679	3,261	1,099	73
Prescott National Forest	14,431	19	1,561	729	646	
Tonto National Forest	880		371	32		
Bureau of Land Management	327		23			
Department of Defense	635			3,543	43	
Canyon De Chelly National Monument						
Coronado National Monument	8					
Grand Canyon National Park					1	
Saguaro National Park						
Walnut Canyon National Monument						
Hopi Tribal						
Hualapai Tribal	947					
Kaibab Tribal						
Navajo Tribal	15		3,099		1	
San Carlos Tribal	2,386		341	982	371	
White Mountain Apache Tribal	3,973		3,614	3,949	232	
Other Tribal						
State & Private	14,549	16	739	112	365	20
<b>Arizona Total</b>	<b>53,323</b>	<b>1,198</b>	<b>19,808</b>	<b>17,788</b>	<b>6,714</b>	<b>97</b>
Carson National Forest		1,111	4,477			7
Cibola National Forest		144	3,535	1	1	2
Gila National Forest	10	95	1,409	349	180	
Lincoln National Forest		1,770	3	924		1
Santa Fe National Forest			235	0	0	14
Bureau of Land Management						
Department of Energy				0		12
Bandelier National Monument						9
El Malpais National Monument						1
Valles Caldera National Preserve						1
Acoma Pueblo						
Isleta Pueblo						
Jemez Pueblo						
Jicarilla Apache Tribal		1,197				
Laguna Pueblo			4			
Mescalero Apache Tribal		276	138			
Navajo Nation			108		93	
Picuris Pueblo						1
Ramah Tribal						
Santa Clara Pueblo						
Taos Pueblo						
Zuni Pueblo						
State & Private	21	4,212	667	299	2	16
<b>New Mexico Total</b>	<b>30</b>	<b>8,716</b>	<b>10,015</b>	<b>1,569</b>	<b>275</b>	<b>61</b>
<b>Grand Total</b>	<b>53,354</b>	<b>9,964</b>	<b>29,823</b>	<b>19,357</b>	<b>6,989</b>	<b>158</b>

<sup>1</sup>Only major abiotic and other damages are shown; less commonly detected damage may not be reported in the table.

<sup>2</sup>Values rounded to the nearest acre, sum of individual values may differ from totals due to rounding and multiple agents occurring in the same location; a blank cell indicates no damage was observed.

<sup>3</sup>Values based on landownership, thus any inholdings are summarized with their ownership category.

<sup>4</sup>Oak damage includes defoliation, dieback, and crown discoloration; other oak damage may be included in "Drought discoloration other spp."

<sup>5</sup>Ponderosa branch flagging includes damage caused by several biotic damage agents including Prescott scale, twig beetles, and *Diplodia* spp.

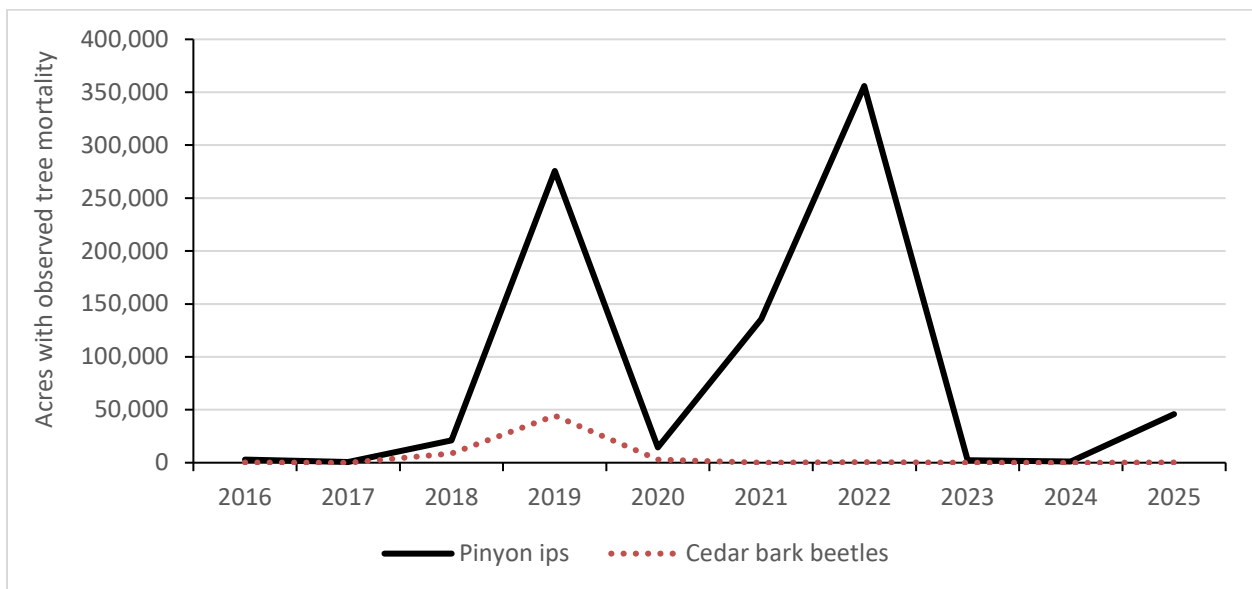
# Status of Major Insects

## Bark Beetles

The overall total acreage with tree mortality attributed to bark beetles increased dramatically across the region in 2025 for species tracked by aerial survey (Table 2). Most of the bark beetle damage across the region was mapped on Forest Service lands (84%).

### Pinyon-Juniper Woodlands

In 2025, 7,960,500 acres of woodlands were surveyed, with coverage being reduced somewhat from the 9,812,700 acres surveyed in 2024. Acres with bark beetle-attributed mortality in pinyon-juniper woodlands remained very low in juniper because most damage to this host has been recorded as drought-driven dieback and not mortality since 2021. Meanwhile, an increase in activity was documented in pinyon pine despite less area being surveyed overall (Figure 6).



**Figure 6. Pinyon-juniper mortality associated with pinyon ips and cedar bark beetles in the Southwestern Region over the last ten years.**

### Pinyon Ips

*Ips confusus*

Host: Pinyon pine

Acres with pinyon pine mortality increased from 1,072 acres in 2024 to 45,942 acres in 2025 (Table 2, Figure 6). As in the past few years, most of this mortality was observed in New Mexico (33,238 acres, 72%). This was an increase from the 963 acres mapped in the previous year. The damage in New Mexico occurred primarily on the Gila (10,851 acres), Lincoln (7,519 acres), and Cibola NFs (6,356 acres, Figure 7) as well as on state and private lands (8,006 acre). In Arizona, the 12,704 acres of pinyon pine mortality recorded in 2025 was an increase from 109 acres in 2024. Coronado NF and neighboring Fort Huachuca had the greatest proportion of pinyon pine mortality in 2025 in Arizona (6,105 acres; 48% and 2,567 acres; 20%, respectively), although significant activity did occur across several other ownerships. It should also be noted that aerial detection surveys are not comprehensive surveys of pinyon-juniper woodlands across the region, and number of acres surveyed can vary from year to year. Pinyon pine

mortality continued to occur in the region through fall and winter, and additional activity was observed after aerial survey flights, especially on the Apache-Sitgreaves and Coronado NFs in Arizona. Ground surveys were conducted on both national forests to document some of the additional impacts (Figure 8).



**Figure 7. Pockets of recent pinyon pine mortality (reddish brown trees) due to pinyon ips bark beetles around Datil, NM on the Magdalena Ranger District, Cibola National Forest in 2025; damage intensified through fall and winter, and monitoring plots are being established in the area.**



**Figure 8. Severe and widespread pinyon pine mortality associated with pinyon ips activity and drought which continued through fall and winter 2025; Black Mesa Ranger District, Apache-Sitgreaves National Forests.**

## Cedar Bark Beetles

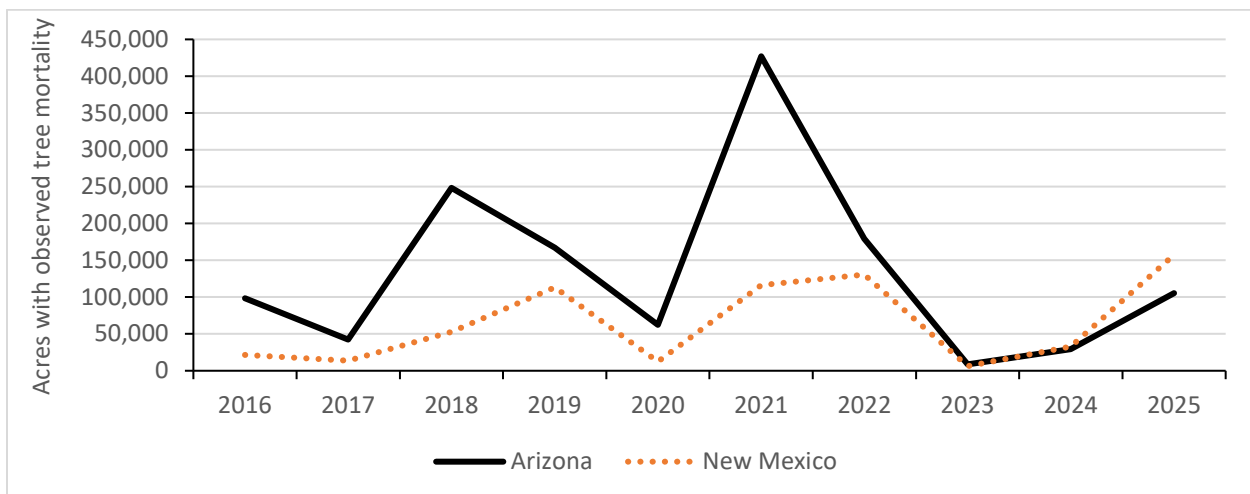
*Phloeosinus* spp.

Host: Junipers and Arizona cypress

Juniper mortality has historically been linked to cedar bark beetle activity in the Southwest. However, in recent years, many junipers had dieback with the lower branches of the trees often remaining green and evidence of bark beetle activity scarce (other than in alligator juniper). Beginning in 2021, most fading juniper has thus been mapped as dieback rather than mortality, as described in the Abiotic Damage section of this document under “Drought”. In 2025, juniper mortality attributed to bark beetles was recorded occurring on 264 acres across the region, up from 10 acres in 2024. Most of this damage (78%) was found in Arizona. Activity may be underestimated in 2025, however, as some juniper drought damage mapped on Coronado NF (14,478 acres, Table 4) did have cedar bark beetles in alligator juniper.

## Ponderosa Pine Forest Type

In the Southwestern Region, ponderosa and similar pines (like Apache, Arizona, and Chihuahua pines) are attacked by a diverse complex of bark beetles, most commonly in the *Ips* and *Dendroctonus* genera. These beetles overlap geographically, and it is quite common to find several species co-occurring within the same tree. Ponderosa pine mortality increased throughout most of the region from 62,093 acres mapped in 2024 to 262,882 acres mapped in 2025 (Figure 9). Significant damage occurred in both Arizona (105,477 acres, 40%) and New Mexico (157,405 acres, 60%). This was an increase for both states from 29,148 acres and 32,945 acres in Arizona and New Mexico, respectively, in 2024. In New Mexico, activity in the last few years has been closely tied to recent wildfire history. Damage in 2025 was more broadly distributed and is likely more associated with drought than fire. In Arizona, most of the activity for the last few years was generally associated with drought.



**Figure 9. Ponderosa pine mortality attributed to bark beetles in the Southwestern Region over the last ten years.**

In Arizona, much of the mortality was again recorded on the Apache-Sitgreaves NFs (Figure 10, 36,346 acres, 34%), but the Coronado NF (13,542 acres, 13%) as well as San Carlos (16,482 acres, 16%) and White Mountain Apache Tribal Lands (13,466 acres, 13%) also accounted for a significant proportion of the damage (Table 2). Most of the mortality in New Mexico was located on Gila NF (Figure 11, 123,304 acres, 79%), with a significant component occurring on Lincoln NF as well (19,869 acres, 13%).



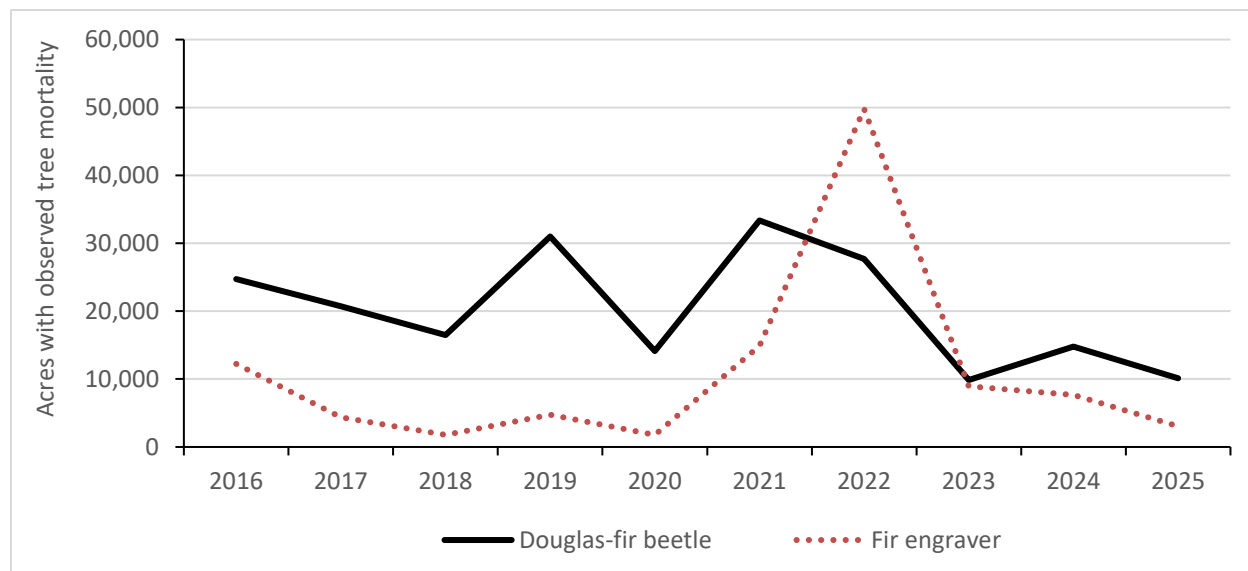
**Figure 10. Extensive ponderosa pine mortality near Heber, AZ on the Black Mesa Ranger District, Apache-Sitgreaves National Forests.**



**Figure 11. Extensive ponderosa pine mortality (reddish brown trees) on Jones Peak (Gila National Forest).**

## Mixed Conifer Forest Type

Mortality in mixed conifer forests from bark beetles, primarily consisting of Douglas-fir beetle in Douglas-fir and fir engraver in white fir, decreased in 2025 across the Southwestern Region. Mixed conifer mortality was mapped on 22,451 acres in 2024, declining to 13,170 acres in 2025 (Figure 12).



**Figure 12. Mixed conifer mortality associated with Douglas-fir beetle and fir engraver in the Southwestern Region over the last ten years.**

### Douglas-fir Beetle

*Dendroctonus pseudotsugae*

Host: Douglas-fir

Douglas-fir beetle activity is most common in dense stands of mature Douglas-fir. At endemic levels, this beetle species will target stressed trees such as those injured by fire, infected by dwarf mistletoe or root disease, or trees experiencing severe defoliation or drought stress. Generally, Douglas-fir beetle will only affect small pockets or individual trees, but infestations may grow to larger outbreaks during periods of suitable climate and widespread susceptible host trees. In 2025, Douglas-fir mortality caused by Douglas-fir beetle decreased across the region from 14,772 acres in 2024 to 10,142 acres (Figure 12). New Mexico accounted for 97% (9,813 acres) of the total Douglas-fir beetle activity (Figure 13), though this activity declined from the 14,136 acres recorded in 2024. About two-thirds of the damage mapped in New Mexico was recorded on the Carson and Santa Fe NFs (6,784 acres, Table 2). Damage was occurring in association with but also outside of the area impacted by the 2022 Hermit Peak / Calf Canyon Fire. Acres with Douglas-fir mortality attributed to Douglas-fir beetle in Arizona continued to decrease from 636 acres observed in 2024 to 329 acres in 2025. Most of this damage occurred on the Apache-Sitgreaves (154 acres) and Coconino NFs (148 acres).



**Figure 13. Douglas-fir beetle activity near Windsor Creek on the Sangre de Cristo Mountains, Santa Fe National Forest.**

### **Fir Engraver**

*Scolytus ventralis*

Hosts: White fir, corkbark fir

Fir engraver-caused mortality is often linked to root disease and drought-stressed trees growing in dense stands on warm, dry sites in the Southwest. White fir mortality attributed to fir engraver continued to decrease in the region, with total acres mapped declining from 7,679 acres in 2024 to 3,028 acres in 2025 (Figure 12). New Mexico accounted for most of the white fir mortality with 2,074 acres, declining by more than half from the 5,374 acres mapped in 2024. The bulk of the mortality in New Mexico was occurring on private lands (1,137 acres, 55%) and on the Santa Fe NF (698 acres, 34%). In Arizona, 953 acres were mapped with white fir mortality, a decrease from the 2,305 acres mapped in 2024. The majority of fir engraver activity in Arizona occurred on White Mountain Apache Tribal Lands (406 acres, 43%) and on the Apache-Sitgreaves NFs (366 acres, 38%). White fir mortality in Arizona mainly consisted of individual or small pockets scattered across the landscape.

### **Spruce-fir Forest Type**

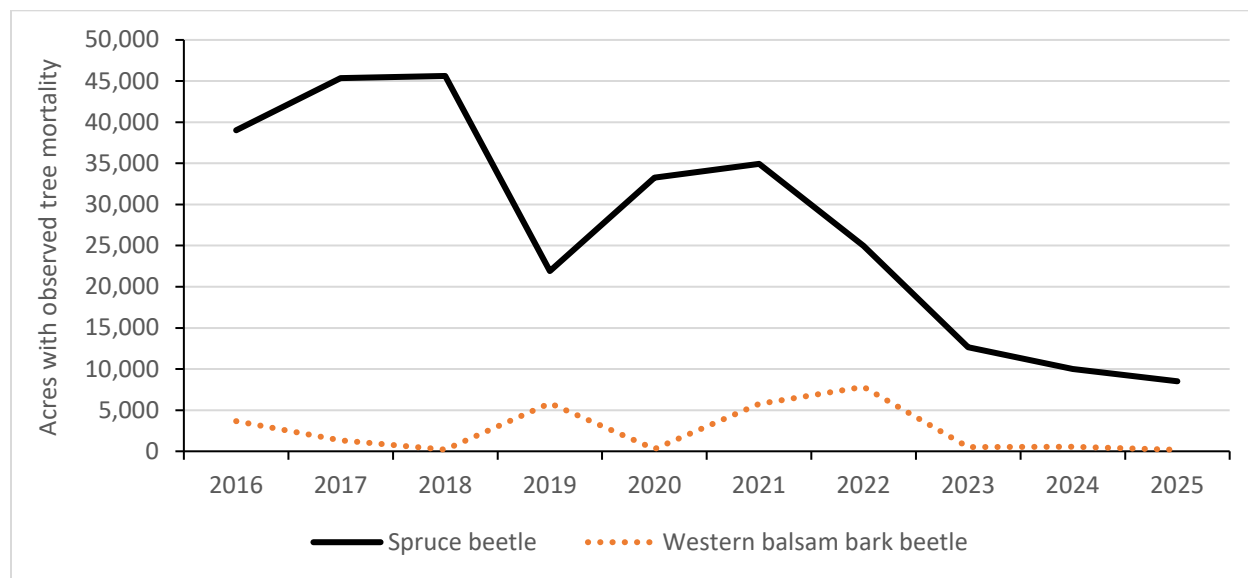
At around 9,000' elevation, mixed conifer forests start to transition to spruce-fir forests. Engelmann spruce and corkbark fir are the primary tree species, but blue spruce, southwestern white and limber pines, Rocky Mountain bristlecone pine, and aspen may also be present.

## Spruce Beetle

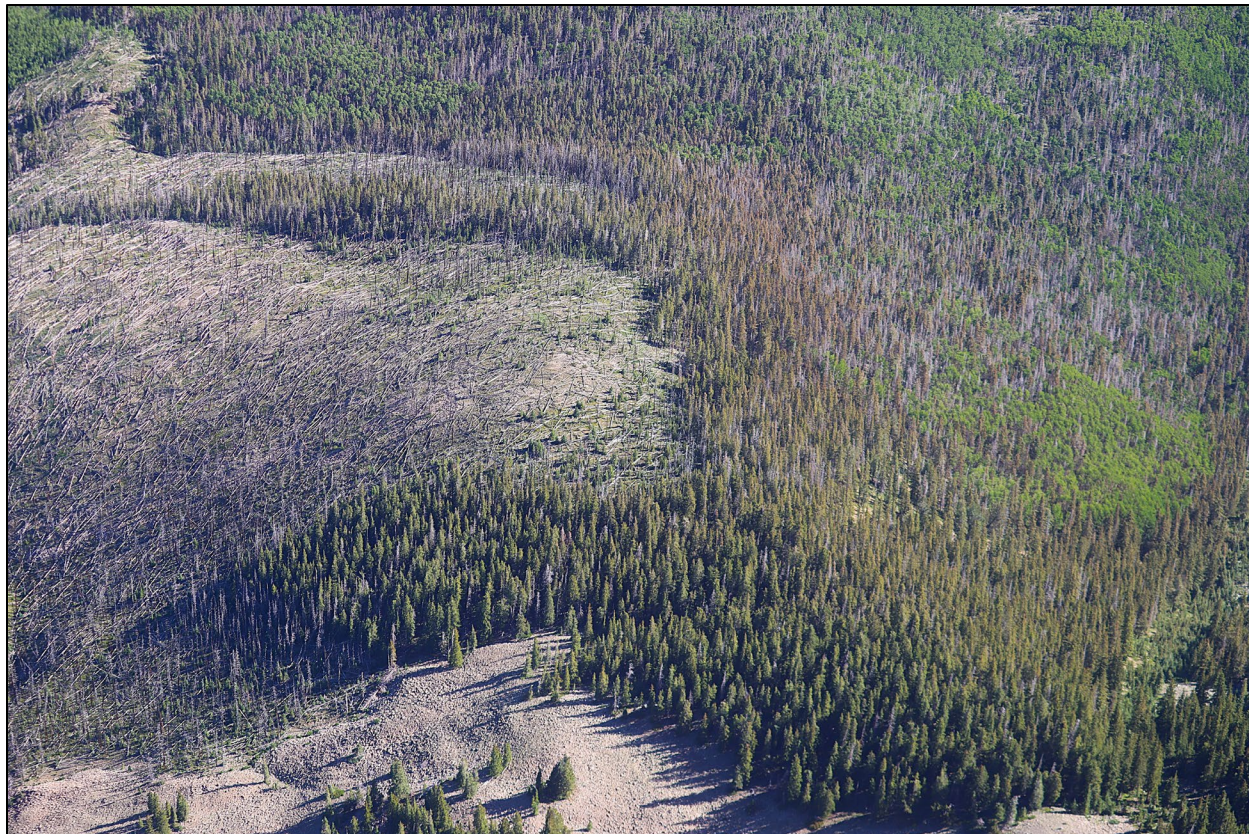
*Dendroctonus rufipennis*

Host: Spruce

Spruce mortality attributed to spruce beetle continued to decrease across the Southwestern Region from 10,016 acres mapped in 2024 to 8,512 acres in 2025 (Figure 14). New Mexico accounted for more than 99.9% of this spruce beetle-caused mortality nationwide with 8,509 acres, a decline from the 9,981 acres reported in 2024 (Figure 15). Within New Mexico, nearly all the spruce mortality was mapped on the Carson (4,789 acres, 56%) and Santa Fe NFs (3,401 acres, 40%). On the Santa Fe NF, the Pecos watershed has experienced many years of spruce beetle activity which has had a dramatic effect on these high elevation forest systems.



**Figure 14. Tree mortality in spruce-fir forests attributed to spruce beetle and western balsam bark beetle in the Southwestern Region over the last ten years.**



**Figure 15. Recent Engelmann spruce mortality (yellow to red trees) on Carson National Forest next to an older blowdown event that may have initiated the bark beetle activity.**

Spruce beetle activity in Arizona was once again very low in 2025 with only four acres mapped, mainly on the Apache-Sitgreaves NFs and White Mountain Apache Tribal Lands (two acres each). This was down from the 35 acres mapped in 2024.

### **Western Balsam Bark Beetle**

*Dryocoetes confusus*

Hosts: Corkbark fir

This bark beetle commonly interacts with root diseases caused by *Armillaria* spp. or *Heterobasidion occidentale* to kill trees. The interaction of bark beetles and root disease is common in many forests throughout the West. Signs of infection by *Armillaria* spp. can consistently be found on dead corkbark fir trees in many spruce-fir forests across the Southwestern Region. Fir engraver can also cause corkbark fir mortality and is indistinguishable from mortality caused by western balsam bark beetle during aerial surveys.

Corkbark fir mortality attributed to western balsam bark beetle decreased regionwide from 554 acres mapped in 2024 to 177 acres in 2025 (Figure 14). This damage was primarily occurring in Arizona (159 acres, 90%) and was almost entirely mapped on White Mountain Apache Tribal Lands. Small areas of damage (each <10 acres affected) were also observed on the Apache-Sitgreaves, Coconino, and Coronado NFs in Arizona and the Carson, Cibola, and Santa Fe NFs in New Mexico.

## Defoliators

Defoliation damage ranges from removal of foliage to crown discoloration, dieback, branch flagging, and premature needle drop due to desiccation or tissue necrosis. Defoliation may be caused by insects, diseases, or abiotic events. Acres observed with damage from biotic agents (including less prominent agents not listed in Table 3) decreased regionwide by more than half from 365,386 acres mapped with damage in 2024 to 170,977 acres in 2025 (Table 3). Western spruce budworm continues to cause the most acreage of defoliation compared to other agents in the region, although pinyon needle scale and Douglas-fir tussock moth were nearly as prevalent in 2025. The most prominent defoliators for each state were western spruce budworm in New Mexico and pinyon needle scale in Arizona.

### Pinyon-Juniper Woodlands

#### Pinyon Needle Scale

*Matsucoccus acalyptus*

Host: Pinyon pine

Pinyon needle scale infestations are persistent in many pinyon-juniper woodlands throughout the Southwestern Region, and repeated defoliation caused by this insect can cause reduced growth and stunted needles. Small trees may be killed in severe outbreaks. While pinyon needle scale is chronic in many places, this damage can be quite difficult to detect from the air. Accuracy may vary from year to year due to variability in the severity and visibility of the defoliation as well as timing of ground visits and survey flights. The total acreage of pinyon-juniper woodlands that are flown year to year can also vary.

Acres with damage attributed to pinyon needle scale increased from 44,581 acres mapped regionwide in 2024 to 48,385 acres in 2025 (Table 3). Most of the damage (39,160 acres, 81%) was detected in New Mexico where there was a substantial increase in area impacted by pinyon needle scale from 16,243 acres mapped in 2024. Most of the damage in New Mexico was mapped on the Lincoln NF (20,160 acres, 51%) and on Mescalero Apache Tribal Lands (11,646 acres, 30%). Much of the damage across these lands occurs on the eastern slopes of the Sacramento Mountains, as in past years (Figure 16).

Pinyon needle scale accounted for about 78% of Arizona's total acres with defoliation as described in Table 3, and the damage was mapped across the state. Activity decreased in Arizona from 28,338 acres mapped in 2024 to 9,225 acres in 2025, in part because many stands have suffered extensive needle loss leading to a grayish discoloration and widespread mortality and will no longer be mapped as pinyon needle scale-caused damage. Still, widespread activity was detected on the Coronado (2,879 acres), Tonto (2,322 acres), and Kaibab NFs (Figure 17, 1,291 acres) and on White Mountain Apache (793 acres) and Navajo Nation Tribal Lands (509 acres). Pinyon needle scale also continued its chronic activity on the Prescott NF (691 acres). Pinyon needle scale damage mapped on the Coronado NF was a mix of drought impacts in Emory oaks and minimal pinyon needle scale as determined during winter site visits.



**Figure 16. Pinyon needle scale damage (gray trees) around Weed, NM on the Lincoln National Forest.**



**Figure 17. Pinyon needle scale on the Tusayan Ranger District, Kaibab National Forest.**

## Ponderosa Pine Forest Type

### Pine Sawflies

*Neodiprion* and *Zadiprion* spp.

Host: Ponderosa pine

Pine sawfly defoliation in ponderosa pine declined from 7,074 acres mapped in 2024 to 5,537 acres in 2025. For the fourth year in a row, all acres were mapped in New Mexico. Nearly all this damage occurred on the Cibola NF centered on the Zuni Mountains. Videography and photographs were also captured during a winter UAS flight to further document the damage in this area (Figure 18). Damage is also typically mapped on state lands on the Luera Mountains near the north end of the Black Range RD of Gila NF, but this area was not flown in 2025.



**Figure 18. Heavy sawfly defoliation damage recorded during a December UAS flight over a ponderosa pine stand on the Zuni Mountains of Cibola National Forest.**

### Pine Needleminer

*Coleotechnites ponderosae*

Host: Ponderosa pine

Ponderosa pine needleminer activity decreased from 13,781 acres mapped in 2024 to 2,248 acres in 2025. Continuing the trend observed from 2022-2024, all damage was reported in New Mexico where it was documented on state and private lands (1,224 acres, 54%) and on the Santa Fe (596 acres, 27%), Carson (243 acres, 11%), and Cibola NFs (184 acres, 8%).

## Prescott Scale

*Matsucoccus vexillorum*

Host: Ponderosa pine

Prescott scale is a native sap sucking scale insect that causes branch tip flagging over the entire length of the crown in early summer. Outbreaks contribute to tip dieback but rarely cause tree mortality. Branch flagging in ponderosa pine was associated with several biotic agents in 2025 including Prescott scale, twig beetles, and the fungal disease Diplodia shoot blight and canker. Prescott scale egg masses (Figure 19, bottom-right) were found at most sites where causal agents of branch flagging symptoms were ground-validated. Prescott scale damage appears as small twig flagging at branch tips across the entire crown length. Diplodia shoot blight and canker infections were more commonly associated with larger branch dieback (Figure 19, top-right). Because multiple agents contributed to the damage it was largely mapped simply as branch flagging in ponderosa pine and not tied to a specific causal agent in our database (Table 4). However, Prescott scale activity is a notable event occurring across Arizona with significant acreage detected on the Coconino, Apache-Sitgreaves, and Kaibab NFs and to a lesser extent on Prescott NF. Acres with ponderosa pine branch flagging increased in Arizona from 676 acres mapped in 2024 to 6,714 acres in 2025. The relative contribution of Prescott scale to the branch dieback varied by geographic location, as twig beetles and Diplodia shoot blight and canker in combination with drought were also identified as causal agents.



**Figure 19. Aerial photo of severe branch and tip flagging attributed to multiple agents including Prescott scale (bottom-right) as noted during a site visit to validate causal agents contributing to branch flagging symptoms on the Coconino and Kaibab National Forests; large branch dieback was more commonly associated with Diplodia shoot blight and canker at several locations including the Prescott and Tonto National Forests (top-right).**

## Mixed Conifer Forest Type

### Aspen Defoliation, Dieback, and Mortality

Western tent caterpillar, *Malacosoma californicum*

Large aspen tortrix, *Choristoneura conflictana*

Oystershell scale, *Lepidosaphes ulmi*

Black leaf spot, *Drepanopeziza populi*

Complex of drought and other insects and diseases (e.g., fungal cankers)

In the Southwestern Region, aspen mortality, dieback, and defoliation are monitored through a combination of aerial and ground surveys. Aspen damage recorded via ADS decreased regionwide from 28,002 acres recorded in 2024 to 7,852 acres in 2025. New Mexico again had more damage (7,179 acres, 91%) than Arizona (674 acres, 9%). Most of the damage across the region was mapped as defoliation (5,923 acres) with more acreage (5,735 acres) in New Mexico than in Arizona (188 acres) (Table 3, Figure 20). Similarly, more mortality was mapped in New Mexico (1,553 acres) than in Arizona (485 acres).

The number of acres with aspen damage decreased in New Mexico from 22,224 acres mapped in 2024. Damage mapped as mortality decreased from the 5,130 acres mapped in 2024 as did acreage mapped as defoliation (17,581 acres in 2024). In 2024, the defoliation in New Mexico was primarily mapped on the Santa Fe NF (3,372 acres, 59%). Western tent caterpillar is often the primary defoliating agent; however, large aspen tortrix has also historically contributed to the defoliation.

In Arizona, the overall number of acres mapped with aspen damage decreased from the 5,778 acres mapped in 2024. Both defoliation and mortality decreased in 2024 from 3,873 acres and 2,021 acres, respectively. Ongoing ground surveys and a network of permanent monitoring plots are used in Arizona to evaluate impacts from agents that are not easily detected by aerial surveys including other native insects and diseases, invasive oystershell scale, and ungulate browse.



**Figure 20.** Heavy defoliation of an aspen stand on Gallina Peak of the Sangre de Cristo Mountains (Questa Ranger District, Carson National Forest).

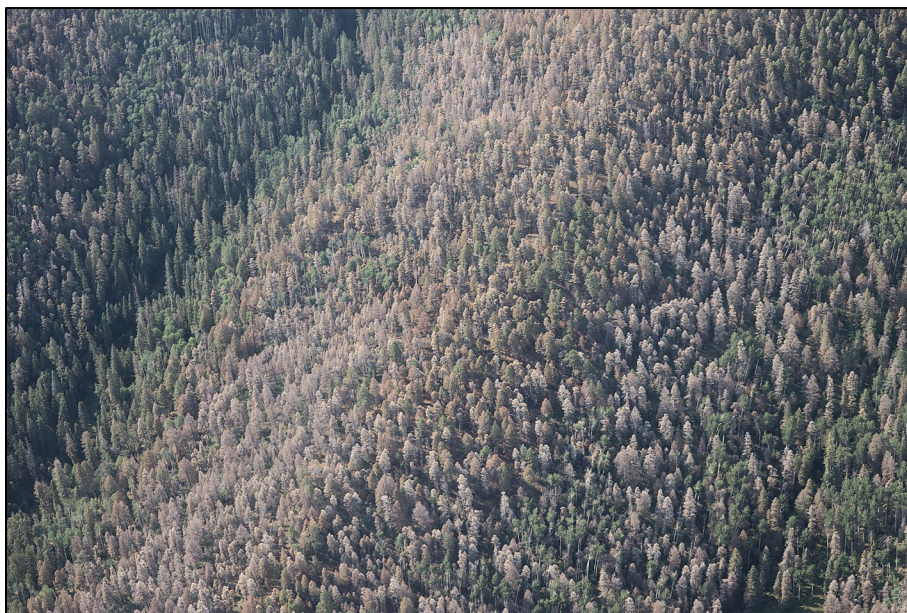
## Douglas-fir Tussock Moth

*Orgyia pseudotsugata*

Hosts: True firs, Douglas-fir, and spruce

Defoliation by Douglas-fir tussock moth (DFTM) continued to increase dramatically in New Mexico from 18,082 acres mapped in 2024 to 42,104 acres in 2025 with several different outbreaks occurring across the state. Severe outbreaks can cause heavy defoliation and significant mortality quickly in both Douglas-fir and white fir. During the last three years, DFTM damage in the region has only been mapped in New Mexico. The bulk of the damage in 2025 was detected on the Santa Fe NF (37,379 acres, 89%), where it increased from 10,991 acres with damage mapped in 2024. Activity was concentrated on the Pecos/Las Vegas and Espanola RDs on the southern end of the Sangre de Cristos and on the Jemez and Coyote RDs on the western Jemez Mountains (Figure 21), on and around San Pedro Parks Wilderness, and along the southern boundary of the Chama River Canyon Wilderness. Significant DFTM activity was also mapped on the Cibola (1,881 acres) and Carson NFs (1,161 acres), state and private lands (1,908 acres), and Jemez Pueblo Tribal Lands (900 acres) in 2025.

In addition to mapping damage with ADS, regular monitoring of DFTM populations using a pheromone-based trapping system started in the Southwestern Region in 1992 and continues annually in both states. Trapping results in 2024 in Arizona at the Knoll Lake Recreation Area (Coconino NF) suggested populations were increasing there, but only two larvae were found during larval surveys in 2025 with no egg masses found the following fall. Trapping for the DFTM Early Warning System was greatly reduced in Arizona in 2025, but all traps that were deployed came back with counts below the 25-moth threshold that would indicate an outbreak may be developing. Populations have been fluctuating on Mount Graham since a small outbreak occurred in 2024, and that location had an average of 13 moths. In New Mexico, male moth and egg mass surveys on the Carson and Santa Fe NFs indicate that the defoliation activity will likely return to lower levels in 2026. Jemez Pueblo Tribal Lands will also likely return to endemic levels based on surveys conducted. However, DFTM activity on Sandia RD, Cibola NF may continue in 2026 in the Balsam Glade Picnic Ground and Capulin Snow Play Site recreation areas based on male moth and egg mass survey results.



**Figure 21. Severe defoliation of a mixed conifer stand on the Jemez Mountains by Douglas-fir tussock moth.**

## Western Spruce Budworm

*Choristoneura freemani*

Hosts: True firs, Douglas-fir, and spruce

Western spruce budworm activity decreased across the Southwestern Region from 248,869 acres recorded with damage in 2024 to only 55,411 acres in 2025, lowest reported in the past ten years (Table 3, Figure 22). Most western spruce budworm-caused defoliation occurred in the northern part of New Mexico, particularly on the Carson NF (26,676 acres, 48%). Defoliation has been observed in mixed conifer and spruce-fir stands in this area for the past four decades. Douglas-fir has been the preferred host, although white fir and Engelmann spruce are also commonly defoliated. Twig dieback, top-kill, and tree mortality have resulted from the chronic defoliation, and understory regeneration has been affected in some stands. Significant activity was also occurring on state and private lands (20,263 acres); Santa Fe (3,740 acres), Lincoln (2,322 acres), and Cibola NFs (690 acres); and Taos Pueblo (721 acres) and Mescalero Apache Tribal Lands (691 acres).

Damage by western spruce budworm has historically been concentrated in New Mexico given the lack of contiguous host type in Arizona, and that was again the case in 2025 with no damage mapped in Arizona. This is partially due to the lack of aerial survey coverage north of the Grand Canyon where this type of damage is most likely to be detected in Arizona. Summer-long aviation restrictions limited surveys in the area due to the Drag Bravo Fire. In 2024, 46 acres with damage were detected on the North Kaibab RD, Kaibab NF.

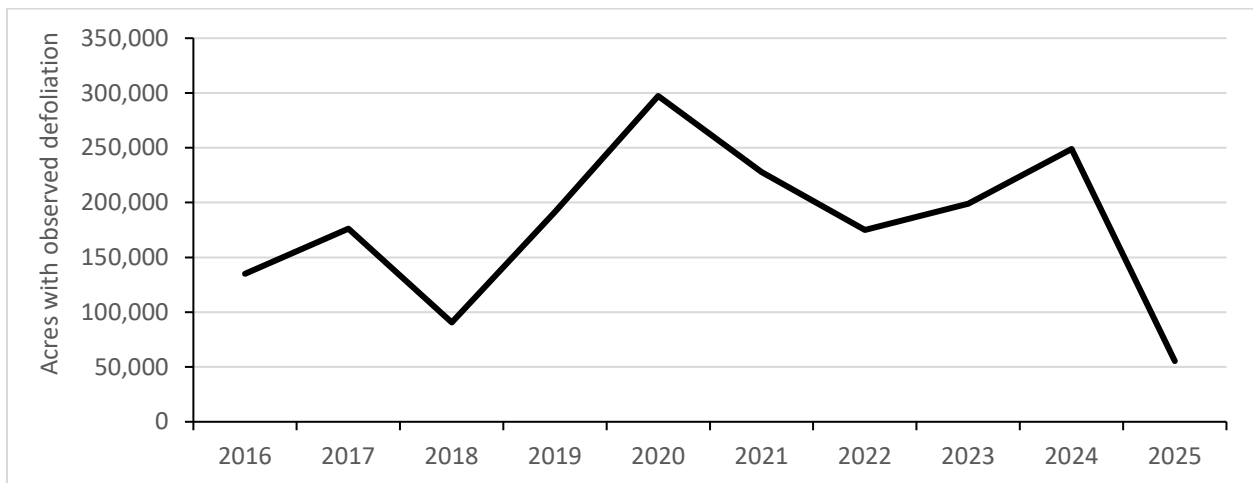


Figure 22. Defoliation attributed to western spruce budworm in the Southwestern Region for the last ten years.

## Spruce-fir Forest Type

### Spruce Aphid

*Elatobium abietinum*

Hosts: Engelmann and occasionally blue spruce

Spruce aphid is an exotic, invasive insect with periodic outbreaks that can cause significant damage and mortality of Engelmann spruce. Spruce aphid damage has been minimal in the last five years and mapped exclusively in Arizona. In 2025, 37 acres with damage were mapped on White Mountain Apache Tribal Lands, increasing from only seven acres recorded in 2024. The most recent spruce aphid activity

observed in New Mexico was reported at Ski Apache on the Lincoln NF during the winter of 2018-2019. At that time, ground visits identified feeding damage and live aphids.

## Bud and Shoot Insects

Injury to buds and shoots may be caused by caterpillars, weevils, bark beetles, midges, aphids, or scale insects. Most of these insects are episodic and only problematic in replanted areas that occur on harsh or marginal sites following disturbance (Figure 23). Pine tip moths have recently been the most damaging of the bud and shoot insects, especially in ponderosa pine reforestation projects in eastern Arizona on the Apache-Sitgreaves NFs.



**Figure 23.** Typical 20-year-old tree that is less than four feet tall due to repeated pine tip moth infestations (left), symptoms of attack including multiple stems resulting from repeated infestations (center), and a single currently infested shoot that is dry and curling; Black Mesa Ranger District, Apache-Sitgreaves National Forests.

## Pine Tip Moths

Native ponderosa pine tip moths, *Rhyacionia* spp.

Invasive Nantucket pine tip moth, *Rhyacionia frustrana*

Host: Ponderosa pine

Pine tip moths prefer expansive areas with young pine seedlings to infest. Seedlings are less susceptible to tip moth damage once they reach a height of six feet. Tip moth larval feeding will damage terminal and lateral shoots, resulting in tip dieback, reduced height growth, stagnation in the susceptible size class, and deformities including forking and multiple leaders (Figure 23).

In 2024, severe pine tip moth damage on the Apache-Sitgreaves NFs was documented on the Black Mesa RD near Heber-Overgaard. Several reforestation projects within the Rodeo-Chediski Fire footprint are affected. Most 15- to 20-year-old seedlings are only three to five feet tall due to repeated tip moth infestation and harsh growing conditions.

Damage was mapped on 23 acres in this area in 2025, although expansive areas are impacted. In 2025, the invasive Nantucket pine tip moth was verified by taxonomists as one of several tip moth species contributing to the damage. Nantucket pine tip moth, a non-native insect from the southeastern U.S., became established in Arizona and New Mexico in the 1970s and 1980s. Ponderosa pine damage assessments and flight periodicity were monitored across six sites on the Sitgreaves side of the Apache-Sitgreaves NFs in 2025 (Figure 24). For more information, see the “Other Entomology and Pathology Activities in 2025” section of this document.

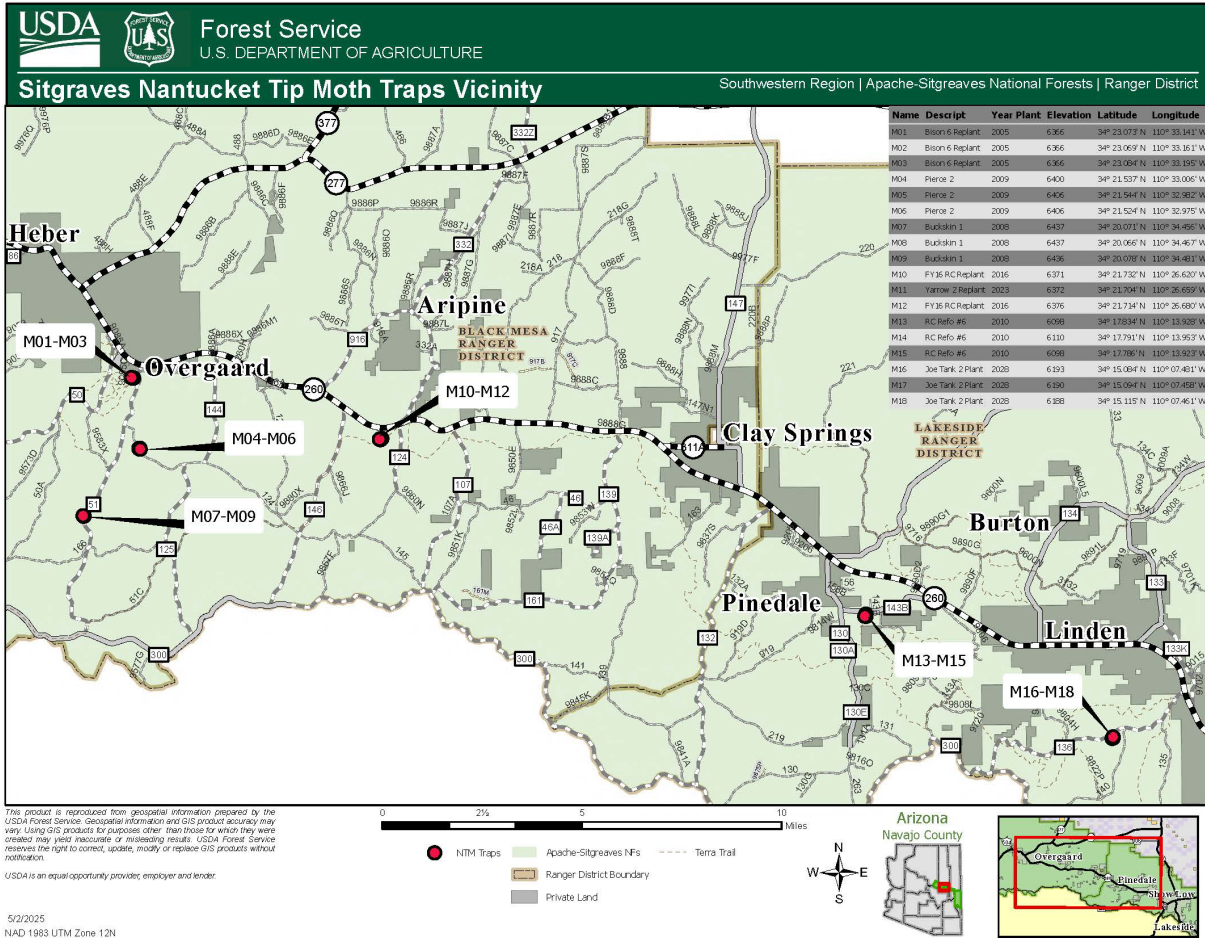


Figure 24. Map of tip moth monitoring locations (red points) on the Black Mesa and Lakeside Ranger Districts, Apache-Sitgreaves National Forests in 2025.

## Miscellaneous Insects

### Twig Beetles

*Pityophthorus* and *Pityogenes* spp.

Host: Ponderosa pine

Twig beetles were observed causing ponderosa pine branch flagging across 126 acres in 2025, down from 2,046 acres mapped in 2024. All damage was found in New Mexico in 2025, primarily on the Gila NF (124 acres). In ponderosa pine, damage from twig beetles can appear very similar to damage from Prescott scale, Diplodia shoot blight and canker, and drought dieback. Ground surveys are necessary to distinguish among the agents. An additional 6,989 acres of ponderosa pine with branch flagging of unknown cause were mapped regionwide in 2025, much of which may be attributed to twig beetles. This damage was primarily observed in Arizona (6,714 acres, 96%) on the Coconino (2,595 acres), Apache-Sitgreaves (1,727 acres), and Kaibab NFs (1,099 acres). Various tribal properties and state and private lands in Arizona also had smaller levels of damage recorded. Some additional branch flagging of unknown cause was also recorded on the Gila NF and Navajo Nation Tribal Lands in New Mexico.

## Cone Beetles

*Conophthorus* spp.

Host: Rocky Mountain bristlecone pine

Cone beetle damage on bristlecone pine was observed on 939 acres in 2025, declining from 2,149 acres recorded in 2024. This damage was again mapped exclusively in New Mexico, primarily on the Carson NF (317 acres) and private lands (597 acres) with a smaller area of damage recorded on the Santa Fe NF (43 acres, Figure 25). Larvae bore into developing cones and into twigs. While not a large acreage is affected compared to other insect and disease activity, the continued damage to this high-elevation pine species warrants attention. Each year new areas of bristlecone pine on the Carson NF are observed with this damage, and ground checks reveal repeated annual damage, though no mortality has yet occurred.



Figure 25. Cone beetle damage to Rocky Mountain bristlecone pine stand on the Santa Fe National Forest.

## Alder Flea Beetle

*Macrohaltica ambiens*

Host: Arizona alder

An outbreak of alder flea beetles has caused total defoliation of Arizona alders along Oak Creek Canyon near Sedona in northern Arizona (Figure 26). Severe defoliation as observed during ADS was documented on 133 acres but likely impacted more area than mapped. Defoliation from alder flea beetles may predispose trees to other secondary agents like alder heat canker. Outreach materials were provided to the national forest to describe this defoliation event to recreators on the Red Rock RD, Coconino NF.



**Figure 26. Severe defoliation of Arizona alder by alder flea beetles along Oak Creek Canyon (Red Rock Ranger District, Coconino National Forest), and an adult beetle on leaves with characteristic skeletonized defoliation (inset).**

## Cottonwood Leaf Beetle

*Chrysomela scripta*

Host: Fremont cottonwood and other poplars

Cottonwoods have been defoliated with leaves either skeletonized or completely consumed along the Blue River between Alpine and Blue, Arizona on the Apache Sitgreaves NF and adjacent private lands during the past few years. Most of the damage has been detected around Blue Crossing Campground during aerial surveys, but private landowners in other locations along the Blue River also reported damage to Arizona Department of Forestry and Fire Management. Samples sent to the University of Arizona Extension office verified that cottonwood leaf beetles are likely causing this damage. Cottonwood defoliation was detected on 75 acres around Blue Crossing in 2025, on 30 acres in 2024, and on 277 acres in 2023.

## Tamarisk Leaf Beetle

*Diorhabda* spp.

Host: Saltcedar

One of the most widely distributed and damaging invasive plants in the Southwestern Region is saltcedar (*Tamarix* spp.), which occurs as a shrub or tree along many waterways and riparian areas. In 2001, several species of the tamarisk leaf beetle (*Diorhabda* spp.) from central Eurasia were released in

western states as a host-specific biocontrol agent. Adult tamarisk leaf beetle and larvae both consume saltcedar foliage, which can damage or kill the plant over several years. Feeding by the beetle causes saltcedar leaves to dry out and turn brown while remaining on the stem; thus, crown discoloration is commonly seen in affected saltcedar stands. Defoliation of saltcedar caused by tamarisk leaf beetle is often documented from the air during ADS and while ferrying between survey areas. Acres with tamarisk leaf beetle-caused damage are likely underestimated in the region as riparian surveys are limited. However, special surveys to document extent of tamarisk leaf beetle-caused defoliation were conducted along portions of the San Pedro and Gila Rivers in southeastern Arizona in 2023 and 2024 at the request of Arizona Department of Forestry and Fire Management to support priorities around invasive species management. Defoliation was mapped across 12,023 acres in 2023 and 7,464 acres in 2024. No special surveys occurred in 2025, but activity was mapped on 2,523 acres regionwide, with 1,373 acres recorded in Arizona and 1,149 acres in New Mexico.

## Goldspotted Oak Borer

*Agrilus auroguttatus*

Hosts: Emory and silverleaf oaks

The goldspotted oak borer is typically a secondary pest in drought-affected oaks stands. Dark-colored wet staining on bark associated with larval feeding galleries is commonly observed (Figure 27). Dieback, discoloration, defoliation, and mortality of oaks have been mapped at low levels across much of the host type for the last few years, but damage is hard to separate by damage agent from the air. Ground surveys indicate that the fungal canker pathogen *Biscogniauxia mediterranea* plays an important role in the decline of many Emory and silverleaf oak stands, and it is impossible to differentiate this disease from goldspotted oak borer damage during aerial surveys. Oak damage (including dieback, discoloration, and defoliation) was recorded on 1,247 acres in Arizona and 8,716 acres in New Mexico in 2025. Much of the drought discoloration mapped in mixed species in southern Arizona included additional oak damage as well, with 3,399 acres impacted on the Coronado NF and 3,543 acres on Department of Defense lands in the Huachuca Mountains.



**Figure 27. Sap flow and staining of a goldspotted oak borer-infested bole on the Huachuca Mountains (left), staining with an exit hole above (center), and adult beetle (right; source: USDA Forest Service, Forest Health Protection).**

# Status of Major Diseases

## Mistletoes

### Dwarf Mistletoes

*Arceuthobium* spp.

Hosts: Conifers

Dwarf mistletoes are among the most widespread and damaging forest pathogens (disease-causing organisms) in the Southwestern Region with over one-third of the ponderosa pine type and up to one-half of the mixed conifer type having some level of infection. Damage to host trees from dwarf mistletoe infection includes growth reduction, deformity (especially the characteristic witches' brooms), and decreased longevity (Figure 28). Severely infested areas have higher tree mortality rates than uninfected areas. Weakened trees can be killed by other damaging agents such as bark beetles. Dwarf mistletoes have an ecological role, as they provide bird roosting habitat and an occasional food source for some mammals and birds. There are eight species of dwarf mistletoe in the region, each with a primary tree host. The species that primarily affect ponderosa pine, pinyon pine, and Douglas-fir are the most common and are found throughout most of their respective host ranges, while the other species have more limited distributions (Figure 29).



Figure 28. Some important dwarf mistletoe species in the Southwestern Region: *Arceuthobium divaricatum* witches' broom on pinyon pine (top-left), *A. vaginatum* subsp. *cryptopodium* witches' broom on ponderosa pine (top-right), *A. douglasii* witches' broom on Douglas-fir (bottom-right), and *A. apachecum* witches' brooms on a southwestern white pine (bottom-left) and associated aerial shoots (insets).

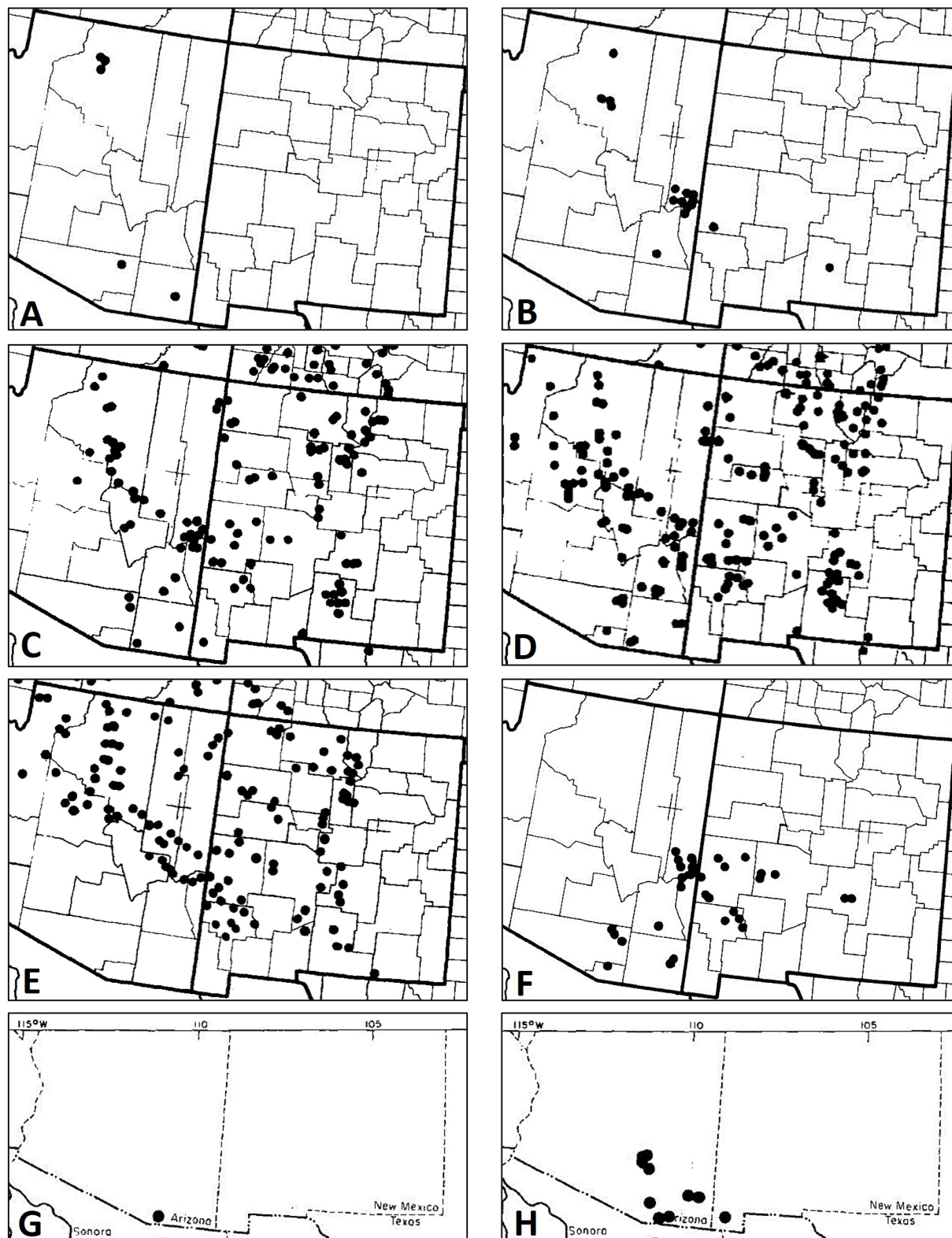


Figure 29. Distributions of dwarf mistletoe species in the Southwestern Region principally infecting white fir (A, *Arceuthobium abietinum* f. sp. *concoloris*), spruce (B, *A. macrocarpum*), Douglas-fir (C, *A. douglasii*), ponderosa pine (D, *A. vaginatum* subsp. *cryptopodum*), pinyon pine (E, *A. divaricatum*), white pines (F, *A. apachecum* and G, *A. blumeri*), and Chihuahua pine (H, *A. gillii*). Maps adapted from Hawksworth and Wiens (1996).

## True Mistletoes

*Phoradendron* spp.

Hosts: Junipers, Arizona cypress, white fir, and various hardwoods

Eight species of true mistletoe occur in the Southwestern Region. These mistletoes are less damaging to their hosts than dwarf mistletoes, but heavy infestations can reduce host longevity during periods of drought. The leafless *Phoradendron juniperinum* on junipers is probably the most widespread and abundant species. Big leaf mistletoe (*P. macrophyllum*) is ubiquitous throughout many riparian areas in the region where it infects most riparian hardwood species (excluding oaks). Southwestern oak mistletoe (*P. coryae*) is common on oaks in lower elevations and in southern portions of the region. Desert mistletoe (*P. californicum*), another leafless species, can be abundant on mesquite and palo verde in desert woodlands. There is one true mistletoe known to infect white fir (*P. pauciflorum*), which is limited to southern Arizona. *Phoradendron densum* is also common in Arizona cypress around Sedona.

## Root Diseases

Root diseases are common in forests of the Southwestern Region. They can predispose trees to root failure, a concern in campgrounds and other developed recreation areas. In the Southwest, root diseases affect a wide range of hosts but are most common in mixed conifer and spruce-fir forests. Root diseases spread slowly, so overall extent changes little from year to year. Root disease is often described as a “disease of the site”, as these pathogens can persist in the soil as saprophytes on stumps and large roots for decades, even after host trees are removed or killed by fire.

### Armillaria Root Disease

*Armillaria* spp.

Hosts: Spruce, true firs, Douglas-fir, ponderosa and pinyon pines, oaks, and occasionally aspen

Armillaria root rot is the most common root disease in the Southwest, where it is estimated to account for up to 80% of all root disease-associated mortality. Although all conifer species and size classes can be infected, root disease is more common in old growth mixed conifer and spruce-fir forests. *Armillaria solidipes* (= *A. ostoyae*) is the major *Armillaria* species in southwestern coniferous forests. Although most common on true firs, Engelmann spruce, and Douglas-fir, it is increasingly observed on southwestern white pine and ponderosa pine in many areas including the San Francisco Peaks on Flagstaff RD, Coconino NF and on Alpine RD, Apache-Sitgreaves NFs. A large pocket of infection was observed in 2023 on ponderosa pine on the North Kaibab RD, Kaibab NF. Previous surveys in mixed conifer forests on the North Kaibab RD, Kaibab NF found *Armillaria* on about 30% of standing live trees. *Armillaria gallica* has been observed on the Mogollon Rim RD, Coconino NF infecting Douglas-fir and is likely more widespread, though information on the species distribution is lacking. *Armillaria mellea* has been observed in southern Arizona oak woodlands. *Armillaria* infection can create hazardous conditions in developed recreation areas and recently prompted the removal of many infected Engelmann spruce and Douglas-fir on Apache Trout Campground, Apache-Sitgreaves NFs.

## Heterobasidion Root and Butt Rot (Formerly Annosus Root Disease)

*Heterobasidion irregulare* and *H. occidentale*

Hosts: Ponderosa pine (*H. irregulare*), true firs and Engelmann spruce (*H. occidentale*)

Heterobasidion root disease is the second most common root disease in the Southwest, where it is found in higher elevation ponderosa pine and mixed conifer forests throughout Arizona and New Mexico. Fruiting bodies are commonly found inside hollow stumps and sometimes on downed logs and upturned roots, and the disease causes a distinctive laminated decay where annual growth rings separate in affected wood. *Heterobasidion occidentale* is common in white fir in the Southwest and is particularly prevalent in areas dominated by this host (like the Sandias in New Mexico) but also occurs on corkbark fir and Engelmann spruce. *Heterobasidion irregulare* affects ponderosa pine and is found throughout the region but does not commonly cause disease in the Southwest. Like *Armillaria* spp., *Heterobasidion* spp. are known as saprophytes or nutrient recyclers of dead woody material as well as pathogens and may persist on a site even in the absence of live hosts.

### Other Common Root Diseases

Other common root diseases in the Southwest include Schweinitzii butt rot, caused by the fungus *Phaeolus schweinitzii*, which is often found on older Douglas-fir and occasionally on ponderosa pine, southwestern white pine, white fir, and spruce. Tomentosus root rot, caused by *Onnia tomentosa*, is found on spruce and Douglas-fir and can be a major hazard tree consideration where it occurs in developed recreation sites. Widespread hazard tree removals due to this disease have occurred recently in the region at Hopewell Lake Campground (Carson NF). Black stain root disease, caused by three *Leptographium* spp., appears to be rare in the Southwest but has been reported in pinyon pine in northern New Mexico and Douglas-fir on Mescalero Apache Tribal Lands. Infections by another less aggressive species of *Leptographium* have also been observed recently in pinyon pine in New Mexico. *Ganoderma applanatum* is the primary root disease pathogen affecting aspen in the Southwest. The disease causes crown dieback, windthrow, and mortality, especially in older aspen stands (though aspen of all ages are affected). Aspen stands on mesic sites seem to have higher incidence of disease compared to drier sites, and infection is particularly widespread on the Carson NF in New Mexico. Other species of *Ganoderma* affect many hardwood species, including Fremont cottonwood, Emory and silverleaf oak, Arizona sycamore, and netleaf hackberry. Infection may lead to gradual decline, and the presence of a fruiting body indicates high potential for failure.

### Stem Decays

Stem decay pathogens are common in older trees throughout the Southwestern Region. Decay represents an economic loss in terms of timber production and can increase hazards on developed sites, but decayed trees also provide important cavity habitat for many wildlife species, especially birds and squirrels. Decay type can be a white rot, where primarily lignin is consumed by the fungus and cellulose remains, or a brown rot, where primarily cellulose is consumed and lignin remains. One of the most common stem decays causing brown rot in the Southwest is red belt fungus, *Fomitopsis schrenkii*, which affects conifers and sometimes aspen. Prominent stem decays causing white rots in the region include red rot, *Dichomitus squalens*, of ponderosa and pinyon pines; red ring rot, *Porodaedalea pini*, affecting most conifers; paint fungus, *Echinodontium tinctorium*, on true fir and occasionally Douglas-fir or spruce; false tinder conk, *Phellinus tremulae*, on aspen; pouch fungus, *Cryptoporus volvatus*, a sap rot found on bark beetle-killed conifers; *Phellinus everhartii*, *Inonotus dryophilus*, and *I. andersonii* on oaks; *I. munzii* on cottonwoods; and *Sanghuangporus weirianus* on Arizona walnut.



In Arizona, white pine blister rust was first detected in 2009 on White Mountain Apache Tribal Lands and neighboring Apache-Sitgreaves NFs, and these are still the only land management units known to be affected in this state (Figure 30). Age estimation of older cankers suggests the white pine blister rust pathogen may have been present for 20 years at that point but at undetectable levels. Since 2009, the pathogen has continued to expand into new areas, including more moderate hazard sites throughout most of the White Mountains. However, white pine blister rust is still absent throughout most of the host type in Arizona.

## Broom Rusts

*Melampsorella caryophyllacearum*

Hosts: True firs (aecial stage) and chickweed (telial stage)

*Chrysomyxa arctostaphyli*

Hosts: Spruce (aecial stage) and bearberry (telial stage)

Broom rusts are native rust diseases in the Southwestern Region that induce dense witches' brooms in infected branches of true firs or spruce. The two species of broom rust pathogens occur at relatively low frequency on their respective hosts in the Southwestern Region. However, higher infestations of fir broom rust occur on the Sandia and Manzano Mountains of central New Mexico and a few other locations. Damage from this easily recognized disease has not been well quantified, but infection can result in top-kill, especially in spruce. Falling brooms or stem breakage when infections occur on the bole may present a hazard in developed recreation sites.

## Limb Rust and Western Gall Rust

*Cronartium arizonicum* and *C. harknessii*

Hosts: Ponderosa pine (aecial stage) and *Castilleja* spp. (telial stage, *C. arizonicum* only)

There are two native stem rust diseases on ponderosa pine in the Southwestern Region. The most frequently observed is *Cronartium arizonicum*, the cause of limb rust. Limb rust is common in portions of Arizona and can be quite damaging to individual trees. Incidence in New Mexico is infrequent, but it has been found on Jicarilla Apache Tribal Lands. The fungus causes orange-colored pustules on dying branches with progressive upward and downward branch mortality, generally initiating from the center of the crown. Waves of new infections are initiated by environmental conditions conducive to the disease and may occur at intervals of several years.

Western gall rust, caused by *C. harknessii*, deforms but seldom kills older trees. Infection typically causes growth of large galls on infected branches. Occasionally, during wave infection years, this pathogen has caused mortality in seedlings and saplings. The pathogen that causes this rust disease does not have an alternate host, and infection proceeds from pine to pine. This disease is uncommon in the Southwestern Region.

## Gymnosporangium Rusts

*Gymnosporangium* spp.

Hosts: junipers and Arizona cypress (telial stage) and Rosaceae / Hydrangeaceae (aecial stage)

Eight *Gymnosporangium* species occur in the Southwestern Region on various juniper hosts, and one species occurs on Arizona cypress. Dramatic deformities can be caused on these telial hosts, including witches' brooms, branch galls, branch knots, and stem swellings (Figure 31). Telia are produced on these

deformities and can be bright orange, gelatinous, and very showy (as with *G. speciosum*) or more subtle, like the small brown pads produced on leaf scales by *G. kernianum*. Damage to telial hosts is minimal beyond these deformities. Defoliation can occur in heavily infected alternate hosts, and *Gymnosporangium* spp. can be agricultural pests of orchard crops in some cases.



**Figure 31.** Various *Gymnosporangium* species producing telia within witches' brooms (left), from galls (top-right), and from stem swellings (bottom-right) on juniper hosts; these rust fungi typically alternate on members of the Rosaceae (top-right inset) or Hydrangeaceae.

## Canker Diseases

Canker diseases are caused by fungi that feed on stem and branch cambium, creating sunken and necrotic areas. Severe infection may girdle trees and cause mortality. Most cankers are considered secondary and are only able to cause disease on stressed host trees. Water stress caused by heat and drought are common abiotic drivers of canker diseases in the Southwestern Region. Mechanical damage to stems and branches predisposes trees to infection and provides infection courts for these pathogens.

Aspen mortality and dieback are commonly associated with a wide array of canker diseases due to the soft living tissue of the bark, which makes aspen extremely susceptible to wounding and subsequent

infection. These cankers are generally secondary pathogens and affect stressed trees. *Cytospora* canker (caused by *Cytospora* spp.) and black canker (caused by *Ceratocystis fimbriata*) are the most common, although Hypoxylon canker (caused by *Entoleuca mammata*) is becoming more common. Sooty bark canker (caused by *Encoelia pruinosa*) is the most lethal canker of aspen and can be considered a primary mortality agent.

*Cytospora umbrina* causes alder heat canker, a disease associated with high temperatures. This disease has been increasingly observed affecting Arizona alder (*Alnus oblongifolia*) in association with dieback and mortality, which have been observed in Oak Creek Canyon on Red Rock RD, Coconino NF as well as along Tonto Creek and the East Verde River on the Payson RD, Tonto NF (Figure 32). Alder heat canker has been associated with dieback and mortality of alder species in Alaska, Colorado, and New Mexico but had not previously been formally documented in Arizona affecting Arizona alder. Forest Health Protection and partners at the University of Arizona formally documented *C. umbrina* as a pathogen of Arizona alder in the state in 2025.



**Figure 32.** Alder heat canker of Arizona alder caused by the fungal pathogen *Cytospora umbrina*.

Pathogens in the genus *Biscogniauxia* cause cankers resulting in dieback and mortality on many different hardwood species, particularly in the *Quercus* genus. These pathogens are associated with hot, dry conditions and tend to cause disease when trees are water stressed. *Biscogniauxia mediterranea* was first observed causing dieback and mortality of Emory and silverleaf oaks in Arizona in 2018 and has now been observed throughout these host ranges across the Southwestern Region (Figure 33). Severe dieback and mortality associated with this pathogen continues to be observed in Madera Canyon in the

Santa Rita Mountains and along Turkey Creek in the Chiricahua Mountains of southeastern Arizona. A large Emory and silverleaf oak mortality event associated with *B. mediterranea* occurred on the Huachuca Mountains (Sierra Vista RD, Coronado NF and Fort Huachuca) in 2025 and was largely mapped as mixed species drought discoloration on 3,358 acres of the Sierra Vista RD, Coronado NF and 3,543 acres on Department of Defense lands (Fort Huachuca). *Biscogniauxia mediterranea* may also play a role in some additional oak damage mapped across the region (9,964 acres, Table 4). Mortality is distributed across size classes and is most severe in the silverleaf oaks. Work is ongoing with partners at Northern Arizona University to better understand the biology, distribution, and impacts of this emerging disease.



**Figure 33. Oak mortality on the Huachuca Mountains (left) associated with charcoal canker caused by *Biscogniauxia* spp.; red arrows point to grey (center) and black fungal fruiting bodies (right).**

*Diplodia sapinea*, the cause of the disease Diplodia shoot blight and canker, was observed for the first time causing tip dieback on ponderosa pine in the town of Payson, Arizona and the surrounding Payson RD, Tonto NF in 2024. Symptoms of infection included foliage discoloration as well as branch and tip dieback. Severity of infection was variable, ranging from full crowns to scattered branches displaying dieback symptoms. Symptomatic branches were collected and sent to the University of Arizona Extension Diagnostics Lab to assess agents involved. *Diplodia sapinea* was isolated from most of the symptomatic branches collected. Prescott scale and twig beetles were also observed on many symptomatic branches in Arizona. This may represent the first observation of *D. sapinea* causing disease on ponderosa pine in Arizona. Ongoing damage was observed in the state in 2025 in additional areas on Bradshaw RD, Prescott NF and Williams RD, Kaibab NF. Damage was also observed in New Mexico in 2025 on the Philmont Scout Ranch and Quemado RD, Gila NF with 115 acres affected and mapped during ADS on Quemado RD (Figure 34). Samples from both areas were sent to the New Mexico State University Plant Diagnostic Clinic, and *D. sapinea* was found in all samples. Additional areas of ponderosa pine branch flagging mapped on 6,989 acres across the Southwestern Region in 2025 may also be caused in part by this disease (Table 4).

Unidentified branch and stem cankers affecting southwestern white pine were observed on the Black Mesa RD, Apache Sitgreaves, NFs and on the Santa Rita Mountains of the Coronado NF in 2025 (Figure 35). Symptoms were also seen on the Sandia RD, Cibola NF in New Mexico. Cankers were associated with crown dieback and mortality in discrete pockets. Samples from Arizona locations were collected and identified as *Diplodia mutila* by the University of Arizona Extension Diagnostics Lab. This pathogen has not previously been observed on southwestern white pine or any other pine species in the United States. A formal first report has been initiated to document this pathogen as a disease-causing agent of southwestern white pine.



Figure 34. Ponderosa pine stand on Quemado Ranger District, Gila National Forest impacted by the fungal disease *Diplodia* shoot blight and canker; branch flagging was heavy and widespread (inset), resulting in crown discoloration across the stand visible during Aerial Detection Survey flights.



Figure 35. Younger (left) and older (right) examples of *Diplodia* canker infections in southwestern white pine.

## Foliar Diseases

Foliar diseases in the Southwest may occur in conifers (needle casts) or hardwoods. Fungal species causing these diseases may overwinter in old leaf litter from the previous year or in previously infected foliage that has not been cast. Outbreaks are sporadic and highly dependent on favorable weather conditions, generally coinciding with above average moisture in the spring and/or early summer. In conifers, symptoms may be similar to winter injury or salt damage, but the presence of fruiting bodies on needles can allow for confirmation of needle cast disease. Fruiting bodies are typically black in color but can be tan or brown. Foliar diseases in hardwoods are most often observed in aspen, cottonwood, willow, and sycamore. Heavy infections may cause defoliation, particularly in the lower crowns where humidity tends to be higher. Although occasional outbreaks can appear quite dramatic, foliar diseases rarely cause long-term damage in the region.

No major damage by foliar pathogens was observed via aerial survey in 2025 across the Southwestern Region. In Arizona, chronic white pine needle cast caused by *Lophodermella arcuata* has been observed impacting southwestern white pine on the San Francisco Peaks and is particularly severe at higher elevations where conditions are more conducive to this pathogen. In addition, sycamore anthracnose (caused by *Apiognomonia veneta*) continues to affect riparian areas throughout Arizona. This foliar disease is particularly noticeable in Oak Creek Canyon and Wet Beaver Creek near Sedona where the infection appears to be a chronic issue. Damage was also recorded in 2025 in New Mexico during ground surveys on Gila NF and nearby private lands where four acres with damage were mapped along Whitewater Creek.

## Abiotic Damage

### Drought

Drought-induced damage across the Southwestern Region continued in 2025. Evidence of acute drought stress was observed to some extent in all tree species but was again particularly notable in ponderosa pine (Table 4). Juniper crown dieback across Arizona increased dramatically from 805 acres mapped in 2024 to 53,323 acres in 2025 (Figure 36). Most of this damage occurred on the Coronado (14,478 acres, 27%) and Prescott NFs (14,431 acres, 27%) and on state and private lands (14,549 acres, 27%) after previously being widespread in northern Arizona. Site visits revealed the presence of cedar bark beetles in most alligator junipers, but dieback damage in other juniper species was directly related to drought. In New Mexico, juniper dieback was mapped on only 30 acres in 2025 with damage recorded on the Gila NF (10 acres) and state and private lands (21 acres), down from 398 acres recorded in 2024.



**Figure 36. A mix of juniper and Emory oak dieback and mortality associated with severe drought in the Huachuca Mountains, Coronado National Forest.**

Drought-stressed ponderosa pine exhibited slight yellowing of needles and some premature needle loss (Figure 37). Symptoms were most evident on dry ridges and upper slopes. Arizona accounted for about two thirds of the drought stress mapped in ponderosa pine with 19,808 acres recorded in 2025, up from 4,898 acres in 2024 (Table 4). Most of this damage was again mapped on the Coconino (5,437 acres, 27%) and Apache-Sitgreaves NFs (4,682 acres, 24%) and on White Mountain Apache (3,614 acres, 18%) and Navajo Nation Tribal Lands (3,099 acres, 16%). Drought-stressed ponderosa pine was mapped across 10,015 acres in New Mexico in 2025, up from 2,383 acres in 2024, with most of this damage mapped on the Carson (4,477 acres, 45%) and Cibola NFs (3,535 acres, 35%). Drought stress affecting mixed species, which may also include ponderosa pine, increased across the region from 7,940 acres mapped in 2024 to 19,357 acres in 2025, mostly in Arizona where it was concentrated around the Coronado (3,399 acres, 19%) and Kaibab NFs (3,261 acres, 18%), White Mountain Apache Tribal Lands (3,949 acres, 22%), and Fort Huachuca (3,543 acres, 20%). Much of this damage in southern Arizona on Coronado NF and Fort Huachuca includes a significant oak component. Delayed, late season damage and mortality associated with drought stress can be high, and normal ADS flights may underestimate damage in years of acute drought. Drought stress may increase susceptibility to insects and diseases which do not typically affect vigorous trees. Ground surveys in Arizona in 2025 revealed high levels of secondary insects and diseases in drought-affected areas, including bark beetles and canker pathogens, particularly in oak, juniper, and pine species on the Coronado NF. These areas also experienced high levels of late season mortality. Drought may also act as a principal mortality agent.



**Figure 37. Discoloration of ponderosa pine crowns due to drought impacts on the Zuni Mountains of Mt. Taylor Ranger District, Cibola National Forest.**

## **Salt**

De-icing salt use has contributed to chronic ponderosa pine damage along highways in the Southwestern Region. Approximately 158 acres with salt damage were mapped across the region in 2025, increasing from 97 acres in 2024. Damage in 2025 was observed across 97 acres in Arizona and 61 acres in New Mexico. Salt impacts have typically been observed along major corridors, including county and city roadways, as states, counties, and municipalities continue to use de-icing salts. Application of dust abatement salt is also associated with damage to ponderosa pine along dirt roads in rural housing areas. Damage may be more widespread than observed during aerial surveys, as it is typically more obvious when viewed from the ground.

## **Red Belt Winter Injury**

A red belt winter injury event occurred across 914 acres of the Valle Vidal Unit of Questa RD, Carson NF between The Rock Wall and Beatty Lakes during the winter of 2023-2024. Ponderosa pine was the primary host damaged, but other conifer species in the area were also affected. No red belt winter injury damage was recorded in 2025 in this area or across the Southwestern Region. Red belt and other winter injury events may become more common with milder winters, and mortality can occur where damage is severe. Associated mortality in the previously affected area on Valle Vidal was not observed during 2025 ADS flights, however.

## Invasive Species

Each year, invasive species bring new and expanding challenges for documentation, monitoring, and treatment. An invasive species is a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health.

Table 5 shows some of the major invasive species that pose the greatest threats to terrestrial and aquatic ecosystems on forests and grasslands in the Southwestern Region. Many other invasive or exotic species (e.g., introduced fish species) also can seriously impact native species. Table 6 shows some of the common invasive plant species in the Southwestern Region. Further information on invasive plants associated with forests and grasslands in the Southwestern Region, including management recommendations, may be found at <https://www.fs.usda.gov/r03/animals-plants/weed-field-guides>.

**Table 5. Major invasive species and diseases threatening forests and grasslands in Arizona and New Mexico.**

Type	Common name, Species	Impacts
Pathogens	Chronic wasting disease, prion-based Chytrid fungus, <i>Batrachochytrium dendrobatidis</i> Whirling disease, <i>Myxobolus cerebralis</i> White pine blister rust, <i>Cronartium ribicola</i>	Deer and elk Amphibians Salmonid fish species Five-needle pines
Terrestrial Plants	Buffelgrass, <i>Cenchrus ciliaris</i> Cheatgrass, <i>Bromus tectorum</i> Giant cane, <i>Arundo donax</i> Musk thistle, <i>Carduus nutans</i> Yellow bluestem, <i>Bothriochloa ischaemum</i>	Desert plant communities Grasslands and shrublands Waterways Grasslands and shrublands Grasslands and shrublands
Invertebrates	Nantucket pine tip moth, <i>Rhyacionia frustrana</i> Northern crayfish, <i>Orconectes virilis</i> Spruce aphid, <i>Elatobium abietum</i> Oystershell scale, <i>Lepidosaphes ulmi</i> Quagga mussel, <i>Dreissena rostriformis bugensis</i>	Ponderosa pine reforestation Aquatic plants and animals Engelmann and blue spruce Aspen and other hardwoods Streams, rivers, and lakes
Vertebrates	American bullfrog, <i>Lithobates catesbeiana</i> Feral hog, <i>Sus scrofa</i>	Aquatic animals Plant communities and small animals

**Table 6. Common invasive plant species in the Southwestern Region\*****Annual Grasses**

Cheatgrass	<i>Bromus tectorum</i>
Red brome	<i>Bromus madritensis</i>

**Perennial Grasses**

Buffelgrass	<i>Pennisetum ciliare</i>
Fountain grass	<i>Cenchrus setaceus</i>
Yellow bluestem grass	<i>Bothriochloa ischaemum</i>

**Annual and Perennial Forbs**

Sahara mustard	<i>Brassica tournefortii</i>
London rocket	<i>Sisymbrium irio</i>
Stinknet	<i>Oncosiphon pilulifer</i>
Russian thistle	<i>Salsola tragus</i>
Dalmatian toadflax	<i>Linaria dalmatica</i>
Diffuse knapweed	<i>Centaurea diffusa</i>
Bull thistle	<i>Cirsium vulgare</i>
Scotch thistle	<i>Onopordum acanthium</i>

**Woody Perennials**

Giant reed	<i>Arundo donax</i>
African sumac	<i>Searsia lancea</i>
Saltcedar	<i>Tamarix ramosissima</i>
Siberian elm	<i>Ulmus pumila</i>
Russian olive	<i>Elaeagnus angustifolia</i>

\*This is not an exhaustive list.

## Other Entomology and Pathology Activities in 2025

### Forest Health Regional Trainings

The FHP staff provides annual training opportunities to resource managers on insect and disease identification, effects, and management as well as hazard tree identification and mitigation. In 2025, the classroom portion of these regional trainings were held virtually. Presentations were given live via Microsoft Teams and were well attended. Trainings included participants from numerous forests, tribes, and National Park Service units. Presentations were recorded and made available on demand to internal and external partners. Follow-up insect and disease field training days for national forest and partner agency staffs occurred in New Mexico on the Sandia RD of Cibola NF (including various tribal staffs), Sacramento RD of Lincoln NF (including Mescalero Apache Tribal Forestry staff), and Jicarilla Apache Tribal Lands and in Arizona on the Apache-Sitgreaves NFs, for Grand Canyon National Park staff in Flagstaff, and for Friends of Northern Arizona's Forests to highlight aspen issues to volunteers who monitor aspen within enclosures across northern Arizona. The training on the Apache-Sitgreaves NFs included participants from San Carlos and White Mountain Apache Tribal Forestry, Bureau of Indian Affairs, Arizona Public Service, National Park Service, Arizona Department of Forestry and Fire Management, and individuals from several other National Forests. Arizona also did a special insect and disease training for White Mountain Apache Tribal Forestry for high school students attending a week-long camp in White River, AZ. Hazard tree training field days occurred in New Mexico on the Smokey Bear RD of Lincoln NF, Quemado and Black Range RDs of Gila NF, Pecos/Las Vegas RD of Santa Fe NF, Sandia RD of Cibola NF, and Bandelier National Monument and in Arizona on the Coronado (including Saguaro National Park staff) and Tonto NFs and Grand Canyon National Park.

### White Pine Blister Rust Genetic Resistance

In 2025, FHP continued work to sustain white pines in the face of the introduced pathogen *Cronartium ribicola*, the causal agent of white pine blister rust (WPBR). This work is being conducted in collaboration with Kristen Waring of Northern Arizona University, Owen Burney of New Mexico State University, Richard Sniezko of the Dorena Genetic Resource Center (DGRC), and others. Seed has been collected from parent trees across the range of southwestern white pine to test resistance to WPBR and assess adaptive traits. Progeny are inoculated with *C. ribicola* at DGRC in Cottage Grove, OR to evaluate resistance. A small percentage (around 5%) of trees have shown resistance in these trials with locations of parent trees distributed across much of the region. Progeny from these inoculations that showed resistance are being grafted into an orchard at Tyrrell Seed Orchard to conserve this resistant genetic material.

Several regional field trials have been established in cooperation with the Mescalero Apache Tribe (2017) and Lincoln National Forest (2024) in New Mexico and the Apache-Sitgreaves NFs (2018, 2024) in Arizona. These long-term, fenced test sites will be used to evaluate durability of disease resistance identified at DGRC. As of 2025, 2,292 trees have been planted in the Arizona field sites and 1,391 at the New Mexico field sites. Trials include families which have shown a range of resistance in the inoculation trials at DGRC. Plantings also include a small selection of seeds sourced from populations in Mexico which will yield valuable information about the potential for assisted gene flow. Mortality surveys for the first trials were completed in New Mexico in 2022 and Arizona in 2023. The 5-year disease assessment and height/caliper measurements at the Arizona site located on the Apache-Sitgreaves NF were completed in October of 2025 where survival remains relatively high at 70%. Some trees, around 5%, are showing symptoms of insects or disease, including needle spots and cankers. Disease progression will continue to be monitored and causal agents identified. In addition, mortality surveys

were conducted on the 2024 plantings at Apache Trout Campground on Apache-Sitgreaves NFs and Trestle Recreation Area and Potato Canyon on Lincoln NF. Survival at Apache Trout Campground was relatively high at 88% in the spring when the survey was conducted. However, prolonged dry periods likely increased mortality as the year progressed. Survival at the Trestle Recreation site was 59% and Potato Canyon, a considerably better site, was higher at 83%. All plantings will be monitored to track survival and insect and disease activity. *For more information, contact Nick Wilhelmi or Greg Reynolds.*

## Nursery Pathogen Monitoring

For the last several years, FHP has worked with Grace Ganter and Jane Stewart of Colorado State University (CSU) to monitor nursery pathogens after outplanting in a plantation established at New Mexico State University's John T. Harrington Forestry Research Center (JTHFRC). Seedlings were grown at two nurseries; 250 ponderosa pine (*Pinus ponderosa*) and 250 southwestern white pine (*P. strobiformis*) were grown at each nursery. Seed was sourced from Santa Fe NF (SFNF), as the planting occurred on lands impacted by the Hermit Peak/Calf Canyon Fire (HPCC). Initial sampling at both nurseries occurred in April 2024. The seedlings were outplanted with assistance from FHP, SFNF, CSU, and JTHFRC staff in October 2024 in a fenced enclosure within a ponderosa pine stand that burned in HPCC. All fire-killed snags and remaining live trees were cut within the site and in a buffer around the fence to reduce hazard tree impacts and homogenize conditions on the site. Seedlings were sampled again for fungal pathogens at the time of planting, and additional sampling occurred in March and October 2025, six- and 12-months post-planting, respectively (Figure 38). Sampling will continue in 2026 in the fall (two-years post-planting) and for several years beyond. Objectives are to look for soilborne pathogens like *Fusarium* spp. and monitor changes in fungal communities associated with nursery stock (i.e., do pathogens from nurseries persist or is there a shift to native fungal communities in soils where planting occurs). This project will help improve survival of planted trees as the scale of restoration plantings on the landscape increases. *For more information, contact Greg Reynolds.*



**Figure 38.** Sampling a pine plantation at the John T. Harrington Forestry Research Center in Mora, NM in spring 2025 for fungal pathogens introduced on nursery stock during planting.

## Pinyon Pine Attributes Associated with Pinyon Ips

Pinyon pine is a drought tolerant tree species that occurs with various junipers in pinyon-juniper woodlands across the southwestern United States. Pinyon-juniper woodlands are important for wildlife habitat, ranching, firewood, recreation, and tribal cultural practices. Pinyon ips, a native bark beetle to the Southwest, is considered one of the most important mortality or disturbance agents of pinyon pines. During outbreaks of pinyon ips, usually in association with extended drought stress, severe levels of tree mortality can occur across large areas. Outbreak conditions raise pinyon ips populations to the point that they may induce further mortality in healthy, vigorous pinyon and even nearby ponderosa pines. Negrón and Wilson (2003) \* examined stand and tree attributes associated with an outbreak in Arizona, providing a method to model probabilities of infestation by pinyon ips. Data on many of these same attributes are being collected in New Mexico pinyon-juniper woodlands currently affected by an outbreak of pinyon ips on the Magdalena RD, Cibola NF (Figure 39). Long-term monitoring field plots located within the current outbreak, combined with data from previous monitoring plots in New Mexico in the early 2000s, may improve our understanding of stand regeneration. This and future work aims to provide information that may be used to assist determination of desired conditions in efforts to thin high-density pinyon-juniper woodlands thereby increasing stand resilience, reducing insect and disease mortality, and lowering fuel and fire risk. *For more information contact Steven Souder.*

\* Negrón, J.F. and Wilson, J.L. 2003. Attributes associated with probability of infestation by the pinyon ips, *Ips confusus* (Coleoptera: Scolytidae), in piñon pine, *Pinus edulis*. *Western North American Naturalist* 63(4):440-451.



**Figure 39. Establishing monitoring plots and collecting data on pinyon attributes associated with mortality caused by the native bark beetle pinyon ips (*Ips confusus*) on Magdalena Ranger District, Cibola National Forest.**

## Anti-aggregant Pheromones to Reduce Ips Beetle Attacks on Ponderosa Pine

Arizona Zone entomologists, in collaboration with researchers Chris Fettig and Jackson Audley from the Pacific Southwest Research Station, tested the efficacy of an anti-aggregant pheromone in preventing bark beetle attacks on ponderosa pine outside of Flagstaff, Arizona. In May of 2023, the team identified 75 small diameter (8-12 inch at breast height) ponderosa pine in an old plantation approximately 10 miles north of Flagstaff. These 75 trees were baited with the attractant lure for pine engraver (*Ips pini*). Two different doses of anti-aggregant (verbenone in the form of SPLAT verb) were then applied to 50 of the trees, with 25 receiving a low dose (70 grams) and 25 receiving a high dose (140 grams). The trees were monitored over summer, and a final check was done in October of 2023 to assess the number of successful attacks (Figure 40). Due to generally low beetle populations, only eight trees in total were attacked (four controls, two low dose, two high dose). The experiment was repeated in 2024 and 2025 and once again experienced low beetle pressure, despite both years having low winter precipitation. In 2024 a total of 12 trees were attacked (seven control, four low dose, and one high dose). In 2025 seven trees were attacked (five control, zero low dose, and two high dose). Unfortunately, rigorous statistical analysis was not possible due to these low attack rates. However, it is promising that in each year more control trees were attacked than in either of the anti-aggregant treatments. This experiment may be revisited at a future date once a new location is identified. *For more information, contact Monica Gaylord.*



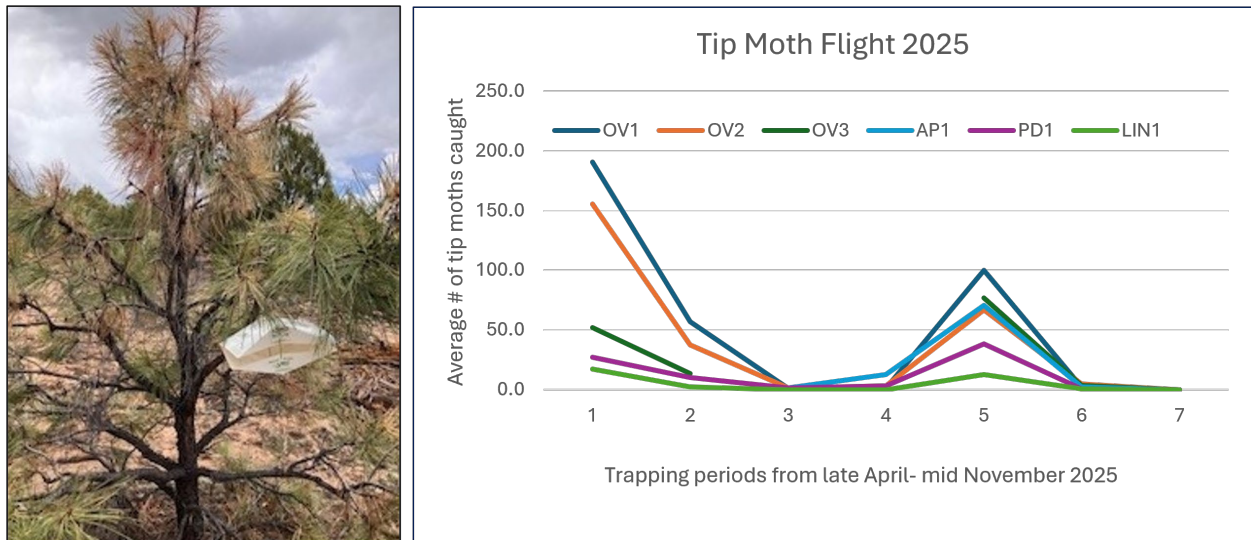
**Figure 40.** Dollop of SPLAT on a ponderosa pine tree, with frass indicating a successful beetle attack.

## Native and Invasive Pine Tip Moth Monitoring on the Apache-Sitgreaves National Forests

Ponderosa pine reforestation projects are being affected by native and invasive tip moths in eastern Arizona, especially on the drier Sitgreaves side of the Apache-Sitgreaves NFs. Pine seedlings planted at low densities on harsh exposed sites following wildfire are still mostly 3-5 ft tall after 15-20 years growth due to repeated pine tip moth attacks. Damaged trees are short and shrubby with severe stem deformities like forking and multiple leaders. Damage has resulted in reduced growth, seedling mortality, reduced planting success, and stagnation in the very susceptible size class (less than 6 ft tall) for decades, delaying advancement into established ponderosa pine forests.

In 2025, the University of Georgia taxonomist determined that specimens sent from Arizona were indeed Nantucket pine tip moth, *Rhyacionia frustrana*. At that time, Arizona Zone entomologists partnered with Elizabeth McCarty, current Nantucket pine tip moth treatment expert in the Southeastern U.S., to develop monitoring plans with and for the national forest to monitor flight periodicity and damage levels in areas identified for future planting projects on national forest system lands. Biweekly pheromone trapping from late April to early November identified two main flight peaks, one in April and another smaller peak in August (Figure 41). Top whorl damage assessments were done at six sites on 20 trees per site at three different times in 2025. Damage continued to progress as the season went on, and plots averaged 25-88% bud and shoot damage by the end of the year. Damage decreased in more easterly sites and in those that were closer to continuous ponderosa pine forests.

Systemic pesticides, not previously registered for tip moth control in Arizona, were advocated for by nursery pest specialists, Arizona Department of Forestry and Fire Management (state employees), and University of Georgia in 2025. Fipronil, which is commonly used to treat Nantucket pine tip moth in the Southeastern U.S., is now registered for use in Arizona, and Acelepryn may also soon be registered for special use in Arizona for tip moth control. *For more information contact Amanda Grady.*



**Figure 41.** Pheromone baited trap used to monitor flight timing of damaging pine tip moths on the Apache-Sitgreaves National Forests (left); and a line graph showing pine tip moths have two major flight peaks, one in early summer (April) and another in late summer (August).

## Plant Pathology Ground Surveys

Because ADS flights can better capture insect and abiotic damage from the air than damage caused by pathogens, ground surveys have historically been used to monitor various biotic forest diseases in the Southwestern Region. In 2025, several quick keys representing common and important forest diseases were developed for the app used in ADS data collection (Digital Mobile Sketch Map, DMSM) to consolidate some of these ground surveys into the same database used by ADS. Surveys were conducted within one chain along roads and trails, and data were primarily captured with points rather than polygons because extent of affected area was typically difficult to ascertain. Data were collected on all five national forests in New Mexico as well as some other property ownerships (e.g., Santa Clara Pueblo, Bandelier National Monument).

In total, 556 miles of roads and trails were surveyed in 2025 across New Mexico, including 281.5 miles in forested, 199.86 acres in woodland, and 74.38 acres in riparian vegetation types. The most frequently recorded damage agents were parasitic plants including southwestern dwarf mistletoe (affecting 357 acres), juniper mistletoe (affecting 110 acres), and Douglas-fir dwarf mistletoe (affecting 106 acres). Dwarf mistletoes were also recorded in pinyon (23 acres) and white pines (five acres), and true mistletoes were also recorded in oak (27 acres). Fungal diseases recorded during ground surveys included broom rusts in true fir (27 acres), spruce (three acres), and juniper (two acres); stem decay and various cankers in aspen (13 and four acres combined, respectively), and black knot of chokecherry (three acres). Additional areas will be surveyed in 2026 and future years, and a cumulative pathogen map will be developed and maintained (Figure 42). *For more information, contact Greg Reynolds.*



Figure 42. Example of forest pathogen data collected with Digital Mobile Sketch Map along trails on the Manzanita Mountains (Sandia Ranger District, Cibola National Forest); common damage agents included southwestern dwarf mistletoe (SW-DM), pinyon dwarf mistletoe (PINTOE), and juniper mistletoe (JUN-MT).

## Biological Evaluations

### Arizona Zone

- Gaylord, M.L. and Wilhelmi, N. 2025. Assessment of ponderosa pine mortality, Black Mesa Ranger District, Apache-Sitgreaves National Forests. USDA Forest Service, Southwestern Region, AZ-FHP-25-07.
- Gaylord, M. and Wilhelmi, N. 2025. Trip report for Highway 260 / FS Road 332 site visit, Black Mesa RD, Apache-Sitgreaves NFs. USDA Forest Service, Southwestern Region, AZ-FHP-25-01.
- Wilhelmi, N. and Gaylord, M.L. 2025. Assessment of widespread ponderosa pine tip dieback on the Williams Ranger District, Kaibab National Forest. USDA Forest Service, Southwestern Region, AZ-FHP-25-05.
- Wilhelmi, N. and Gaylord, M.L. 2025. Pine mortality assessment Santa Rita Mountains, Nogales Ranger District, Coronado National Forest. USDA Forest Service, Southwestern Region, AZ-FHP-25-02.
- Wilhelmi, N., Gaylord, M.L., and Grady, A. 2025. Assessments of planned trailhead development and silviculture treatments on Payson RD, Tonto NF. USDA Forest Service, Southwestern Region, AZ-FHP-25-04.
- Wilhelmi, N., Gaylord, M.L., and Grady, A. 2025. Ponderosa blowdown assessment at Ponderosa Campground, Payson Ranger District, Tonto National Forest. USDA Forest Service, Southwestern Region, AZ-FHP-25-03.
- Wilhelmi, N., Grady, A., and Gaylord, M.L. 2025. Assessment of widespread ponderosa pine tip dieback on the Bradshaw Ranger District, Prescott National Forest. USDA Forest Service, Southwestern Region, AZ-FHP-25-06.

### New Mexico Zone

- Reynolds, G.J. 2025. Evaluation of hazard tree issues in Panchuela and Cowles Campgrounds on Santa Fe National Forest. USDA Forest Service, Southwestern Region, NM-FHP-25-02.
- Reynolds, G.J. 2025. Forest health issues on Tusas Mesa of the Zuni Mountains (Mt. Taylor Ranger District, Cibola National Forest). USDA Forest Service, Southwestern Region, NM-FHP-25-15.
- Reynolds, G.J. 2025. Hazard tree considerations in postfire disaster recovery areas on Smokey Bear Ranger District, Lincoln National Forest. USDA Forest Service, Southwestern Region, NM-FHP-25-03.
- Reynolds, G.J. 2025. Hazard tree issues at Beaverhead Work Center and Continental Divide Trailhead on the Black Range Ranger District. USDA Forest Service, Southwestern Region, NM-FHP-25-05.
- Reynolds, G.J. 2025. Hazard tree issues at Kingston and Wolf Hollow Campgrounds on the Black Range Ranger District. USDA Forest Service, Southwestern Region, NM-FHP-25-08.
- Reynolds, G.J. 2025. Hazard tree issues following the 2025 Trout Fire on the Silver City Ranger District, Gila National Forest. USDA Forest Service, Southwestern Region, NM-FHP-25-13
- Reynolds, G.J. 2025. Hazard tree issues in El Caso Campground Units 1-3 on the Quemado Ranger District. USDA Forest Service, Southwestern Region, NM-FHP-25-04.
- Reynolds, G.J. 2025. Salvage logging opportunities on the Hermit Peak/Calf Canyon fire (Pecos/Las Vegas Ranger District, Santa Fe National Forest). USDA Forest Service, Southwestern Region, NM-FHP-25-14.
- Reynolds, G.J. and Graves, A. 2025. Insect and disease issues affecting "green islands" and roadside hazard trees in the Luna and Hermit Peak / Calf Canyon Fire footprints. USDA Forest Service, Southwestern Region, NM-FHP-25-06.
- Reynolds, G.J. and Souder, S.K. 2025. Evaluation of a proposed FY 2026 dwarf mistletoe suppression project on Santa Clara Pueblo Tribal Lands and closeout of their FY 2022 project. USDA Forest Service, Southwestern Region, NM-FHP-25-01.

- Reynolds, G.J. and Souder, S.K. 2025. Forest health and management recommendations for Jicarilla Trust Land on Tierra Amarilla Land Grant. USDA Forest Service, Southwestern Region, NM-FHP-25-07.
- Reynolds, G.J. and Souder, S.K. 2025. Forest health assessment and juniper mistletoe suppression projects on San Felipe Pueblo Tribal Lands. USDA Forest Service, Southwestern Region, NM-FHP-25-09.
- Reynolds, G.J. and Souder, S.K. 2025. Forest health assessment for Mesa del Medio on Coyote Ranger District, Santa Fe National Forest. USDA Forest Service, Southwestern Region, NM-FHP-25-10.
- Reynolds, G.J. and Souder, S.K. 2025. Forest health assessment for Sacramento Ranger District, Lincoln National Forest. USDA Forest Service, Southwestern Region, NM-FHP-25-12.
- Reynolds, G.J. and Souder, S.K. 2025. Southwestern dwarf mistletoe management on Santa Clara Pueblo Tribal Lands. USDA Forest Service, Southwestern Region, NM-FHP-25-16.
- Souder, S.K. 2025. Defoliation by Douglas-Fir Tussock Moth on Jemez Pueblo Tribal Lands. USDA Forest Service, Southwestern Region, NM-FHP-25-11.

## Peer-reviewed Publications

- Crouch, C.D., **Wilhelmi N.P.**, Rogers P.C., Moore, M.M., and Waring, K.M. 2025. Sustainability and drivers of *Populus tremuloides* regeneration and recruitment near the southwestern edge of its range. *Forestry: An international Journal of Forest Research* 98(2):148-166. <https://doi.org/10.1093/forestry/cpae018>
- Hansen, E.M., Powell, J.A., **Graves, A.**, **Souder, S.**, Vandygriff, J.C., **Gaylord, M.**, **McMillin, J.**, and Bentz, B.J. 2025. Empirical and mechanistic models predict pinyon ips (*Ips confusus*) phenology. *Ecological Modelling* 510:111282. <https://doi.org/10.1016/j.ecolmodel.2025.111282>
- Hofstetter, R.W., **Grady, A.**, Hanavan, R., Hoffman, C., McElfresh, J.S., and Millar, J.G. 2025. Sex attractant for the pandora moth (*Coloradia pandora davisii*, Lepidoptera: Saturniidae) in Arizona. *The Journal of the Lepidopterists' Society* 79(2):143-152. <https://doi.org/10.18473/lepi.79i2.a8>
- Hurteau, M.D., Baker, R., Gonterman, K., Granath, A., Lopez-Binder, J., Taylor, M.D., Rojas, L.S., Rotche, L., **Graves, A.**, Goodwin, M.J., Jones, G., and Marsh, C. 2025. Changing climate and disturbance effects on southwestern US forests. *Forest Ecology and Management* 575:122388. <https://doi.org/10.1016/j.foreco.2024.122388>
- Kolb, T., **Gaylord, M.**, **Grady, A.**, Hansen, M., Lynch, A. **McMillin, J.**, and Runyon, J. 2025. Does spruce aphid defoliation alter Engelmann spruce resistance to spruce beetle? In: Conkling, B.L.; Pandit, K., eds. *Forest Health Monitoring: Evaluation Monitoring project summaries 2023*. Gen. Tech. Rep. WO-105a. Washington, DC: U.S. Department of Agriculture, Forest Service. 81–87: Chapter 10. <https://doi.org/10.2737/WO-GTR-105a-Chap10>

## Field Guide to Insects and Diseases of Arizona and New Mexico Forests

Revisions were completed on the regional field guide for insects and diseases of forests in the Southwest in 2025, and hard copies were printed for both Arizona and New Mexico Zones of Forest Health Protection. These are available on-demand and will be provided during future field training. The document can be accessed online at: <https://www.fs.usda.gov/media/257265>



## Forest Health Staff

### Regional Staff

*Crystal Tischler*

*(505) 842-3284*

Crystal has been the regional aerial survey program manager since September 2022. Crystal previously served as forest health coordinator with the NM office since September 2008. Responsibilities include managing the ADS program for the region and providing UAS capability to the FHP staff. Her previous work experience is in forest management, fuels reduction, timber sale administration, and community wildfire protection planning.

*Janet Nickerman*

*(626) 353-8439*

Invasive Plant Program Manager and Pesticide Use Coordinator since June 2023 and previously served as Acting Regional Invasive Species Program Manager and Pesticide Use Coordinator from August 2022 through February 2023. Primary responsibilities include providing oversight of pesticide use in the region and guiding the invasive species program for NFs and in collaboration with State, Private, Tribal and other federal partners in the Southwest.

### Arizona Zone

*Monica Gaylord*

*(928) 556-2074*

Monica has been a forest entomologist with the Arizona Zone since July 2014. Her primary responsibility is providing technical assistance on bark beetle management to land managers. Previously she was assistant research professor at Northern Arizona University. Forest Health interests include how drought and restoration treatments impact tree susceptibility to southwestern pine bark beetles, fire-bark beetle interactions, and single tree protection against bark beetle attacks.

*Amanda Grady*

*(928) 556-2072*

Amanda has been a forest entomologist with the Arizona Zone since October 2011, previously with the Pacific Southwest Region. Primary responsibilities include providing technical assistance on forest insect management to federal land managers, forest health monitoring related to defoliating and sap sucking insects and conducting ADS. Special interests include integrated pest management development for emergent invasive insects in Arizona.

*Nicholas Wilhelmi*

*(928) 556-2075*

Nicholas has been a plant pathologist with the Arizona Zone since January 2017. Primary responsibilities include providing forest disease technical assistance to federal and tribal land managers and hazard tree identification/mitigation training for the Arizona Zone. Current interests include conservation of genetic resistance to white pine blister rust in five needle pines, emerging drought driven pathogens, and aspen monitoring.

## New Mexico Zone

*Andrew Graves*

*(505) 842-3287*

Andrew has been the Zone Leader for the New Mexico Zone since October 2020. His primary duties include supervisory and managerial responsibilities for the New Mexico Zone staff. Interests include bark beetle/fungal interactions, the response of insects to drought stressed hosts, pheromones, and DNA analysis of bark beetle species and their hosts. Andrew previously served as a forest entomologist with the New Mexico Zone since October 2010.

*Gregory J. Reynolds*

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Greg has been a plant pathologist with the New Mexico Zone since January 2017. His primary responsibilities are providing forest disease technical assistance to federal and tribal land managers and managing the hazard tree program for the zone. His current focus is on nursery pathogens (e.g. *Fusarium* spp.), preservation of genetic resistance to white pine blister rust in five-needle pines, and dwarf mistletoe epidemiology. Greg previously served as a plant pathologist (identifier) with the Animal and Plant Health Inspection Service in New Jersey.

*Steven Souder*

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Steve has been an entomologist with the New Mexico Zone since October 2020. His primary responsibility is providing technical assistance on forest insect management to NFs, tribal lands, and other federal land managers in New Mexico. Steve previously worked on fruit fly research with the Agricultural Research Service in Hawaii for over a decade.

## Appendix: Species Index

Table 7. Common and scientific names for forest insects and diseases\* frequently encountered in the Southwestern Region.

Insects		Diseases	
Cedar bark beetles	<i>Phloeosinus</i> spp.	Alder heat canker	<i>Cytospora umbrina</i>
Cone beetles	<i>Conophthorus</i> spp.	Armillaria root disease	<i>Armillaria</i> spp. (primarily <i>A. solidipes</i> )
Douglas-fir beetle	<i>Dendroctonus pseudotsugae</i>	Black canker	<i>Ceratocystis fimbriata</i>
Douglas-fir tussock moth	<i>Orgyia pseudotsugae</i>	Black leaf spot	<i>Drepanopeziza populi</i>
Fall webworm	<i>Hyphantria cunea</i>	Charcoal canker of oak	<i>Biscogniauxia mediterranea</i>
Fir engraver	<i>Scolytus ventralis</i>	Comandra blister rust	<i>Cronartium comandrae</i>
Flatheaded wood borers	Buprestidae	Cytospora canker	<i>Cytospora chrysosperma</i>
Janet's looper	<i>Nepytia janetae</i>	Diplodia shoot blight and canker	<i>Diplodia sapinea</i>
Juniper twig pruner	<i>Styloxus bicolor</i>	Dwarf mistletoe	<i>Arceuthobium</i> spp.
Large aspen tortrix	<i>Choristoneura conflictana</i>	Elytroderma needle cast	<i>Elytroderma deformans</i>
Mountain pine beetle	<i>Dendroctonus ponderosa</i>	False tinder conk	<i>Phellinus tremulae</i>
Nantucket pine tip moth	<i>Rhyacionia frustrana</i>	Fir broom rust	<i>Melampsorella caryophyllacearum</i>
New Mexico fir looper	<i>Galenara consimilis</i>	Ganoderma root rot	<i>Ganoderma applanatum</i>
Oystershell scale	<i>Lepidosaphes ulmi</i>	Gymnosporangium rusts	<i>Gymnosporangium</i> spp.
Pandora moth	<i>Coloradia pandora</i>	Heterobasidion root and butt rot	<i>Heterobasidion irregulare</i> , <i>H. occidentale</i>
Pine coneworm	<i>Dioryctria auranticella</i>	Hypoxylon canker	<i>Entoleuca mammata</i>
Pine engravers	<i>Ips</i> spp.	Paint fungus	<i>Echinodontium tinctorium</i>
Pine needle scale	<i>Chionaspis pinifoliae</i>	Ink spot leaf blight	<i>Ciborinia whetzellii</i>
Pine sawflies	<i>Neodiprion</i> spp., <i>Zadiprion</i> spp.	Limb rust	<i>Cronartium arizonicum</i>
Pine-feeding needleminers	<i>Coleotechnites</i> spp.	Lophodermella needle cast	<i>Lophodermella</i> spp.
Pine tip moths	<i>Rhyacionia</i> spp.	Melampsora rust	<i>Melampsora</i> spp.
Pinyon ips	<i>Ips confusus</i>	Pinyon needle rust	<i>Coleosporium jonesii</i>
Pinyon needle scale	<i>Matsucoccus acalyptus</i>	Red band needle blight	<i>Dothistroma septosporum</i>
Ponderosa pine seedworm	<i>Cydia piperana</i>	Red belt fungus	<i>Fomitopsis schrenkii</i>
Red turpentine beetle	<i>Dendroctonus valens</i>	Red ring rot	<i>Porodaedalea pini</i>
Roundheaded pine beetle	<i>Dendroctonus adjunctus</i>	Red rot	<i>Dichomitus squalens</i>
Roundheaded wood borers	Cerambycidae	Rhabdocline needle cast	<i>Rhabdocline</i> spp.
Spruce aphid	<i>Elatobium abietum</i>	Schweinitzii butt rot	<i>Phaeolus schweinitzii</i>
Spruce beetle	<i>Dendroctonus rufipennis</i>	Sooty bark canker	<i>Encoelia pruinosa</i>
Tiger moth	<i>Lophocampa ingens</i>	Spruce broom rust	<i>Chrysomyxa arctostaphyli</i>
Twig beetles	<i>Pityophthorus</i> spp., <i>Pityogenes</i> spp., <i>Pityoborus secundus</i>	Sycamore anthracnose	<i>Apiognomonina veneta</i>
Western balsam bark beetle	<i>Dryocoetes confusus</i>	Tomentosus root rot	<i>Onnia tomentosa</i>
Southwestern pine beetle	<i>Dendroctonus barberi</i>	True fir needle cast	<i>Lirula abietis-concoloris</i>
Western shoot borer	<i>Eucosma sonomana</i>	True mistletoe	<i>Phoradendron</i> spp.
Western spruce budworm	<i>Choristoneura fremmanni</i>	Western gall rust	<i>Cronartium harknessii</i>
Western tent caterpillar	<i>Malacosoma californicum</i>	White pine blister rust	<i>Cronartium ribicola</i>
Willow scale	<i>Diaspidiotus gigas</i>		

\*Pathogen scientific names are updated annually as needed and may not match the regional field guide.