New Mexico Forest Health Conditions Report, 2015

Widespread and severe spruce mortality, San Juan Mountains (NM/CO border)

Energy, Minerals, and Natural Resources Department
Forestry Division

1. Summary

New Mexico State Forestry (NMSF) Division cooperates with United States Department of Agriculture (USDA), Forest Service, Forest Health Protection (FHP), NM Zone to conduct annual insect and pathogen surveys of the state's forests and woodlands. The majority of data is collected by aerial detection survey[1] (ADS). Additional information is gathered through interactions with the private sector, the observations of NMSF personnel, ground checks, and ongoing research. The following report describes what forest health specialists and aerial surveyors documented across New Mexico in 2015. ADS data and associated maps (**Appendix 1**) were produced in partnership with FHP staff. Observational data was provided by NMSF Division's Forest Health Specialist.

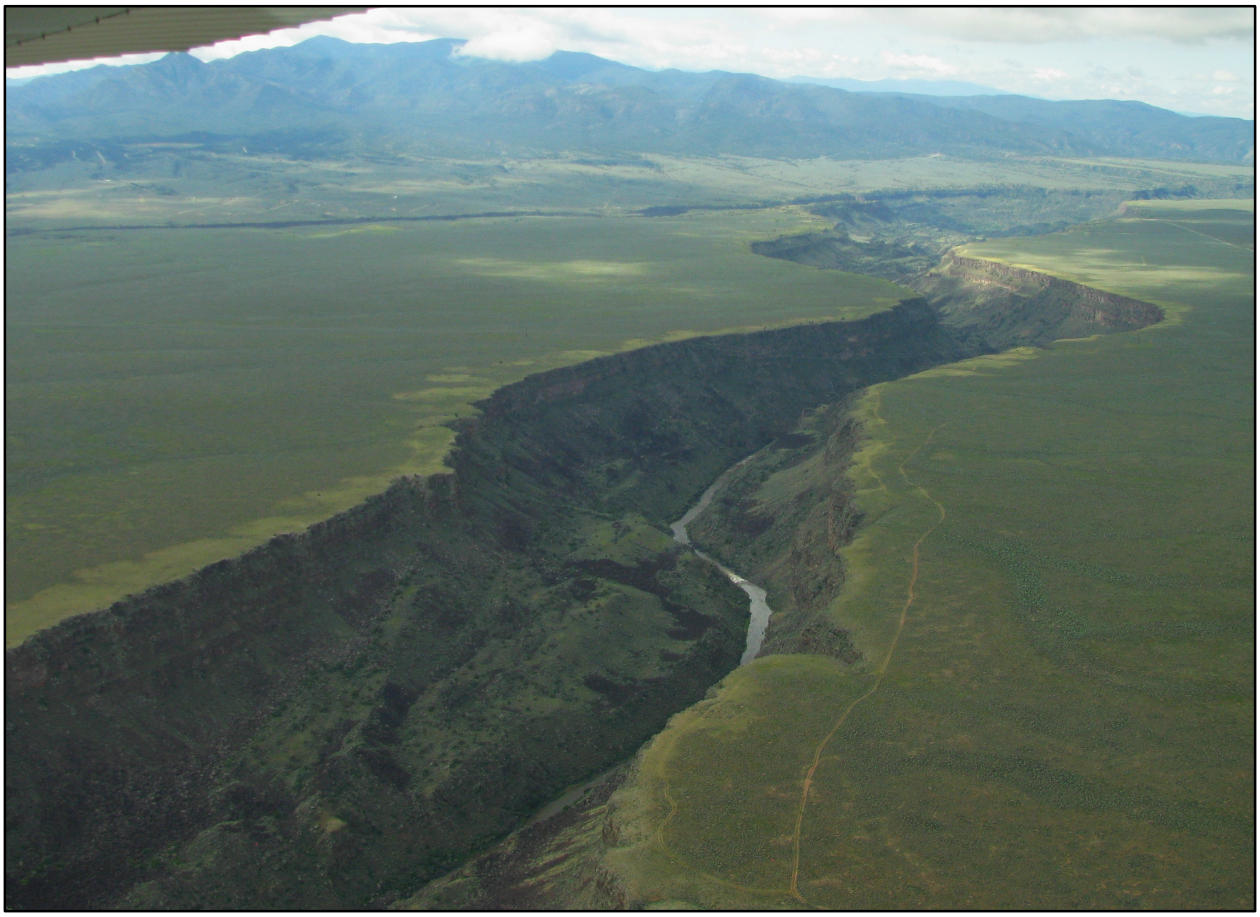
A variety of defoliating and tree-killing forest insects and pathogens were identified and mapped by ADS during the 2015 flight season. The surveys encompassed ~11.5 million acres of forests and woodlands, including ~2.7 million acres of state and private lands. Across the entire state, ~399,000 of the acres surveyed were damaged[2] by insects and pathogens. This is a considerable decrease (-28%) from the ~552,000 acres of damage mapped in 2014 (**Table 1; Fig. 1**). Of this damage, 29% (~117,000 acres) occurred on state and private land, which is a corresponding decrease (-22%) from the ~149,000 acres mapped in 2014 (**Table 2; Fig. 1**). Statewide trends for defoliation and mortality have declined since 2012 and 2013, respectively (**Fig. 2**), and overall damaged acres across New Mexico decreased by nearly 50% since 2013.

Much of the difference between 2014 and 2015 was due to an uncharacteristically wet spring coupled with a moderate-to-strong summer monsoon. In short, long-term drought conditions abated in 2015, contributing to sharp reductions in defoliator and bark beetle activity across New Mexico. Despite these encouraging trends, severe activity was observed in portions of the state:

i) Aspen and mixed conifer defoliation north of Interstate 40;
ii) Ponderosa pine mortality on the Black Range and Sacramento Mountains;
iii) Mixed conifer mortality on mid-to-high elevation slopes statewide;
iv) Spruce mortality at the NM/CO border and on portions of the Jemez and Sangre de Cristo Mountains.

These issues emphasize the continued need for managers to develop and conduct silvicultural treatments to reduce the density of much of the state's forests and woodlands. Insect infestations and forest disease complexes (many interacting factors) are nearly impossible to suppress or control once in place; therefore, prevention is the proper forest health strategy. Prevention is achieved by restoring the capacity of a forest ecosystem to resist disturbance, recover quickly, and retain vital structure and function. This is called *forest resiliency*. Without resilient forests, damage will continue until the responsible agents run out of host or the drought fully abates.

Mastication of overly dense piñon-juniper, Sandia Mountains


ADS, Rio Grande Gorge

[1] ADS datasets are collected under difficult conditions and are not intended to replace more specific forest health information. An accuracy assessment has not been done for this dataset; however, ground checks were completed in accordance with local and national guidelines. USDA Forest Service, FHP and NMSF Division shall not be held responsible for missing or inaccurate data. Maps and data may be updated without notice.

[2] Much like a fire, not all of the trees in a damaged area are defoliated or killed. Areas may be mapped with more than one damage agent. The acres reported represent the total "footprint" of damaged acres, with no multiple counting of acres.

2. Observed Forest Health Conditions

2.1. Technical assistance

The NMSF Forest Health Specialist provided a broad range of technical assistance to private landowners and various state and federal agencies in 2015 (**Table 3**). There were 79 documented requests for technical support; 37% of these interactions involved crown dieback or mortality of conifers and 19% were requests for insect or pathogen identification. Of these interactions, 15 required direct site visits. Compared to last year when piñon mortality was rampant across the Sandia and Manzano Mountains, requests for support regarding conifer dieback or mortality were half as frequent, while requests for identification were considerably more frequent.

The picture below illustrates why a proper sample is superior to casual observations and anecdotal evidence. Based solely upon the descriptions of a private landowner's visual observations, this banded ash borer was initially identified as a non-native sirex woodwasp. Please submit samples along with diagnostic requests whenever possible.

Banded ash borer, a native longhorn beetle

2.2. Defoliation agents

Defoliation agents cause striking visible damage, but do not often kill mature trees outright. The direct effects of defoliation are reduced vigor and photosynthetic capacity. Successive years of severe defoliation can cause crown dieback and, ultimately, tree mortality. In general, defoliation weakens trees and predisposes them to the attack of more threatening damage agents. Statewide defoliation decreased by 26% from 2014 to 2015.

2.2.1. western spruce budworm (*Choristoneura occidentalis*)

Douglas-fir, spruce, and true fir are the preferred hosts of this moth. Infestations can be widespread and severe, resulting in entire landscapes of damaged forest type. The mountains of northern New Mexico are currently experiencing a savage, multi-year spruce budworm outbreak. However, budworm activity peaked in 2011 at ~500,000 acres and has now leveled off between 200,000 and 300,000 acres. With such a high population already in place, similarly large defoliation footprints are likely until conditions improve for mixed conifer forests.

2.2.2. Douglas-fir tussock moth (*Orgyia pseudotsugae*)

Douglas-fir, spruce, and white fir are the preferred hosts of this moth. Defoliation is often complete in both overstory and understory trees, and, unlike other common defoliators, severe outbreaks can cause mortality in less than two years. Tussock moth defoliation in New Mexico is rarely widespread, but outbreaks are highly visible and troublesome (due to tussockosis) when they occur near population centers. Only ~1,600 acres of tussock moth activity were mapped, which is a slight reduction from 2014.

2.2.3. needlecast

Several different species of needlecast fungi attack conifers in New Mexico. These fungal pathogens are uncommon in the Southwest because the weather conditions required for infection and reproduction (i.e., high humidity, splashing rain, etc.) are not present in the spring and/or fall when the fungi require them. Spring 2015 was uncommonly wet for New Mexico, and *Lophodermium* spp. on piñon, *Davisomycella* spp. on ponderosa pine, and *Rhizosphaera* spp. on spruce were reported and observed across the state. Of the three, piñon was the most widespread host infected. These fungi caused a combined total of ~5,000 acres of statewide defoliation, which is an 87% increase from 2014. The picture below shows the symptoms but not the signs (fruiting bodies) of needlecast.

Lophodermium needlcast, piñon

2.3. Mortality agents

The primary cause of tree mortality in New Mexico is the activity of native bark beetles. Endemic (non-outbreak) beetle populations always have, and always will, kill New Mexican trees as part of an ordinary cycle. Problematic tree mortality occurs when endemic populations switch to an epidemic phase, leading to widespread and severe outbreaks that have sizeable impacts on the ecology of entire forested regions. These outbreaks have strong relationships with environmental factors that reduce tree defenses, especially prolonged drought. Statewide mortality decreased by 40% from 2014 to 2015, largely because abundant moisture allowed conifers to produce pitch to defend against bark beetle attacks.

Unsuccessful ("pitched out") bark beetle attack, ponderosa pine

2.3.1. ponderosa pine bark beetles

Dendroctonus and *Ips* bark beetles attack New Mexico's ponderosa pine. The important species in these two genera are: pine engraver (*I. pini*); western pine beetle (*D. brevicomis*); roundheaded pine beetle (*D. adjunctus*); and red turpentine beetle (*D. valens*). Each beetle exhibits different behaviors and attack preferences, but all result in tree death. These bark beetles caused a combined total of ~32,000 acres of statewide ponderosa pine mortality, which is a 54% decrease from 2014. Despite this dramatic decrease, southern portions of the state continue to suffer from the severe impacts of ponderosa bark beetles.

2.3.2. mixed conifer bark beetles

Fir engraver (*Scolytus ventralis*) and Douglas-fir beetle (*D. pseudotsugae*) attack New Mexico's white and Douglas-fir, respectively. They caused a combined total of ~58,000 acres of statewide mixed conifer mortality, which is a 21% decrease from 2014. Despite this decrease,

mixed conifer forests continue to be one of the most assailed forested habitats in New Mexico. Historically imbalanced tree species distributions and overly dense forest conditions beget the constant threat of bark beetle outbreaks and catastrophic wildfire.

2.3.3. spruce-fir bark beetles

Spruce beetle (*D. rufipennis*) and western balsam bark beetle (*Dryocoetes confusus*) attack New Mexico's spruce and subalpine fir, respectively. Extensive spruce mortality in southern Colorado has been documented and monitored for years, and now, as was inevitable, spruce beetle populations have spread into northern New Mexico. ADS mapped ~34,000 acres of statewide spruce-fir mortality, which is a 38% *increase* from 2014. Nearly all mortality occurred in spruce, which gives spruce beetle the bitter distinction of being the only major bark beetle to gain acres from last year. Given the new outbreaks south to the Santa Fe NF and the lessons learned from Colorado, the threat of imminent landscape-level spruce mortality is high.

2.3.4. pinyon ips (*I. confusus)*

The pinyon ips outbreaks of the last two years on the Manzano and Sandia Mountains have subsided. Only 210 acres of piñon mortality were mapped, which is a 99% decrease from 2014. Early spring freeze events killed overwintering adults and ample water provided for defensive pitch production.

2.4. Multiple agent types

Several tree species are damaged by a set of defoliation and mortality agents that cannot be distinguished during ADS. Rather than introduce errors into the dataset, damaged acres are mapped by tree host instead of agent. These sets of agents have no overlap with the agents that are mapped for other hosts.

Severe aspen defoliation, Sangre de Cristo Mountains

2.4.1. aspen

Aspen is biologically and economically important to New Mexico because it provides high amounts of habitat and aesthetics. Of the broad set of insects that defoliate aspen, the western tent caterpillar (*Malacosoma californicum*) was this year's most important species. Impressive western tent caterpillar outbreaks were observed on the Santa Fe NF in the Pecos River watershed and near the Santa Fe ski area. Despite these localized outbreaks, there was a 58% statewide decrease in aspen defoliation since 2014. Aspen mortality experienced a steep increase (>100%) in mapped acres, but overall acres remain low compared to the outrageous regional losses observed during the mid-2000's.

2.5. Emerging agents

2.5.1. tamarisk (saltcedar) leaf beetles (*Diorhabda* spp.)

Tamarisk leaf beetle is an exotic biocontrol agent that entered New Mexico from legal introductions in Utah, Colorado, and Texas. Several species of leaf beetle currently defoliate tamarisk along river corridors statewide. The northern half of the state has the northern tamarisk beetle (*Diorhabda carinulata*), an ecotype adapted to colder environments. A newer introduction to the southern half of the state is the subtropical tamarisk beetle (*Diorhabda sublineata*), an ecotype adapted to warmer environments. The southern population advanced north of Elephant Butte Dam in 2015, and the two species will soon meet in central New Mexico. These converging outbreaks offer land mangers an exciting chance to intensify control efforts for the non-native, invasive tamarisk where it has replaced cottonwood, willow, and other native riparian tree species.

Tamarisk leaf beetle, mating pair

3. Conclusions

Forest health in the state of New Mexico is closely tied to climatic trends and large-scale weather cycles. These include the El Niño Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), and others. These cycles impact New Mexico's weather by controlling the location of high and low pressure centers, which, in turn, dictate precipitation across the state. New Mexico's long-term climate follows a bimodal distribution of precipitation, with spikes in winter and the summer monsoon. Trees suffer during the warm and dry spring because the timing of seasonal drought coincides with insect emergence and attack. The unusually wet 2015 spring provided our forests with much-needed relief from years of deep, multi-year drought and associated insect outbreaks. 2015 will be remembered as when moisture finally returned to New Mexico after long absence.

The National Oceanic and Atmospheric Administration predicts that 2016 has the potential to have the best moisture conditions since 1941, which was by far the wettest year on record (**Fig. 3**). Factors predicting a wet 2016 are: super ENSO; positive PDO; elevated sea surface temps along the Pacific Coast; an above-average monsoon; and the synergy of all factors together (no confounding effects). In short, the precipitation of 2015 and an expected wet 2016 are good news for New Mexico's short-term forest health.

Strong monsoon, lower Rio Grande

Cantharellus roseocanus, a newly classified southwestern chanterelle

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Photographs taken by Tom Zegler

Table 1. Aerial survey results for forest insect and pathogen activity on all jurisdictional lands in New Mexico, 2015

Class	Name	2015 acres	2014 acres	% Δ[1]
Defoliation				
By host[2]				
	aspen	25,360	60,780	-58
	oak	420	0	–
	cottonwood	40	150	-73
By agent				
	western spruce budworm	242,170	302,560	-20
	needlecast (multiple hosts)	5,010	2,680	87
	tamarisk leaf beetle	2,710	450	>100
	Douglas-fir tussock moth	1,570	1,920	-18
	pine sawfly	140	990	-86
	unknown (multiple hosts)	130	580	-78
	pinyon needle scale	0	4,480	-100
	defoliation summary	277,550	374,590	-26
Mortality				
By forest type[3]				
	mixed conifer	58,420	73,870	-21
	spruce-fir	32,900	23,900	38
By host[2]				
	ponderosa pine	32,470	70,400	-54
	aspen	7,340	2,590	>100
	southwestern white pine	100	380	-74
	cottonwood	90	100	-10
	oak	70	0	–
	saltcedar	0	80	-100
By agent				
	pinyon ips	210	45,970	-99
	cedar bark beetle	50	930	-95
	mortality summary	131,650	218,220	-40
Other				
	dieback (multiple hosts)	2,630	950	>100
	discoloration (multiple hosts)	250	430	-42
	branch flagging (multiple hosts)	40	60	-33
	other summary	2,920	1,440	>100
	grand summary	412,120	594,250	-31
	total area mapped[4]	398,810	551,730	-28

[1] (2015 acres – 2014 acres) / 2014 acres * 100

[2] Damage to a single tree species caused by multiple known agents that cannot be distinguished from the air

[3] Damage to multiple commingled tree species caused by known agents

[4] Areas may be mapped with more than one damage agent. The total area mapped represents the "footprint" of damaged area, with no multiple counting of acres; summary values reflect multiple counting

Table 2. Aerial survey results for forest insect and pathogen activity on state and private lands in New Mexico, 2015

Class	Name	2015 acres	2014 acres	% Δ[1]	% all lands[2]
Defoliation					
By host[3]					
	aspen	8,060	20,590	-61	32
	oak	30	0	–	7
	cottonwood	10	110	-91	25
By agent					
	western spruce budworm	82,670	80,690	2	34
	needlecast (multiple hosts)	2,060	2,100	-2	41
	tamarisk leaf beetle	2,240	60	>100	83
	Douglas-fir tussock moth	490	140	>100	31
	pine sawfly	50	990	-95	36
	unknown (multiple hosts)	0	80	-100	0
	pinyon needle scale	0	0	–	0
	defoliation summary	95,610	104,760	-9	34
Mortality					
By forest type[4]					
	mixed conifer	16,790	22,870	-27	29
	spruce-fir	3,100	2,480	25	9
By host[3]					
	ponderosa pine	2,120	8,060	-74	7
	aspen	2,410	220	>100	33
	southwestern white pine	0	*	-100	0
	cottonwood	60	80	-25	67
	oak	0	0	–	0
	saltcedar	0	70	-100	0
By agent					
	pinyon ips	70	21,750	-99	33
	cedar bark beetle	50	240	-79	100
	mortality summary	24,600	55,770	-56	19
Other					
	dieback (multiple hosts)	140	380	-63	5
	discoloration (multiple hosts)	210	330	-36	84
	branch flagging (multiple hosts)	30	0	–	75
	other summary	380	710	-46	13
	grand summary	120,590	161,240	-25	29
	total area mapped[5]	116,650	148,740	-22	29

[1] (2015 acres – 2014 acres) / 2014 acres * 100

[2] State and private acres as a percentage of statewide acres (**Table 1)**

[3] Damage to a single tree species caused by multiple known agents that cannot be distinguished from the air

[4] Damage to multiple commingled tree species caused by known agents

[5] Areas may be mapped with more than one damage agent. The total area mapped represents the "footprint" of damaged area, with no multiple counting of acres; summary values reflect multiple counting

* Activity detected, but on less than 5 acres

Table 3. Summary of forest health technical assistance given in 2015

Class	Issue	#[1]	%	Site visit	Confirmed[2] insects & pathogens
Private landowner					
	mortality (conifer)	10	20	1	pinyon ips, pinyon twig beetle
	request (identification)	10	20	0	banded ash borer, dermestid beetle, elm leaf beetle
	dieback (conifer)	7	14	3	pinyon twig beetle, pinyon needle scale, needlecast
	request (info)	7	14	0	–
	defoliation (hardwood)	4	8	2	western tent caterpillar, fall webworm
	dieback (hardwood)	4	8	0	locust borer, poplar twiggall fly
	defoliation (conifer)	4	8	1	tiger moth, pinyon sawfly, pandora moth
	mortality (hardwood)	2	4	1	bronze poplar borer, aspen bark beetle, cytospora canker
	decay (hardwood)	1	2	0	artist's conk
	landowner total	49		8	
State government					
	dieback (conifer)	8	29	0	pinyon needle scale, needlecast
	request (identification)	5	18	0	western tent caterpillar, gymnosporangium rust
	mortality (conifer)	4	14	1	pinyon ips, pouch fungus
	request (info)	4	14	0	–
	decay (hardwood)	2	7	1	cottonwood trunk rot, walnut trunk rot
	defoliation (hardwood)	2	7	1	aspen skeletonizer, saltcedar leaf beetle
	mortality (hardwood)	2	7	2	ash bark beetle, sooty bark canker
	defoliation (conifer)	1	4	0	pine sawfly
	state total	28		5	
Federal government					
	defoliation (conifer)	1	50	1	pandora moth
	mortality (hardwood)	1	50	1	locust borer
	federal total	2		2	
	grand total	79		15	

[1] Number of requests for technical assistance
[2] Identity determined by site visits, samples, or picture analysis

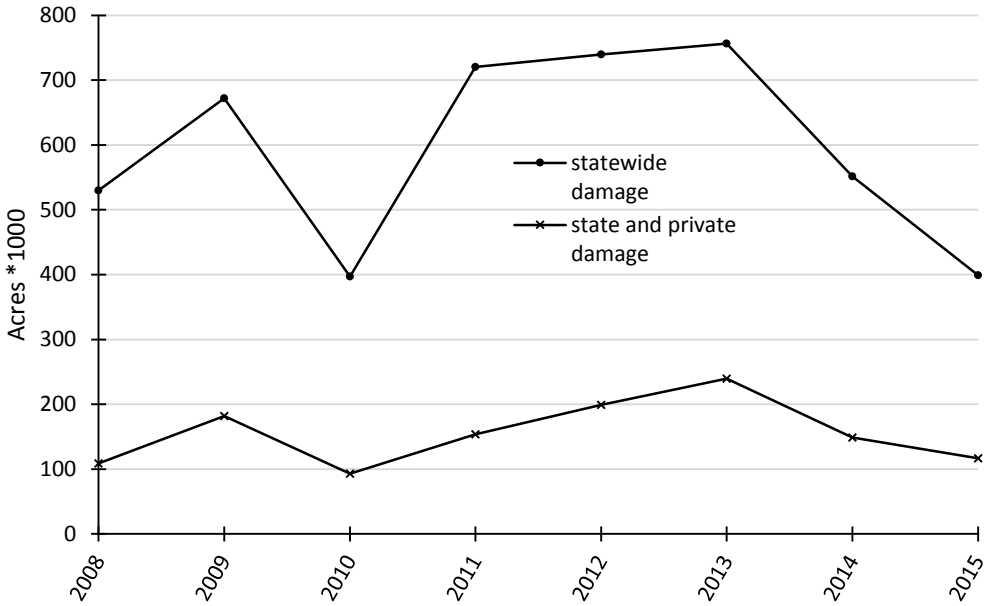


Figure 1. Statewide and state and private forest damage trends in New Mexico; data before 2008 is not directly comparable to current data

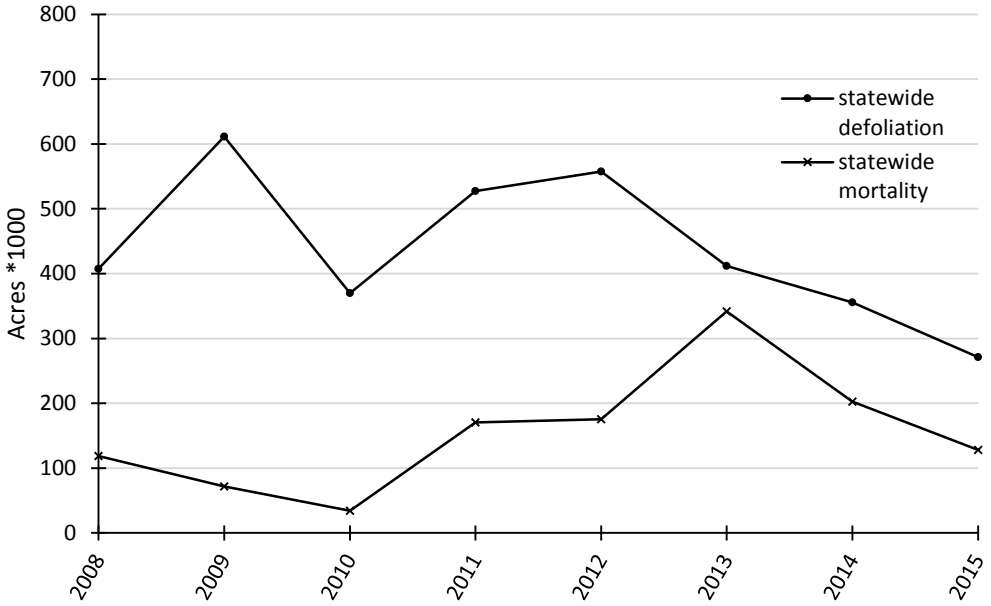


Figure 2. Statewide forest defoliation and mortality trends in New Mexico; data before 2008 is not directly comparable to current data

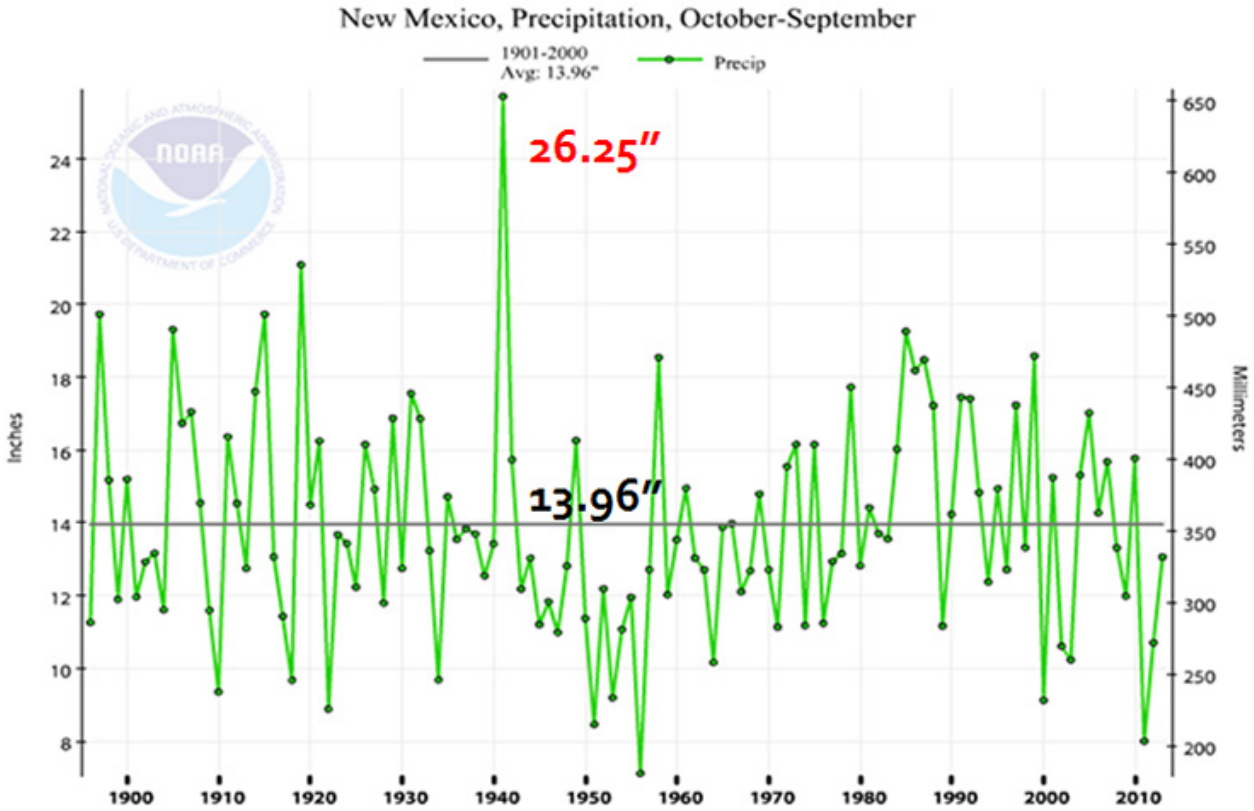
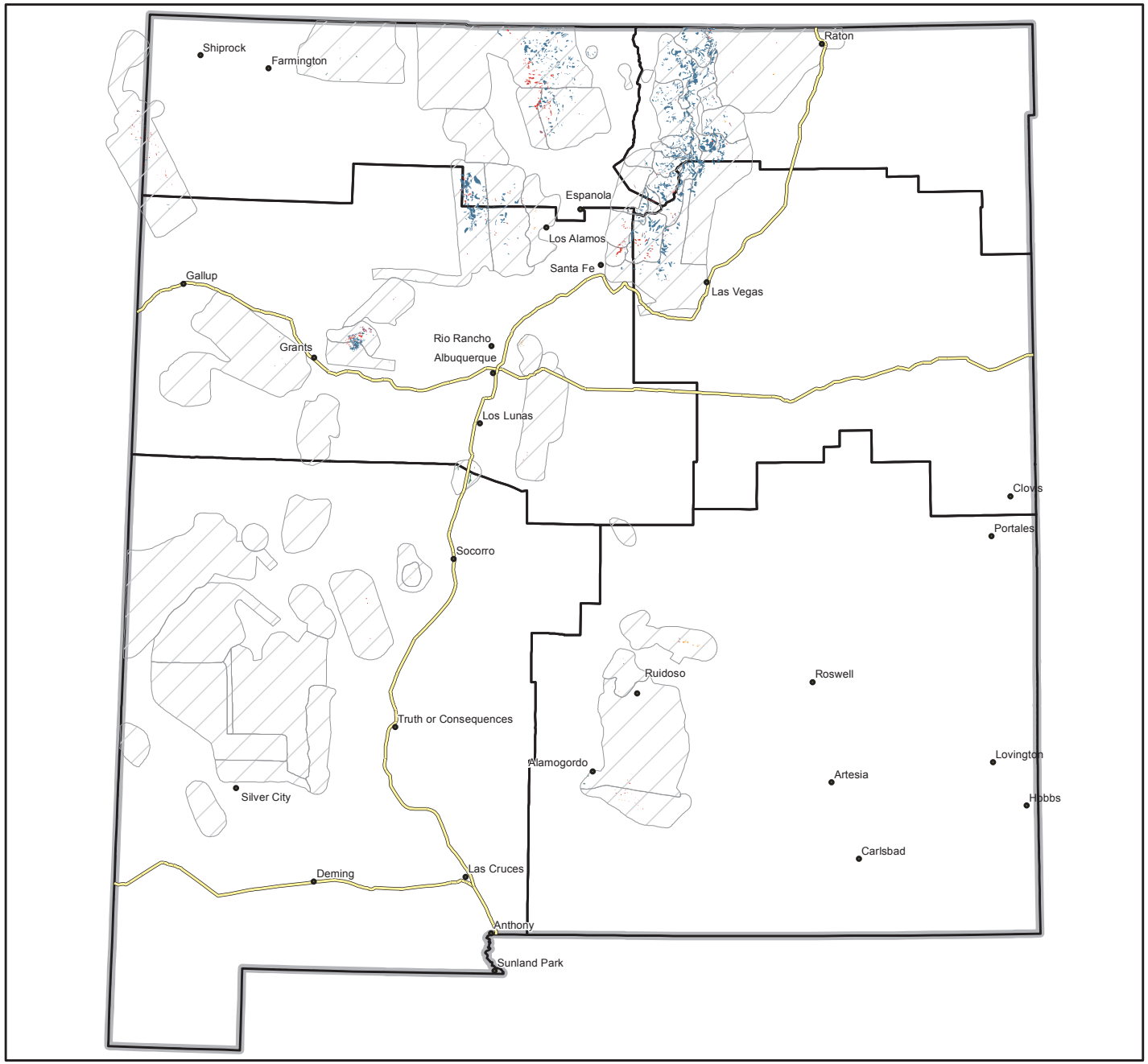


Figure 3. Precipitation trends in New Mexico; 26.25" = observed precipitation in 1941, the wettest year on record (figure provided by the National Oceanic and Atmospheric Administration)

2015 Forest Insect and Pathogen Activity

Defoliation

- Aspen
- Western spruce budworm
- Douglas-fir tussock moth
- Tamarisk leaf beetles
- Needlecast
- Survey Extent
- NMSF Districts
- NM Boundary



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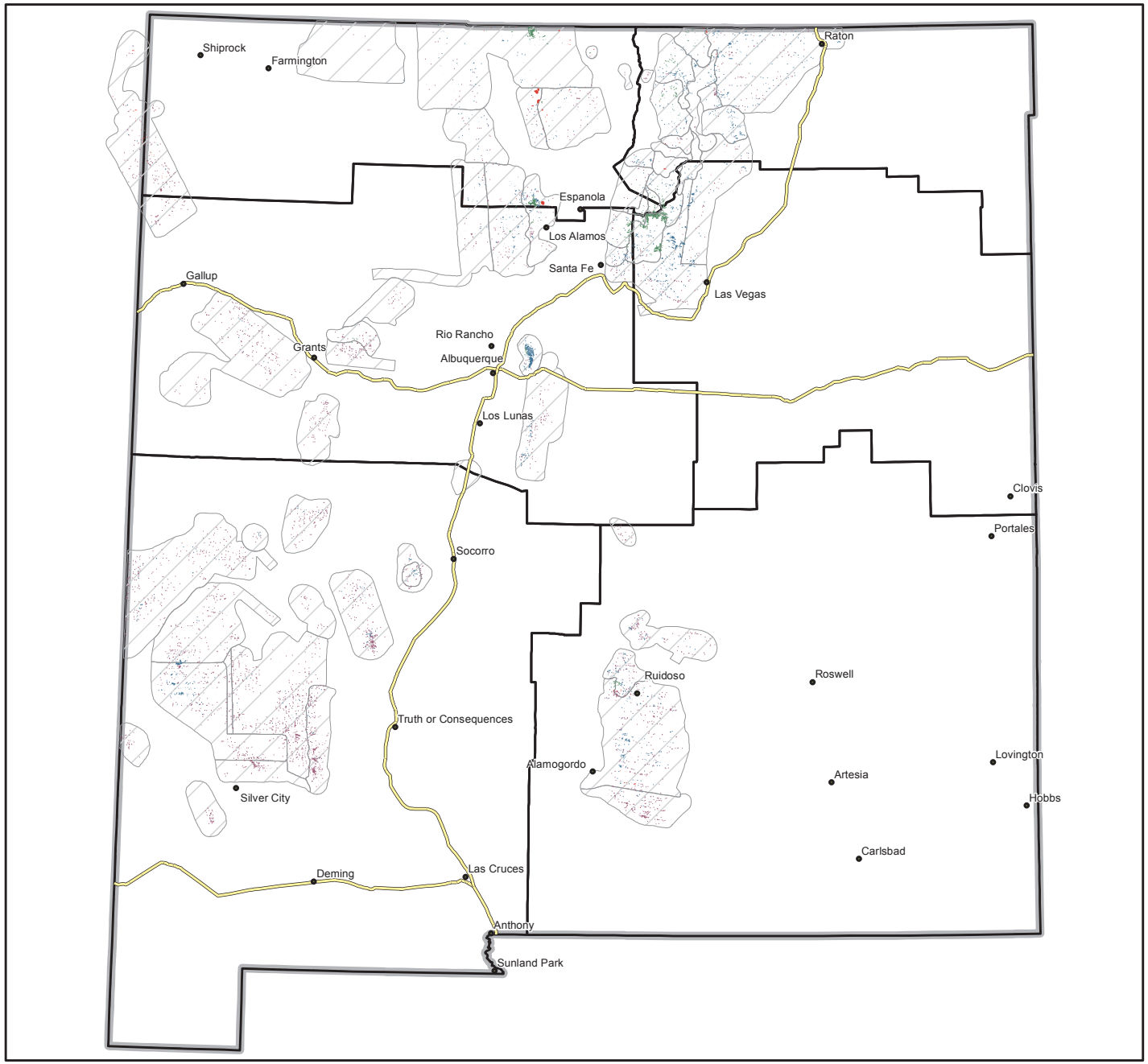
2015 Forest Insect and Pathogen Activity

Mortality

- Ponderosa pine
- Mixed conifer
- Spruce-fir
- Aspen
- Survey Extent
- NMSF Districts
- NM Boundary



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