

New Mexico Forest Health Conditions 2017



Energy, Minerals, and Natural Resources Department
Forestry Division





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Summary

The New Mexico State Forestry (NMSF) Division collaborates with the USDA Forest Service, Forest Health Protection (FHP), New Mexico Zone to conduct annual insect and pathogen surveys of the state's forests and woodlands. The following report describes what forest health specialists, entomologists, pathologists, and aerial surveyors observed and documented across New Mexico in 2017.

Most of the information in this report was collected by aerial detection surveys (ADS)¹. The maps associated with ADS data (**Appendix 1**) were produced in partnership with FHP². Additional materials were gathered through the observations of NMSF and FHP personnel, interactions with the private sector, ground checks, and cooperative monitoring projects.

The 2017 ADS encompassed 10.2 million acres of forests and woodlands, including 2.7 million acres of state and private lands. Across the state, 310,000 acres surveyed were damaged by insects and pathogens³ (**Fig. 1**). This is an 8% increase from the 286,000 damage acres mapped in 2016 (**Table 1**). Of this damage, 84,000 acres occurred on state and private land, which is a slight increase (+2.5%) from the 82,000 acres mapped in 2016 (**Table 2; Fig. 1**) and is mostly due to an increase in defoliation activity (**Fig. 2**).

In 2017, New Mexico's statewide precipitation averaged 0.83 inches above normal (the 51st wettest year on record) offering additional recovery from long-term drought conditions. Despite relief from long-term drought, serious forest damage was observed in some areas:

- Douglas-fir tussock moth outbreak on the Sandia Mountains, near the Balsam Glade Group Picnic Site, Cibola National Forest
- Aspen defoliation (seen from Santa Fe and along Hyde Park Road) near Aspen Vista/Big Tesuque, Santa Fe National Forest
- Western spruce budworm damage on the Carson and Santa Fe National Forests and on private land in Colfax and Taos counties
- Spruce mortality caused by spruce beetle on Elk Mountain (near Terrero, NM), Santa Fe National Forest
- Mixed conifer mortality on middle elevation slopes statewide

These issues emphasize the continued need for managers to develop and conduct silvicultural treatments to reduce tree density on 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 agent(s) run out of hosts.



Cooley spruce gall adelgid (*Adelges cooleyi*) damage on Colorado blue spruce, Santa Fe

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. NMSF and FHP shall not be held responsible for missing or inaccurate data. Maps and data may be updated without notice.

² Geospatial data shown for only defoliation and mortality damage types with ≥ 1000 statewide acres.

³ Damaged areas may be mapped with more than one damage agent. The acres reported in this section represent the total “footprint” of damage, with no multiple counting of acres. Not all trees in a damaged footprint are defoliated or dead.

Observed Conditions

Technical assistance

The NMSF Forest Health Program Manager provided a variety of technical assistance to private landowners and state and federal agencies in 2017 (**Table 3**). Of these, private landowners made up the largest percentage (61%) requesting and receiving technical assistance. There were 76 documented requests for support; 33% involved conifer defoliation or mortality and 18% were requests for insect or pathogen identification. Twelve of these interactions required site visits. Assistance regarding tree health is more frequent during years of drought or when tree damage and mortality occurs near population centers. The Forest Health Program Manager is always available to answer questions or provide technical assistance regarding forest health issues in New Mexico; please call (505) 469-6660 if you have questions or concerns.



Piñon needle scale (*Matsucoccus acalyptus*; black specks on needles) found during a technical assistance site visit, private land, eastern Santa Fe

Defoliation agents

Defoliation agents cause dramatic visible damage, but do not often kill mature trees during a single event. The immediate effects of defoliation are reduced vigor and photosynthetic capacity. Successive years of heavy defoliation can cause growth deformity, crown dieback, and eventually tree death. In general, defoliation weakens trees and predisposes them to the attack of deadlier damage agents. Statewide defoliation increased by 19% from 2016 to 2017, most of which was caused by the western spruce budworm (**Table 1**).

Western spruce budworm (*Choristoneura freemani*)

Western spruce budworm (WSBW) was the most damaging defoliator in 2017 impacting 176,170 acres across New Mexico, which was a 31% increase in mapped acres from the 2016 aerial survey (**Table 1**). Larvae of this moth feed on most mid-to-high elevation conifer species, although in New Mexico, Douglas-fir and true firs (*Abies* spp.) are the preferred hosts. Overstocked mixed conifer forests of New Mexico have led to and sustained high populations of the WSBW over multiple years. Severe infestations can spread across entire forested landscapes without following an apparent pattern. However, the southern half of the state generally does not suffer from the large-scale WSBW defoliation events common north of Interstate 40.



Western spruce budworm (*Choristoneura freemani*) damage, Carson National Forest (photo: Crystal Tischler, US Forest Service, FHP)

Aspen

A broad set of insects and fungi defoliate aspen in New Mexico. Of these, the western tent caterpillar (*Malacosoma californicum*) has been the most important species over the past few years. Many of the aspens along Hyde Park Road near Aspen Vista/Big Tesuque in the Santa Fe National Forest were defoliated by western tent caterpillar in 2015, 2016, and again in 2017; however, these trees seem to be recovering well and have experienced little to no mortality. Moreover, defoliation events in aspen, such as the one along Hyde Park Road (visible from many parts of Santa Fe) can reduce fall foliage colors and negatively impact tourism. There was a 111% statewide increase in aspen defoliation acres from 2016 to 2017 (**Table 1**).



Western tent caterpillar (*Malacosoma californicum*) on aspen, Santa Fe National Forest

Douglas-fir tussock moth (*Orgyia pseudotsugae*)

Douglas-fir and white fir are the preferred hosts of the Douglas-fir tussock moth (DFTM) in New Mexico. Defoliation is often complete in both overstory and understory trees, and, unlike other common defoliators, severe outbreaks of DFTM can cause tree mortality in less than two years. Dispersal is somewhat limited because females are flightless and must reproduce near their place of origin; therefore, DFTM defoliation in New Mexico is rarely widespread, but outbreaks are highly visible and can become a public health concern (due to tussockosis) when

they occur near population centers. In 2016, there was a large DFTM outbreak on Shaggy Peak; however, this population crashed in 2017 likely due to a naturally-occurring virus that attacks this species of moth. In 2017, there was large (~1800 acres) DFTM outbreak on the Sandia Mountains along the Sandia Crest Highway. This busy recreational thoroughfare provided the public with an unobstructed view of a lethal defoliation event (see image below). The population of DFTM in the Sandia Mountains is likely to crash in 2018, due to the same type of virus that impacted the Shaggy Peak population.



Douglas-fir tussock moth (*Orgyia pseudotsugae*) **A**) caterpillar and **B**) defoliation, Sandia Mountains, Cibola National Forest (photos: Dr. Tom Coleman, US Forest Service, FHP)

Piñon needle scale (*Matsucoccus acalyptus*)

Piñon needle scale (PNS) is a native, host specific sap sucking insect pest of piñon trees. Piñon needle scale feeds on needles older than one year, and, due to their limited dispersal ability, often attacks the same trees year after year. The repeated attacks can lead to stunted and/or reduced new growth and crown thinning (see next image), but feeding rarely kills trees. Tree mortality can occur, however, from a combination of PNS feeding, drought, and pinon ips, which are attracted to the stressed trees. Piñon needle scale infestations are more of a concern in the urban forest, where damage is more apparent and could affect aesthetic and property values. Piñon needle scale is widely reported around Santa Fe and has been found in the lower elevations of the Magdalena Mountains. The largest infestations of PNS mapped during the 2017 aerial

detection survey were 880 acres on state and private land in Colfax County and 300 acres on the Mescalero Apache tribal lands (acreage reported is not a contiguous area).



Thinning piñon crown due to severe piñon needle scale infestation, private land, Santa Fe

Mortality agents

The principal 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 a normal predator–prey relationship. However, problematic tree mortality occurs when endemic populations switch to an epidemic phase, which can lead to widespread and severe outbreaks of entire forested regions. These outbreaks can have substantial impacts on ecological processes and can be exacerbated by abiotic factors (e.g. drought, wind storms). Statewide mortality decreased by 16% from 2016 to 2017, primarily because slightly above average precipitation in 2017 helped healthy conifers resist bark beetle attacks with a greater amount of defensive resins. Trends in bark beetle activity since 2008 are provided in **Fig. 3**.



Dendroctonus spp. galleries in southwestern white pine, Magdalena Mountains, Cibola National Forest

Spruce–fir bark beetles

Spruce beetle (*Dendroctonus rufipennis*) and western balsam bark beetle (*Dryocoetes confusus*) attack New Mexico’s spruce and subalpine fir, respectively. There were ~46,000 acres of statewide spruce–fir mortality in 2017, which is a 12% increase from last year. Nearly all spruce–fir mortality occurred in spruce; bark beetle activity in neighboring subalpine fir was extremely low (~1,200 acres). Warm summers and lack of extreme and sustained freezing in the New Mexican high country during the winter are probable contributors of the current population explosion.

Statewide spruce mortality has increased 357% since 2013 and the extremely high spruce beetle populations in Colorado are moving closer to the New Mexico border. This more than likely means that spruce beetle populations in New Mexico will continue to trend upward over the next few years or until a series of harsh winter freezes (below -15°F) in the high country reduce epidemic populations. Until then, the continued threat of imminent landscape-level spruce mortality remains high.

Mixed conifer bark beetles

Douglas-fir beetle (*Dendroctonus pseudotsugae*) and fir engraver (*Scolytus ventralis*) attack New Mexico’s Douglas-fir and white fir, respectively. They caused a combined total of ~24,000 acres of statewide mixed conifer mortality, which is a 27% decrease from 2016 and a 59% decrease since 2015. Despite this dramatic decrease, mixed conifer forests continue to be one of the most assailed forested habitats in New Mexico, i.e. historically imbalanced tree species distributions and overly dense forest conditions exacerbate the threat of bark beetle outbreaks and catastrophic wildfire.

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*). These beetles caused a combined total of ~13,500 acres of statewide ponderosa pine mortality, which is a 37% decrease from 2016 and a 59% decrease since 2015. This decline in activity is apparent everywhere except the forests of southern New Mexico, where ponderosa pine continues to suffer from the severe impacts of long-term bark beetle infestations. The largest amount of area mapped during the 2017 aerial survey was ~7,900 acres on the Gila National Forest, ~1,200 acres on private land, and ~1,800 acres on Navajo tribal lands.

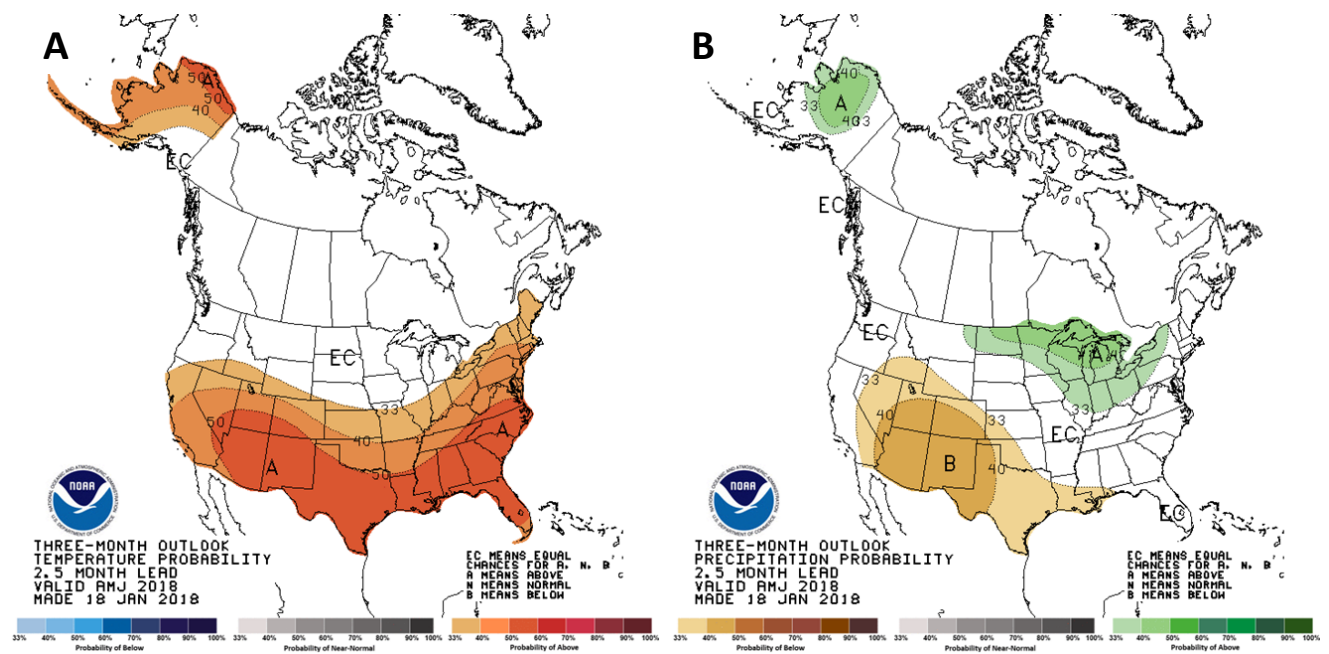
Piñon ips (*Ips confusus*)

Piñon occupy low elevation sites that are particularly prone to drought in New Mexico. Predictable piñon ips outbreaks occur during or following any hot and dry year. Due to multiple years of adequate precipitation, Piñon ips only caused ~100 acres of statewide piñon mortality in 2017, a decrease of 96% since 2016. Most of the piñon ips damage in 2017 occurred on Bureau of Land Management (~34 ac), private (~22 ac), and National Forest lands (~30 ac).

Conclusions

Forest health in the state of New Mexico is tied to climatic trends and large-scale weather cycles. These include the El Niño Southern Oscillation, the Pacific Decadal Oscillation, 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 springs of 2015 and 2016, and slightly above average precipitation of 2017, continue to provide our forests with much-needed relief from years of multi-year drought and associated insect outbreaks (with the exception of spruce beetle).

However, several years of adequate moisture cannot defeat a 15-year drought. Current reservoir levels (some are above last year’s capacity levels) tell a story that is consistent with the region’s long-term moisture deficit (**Table 4**). Of the ten largest reservoirs in New Mexico, only four are above 30% capacity, and three are above their respective 30-year average. Averaged together, these large reservoirs are 10% below average capacity. Unfortunately, the National Oceanic and Atmospheric Administration predicts a 50% probability of above average temperatures and 40% probability of below average precipitation for the spring and early summer of 2018 (see graphic below). This could lead to an increase in insect activity across New Mexico in 2018.



Three-month probability outlook for **A**) temperature and **B**) precipitation for the spring and early summer 2018 (source: NOAA Climate Prediction Center)

Table 1. Aerial detection survey results for forest insect and disease activity on all lands in New Mexico in 2016 and 2017

Damage Type ¹	2017 acres	2016 acres	% change ²
DEFOLIATION			
<i>by host</i> ³			
aspen	46,670	22,140	111
<i>by agent</i>			
western spruce budworm	176,170	134,670	31
needle cast (multiple hosts)	1,970	14,640	-87
Douglas-fir tussock moth	3,070	10,870	-72
piñon needle scale	1,330	890	49
pine sawfly	520	640	-19
unknown (multiple hosts)	610	410	49
Defoliation Total	230,340	184,260	25
MORTALITY			
<i>by forest type</i> ⁴			
spruce-fir	46,050	40,670	13
mixed conifer	24,050	32,990	-27
<i>by host</i> ³			
ponderosa pine	13,480	21,480	-37
aspen	780	3,240	-76
<i>by agent</i>			
pinyon ips	90	2,670	-97
Mortality Total	84,460	101,050	-16
OTHER			
branch flagging (multiple hosts)	350	2,680	-87
discoloration (multiple hosts)	260	510	-49
dieback (multiple hosts)	50	150	-67
Other Total	660	3,340	-80
Grand Total	315,460	288,650	9
Total Area Mapped⁵	310,070	286,170	8

¹ Data not shown for damage types with <100 acres in both current and preceding years

² (2017 acres – 2016 acres) / 2016 acres * 100

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 >1 damage agent. The total area mapped represents the “footprint” of damage, with no multiple counting of acres; total values can reflect multiple counting

Table 2. Aerial detection survey results for forest insect and disease activity on state and private lands in New Mexico in 2016 and 2017

Damage Type	2017 acres	2016 acres	% change ¹	% of all lands ²
DEFOLIATION				
<i>by host</i> ³				
aspen	15,230	9,350	63	33
<i>by agent</i>				
western spruce budworm	50,450	36,320	39	29
needle cast (multiple hosts)	1,950	13,300	-85	99
Douglas-fir tussock moth	140	290	-52	5
piñon needle scale	890	0	>100	67
pine sawfly	420	640	-34	81
unknown (multiple hosts)	110	110	0	18
Defoliation Total	69,190	60,010	15	30
MORTALITY				
<i>by forest type</i> ⁴				
spruce-fir	9,650	5,540	74	21
mixed conifer	3,550	9,590	-63	15
<i>by host</i> ³				
ponderosa pine	1,270	1,050	21	9
aspen	260	1,530	-83	33
southwestern white pine	0	0	0	0
<i>by agent</i>				
pinyon ips	30	40	-25	33
Mortality Total	14,760	17,750	-17	17
OTHER				
branch flagging (multiple hosts)	230	1,540	-85	66
discoloration (multiple hosts)	50	110	-55	19
dieback (multiple hosts)	50	40	25	100
Other Total	330	1,690	-80	50
Grand Total	84,280	79,450	6	27
Total Area Mapped⁵	83,810	82,380	2	27

¹ (2017 acres – 2016 acres) / 2016 acres * 100

² State and private acres as a percentage of statewide acres (see 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 >1 damage agent. The total area mapped represents the “footprint” of damage, with no multiple counting of acres; total values can reflect multiple counting

Table 3. Summary of forest health technical assistance given in 2017

Assistance Type	#	%	Site visit	Confirmed damage agents ¹
Private landowner				
request (identification)	7	15	0	pine sawfly, pouch fungus
mortality (conifer)	4	9	0	piñon ips
request (info)	11	24	2	cedar-apple rust
defoliation (conifer)	13	28	4	piñon needle scale
dieback (conifer)	5	11	1	mechanical damage, lightning
defoliation (hardwood)	3	7	0	black leaf spot, tamarisk leaf beetle
mortality (hardwood)	2	4	0	honeylocust borer
dieback (hardwood)	1	2	0	drought
Landowner total	46		7	
State government				
request (identification)	5	21	1	<i>Automeris io</i> sub. <i>neomexicana</i>
request (info)	9	38	0	
defoliation (hardwood)	2	8	1	European elm flea weevil
dieback (conifer)	1	4	0	woodborers
mortality (hardwood)	1	4	0	honeylocust borer
defoliation (conifer)	2	8	0	piñon needle scale
mortality (conifer)	4	17	2	piñon ips
State total	24		4	
Federal government				
request (info)	2	33	1	
defoliation (conifer)	1	17	0	Douglas-fir tussock moth
mortality (conifer)	1	17	0	
request (identification)	2	33	0	<i>Battarea phalloides</i>
Federal total	6		1	
Grand Total²	76		12	

¹ Identity determined by site visits, samples, or picture analysis

² 2016: # = 72; site visit = 13

Table 4. Water storage of the ten largest reservoirs in New Mexico by percent volume (USDA NRCS)

Reservoir/Lake	Current % capacity ¹	Average % capacity ²
El Vado	38	54
Conchas	83	78
Caballo	11	20
Heron	37	77
Santa Rosa	22	12
Cochiti	10	13
Brantley	4	2
Abiquiu	10	13
Navajo	75	79
Elephant Butte	19	58
Average	31	41

¹ As of January 1, 2018

² Based on 1981 – 2010 reference period

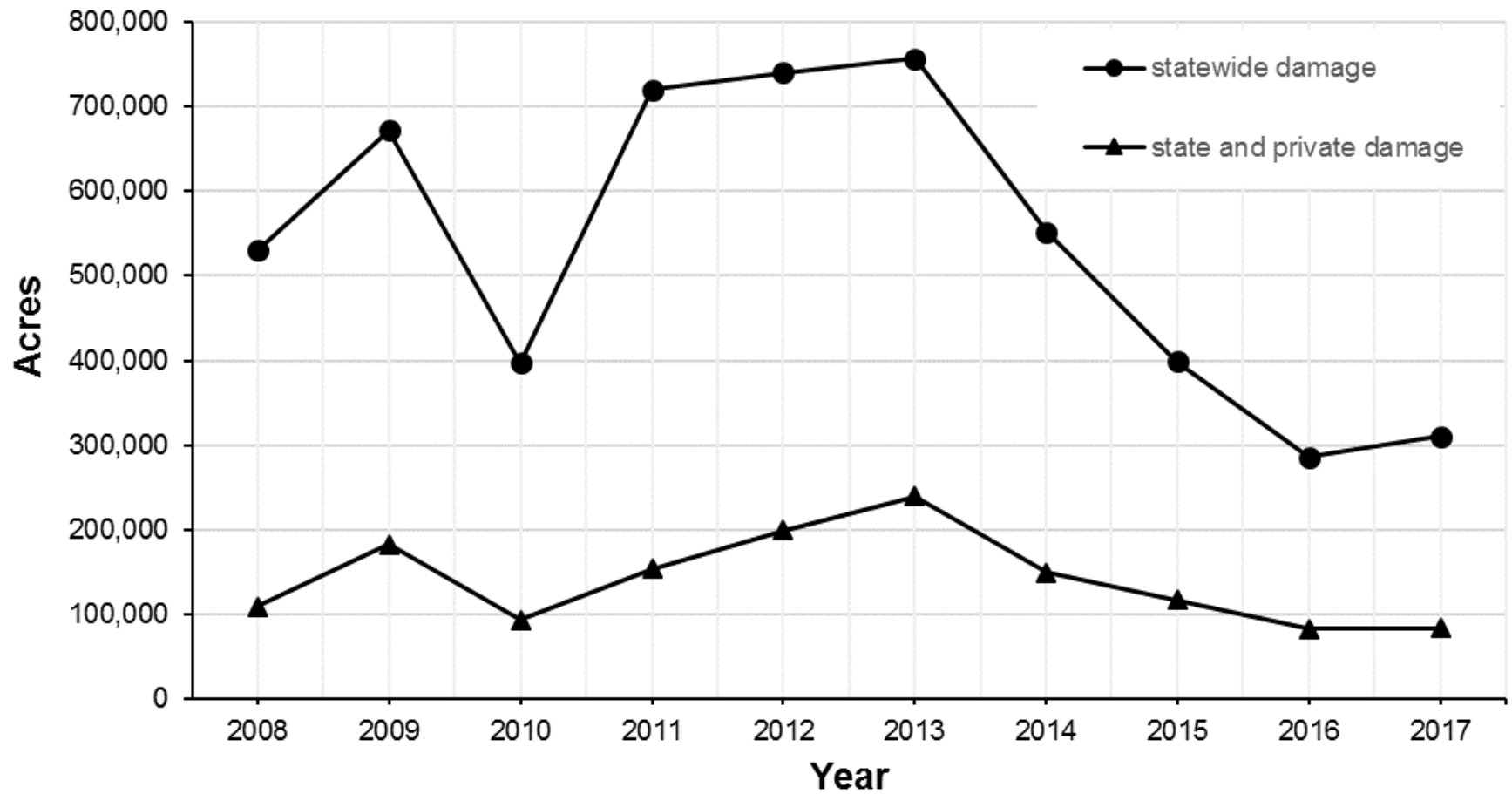


Figure 1. Trends between statewide and state and private forest damage in New Mexico from 2008 to 2017. Data before 2008 is not directly comparable to current data.

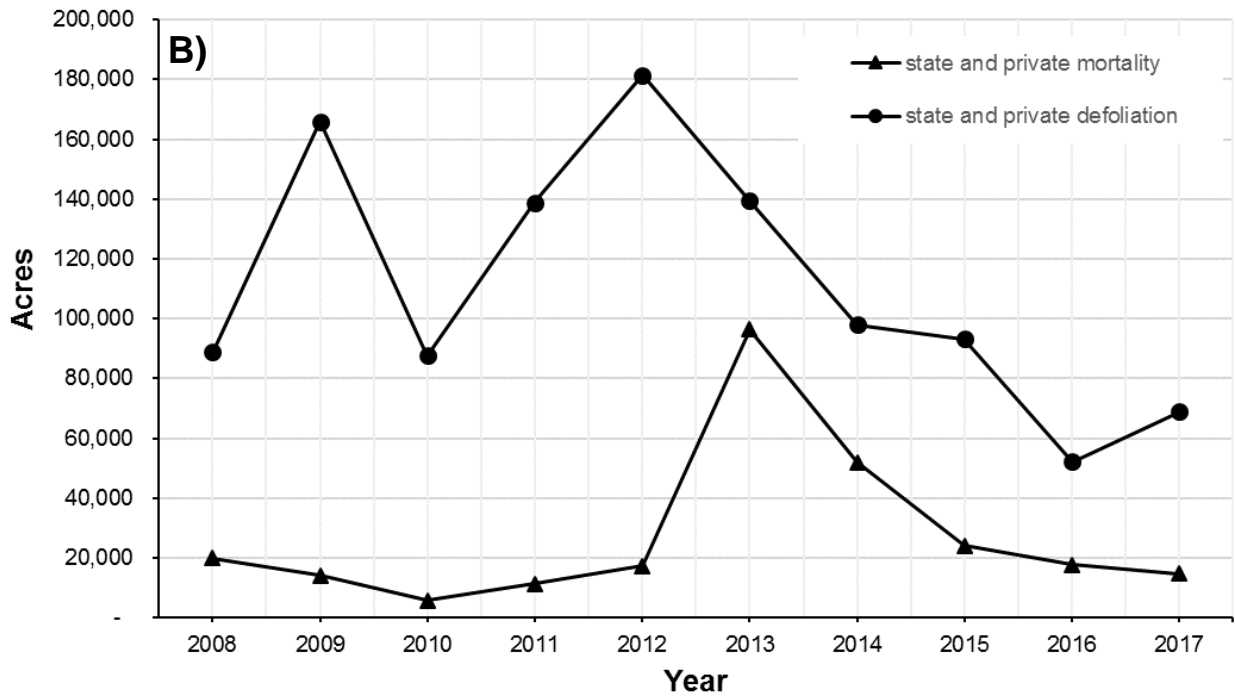
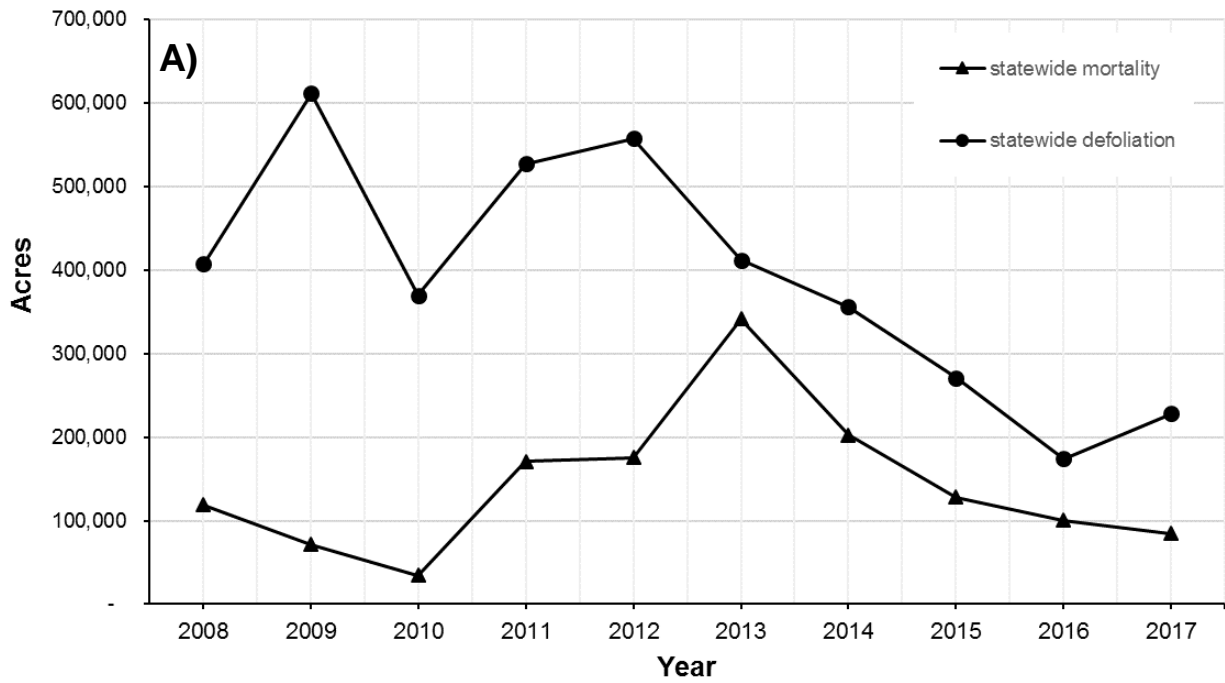


Figure 2. Trends for **A)** statewide forest mortality and defoliation and **B)** state and private forest mortality and defoliation in New Mexico from 2008 to 2017. Data before 2008 is not directly comparable to current data.

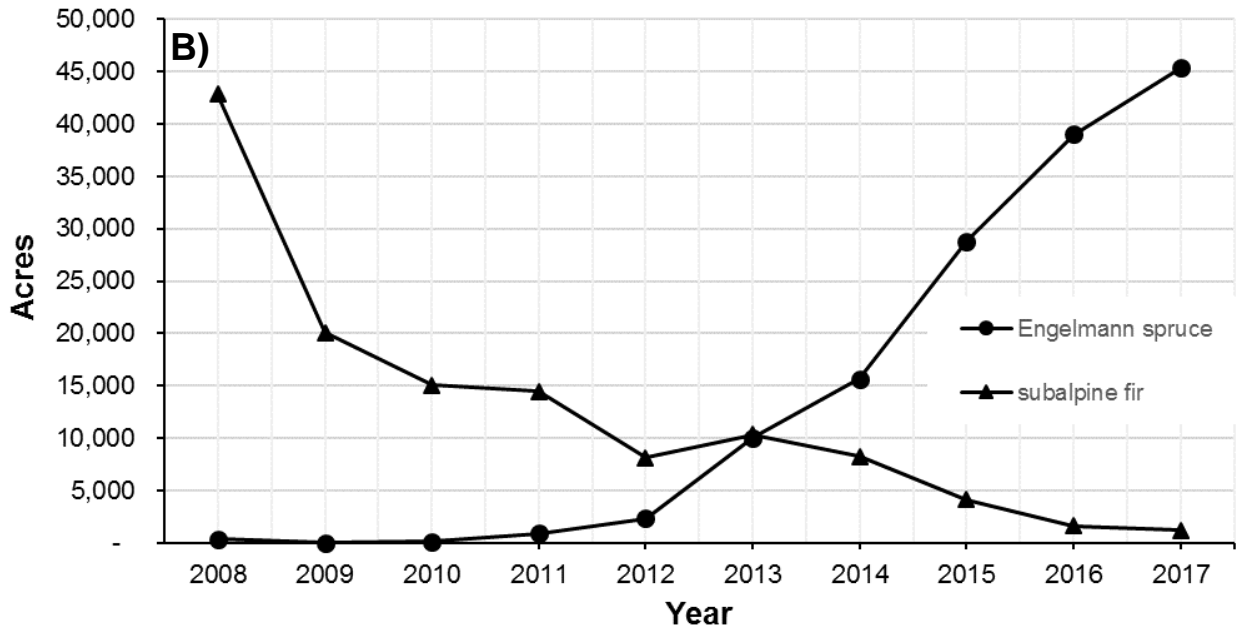
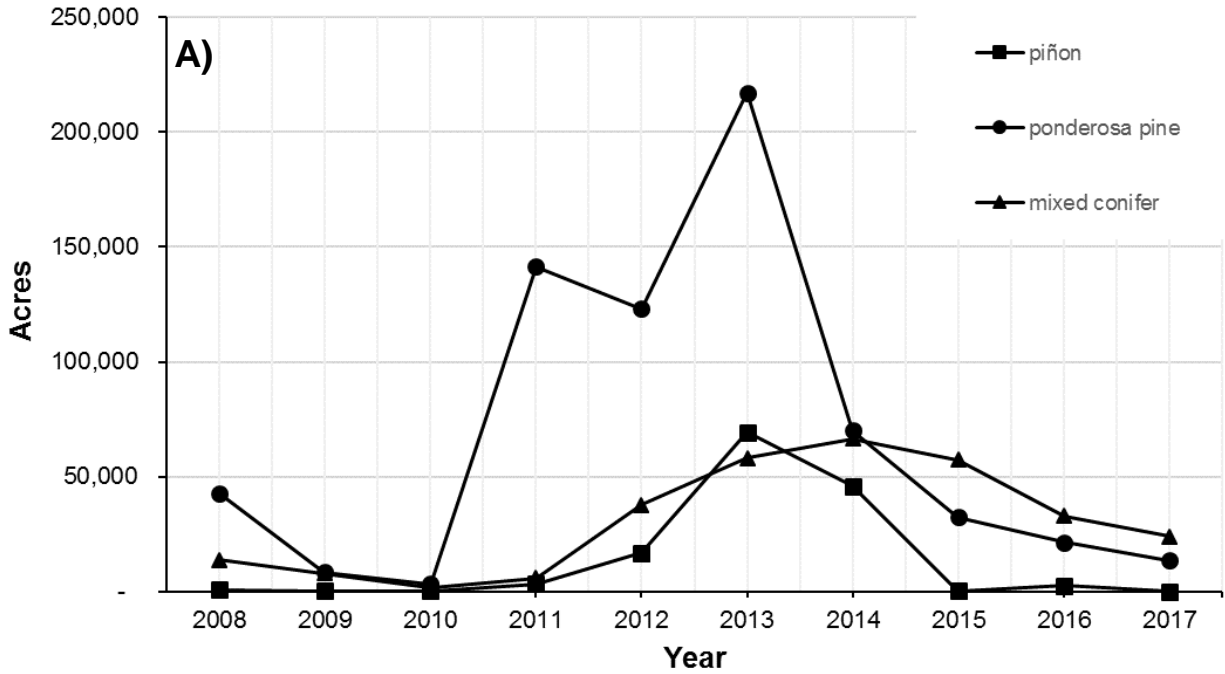
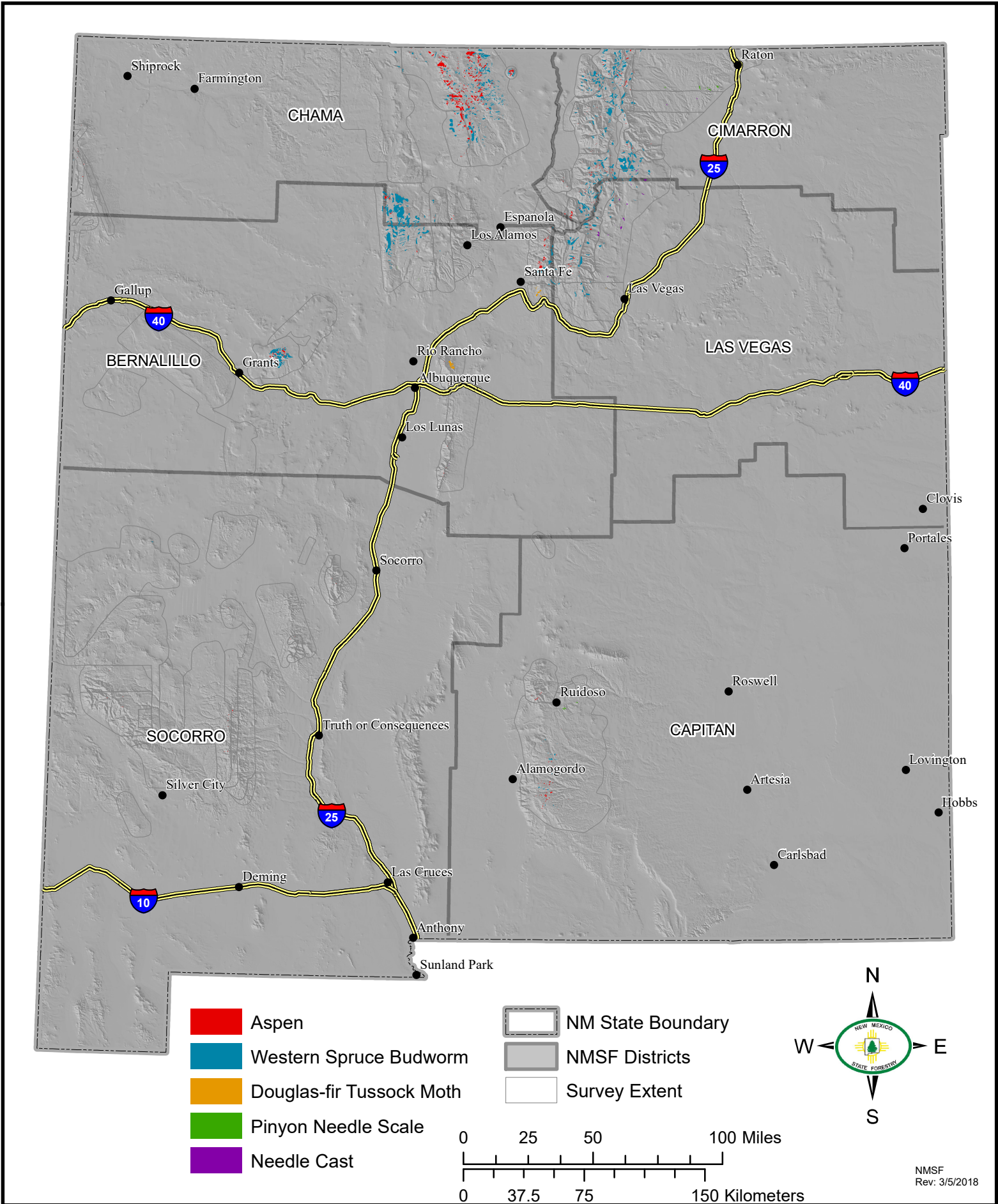


Figure 3. Statewide forest mortality trends due to bark beetle activity for **A)** low to middle and **B)** high elevation conifer species in New Mexico from 2008 to 2017.

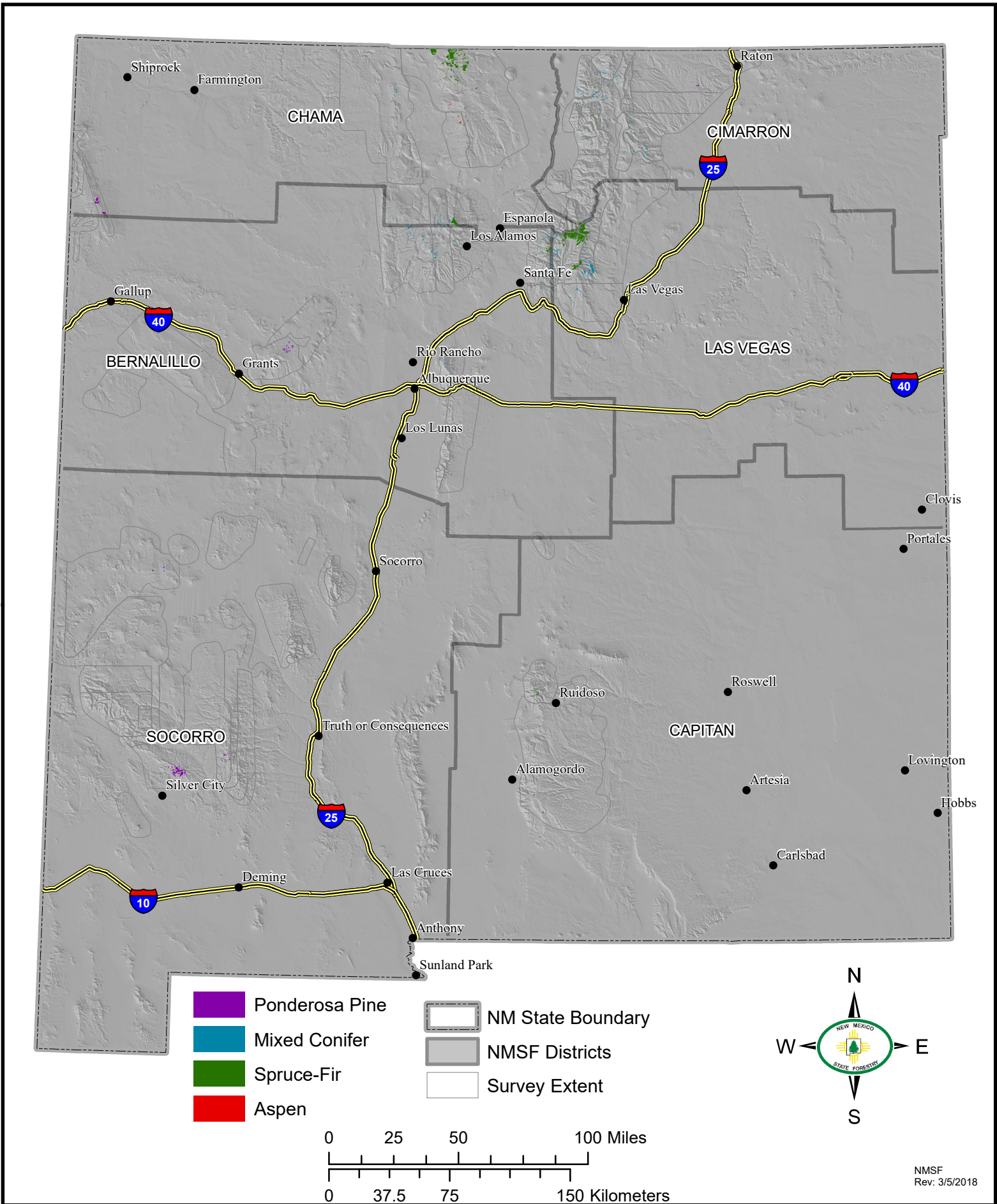


2017 Forest Defoliation Activity New Mexico



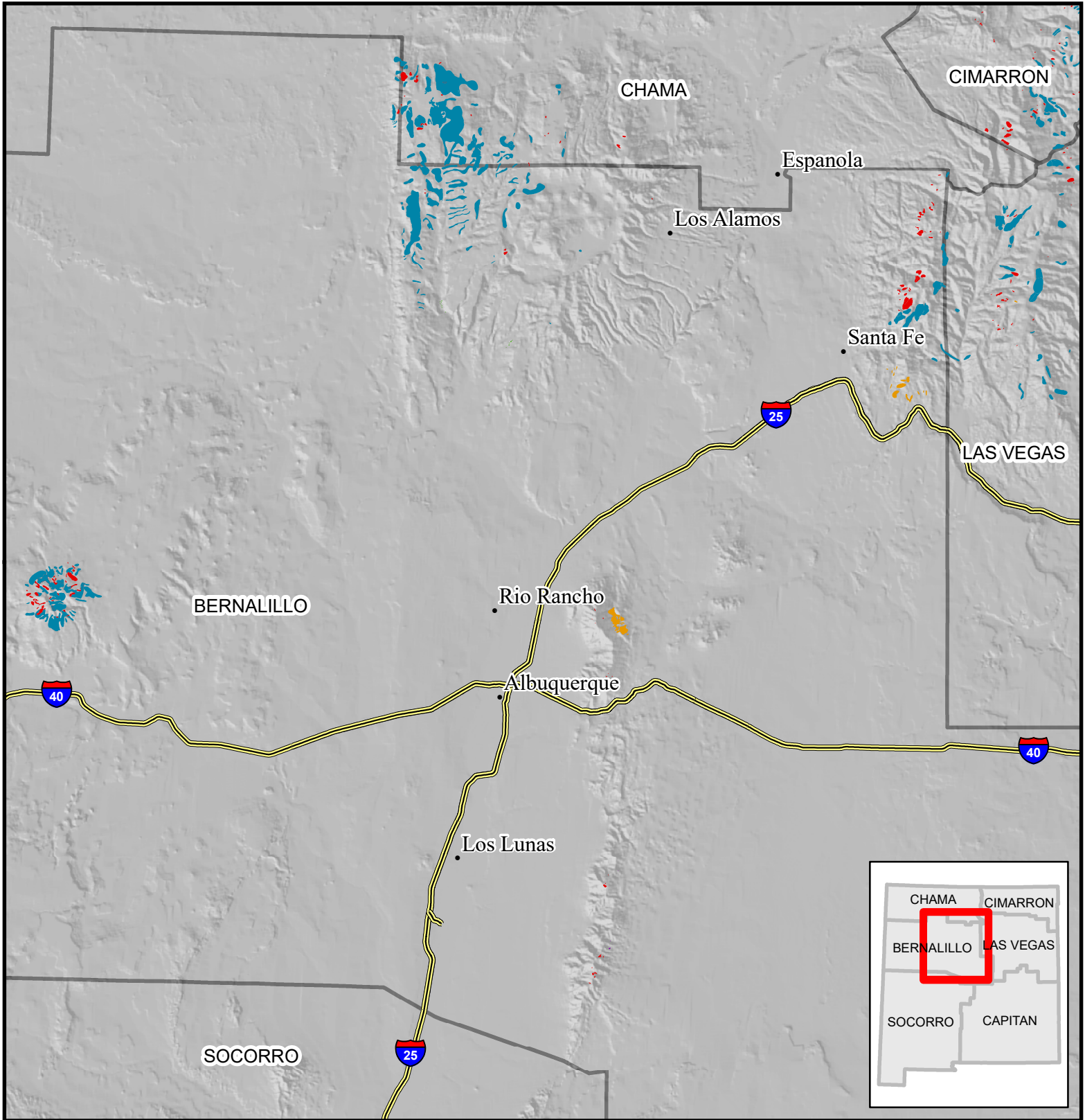


2017 Forest Mortality Activity New Mexico

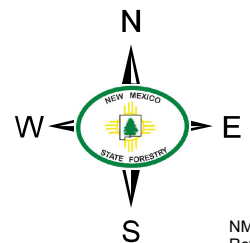
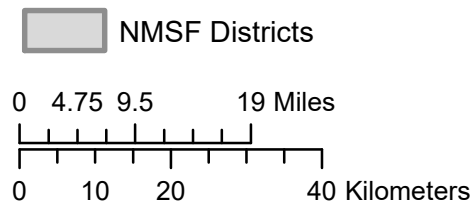




2017 Forest Defoliation Activity Bernalillo District

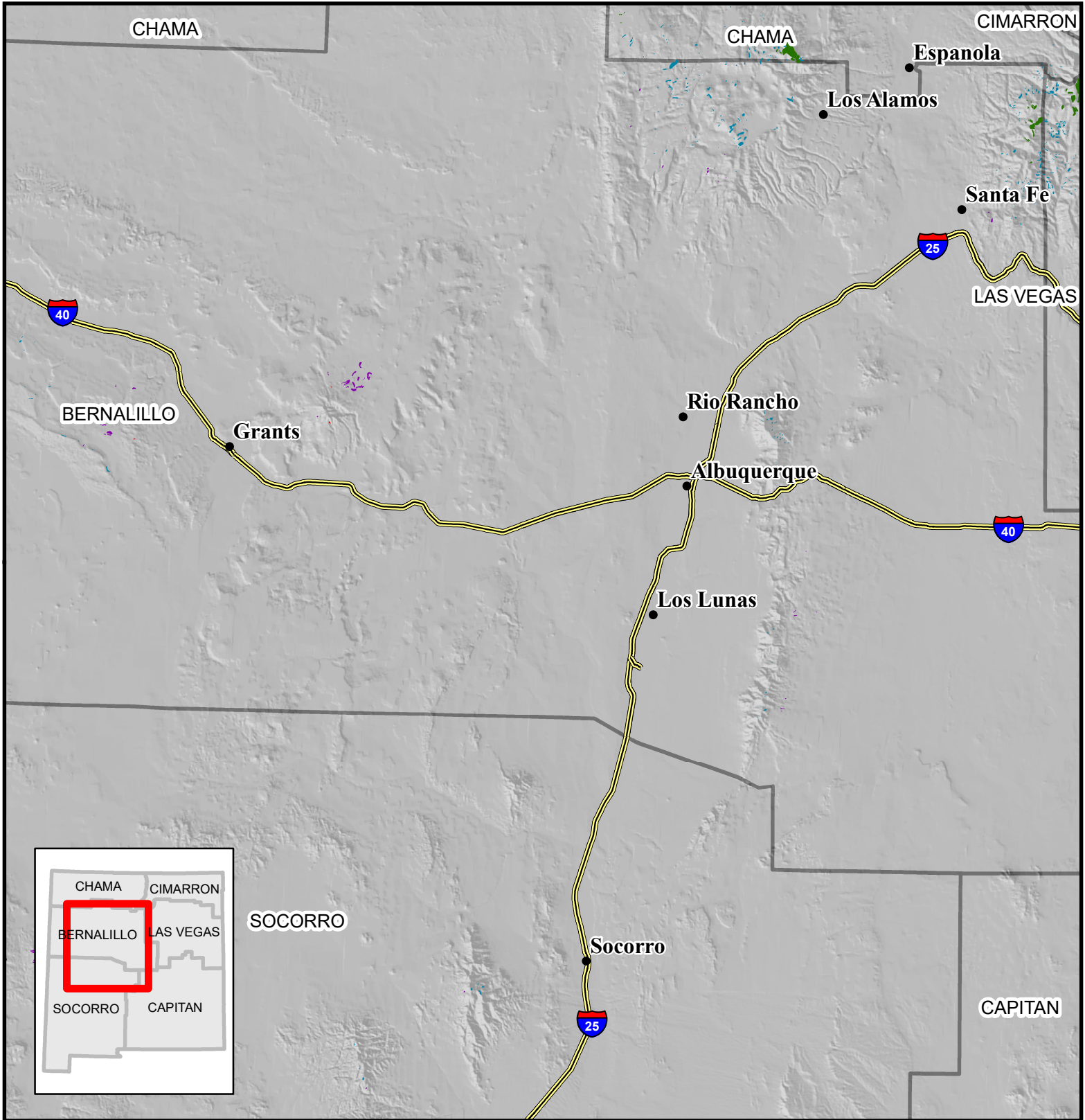


- Aspen
- Western Spruce Budworm
- Douglas-fir Tussock Moth
- Pinyon Needle Scale
- Needle Cast



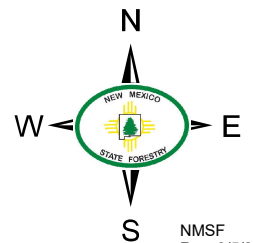
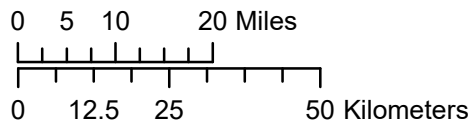


2017 Forest Mortality Activity Bernalillo District

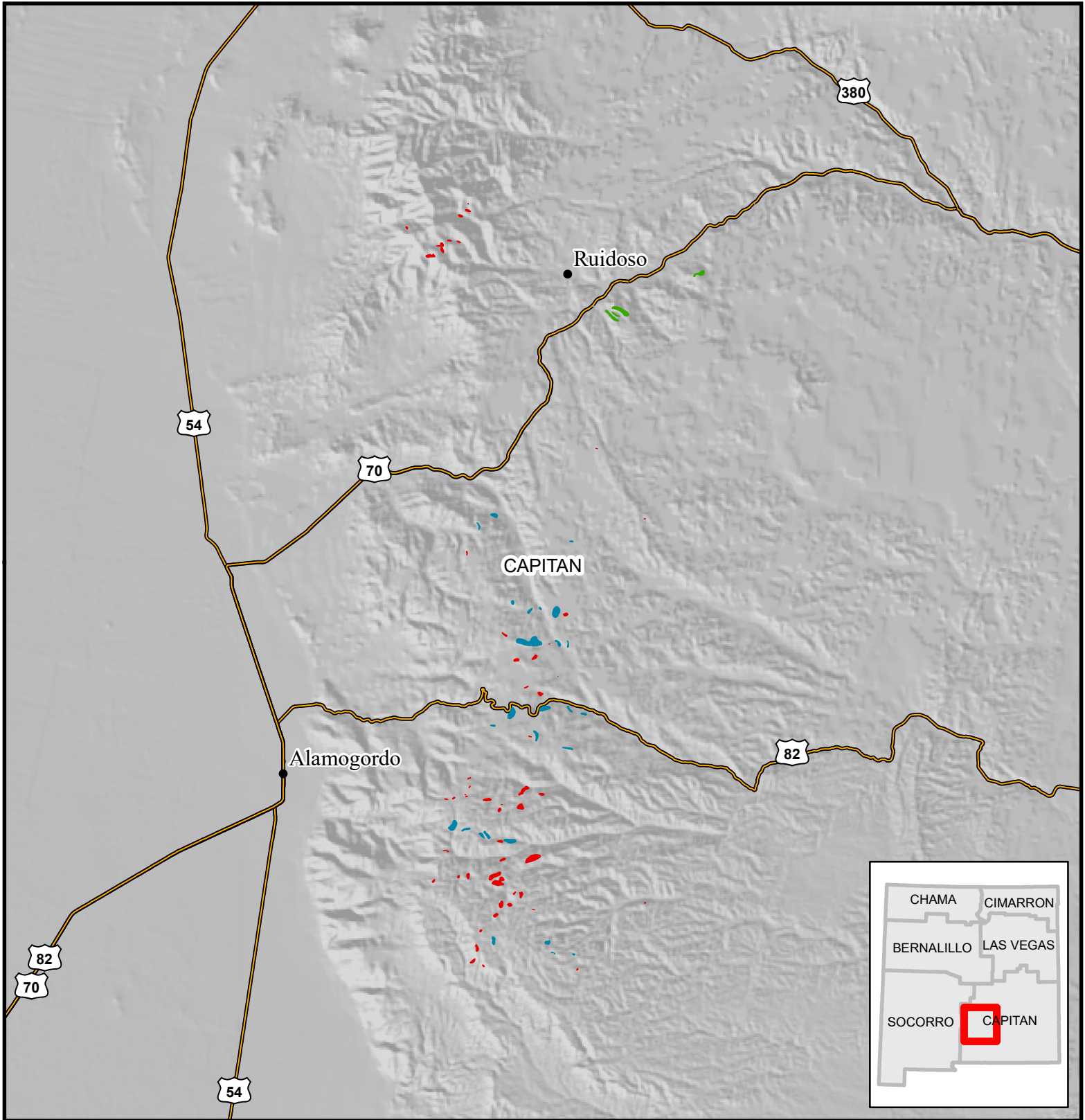


-  Ponderosa Pine
-  Mixed Conifer
-  Spruce-Fir
-  Aspen

 NMSF Districts

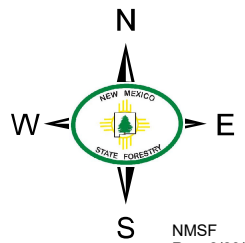
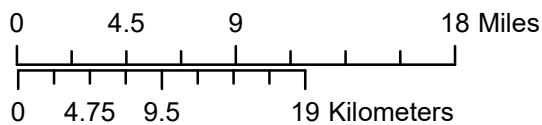


2017 Forest Defoliation Activity Capitan District



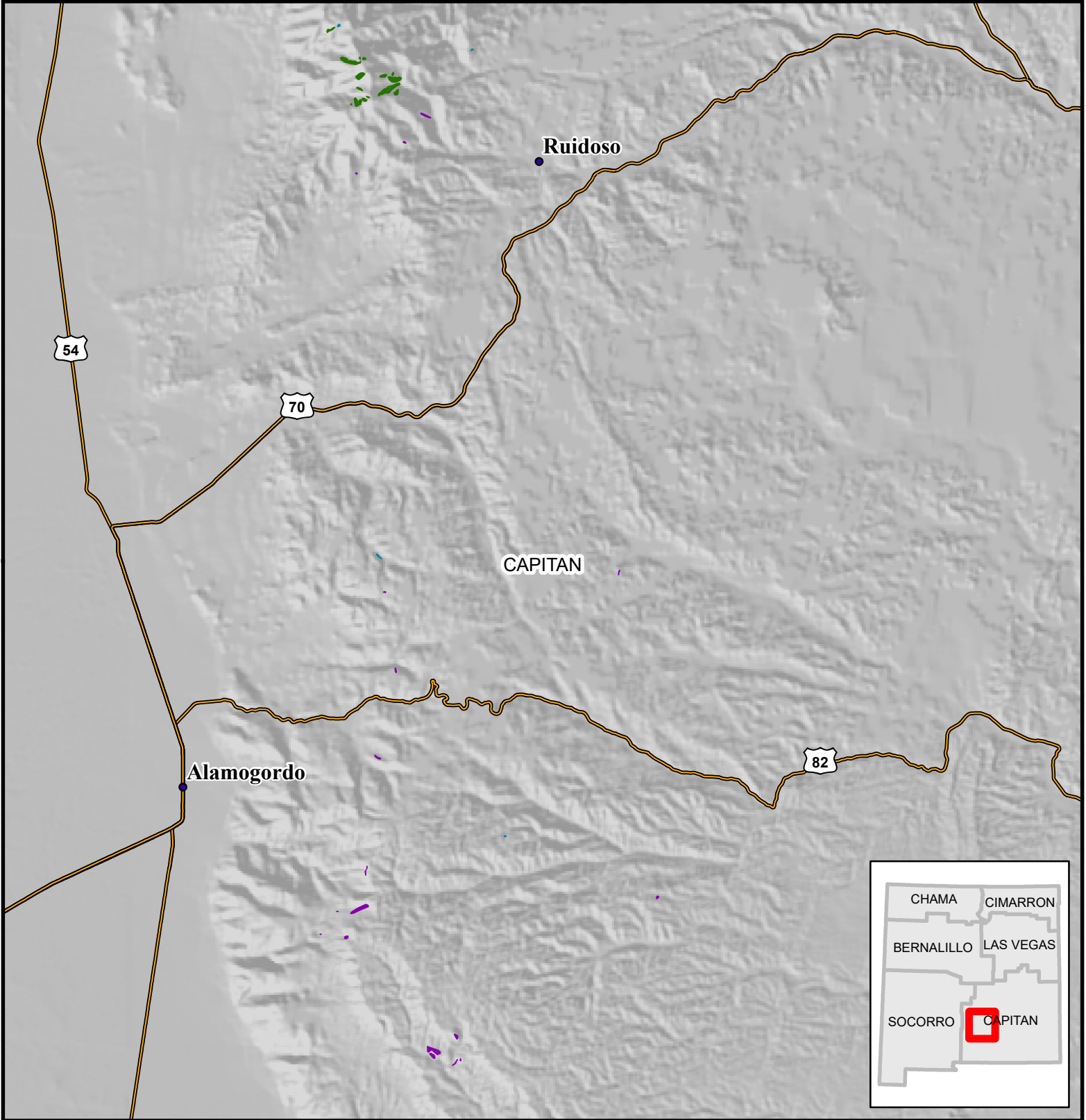
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- Western Spruce Budworm
- Douglas-fir Tussock Moth
- Pinyon Needle Scale
- Needle Cast

NMSF Districts



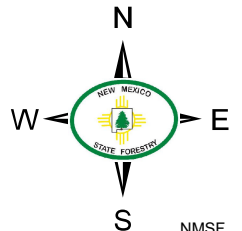
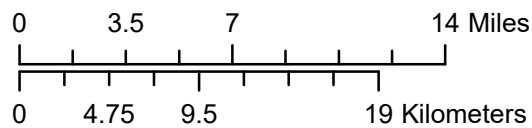


2017 Forest Mortality Activity Capitan District



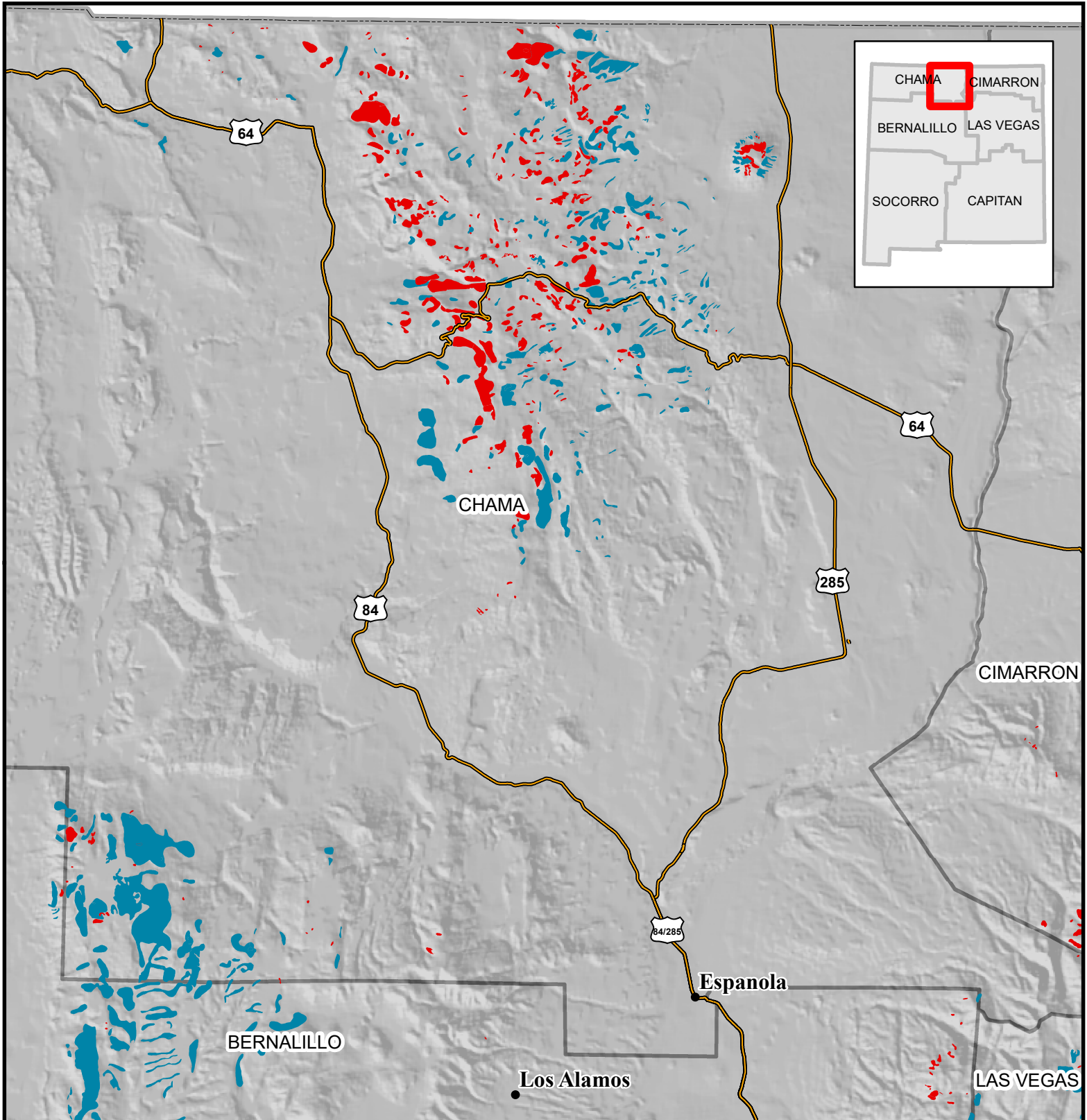
-  Ponderosa Pine
-  Mixed Conifer
-  Spruce-Fir
-  Aspen

 NMSF Districts



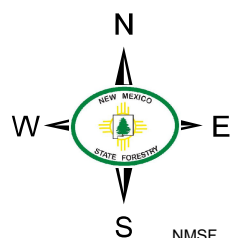
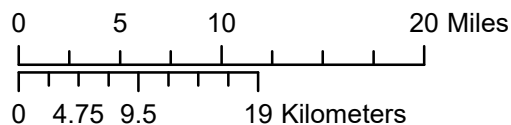


2017 Forest Defoliation Activity Chama District- East



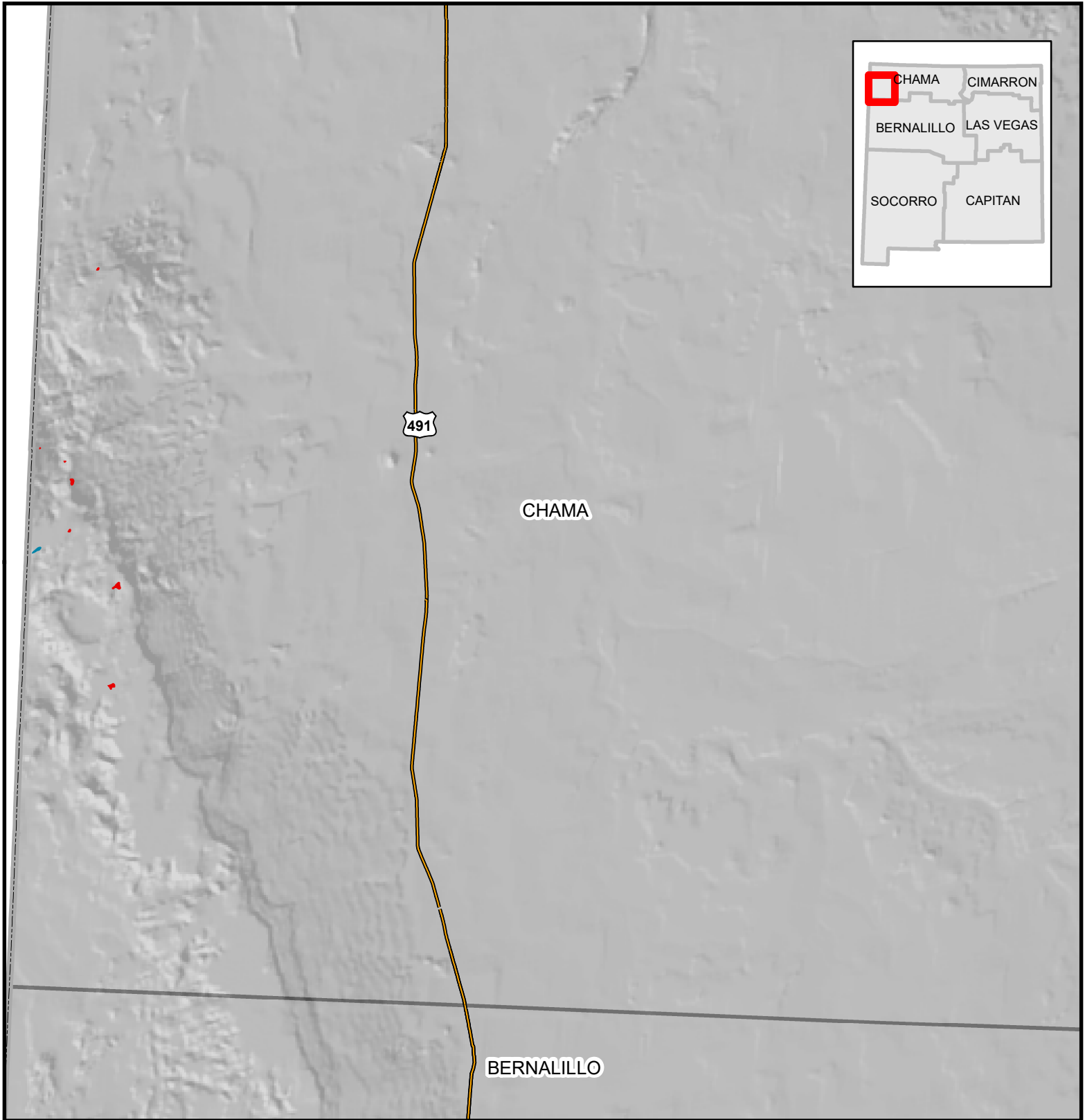
- Aspen
- Western Spruce Budworm
- Douglas-fir Tussock Moth
- Pinyon Needle Scale
- Needle Cast






- NM State Boundary
- NMSF Districts



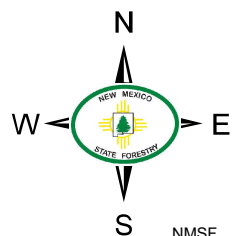
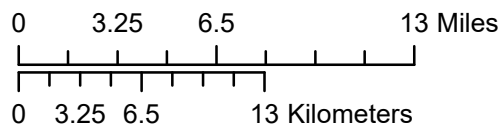


2017 Forest Defoliation Activity Chama District- West



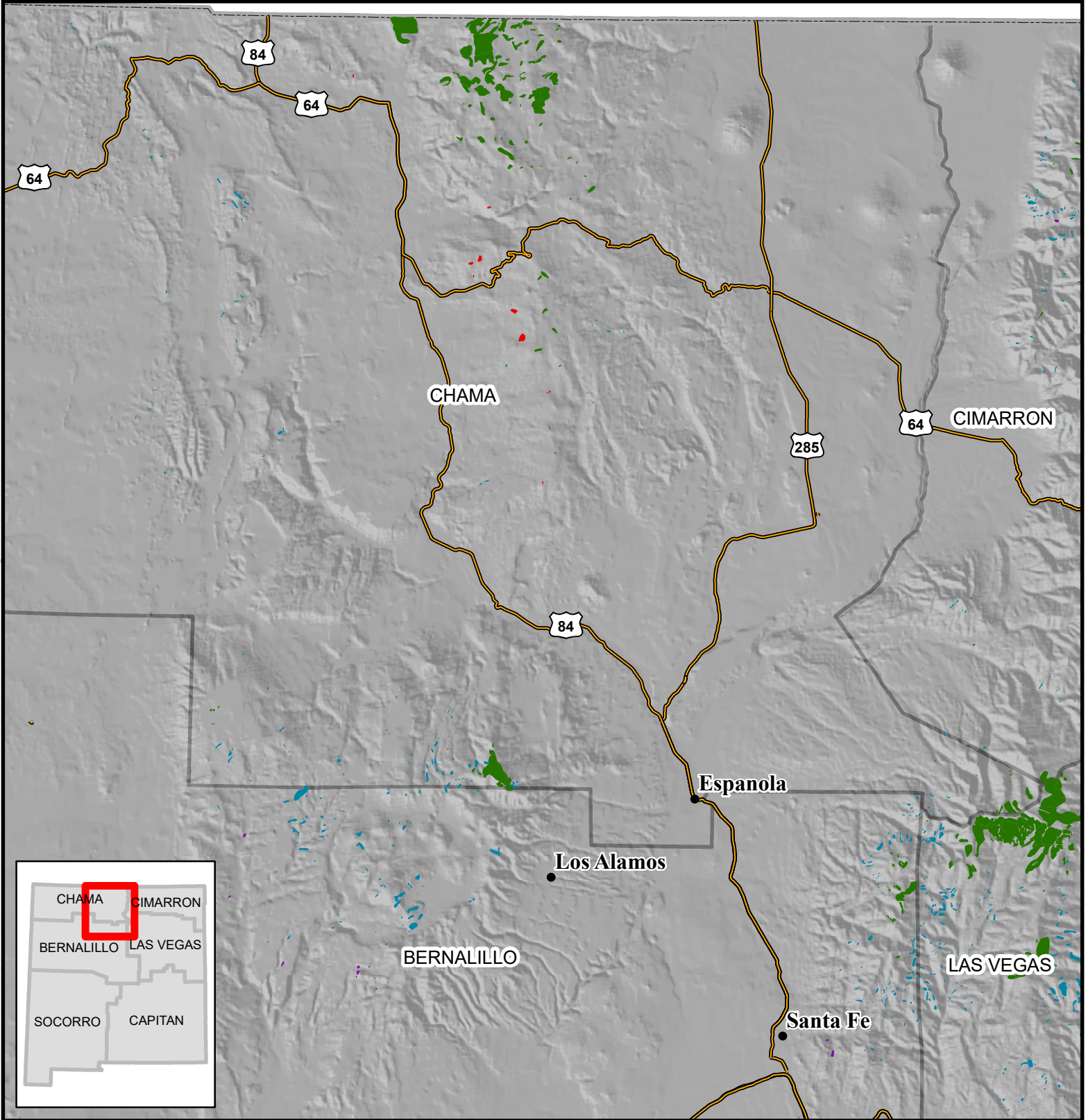
-  Aspen
-  Western Spruce Budworm
-  Douglas-fir Tussock Moth
-  Pinyon Needle Scale
-  Needle Cast

-  NM State Boundary
-  NMSF Districts



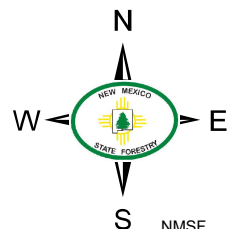
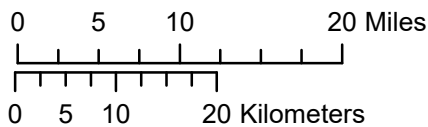


2017 Forest Mortality Activity Chama District- East



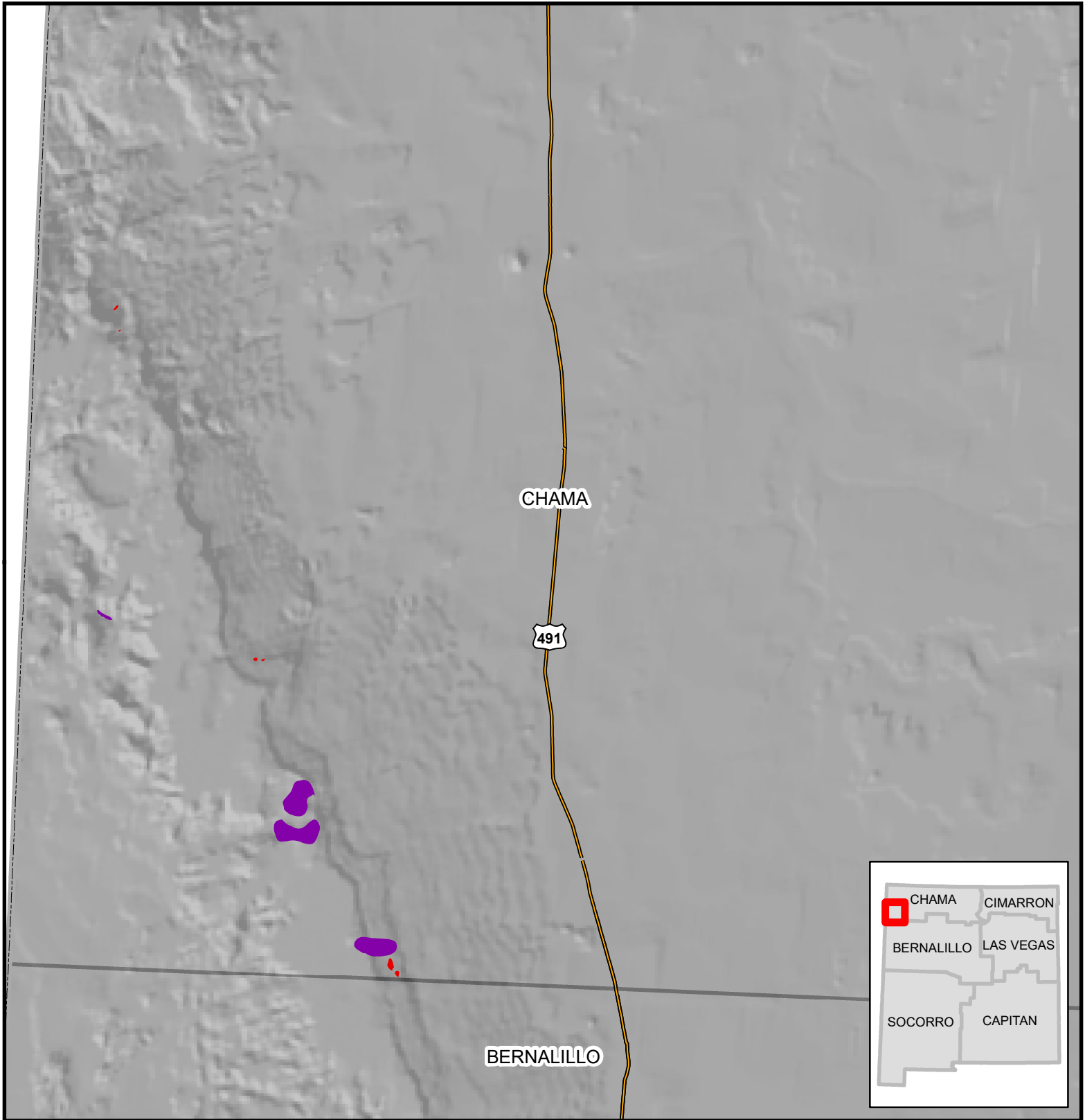
-  Ponderosa Pine
-  Mixed Conifer
-  Spruce-Fir
-  Aspen

-  NM State Boundary
-  NMSF Districts



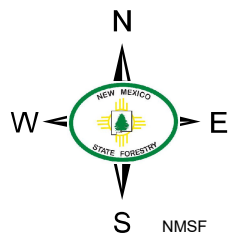
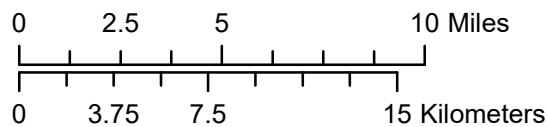


2017 Forest Mortality Activity Chama District- West



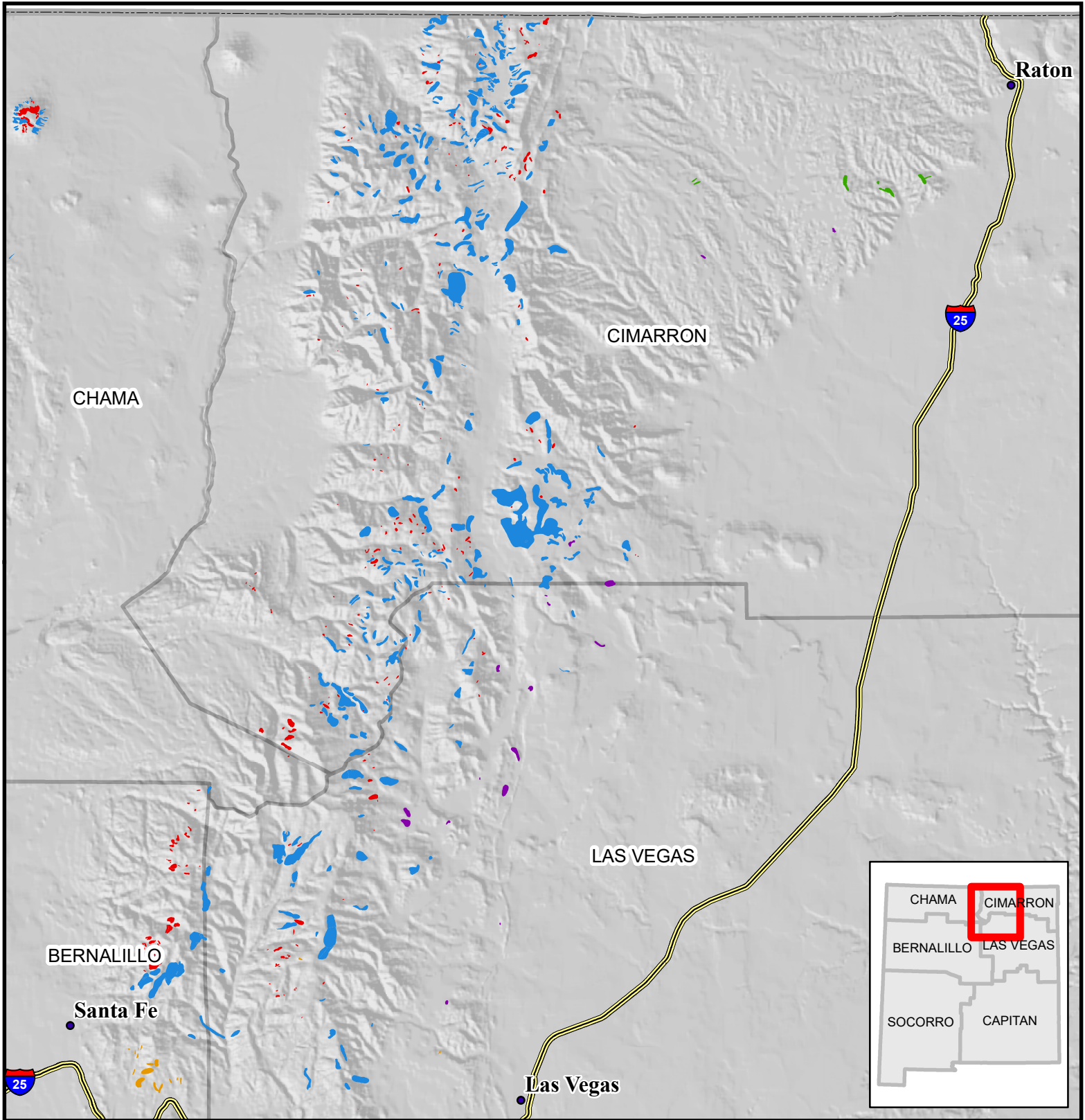
-  Ponderosa Pine
-  Mixed Conifer
-  Spruce-Fir
-  Aspen

-  NM State Boundary
-  NMSF Districts



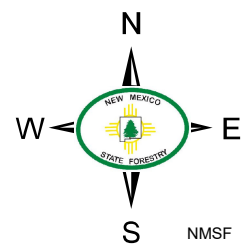
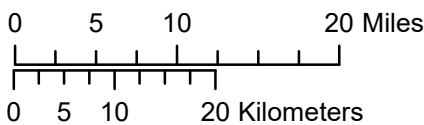


2017 Forest Defoliation Activity Cimarron and Las Vegas Districts



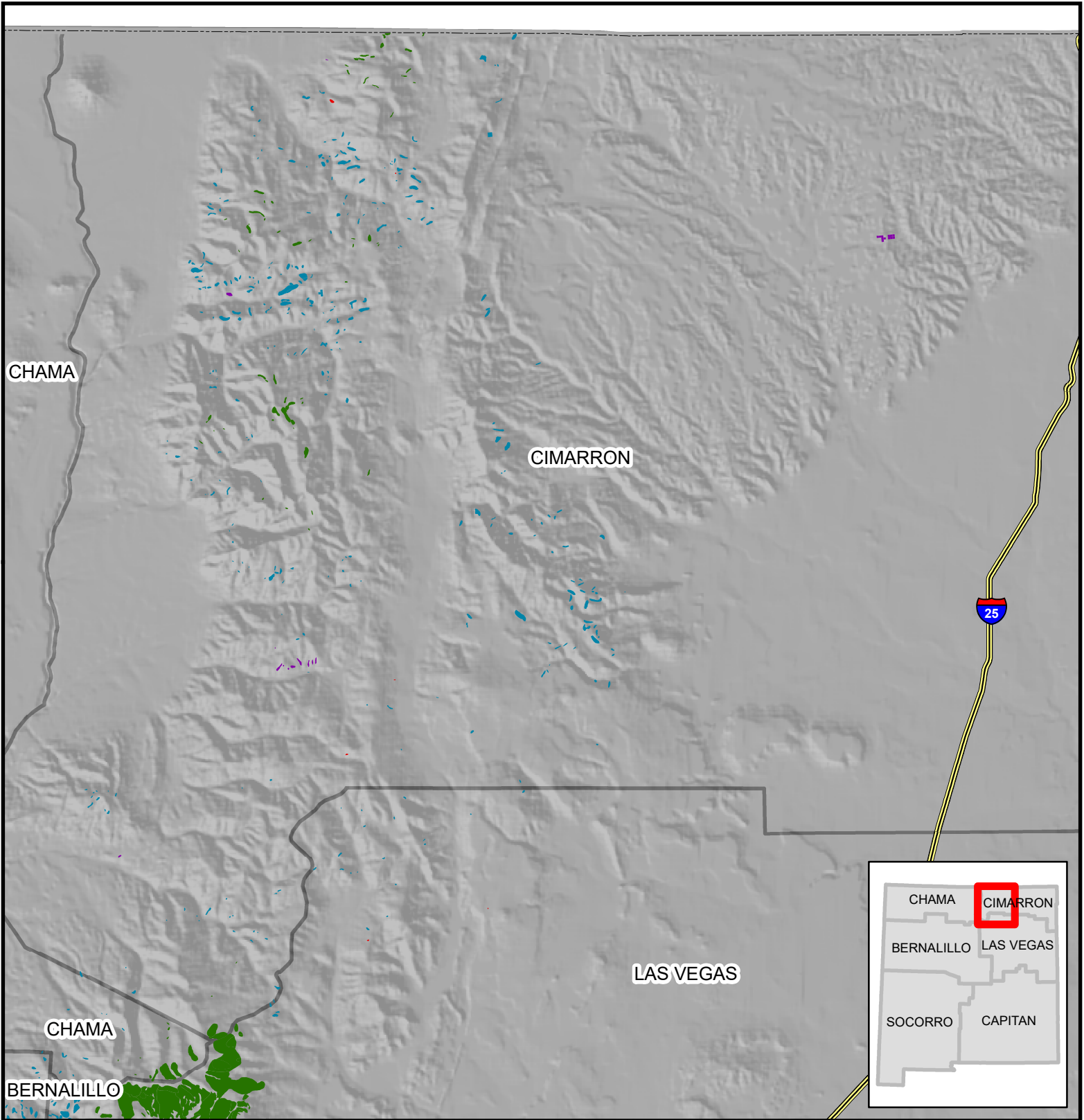
- Aspen
- Western Spruce Budworm
- Douglas-fir Tussock Moth
- Pinyon Needle Scale
- Needle Cast

- NM State Boundary
- NMSF Districts



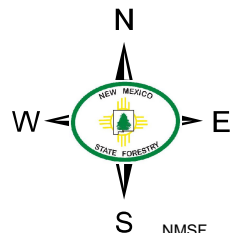
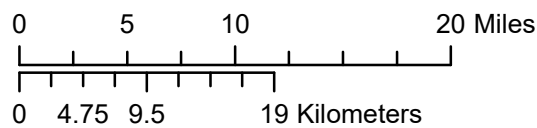


2017 Forest Mortality Activity Cimarron District



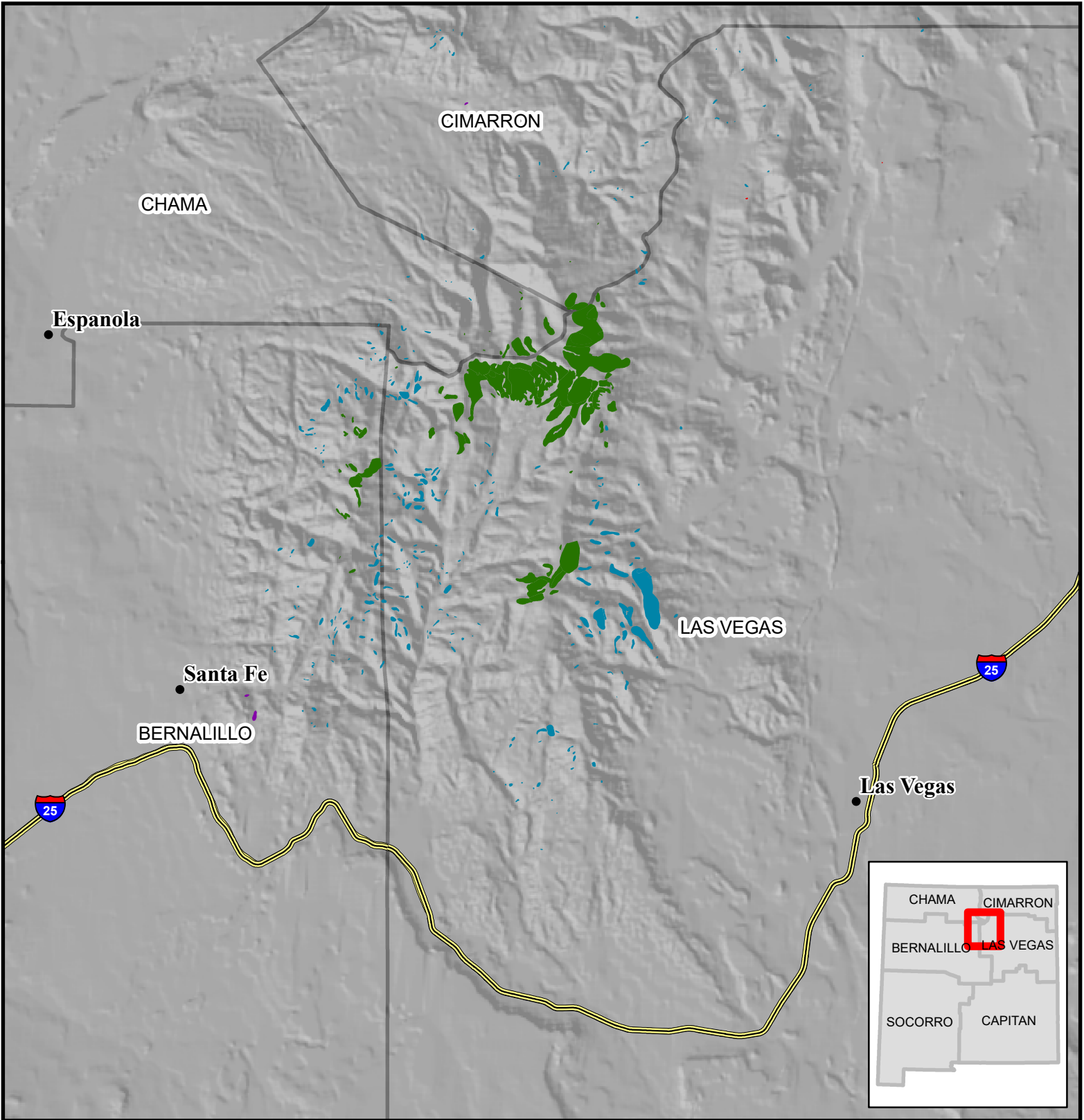
-  Ponderosa Pine
-  Mixed Conifer
-  Spruce-Fir
-  Aspen

-  NM State Boundary
-  NMSF Districts



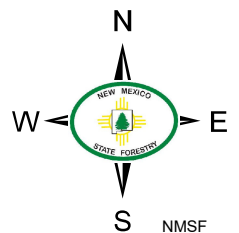
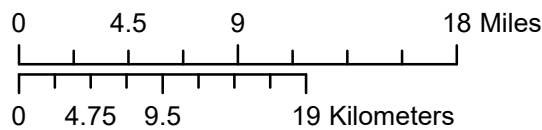


2017 Forest Mortality Activity Las Vegas District



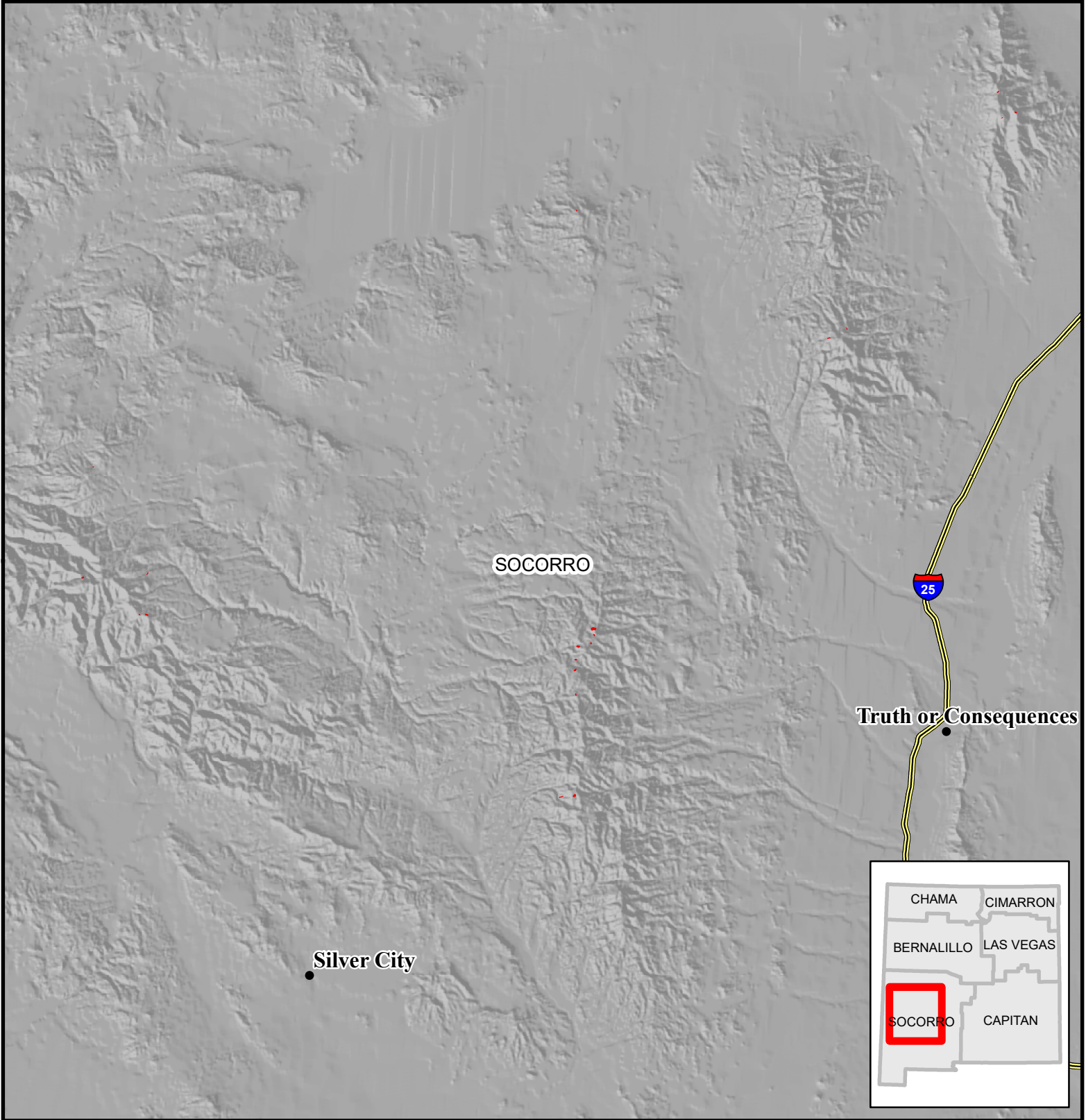
- Ponderosa Pine
- Mixed Conifer
- Spruce-Fir
- Aspen

NMSF Districts



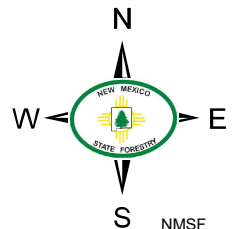
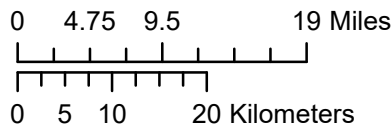


2017 Forest Defoliation Activity Socorro District



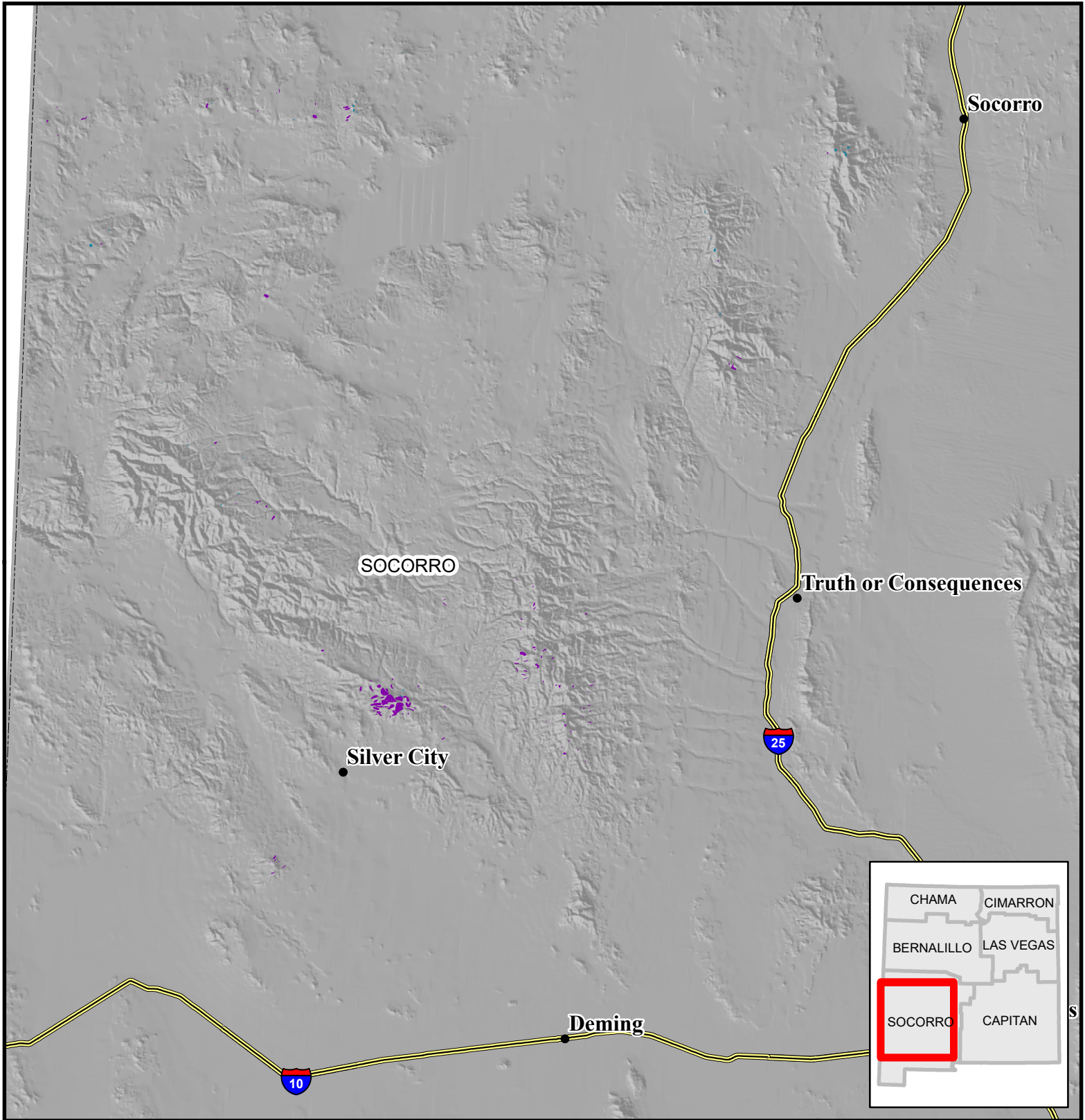
- Aspen
- Western Spruce Budworm
- Douglas-fir Tussock Moth
- Pinyon Needle Scale
- Needle Cast

NMSF Districts



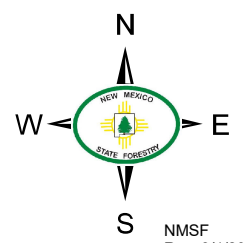
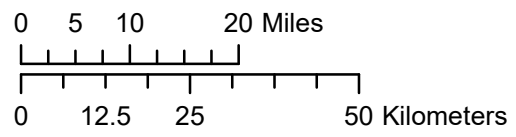


2017 Forest Mortality Activity Socorro District



- Ponderosa Pine
- Mixed Conifer
- Spruce-Fir
- Aspen

- NM State Boundary
- NMSF Districts





Janet's looper (*Nepytia janetae*) defoliation damage, Santa Fe National Forest

Written by Tom Zegler and Dr. John Formby

For more information or questions, please contact:

John P. Formby, Ph.D.

Forest Health Program Manager

New Mexico State Forestry

Phone: (505) 469-6660

Email: john.formby@state.nm.us

Photographs taken by Dr. John Formby except where noted

