



2018 Wildfire Season: An Overview

Southwestern US

JUNE 2019



Ecological Restoration Institute



**SOUTHWEST
FIRE SCIENCE
CONSORTIUM**

Intermountain West Frequent-fire Forest Restoration

Ecological restoration is a practice that seeks to heal degraded ecosystems by reestablishing native species, structural characteristics, and ecological processes. The Society for Ecological Restoration International defines ecological restoration as “an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability....Restoration attempts to return an ecosystem to its historic trajectory” (Society for Ecological Restoration International Science & Policy Working Group 2004).

Most frequent-fire forests throughout the Intermountain West have been degraded during the last 150 years. Many of these forests are now dominated by unnaturally dense thickets of small trees, and lack their once diverse understory of grasses, sedges, and forbs. Forests in this condition are highly susceptible to damaging, stand-replacing fires and increased insect and disease epidemics. Restoration of these forests centers on reintroducing frequent, low-severity surface fires—often after thinning dense stands—and reestablishing productive understory plant communities.

The Ecological Restoration Institute at Northern Arizona University is a pioneer in researching, implementing, and monitoring ecological restoration of frequent-fire forests of the Intermountain West. By allowing natural processes, such as low-severity fire, to resume self-sustaining patterns, we hope to reestablish healthy forests that provide ecosystem services, wildlife habitat, and recreational opportunities.

The Southwest Fire Science Consortium (SWFSC) is a way for managers, scientists, and policy makers to interact and share science. SWFSC’s goal is to see the best available science used to make management decisions and scientists working on the questions managers need answered. The SWFSC tries to bring together localized efforts to develop scientific information and to disseminate that to practitioners on the ground through an inclusive and open process.

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Cover photo: Task Force Leader Doug Niemynski scrapes a fire line around a hotspot on the 2018 Ute Park Fire, New Mexico. *Photo by Mike McMillan, Ute Park Fire PIO. Photo courtesy of the USDA Forest Service, via InciWeb, <https://inciweb.nwcg.gov/incident/photograph/5820/15/78317>*

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Introduction

Wildfire is part of the landscape in the Southwest. It can be a threat to lives and property, but it is also crucial to maintaining healthy ecosystems. Forests in the Southwest are adapted to fire and many trees can easily survive low-intensity fires burning along the forest floor. For example, ponderosa pine forests need regular, low-severity fires to remain healthy. Over decades without fire on the landscape, fuel loads accumulated and facilitated more intense, high-severity fire. Each fire is different, and while some burn in ways that increase ecosystem resilience, others burn with greater severity than forests are adapted to, killing even the toughest trees and threatening lives and homes. Weather, climate, vegetation type, fuel conditions, and topography all influence how an individual wildfire burns on the landscape and whether it has beneficial effects. Some fires will leave many unburned patches, creating a mosaic burn pattern, whereas others will burn more contiguously.

This report is the sixth in a series of annual overviews available from the Southwest Fire Science Consortium and the Ecological Restoration Institute. The goal of this overview is to provide a concise summary of the fire season and to facilitate comparison with past fires. It follows the format of past years' overviews¹ and describes the impacts of the 13 largest fires in Arizona and New Mexico in 2018 (all fires greater than 8,000 acres in the Southwest region). As in previous overviews, this report covers: when the fire burned, fire management costs, vegetation types, previous burn footprints, and burn severity, where available. The conclusion section summarizes these same measures for the large wildfires in the region and touches on how these fires burned in proximity to human communities.

Wildfire Management

Managers can approach each wildfire with multiple objectives that range from managing the wildfire for public safety to managing the fire to improve natural resources. Federal wildland fire management policy states:

“Response to wildland fires is based on ecological, social and legal consequences of the fire. The circumstances under which a fire occurs, and the likely consequences on firefighter and public safety and welfare, natural and cultural

resources, and, values to be protected, dictate the appropriate response to the fire.”²

A full range of wildland fire response strategies may be employed to meet these objectives, including containing, confining, or suppressing the wildfire. The national Incident Management Situation Report identifies the percentage of each fire managed with a monitor, confine, point protection, or suppression strategy. This report compiles these figures to better understand how fires were managed in 2018.

Wildland fire management strategies are based on a thoughtful and systematic risk-based approach that considers firefighter and public safety, cause of the wildfire, location, existing land management plans, availability of resources, values at risk, and social factors. Federal policy dictates that “initial action on human-caused wildfire will be to suppress the fire.”³ The same federal policy allows naturally ignited wildfires (or parts of wildfires) to be managed for resource benefits, such as mitigating fuel loads to reduce the risk of high severity, enhancing wildlife habitat, improving watershed health, and reducing risk to neighboring communities. Though multiple strategies are used to manage wildfires, it is important to note that federal agencies only recognize two types of fires: prescribed fires and wildfire.

The 2018 Fire Season

In 2018, wildfire burned 547,701 acres in the Southwest (Arizona and New Mexico), which is 3 percent less than 2017 and significantly less than the average for the previous 10 years (627,893 acres). New Mexico had more wildfire (382,345 acres) than its 10-year average, while Arizona had less (165,356 acres) than its 10-year average. Both states had less prescribed fire than the 10-year average (75,837 acres in Arizona and 71,027 acres in New Mexico).

In 2018, wildfires over 100 acres represented 93 percent of the total acreage burned by wildfire in Arizona and New Mexico. Less detailed information is available on the choice of strategies managers used on fires greater than 100 acres in 2018 than in other recent years. Of the 141,180 acres of wildfire for which strategy is recorded in the Southwest Coordination Center's data, 97 percent were managed with a fire suppression strategy.

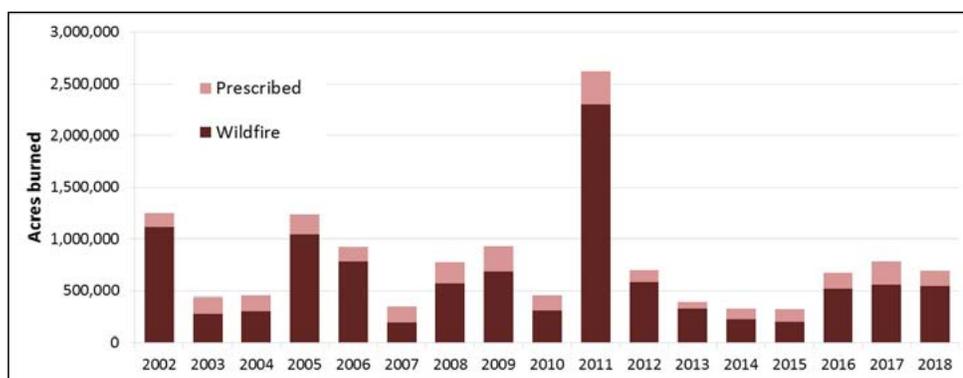


Figure 1. Wildfires and prescribed fires acres burned in Arizona and New Mexico, 2002 to 2018.³

1 2017, 2016, 2015, 2014, and 2013 *Wildfire Season: An Overview, Southwestern U.S.* <https://cdm17192.contentdm.oclc.org/digital/search/searchterm/wildfire%20season%20overview/field/type/mode/exact/conn/and/order/date/ad/asc>

2 *Guidance for Implementation of Federal Wildland Fire Management Policy* www.nifc.gov/policies/policies_documents/GIFWFMP.pdf

3 National Interagency Coordination Center Wildland Fire Annual Reports www.predictiveservices.nifc.gov/intelligence/intelligence.htm



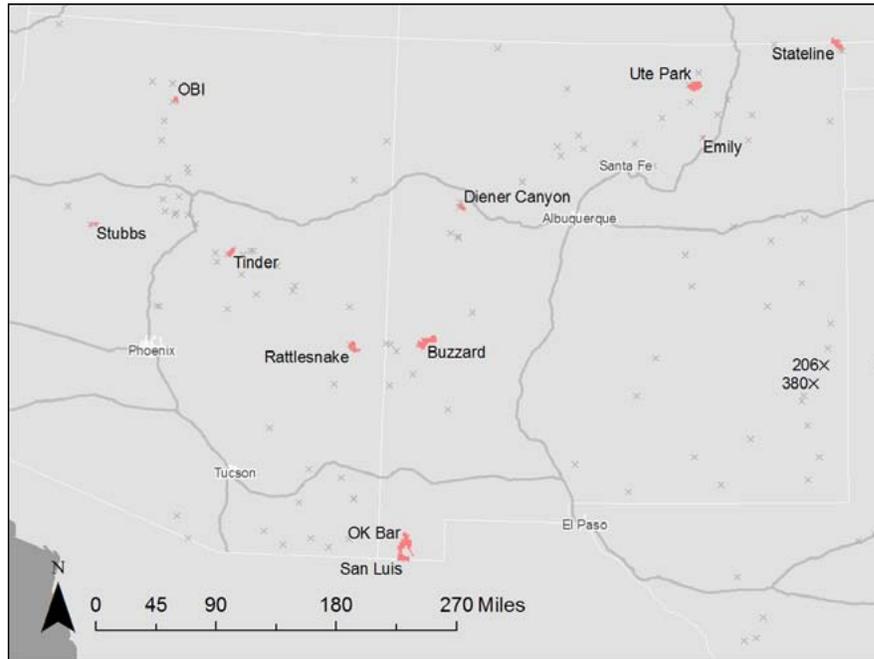


Figure 2. Map indicating the location of the 13 large fires in 2018 analyzed in this report.

This overview focuses on the 13 largest fires (Figure 2), which includes nine New Mexico fires: OK Bar, Buzzard, 206, Ute Park, Stateline, San Luis, 380, Diener Canyon, Emily; and four Arizona fires: Rattlesnake, Tinder, OBI, and Stubbs. The 13 largest fires in this report represent 63 percent of the acres burned by wildfire in 2018.

Regional Context

Warm and dry conditions during the winter of 2017–2018 combined with below normal precipitation resulted in a meager snow pack. February provided a significant mid to late winter precipitation across portions of central and southern Arizona into southern New Mexico. The El Niño–Southern Oscillation (ENSO) was in a neutral phase leading into the spring of 2018. Temperatures were above average across much of the region for much of the spring while precipitation in April was below normal. Long term drought increased across the region with moderate to severe drought across most of the region in April. Large areas of northern Arizona and New Mexico experienced the driest water year (October 2017 to June 2018) on record. Hurricane Bud brought some precipitation to the region in June, usually a very dry month. Though temperatures were warmer than average in June, no extreme heatwave hit the region as in previous years. Though the monsoon season started a little later than usual, it brought above average precipitation to much of the region, including an approximately 4-inch rain event in Santa Fe, New Mexico that caused significant damage.

Given the dry winter and significant fine fuel carryover from 2017, the 2018 fire season could have been more active than it was. It may be that June precipitation helped moderate fire activity (at least in southern Arizona). It is also possible that though conditions were primed for more fire activity, lack of ignitions reduced the acreage burned. Although not easily quantifiable, something should be said of the efforts of federal and state agency fire personnel in getting the message out about the conditions during the mid-late spring and early summer

to reduce human ignitions. Some restrictions and closures also likely played a role in reducing unwanted human ignitions.

The Energy Release Component (ERC) is an index that estimates potential available energy released per unit area in the flaming front of a fire based on the fuel model and live and dead fuel moistures. The ERC is often used to track seasonal fire danger focused on fuel loading, woody fuel moistures, and larger fuel moistures (lighter fuels have less influence and wind speed has no influence on ERC). A graph of ERC show the 2018 fire season (blue line) in comparison to the 10-year average (gray line) and 10-year maximums (red line).⁴ In much of the Southwest, ERCs were above the 10-year average, approaching the 10-year maximums, in May and June. ERCs dropped quickly when monsoons brought moisture in July.

Data Sources

Management, Objectives, and Cost

The InciWeb website (inciweb.nwccg.gov) provides background information on most large fires such as location and start date. InciWeb is an interagency information management system designed to provide the public a single source of incident-related information. Because InciWeb only sporadically reports costs, Incident Status Summary (ICS-209) reports were collected to document suppression or management costs. These costs do not reflect any post-fire costs such as rehabilitation or soil stabilization. The cost data from each fire is collected in a final table at the end of the document. Incident Status Summaries also provide “strategic objectives,” which briefly describe the desired outcome for the incident, high-level objectives, and in some cases strategic benefits. Though strategic objectives often change during a fire, review of the most common or persistent strategic objectives for each fire provides some insight into the overarching management goals.

⁴ Graphs produced by Charles Maxwell and Jay Ellington, Predictive Services Meteorologist, Southwest Coordination Center. For more information see http://gacc.nifc.gov/swcc/predictive/fuels_fire-danger/nfdrs_charts/Areawide.htm

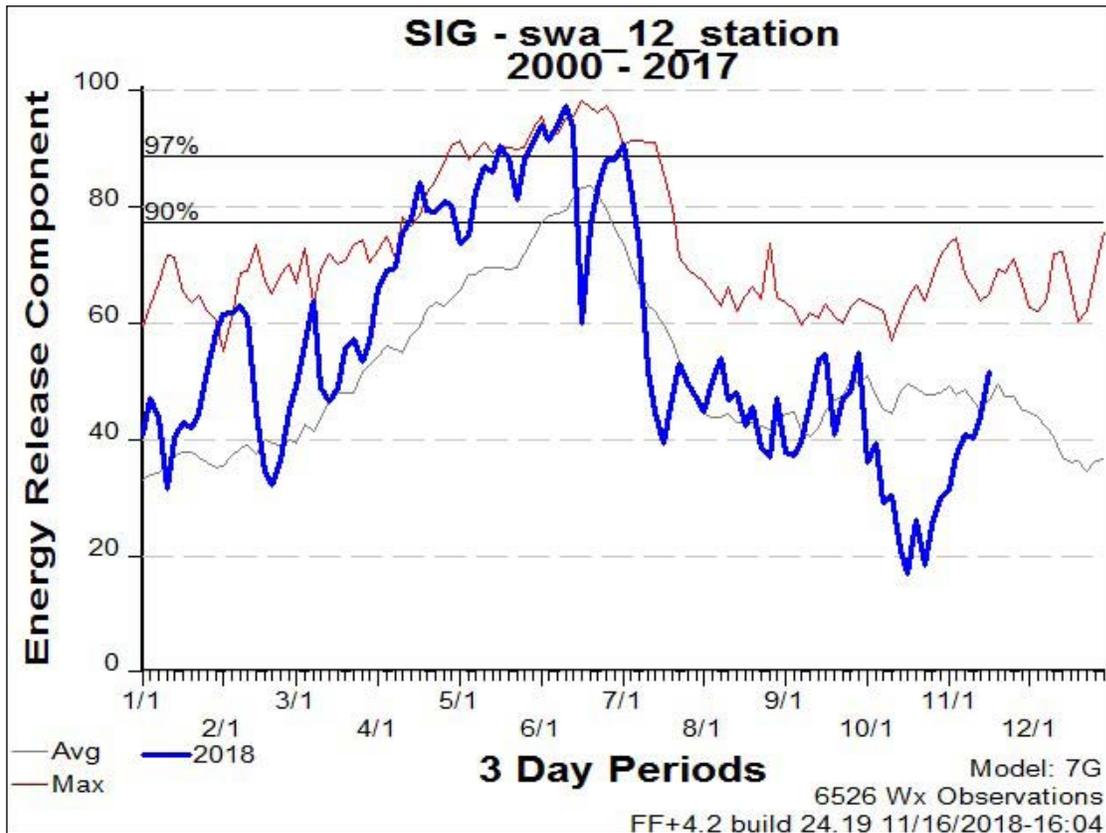


Figure 3. Energy release component (ERC) index for the 2017 fire season in the south-central mountains of New Mexico. Note the elevated ERCs at the start of the Buzzard Fire (black circle) and around the time of the Rattlesnake Fire (black triangle).

Perimeters

Boundaries for each fire were taken from the Geospatial Multi-Agency Coordination (GeoMAC) archive of fire perimeter maps (rmgsc.cr.usgs.gov/outgoing/GeoMAC/). GeoMAC also provides perimeters of fires dating back to 2000, which provided a historic context for this year's fires.

Vegetation

Basic information about vegetation and topography of burned areas was available from LANDFIRE (www.landfire.gov). LANDFIRE provides nationally consistent, scientifically based maps of existing vegetation as well as Vegetation Condition Class (VCC). Vegetation Condition Class was formerly referred to as Fire Regime Condition Class (FRCC). Vegetation Condition Class is a map of how existing vegetation has departed from an estimated natural or historic condition. In the Southwest, this departure is generally due to fire exclusion, past logging, and grazing and results in greater density of trees and less healthy conditions. Vegetation Condition Class is a useful metric because it integrates information on existing vegetation, historic vegetation, and fire regimes into one variable and has been used to help determine where to focus restoration efforts. The most current VCC maps (2014) were used in this report.

Soil Burn Severity

Soil burn severity maps provide Burned Area Emergency Response (BAER) teams a tool to quantify soil impacts and assess potential for post-fire erosion (<https://fsapps.nwcg.gov/afm/baer/download.php>). In the immediate aftermath of a fire, BAER teams perform an emergency assessment of post-fire soil conditions based on a combination of field observations

and remote sensing change detection products derived from the differenced Normalized Burn Ratio (dNBR). The dNBR measures change in the ratio of near infrared reflected by healthy green vegetation to the shortwave infrared reflected by bare soil and rock. Most soil burn severity maps have four classes: high, moderate, low, and unburned; but some combine the last two categories into a "low/unchanged" category. The distribution of soil burn severity is included in the individual fire discussions (where available) as well as in the final summary table.

Rapid Assessment of Vegetation Condition after Wildfire

Rapid Assessment of Vegetation Condition after Wildfire (RAVG) maps estimate canopy mortality (www.fs.fed.us/postfirevegcondition). The USDA Forest Service (Forest Service) Remote Sensing Applications Center provides RAVG analysis as a first approximation of areas that may require reforestation treatments because of canopy killed by high-severity fire. RAVG maps are created for wildfires that burn greater than 1,000 acres of forested Forest Service land or for fires where it is requested. The maps are produced by measuring the change between a satellite image before and immediately after a wildfire using an algorithm called relative differenced Normalized Burn Ratio (RdNBR), which is sensitive to vegetation mortality resulting from the wildfire event. The RdNBR is derived directly from the dNBR but is more sensitive to vegetation mortality than the dNBR.

While soil burn severity maps and RAVG canopy mortality maps use similar satellite change detection methods, they measure fundamentally different forest attributes. In many



areas, canopy mortality and soil burn severity patterns are similar. However, in some vegetation types, such as chaparral or grass, it is possible for a fire to cause complete canopy mortality with little effect on soils.

Wildland Urban Interface

Another geospatial dataset that helps put fires in context is the location and density of housing, often referred to as the wildland-urban interface, or WUI. The Silvis Lab at the University of Wisconsin developed a nationwide map of the WUI based on US Census data (<http://silvis.forest.wisc.edu/data/wui-change/>). The Silvis map uses fairly standard definitions of the two main WUI conditions: intermix (one

or more structures per 40 acres) and interface (three or more structures per acre, with shared municipal services).

Caveats

There are important caveats for all the data used in this summary. First, the fire information presented here was taken from official sources between December 2018 and February 2019 and may not include updates or revisions. Second, the geospatial data used to generate the maps and tables are also based on the best available information, but these data have errors and uncertainties. For example, the remote sensing data used in all these datasets can include errors introduced during collection, processing, and interpretation.



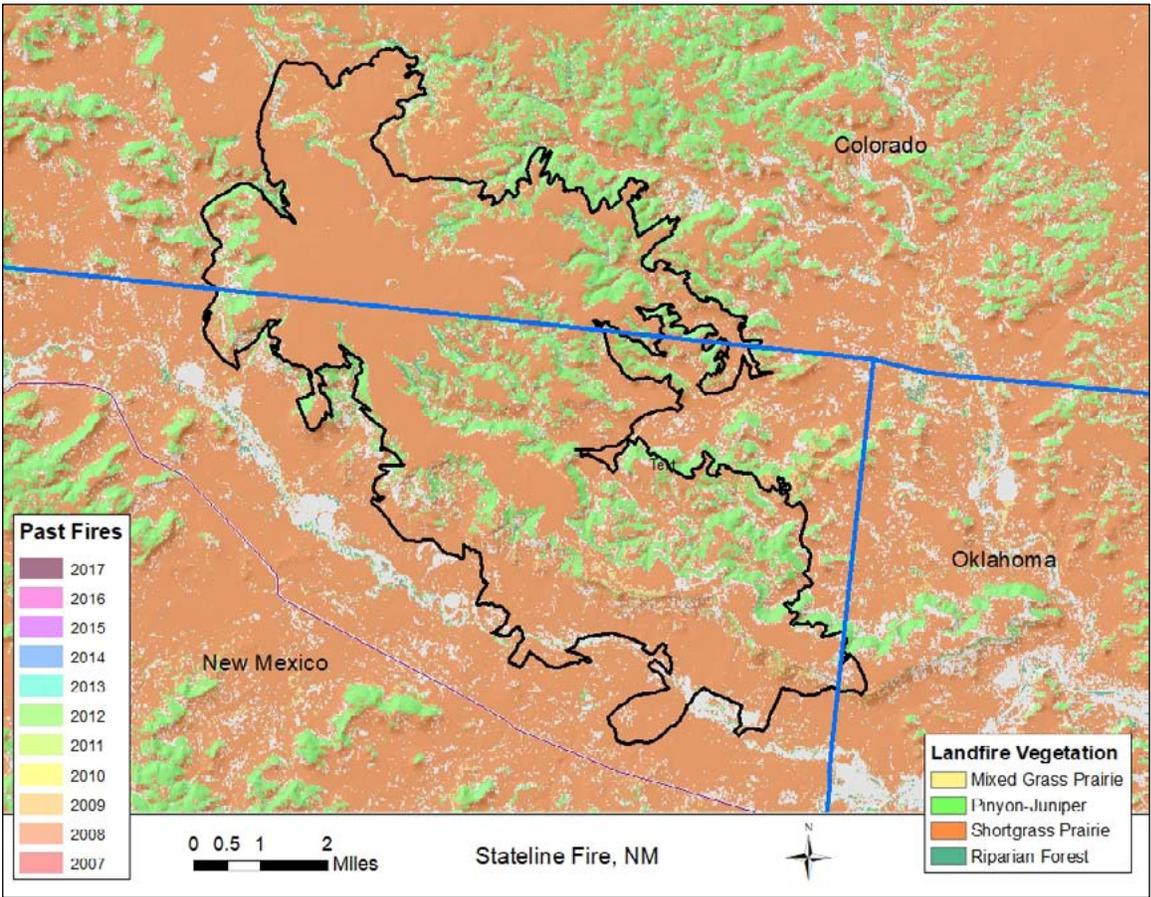


Figure 4. Landfire vegetation in the Stateline Fire burn area.

Stateline Fire, New Mexico

The Stateline Fire burned 28,105 acres of mostly grass 35 miles north of Clayton, New Mexico on the Colorado and New Mexico state line. The fire crossed two state lines and ended up burning about 18,000 acres in New Mexico, 10,000 acres in Colorado, and an additional 112 acres in Oklahoma. The Stateline Fire burned across state and private land. The fire started in Union County, New Mexico, but the cause has not been determined. It started on March 8 and burned for 19 days. State and federal fire managers used a full suppression strategy on this fire due to the presence of some residential structures, remote rugged terrain, lack of communication system, and the potential loss of agricultural resources such as cattle grazing. Ultimately, only one minor abandoned structure was destroyed. The Stateline Fire cost \$2.3 million to manage, or \$81.84 per acre.

Vegetation and Past Fires

Over 97 percent of the area burned by the Stateline Fire was grass (81 percent) or piñon-juniper (16 percent). There were no documented fires in the area over the last 10 years. Ninety-five percent of the vegetation within the Stateline Fire had low departure from historic conditions according to the LANDFIRE Vegetation Condition Class analysis (Figure 4).

Fire Severity

No fire severity data was available for the Stateline Fire.



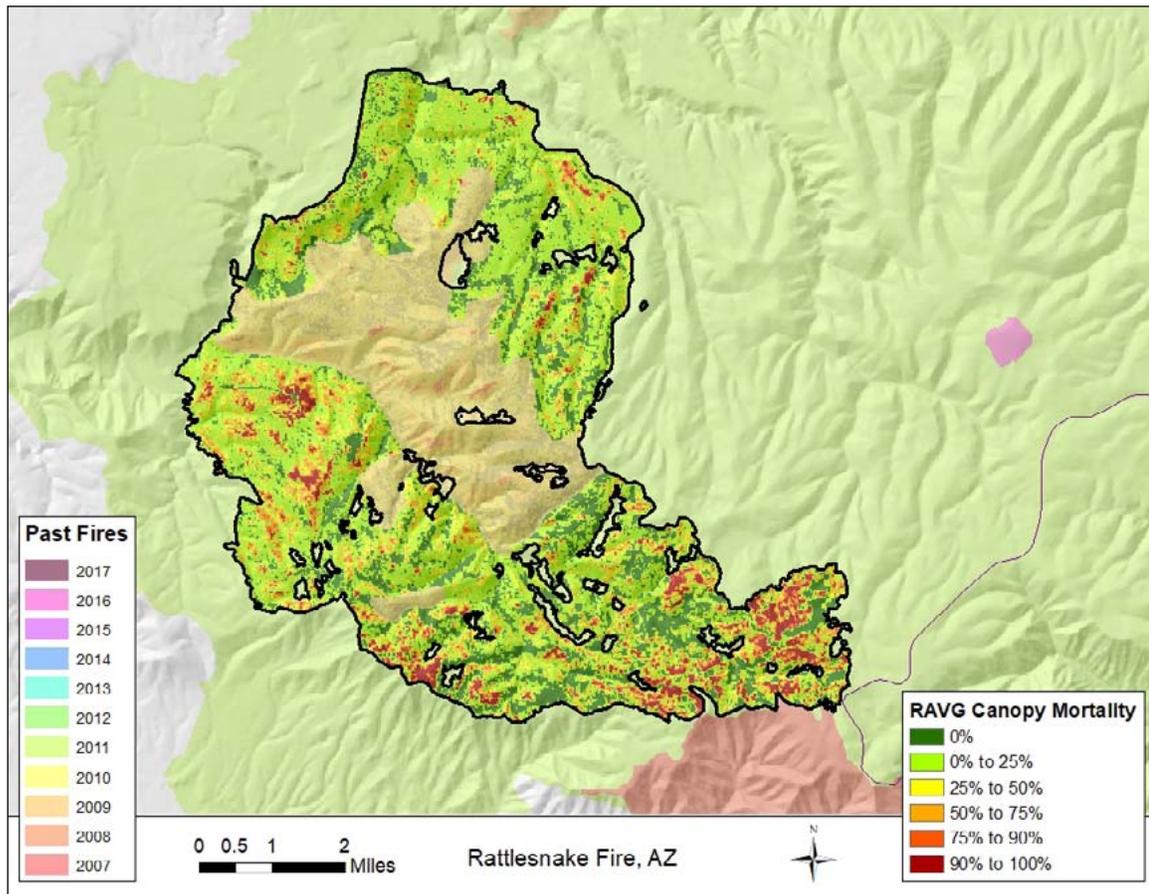


Figure 5. RAVG canopy mortality in the Rattlesnake Fire. Note the footprint of the 2009 Reno Fire in the center of the Rattlesnake Fire. The entire area was previously burned in the 2011 Wallow Fire.

Rattlesnake Fire, Arizona

The cause of the 26,000-acre Rattlesnake Fire is unknown. This fire started on April 11 and burned for 46 days in Apache County. This isolated area included sections of the San Carlos Apache Reservation, White Mountain Apache Reservation, and Apache National Forest. The area consisted of steep canyons and ridgetops within the 2011 Wallow Fire footprint. As a result of the previous high-severity wildfire, all fuel types were available and receptive including timber litter and heavy dead/down. Live fuels contributed to isolated and group torching and spotting.

Fire managers chose to use a 100 percent full suppression approach to protect the identified values and infrastructure from adverse fire effects while ensuring public and firefighter safety. The planned end-state was for the fire to burn in ponderosa pine, dry mixed-conifer, and aspen with mixed severity, including areas of low to moderate severity. No structures were affected by the Rattlesnake Fire, but road and area closures were put in place during the fire. Fifteen injuries or illnesses were reported for responders. The causes varied from a broken hand to smoke-related asthma issues and non-fire related illnesses. Management of the wildfire cost \$11.4 million, or \$437.25 per acre.

Vegetation and Past Fires

The area effected by the Rattlesnake Fire was predominantly ponderosa pine (44 percent), mixed conifer (34 percent), and grass (13 percent) with lesser components of conifer-oak (6 percent) and riparian forest (3 percent). The entire Rattlesnake Fire fell within the perimeter of the 538,000-acre Wallow Fire of 2011. It also shared a roughly two-mile perimeter with the 2007 Chitty Fire and encompassed all of the 6,000-acre Reno Fire of 2009. Nearly half (48 percent) of the Rattlesnake Fire had a high departure from historic vegetation conditions based on the Vegetation Condition Class analysis; including nearly all the northern part of the burn area.

Fire Severity

Fire severity was generally low in the Rattlesnake Fire. RAVG maps identified nearly three quarters of the area to have zero (23 percent) or less than 25 percent (51 percent) canopy mortality. However, 1,000 acres experienced greater than 90 percent mortality; nearly a third of which was grass (Figure 5). The soil burn severity analysis indicated a lower severity fire with nearly all of the acres exhibiting low severity (78 percent) or undetected (21 percent). In fact, the soil burn severity analysis identified only one acre of high severity.



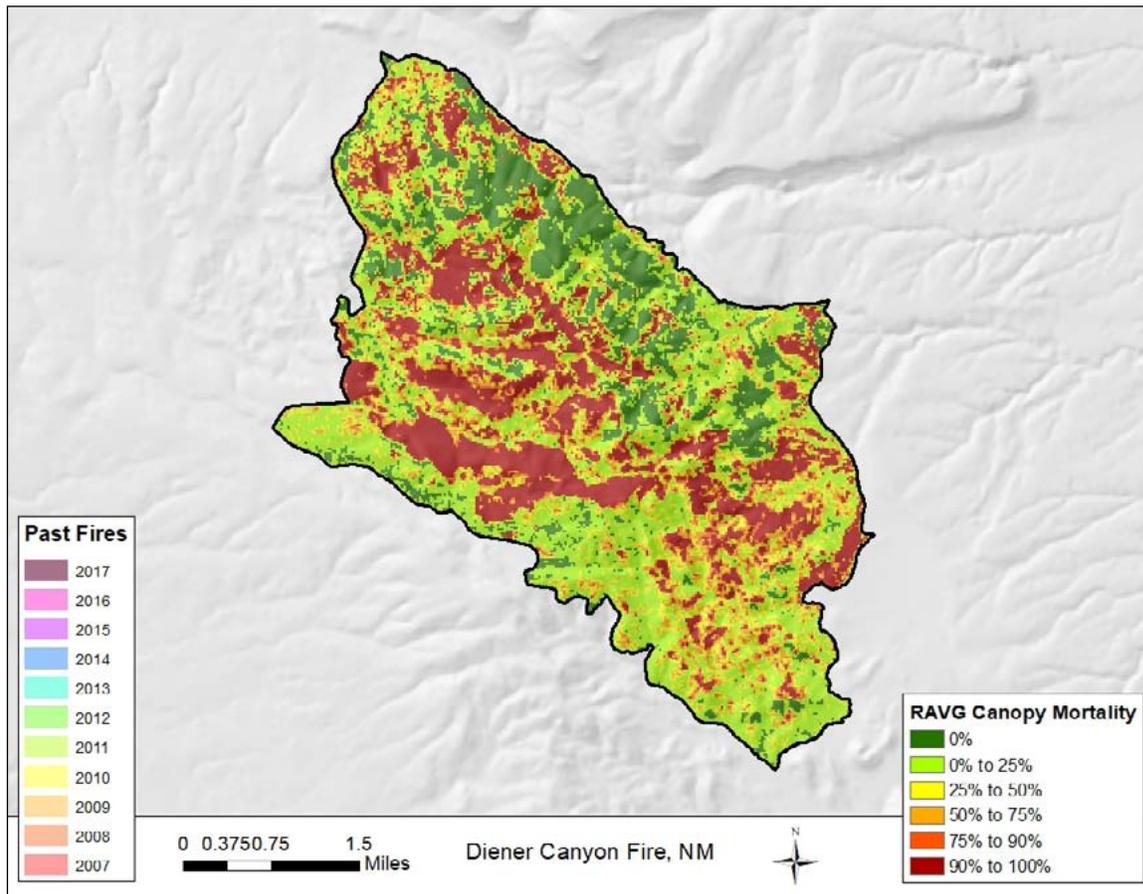


Figure 6. Canopy mortality in the Diener Canyon Fire.

Diener Canyon Fire, New Mexico

The Diener Canyon Fire was reported on April 12 about 7 miles south of Bluewater, New Mexico on Mount Sedgwick. This fire predominantly burned through ponderosa pine litter and short grasses. Fire managers chose to use a full suppression strategy, using the road system as containment features to protect the communities of Bluewater Acres and La Jara Subdivision. Fire investigators determined that multiple spot fires from the Redondo prescribed burn started the Diener Canyon Fire. The fire burned for 21 days and covered 9,338 acres. No injuries or damaged structures were reported. The wildfire cost \$3.5 million to manage, or about \$347.81 per acre.

A full description of the Redondo prescribed fire and the escape that led to the Diener Canyon Fire is available in the *Redondo Escaped Prescribed Fire – Facilitated Learning Analysis*.⁵ The assessment of the escape concludes, “A well designed, well implemented 2,600-acre prescribed fire was impacted by mechanical failure, a larger than expected inversion, an 11-hour wind event with gusts in excess of 65 mph, and a suspected serial arsonist.” It is worth emphasizing that the Redondo prescribed fire was not responsible for other wildfires because there was significant public confusion about these other, human-ignited wildfires.

Vegetation and Past Fires

The area burned by the Diener Canyon Fire had not burned in the previous 10 years, nor had any of the surrounding landscape. The Diener Canyon Fire burned into the perimeter of the 2004 Sedgwick Fire. Most of the Diener Canyon area was ponderosa pine (82 percent) with smaller areas of mixed conifer (7 percent), piñon-juniper (6 percent), and riparian forest (4 percent). Ninety-nine percent of the Diener Canyon Fire showed moderate departure from historic vegetation.

Fire Severity

The RAVG analysis indicates that nearly half of the area had less than 25 percent canopy mortality, while nearly a quarter of the area had over 90 percent mortality (Figure 6). The soil burn severity analysis showed a slightly different story. Nearly 80 percent of the area was classified as low severity (50 percent) or unburned/undetected (29 percent). This analysis indicated only 3 percent of the Diener Canyon Fire had high severity. This high severity area was concentrated to a ridge on the western edge of the burn area.

5 Redondo Escaped Prescribed Fire – Facilitated Learning Analysis. 2018. USDA Forest Service, Cibola National Forest https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd586174.pdf



206 Fire, New Mexico

The cause of the 206 Fire on April 12 is unknown, but it spread rapidly through the grasslands between Tatum and Milnesand in Lea County, consuming vegetation on over 44,000 acres of state and private land in just two days. This extreme running and spotting behavior led to the evacuation of 12 primary structures and the destruction of one primary structure along with two other minor structures. Aside from these structure losses there were no other reports of impacts on civilians or responders. A full suppression approach was used by fire managers on this fast-moving grass fire. The management cost of the fire was \$96,000, or about \$2.17 per acre.

A fire perimeter shapefile was not made available in far eastern New Mexico, and therefore assessment of the vegetation and past fires is quite limited.

380 Fire, New Mexico

The 380 Fire started on April 17 eight miles west of Tatum in Lea County. The cause of the fire is unknown, but it spread rapidly through the area's grasslands. It covered more than 20,000 acres in a single day, leading the fire manager to employ a full suppression approach. The 380 Fire burned across state and private land. The cost for managing the 380 Fire was \$38,000, or about \$1.71 per acre.

A fire perimeter shapefile was not made available in far eastern New Mexico, and therefore assessment of the vegetation and past fires is limited.

OK Bar Fire, New Mexico

Lightning ignited the OK Bar Fire on April 22, approximately 40 miles south of Animas, NM on the Diamond A/Gray Ranch in far southwestern New Mexico, approximately 5 miles from Mexico and 15 miles from Arizona. This Hidalgo County fire burned for 21 days and covered nearly 62,000 acres. It was the largest fire in New Mexico or Arizona during the 2018 season. Managers working on the fire opted to use a combination of monitor (40 percent), confine (20 percent), and point zone protection (40 percent) strategies. This contain and confine strategy followed the guidelines of a landscape-scale fire management plan in place for over 20 years. These tactics were previously used in the area and the extreme topography, lack of road access, and problems with logistics would have made it difficult to support a large management response. Using a small, efficient type 3 organization to burn out and secure the appropriate perimeter was determined to be the most effective way to suppress/manage this fire to meet resource objectives, ensure the safety of firefighters, and reduce cost based on the values at risk. No citizens, responders, or structures were affected by the OK Bar Fire. Wildfire management cost \$1.4 million, or about \$22.72 per acre.

Vegetation and Past Fires

More than 75 percent of the OK Bar Fire burned through grass, with conifer-oak (11 percent), piñon-juniper (6 percent), and scrub (4 percent). The OK Bar fire reburned approximately 3,000 acres of the 2016 Cowboy Fire, 11,000 acres of the 2009 Pasco Fire, and 19,000 acres of the Center Peak Fire. It also shared a 1.5-mile perimeter with the 2011 Godfrey Fire. Ninety-six percent of the vegetation within the OK Bar Fire had moderate (54 percent) or low (42 percent) departure from historic conditions according to the LANDFIRE Vegetation Condition Class analysis (Figure 7).

Fire Severity

No fire severity data was available for the OK Bar Fire.

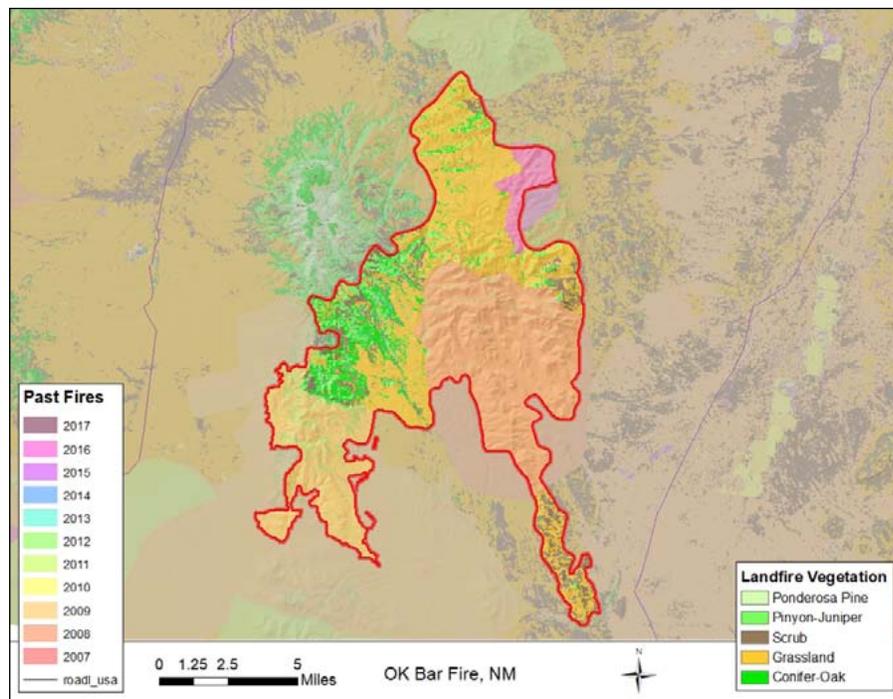


Figure 7. Landfire vegetation in the OK Bar Fire burn area.

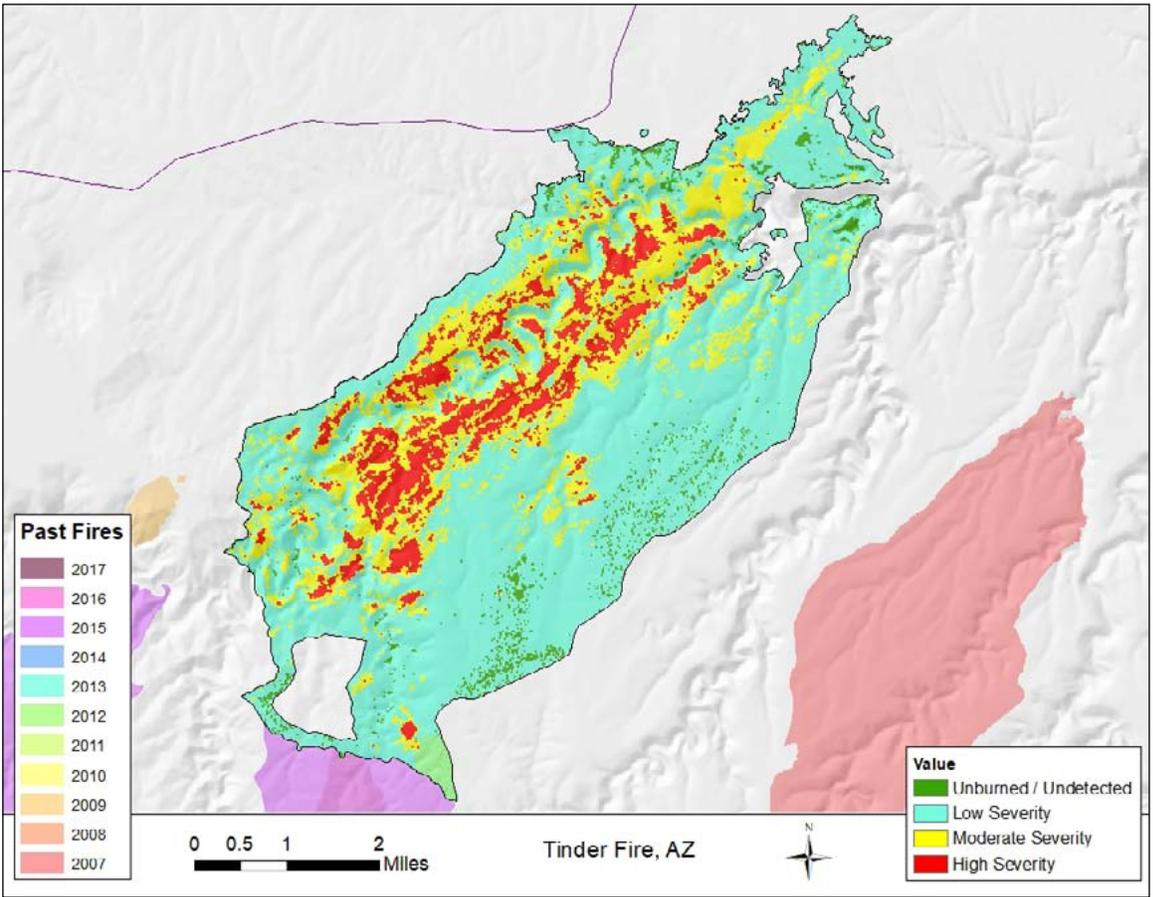


Figure 8. Soil burn severity map of the Tinder Fire.

Tinder Fire, Arizona

The Tinder Fire burned for 27 days, from April 27 to May 24, and covered 16,309 acres in Coconino County, Arizona just northeast of the Blue Ridge Reservoir in the Coconino National Forest. This fire was caused by an abandoned illegal campfire. Fire managers used a full suppression strategy. Crews focused on protecting residential neighborhoods as the fire threatened more than 1,700 residences and destroyed 33 of them along with 63 minor structures. There were no reported injuries, but 300 civilians were evacuated in response to the fire in addition to area and road closures. The area included many hazards including significant rocky slopes on the eastern flanks and propane tanks. The cost for managing the Tinder Fire was \$7.5 million, or about \$459.87 per acre.

Vegetation and Past Fires

The Tinder Fire burned through a primarily ponderosa pine (82 percent) area with scattered grasslands (7 percent) and areas of mixed conifer along Clear Creek. Eighty-three percent of

the Tinder Fire had a high departure from historic vegetation conditions based on the Vegetation Condition Class analysis. The Tinder Fire shared a 2.4-mile boundary with the 2015 Rebel Fire. Only about 100 acres of the Tinder Fire had burned in the last 10 years (small unnamed 2012 fire). Other nearby fires include the 2015 General Fire and the 2007 Wilkins Fire in the neighboring drainage.

Fire Severity

The soil burn severity maps showed about 10 percent of the burn area in the highest severity class (Figure 8). Eighty-six percent of the area was in low (64 percent) or moderate (22 percent) severity categories. The RAVG data indicated a higher severity with 27 percent (4,200 acres) of the burn area experiencing greater than 90 percent mortality. Ponderosa pine made up 82 percent of the vegetation in the Tinder Fire and 82 percent of the highest canopy mortality class. This represented 22 percent of the total ponderosa pine acreage.



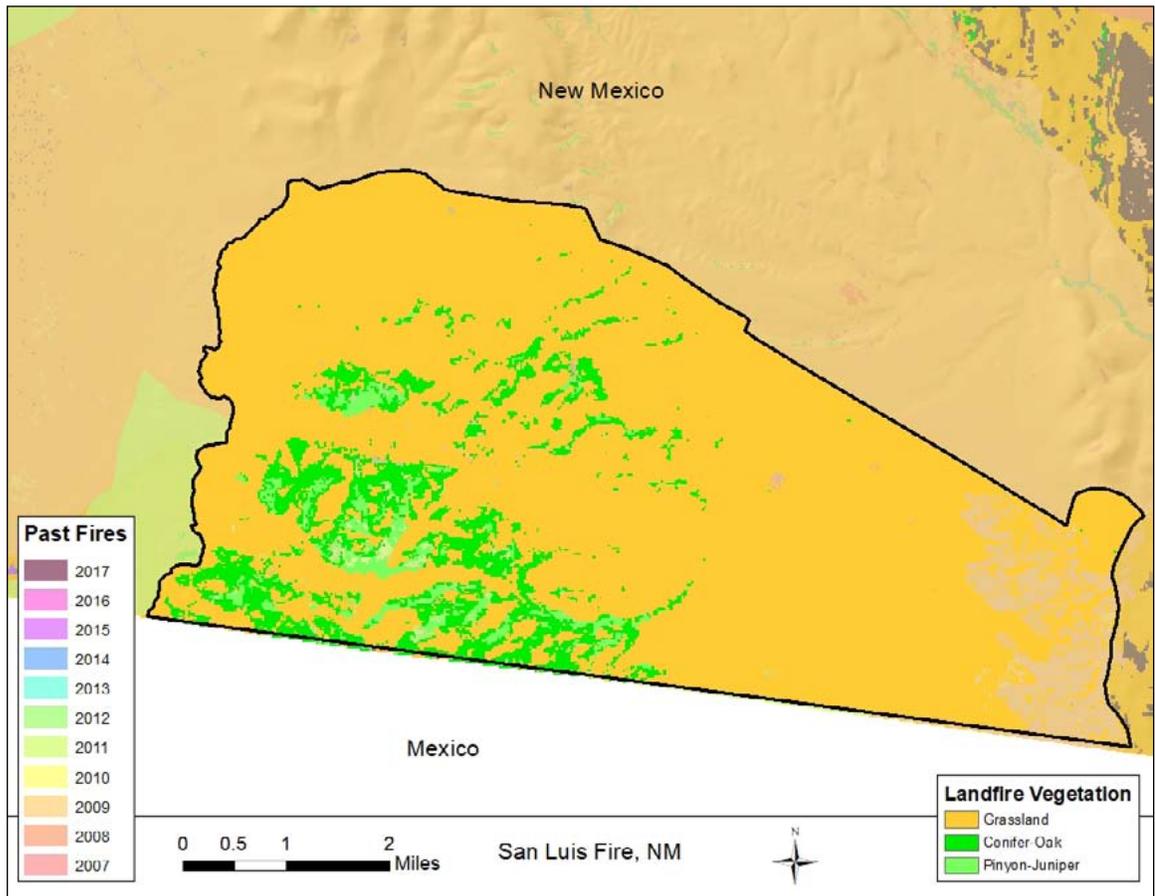


Figure 9. LANDFIRE vegetation in the San Luis Fire. Note: this fire extended into Mexico.

San Luis Fire, New Mexico

The San Luis Fire started in Mexico from an unknown cause and crossed the US/Mexico Border after Mexican Forestry officials were unable to control its spread. The fire started on May 16 and burned more than 20,000 acres in Hidalgo County 10 miles west of Antelope Wells over four days. The fire was likely much larger than 20,000 acres, as this only counts the area burned in the US. This fire burned on private lands southeast of the OK Bar Fire. Fire managers chose to use a combination of monitor (50 percent), confine (45 percent), and point zone protection (5 percent) as a fire suppression strategy. This contain and confine strategy followed the guidelines of a landscape-scale fire management plan in place for over 20 years. These tactics were previously used in the area and the extreme topography, lack of road access, and problems with logistics would have made it difficult to support a large management response. Using a small, efficient type 4 organization to burn out and secure the appropriate perimeter was the most effective way to suppress/manage this fire to meet

resource objectives, ensure firefighter, and reduce cost based on the value at risk. The cost to manage the fire was \$300,000, or about \$14.57 per acre.

Vegetation and Past Fires

Nearly 88 percent of the San Luis Fire burned through grass with conifer-oak (9 percent) and piñon-juniper (3 percent). The entire area affected by the San Luis Fire had previously burned in the 2009 Pasco Fire or the 2011 Truck Top Fire. Roughly 3,100 acres burned in all three fires. Ninety-six percent of the vegetation within the San Luis Fire had moderate (62 percent) or low (34 percent) departure from historic conditions according to the LANDFIRE Vegetation Condition Class analysis (Figure 9).

Fire Severity

No fire severity data was available for the San Luis Fire.



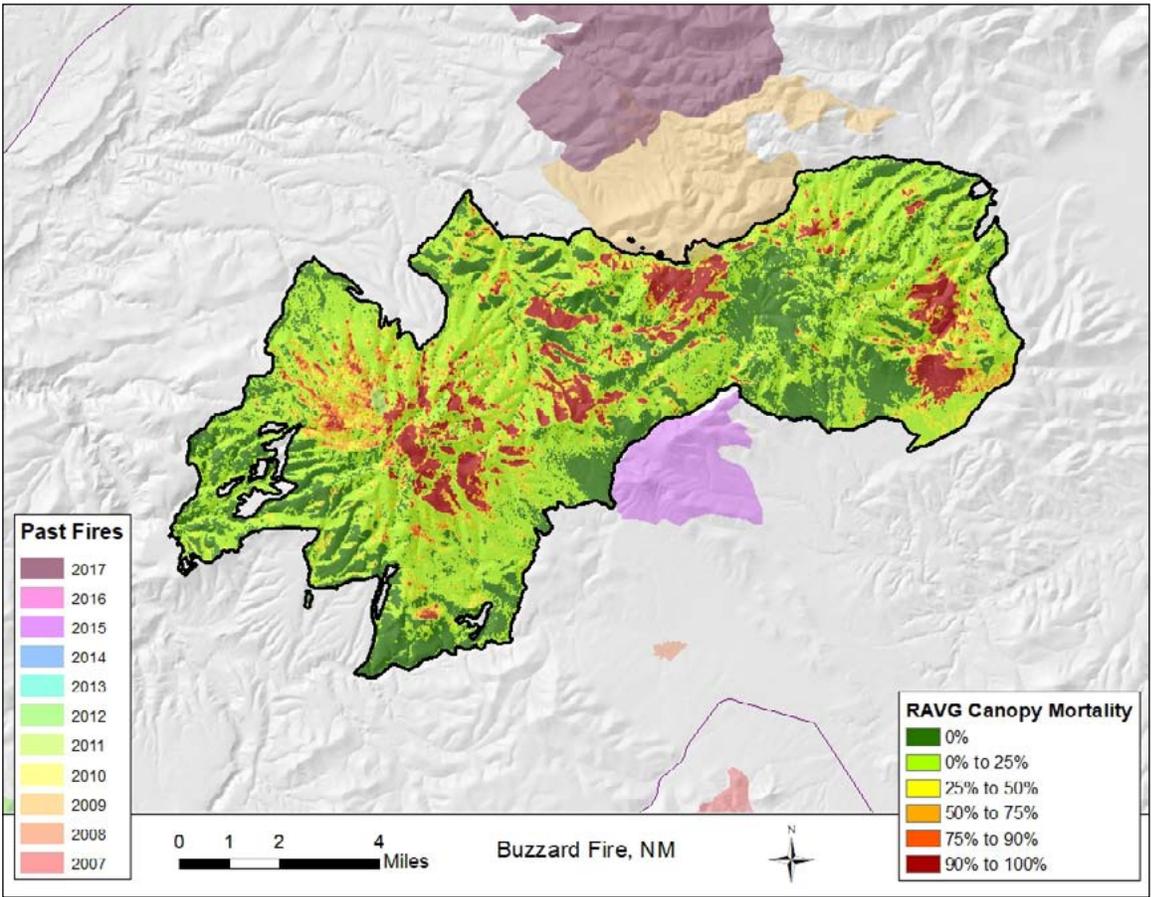


Figure 10. RAVG canopy mortality in the Buzzard Fire.

Buzzard Fire, New Mexico

The Buzzard Fire was the second largest fire in this report. It consumed more than 50,000 acres in a 51-day span from May 22 to July 12. This human-caused fire burned near the Eagle Peak Lookout in the Gila National Forest about 10 miles east of Reserve, NM. Fire managers chose to use a full suppression approach, using multiple strategies to protect natural resource, cultural, and private property values within the fire planning area. The steep terrain and lack of road access on the western side of Eagle Peak led crews to monitor the fire as it progressed to lower elevations, where it was eventually starved for fuel. Crews constructed and controlled fire lines around the remainder of the fire. Safety concerns led to an area closure, which included the shutdown of several area roads and portions of the Continental Divide Trail. No citizens or structures were affected by the Buzzard Fire, but five responders suffered injuries or illnesses. Suppression of the Buzzard Fire cost \$15.1 million, or about \$300.22 per acre.

Vegetation and Past Fires

The majority of the Buzzard Fire burned through ponderosa pine (64 percent, nearly 32,000 acres), mixed conifer (20 percent),

and piñon-juniper (8 percent). Nearly half (48 percent) of the vegetation within the Buzzard Fire had a high departure from historic conditions according to the Vegetation Condition Class analysis. The area affected by the Buzzard Fire had not burned in the last 10 years, but had seen several nearby fires. The Buzzard Fire was only about a mile from the edge of the 2017 Kerr Fire, which burned nearly 12,000 acres to the north. It also shared nearly six miles of perimeter with the 2009 Willow Fire and another four miles of shared perimeter with the 2015 Pinon Fire to the south. These recent fire perimeters served as an effective break line. The Buzzard Fire also burned through the 1995 HB Fire perimeter, where it consumed dead and down fuel.

Fire Severity

Nearly 75 percent of the 50,000-acre fire had less than 25 percent mortality in the RAVG analysis (Figure 10). Nearly 14,000 acres exhibited 0 percent mortality. However, more than 4,000 acres had over 90 percent mortality. These areas were primarily on eastern slopes with a mixed conifer or conifer oak component. Soil burn severity maps were not available for this fire.



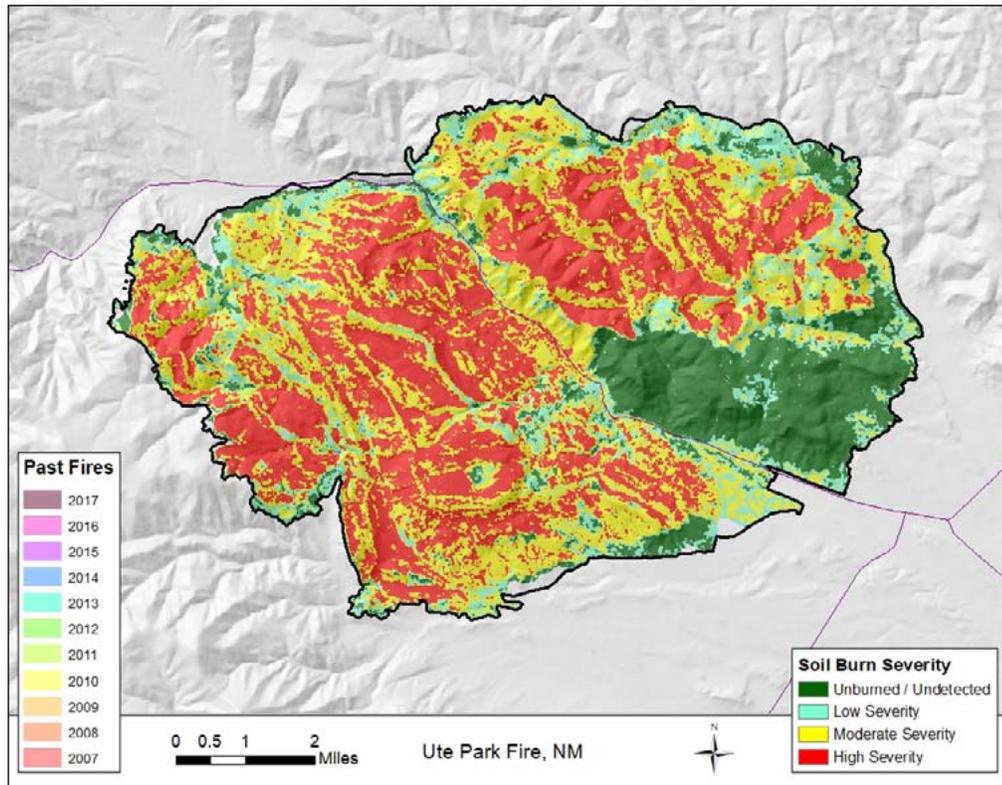


Figure 11. Soil burn severity from the Ute Park Fire.

Ute Park Fire, New Mexico

The Ute Park Fire burned for 19 days (May 31–June 19) on both sides of US Highway 64 just east of the town of Ute Park in Colfax County, NM. The cause of this 36,740-acre fire is unclear. This fire moved rapidly with strong winds that led to spotting about a half-mile out of the flame front. The fire also featured two heads, one moving south and another moving northeast. Given the values at risk, the fire managers chose a full suppression approach that used direct attack tactics where possible. Control features to the southwest of the fire were limited, leading to more indirect tactics. The response to this fire included many fire personnel, a variety of aircraft, and the New Mexico National Guard, which was dispatched to assist law enforcement with security.

Nearly 3,500 civilians, including the residents of Ute Park and Cimarron and all 1,100 employees of the Philmont Boy Scout Camp, evacuated as a result of the fire. Fourteen outbuildings were confirmed destroyed, along with damage to power lines and fiber optic lines along US Hwy 64, which was closed for several days due to trees and boulders strewn across the road. Five responders suffered some sort of illness or injury. Additionally, the municipal water supplies for Cimarron and Philmont were impacted and several bridges were damaged by the fire and heavy machinery crossings. Suppression of the Ute Park Fire cost \$10 million, or \$272.18 per acre.

Vegetation and Past Fires

The Ute Park Fire burned primarily through mixed conifer (38 percent), ponderosa pine (32 percent), and piñon-juniper (24 percent), with small amounts of scrub, riparian forest, and grass. None of the area affected by the Ute Park Fire had burned

in the last 10 years. In fact, there had not been a significant fire within 35 miles of the Ute Park Fire in the last 10 years. Seventy-three percent of the vegetation within the Ute Park Fire perimeter had moderate departure from historic conditions according to the LANDFIRE Vegetation Condition Class analysis. Only 1 percent had high departure.

Fire Severity

Over 70 percent of the Ute Park Fire had high (36 percent) or moderate (35 percent) severity according to the Soil Burn Severity analysis (Figure 11). This included 80 percent of the mixed conifer and ponderosa pine areas. Only 13 percent exhibited low severity but there was a large area that remained unburned or undetectable north of US Highway 64. RAVG canopy analysis was not available for this fire. The Soil Burn Severity map is available because of a special request from the state because the fire occurred on state and private land. A report on the post-fire impacts noted that the Ute Park Fire damaged and disrupted watershed function on mostly private lands. Fortunately, because the fire burned through the canopy, watershed condition was not as severely impacted as initially anticipated.⁶ However, post-fire flooding after the Ute Park Fire caused a debris flow that damaged the community of Ute Park and is likely to continue to have significant adverse impacts to water quality.

⁶ Ute Park Fire Damage Assessment and Burned Area Emergency Rehabilitation Plan <https://allaboutwatersheds.org/groups/ute-park-fire-recovery/ute-park-fire-recovery-public-group-folder/ute-park-fire-damage-assessment-and-burned-area-emergency-rehabilitation-plan>

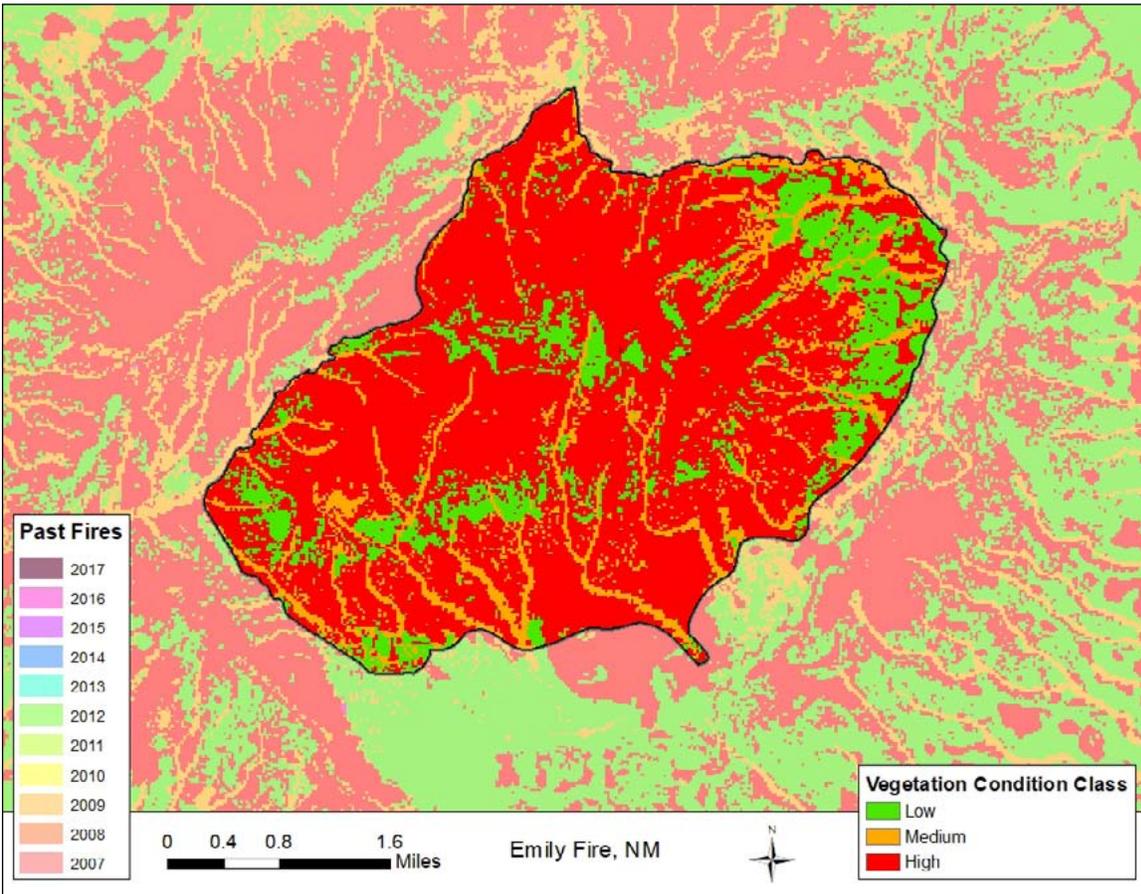


Figure 12. Vegetation Condition Class showing departure from historic conditions in the Emily Fire.

Emily Fire, New Mexico

The Emily Fire was reported on June 28 approximately 25 miles north of Las Vegas, NM and burned nearly 8,500 acres over 20 days until monsoonal rains arrived. The Emily Fire burned on private land. As reported in the Incident Status Summaries, also known as the ICS-209s, fire managers used a full suppression strategy with the strategic objective to successfully protect and eliminate damage to power lines, the high-value Turkey Mountain communications site, and private grazing land. It was also important to prevent the fire from impacting Interstate 25. No injuries were reported, unfortunately there was some structural damage to the Turkey Mountain repeater site. The Emily Fire cost \$1.8 million to manage, or about \$216.95 per acre.

Vegetation and Past Fires

Most of the area affected by the Emily Fire was ponderosa pine (45 percent) or piñon-juniper (36 percent). Riparian forest (8 percent), scrub (7 percent), mixed conifer (2 percent), and grass (2 percent) were also affected. None of the area burned in the Emily Fire had burned in the past 10 years. Seventy percent of the vegetation within the Emily Fire had high departure from historic conditions according to the LANDFIRE Vegetation Condition Class analysis (Figure 12).

Fire Severity

No fire severity data was available for the Emily Fire.



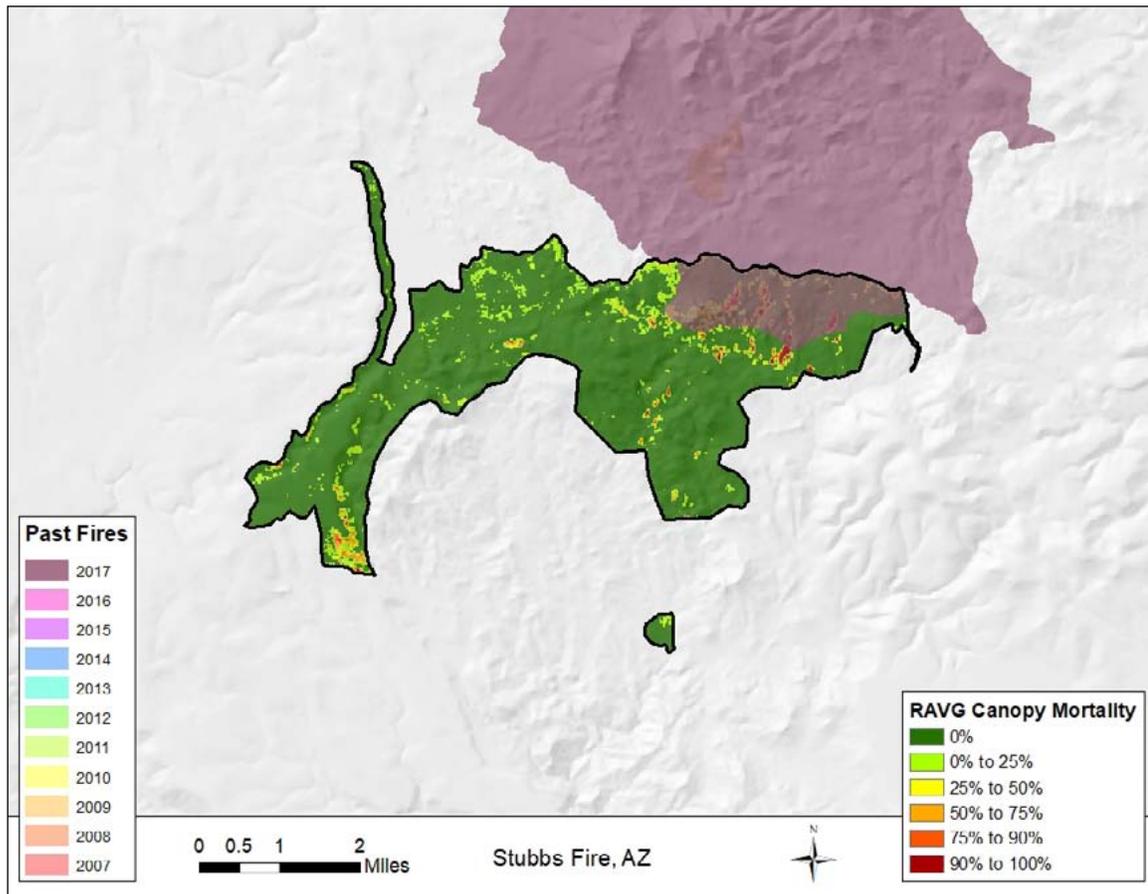


Figure 13. Canopy mortality map for the Stubbs Fire.

Stubbs Fire, Arizona

The 8,500-acre Stubbs Fire was reported on July 8 on the Prescott National Forest 25 miles northwest of Prescott, Arizona. This lightning/natural caused fire was characterized by short duration understory burning with isolated torching in brush. Management chose a 100 percent monitor approach to provide for firefighter/public safety and restore fire to its natural role in ponderosa pine and chaparral vegetation types. Success of this approach was defined as reducing future risk to the ecosystem. The fire burned for 39 days and cost \$145,000 to manage, or about \$17.06 per acre.

Vegetation and Past Fires

Approximately 15 percent (1,400 acres) of the Stubbs Fire burned the previous year as part of the Hyde Fire. No other fires occurred in this area over the last 10 years. The Stubbs

Fire mainly burned through ponderosa pine (39 percent), piñon-juniper (38 percent), conifer-oak (10 percent), and chaparral (8 percent) but also affected small areas of riparian forest, grass, and scrub. One disjunct burn area to the south was added to the Stubbs Fire perimeter. The majority (73 percent) of the Stubbs Fire was mapped as low departure from historic conditions, yet 25 percent showed high departure.

Fire Severity

Nearly 90 percent (7,300 acres) of the Stubbs Fire exhibited little to no canopy mortality. Less than 300 acres had more than 25 percent canopy mortality according to the RAVG analysis (Figure 13). Those higher severity acres were primarily located in and around the area that burned in the 2017 Hyde Fire.



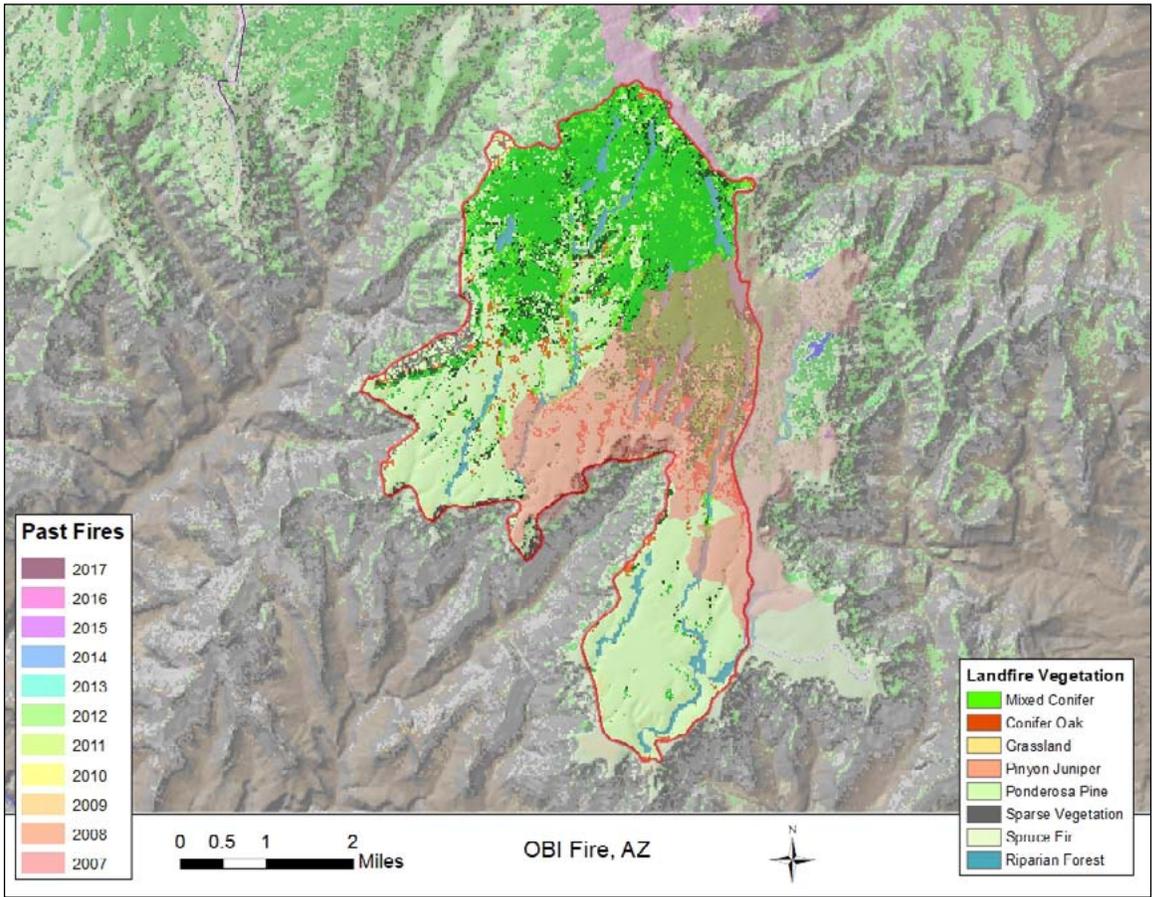


Figure 14. Vegetation and past fires in the OBI Fire burn area.

OBI Fire, Arizona

Lightning started the OBI Fire on July 21 and it burned until August 31. During those 41 days, it burned 11,656 acres on the Walhalla Plateau of the Grand Canyon National Park. This fire was managed using a 100 percent confine strategy. The terrain in the area made access to the fire difficult and led to a heavy reliance on aircraft. Grand Canyon National Park implemented a number of temporary closures as part of the fire response, but no injuries or damaged structures were reported. The management cost of the wildfire was \$250,000, or \$21.45 per acre.

Vegetation and Past Fires

The OBI Fire mainly burned through ponderosa pine (48 percent) and mixed conifer (38 percent) forests, but also

affected small areas of riparian forest (6 percent), conifer-oak (4 percent), non-vegetated/developed (2 percent), spruce-fir (1 percent) and grassland (1 percent). Over half (56 percent) of the OBI Fire was identified as high departure from historic conditions according to the Vegetation Condition Class analysis (Figure 14). Roughly one-third of the area affected by the OBI Fire (approximately 4,000 acres) burned in the 2007 Roosevelt Fire. Otherwise the area had not been burned in recent years; however, it shared a nearly two-mile perimeter with the 2016 Fuller Fire.

Fire Severity

Fire severity information was not available for the OBI Fire.



Conclusion

This report covers the 13 largest wildfires of 2018 and more than half of the acreage burned. Grassland was the most commonly burned vegetation type closely followed by ponderosa pine, making up roughly 90,000 acres each (Figure 15). Far more acres of grassland and ponderosa pine were burned in the largest wildfires of 2018 than 2017, while fewer acres of piñon-juniper, conifer-oak, chaparral, and scrub burned. Nearly 50,000 more acres of ponderosa pine were burned in these large 2018 fires than those in 2017. Most of the burned grassland was from the three large fires occurring on the northern and southern boundaries of New Mexico. This number would likely have been much higher if data were available for the 206 and 380 fires in eastern New Mexico.

Soil burn severity maps analyzed in this report account for only 16 percent of the total acres burned in 2018. For the four fires in this report with soil burn severity maps, 62 percent of the the acres burned with low or undetectable soil burn severity (Figure 16). Nearly 15,000 acres (17 percent) of this area experienced high soil burn severity. More than 87 percent

of the high soil burn severity acres in this report were from the Ute Park Fire.

RAVG maps were available for five fires in this analysis and show the majority (68 percent) of acres analyzed experienced less than 25 percent canopy mortality (Figure 17). Eleven percent of the area analyzed burned with greater than 90 percent canopy mortality. The Buzzard and Tinder fires account for nearly 72 percent of the highest canopy mortality areas. These fires were both primarily ponderosa pine, and canopy mortality can be more ecologically significant in this plant community than fires that mainly burn in low-stature vegetation (grass, scrub, chaparral). Nearly 3,500 acres of ponderosa pine in the Tinder Fire and an additional 1,600 acres of ponderosa pine and 2,100 acres of mixed conifer in the Buzzard Fire had greater than 90 percent mortality (Figure 18). RAVG maps were not available for the Ute Park Fire but this would likely have significantly increased the acreage in this highest canopy mortality class.

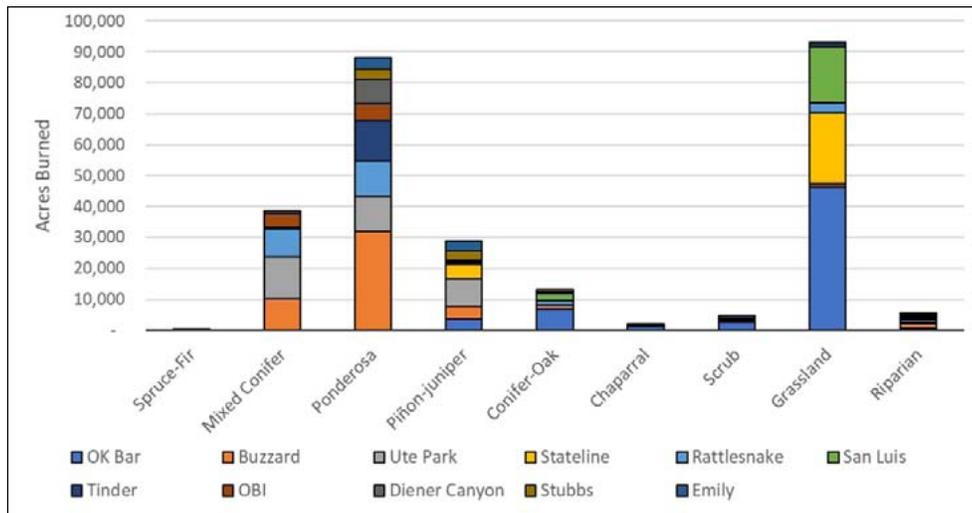


Figure 15. Summary of acres burned in the largest fires by vegetation type. Note: Fire perimeters were not available for the 206 and 380 fires and were therefore left out of this analysis.

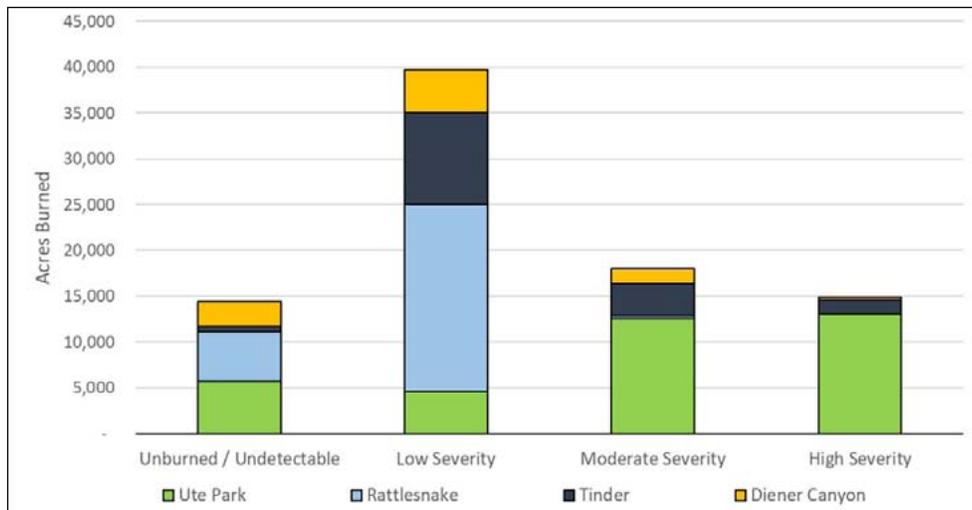


Figure 16. Summary of acres burned by soil burn severity class.



Only a quarter of the area in this analysis was highly departed from historic conditions based on the LANDFIRE vegetation condition class analysis. It is reasonable to assume that the high proportions of wildfire burning with low severity and the high portion of the area burned close to the historic condition are related. Most of the 68,000 acres of high departure from historic conditions was isolated to three fires: Buzzard (35 percent), Tinder (20 percent), and Rattlesnake (18 percent). These were among the most intense fires with over 4,000 acres of the Buzzard and Tinder fires having greater than 90 percent canopy mortality. The Tinder Fire was also the most destructive fire in this report to human communities, leading to the loss of 33 residences and 63 minor structures.

Human communities were most affected by the Tinder and Ute Park fires. The Tinder Fire threatened over 1,700 residences and required the evacuation of 300 civilians, in addition to area and road closures. It ended up destroying 33 of residences along with 63 minor structures. The Ute Park Fire led to the evacuation of nearly 3,500 civilians in Ute Park, Cimarron, and the Philmont Boy Scout Camp. This fire consumed 14 outbuildings and damaged power lines and fiber optic lines along US Hwy 64, which was closed for several days with trees and boulders strewn across the road.

The cause of most fires in this report was undetermined at the time of this writing. Fire investigators identified two of them as human caused, including the Tinder and Diener Canyon fires. The Tinder Fire was caused by an abandoned illegal campfire, while the cause of the Diener Canyon Fire was spot fires from a prescribed burn.

The role of past fires was highly variable in the fires summarized in this report. Past fires played a role in most fires in this analysis and in many cases the edge of these 10-year-old or less fire scars served as a fire break within

only limited overlap. For example, recent burn perimeters facilitate control of the Buzzard Fire. The Rattlesnake Fire burned entirely within the fire scar of the 538,000-acre 2011 Wallow Fire. The Rattlesnake Fire is also likely an example of a reburn that is likely to have had low burn severity at least in part because of previous fires. In contrast, the Ute Park Fire did not interact with recently burned areas and burned at high severity. Of course, many factors in addition to past fires help determine wildfire severity.

On the other end of this range was the Ute Park Fire, which burned in an area without a significant fire within 35 miles in the last 10 years. Further, the utility of this metric is particularly relevant to the woody vegetation types. The 2009 and 2011 fires within the OK Bar and San Luis fire perimeters were unlikely to play a significant role in these primarily grass fires. Fires in this report, such as Diener Canyon and Buzzard Fires, burned into older fire perimeters.

The 13 fires in this analysis cost nearly \$54 million dollars to manage (with a range of strategies) for an average of \$157 per acre. This was half the average cost in our 2017 analysis. As noted above, managers identify the most appropriate strategy for each part of a wildfire to minimize threats and maximize positive outcomes. Using the percentage of strategies reported in the ICS-209 forms allows a portioning of acres and costs by the strategy used. In 2018, managers used full suppression strategies on 70 percent of the acres burned in the large fires summarized in this report. Limited data make it difficult to assess how this percentage compares to all fires over 100 acres in the Southwest. It is worth noting that managers were able to use strategies other than full suppression on all three naturally ignited fires (OBI, Stubbs, and OK Bar). The 100,000 acres where managers were able to use strategies other than full suppression is only a third less than the number of acres treated with prescribed fire in the Southwest during 2018.

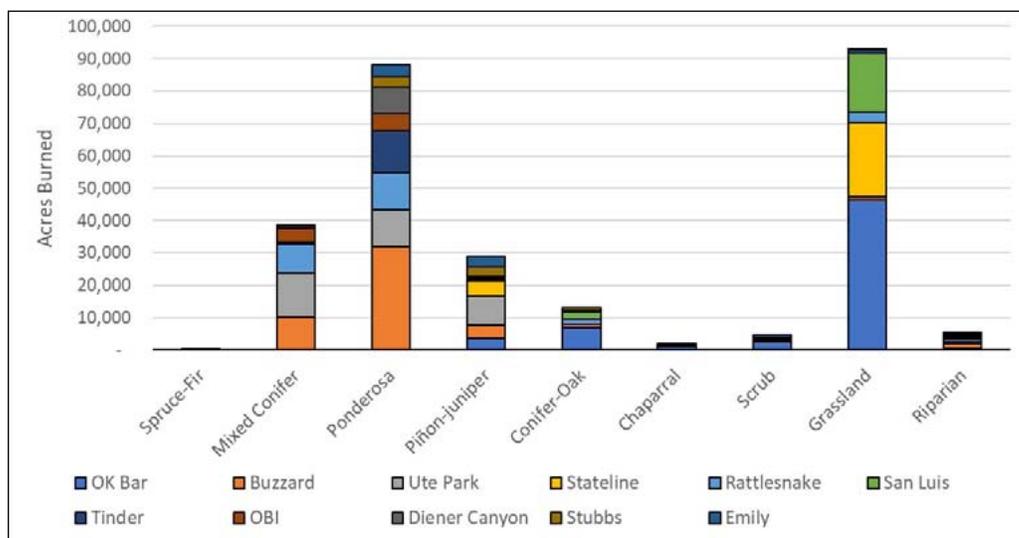


Figure 17. Summary of acres burned by canopy mortality class.



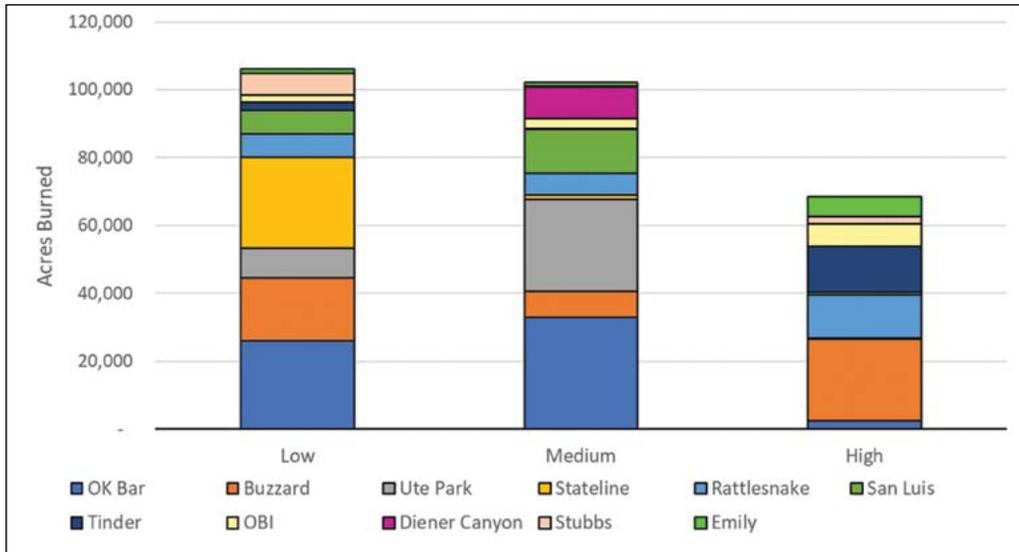


Figure 18. Summary of acres burned by vegetation condition class. Note: Fire perimeters were not available for the 206 and 380 fires and were therefore left out of this analysis.



Appendix 1. Fire Statistics

| General | | | | Vegetation Departure | | |
|---------------|--------|--------------|----------|----------------------|--------|------|
| Name | Acres | Cost | cost/ac | Low | Medium | High |
| OK Bar | 61,620 | \$1,400,000 | \$22.72 | 42% | 54% | 4% |
| Buzzard | 50,296 | \$15,100,000 | \$300.22 | 37% | 15% | 48% |
| 206 | 44,162 | \$96,000 | \$2.17 | - | - | - |
| Ute Park | 36,740 | \$10,000,000 | \$272.18 | 24% | 73% | 1% |
| Stateline | 28,105 | \$2,300,000 | \$81.84 | 95% | 4% | 0% |
| Rattlesnake | 26,072 | \$11,400,000 | \$437.25 | 27% | 25% | 48% |
| San Luis | 20,586 | \$300,000 | \$14.57 | 34% | 62% | 4% |
| 380 | 20,480 | \$35,000 | \$1.71 | - | - | - |
| Tinder | 16,309 | \$7,500,000 | \$459.87 | 14% | 2% | 83% |
| OBI | 11,656 | \$250,000 | \$21.45 | 18% | 26% | 56% |
| Diener Canyon | 9,338 | \$3,500,000 | \$374.81 | 1% | 99% | 0% |
| Stubbs | 8,500 | \$145,000 | \$17.06 | 73% | 2% | 25% |
| Emily | 8,432 | \$1,829,302 | \$216.95 | 16% | 14% | 70% |

| Name | Soil Burn Severity | | | | RAVG canopy mortality | | | | | |
|---------------|--------------------|-----|----------|------|-----------------------|-------|-------|-------|-------|-------|
| | Unburned | Low | Moderate | High | 0% | < 25% | < 50% | < 75% | < 90% | ≥ 90% |
| OK Bar | - | - | - | - | - | - | - | - | - | - |
| Buzzard | - | - | - | - | 27% | 47% | 9% | 5% | 3% | 8% |
| 206 | - | - | - | - | - | - | - | - | - | - |
| Ute Park | 16% | 13% | 35% | 36% | - | - | - | - | - | - |
| Stateline | - | - | - | - | - | - | - | - | - | - |
| Rattlesnake | 21% | 78% | 1% | 0% | 23% | 51% | 13% | 7% | 3% | 4% |
| San Luis | - | - | - | - | - | - | - | - | - | - |
| 380 | - | - | - | - | - | - | - | - | - | - |
| Tinder | 3% | 64% | 22% | 10% | 2% | 35% | 18% | 12% | 6% | 27% |
| OBI | - | - | - | - | - | - | - | - | - | - |
| Diener Canyon | 29% | 50% | 17% | 3% | 16% | 32% | 14% | 10% | 5% | 23% |
| Stubbs | - | - | - | - | 88% | 8% | 1% | 1% | 0% | 1% |
| Emily | - | - | - | - | - | - | - | - | - | - |





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