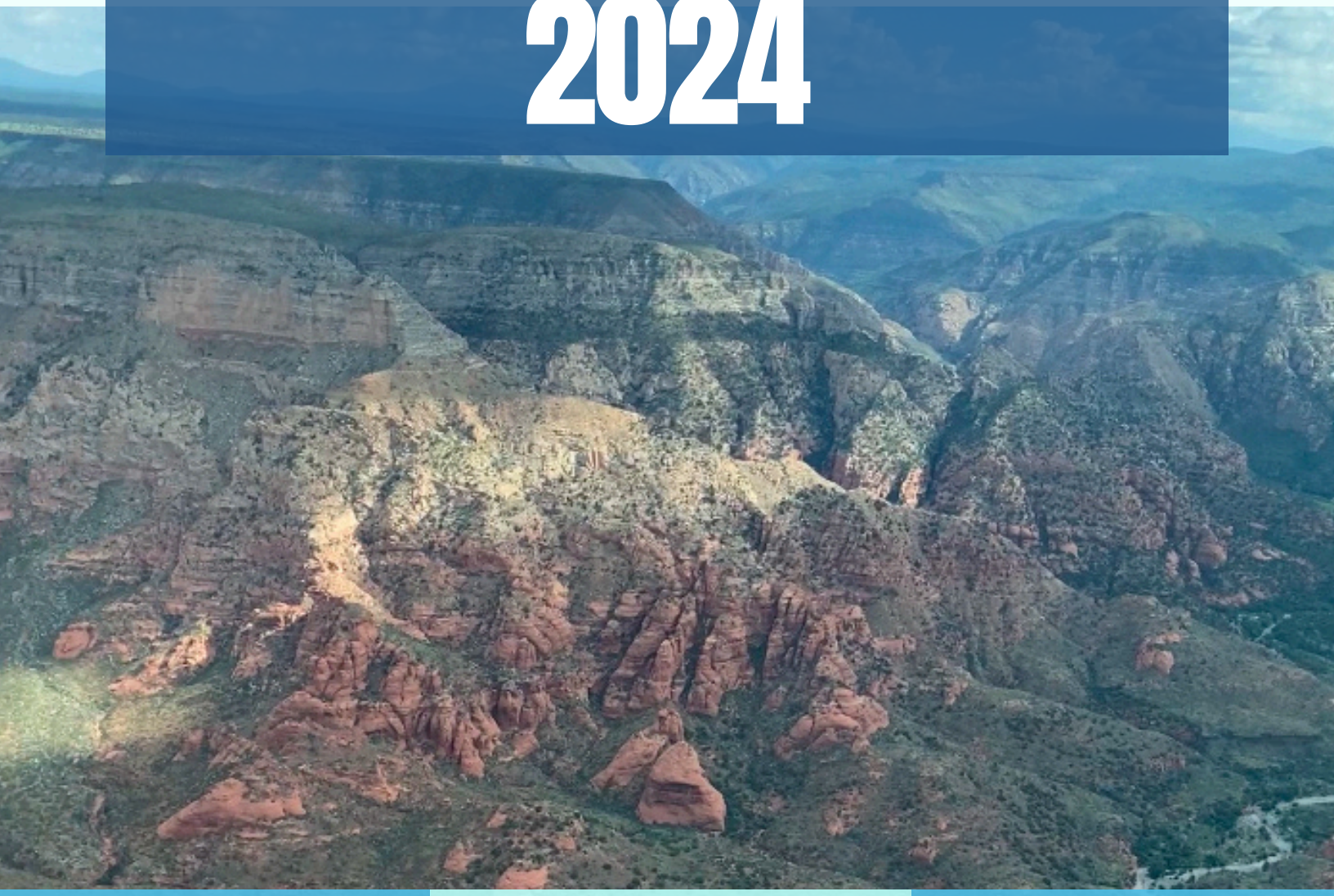
Arizona Forest Health Conditions 2024



Over 33,000 acres observed with bark beetle damage

Over 15,000,000 acres surveyed by air

Over 9,000 acres observed with drought damage

A PUBLICATION BY THE FOREST HEALTH PROGRAM OF THE ARIZONA DEPARTMENT OF FORESTRY AND FIRE MANAGEMENT

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Introduction

Arizona is a state with incredible landscape diversity that ranges from the lower Sonoran Desert scrub and pinyon-juniper woodland to the high elevation spruce-fir forests.

Forests cover roughly 27% of the state and occupy 19.4 million acres. These forests are comprised of 37 species of coniferous and hardwood trees. The majority of forestland is located above the Mogollon Rim with distinct forested areas scattered throughout the rest of the state. Forests in the southern part of the state are often referred to as the "Sky Islands", as they are completely surrounded by lowland deserts, providing habitat for species found at higher elevations unable to survive the harsh desert climate. Juniper (*Juniperus* spp.) and pinyon juniper (*Pinus edulis-Juniperus* spp.) woodlands are the most abundant forest type in Arizona, occupying approximately 14.8 million acres, or 20.3% of the state. The rarest and most significant in ecological terms is riparian forest, which occupy less than 0.5% of Arizona's land.

Urban areas include forests that are typically composed of a mix of native and introduced tree species that require various management techniques. Nearly 90% of Arizona's residents live in an urban forest, which provides numerous environmental, economic and social benefits. Arizona's trees and landscapes create diversity in the insects and diseases that attack them.

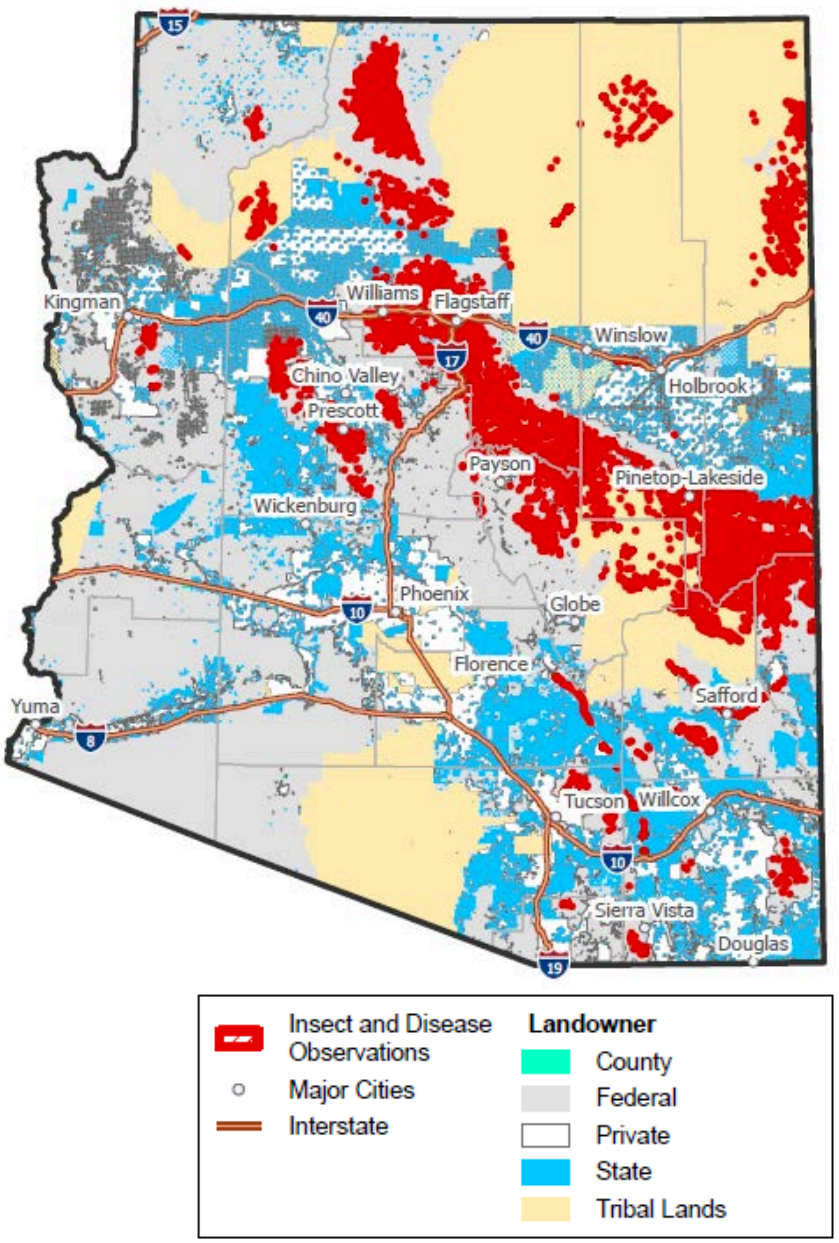


Figure 1. All Insect and Disease Observations in the State of Arizona - 2024

This report includes information on the insects and diseases having significant impacts on Arizona's forested landscapes.

Aerial Survey Summary

Annually, the Arizona Department of Forestry and Fire Management (AZDFFM) partners with the USDA Forest Service-Forest Health Protection (FHP) Team to survey millions of acres of forest and woodland resources from the air. The Aerial Detection Survey (ADS) provides land managers and the public information about landscape-level forest and woodland health conditions. This report summarizes the 2024 ADS program and discusses Arizona's most recent forest and woodland health issues.

During the ADS season in the summer of 2024, over 15 million acres were flown to identify dead, dying, or declining trees (Figure 2). The aerial surveys cover National Forest lands (54% of the area surveyed), tribal lands (31% of the area surveyed), private lands (9% of the area surveyed), state lands (6% of the area surveyed), and county lands (less than 1% of the area surveyed) (Table 1). Throughout the ADS season and the rest of the year, USDA Forest Service, DFFM forest health professionals, and District staff verify ADS data by conducting ground surveys and providing landowners with technical assistance.

Arizona 2024 ADS: Approximate Surveyed Area by Land Ownership		
Land Ownership*	**GIS Acres**	**%**
County	2,553.7	0.02%
Federal	8,232,426.4	54.07%
Private	1,293,553.6	8.50%
State	904,991.2	5.94%
Tribal Lands	4,792,789.0	31.48%
Grand Total	**15,226,314.0**	**100.00%**
*2024 BLM Surface Management Agency data		

Table 1. Surveyed Area by Land Ownership for the State of Arizona - 2024

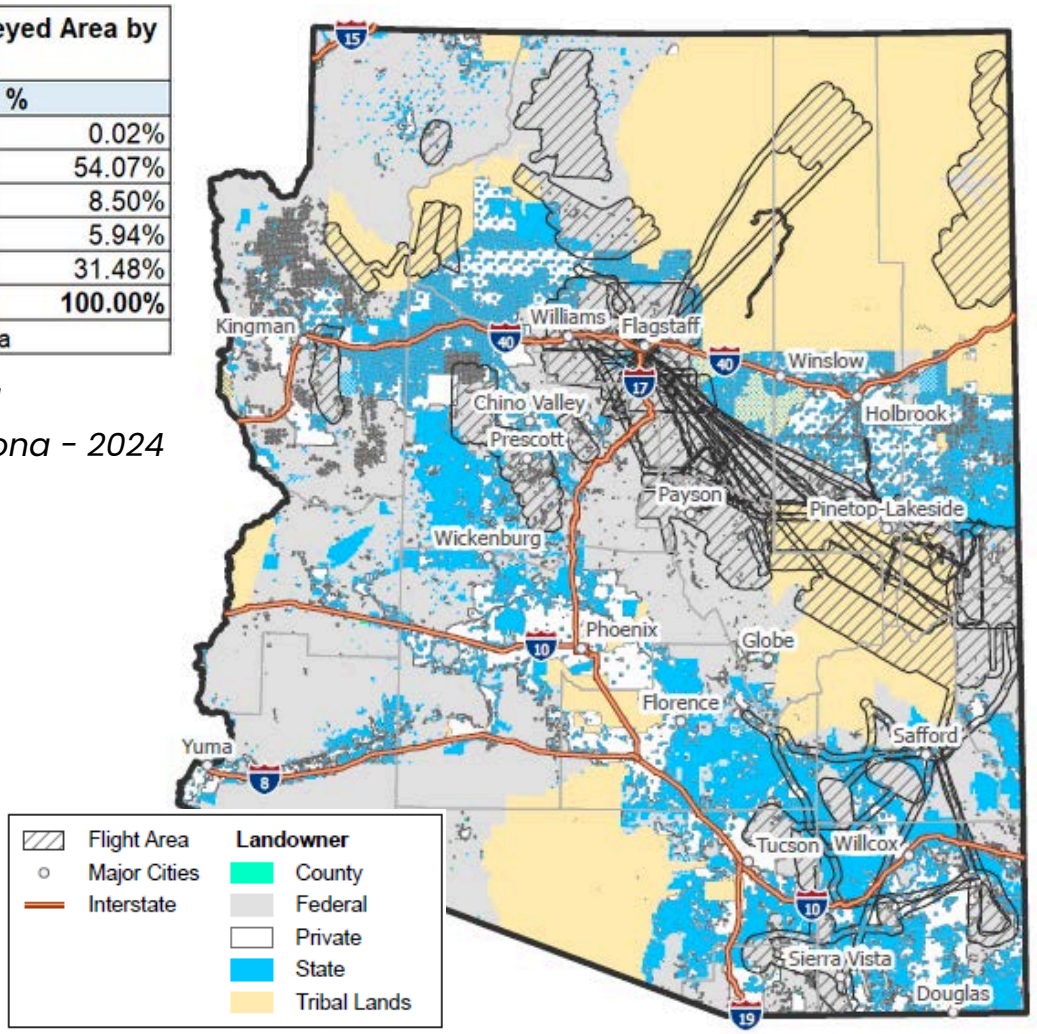


Figure 2. All Surveyed Areas in the State of Arizona - 2024

Climatic Overview

Relevance

It is important to understand the climatic conditions occurring throughout Arizona, as precipitation and temperature are two of the biggest environmental factors influencing forest health. When trees are drought stressed from a lack of precipitation, and stressed from increased average temperatures, they become increasingly susceptible to infection and infestation from diseases and insects. In severe drought conditions, the lack of water can lead to decreased overall tree health and direct drought-related tree mortality.

Tree tissues produce and collect more ethanol and terpenes when they are stressed. Many insects, in particular bark beetles, can detect these chemicals. Thus, stressed trees are releasing more ethanol and terpenes into the atmosphere, attracting bark beetles and other pests to their location, and rousing their attacks. The connection between stress and increased susceptibility to insects and diseases underscores the importance of understanding the type and severity of stress.

Review of Arizona's Drought Conditions

Arizona experienced a lack of precipitation in January of 2024, but improvements were seen in February and March, with southwestern precipitation reducing drought coverage in some areas. Small areas in Cochise and Graham county were still experiencing Extreme Drought levels (D3-D4) according to the Drought Monitor. Severe drought levels (D3) were still present in Maricopa, Navajo, Apache, Gila, counties (Figure 3).

In April, Arizona experienced mostly normal temperatures and unchanged drought conditions, with drier conditions from May to June. May started the record breaking streak of 113 days over 100 degree weather in Maricopa County from May 27th through September 16th.

June brought a surge of moisture and flash flooding in AZ which contributed to improved drought conditions in July. Drought conditions improved in the northeast. However, Abnormally Dry (D0) and Moderate Drought (D1) conditions persisted in most of the state while temperatures soared over 90 degrees. August saw even warmer temperatures, averaging 2-8 degrees above normal.

In September, Moderate Drought (D1) expanded in Arizona. In October, Moderate (D1) and Severe (D2) Drought expanded in the southern and central parts of the state. In November, Extreme Drought (D3) was introduced in western Arizona near the Lower Colorado River in Mohave and La Paz counties and small parts of Maricopa, Yuma, and Yavapai counties. Moderate (D1) Drought increased in southwestern and northeastern Arizona. Overall, September through December saw unusually warm temperatures, with the heat exacerbating dryness and drought conditions in the region.

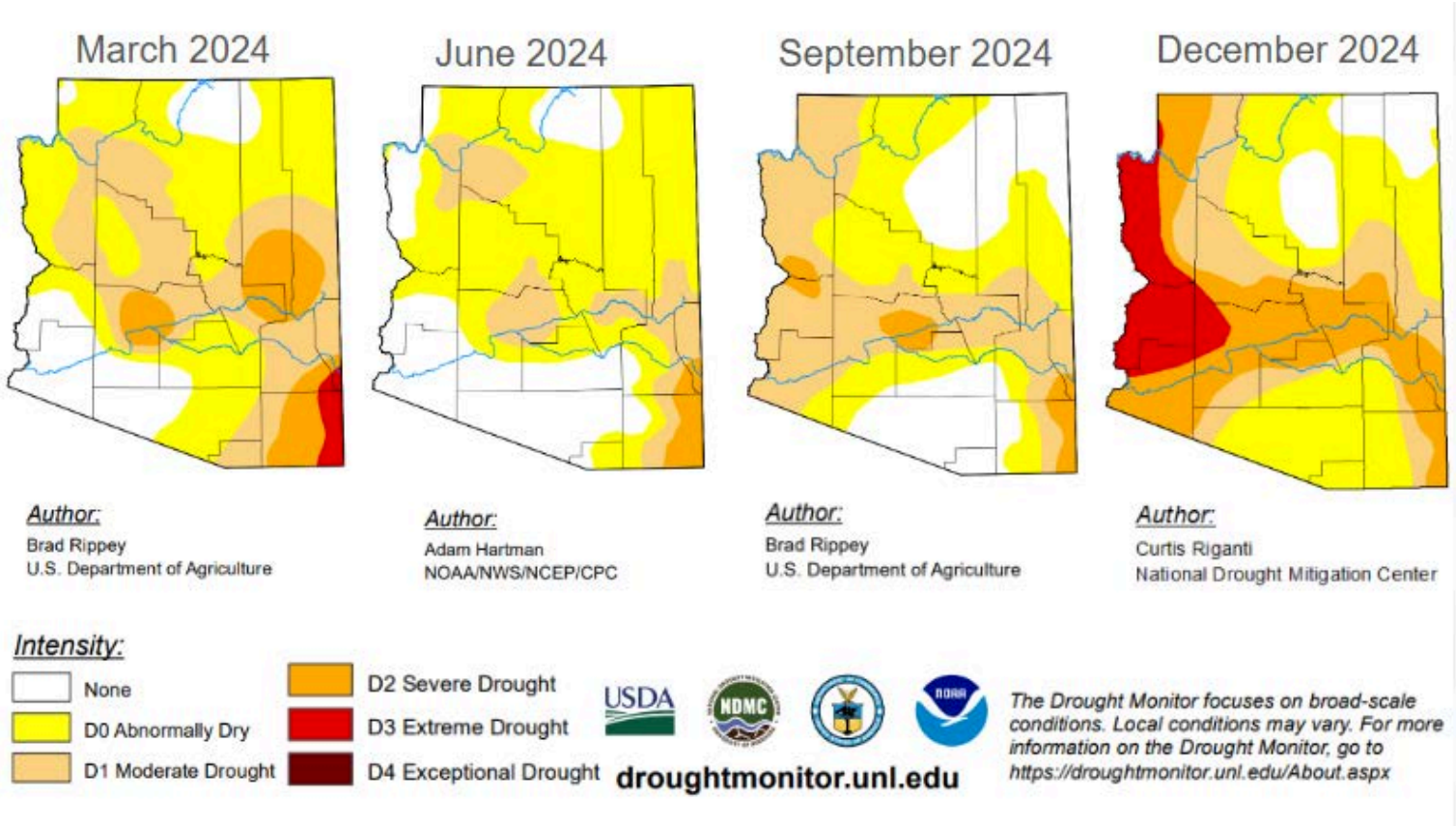


Figure 3. U.S. Drought monitor maps of Arizona in March, June, September, and December, 2024; obtained from droughtmonitor.unl.edu

Statewide Highlights

Bark Beetle Update

When we compare the acres with bark beetle-caused tree mortality throughout Arizona, between 2023 and 2024, we see an increase in areas with mortality. Figure 4 shows all bark beetle mortality observations from 2024; this damage is spread throughout the state, occurring mostly on federal and tribal lands (Table 1). During the summer of 2023 just over 17,000 acres with bark beetle-caused mortality were observed; in the summer of 2024 that number increased to just over 33,000 acres (Table 2), this is a 94% increase in bark beetle caused mortality statewide.

Bark beetle damage will be broken down by AZDFFM District, with detail provided on each bark beetle. One type of bark beetle mortality identified in every district is observed "Unknown Bark Beetle" damage, which represents all ponderosa pine bark beetles. As there are more than a dozen bark beetles that attack and kill ponderosa pine trees in Arizona, there is often more than one species within a single tree; thus, ponderosa pine mortality is represented by the "Unknown Bark Beetle" type within our ADS data. In the Southeast (A3S) and Central Districts (A4S) this "Unknown Bark Beetle" category also includes the Southern pine beetle (*Dendroctonus frontalis*) and Mexican Pine Beetle (*Dendroctonus mexicanus*) as they attack Chihuahua and apache pines that are found in this part of Arizona.

Arizona 2024 ADS: Observed Bark Beetle Species and Land Ownership						
Bark Beetle Damage Causal Agent	**County**	**Federal**	**Private**	**State**	**Tribal Lan**	**Grand Total**
Blue Spruce Engraver		1.00			8.75	9.75
Cedar & Cypress Bark Beetles		4.50	1.50	0.25	1.50	7.75
Douglas-Fir Beetle		504.45	1.00		130.50	635.95
Fir Engraver		2,043.52			261.54	2,305.06
Mountain Pine Beetle		1.50				1.50
Pinyon Ips		76.05	9.14	3.08	21.00	109.26
Spruce Beetle		27.37			7.50	34.87
Twig Beetles		195.25	0.25		469.33	664.83
Unknown Bark Beetle	0.85	18,309.81	235.18	41.24	10,560.62	29,147.70
Western Balsam Bark Beetle		232.22			29.46	261.68
Grand Total	**0.85**	**21,395.67**	**247.07**	**44.56**	**11,490.20**	**33,178.36**

Table 2. Estimated Acres with Observed Bark Beetle Damage by Land Ownership for the State of Arizona - 2024

Fir engraver bark beetle (*Scolytus ventralis*) damage was observed in all Arizona Districts in 2024. This species primarily attacks white fir and subalpine fir (including corkbark fir) trees at higher elevations. Extensive damage and mortality is often observed following drought events.

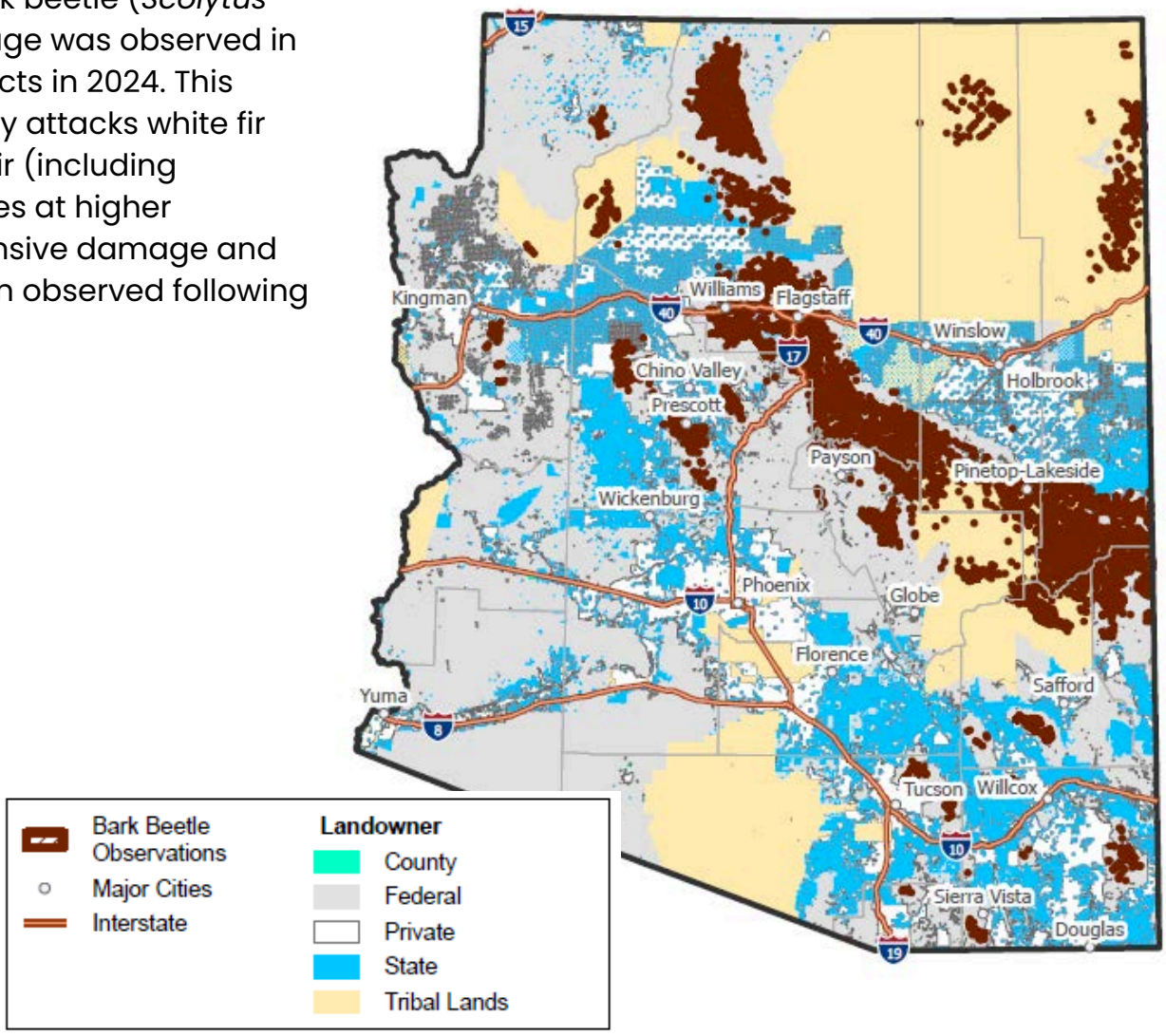


Figure 4. All ADS Bark Beetle Observations within Arizona - 2024



Photo: Douglas-fir Beetle on the Apache-Sitgreaves National Forest-2024

Tamarisk Leaf Beetle Update

Tamarisk leaf beetles (*Diorhabda* spp.) were introduced in the 1990's as a potential bio-control agent for the invasive tamarisk plant (*Tamarix* spp.), also known as salt cedar. Salt cedar was introduced as an ornamental in the southwest in the 1800s; thus, it had centuries to become established within Arizona. Since, it has taken over native riparian habitat throughout much of the state. Salt cedar grows rapidly and densely, outcompeting native trees and shrubs in a matter of years.

Tamarisk leaf beetles were released in hopes that they would help slow or stop the salt cedar invasion, and allow native plants to move back into their natural habitat. However, as salt cedar became established, and native riparian habitats declined, the endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) began using salt cedar for its nesting grounds. The extent of control that the beetle will exert on salt cedar and the affect that will have on Southwestern Willow Flycatcher habitat is still unknown. Tamarisk leaf beetles were not expected to persist below the Arizona-Utah border; however, they have been consistently moving south along the Colorado River, and into the rivers and riparian areas of Arizona. Areas in Arizona along the Gila, Salt, Little Colorado, San Pedro, Santa Cruz, and Verde Rivers are now known to be infested with Tamarisk leaf beetles. Four out of the 5 Arizona Districts have observed salt cedar defoliation from Tamarisk leaf beetle (Figure 5), and special surveys were conducted to record their range in southern Arizona. The acres observed with tamarisk leaf beetle damage are areas that are not typically flown over during ADS flights. It is reasonable to assume damage from these insects is on additional acres throughout Arizona, therefore the acres reported here are not representative of the entire state.

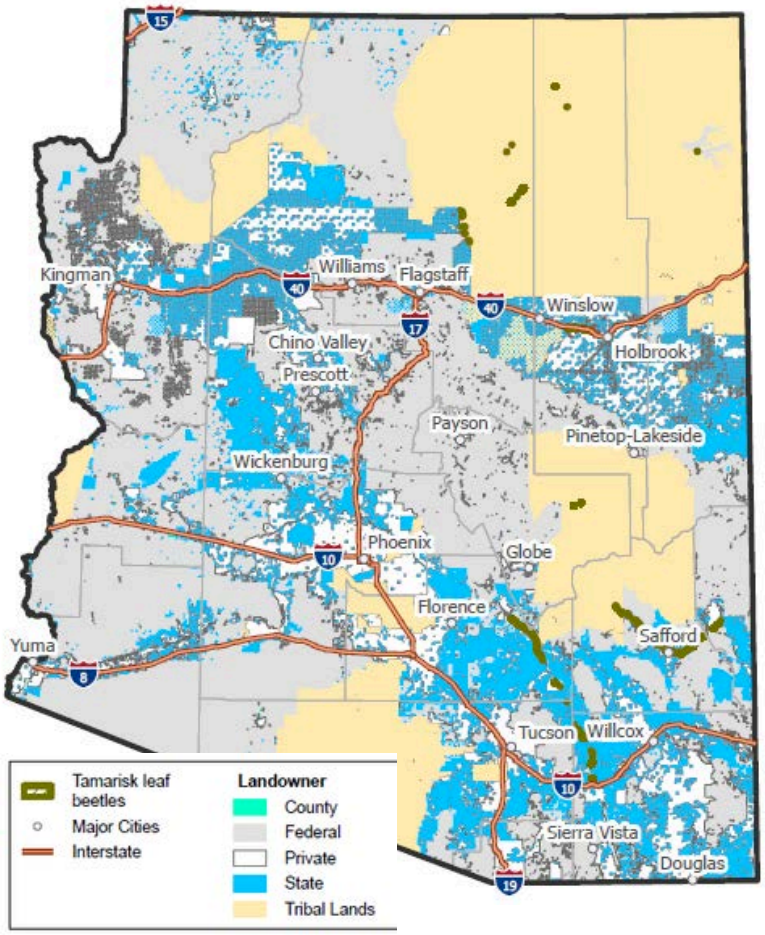


Figure 5. All ADS Tamarisk Leaf Beetle Observations within Arizona - 2024

Noninfectious Disorders (Abiotic Damage)

Abiotic disorders mimic symptoms of some insects and diseases, complicating diagnosis. Abiotic disorders and damages can become entry points for pathogens, while also increasing the tree's overall stress, making it more susceptible to other insect and disease infestation. In this report abiotic damage falls into 3 categories: Drought, Human Activities, or Unknown. Drought refers to a water deficit that develops when there is a lack in precipitation or changes to a watering schedule. When the water loss exceeds the rate of water absorption from the soil, chronic injury within the plant host can occur. This injury is expressed through symptoms such as a lack in growth, wilting, discoloration of the foliage, and premature leaf drop. In the Southwest, winter drought is particularly harmful to forests and can render large areas more susceptible to bark beetles and wildfire. The progression of decline in the tree will typically begin from the top down and from the outside in; the roots are usually the last part of the tree to die. The symptoms associated with chronic drought stress and drought damage can look very similar to root disease symptoms.

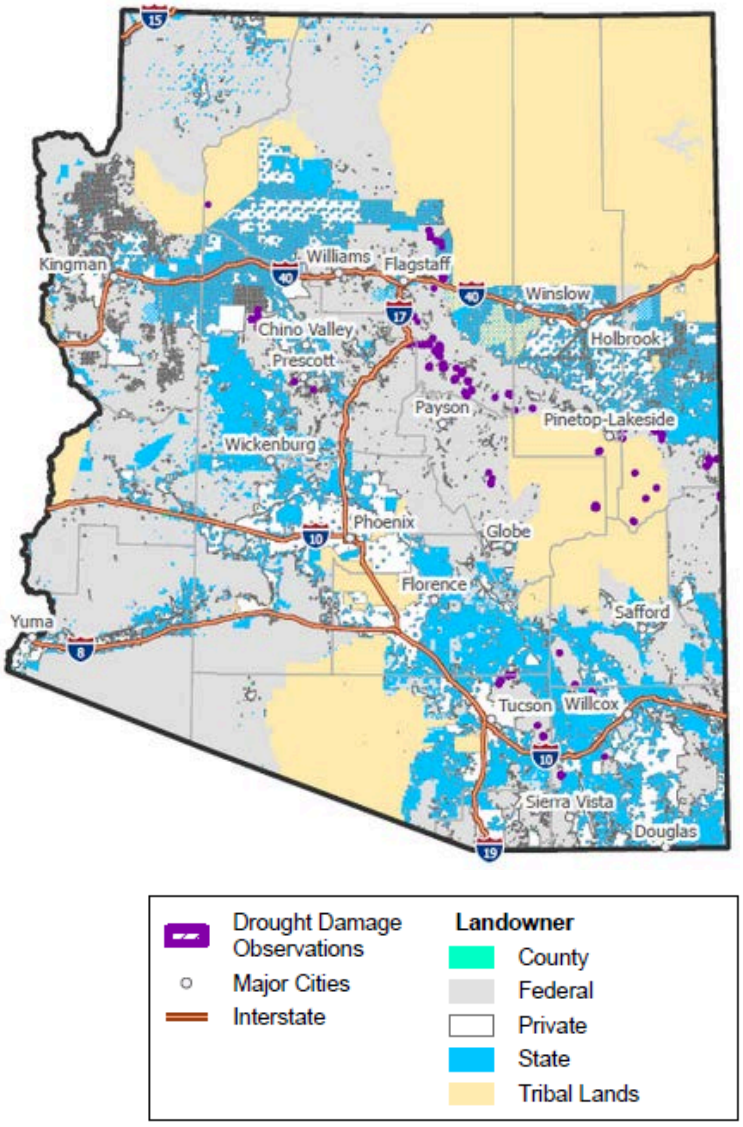


Figure 6. All Drought Damage Observations within Arizona - 2024

Human Activity is another group of noninfectious disorders dedicated to observed salt and de-icer damage along roadways. The salt uptake by roots is a common issue where sodium chloride, calcium chloride, and magnesium chloride are applied to de-ice highways in winter or for dust abatement on spring/summer/summer/fall dirt roads. The salt leached off the roads in heavy rains goes into drainages where trees will capture the water, resulting in damage and even mortality. Often the symptoms associated with salt damage look insignificant, and appear as tip burn.

Drought damage increased from 5,323 acres to more than 9,241 acres with observed drought damage. The majority of drought damage was observed in northern Arizona.

Disease Identification during Aerial Detection Surveys

Many of the signs and symptoms associated with tree diseases can be difficult to identify from the air, as the aerial signatures can look very similar to insect activity. For this reason, USDA Forest Service and AZ DFFM forestry professionals ground truth, and verify that the damage observed from the air is the same agent that is causing the damage on the ground. Due to the complexities with identifying diseases from the air, there were not many acres with observed disease damage. The majority of observed disease damage is found on the ground by forestry professionals working in the field.

Arizona's Five Districts

The Arizona Department of Forestry and Fire Management divides the state into five (5) distinct Districts (Appendix I). Each District shares similar forest and woodland health issues while experiencing a varying degree of tree damage from insects and disease. Each District will be reviewed individually to more accurately show which insects and diseases are impacting the state, and where their damage can be found throughout the state.

It is important to note that the acreages for each District may look inflated due to the fact that some acres are counted twice because more than one damage causal agent was found on those acres.

Northern District (A1S)

The Northern District (A1S) is composed of the Kaibab National Forest, Coconino National Forest, Grand Canyon National Park, and Navajo, Hualapai, Havasupai, and Kaibab Reservations; these areas are surrounded by scattered county, state, and military reservation lands (Appendix I).

Status of Insects

Figure 7 is a map showing all insect and disease observations within the Northern District in 2024. The majority of insect observations occurred on federal lands. In total, more than 9,227 acres were observed with bark beetle mortality, over 1,833 acres with observed defoliator damage, and 336 acres with observed sap feeder activity was seen. The bark beetle mortality observed (Figure 7) was caused by multiple bark beetle species (Table 4) attacking multiple species of pine, fir, and spruce.

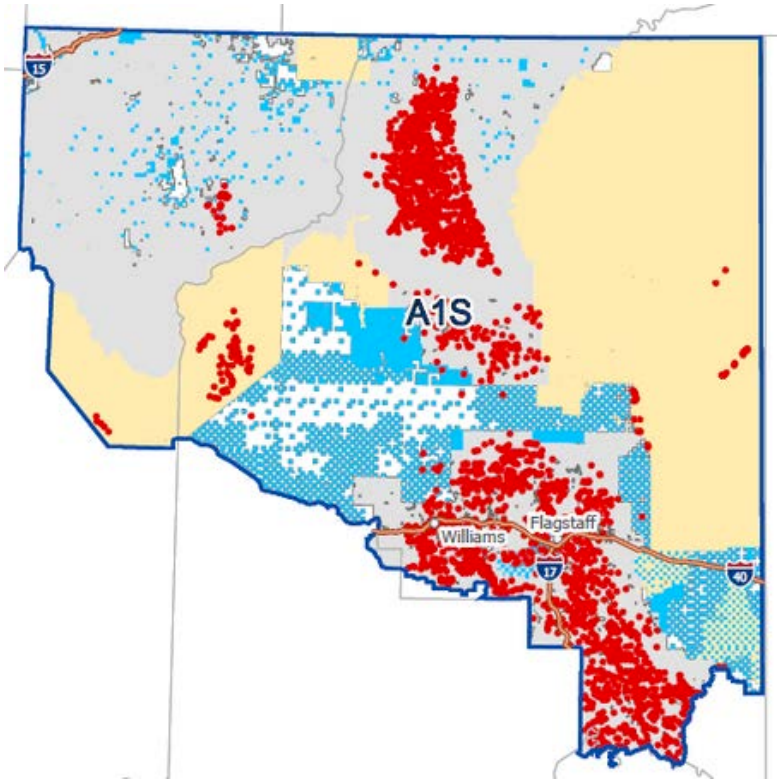


Figure 7. All Insect and Disease observations within the Northern District (A1S) - 2024

A1S - Estimated Acres with Observed Bark Beetle Damage by Land Ownership						
Bark Beetle Damage Causal Agent	**County**	**Federal**	**Private**	**State**	**Tribal Lands**	**Grand Total**
Blue Spruce Engraver		0.25				0.25
Cedar & Cypress Bark Beetles		1.50	0.25	0.25	0.25	2.25
Douglas-Fir Beetle		492.25	1.00			493.25
Fir Engraver		1,755.36				1,755.36
Mountain Pine Beetle		1.25				1.25
Pinyon Ips		19.25	0.92	1.58	3.25	25.00
Spruce Beetle		27.12				27.12
Twig Beetles		108.06	0.25			108.31
Unknown Bark Beetle	0.85	6,477.34	75.59	20.68	12.00	6,586.45
Western Balsam Bark Beetle		227.72				227.72
Grand Total	**0.85**	**9,110.11**	**78.01**	**22.51**	**15.50**	**9,226.97**

Table 3. Estimated acres with Observed Bark Beetle Damage by Land Ownership for the Northern District (A1S) - 2024



Photo: Scattered bark beetle mortality on the Coconino National Forest, 2024

Northern District (A1S)

Table 3 summarizes the major contributors of bark beetle damage in the Northern District. Douglas-fir beetle decreased from over 2,000 acres in 2023 to 493 acres in 2024 with damage mostly on federal lands. Spruce beetle damage increased from less than an acre observed in 2023 to 108 acres observed in 2024 mainly on federal lands. Lastly, the Unknown Bark Beetle category includes over 6,000 acres with observed mortality. This category of unknown bark beetles includes all the bark beetles that attack ponderosa pines: damage increased from 2,625 acres observed in 2023 to 6,586 acres in 2024 mostly on private lands.

Lastly, additional insect damage observed fell primarily into the defoliator category. There is a group of defoliators identified as "Unknown Defoliator". This is a catch-all name for defoliation seen from the air that cannot be identified as a specific insect or disease-causing agent. The majority of "Unknown Defoliator" damage occurs in aspen or other deciduous tree stands. Only some of these locations are able to be reached on the ground by forestry professionals, thus there are still locations that are not double checked and are left as "Unknown Defoliation". This year, over 1,000 acres with observed "Unknown Defoliator" damage were mapped within the Northern District (Table 4).

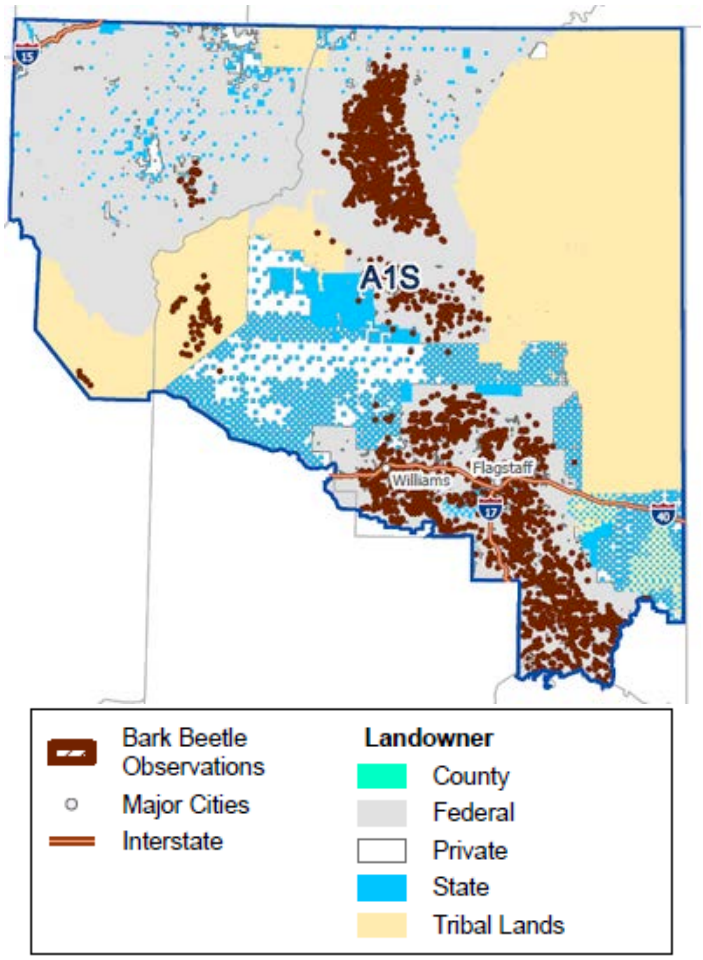


Figure 8. All Bark Beetle observations within the Northern District (A1S) – 2024



Photo: Sawfly larvae on Coconino National Forest, -2024

A1S - Estimated Acres with Observed Insect Agents by Land Ownership						
Disease Causal Agent	**County**	**Federal**	**Private**	**State**	**Tribal La**	**Grand Total**
Bark Beetles	0.85	9,110.11	78.01	22.51	15.50	9,226.97
Defoliators		1,366.78	69.88	0.38	396.18	1,833.22
Sap Feeders		66.77			269.64	336.41
Unknown Defoliator		1,319.00				1,319.00
Grand Total	**0.85**	**11,862.66**	**147.89**	**22.89**	**681.32**	**12,715.61**

Table 4. Estimated acres with Observed Insect Damage by Land Ownership for the Northern District (A1S) - 2024

Status of Tamarisk Leaf Beetle

This year a couple riparian areas were surveyed which had defoliation of salt cedar from tamarisk leaf beetle. In 2023, 359 acres were observed with tamarisk leaf beetle damage in the Northern District. This number increased in 2024 with 468 acres observed with defoliation damage from the tamarisk leaf beetle (Table 5). The majority of this damage was observed on tribal lands similar to 2023 (Figure 9).

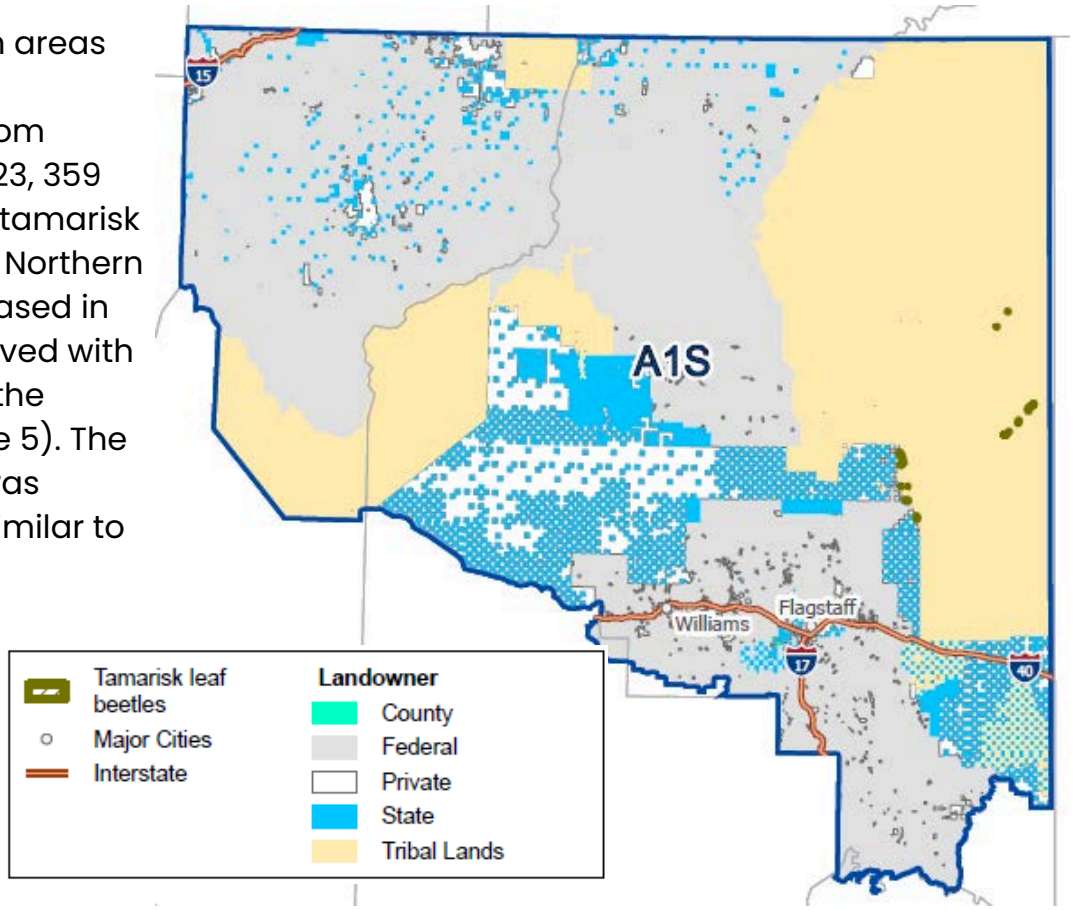


Figure 9. All ADS Tamarisk Leaf Beetle Observations within the Northern District (A1S) – 2024

A1S - Estimated Acres with Observed Tamarisk Leaf Beetle Damage by Land Ownership					
Insect Agent	**Federal**	**Private**	**State**	**Tribal La**	**Grand Total**
Tamarisk Leaf Beetles	1.85	69.88	0.38	396.18	468.29
Grand Total	**1.85**	**69.88**	**0.38**	**396.18**	**468.29**

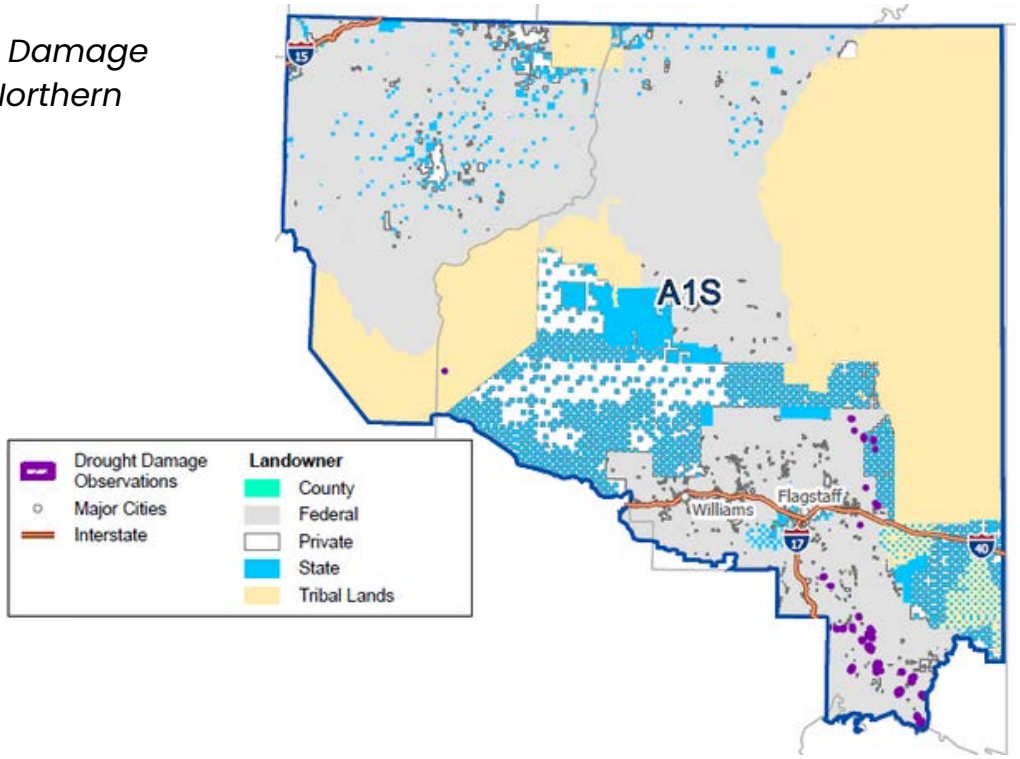
Table 5. Estimated acres with Observed Invasive Insect Damage by Land Ownership for the Northern District (A1S) - 2024

Status of Unknown and Non-Infectious Disorders

This year, roughly 3,877 acres with observed drought damage were identified (Table 6). Most of these observed acres were on federal and private lands within pinyon-juniper woodlands (Figure 10), an 87% increase since 2023. Just over 40 acres had observed salt or de-icer damage, all of which were found along roadways, mostly on federal lands (Table 7).

Of the 452 acres observed with “Unknown damage”, half was attributed to unknown mortality and the other was attributed to unknown defoliation.

Figure 10. All ADS Drought Damage Observations within the Northern District (A1S) – 2024



A1S - Estimated Drought Damage by Host and Land Ownership					
Host	**Federal**	**Private**	**State**	**Tribal Lands**	**Grand Total**
All tree species	1,082.19	73.13		5.03	1,160.34
Az cypress,utah,oneseed,rcky mtn&alligator juniper	65.04	0.50	0.25		65.79
Ponderosa pine	2,615.64	35.20			2,650.84
Grand Total	**3,762.86**	**108.83**	**0.25**	**5.03**	**3,876.96**

Table 6. Estimated acres with Observed Drought Damage by Host and Land Ownership for the Northern District (A1S) - 2024

A1S - Estimated Acres of Abiotic and Unknown Damage by Land Ownership					
Disease Causal Agent	**Federal**	**Private**	**State**	**Tribal Lands**	**Grand Total**
Abiotic Agents	3,766.61	108.83	0.25	5.03	3,880.71
Human Activities	24.90	20.67			45.57
Road Salt Or Deicers	24.90	20.67			45.57
Wind-Tornado/Hurricane	3.75				3.75
Unknown	430.14	22.31			452.45
Grand Total	**4,250.29**	**172.48**	**0.25**	**5.03**	**4,428.05**

Table 7. Estimated acres with Observed Abiotic and Unknown Damage by Land Ownership for the Northern District (A1S) - 2024

Northeast District (A2S)

Status of Insects

The Northeast District is composed of Navajo, Apache, Fort Apache, and Hopi Reservation lands, as well as the Apache-Sitgreaves National Forest; these lands are surrounded by scattered county and state lands (Appendix I).

Figure 11 is a map showing all insect and disease observations within the Northeastern District in 2024. The majority of insect observations occurred on federal lands. In total, more than 15,000 acres were observed with bark beetle mortality (Figure 11) which is a 122.6% increase from 2023 with 7,024 acres observed. Over 2,826 acres with observed defoliator damage, and 14,446.95 acres with observed sap feeder activity was seen. The bark beetle mortality that was observed was caused by multiple bark beetle species (Table 9), attacking multiple species of pine, fir, and spruce.

Of the 10 different bark beetles observed causing mortality in the northeastern district, fir engraver beetle and twig beetles caused a considerable amount of damage.

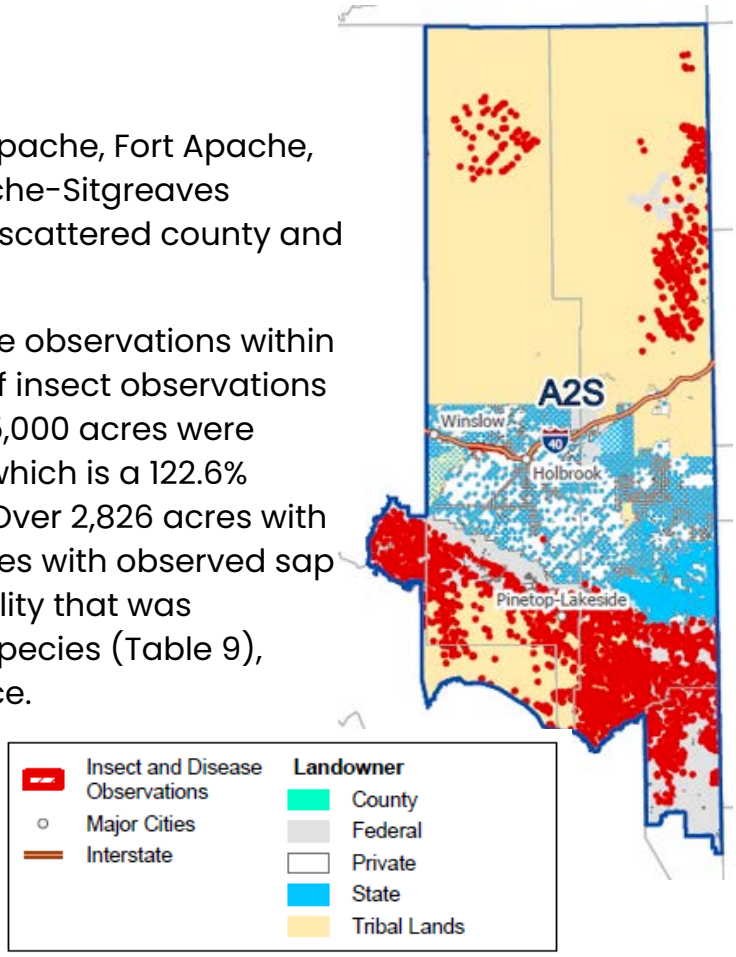


Figure 11. All Insect and Disease observations within the Northeast District (A2S) - 2024

Twig Beetle (Pityophthorus spp., Pityogenes spp., and/or Pityoborus secundus) attack and kill the small limbs and branches of weakened and stressed pines and other conifers. These beetles are typically considered secondary insects as they often only kill trees that were previously weakened or stressed. If conditions are favorable, twig beetles could develop large populations and attack and kill small trees. These beetles are hard to identify, thus similarly to the "Unknown Bark Beetle" damage type they are all represented by the "Twig Beetle" damage type within the ADS data.

A2S - Estimated Acres of Observed Insect Damage by Land Ownership					
Disease Causal Agent	**Federal**	**Private**	**State**	**Tribal Lands**	**Grand Total**
Bark Beetles	9,025.45	38.64	2.20	6,570.23	15,636.52
Defoliators	695.87	247.90		1,882.67	2,826.45
Sap Feeders	499.46	7.61		13,939.88	14,446.95
Unknown Defoliator	677.95			1,865.36	2,543.31
Grand Total	**10,898.72**	**294.16**	**2.20**	**24,258.14**	**35,453.22**

Table 8. Estimated acres with all Observed Insect Damage by Land Ownership for the Northeastern District (A2S) - 2024

Lastly, the "Unknown Bark Beetle" category included 14,318 acres with observed mortality (Table 9). This category of unknown bark beetles includes all the bark beetles that attack ponderosa pines. As more than one species often contributes to the decline and death of ponderosa pines, we lump all ponderosa bark beetles into this one category "Unknown Bark Beetles." It is worth mentioning this is a 216% increase in ponderosa pine mortality from the Unknown Bark Beetle category in 2023; which only saw 4,525 acres with Unknown Bark Beetle caused mortality in the Northeast District (A2S).

A2S - Estimated Acres with Observed Bark Beetle Damage by Land Ownership					
Bark Beetle Damage Causal Agent	**Federal**	**Private**	**State**	**Tribal Lands**	**Grand Total**
Blue Spruce Engraver	0.75			8.75	9.50
Cedar & Cypress Bark Beetles	2.50	0.25		1.25	4.00
Douglas-Fir Beetle	10.95			130.50	141.45
Fir Engraver	232.26			261.04	493.30
Mountain Pine Beetle	0.25				0.25
Pinyon Ips	49.30	6.97	0.75	14.75	71.76
Spruce Beetle	0.25			7.50	7.75
Twig Beetles	87.18			469.33	556.51
Unknown Bark Beetle	8,637.76	31.42	1.45	5,647.65	14,318.29
Western Balsam Bark Beetle	4.25			29.46	33.71
Grand Total	**9,025.45**	**38.64**	**2.20**	**6,570.23**	**15,636.52**

Table 9. Estimated acres with all Observed Bark Beetle Damage by Land Ownership for the Northeastern District (A2S) - 2024



Photo: Western balsam bark beetle damage on the Apache-Sitgreaves National Forest-2024

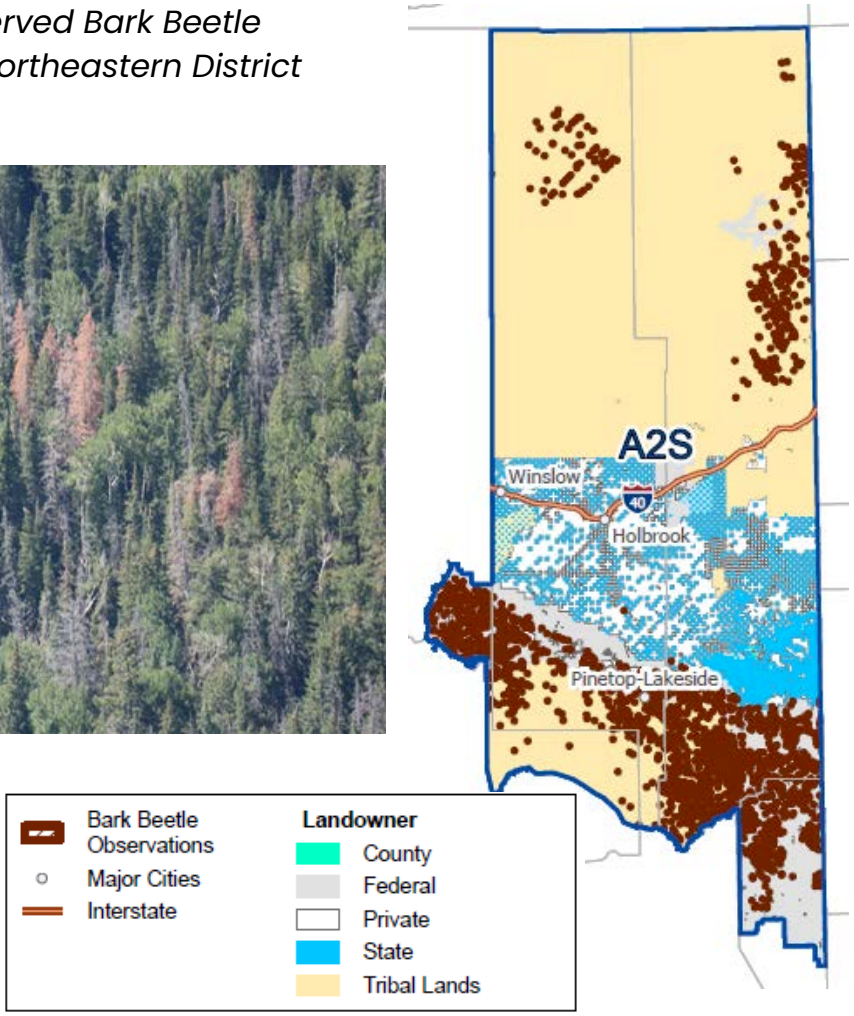


Figure 12. All Bark Beetle observations within the Northeast District (A2S) – 2024

Status of Tree Diseases

Tree diseases are typically one of four categories (fungal, bacterial, viral, or oomycetes). Plant diseases often thrive in warm and damp conditions not commonly seen in Arizona, making diseases less of a concern within the state. This year, the Northeast District (A2S) observed damage from Sycamore anthracnose. This disease accounted for only 1 acre of observed damage split between federal and private lands. Sycamore anthracnose is a foliar disease that infests Arizona sycamore. The symptoms include twig and stem cankers, shoot blight following cold snaps in the spring, and leaf blight from direct infection of leaves. This disease is ubiquitous with Arizona sycamore.

Status of Tamarisk Leaf Beetle

This year a couple riparian areas were surveyed which had defoliation of salt cedar from tamarisk leaf beetle. In 2023, 124 acres were observed with tamarisk leaf beetle damage in the Northeast District. This number increased in 2024 with 283 acres observed with defoliation damage from the tamarisk leaf beetle (Table 10). The majority of this damage was observed on private lands (Figure 13).

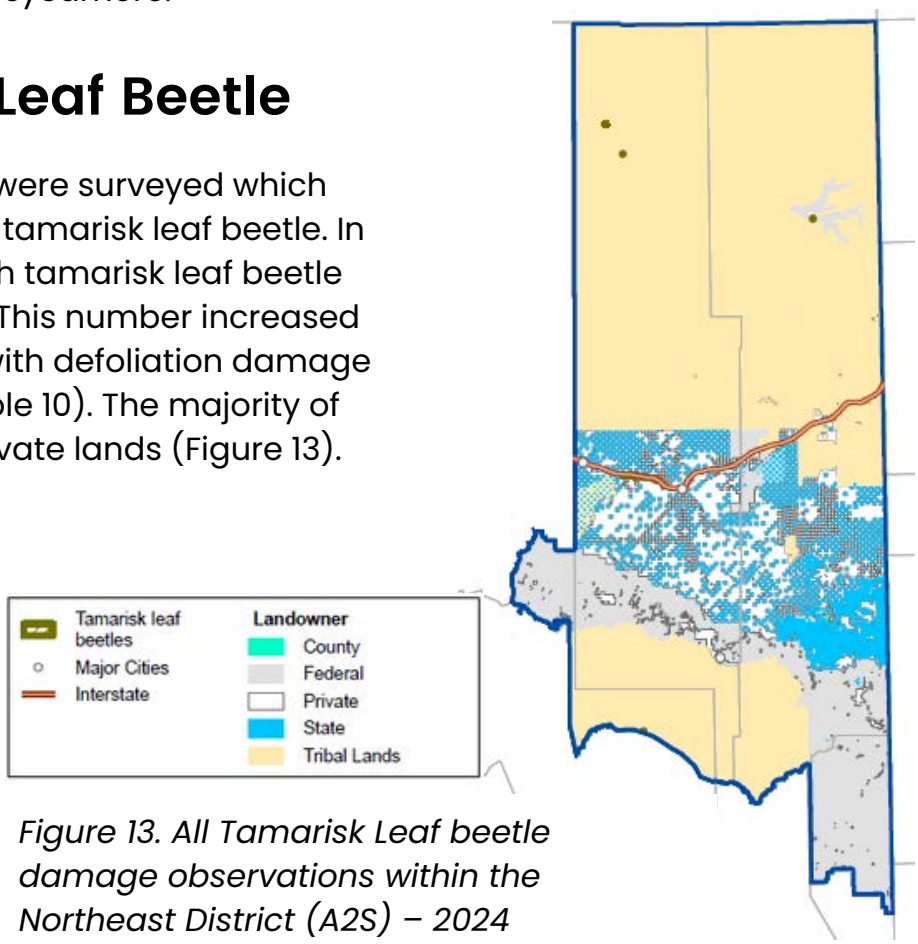


Figure 13. All Tamarisk Leaf beetle damage observations within the Northeast District (A2S) – 2024

A2S - Estimated Acres with Observed Tamarisk Leaf Beetle Damage by Land Ownership					
Disease Causal Agent	**Federal**	**Private**	**State**	**Tribal Lands**	**Grand Total**
Tamarisk Leaf Beetles	17.92	247.90		17.31	283.13
Grand Total	**17.92**	**247.90**	**-**	**17.31**	**283.13**

Table 10. Estimated acres with Observed Tamarisk Leaf Beetle Damage by Land Ownership for the Northeast District (A2S) - 2024

Status of Unknown and Non-Infectious Disorders

This year roughly 3,259 acres with observed drought damage were identified in the northeast district (Table 12). This is a 35% increase from 2023 when 2,420 acres were observed with drought damage in this area. Most of these observed acres were on federal and tribal lands and among several pine tree species (Table 11). There was over 2,000 acres with observed unknown damage(Table 12).

Of the 2,385 acres with unknown damage (Table 12), over 1,800 acres were recorded with unknown mortality and 473 acres were recorded with unknown defoliation (Table 13).

A2S - Estimated Drought Damage by Host and DFFM District				
Host	**Federal**	**Private**	**Tribal Lands**	**Grand Total**
All tree species	574.88	1.29	185.21	761.38
Ponderosa pine	1,501.23		630.21	2,131.43
Two-needle,mexican & border pinyon, az pine			366.02	366.02
Grand Total	**2,076.10**	**1.29**	**1,181.44**	**3,258.83**

Table 11. Estimated acres with Observed Drought Damage by Land Ownership for the Northeast District (A2S) - 2024

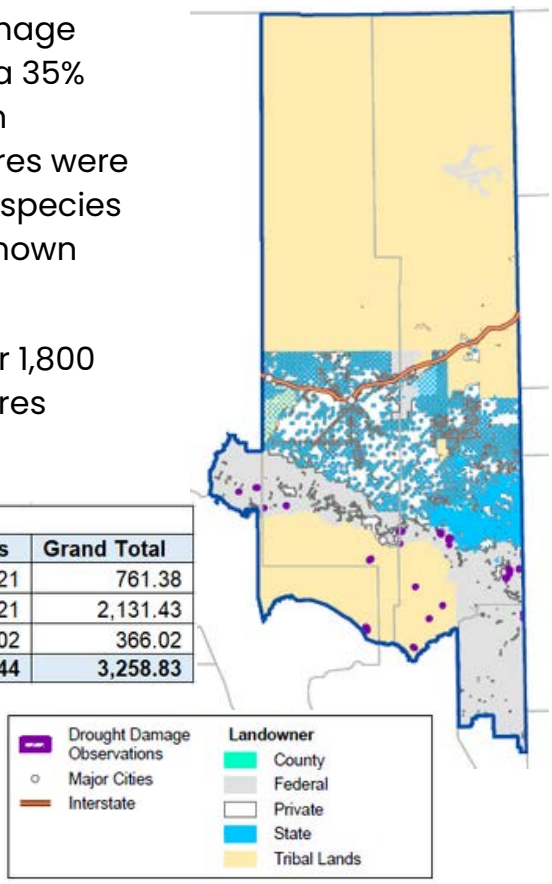


Figure 14 – All Drought damage observations within the Northeast District (A2S) – 2024

A2S - Estimated Acres of Observed Abiotic and Unknown Damage by Land Ownership					
Disease Causal Agent	**Federal**	**Private**	**State**	**Tribal Lands**	**Grand Total**
Drought	2,076.10	1.29		1,181.44	3,258.83
Road Salt Or Deicers	0.75	3.68			4.43
Unknown	1,164.03	12.32		1,208.43	2,384.79
Grand Total	**3,240.89**	**17.29**	**-**	**2,389.87**	**5,648.05**

Table 12. Estimated acres with Observed Abiotic and Unknown Damage by Land Ownership for the Northern District (A2S) - 2024

A2S - Estimated Acres with Unknown Damage by Land Ownership				
Damage Type	**Federal**	**Private**	**Tribal Lands**	**Grand Total**
Crown Dieback			27.19	27.19
Crown Discoloration	74.98	9.34		84.32
Defoliation	375.14	2.99	94.46	472.58
Mortality	713.91		1,086.78	1,800.70
Grand Total	**1,164.03**	**12.32**	**1,208.43**	**2,384.79**

Table 13. Estimated acres with Unknown Damage by Land Ownership for the Northern District (A2S) - 2024

Southeast District (A3S)

Status of Insects

The Southeast District is composed of the Ak-Chin, Tohono O' Odham, and San Xavier reservation lands, as well as the Coronado National Forest Sky Islands, the Cabeza Prieta National Wildlife Refuge, Organ Pipe Cactus National Monument, Saguaro National Park, and Chiricahua National Monument. These areas are surrounded by scattered county and state lands, with some military reservation lands as well (Appendix I).

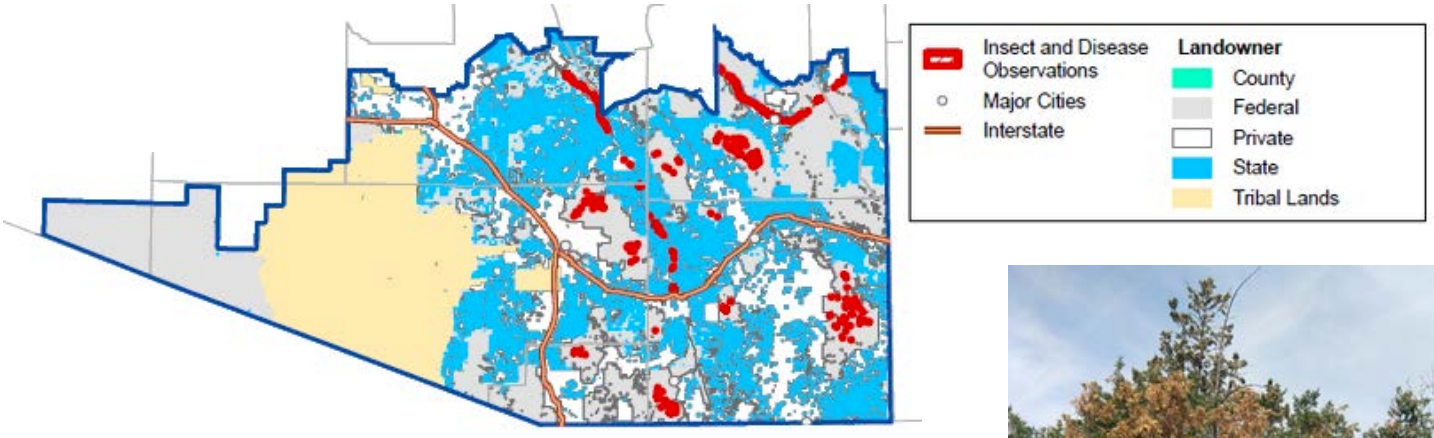


Figure 15. All Insect and Disease observations within the Southeast District (A3S) - 2024

Figure 15 is a map showing all insect and disease observations within the Southeast District in 2024. The majority of insect observations occurred on federal lands. In total, more than 130 acres were observed with bark beetle mortality. This is an 85% decrease from bark beetle observations in 2023. The bark beetle mortality that was observed (Figure 15) was caused by multiple bark beetle species (Table 15), attacking multiple species of pine, fir, and juniper. Over 6,384 acres were observed with defoliator damage and no sap feeder activity was observed (Table 14). The defoliator damage observed was caused by tamarisk leaf beetle on tamarisk.



Photo: Cypress Beetle Damage on private land in southeastern Arizona, 2024.

A3S - Estimated Acres of Observed Insect Damage by Land Ownership					
Disease Causal Agent	**Federal**	**Private**	**State**	**Tribal La**	**Grand Total**
Bark Beetles	128.92	1.25	0.25		130.42
Defoliators	439.88	5,578.08	276.52	89.51	6,383.99
Unknown Bark Beetle	124.42	1.25			125.67
Grand Total	**693.22**	**5,580.58**	**276.77**	**89.51**	**6,640.08**

Table 14. Estimated acres with Bark Beetle Damage by Land Ownership for the Southeast District (A3S) - 2024

The "Unknown Bark Beetle" category included roughly 126 acres with observed mortality (Table 15). This category of unknown bark beetles includes all the bark beetles that attack ponderosa pines. As more than one species often contributes to the decline and death of ponderosa pines, we lump all ponderosa bark beetles into this one category "Unknown Bark Beetles." It is worth mentioning this is a decrease in ponderosa pine mortality from the Unknown Bark Beetle category in 2023; which saw 470 acres with Unknown Bark Beetle caused mortality in the Southeast District (A3S).

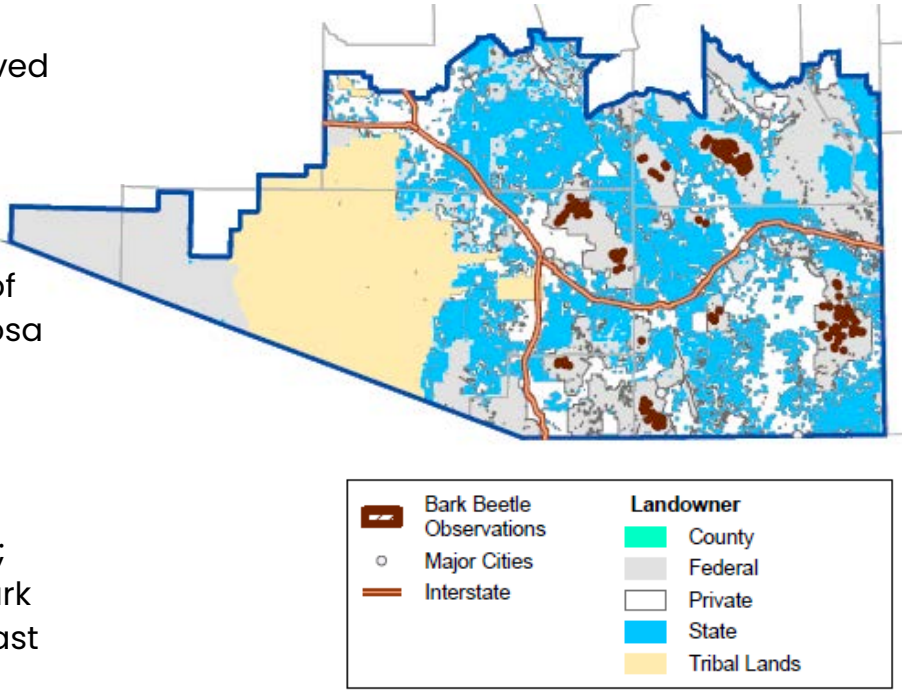


Figure 16. All Bark Beetle observations within the Southeast District (A3S) - 2024

A3S - Estimated Acres with Observed Bark Beetle Damage by Land Ownership				
Bark Beetle Damage Causal Agent	**Federal**	**Private**	**State**	**Grand Total**
Cedar & Cypress Bark Beetles	0.50			0.50
Fir Engraver	3.50			3.50
Pinyon Ips	0.25		0.25	0.50
Unknown Bark Beetle	124.42	1.25		125.67
Western Balsam Bark Beetle	0.25			0.25
Grand Total	**128.92**	**1.25**	**0.25**	**130.42**

Table 15. Estimated acres with Bark Beetle Damage by Land Ownership for the Southeast District (A3S) - 2024

Status of Tree Diseases

Due to the complexities with identifying diseases from the air, there were not many acres with observed disease damage. The majority of observed disease damage is found on the ground by forestry professionals working in the field. This year, foresters in the Southeast District (A3S) district observed *biscogniauxia* canker disease in native oaks.



Photo: Biscogniauxia canker disease in oak in southeast Arizona, 2024

Status of Tamarisk Leaf Beetle

This year several locations along portions of the San Pedro and Gila Rivers near Safford were surveyed specifically to record the presence of Tamarisk leaf beetles. In these riparian areas, severe defoliation of salt cedar from tamarisk leaf beetle was recorded. Over 6,383 acres were observed having defoliation damage from the Tamarisk leaf beetle (Table 16). This is a 39% decrease from 2023 when 10,565 acres were observed of damage observed in these same areas. The observed damage was on federal, private, state, and tribal lands (Table 16). This damage was observed in the northern end of the Southeast District (Figure 17).

A3S - Estimated Acres with Observed Tamarisk Leaf Beetle Damage by Land Ownership					
Insect Agent	**Federal**	**Private**	**State**	**Tribal Lands**	**Grand Total**
Tamarisk Leaf Beetles	439.88	5,578.08	276.52	89.51	6,383.99
Grand Total	**439.88**	**5,578.08**	**276.52**	**89.51**	**6,383.99**

Table 16. Estimated acres with tamarisk Leaf Beetle Damage by Land Ownership for the Southeast District (A3S) - 2024

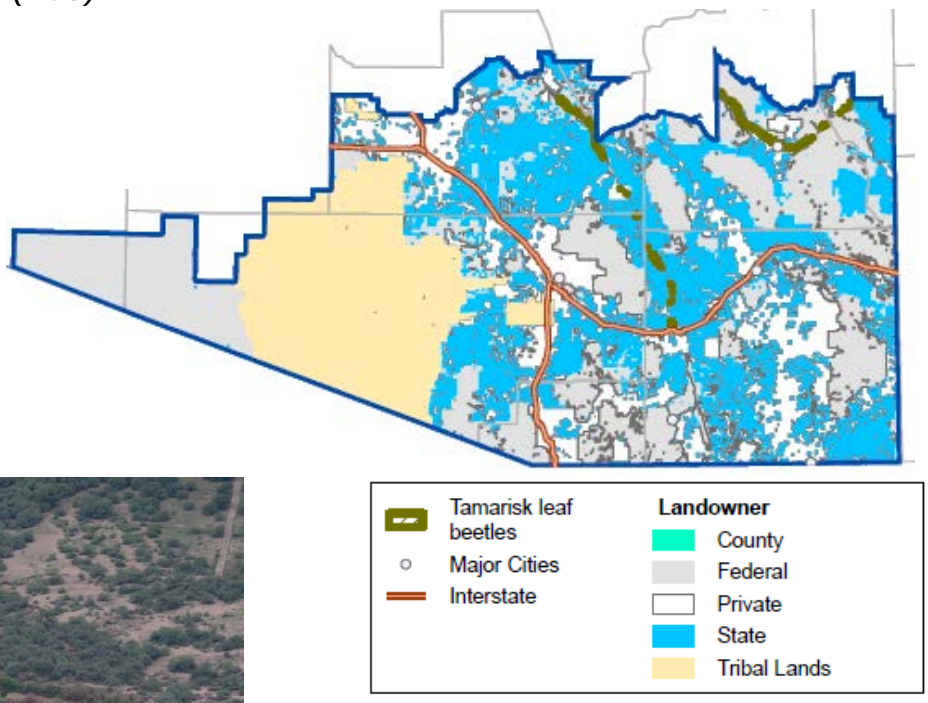


Figure 17. All Tamarisk Leaf Beetle damage observations on salt cedar within the Southeast District (A3S) - 2024



Photo: Tamarisk Leaf Beetle Defoliation of Salt Cedar in southeast Arizona, 2024

Status of Unknown and Non-Infectious Disorders

This year roughly 1,472 acres with observed drought damage were identified in the Southeast District (Table 17), which is a significant increase from 2023 which recorded only 65 acres of drought damage in these areas. All of these acres were on federal, state, and private lands within oak woodlands and mixed conifer forests (Figure 18).

Lastly, there were just over 107 acres with unknown damage (Table 17), identified as unknown crown dieback, defoliation, and mortality during the surveys (Table 19). These areas were not able to be confirmed on the ground, thus their damage causal agent remains as unknown damage.

A3S - Estimated Acres of Observed Abiotic and Unknown Damage by Land Ownership					
Disease Causal Agent	**Federal**	**Private**	**State**	**Tribal Lands**	**Grand Total**
Drought	1,330.89		142.00		1,472.88
Unknown	80.74	26.65			107.40
Grand Total	**1,411.63**	**26.65**	**142.00**	**-**	**1,580.28**

Table 17. Estimated acres with Observed Abiotic and Unknown Damage by Land Ownership for the Southeast District (A3S) - 2024

A3S - Estimated Drought Damage by Host and Land Ownership			
Host	**Federal**	**State**	**Grand Total**
All tree species	664.56	69.13	733.69
Az cypress,utah,oneseed,rcky mtn&alligator junipe	666.33	72.86	739.19
Grand Total	**1,330.89**	**142.00**	**1,472.88**

Table 18. Estimated acres with Drought Damage by Land Ownership for the Southeast District (A3S) - 2024

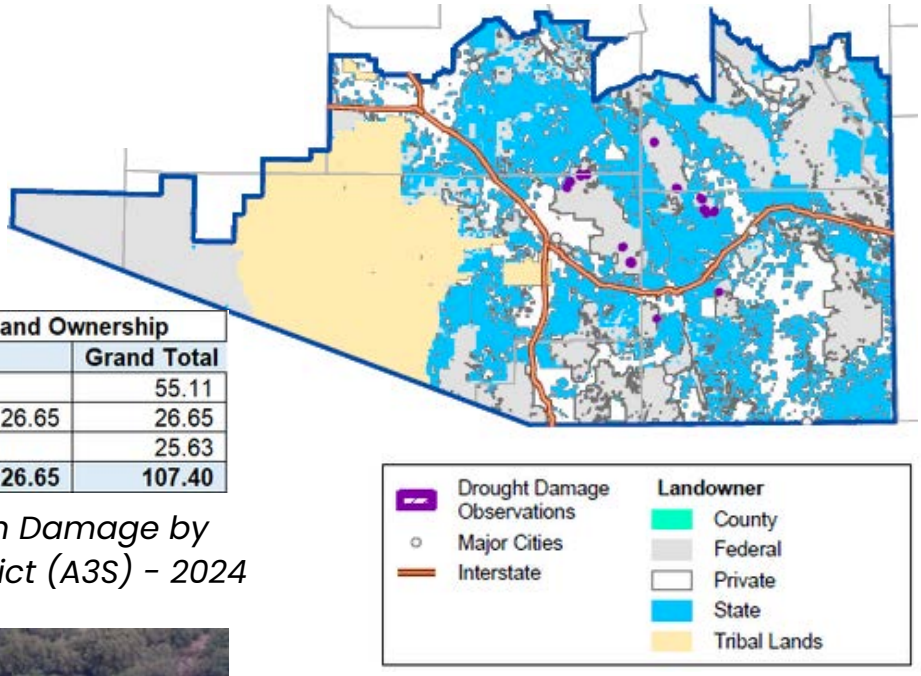


Figure 18. All Drought Damage observations within the Southeast District (A3S) - 2024

A3S - Estimated Acres with Unknown Damage by Land Ownership			
Damage Type	**Federal**	**Private**	**Grand Total**
Crown Dieback	55.11		55.11
Defoliation		26.65	26.65
Mortality	25.63		25.63
Grand Total	**80.74**	**26.65**	**107.40**

Table 19. Estimated acres with Unknown Damage by Land Ownership for the Southeast District (A3S) - 2024



Photo: Defoliation in cottonwood in the Southeast District (A3S)-2024

Central District (A4S)

Status of Insects

The Central District is composed of the Tonto National Forest, San Carlos, Gila River, Salt River, and Fort Howell Reservation lands, and the Kofa National Wildlife Refuge; these areas are surrounded by scattered county and state lands, with some military reservation lands as well (Appendix I).

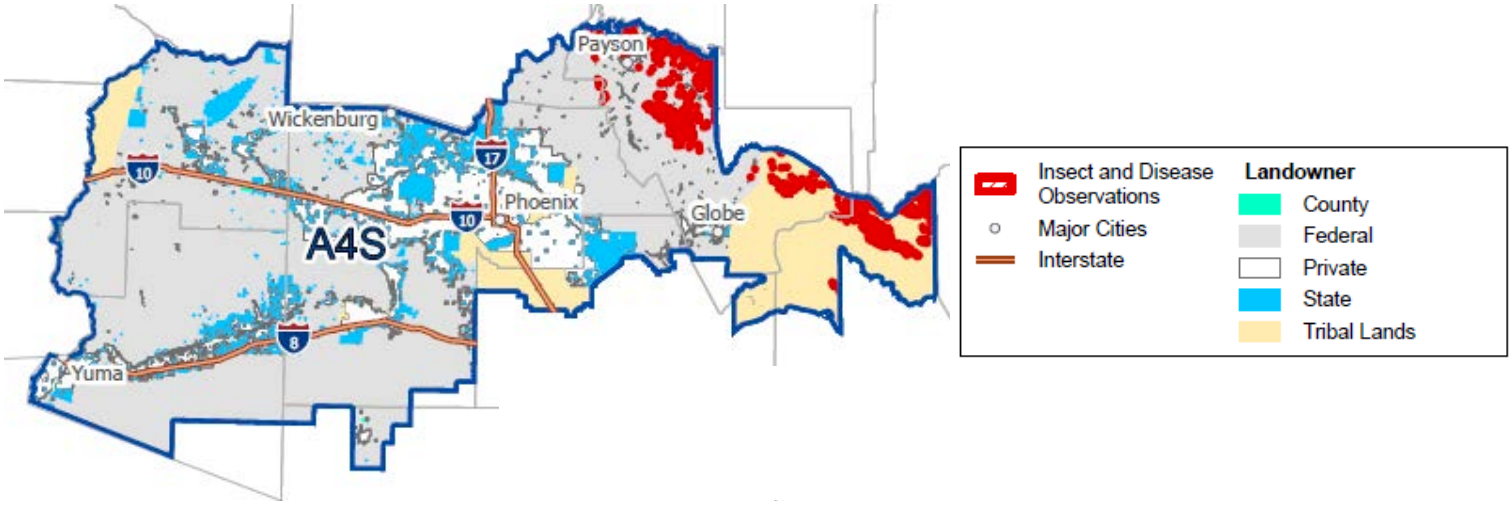


Figure 19 – All Insect and Disease observations within the Central District (A4S) - 2024

Figure 19 is a map showing all insect and disease observations within the Central District in 2024. The majority of insect observations occurred on federal and tribal lands in the higher elevation areas of the central district. In total, roughly 6,301 acres were observed with bark beetle mortality, over 329 acres with observed defoliator damage, and 11,301 acres with observed sap feeder activity(Table 20). The bark beetle mortality that was observed (Figure 20) was caused by multiple bark beetle species (Table 21), attacking multiple species of pine and fir.



Picture: Bark Beetle damage on ponderosa pine in Payson, AZ-2024

The 3 major contributors to bark beetle damage in the Central District included fir engraver beetle, pinyon ips, and over 6,000 acres observed of "unknown bark beetle". The category of "Unknown Bark Beetles" includes all the bark beetles that attack ponderosa pine. As more than one species often contributes to the decline and death of ponderosa pines, we lump

all ponderosa bark beetles into this one category "Unknown Bark Beetles". Pinyon ips (*Ips confusus*) mortality was observed on just 4 acres. This damage was observed in the lower elevation woodlands mostly on tribal lands (Table 20). Fir engraver (*Scolytus ventralis*) damage accounted for roughly 37 acres with bark beetle caused tree mortality in the high elevation forests of the Tonto National Forest and Tribal lands.

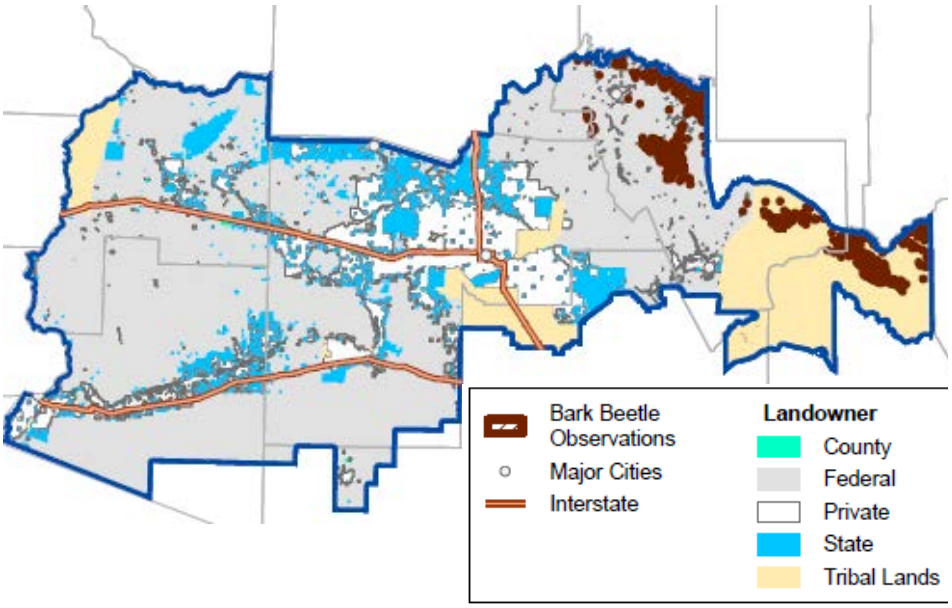


Figure 20. All Insect and Disease observations within the Central District (A4S) - 2024

A4S - Estimated Acres of Observed Insect Damage by Land Ownership				
Disease Causal Agent	**Federal**	**Private**	**Tribal Lands**	**Grand Total**
Bark Beetles	1,394.52	2.11	4,904.47	6,301.11
Defoliators			329.03	329.03
Sap Feeders	5,858.56	31.66	5,410.71	11,300.94
Unknown Bark Beetle	1,356.30	2.11	4,900.97	6,259.38
Grand Total	**8,609.39**	**35.89**	**15,545.19**	**24,190.46**

Table 20. Estimated acres with observed Insect Damage by Land Ownership for the Central District (A4S) - 2024

A4S - Estimated Acres with Observed Bark Beetle Damage by Land Ownership				
Bark Beetle Damage Causal Agent	**Federal**	**Private**	**Tribal Lands**	**Grand Total**
Fir Engraver	37.23		0.50	37.73
Pinyon Ips	1.00		3.00	4.00
Unknown Bark Beetle	1,356.30	2.11	4,900.97	6,259.38
Grand Total	**1,394.52**	**2.11**	**4,904.47**	**6,301.11**

Table 21. Estimated acres with Observed Bark Beetle Damage by Land Ownership for the Central District (A4S) - 2024



Photo: Bark Beetle mortality on the Tonto National Forest, 2024

It is worth mentioning that the sap feeder damage observed in 2024 (Table 20) was from Pinyon needle scale (Table 22) over 11,000 acres of damage was recorded on federal, private, and tribal lands.

A4S - Estimated Acres with Observed Insect Agents by Land Ownership				
Insect Agent	**Federal**	**Private**	**Tribal Lands**	**Grand Total**
Pinyon Needle Scale	5,858.56	31.66	5,410.71	11,300.94

Table 22. Estimated acres with Observed Insect Damage by Land Ownership for the Central District (A4S) - 2024

Status of Tamarisk Leaf Beetle

Just over 329 acres were observed with Tamarisk leaf beetle damage in the Central District (Table 23). All acres with salt cedar defoliation were observed within San Carlos Tribal lands, in the north western edge of the reservation (Figure 21). Tamarisk leaf beetle is also highly prevalent in the riparian areas around the Phoenix Metropolitan area, but these areas were not surveyed in 2024.

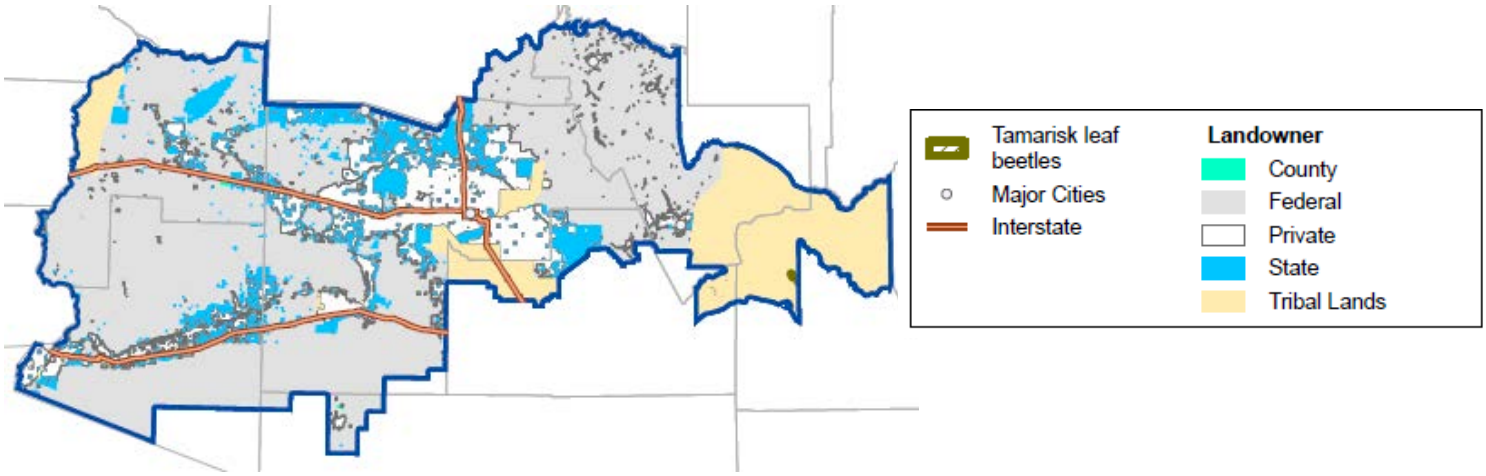


Figure 21. All Tamarisk Leaf Beetle Damage observations within the Central District (A4S) - 2024

A4S - Estimated Acres with Observed Insect Agents by Land Ownership				
Insect Agent	**Federal**	**Private**	**Tribal Lands**	**Grand Total**
Tamarisk Leaf Beetles			329.03	329.03
Grand Total	**-**	**-**	**329.03**	**329.03**

Table 23. Estimated acres with Observed Tamarisk Leaf Beetle Damage by Land Ownership for the Central District (A4S) - 2024

Status of Unknown and Non-Infectious Disorders

This year roughly 41 acres were observed with drought damage in the Central District (Table 24). This is a 95% decrease from 2023 which documented 759 acres with damage. This damage was observed along the eastern edge of the District (Figure 22), all being on federal lands (Table 24). This damage mostly occurred in ponderosa pine in higher elevation forest (Table 25).

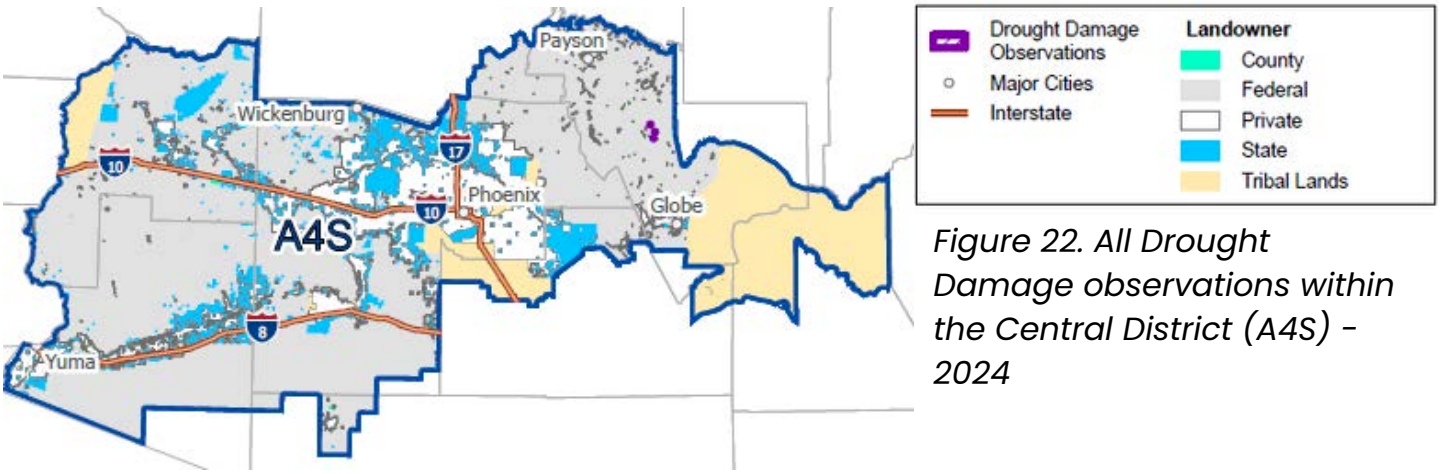


Figure 22. All Drought Damage observations within the Central District (A4S) - 2024

A4S - Estimated Acres of Observed Abiotic and Unknown Damage by Land Ownership				
Disease Causal Agent	**Federal**	**Private**	**Tribal Lands**	**Grand Total**
Drought	41.62			41.62
Road Salt Or Deicers	0.25			0.25
Unknown		1.00		1.00
Grand Total	**41.87**	**1.00**	**-**	**42.87**

Table 24. Estimated acres with Observed Abiotic and Unknown Damage by Land Ownership for the Central District (A4S) - 2024

A4S - Estimated Drought Damage by Host and Land Ownership		
Host	**Federal**	**Grand Total**
All tree species	12.55	12.55
Ponderosa pine	29.07	29.07
Grand Total	**41.62**	**41.62**

Table 25. Estimated acres with Drought Damage by Host and Land Ownership for the Central District (A4S) - 2024

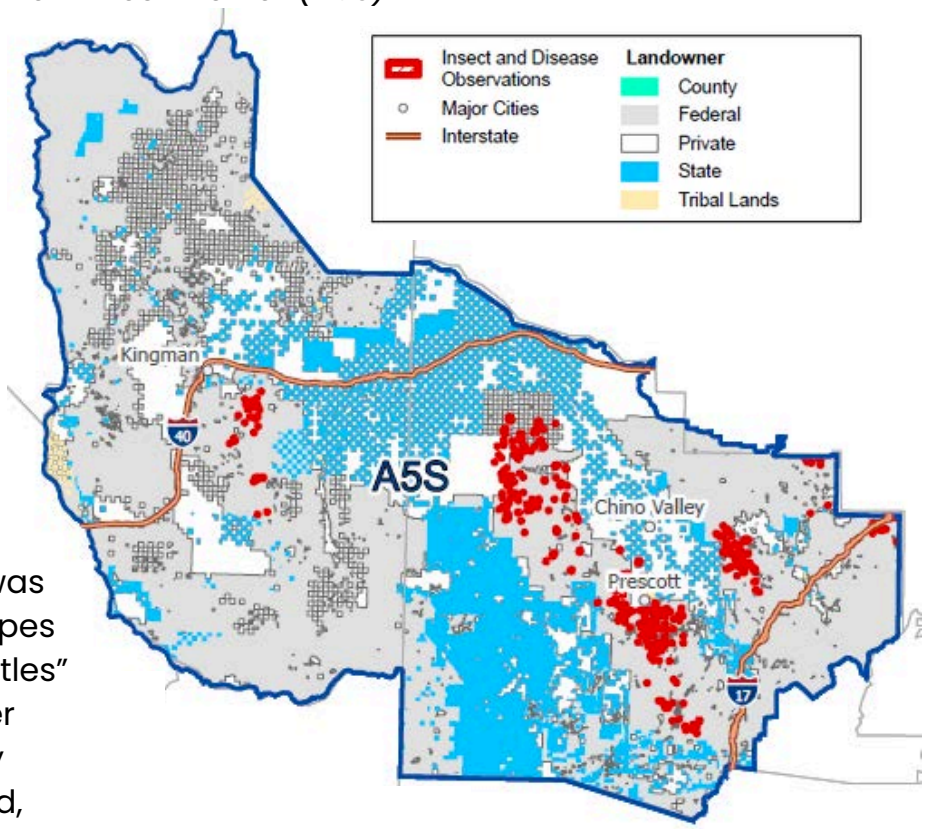
Northwest District (A5S)

Status of Insects

The Northwest District (A5S) is composed of the Prescott National Forest, Lake Mead National Recreation Area, Fort Mohave Reservation, and the Havasu National Wildlife Refuge; these areas are surrounded by scattered county and state lands, with some military reservation lands as well (Appendix I).

Figure 23 is a map showing all insect and disease observations within the Northwest District. The majority of insect observations occurred on federal lands, with over 1,800 acres with observed bark beetle mortality, roughly 11 acres with observed defoliator damage, and over 2,900 acres with observed sap feeding insect damage, occurring throughout Arizona's Northwest District (Table 26).

Figure 23. All Insect and Disease observations within the Northwest District (A5S) - 2024



The bark beetle mortality observed throughout the Northwest District was caused by more than 5 different types of bark beetles. "Unknown Bark Beetles" caused the most damage with over 1,800 acres with observed mortality (Table 26). As previously mentioned, this category of unknown bark beetles includes all the bark beetles that attack ponderosa pines. As more than one species often contributes to the decline and death of ponderosa he majority of this bark beetle caused mortality occurred on federal lands (Figure 23). This mortality was a significant increase from 2023, when over 300 acres were observed with bark beetle *caused mortality.*

A5S - Estimated Acres of Observed Insect Damage by Land Ownership				
Disease Causal Agent	**Federal**	**Private**	**State**	**Grand Total**
Bark Beetles	1,736.67	127.06	19.60	1,883.33
Defoliators	0.87		10.30	11.17
Sap Feeders	2,067.20	835.71	35.31	2,938.22
Unknown Bark Beetle	1,714.00	124.81	19.10	1,857.91
Grand Total	**5,518.74**	**1,087.58**	**84.32**	**6,690.64**

Table 26. Estimated Acres of Observed Insect Damage observations by land ownership within the Northwest District (A5S) - 2024

A5S - Estimated Acres with Observed Bark Beetle Damage by Land Ownership				
Bark Beetle Damage Causal Agent	**Federal**	**Private**	**State**	**Grand Total**
Cedar & Cypress Bark Beetles		1.00		1.00
Douglas-Fir Beetle	1.25			1.25
Fir Engraver	15.17			15.17
Pinyon Ips	6.25	1.25	0.50	8.00
Unknown Bark Beetle	1,714.00	124.81	19.10	1,857.91
Grand Total	**1,736.67**	**127.06**	**19.60**	**1,883.33**

Table 27. Estimated Acres of Observed Bark Beetle Damage Observations by land ownership within the Northwest District-2024.

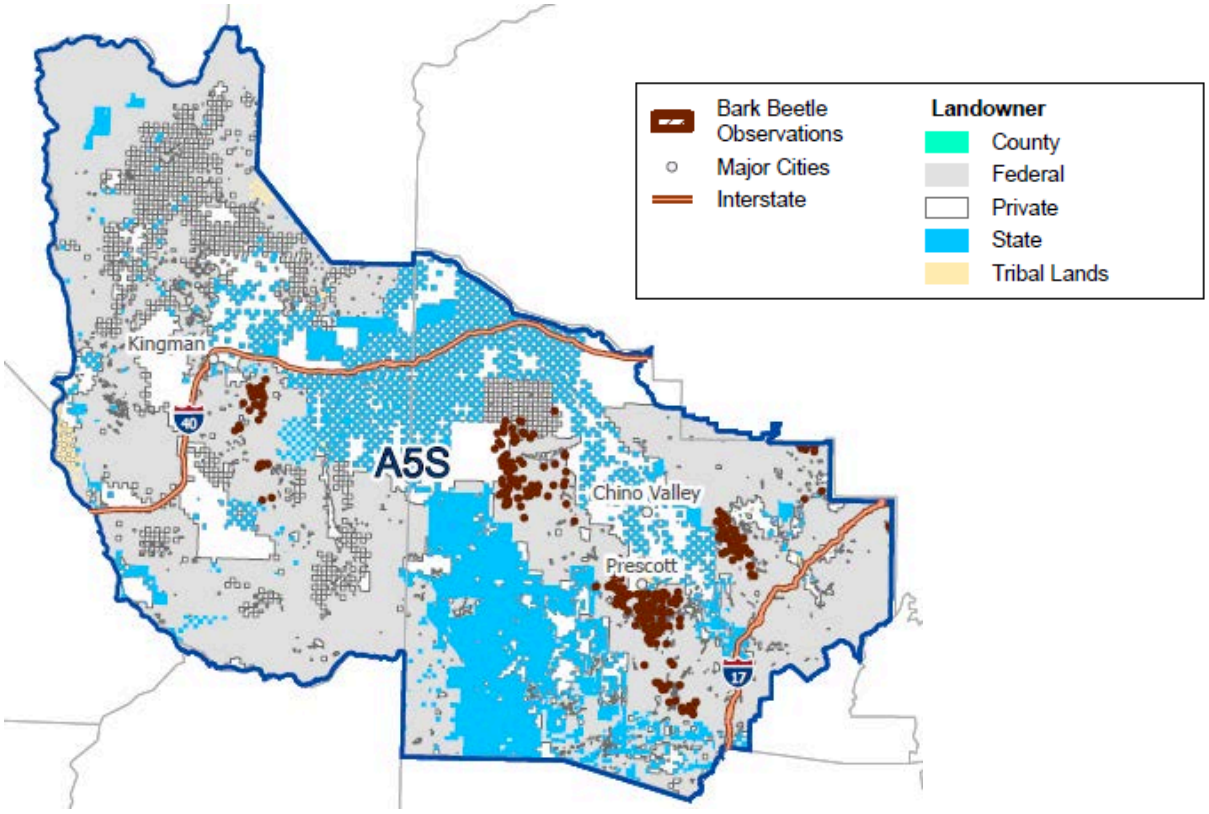


Figure 24. All Bark Beetle Damage observations within the Northwest District (A5S) - 2024

Additional insect damage was observed in the Northwest District (A5S); this damage was identified as sap-feeding and defoliator insect damage (Table 26), with all sap-feeding insect damage attributed to pinyon needle scale. Pinyon needle scale (*Matsucoccus acalyptus*) is a sap sucking insect that attacks pinyon pines. Pinyon needle scale can cause needles to yellow and drop early. Repeated attacks can cause reduced growth, and stunted needles. Severe outbreaks may kill small trees, while larger trees can become more susceptible to bark beetle attacks. This year 2,938 acres with pinyon needle scale damage was observed in the Northwest District (Table 26).



Photo: Bark Beetle damage on the Prescott National Forest-2024

Status of Unknown and Non-Infectious Disorders

This year roughly 591 acres with observed drought damage was identified within the Northwest District (Table 28); mostly on federal lands (Figure 25). This is a significant increase from 2023 which only observed less than an acre of drought damage in the Northwest District. Over 280 acres were observed with unknown damage (Table 28). Of these 280 acres with unknown damage, just over 270 acres were observed with unknown defoliation. These areas were not able to be confirmed on the ground, thus their damage causal agent remains as unknown damage.

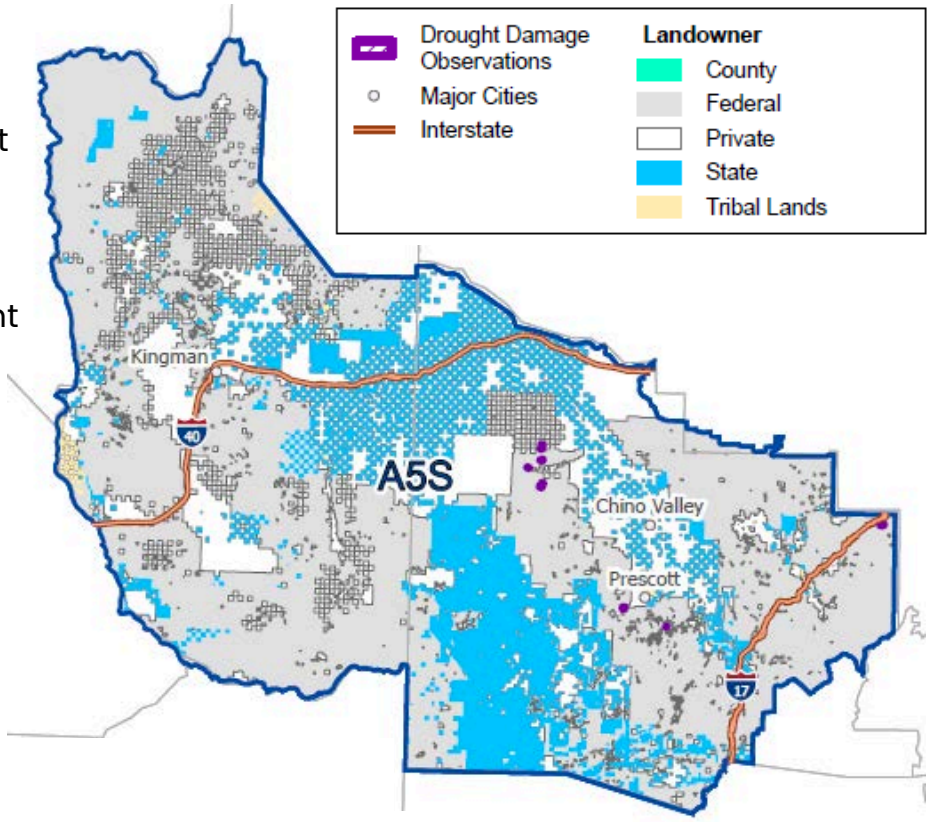


Figure 25. All Drought Damage observations within the Northwest District (A5S) - 2024

A5S - Estimated Acres with Observed Disease Damage by Land Ownership				
Disease Causal Agent	**Federal**	**Private**	**State**	**Grand Total**
Drought	568.87	22.40		591.27
Unknown	272.26	6.60	3.54	282.39
Grand Total	**841.13**	**28.99**	**3.54**	**873.66**

Table 28. Estimated Acres of Observed Abiotic and Unknown Damage Observations by land ownership within the Northwest District-2024.

A5S - Estimated Drought Damage by Host and DFFM District			
Host	**Federal**	**Private**	**Grand Total**
All tree species	251.42	4.72	256.14
Ponderosa pine	76.46	9.93	86.39
Two-needle,mexican & border pinyon, az pine	241.00	7.74	248.74
Grand Total	**568.87**	**22.40**	**591.27**

Table 29. Estimated Acres of Observed Drought Damage Observations by host and land ownership within the Northwest District-2024.

A5S - Estimated Acres with Unknown Damage by Land Ownership				
Damage Type	**Federal**	**Private**	**State**	**Grand Total**
Crown Dieback		0.50		0.50
Crown Discoloration	10.65			10.65
Defoliation	261.61	6.10	3.54	271.24
Grand Total	**272.26**	**6.60**	**3.54**	**282.39**

Table 30. Estimated Acres of Observed Unknown Damage Observations by land ownership within the Northwest District-2024.

Mediterranean Pine Engraver



Photo: MPE. Photo Credit: Chris Baptista, Entomology Program Manager, AZDA

The Mediterranean pine engraver (*Orthotomicus erosus*), or MPE, was first discovered in the Central Valley of California in 2004. Since its introduction, this non-native bark beetle has steadily spread to Arizona. In 2018, the AZ DFFM began monitoring for the presence and distribution of MPE, to determine if it had become established in the Phoenix Metro area. This monitoring program collected over 355,000 MPE beetles from 2018 through 2022; the data collected from these four years of trapping helped DFFM confirm its establishment in the Phoenix metro area and Tucson. In 2023 Early Detection Rapid Response trapping efforts in collaboration with the USDA Forest Service found MPE to have spread to Pinetop-Lakeside, Nogales, Superior, Topock, and Kingman. In 2024 additional trapping efforts confirmed MPE in in two new locations; Sedona and Cottonwood. These observations indicate the range of this beetle increasing into higher elevations and becoming a possible threat to native tree species. At this point, MPE has only been found in urban forests. But due to its large host range, this invasive insect poses the risk of infesting wildland forests, underscoring the importance of continued monitoring and exploring management options.



Photo: Insect Funnel Trap used for monitoring MPE in the Phoenix Metro area.

Projects and their descriptions:

Invasive Insect Monitoring: This project will carry on with trapping efforts across the state in 2025 for the detection of non-native insect pests of trees. We will expand this monitoring program to several Arizona cities that have not yet been monitored, including Safford, Prescott Valley, Camp Verde. This will help determine the spread and severity of MPE, along with other invasive insects, in each city.

Push-pull Assessment: This project will continue in parks around Phoenix with the intention of reducing MPE populations in these localized areas. This strategy will test different push pull methods to test the ability of verbenone, a known bark beetle deterrent (anti-aggregation), to "push" MPE out of an area. This project will help assess if verbenone has an effect on MPE behavior.

Host Tree Assessment: This project involves working with local tree care contractors and tree care professionals in urban areas around the state to collect bark beetles from recently cut conifer trees. This assessment will help us to determine which bark beetle species, including MPE, are attacking Arizona's ornamental conifers.
Bolt Assessment: Similar to the Host Tree Assessment, this project will be looking to see which native tree species are susceptible to an MPE attack. We will bait native logs (bolts) with MPE lures to see if the beetles are able to bore into and reproduce in these trees. Knowing which native species are susceptible to MPE will help us predict their spread throughout the state.

Emerald Ash Borer

As invasive insects such as MPE spread through Arizona, other, potentially more harmful insects such as the Emerald Ash Borer (EAB) spread closer to the Arizona border. In 2024, trapping efforts for EAB began, and at this time, EAB has NOT been found in Arizona, and AZ DFFM will continue monitoring in 2025. The AZ DFFM is working to improve public awareness and create a preparedness plan for communities to help slow the spread.

Emerald Ash Borer Emerald Ash Borer (EAB, *Agrilus planipennis*) is a non-native, invasive insect spreading through the US. This insect attacks and kills ash trees of all sizes and species and has recently been found to attack and kill olive species as well. Many ash species are native to Arizona, along with many planted olive species, making this pest especially concerning. EAB is a woodboring beetle that feeds on the tissue underneath the bark of the tree, girdling the tree. Again, this insect has not been detected in AZ but continues to spread westward, now in Oregon and Colorado. The Arizona Department of Forestry and Fire Management will continue to monitor for this pest in the spring of 2025. DFFM has begun outreach efforts for EAB and other westward-spreading invasive insects to help increase public awareness.



Photo: EAB purple sticky trap used for monitoring EAB in Gilbert, AZ

Department of Forestry and Fire Management

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ARIZONA DEPARTMENT OF FORESTRY & FIRE MANAGEMENT

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Appendix I: AZ DFFM Districts

