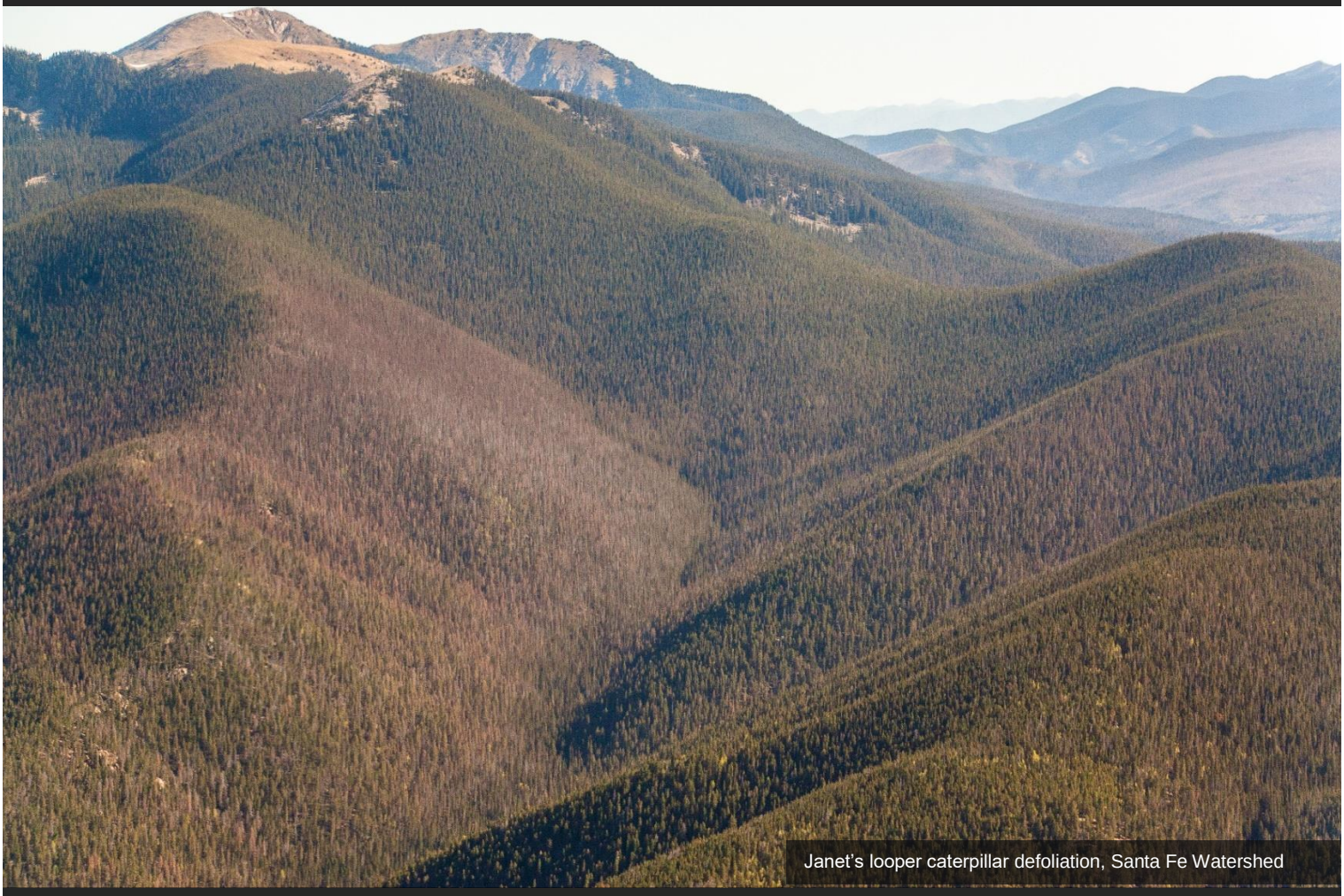
NEW MEXICO
FOREST HEALTH CONDITIONS
2018



Janet's looper caterpillar defoliation, Santa Fe Watershed

Energy, Minerals, and Natural Resources Department

Forestry Division

Acknowledgment: Funding for this publication is supported by the USDA – Forest Service.

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NEW MEXICO FORESTRY DIVISION

Joe Carrillo (Chama District TMO) talks to land managers and property owners (photo: Wendy Mason, NMSF)

Headquartered in Santa Fe with six District offices statewide, the Forestry Division provides leadership in New Mexico's approach to managing its complex ecological needs. The Division's primary responsibility is to sustain healthy and productive forests on the ~8.7 million acres of state and private forest and woodlands across New Mexico. The Division recognizes the importance of forests and woodlands and their connection to other landscapes (e.g. watersheds and waterways). This understanding provides the foundation for the Division's efforts, which are collaborative, interdisciplinary, and focused on long-term sustainability.

The Forestry Division also empowers New Mexico communities to protect, enhance, and utilize their forest resources, as well as having the lead responsibility for wildland fire management on approximately 43 million acres of nonfederal, non-municipal, and non-tribal lands. The Forestry Division also manages a variety of cooperative programs, which are implemented through a partnership between the State of New Mexico, the USDA Forest Service and many other private, non-profit, and government entities.

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FOREST HEALTH IN NEW MEXICO

Forest health management in New Mexico began in 1952 with the creation of the U.S. Forest Service's Forest Insect Laboratory in Albuquerque. The injurious forest pests of concern at that time were western spruce budworm, western tent caterpillar, dwarf mistletoe, foliar disease, and bark beetles. These pests still impact New Mexico's forests today.

Much of the early research and management of forest pests focused on pesticide application studies and silviculture treatments, such as clearcutting. These early studies have helped forest health professionals understand that the key to managing or mitigating pests is prevention because insect infestations and forest disease complexes are nearly impossible to suppress or control once in place.

1980 silviculture control study of spruce budworm, Carson National Forest

Prevention is achieved by restoring the capacity of a forest to resist disturbance, recover quickly, and maintain structure and function. The main prevention techniques used to mitigate forest health issues in New Mexico is reducing tree density via thinning and proper management of logging slash. To help accomplish this mission, the Forestry Division's Forest Health Initiative (FHI) program helps private landowners in New Mexico by providing technical assistance and cost-share funds for reducing tree densities and managing slash. *If you'd like to see if you qualify for the FHI program or need technical assistance identifying insect or disease issues on your property, please call the NM Forest Health Program Manager at (505) 469-6660.* See **Table 3** for technical assistance given in 2018.

The State of New Mexico's forest health program started in the 1980's and, at the time, was nested within the New Mexico Department of Agriculture (NMDA). Aerial surveys were as an integral part of monitoring the health of New Mexico's forests then as they are today. Below are the forest health observations made in 1988 by Bob Cain and Tony Smith, the forest entomologists and aerial surveyors at the NMDA.

Western spruce budworm- ~27,000 acres of light and moderate defoliation, mostly around Tierra Amarilla

Mountain pine beetle- low levels of activity noted in Colfax county (19 infestation spots with varying numbers of dead trees)

Douglas-fir beetle- 405 acres of mortality were observed (27 infestation spots were recorded on the Philmont Scout Ranch)

Hardwood defoliation- ~3,000 acres of aspen and oak defoliation [primary causal agents were foliar diseases and tortricids (leaf-roller moths)]

AERIAL DETECTION SURVEY

Aerial detection surveys (ADS) are the primary method of collecting annual data on the health of forests in the United States. These surveys are the most efficient and cost-effective method for collecting annual forest health data. In fact, the cost of ADS is about a penny per acre. Approximately 373 million acres of forestland in the United States are surveyed for insect and disease issues each year. Of those, approximately 10 million acres of forest and woodlands are surveyed in New Mexico.

Each Forest Service region in the U.S. has specially trained aerial survey observers, fixed-wing aircraft, and procedures for collecting aerial survey data. In New Mexico, the Forestry Division's Forest Health Program Manager works with U.S. Forest Service, Forest Health Protection, New Mexico Zone personnel to aerially survey the state's forests and woodlands. Ground surveys are conducted post-ADS to check unknown or anomalous conditions observed from the air. Most of the information in this report was collected by ADS, however, some additional information was gathered through interactions with landowners or ground-based observations made by the NM Forest Health Specialist or US Forest Service, Forest Health Protection personnel.

2018 FOREST HEALTH SUMMARY

The following summary describes the amount of forest pest damage identified during the 2018 aerial detection survey

- 307,000 acres were damaged across the state (↓1% since 2017)
- 125,000 acres were damaged on state and private lands (↑49% since 2017)
- 171,000 acres were damaged on National Forests
- 9,000 acres were damaged on tribal lands

PEST HIGHLIGHTS

The following sections highlight the major pests that caused damage to New Mexico's forest and woodlands in 2018.

MORTALITY AGENTS

Insects kill more trees each year in the United States than any other biotic or abiotic agent, including wildfire (Raffa et al. 2008). Native bark beetles are the principle cause of tree mortality in New Mexico. About 90% of tree mortality in the state each year is due to these tree-dwelling indigenous pests. These mortality events can have substantial impacts on ecological processes, such as reduced forest carbon uptake and increased future emissions from the decay of killed trees (Kurz et al. 2008). This effect can be especially profound when bark beetles kill large swaths of forest. However, bark beetles do play an essential role in ecosystem function by acting as the forest's thinning agent. They do this by seeking out and killing stressed, over-mature, overstocked, or otherwise unhealthy trees. These forest stands are then replaced with vigorous and healthy trees. These young, vigorous forests resist disturbance, recover more quickly, and maintain structure and function better than older forest stands. Moreover, bark beetle-killed trees also create quality habitat for myriad wildlife species.

Bark beetle activity is known to intensify in response to warmer temperatures and/or decreased precipitation (Bale et al. 2002), and due to the mild and relatively dry winter of 2017/2018, NM forest health professionals were concerned of increased large-scale bark beetle outbreaks in the summer of 2018, particularly in low elevation ponderosa and piñon forests. While there was an increase in scattered bark beetle activity in ponderosa and piñon across the state (**Table 1; Fig. 3**)**,** no large-scale outbreaks were noted. The Gila National Forest was impacted the most by bark beetle-related ponderosa mortality. Most bark beetle-related piñon mortality occurred in the Gila National Forest and on BLM, Navajo, and state and private lands.

Overall statewide mortality from bark beetles increased 70% from 2017 to 2018 (**Table 1; Fig. 1**), most likely due to the lack of snow pack during the 2017/2018 winter and inadequate spring rain. Over the last decade and primarily driven by drought conditions and above average temperatures, 1.55 million acres of forest and woodlands in New Mexico have been killed by bark beetles or other mortality agents. See pages 17 and 18 for bark beetle-induced mortality trends in low, middle, and high-elevation conifer species (**Figs. 3, 4**).

Spruce Beetle

(*Dendroctonus rufipennis)*

Spruce beetle attacks high elevation, mature Engelmann spruce trees and was the second most destructive forest insect in New Mexico in 2018 (**Table 1**). Approximately 45,500 acres of Engelmann spruce in the state were impacted by spruce beetle this year. Most of the spruce mortality occurred on the Santa Fe National Forest (26,000 acres), which was followed by the Carson National Forest and state and private lands, both with 12,000 acres of mortality each. Mortality on tribal lands accounted for nearly 1,600 acres, 75% of which occurred on the Jicarilla Apache lands. An isolated area of ~400 acres of spruce mortality was mapped in and around Ski Apache on both Mescalero Apache and Lincoln National Forest lands. This area contains the southernmost spruce beetle population in the state.

Spruce beetle infestations have expanded annually since 2013 (**see Fig. A**) and a cumulative total of 188,000 acres of spruce forest have been impacted between 2010 and 2018. Warmer summers and lack

of extreme and sustained freezing in the high-country during winter are the most likely contributors of the current spruce beetle outbreaks.

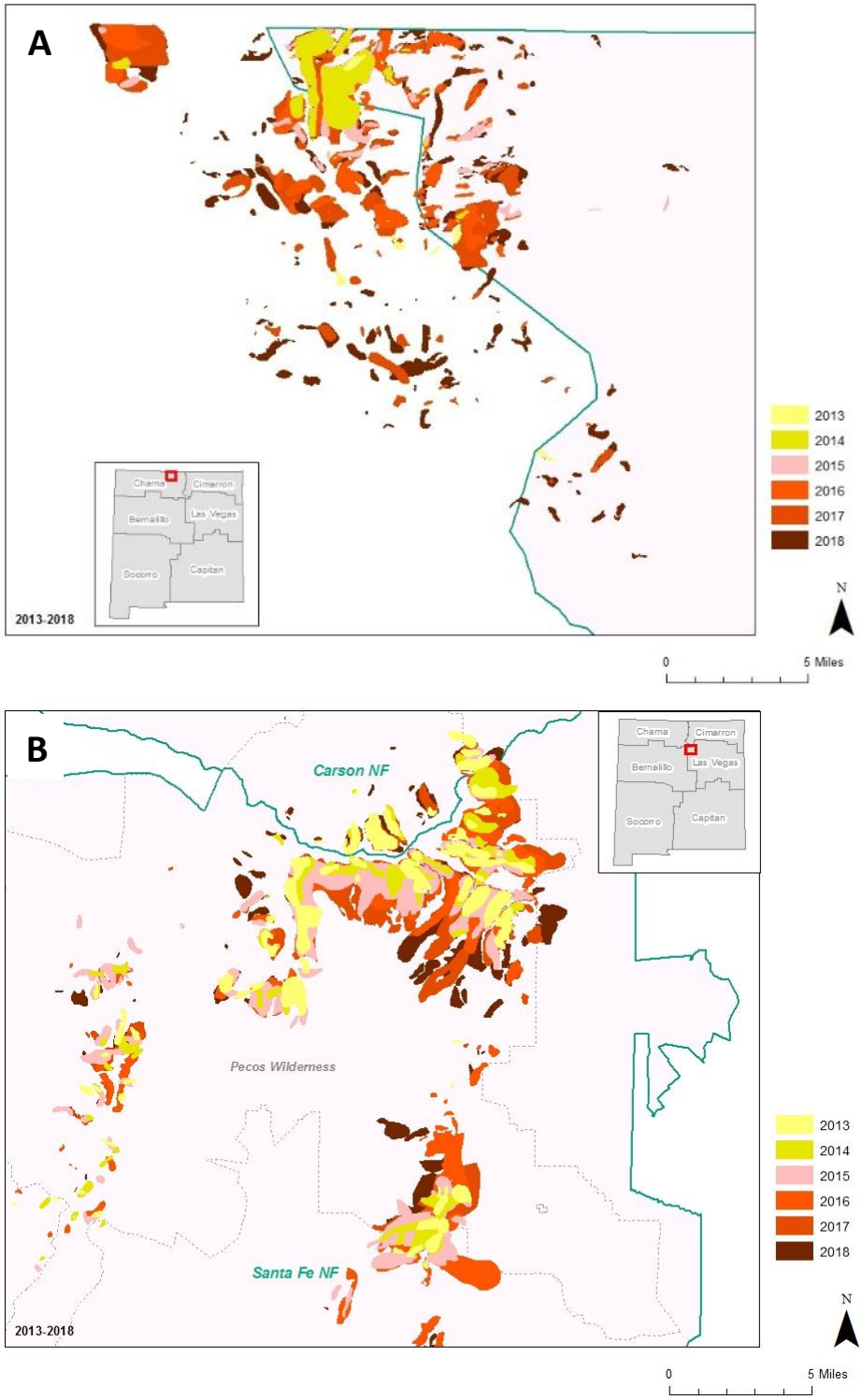
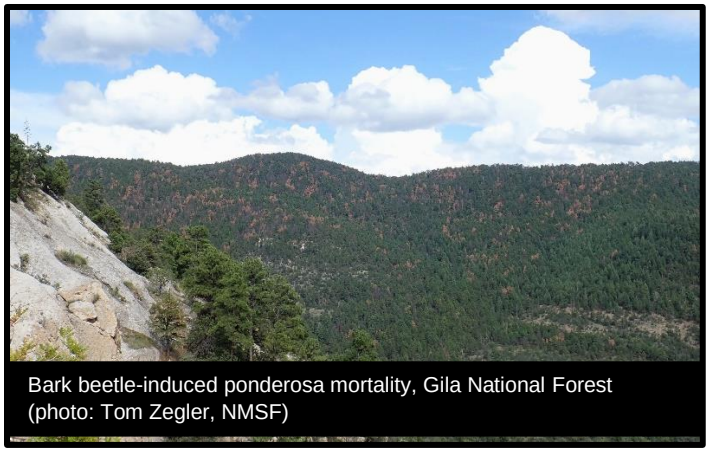


Figure A. Progression of spruce beetle-induced Engelmann spruce mortality mapped from 2013-2018 during aerial detection surveys A) on or adjacent to the northwest corner of the Tres Piedras Ranger District (Carson National Forest) and B) in and around the Pecos Wilderness (Santa Fe National Forest).



Bark beetle-induced ponderosa mortality, Gila National Forest (photo: Tom Zegler, NMSF)

Ponderosa Pine Bark Beetles

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

This complex of bark beetles killed nearly 53,000 acres of ponderosa across the state and was the most destructive forest mortality agent this year. In fact, bark beetle-induced ponderosa mortality increased more than 100% since the 2017 aerial survey (**Table 1**). This year, 60% of the state's ponderosa mortality occurred on the Gila National Forest, an area that has experienced prolonged bark beetle activity. The Cibola National Forest experienced the second highest amount of ponderosa mortality (7,600 acres), the majority of which occurred on Mt. Taylor. State and private lands had the third most mortality with 6,100 acres. Mortality on tribal lands totaled 3,200 acres, 76% of which occurred on the Navajo Nation. A cumulative total of 675,000 acres of ponderosa have been killed by this bark beetle-complex between 2010 and 2018. Bark beetle-induced ponderosa mortality may decline in 2019 due to increased statewide winter precipitation.

Mixed Conifer Bark Beetles

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

Douglas-fir beetle and fir engraver attack New Mexico's mid-elevation tree species, Douglas-fir and white fir, respectively. These two species of bark beetles caused a total of 17,900 acres of mixed conifer mortality statewide, which is a 26% decrease in acres since the 2017 aerial survey. The fir engraver beetle was relatively inactive this year with 90% of the mixed conifer mortality caused by the Douglas-fir beetle. The number of acres killed by these bark beetles has decreased 73% since 2014.

Douglas-fir mortality due to Douglas-fir beetle, Santa Fe National Forest

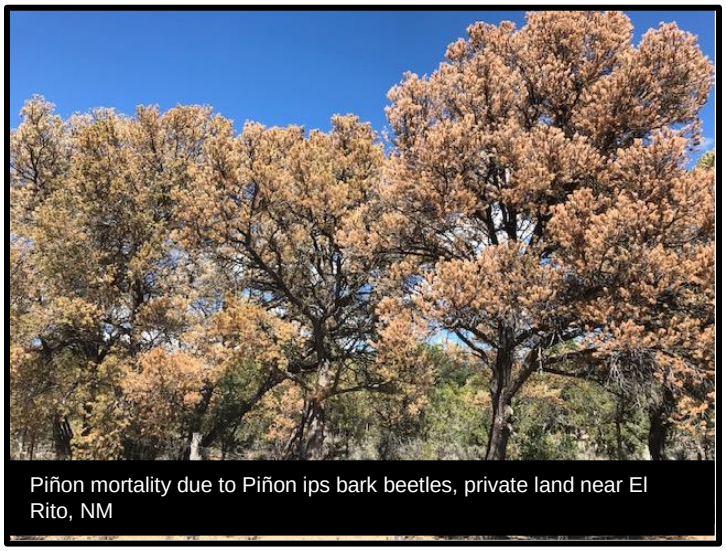
Large-scale outbreaks of these bark beetles are rare in the southwest; however, there have been some notable outbreaks of Douglas-fir beetle in Oregon and Washington. In New Mexico, increased Douglas-fir beetle-induced mortality can be observed in the stressed forests immediately surrounding recent fire scars. The downward trend of acres affected since 2014 is possibly due to improved stands conditions or the unusually wet springs of 2015 and 2016, which helped mid-elevation tree species better resist bark beetle attack in the years following.

In 2018, about 45% of mixed conifer mortality occurred on the Santa Fe National Forest, mostly in and around the Pecos Wilderness. The Carson and Cibola National Forests collectively accounted for 32% of mixed conifer mortality. There was 830 acres of Douglas-fir mortality mapped on the Valle Caldera National Park, an area with critically important, old-growth Douglas-fir in and around the historic building sites. In fact, there have been some attempts by forest health professionals to protect these trees from Douglas-fir beetle attack. Despite these attempts and possibly exacerbated by the continued wildfire activity in the Jemez Mountains, Douglas-fir beetle infestations persist in the area. Tribal lands accounted for 5% of overall mortality, most of which occurred on the Jicarilla Apache and Taos Pueblo lands. Mortality on state and private lands accounted for 13% of the overall acreage mapped this year (see page 11 for forest pests on state and private lands). A total of 302,000 acres have been killed in New Mexico by these two bark beetle species between 2010 and 2018.

Piñon Ips

(*Ips confusus*)

Piñon ips is the most significant mortality agent of piñon in New Mexico and outbreaks of this species are known to be driven by prolonged drought conditions. In fact, piñon ips killed millions of drought-stressed piñon across the southwest from 2002 to 2004. In 2018, 2,800 acres of piñon ips-induced mortality were mapped in the state. This is more than a 100% increase since the 2017 aerial survey when only 90 acres were mapped statewide.



Piñon mortality due to Piñon ips bark beetles, private land near El Rito, NM

About 54% of the piñon mortality this year occurred on the Gila National Forest. Most of the remaining mortality occurred on BLM, tribal, and state and private lands, which collectively accounted for 31% of the piñon mortality in the state. Most of the mortality on BLM and state and private lands occurred in the southern and western part of the state and 61% of the piñon mortality on tribal lands occurred on the Navajo Nation. Surprisingly, the Carson and Santa Fe National Forests only had 2 acres of mapped piñon mortality.

DEFOLIATION AGENTS

Defoliation agents have impacted 4.1 million acres of forest and woodlands in New Mexico over the last decade. Defoliating agents rarely kill trees in a single season, but prolonged multi-year defoliation activity can result in growth loss, crown dieback, and in some instances, tree death. Defoliation also weakens trees and can predispose them to attack by bark beetles or pathogens. In general, deciduous trees (e.g. aspen) can withstand defoliation activity better than evergreen species (e.g. pine, fir), although some exceptions do occur.

Statewide defoliation decreased by 19% from 2017 to 2018 (**Fig. 1**), mostly due to a decrease in western spruce budworm and aspen defoliator activity (**Table 1**). However, there was increased defoliation

activity from two rarely encountered species, Janet's looper and needleminer. These species collectively damaged approximately 77,000 acres in the northern part of the state.

Western Spruce Budworm

(*Choristoneura freemani*)

Caterpillars of this moth feed on Douglas-fir, true firs (e.g. white fir, subalpine fir), and spruce. In 2018, western spruce budworm (WSBW) impacted nearly 90,000 acres and was the most damaging defoliation agent in New Mexico. Number of acres impacted by WSBW decreased 49% between the 2017 and 2018 aerial survey (**Table 1**), possibly due to improved forest stands conditions and/or a decrease in defoliation severity. Western spruce budworm usually is the most destructive defoliator in the western U.S. and New Mexico is no exception. The overstocked mixed conifer forests of New Mexico have led to and sustained high populations of WSBW for the last decade. However, the southern portion of the state generally does not have large-scale WSBW events that is common north of Interstate 40.

The majority of WSBW defoliation in 2018 occurred on the Carson National Forest and state and private lands (**Table 2**). Collectively, these two areas accounted for 84% of the total acres impacted by WSBW. The National Forests in the southern half of the state (i.e. Gila, Lincoln, Cibola) accounted for only 348 acres or less than 1% of the overall acres impacted by WSBW. Most WSBW damage on tribal lands occurred on the Taos Pueblo and was generally concentrated around the area of Blue Lake. Approximately 1250 acres were damaged on the Valle Caldera National Park in 2018, which is a slight decrease from 2017.

Ponderosa Needleminer

(*Coleotechnites ponderosae*)

The tiny moth larvae of this species feeds within needles of ponderosa pine and can cause dramatic visual change over large areas. Recent large-scale outbreaks of this moth species are uncommon in New Mexico; however, there are reports of large outbreaks occurring in the northeastern part of the state in the 1980's and 1990's. For example, about 52,000 acres were impacted in 1989 in San Miguel County.

In 2018, over 64,000 acres of defoliation by an unknown defoliation agent were recorded in and around the Vermejo Ranch. There were a few possibilities for this defoliation activity, needleminer or needle cast disease. Post-aerial survey ground-checks of the area found mined needles in several of the defoliated trees, but the presence of needle cast could not be confirmed. Historical aerial survey reports from the 1980's and 1990's helped to further confirm that the activity was, in part, caused by needleminer. That said, ground-checks will be conducted in 2019 to further elucidate the cause of the damage.

Janet's Looper

(*Nepytia janetae*)

This is only the second known outbreak of Janet's looper caterpillar, a native species which feeds during the winter on high-elevation conifers, in New Mexico. The first Janet's Looper outbreak in New Mexico impacted over 10,000 acres on the Lincoln National Forest during the winters of 2005 and 2006. Because of the dramatic defoliation activity around the Village of Cloudcroft, NM, the Lincoln National Forest

authorized aerial spraying of *Bacillus thuringiensis* var. *kurstaki (Btk)*, a bacterium that mortally infects larvae of moths and butterflies, in the National Forest lands surrounding Cloudcroft. Ground surveys later determined that the aerial application of *Btk* around Cloudcroft had noticeable effects on the outbreak population of Janet's looper in the area. Despite these efforts, approximately 10-30% of the defoliated trees had died, either directly from Janet's looper feeding damage or from secondary attack by bark beetles.

Janet's looper caterpillar defoliation in mixed-conifer forest, Pecos Wilderness, Santa Fe National Forest (photo: Dan Ryerson, USFS)

The first Janet's looper defoliation activity on the Santa Fe National Forest was noticed during the winter of 2017/2018 along Hyde Park Road near the Big Tesuque Campground. Initially, the primary suspect was western spruce budworm (*Choristoneura freemani*), an insect that is very active in the area. However, upon closer inspection, New Mexico State Forestry and US Forest Service, Forest Health personnel discovered an outbreak of Janet's Looper in the area. This was a surprising find and only the second known outbreak of this species in New Mexico. To determine the extent of defoliation damage, a special aerial detection survey was conducted in the spring of 2018 on the Santa Fe National Forest. It was determined that approximately 11,000 acres have been impacted on the Espanola and Pecos/Las Vegas Ranger Districts. Most notably, Janet's looper has impacted trees in the Santa Fe Watershed within the Pecos Wilderness. The defoliation activity in this sensitive area could lead to unexpected watershed issues due to some likely tree mortality.

Aspen Defoliators

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

Currently, the western tent caterpillar and large aspen tortrix are the main defoliating agents of aspen in New Mexico and large-scale outbreaks of these species are common. Large-scale aspen foliar disease (e.g. black ink spot) outbreaks were recorded in 1980's and 1990's; however, these disease events are currently rare in New Mexico.

In 2018, approximately 16,400 acres of aspen were defoliated across the state (**Table 1**), the majority (56%) of which occurred on the Carson National Forest. Aspen defoliation on state and private lands and the Santa Fe National Forest accounted for 16% and 19% of the overall total, respectively.

The large-scale outbreak of western tent caterpillar around the Aspen Vista area of the Santa Fe National Forest is still on-going. This outbreak has been present since 2015 and, as a result, has negatively impacted the vibrant fall color of aspen in the area. Despite the prolonged defoliation activity, little to no aspen mortality has been observed in the infested area and these epidemic western tent caterpillar populations are expected to crash in the next few years.

CONCLUSIONS

The health of forests and woodlands in New Mexico is strongly influenced by temperature and precipitation. For example, warmer temperatures can increase insect activity and drier conditions can reduce the ability of trees to fight off pests, as exemplified by the large-scale piñon mortality event during the early 2000's.

According to the National Weather Service, 2018 was the 3rd warmest year on record in New Mexico and statewide precipitation average 1.22 inches below normal. Despite this, acres of forest damage declined slightly between the 2017 and 2018 aerial surveys. However, both ponderosa and pinon pine mortality significantly increased in 2018, most likely due to continued drought-related stress. The unusually wet springs of 2015 and 2016 was a benefit to forest health conditions in the following years, but without additional spring and monsoon rains forest pest activity may increase, especially in lower elevations. The good news: Snow water equivalent as of February 11, 2019 is much improved from the same time last year (**Fig. B**). This could help improve the health conditions in the mid- to high-elevation forests in the state. However, current reservoir levels are still well below historic levels and this tells a story that is consistent with the regions long-term precipitation deficit (**Table 4**).

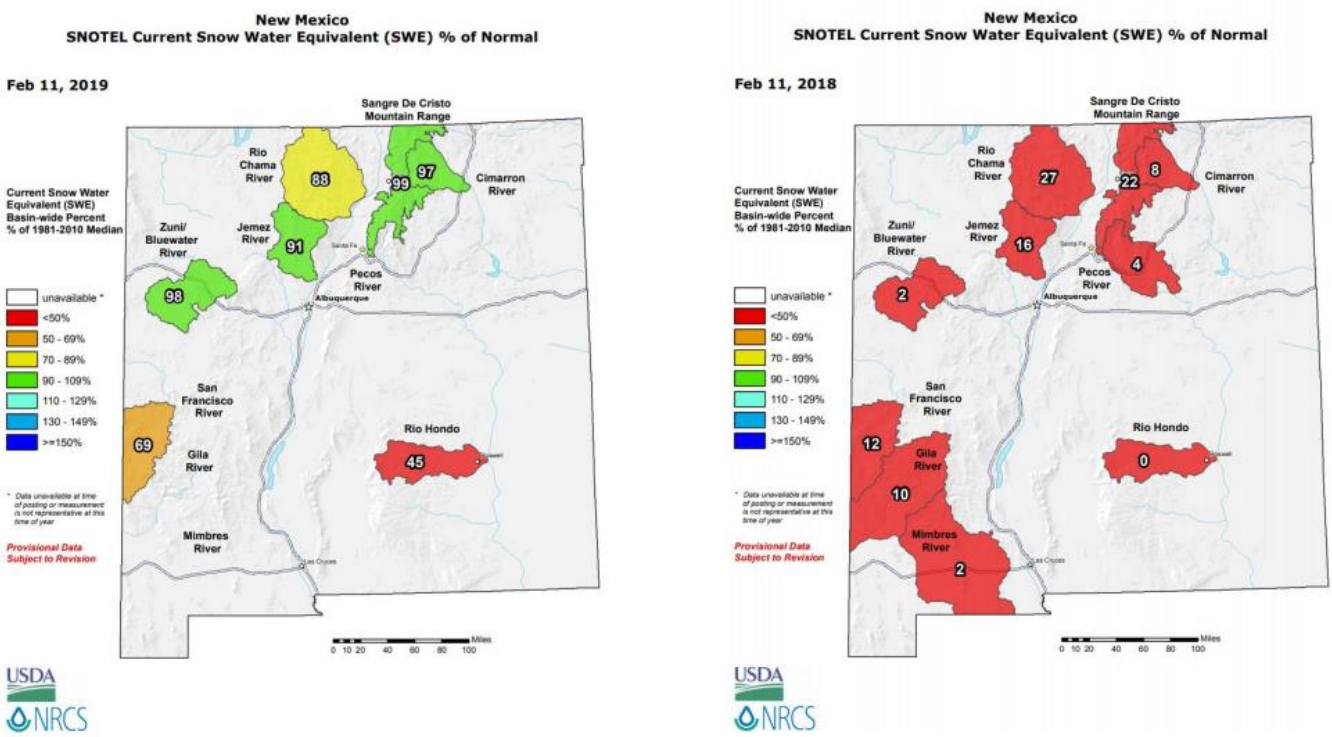


Figure B. Comparison between snow water equivalents one year apart (Feb. 11, 2018 and 2019; NRCS data).

PEST HIGHLIGHTS BY DISTRICT
(State and Private Lands Only)

BERNALILLO

Bernalillo County
- Ponderosa Mortality from Bark Beetles
  750 acres

Cibola County
- Ponderosa Mortality from Bark Beetles
  2,120 acres
- Hail Damage to Ponderosa Pine
  810 acres
- Western Spruce Budworm
  110 acres
- Aspen Defoliation
  170 acres

McKinley County
- Ponderosa Mortality from Bark Beetles
  280 acres
- Piñon Ips
  60 acres

Sandoval County
- Ponderosa Mortality from Bark Beetles
  30 acres
- Douglas-fir Beetle
  30 acres
- Cottonwood Mortality
  10 acres
- Western Spruce Budworm
  40 acres
- Aspen defoliation
  10 acres
- Douglas-fir tussock moth
  90 acres

Santa Fe County
- Douglas-fir Beetle
  40 acres

Torrance County
- Ponderosa Mortality from Bark Beetles
  800 acres
- Oak Defoliation
  60 acres

Valencia County
- Oak Defoliation
  10 acres

CAPITAN

Lincoln County
- Ponderosa Mortality from Bark Beetles
  240 acres

Otero County
- Ponderosa Mortality from Bark Beetles
  50 acres

CHAMA

Rio Arriba County
- Douglas-fir Beetle
  10 acres
- Spruce Beetle
  10,430 acres
- Aspen Mortality
  980 acres

Taos County
- Ponderosa Mortality from Bark Beetles
  50 acres
- Piñon Ips
  30 acres
- Douglas-fir Beetle
  440 acres
- Spruce Beetle
  1,520 acres
- Western Spruce Budworm
  13,340 acres
- Aspen Defoliation
  440 acres

CIMARRON

Colfax County

- Ponderosa Mortality from Bark Beetles **210 acres**
- Douglas-fir Beetle **1,360 acres**
- Aspen Mortality **110 acres**
- Western Spruce Budworm **12,620 acres**
- Ponderosa Defoliation (needleminer) **54,160**

Taos County

- Ponderosa Mortality from Bark Beetles **50 acres**
- Piñon Ips **30 acres**
- Douglas-fir Beetle **440 acres**
- Spruce Beetle **1,520 acres**
- Western Spruce Budworm **13,340 acres**
- Aspen Defoliation **440 acres**

LAS VEGAS

Mora County

- Ponderosa Mortality from Bark Beetles **370 acres**
- Spruce Beetle **120 acres**
- Western Spruce Budworm **2,570 acres**
- Ponderosa Defoliation (needleminer) **10,290 acres**
- Oak Defoliation **50 acres**

San Miguel County

- Ponderosa Mortality from Bark Beetles **310 acres**
- Douglas-fir Beetle **90 acres**
- Fir Engraver **70 acres**
- Ponderosa Defoliation (needleminer) **1,250 acres**
- Aspen Defoliation **110 acres**
- Janet's Looper Defoliation **100 acres**

SOCORRO

Catron County

- Ponderosa Mortality from Bark Beetles **550 acres**
- Piñon Ips **150 acres**
- Piñon Needle Scale **180 acres**
- Pine Sawfly **180 acres**

Grant County

- Ponderosa Mortality from Bark Beetles **220 acres**
- Piñon Defoliation **50 acres**
- Cottonwood Defoliation **10 acres**

Sierra County

- Cedar Bark Beetles **70 acres**

Socorro County

- Ponderosa Mortality from Bark Beetles **140 acres**

TABLES AND GRAPHS

Table 1. Aerial detection survey results for forest insect and disease activity on all lands in New Mexico in 2017 and 2018

Damage Type[1]		2018 acres	2017 acres	% change[2]
DEFOLIATION				
by host[3]				
	aspen	16,410	46,670	-65
by agent				
	western spruce budworm	89,580	176,170	-49
	Janet's looper	10,670	0	>100
	Douglas-fir tussock moth	1,890	3,070	-38
	piñon needle scale	240	1,330	-82
	pine sawfly	300	520	-42
	needleminer[6]	66,010	0	>100
Defoliation Total		**185,100**	**227,760**	**-19**
MORTALITY				
by forest type[4]				
	spruce-fir	45,660	46,050	-1
	mixed conifer	17,880	24,050	-26
by host[3]				
	ponderosa pine	52,590	13,480	>100
	aspen	2,470	780	>100
	southwestern white pine	10	*	
by agent				
	piñon ips	2,760	90	>100
Mortality Total		**121,370**	**84,450**	**44**
OTHER				
	branch flagging (multiple hosts)	400	350	14
	discoloration (multiple hosts)	1,710	260	>100
	dieback (multiple hosts)	10	50	-80
Other Total		**2,120**	**660**	**>100**
	Grand Total	**308,590**	**312,870**	**-1**
	Total Area Mapped[5]	**306,590**	**310,070**	**-1**

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

[2] (2018 acres – 2017 acres) / 2017 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

[6] Needleminer was confirmed in several trees during a post-ADS ground check

Table 2. Aerial detection survey results for forest insect and disease activity on state and private lands in New Mexico in 2017 and 2018

Damage Type		2018 acres	2017 acres	% change[1]	% of all lands[2]
DEFOLIATION					
by host[3]					
	aspen	2,700	15,230	-82	16
by agent					
	western spruce budworm	32,870	50,450	-35	37
	Janet's looper	100	0	>100	1
	Douglas-fir tussock moth	90	140	-36	5
	piñon needle scale	180	890	-80	75
	pine sawfly	180	420	-57	60
	needleminer[6]	65,700	0	>100	100
Defoliation Total		**101,820**	**67,130**	**52**	**55**
MORTALITY					
by forest type[4]					
	spruce-fir	12,100	9,650	25	27
	mixed conifer	2,380	3,550	-33	13
by host[3]					
	ponderosa pine	6,290	1,270	>100	12
	aspen	1,120	260	>100	45
	southwestern white pine	*	0	>100	~50
by agent					
	piñon ips	250	30	>100	9
Mortality Total		**22,140**	**14,760**	**50**	18
OTHER					
	branch flagging (multiple hosts)	170	230	-26	43
	discoloration (mutiple hosts)	270	50	>100	16
	dieback (multiple hosts)	*	50	~-90	~50
Other Total		**440**	**330**	**33**	21
	Grand Total	**124,400**	**82,220**	**51**	40
	Total Area Mapped[5]	**124,660**	**83,810**	**49**	41

[1] (2018 acres – 2017 acres) / 2017 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

[6] Needleminer was confirmed in several trees during a post-ADS ground check

Table 3. Summary of forest health technical assistance given by the NM Forest Health Specialist in 2018

Assistance Type	#	%	Site visit	Confirmed damage agents[1]
Private landowner				
request (identification)	6	16	5	longhorned borer larva
mortality (conifer)	6	16	6	piñon ips
request (info)	10	27	7	management strategies for bark beetles
defoliation (conifer)	10	27	10	piñon needle scale
dieback (conifer)	3	8	2	twig beetle
defoliation (hardwood)	1	3	1	honeylocust plant bug
mortality (hardwood)	1	3	1	honeylocust borer
Landowner Total	**37**		**32**	
Private company				
request (info)	1	100	1	dwarf mistletoe, twig beetle, piñon ips
Company Total	**1**		**1**	
City government				
request (info)	1	100	1	nantucket pine tip moth, European elm scale
City Total	**1**		**1**	
State government				
request (identification)	2	17	0	woodwasp
request (info)	3	25	3	thinning evaluation
defoliation (hardwood)	1	8	1	Marssonina leaf blight
dieback (conifer)	2	17	0	Cooley spruce adelgid
mortality (conifer)	4	33	1	piñon ips, twig beetle
State Total	**12**		**5**	
Federal government				
request (survey)	15	63	15	spruce beetle, honeylocust borer
defoliation (conifer)	8	33	8	Janet's looper, Douglas-fir tussock moth
mortality (conifer)	1	4	1	Douglas-fir beetle
Federal Total	**24**		**24**	
Grand Total[2]	**75**		**63**	

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

[2] 2017: # = 76; site visit = 12

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

Reservoir/Lake	Current % capacity	Average % capacity
El Vado	6	55
Conchas	51	78
Caballo	8	18
Heron	15	80
Santa Rosa	12	12
Cochiti	9	13
Brantley	3	2
Abiquiu	7	13
Navajo	52	81
Elephant Butte	4	56
Average	**17**	**41**

[1] As of January 7, 2019

[2] Based on 1981 – 2019 reference period

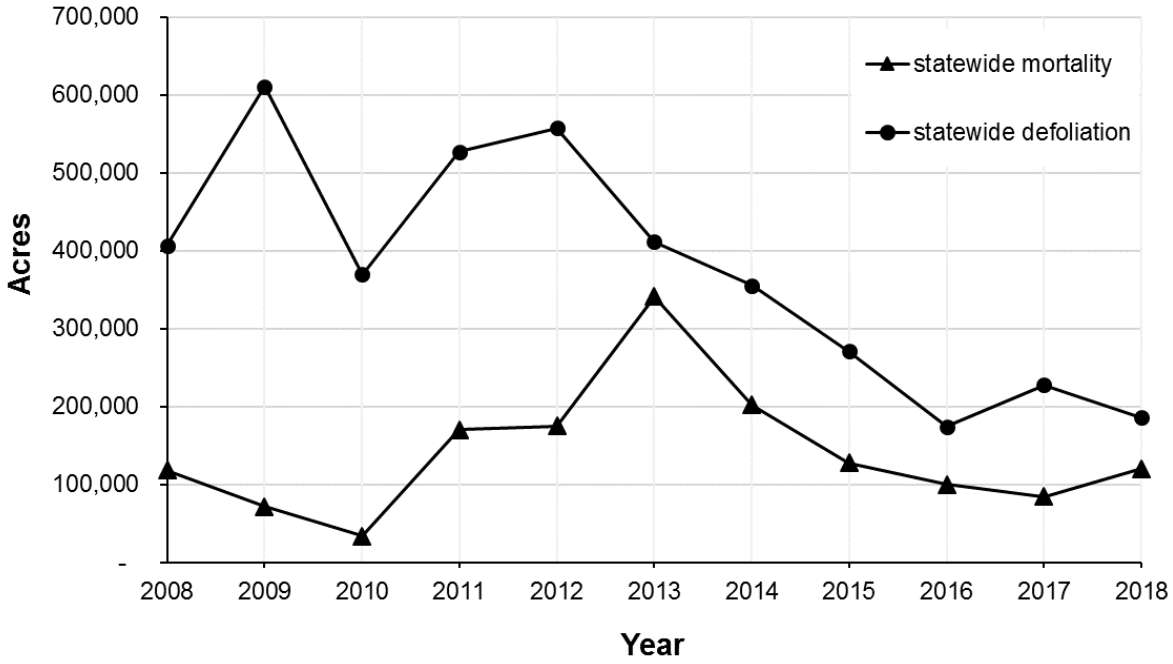


Figure 1. Trends for statewide forest mortality and defoliation in New Mexico from 2008 to 2018

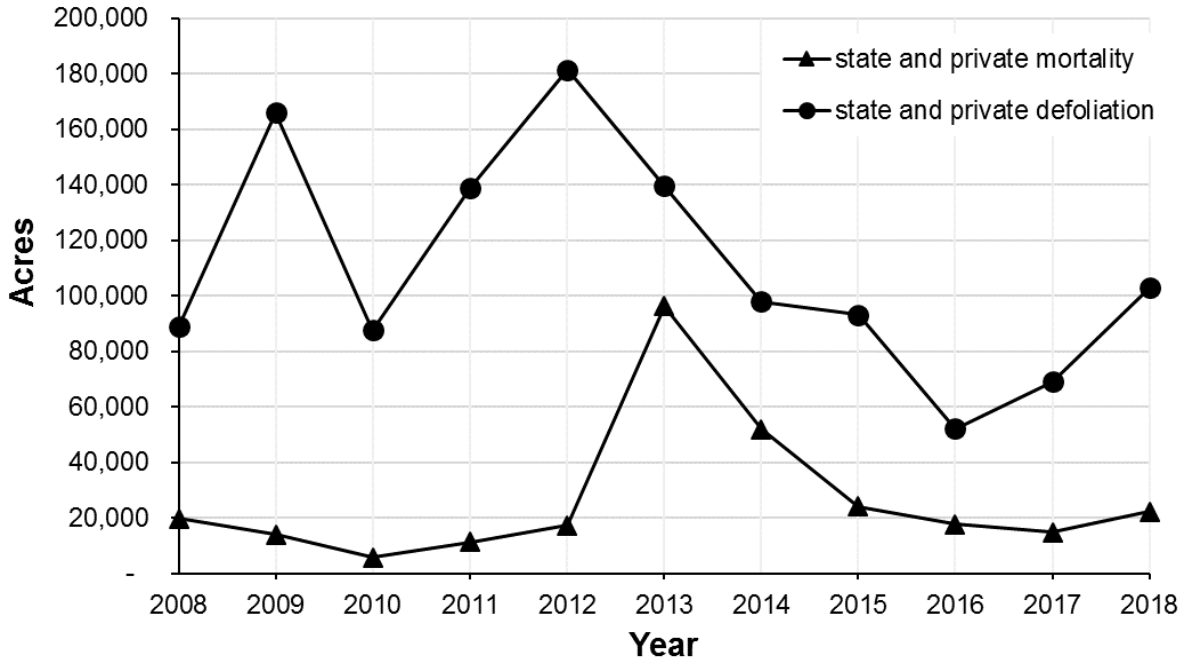


Figure 2. Trends for state and private forest mortality and defoliation in New Mexico from 2008 to 2018

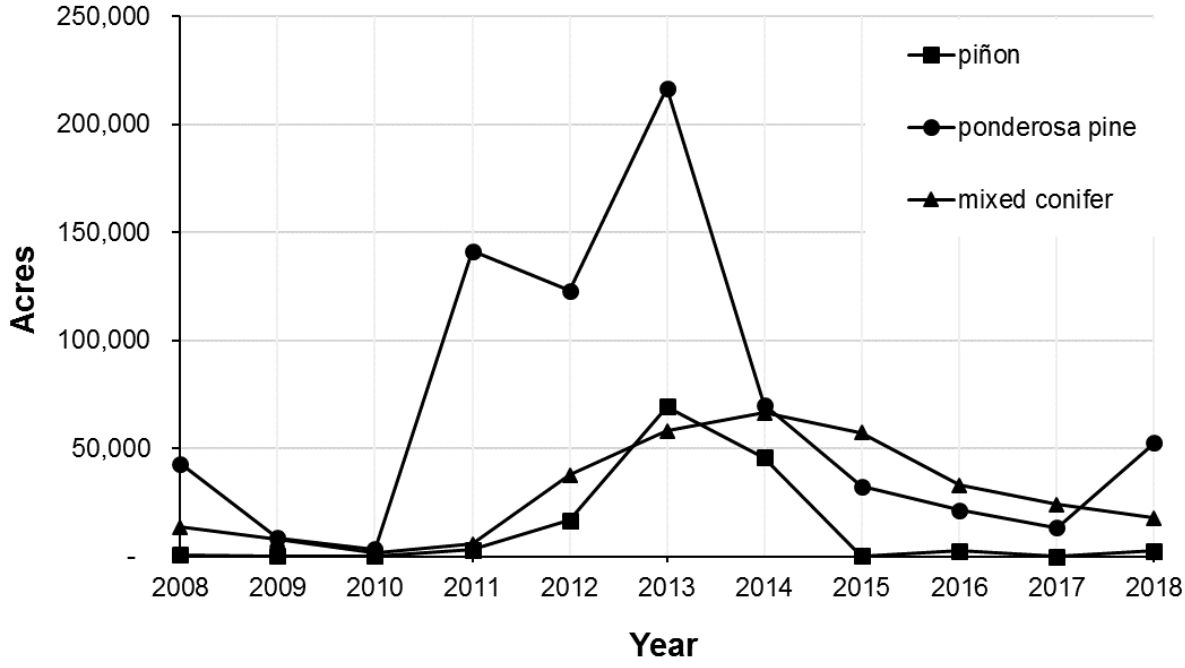


Figure 3. Statewide forest mortality trends due to bark beetle activity in low- to middle-elevation conifer species in New Mexico from 2008 to 2018

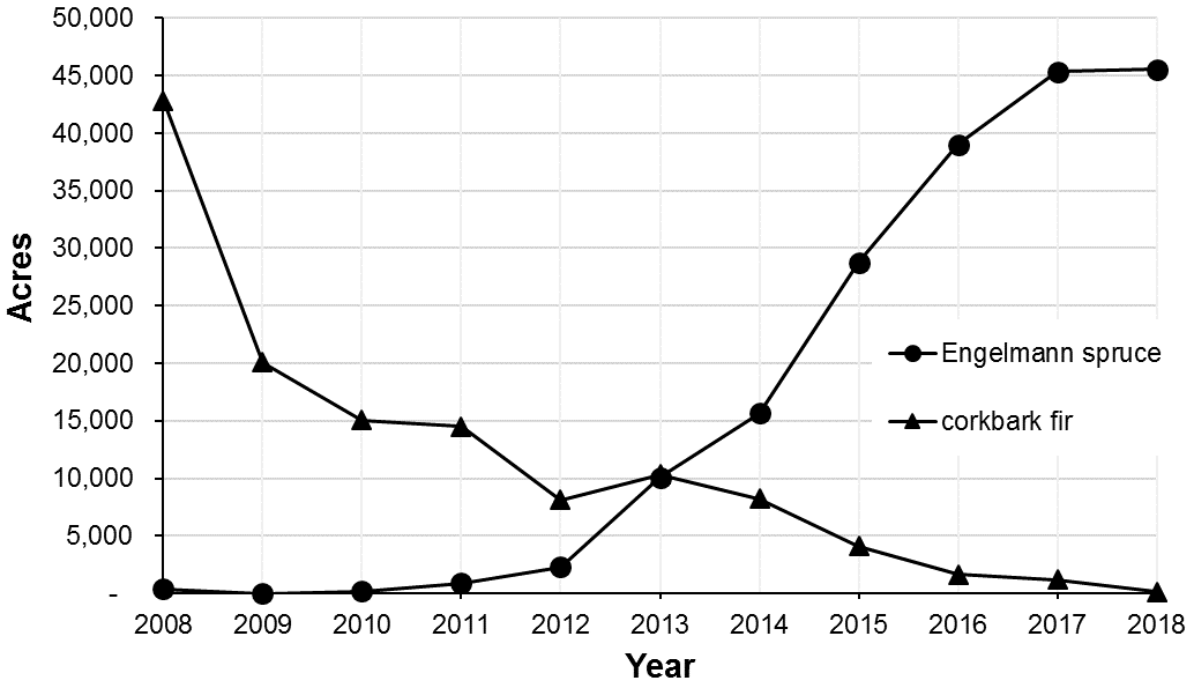


Figure 4. Statewide forest mortality trends due to bark beetle activity in high-elevation conifer species in New Mexico from 2008 to 2018

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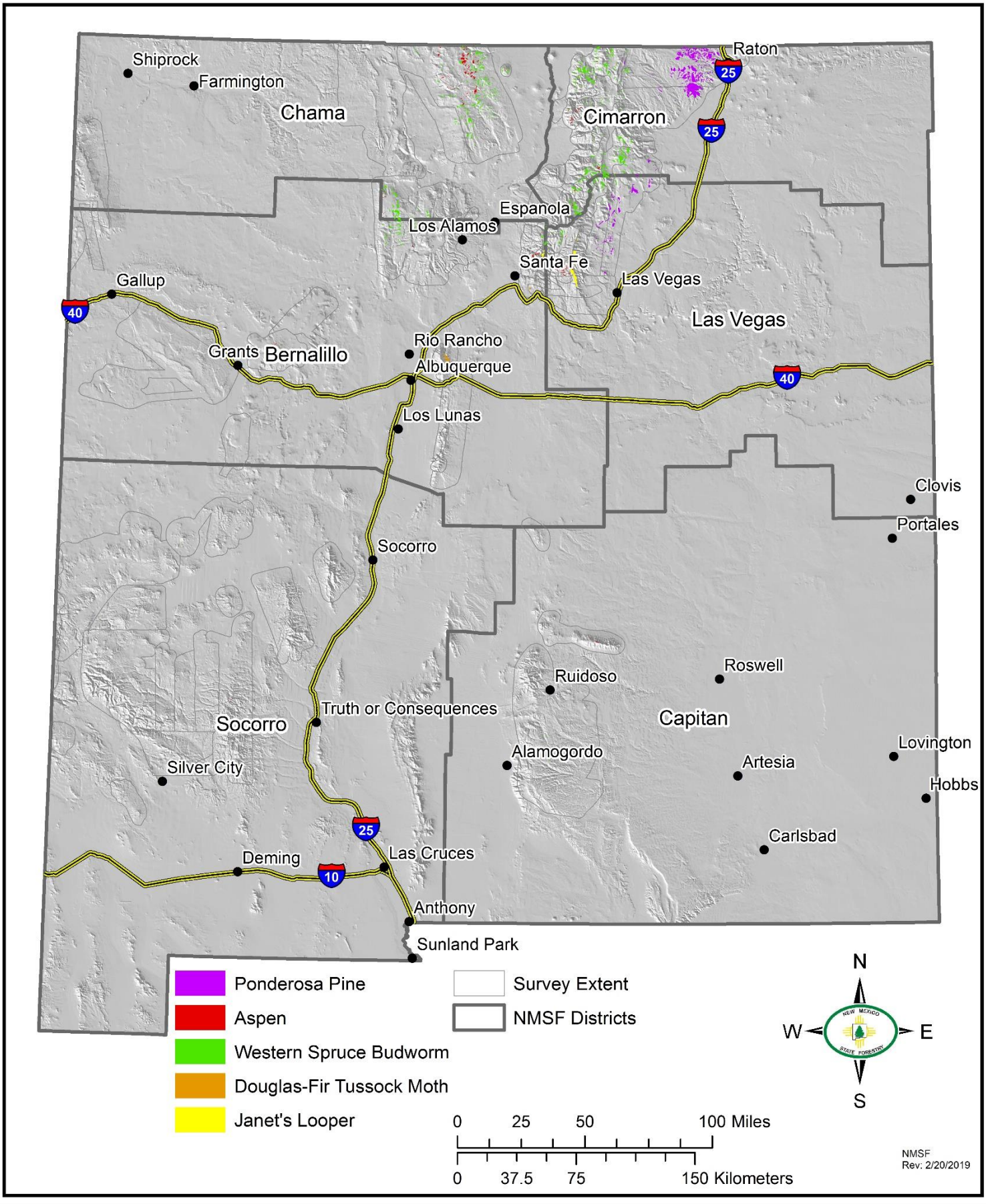
2018 Forest Defoliation Activity
New Mexico



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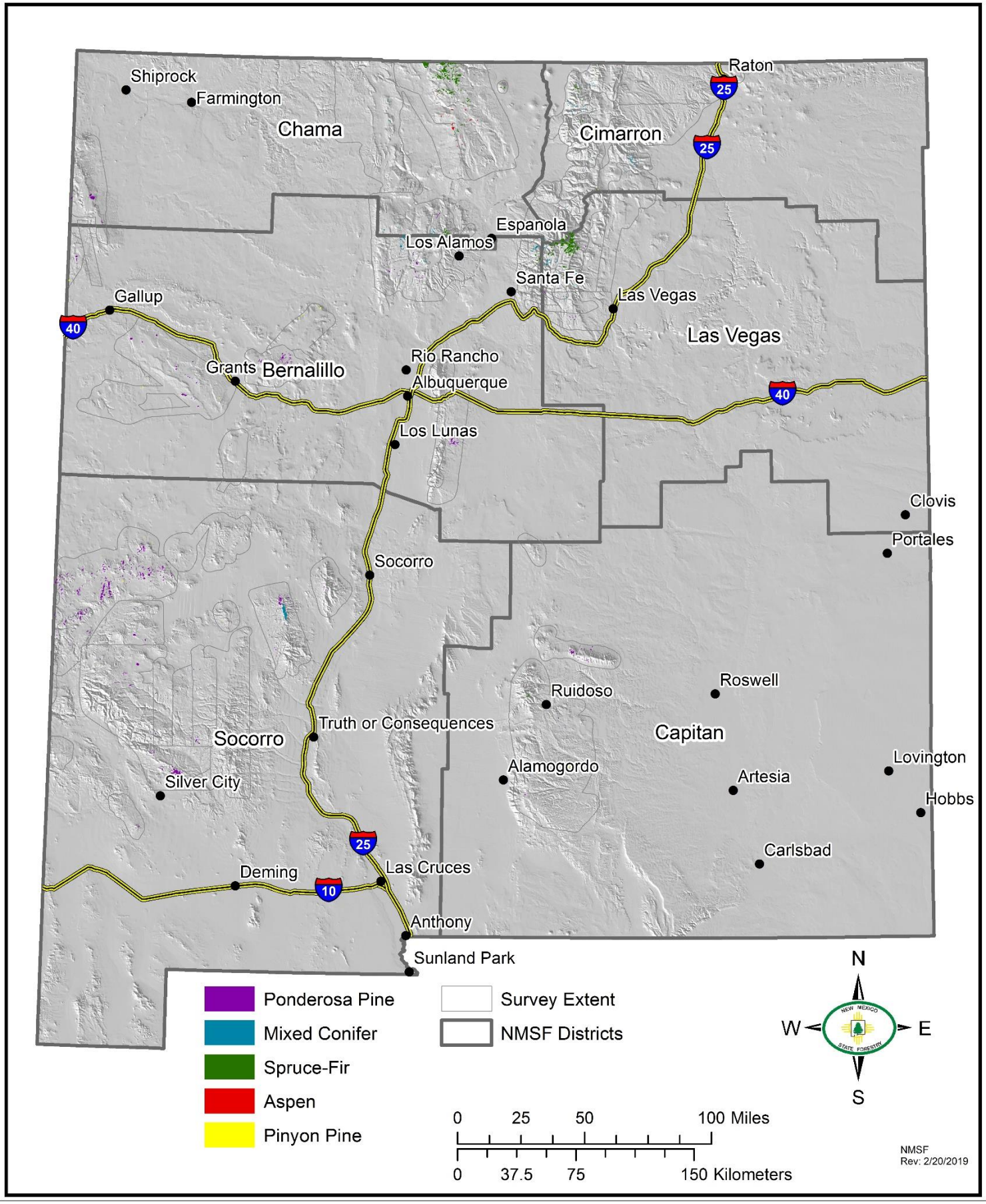
2018 Forest Mortality Activity
New Mexico



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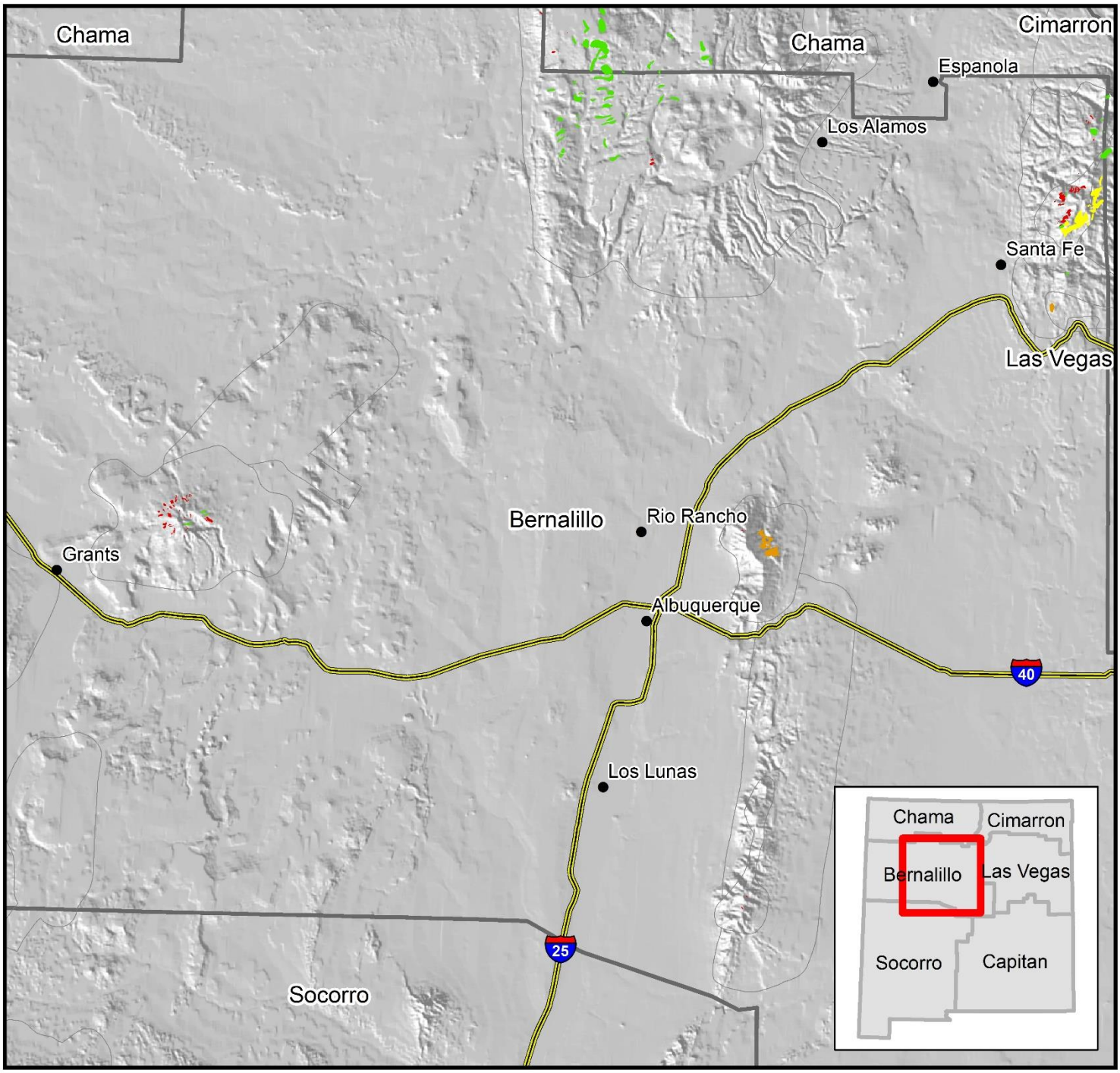
2018 Forest Defoliation Activity
Bernalillo District



- Ponderosa Pine
- Aspen
- Western Spruce Budworm
- Douglas-Fir Tussock Moth
- Janet's Looper
- Survey Extent
- NMSF Districts

N
W
E
S

0 5 10 20 Miles
0 12.5 25 50 Kilometers

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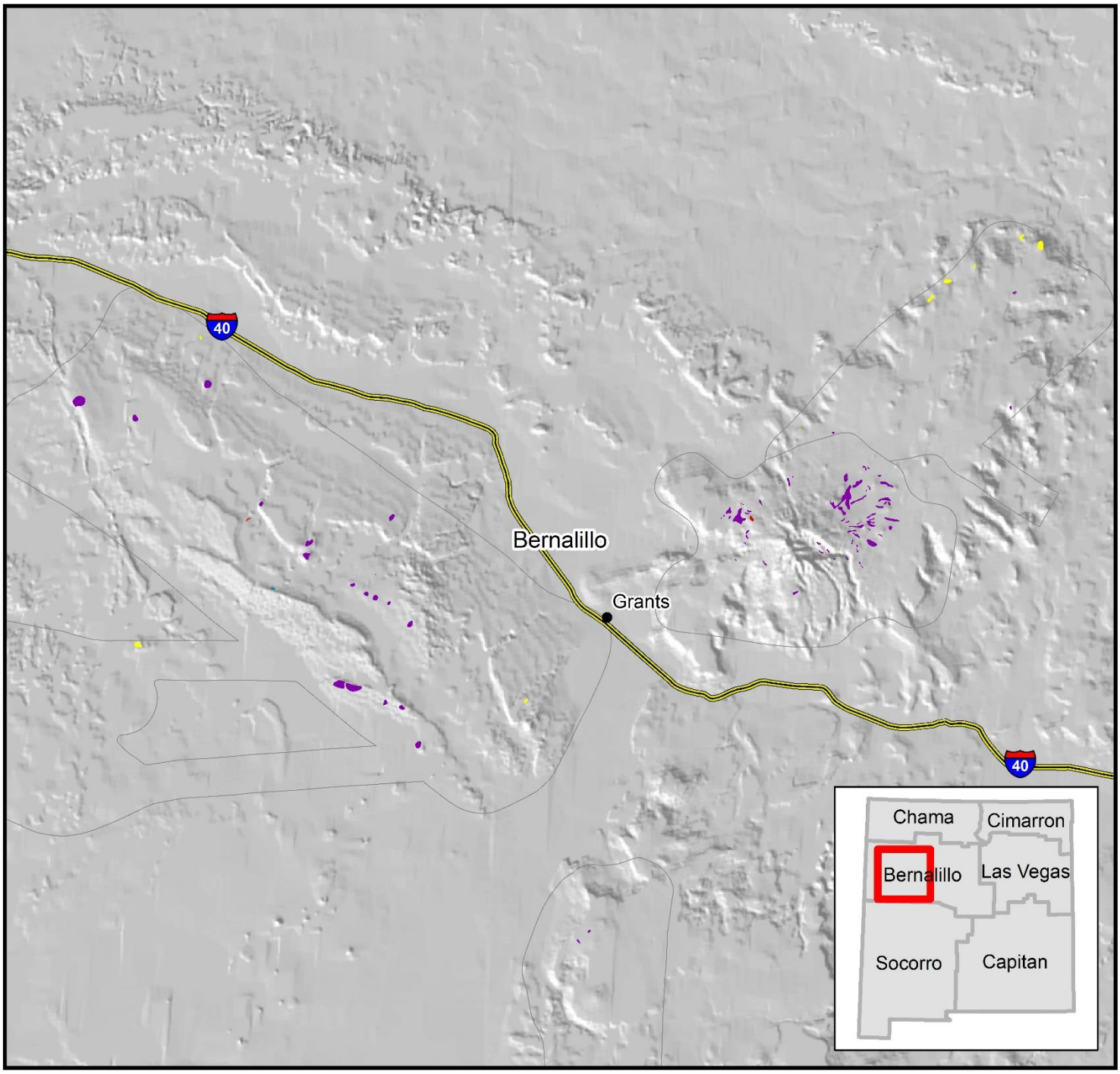
2018 Forest Mortality Activity
Bernalillo District



Ponderosa Pine
Mixed Conifer
Spruce-Fir
Aspen
Pinyon Pine
Survey Extent
NMSF Districts

N
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S

0 5 10 20 Miles
0 5 10 20 Kilometers

NMSF
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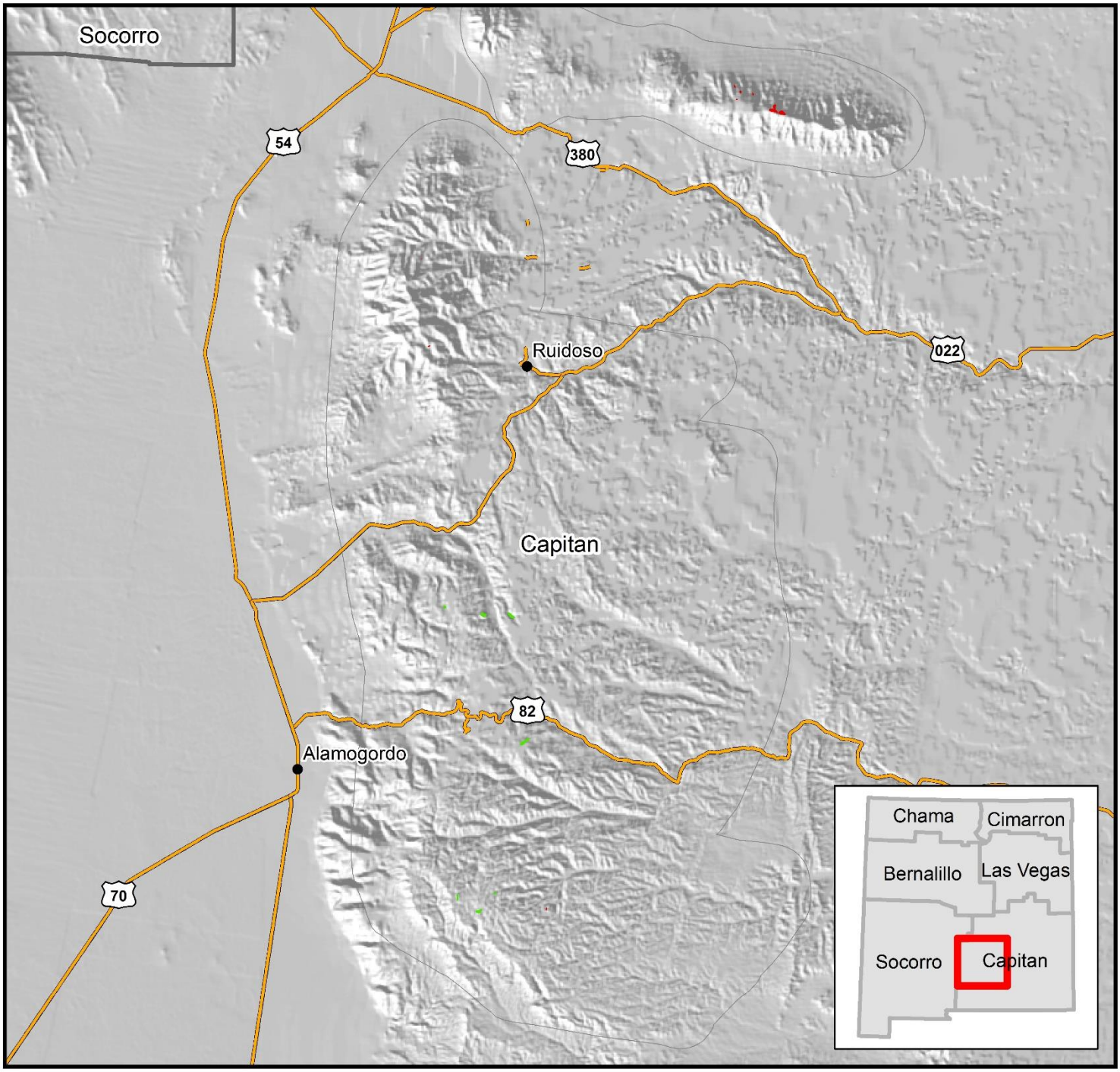
2018 Forest Defoliation Activity
Capitan District



- Ponderosa Pine
- Aspen
- Western Spruce Budworm
- Douglas-Fir Tussock Moth
- Janet's Looper
- Survey Extent
- NMSF Districts

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W E
S

0 5 10 20 Miles

0 5 10 20 Kilometers

NMSF
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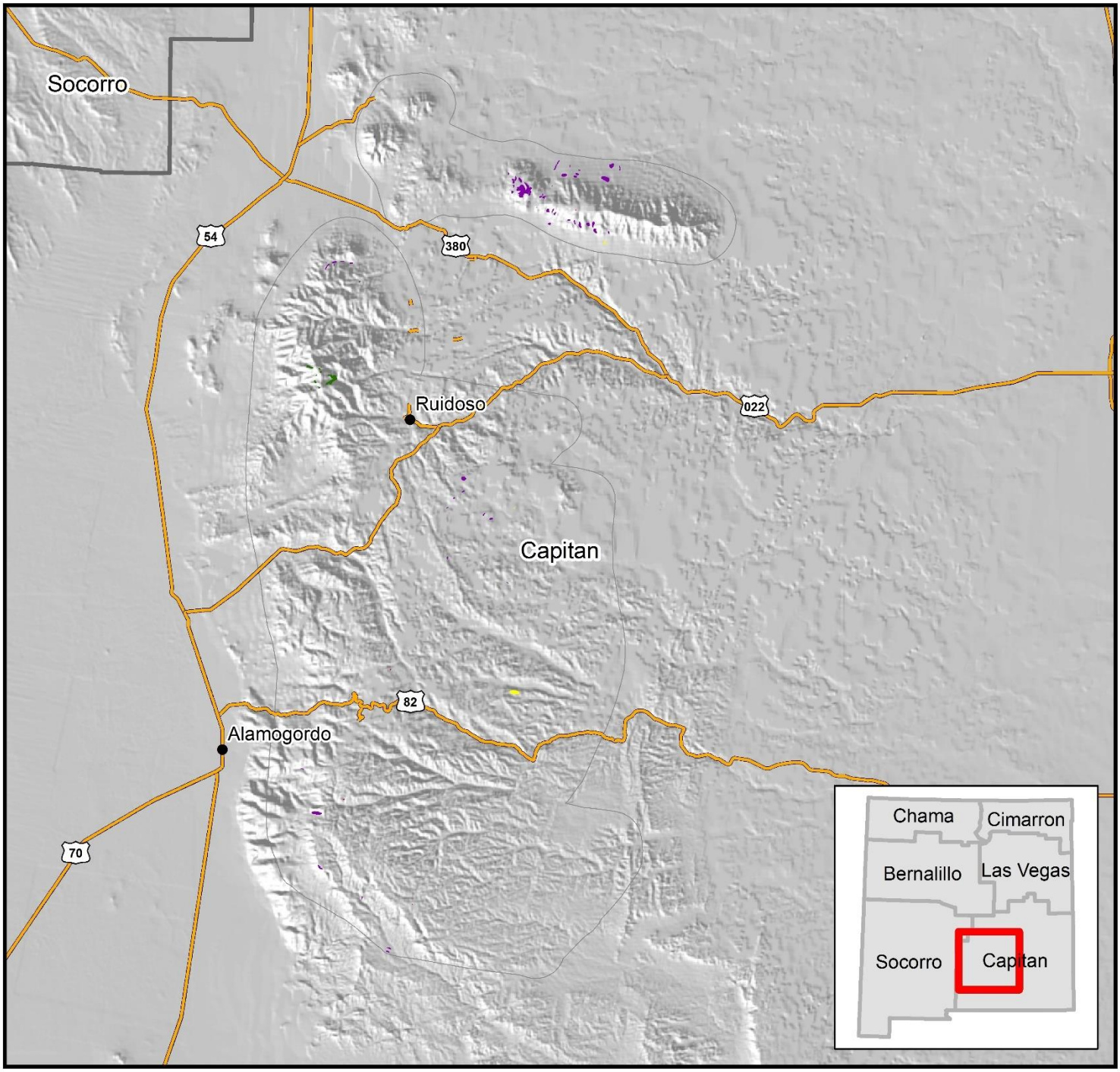
2018 Forest Mortality Activity
Capitan District



Ponderosa Pine
Mixed Conifer
Spruce-Fir
Aspen
Pinyon Pine
Survey Extent
NMSF Districts

N
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0 5 10 20 Miles
0 10 20 40 Kilometers

NMSF
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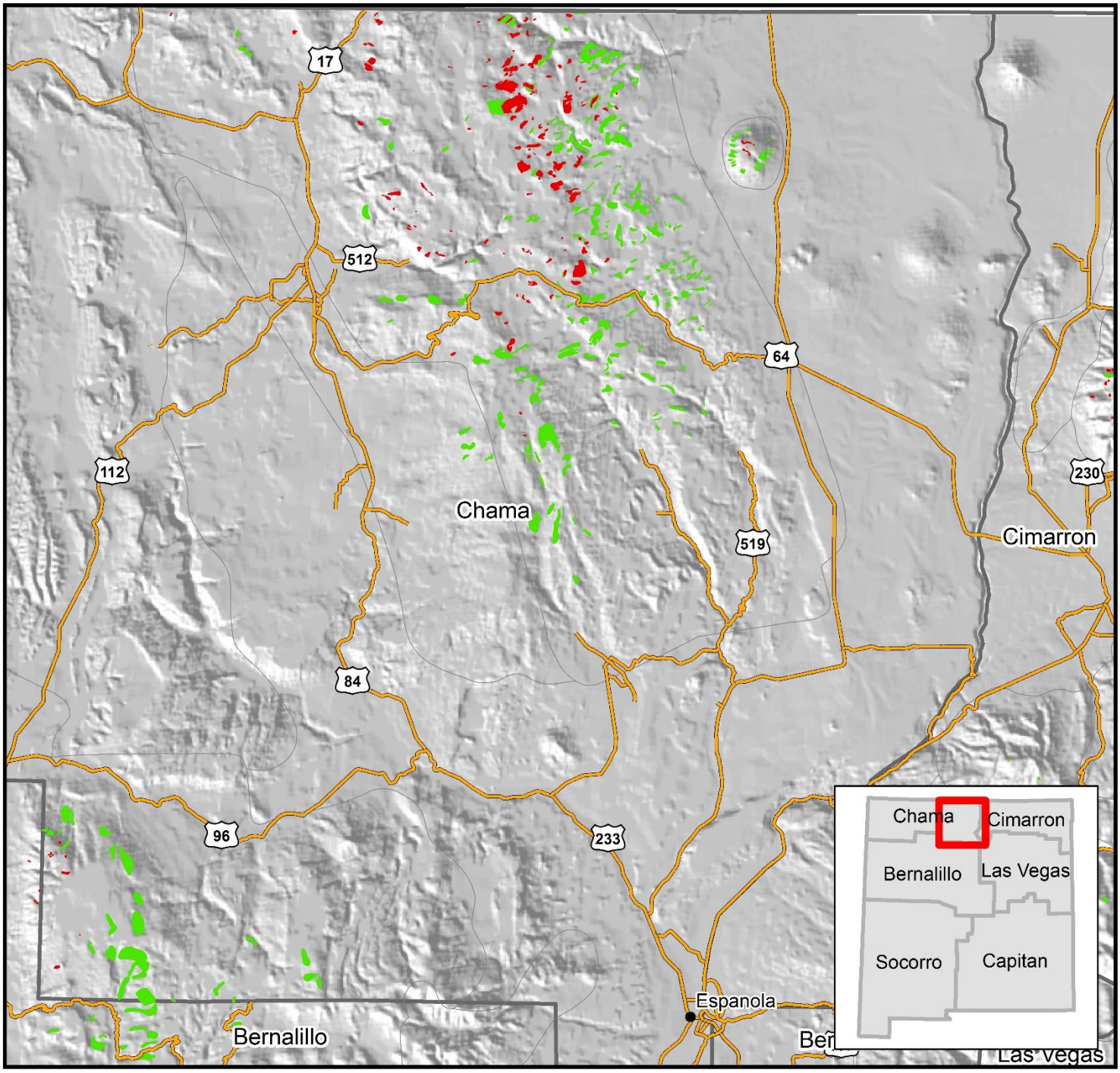
2018 Forest Defoliation Activity
Chama District



Ponderosa Pine
Aspen
Western Spruce Budworm
Douglas-Fir Tussock Moth
Janet's Looper

Survey Extent
NMSF Districts

N
W
E
S

0 5 10 20 Miles
0 5 10 20 Kilometers

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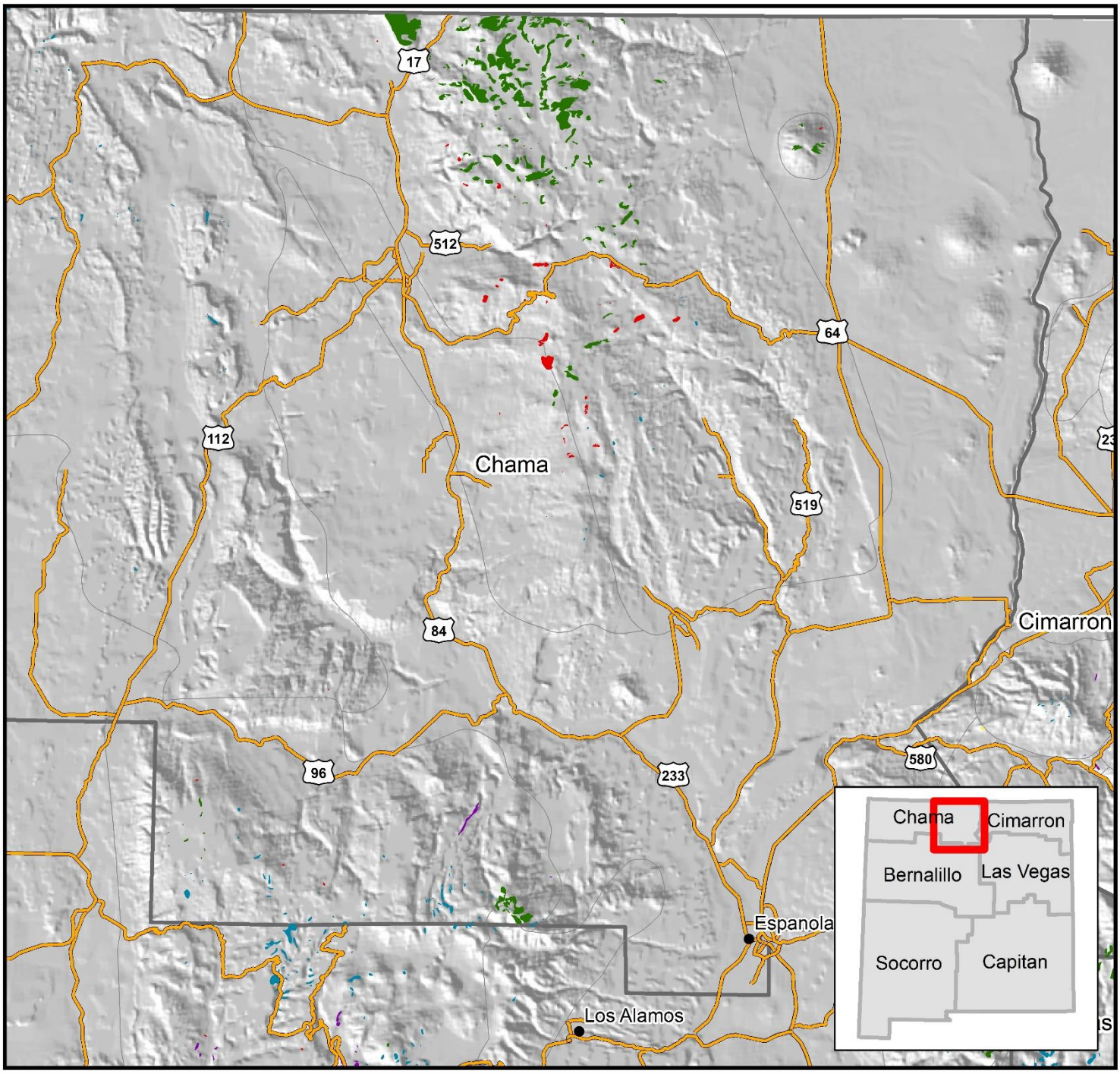
2018 Forest Mortality Activity
Chama District



Ponderosa Pine
Mixed Conifer
Spruce-Fir
Aspen
Pinyon Pine
Survey Extent
NMSF Districts

N
W
E
S

0 5 10 20 Miles
0 5 10 20 Kilometers

NMSF
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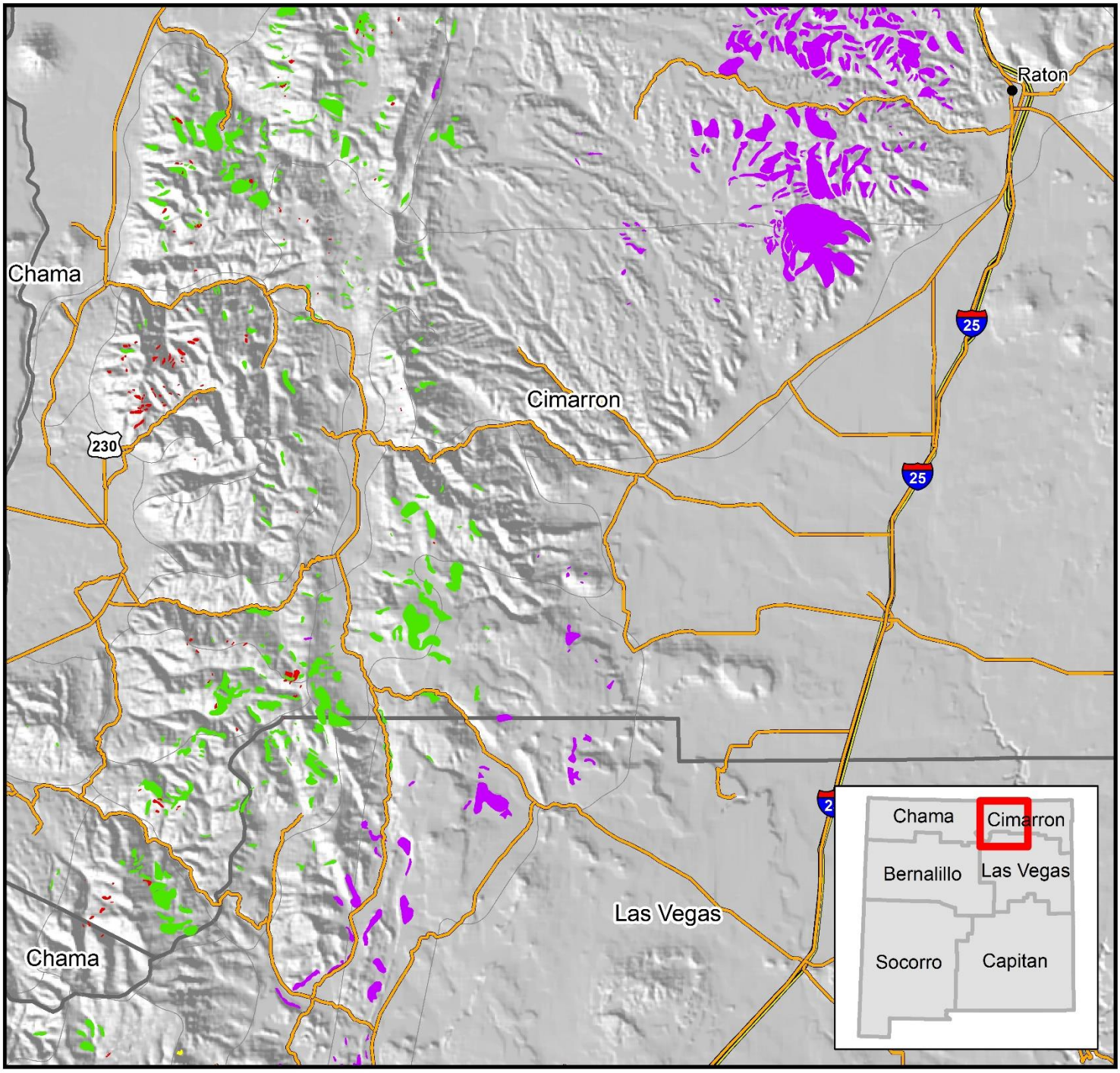
2018 Forest Defoliation Activity
Cimarron District



Ponderosa Pine
Aspen
Western Spruce Budworm
Douglas-Fir Tussock Moth
Janet's Looper
Survey Extent
NMSF Districts

N
W
E
S

0 5 10 20 Miles
0 5 10 20 Kilometers

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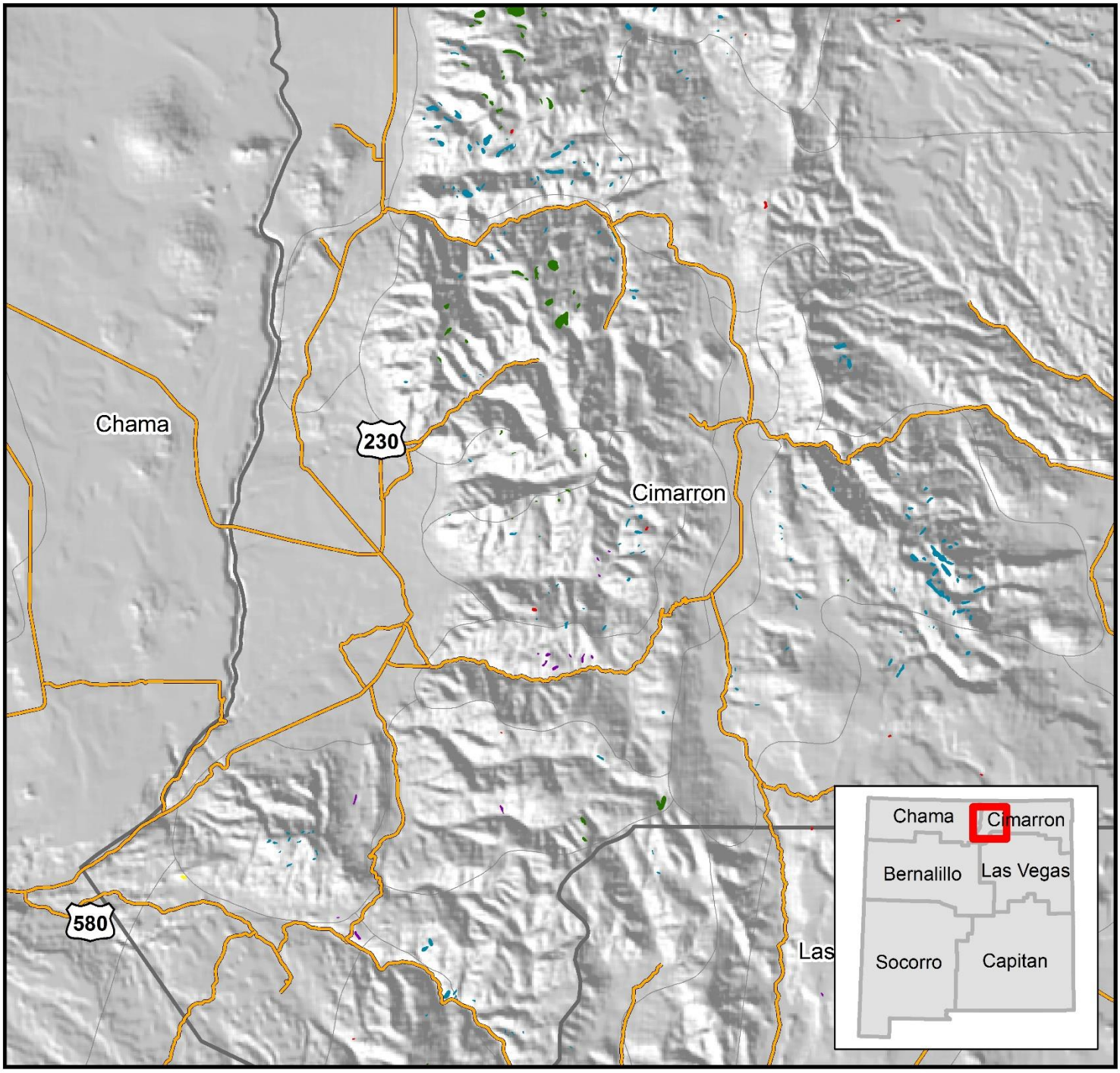
2018 Forest Mortality Activity
Cimarron District



Ponderosa Pine
Mixed Conifer
Spruce-Fir
Aspen
Pinyon Pine
Survey Extent
NMSF Districts

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0 3.5 7 14 Miles
0 5 10 20 Kilometers

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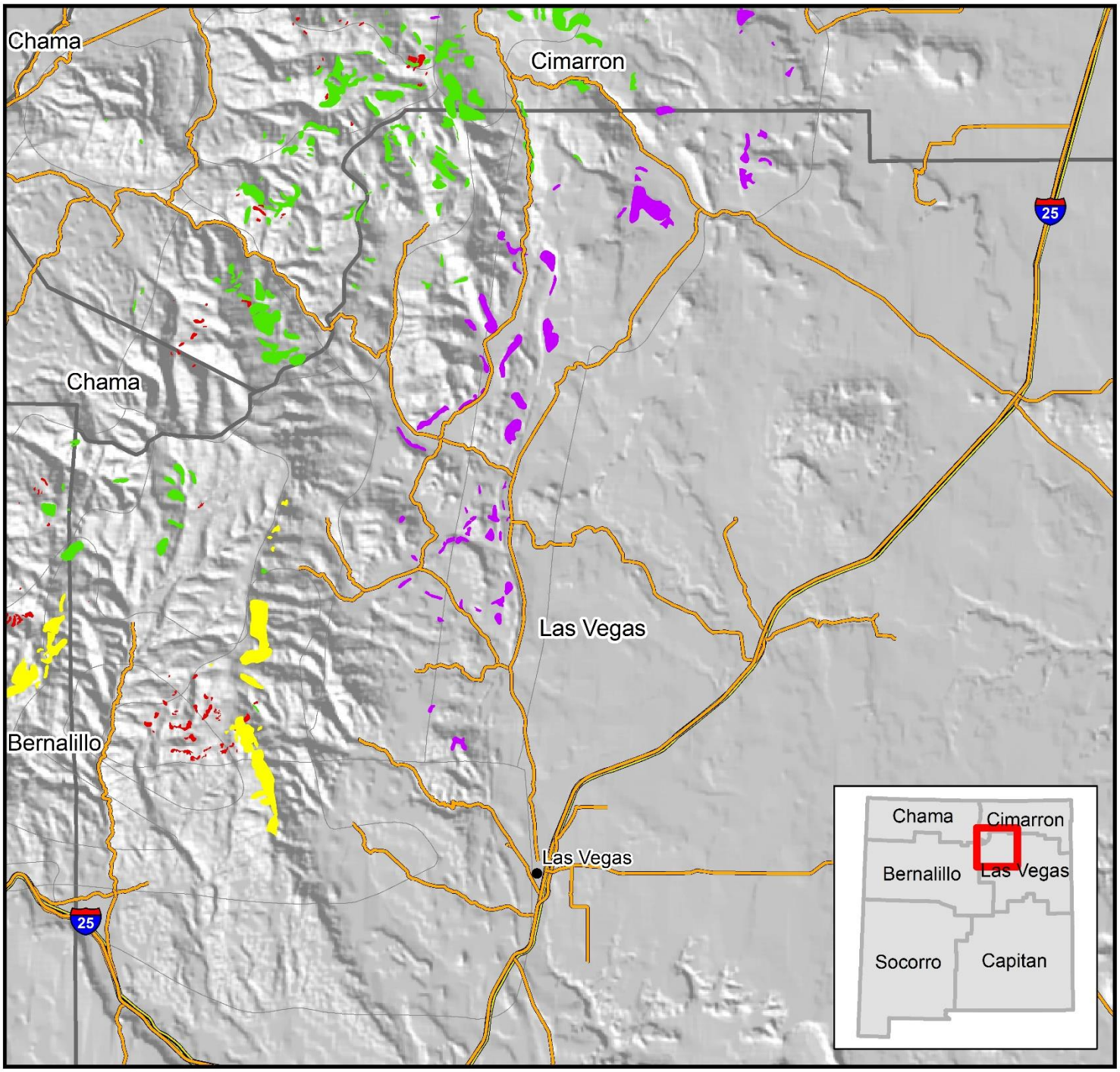
2018 Forest Defoliation Activity
Las Vegas District



- Ponderosa Pine
- Aspen
- Western Spruce Budworm
- Douglas-Fir Tussock Moth
- Janet's Looper
- Survey Extent
- NMSF Districts

N
W
E
S

0 4.25 8.5 17 Miles

0 5 10 20 Kilometers

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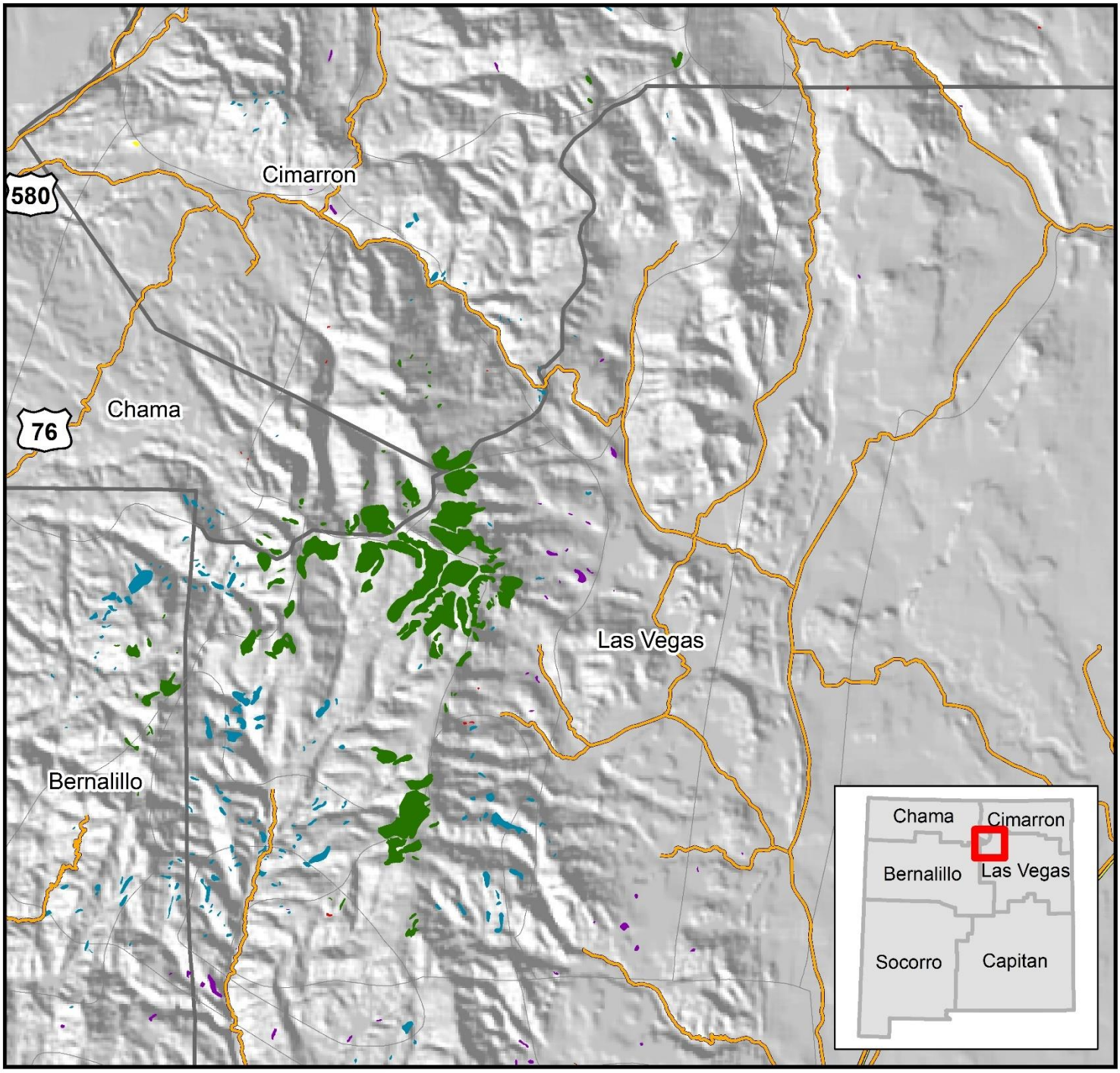
2018 Forest Mortality Activity
Las Vegas District



Ponderosa Pine
Mixed Conifer
Spruce-Fir
Aspen
Pinyon Pine
Survey Extent
NMSF Districts

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0 5 10 20 Kilometers

NMSF
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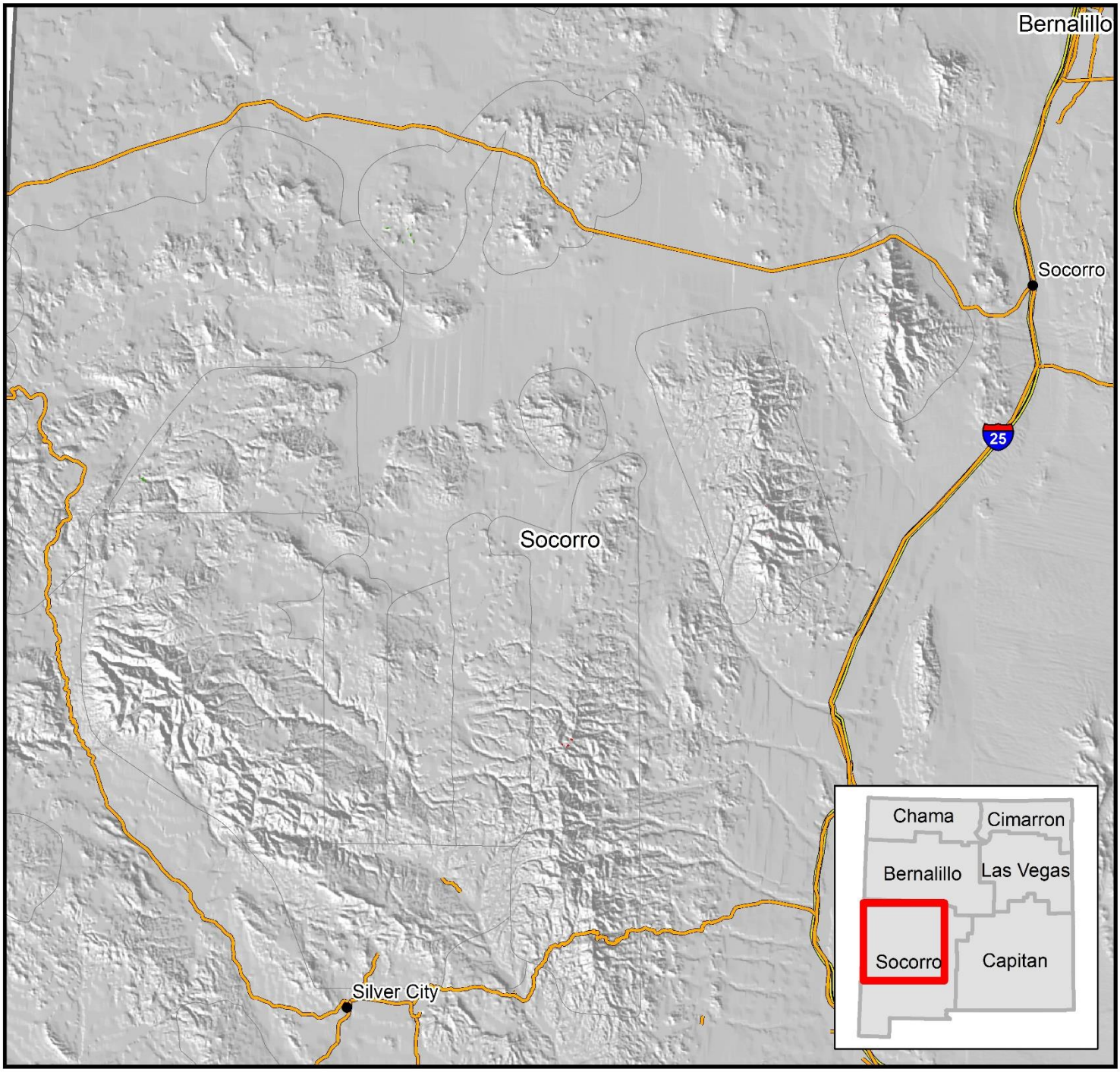
2018 Forest Defoliation Activity
Socorro District



- Ponderosa Pine
- Aspen
- Western Spruce Budworm
- Douglas-Fir Tussock Moth
- Pinyon Needle Scale
- Janet's Looper
- Survey Extent
- NMSF Districts

N
W
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S

0 5 10 20 Miles

0 12.5 25 50 Kilometers

NMSF
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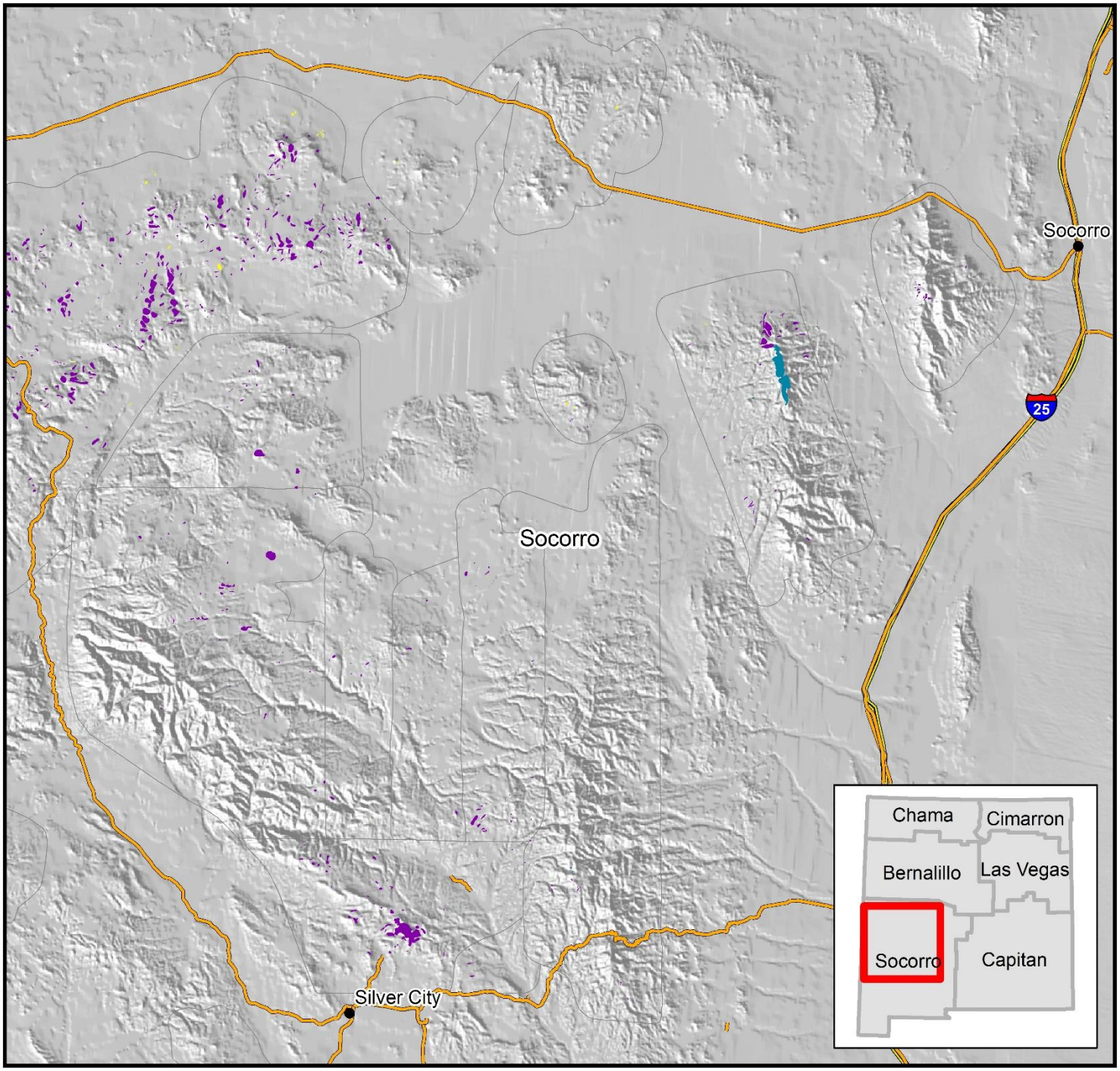
2018 Forest Mortality Activity
Socorro District



Ponderosa Pine
Mixed Conifer
Spruce-Fir
Aspen
Pinyon Pine
Survey Extent
NMSF Districts

N
W
E
S

0 5 10 20 Miles
0 12.5 25 50 Kilometers

NMSF
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John Formby (NMSF Forest Health Program Manager) worked with Rocky Mountain Youth Corps and the US Forest Service to monitor Douglas-fir tussock moth populations during the summer of 2018 (photo: Tom Coleman, USFS)

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Photographs taken by John Formby except where noted