Eaton Fire Burned Area Summary

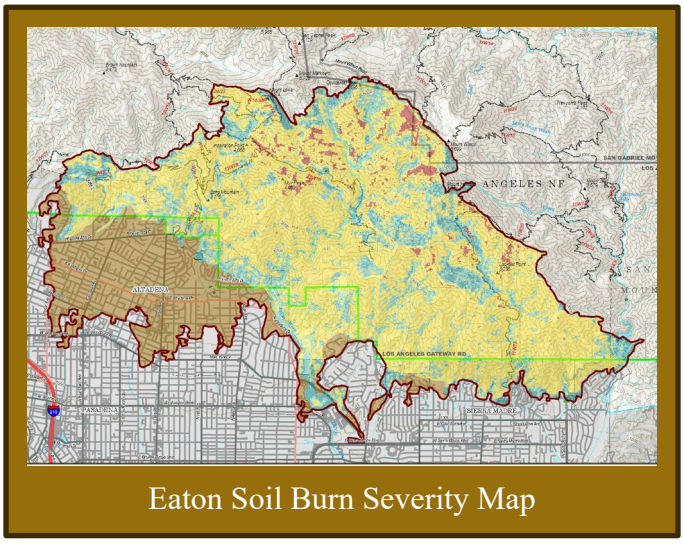
Burned Area Report

Fire Background

The Eaton Fire ignited in the hills of Eaton Canyon, near Altadena, California on the evening of January 7, 2025. By 10:30 a.m. the next day, the fire had quickly grown to cover more than 10,000 acres (40 square kilometers), according to CAL FIRE. By January 11, it had expanded to 14,117 acres (57 square kilometers). The fire started during a “Particularly Dangerous Situation” red flag warning; and was wind-driven with Santa Ana winds up to 100 mph. The previous 3-month period from October to January is the driest on record.

While many wildfires cause minimal damage to the land and pose few threats to the land or people downstream, some fires result in damage that requires special efforts to reduce impacts afterwards. The Burned Area Emergency Response (BAER) program is designed to identify and manage potential risks to resources on National Forest System (NFS) lands and reduce these threats through appropriate emergency measures to protect human life and safety, property, and critical natural or cultural resources. BAER is an emergency program for stabilization work that involves time critical activities to be completed before damaging events to meet program objectives.

The Forest Service assembled a BAER team on January 14, for the Eaton Fire. This team of experts in various resource disciplines began assessing the post-fire effects to critical values on Forest Service lands. Impacts to the soil are the primary indicator of potential post-fire changes in watershed response, as well as watershed recovery. The team developed soil burn severity (SBS) maps to document the degree to which the fires had changed soil properties. Using the SBS map, physical scientists can predict erosion potential, changes to runoff and flood flows, and increased geologic hazards. Field evaluations and modeling results are used to determine relative increases in post-fire risk to different critical values and inform recommendations to address these increased risks.



Eaton Soil Burn Severity Map

Soils

Soil burn severity is not an assessment of vegetation consumption, but rather an integration of vegetation loss, changes in soil structure and infiltration capacity, remaining vegetation, duff, or ash, and soil color, all of which may indicate relative degrees of soil heating.

The final soil burn severity maps were developed with ESRI ArcGIS software using satellite-imagery-derived Burned Area Reflectance Classification (BARC) and field survey data. Field work included assessment of ash characteristics, ground cover, root condition, soil structure, soil water-repellency, and vegetation burn severity as described in the Field Guide for Mapping Post-fire Soil Burn Severity (Parsons et al. 2010). High burn

severity is characterized by a complete consumption of organic material with the surface layers of the soil resulting in a change to single-grain structure. Fine roots are commonly charred or consumed 3-5 cm deep. The highest-severity areas often have a loose, dusty appearance, and no longer have any cohesion or soil strength. Generally, there will be less destruction of soil organic matter, roots, and structure in an area mapped as moderate compared to high. In areas mapped as moderate SBS, soil structure, roots, and litter layer may remain intact beneath a thin ash layer. Low soil burn severity results in very little alteration of soil organic matter and little or no change in soil structural stability.

Mapped and validated SBS for the burned area is High (4%), Moderate (74%), Low (17%), and Very Low/Unburned (5%) (see map on page 7). The more severe a fire's effects are on the soil, the more likely those soils will erode in subsequent rainstorms – especially in locations with steep slopes. Erosion after fires can cause tremendous damage to homes and other structures in the years after a fire.

Developed areas (both urban and rural) were not mapped for soil burn severity. This method has been developed for wildland vegetation and landscapes and therefore is not appropriate for describing effects of fire on developed lands and burned structures. As such, these areas were not visited or evaluated by the BAER team.

Geology

The team identified the geologic conditions and processes that have shaped and altered the watersheds and landscapes and assessed the impacts from the fire on those conditions and processes that could affect downstream critical values. Using the understanding of rock types and characteristics, geomorphic processes, and distribution of geologic hazards helps predict how the watersheds will respond to and be impacted by upcoming storms.

The Eaton Fire burned primarily in the Eaton Canyon and Little Santa Anita watersheds, in addition to some smaller watersheds, within the San Gabriel Mountains National Monument of the Angeles National Forest (NF). The burn area is dominated by steep slopes and rugged canyons largely draining to the south-east, south and south-west, and include the Eaton Canyon watershed, the Little Santa Anita watershed, and other smaller watershed flowing south directly into the communities of Altadena and Sierra Madre. The average slope gradient in the San Gabriel Mountains is over 65 percent which leads to high erosion rates in both dry and wet periods.

The burn area footprint occurred on the south slopes of the central San Gabriel Mountains rock assemblage, a group of rocks that form part of the east-west oriented Transverse Ranges of Southern California. The Transverse Ranges resulted from complex tectonic interaction between the Pacific and North American plates along the right-lateral, strike-slip San Andreas Fault.

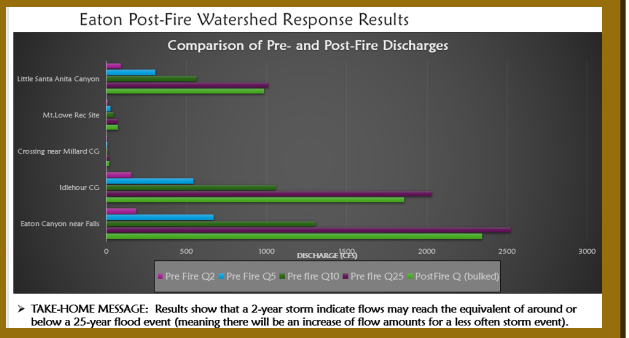
The team provided soil burn severity field data to the US Geological Survey Landslide Hazard Program to assist in forecasting the probability, potential volumes, and hazards of debris flows through their developed empirical models. The USGS Post-fire Debris Flow Hazard Model estimates that under conditions of a peak 15-minute rainfall intensity storm rate of 1.57 inches/hour, corresponding to a 1-year return interval storm, a majority of the drainages in the burn scar show high to very high likelihood of debris flow initiation, with a high combined hazard rating (see debris flow maps on pages 8-10).

Based on the steep slopes in the burn area, the soil burn severity, the elevated hydrophobicity/water repellency of the burned soil, and the amounts of stored sediments in most drainages in the burn area, it is estimates that as a result of short duration, high intensity storms (>40 mm/hr.), the probabilities of hyper-concentrated flows and/or debris flows are high to very high in most channels in the Eaton Fire burn area. These channels for the most part flow into communities impacted by the fire and downstream of the fire.

Steep Slopes within Eaton Fire

Hydrology

Primary watershed response is expected to include an initial flush of ash and burned materials, erosion in drainages and on steep slopes in the burned area, increased peak flows and sediment transport and deposition, and debris flows. Watershed response is dependent on the occurrence of rainstorms and rain-on-snow events and will likely be greatest with initial storm events. Increased watershed response is most likely in areas with high to moderate soil burn severity. Disturbances will become less evident as vegetation is reestablished, providing ground cover that reduces erosion and increases surface roughness which slows flow accumulation and increases infiltration.



A rapid hydrologic assessment of the Eaton burned area suggests that there will be: 1) an initial flush of ash and debris, 2) rill and gully erosion on steep slopes within the burned area, and 3) potential flash floods and debris flows during short duration high intensity summer monsoonal precipitation events (less common), as well as during long duration winter atmospheric river precipitation events (more common). A lot of the topography is steep with widespread moderate soil burn severity and high soil hydrophobicity/water repellency. Storms will likely create increased surface flow that could trigger floods, or debris flows with sediment and floatable debris due to the areas now devoid of vegetation and groundcover after the fire. These responses are expected to be most pronounced during the first five years after the fire and will become less evident as vegetation and soil-hydrologic function recover.

TABLE 9. ESTIMATED HYDROLOGIC RESPONSE MODELING

Critical Values Pour Point Watersheds	Drainage size (acres)	% Mod + High SBS	Pre-Fire Discharge (cfs) Q2	Post-Fire Discharge, Bulked (cfs)	Magnitude of Post-Fire streamflow increase w/bulking
Eaton Canyon near Falls	4,133	74%	187	2346	12.52
Idlehour Campground	2,925	68%	155	1857	12.01
Crossing near Millard Campground	14	71%	3	17	5.04
Mt. Lowe Rec Site	53	70%	10	70	6.87
Millard at Arroyo Seco Crossing	1,768	19%	95	426	4.51
Little Santa Anita Canyon	1,583	79%	92	986	10.71

Critical Values

The first critical value BAER teams assess is always human life and safety on National Forest System (NFS) lands. During and after heavy rainstorms, Forest Service employees and visitors to NFS lands could be threatened by floodwaters and debris flows. In addition, users of roads within and downstream of the burned areas may be affected by road washouts during and after heavy rainstorms. The National Weather Service can establish an early warning alert plan for areas that are potentially at risk from these events. The BAER team recommends a fire area closure, general warning signs, and communications to travelers on any NFS roads and trails within or directly adjacent to the

Eaton Fire.

Road crossing near Millard Campground have potential for culverts to plug

Roads and Bridges

Roads in and downstream of burned areas are at risk of damage due to post-fire conditions. The most likely threat due to the fires is clogging of culverts, bridges, and other in-channel infrastructure from the higher levels of floatable debris (especially burned trees) in burned watersheds. Once blocked by debris, road drainage structures no longer function and the stream flows over the road, often causing considerable damage and limiting access. Various measures can reduce this risk, including protecting culvert inlets with debris racks, removing large floatable debris from channels upstream of structures before floods, and making heavy equipment available and readily mobilized during storm events to keep structures clear of debris.

Debris flows are less likely than debris-laden flood flows, but they pose a greater threat to roads when they do occur and are difficult to mitigate.

Critical values addressed in the BAER report include Forest Service system roads and related drainage features. Treatments for the protection of these roads include restoring drainage features, armor drainage crossings, conduct storm inspections and response actions, and install warning signs to alert travelers of hazardous conditions within the Eaton burned areas.

Recreation

National Forest System recreation infrastructure includes campgrounds, trails, and day use areas. Most of the recreation assets within the Eaton Fire burned area relate to developed recreation sites, concentrated use areas, and 23 miles of trails. Like roads, recreation infrastructure could be damaged in post-fire storm events.

The team proposes trail drainage stabilization treatments, which include armoring and/or cleaning existing water control features and adding additional drainage features to provide additional capacity for elevated sediment laden post-fire runoff, and closure of specific recreation sites.

Botany

Invasive plants adversely affect native plant communities through allelopathy (suppression of growth of a native plant by release of a toxin from a nearby invasive plant) and direct competition for water and resources. Over time, native plant diversity decreases as invasive plants expand, reducing habitat for native plant species and wildlife. Shifts from diverse native plant communities to non-native invasive plant dominance could alter future fire behavior, intensity, extent, and season of burning.

Current infestations are primarily located along roads, old dozer lines, campgrounds, and trails throughout the burned area, with interior areas being largely un-infested. However, the burned area creates conditions for invasive species to outcompete native plants. The BAER team recommends a treatment of Early Detection, Rapid Response (EDRR) to monitor for noxious weed infestation and expansion in areas disturbed due to mechanical suppression activity and burned areas prone to new noxious weed infestations.

Cultural Resources

The most typical post-fire threats to cultural sites are physical threats such as erosion or damage from (now dead) falling trees. In some cases, newly exposed artifacts are threatened by human damaging activities such as looting or vandalism. Cultural resources were evaluated by the BAER team and treatments proposed for road and recreation will also protect these values from post-fire threats.

Hazardous Materials

The highly toxic nature of exposed hazardous materials (hazmat) such as asbestos, lead, mercury, arsenic and polychlorinated biphenyl [PCBs] are generated by the burning of structures and located within the burned refuse. The BAER team noted the potential for impacts to human health and the environment. Concerns for the hazmat are two-fold: 1) exposure can present a threat to human health, and 2) can contaminate soil and water and have long-lasting environmental and public health threats to Forest Service employees, forest visitors, and wildlife.

Areas of concern are Millard Canyon Recreation Residence Tract and Campground, and a burned shade structure at Inspiration Point. The BAER team recommends area closures, hazmat stabilization and removal, and restricting access to specific affected sites.

Federally Listed Species - Wildlife and Fisheries

No occurrences of federally-listed threatened or endangered plants and animals are known within or downslope/downstream from the Eaton Fire area. No designated Critical Habitat is present.

Anticipated Vegetation Recovery

Post-fire recovery varies greatly based on climate, vegetation types and burn severity. It is typical for recovery to take between 3-5 years for reestablishment of ground cover. The persistence of drought in the years following wildfires also delays the recovery time frame. Even with only a short period of time since fire containment, resprouting of trees and shrubs as well as emergence of forbs have been noted within the burned area.

Non-Forest Service Values

Since fire effects know no administrative boundaries, additional threats exist for assets not owned or managed by the Forest Service. Post-fire emergency response is a shared responsibility. There are several Federal, State, and local agencies that have emergency response responsibilities or authorities in the post-fire environment. The BAER team and local unit BAER Coordinator has engaged with interagency partners to facilitate consideration of off-Forest values covered through other programs with the relevant responsible entities.

Partner agency contacts:

Don Lindsay, CA Geological Survey-CAL WERT
California Department of Conservation

Bennett Cummings, Los Angeles County Office of Emergency Management
Emergency Management – Los Angeles County

Natural Resources Conservation Service (NRCS)
California | Natural Resources Conservation Service

Alex Tardy, NOAA NWS-San Diego
https://www.weather.gov/sgx/

Jayme Laber, NOAA NWS-Los Angeles-Oxnard
https://www.weather.gov/lox/

Conclusion

There are multiple phases of post-fire actions after a wildfire covering suppression repair through long-term recovery. BAER is the rapid assessment of burned watersheds by a BAER team to identify imminent post-wildfire threats to human life and safety, property, and critical natural or cultural resources on National Forest System lands and take immediate actions to implement emergency stabilization measures before the first major storms. The BAER team has identified imminent threats to critical values based on a rapid assessment of the

area burned by the Eaton Fire. The assessment was conducted using the best available methods to analyze the potential for damage from post-fire threats, including flooding and debris flows. The findings provide the information needed to prepare and protect National Forest System critical values against post-fire threats. The recommended BAER treatments in this report have been approved and funded.

Because of the emergency nature of BAER, and per Forest Service BAER policy, initial requests for funding of proposed BAER treatments are supposed to be submitted by the Forest Supervisor to the Regional Office within 7 days of total containment of the fire. The Regional Forester's approval authority for individual BAER projects is limited. Approval for BAER projects exceeding this limit is forwarded onto the Washington Office.

BAER treatments cannot prevent all the potential flooding or soil erosion impacts, especially after a wildfire-changed landscape. It is important for the public to stay informed and prepared for potentially dramatic increased run-off events. Many burned-area watersheds were already hydrologically responsive to rainfall and prone to erosion and sediment transport prior to the fire and will likely be even more responsive due to post-fire conditions. However, vegetation recovery is anticipated to be rapid with ground cover approaching pre-fire conditions within 1-3 years, which will attenuate any post-fire effects on watershed processes. The Forest Service will continue to provide information and participate in interagency efforts to address threats to public and private values resulting from the Eaton Fire. Information can be found on-line at https://inciweb.wildfire.gov/incident-information/caanf-eatonhurst-postfire-baer.

The Forest Service will continue to work towards long-term recovery and restoration of the burned area in coordination with efforts to rebuild and restore the communities affected. A vegetation burn severity map, or mortality map, may be produced as a part of the recovery efforts to help other scientists, such as wildlife biologists, botanists, and silviculturists understand what to expect from this changed landscape for wildlife habitat, invasive weeds, timber salvage, and reforestation needs.

Local Forest Service Leadership

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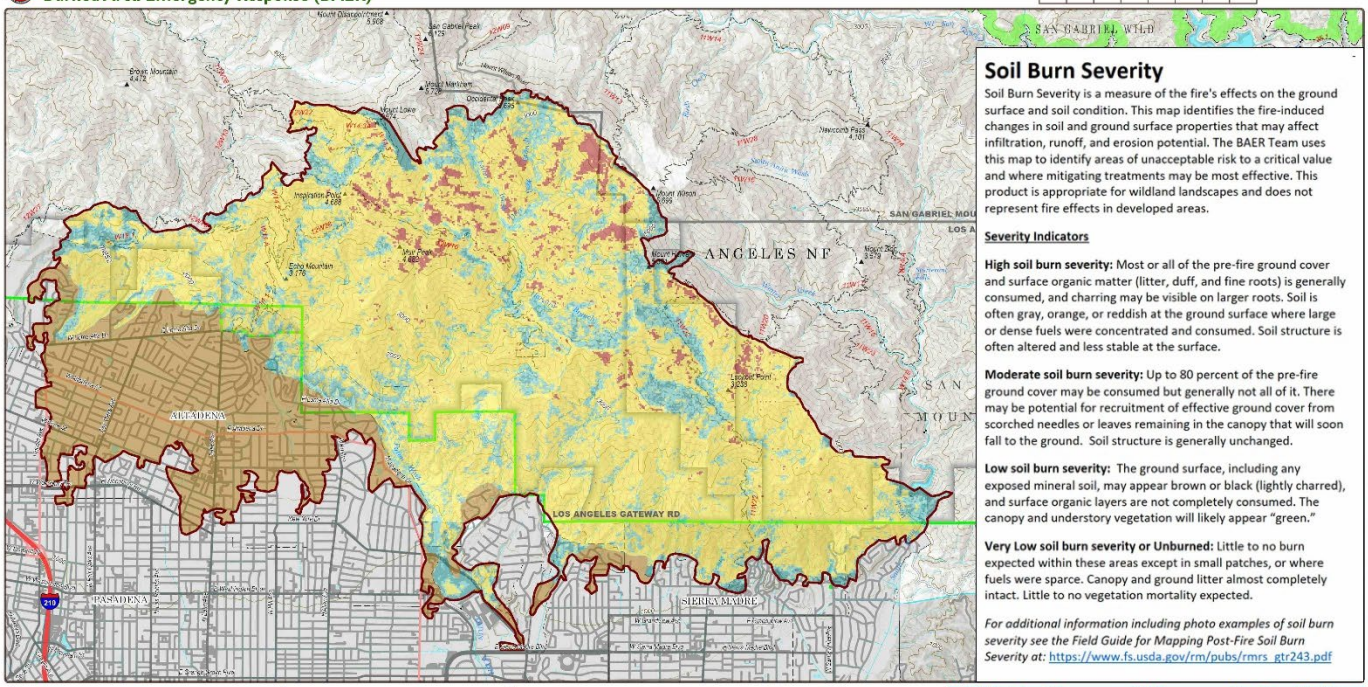
Local Forest Service BAER Coordinator

Jason Collier, Jason.collier@usda.gov

References:

Parson, Annette; Robichaud, Peter R.; Lewis, Sarah A.; Napper, Carolyn; Clark, Jess T. 2010. Field guide for mapping post-fire soil burn severity. Gen. Tech. Rep. RMRS-GTR-243. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 49 p. (https://www.fs.usda.gov/rm/pubs/rmrs_gtr243.pdf)

Eaton Soil Burn Severity
Burned Area Emergency Response (BAER)



Soil Burn Severity

Soil Burn Severity is a measure of the fire's effects on the ground surface and soil condition. This map identifies the fire-induced changes in soil and ground surface properties that may affect infiltration, runoff, and erosion potential. The BAER Team uses this map to identify areas of unacceptable risk to a critical value and where mitigating treatments may be most effective. This product is appropriate for wildland landscapes and does not represent fire effects in developed areas.

Severity Indicators

High soil burn severity: Most or all of the pre-fire ground cover and surface organic matter (litter, duff, and fine roots) is generally consumed, and charring may be visible on larger roots. Soil is often gray, orange, or reddish at the ground surface where large or dense fuels were concentrated and consumed. Soil structure is often altered and less stable at the surface.

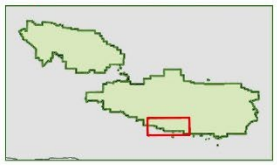
Moderate soil burn severity: Up to 80 percent of the pre-fire ground cover may be consumed but generally not all of it. There may be potential for recruitment of effective ground cover from scorched needles or leaves remaining in the canopy that will soon fall to the ground. Soil structure is generally unchanged.

Low soil burn severity: The ground surface, including any exposed mineral soil, may appear brown or black (lightly charred), and surface organic layers are not completely consumed. The canopy and understory vegetation will likely appear "green."

Very Low soil burn severity or Unburned: Little to no burn expected within these areas except in small patches, or where fuels were sparce. Canopy and ground litter almost completely intact. Little to no vegetation mortality expected.

For additional information including photo examples of soil burn severity see the Field Guide for Mapping Post-Fire Soil Burn Severity at: https://www.fs.usda.gov/rm/pubs/rmrs_gtr243.pdf

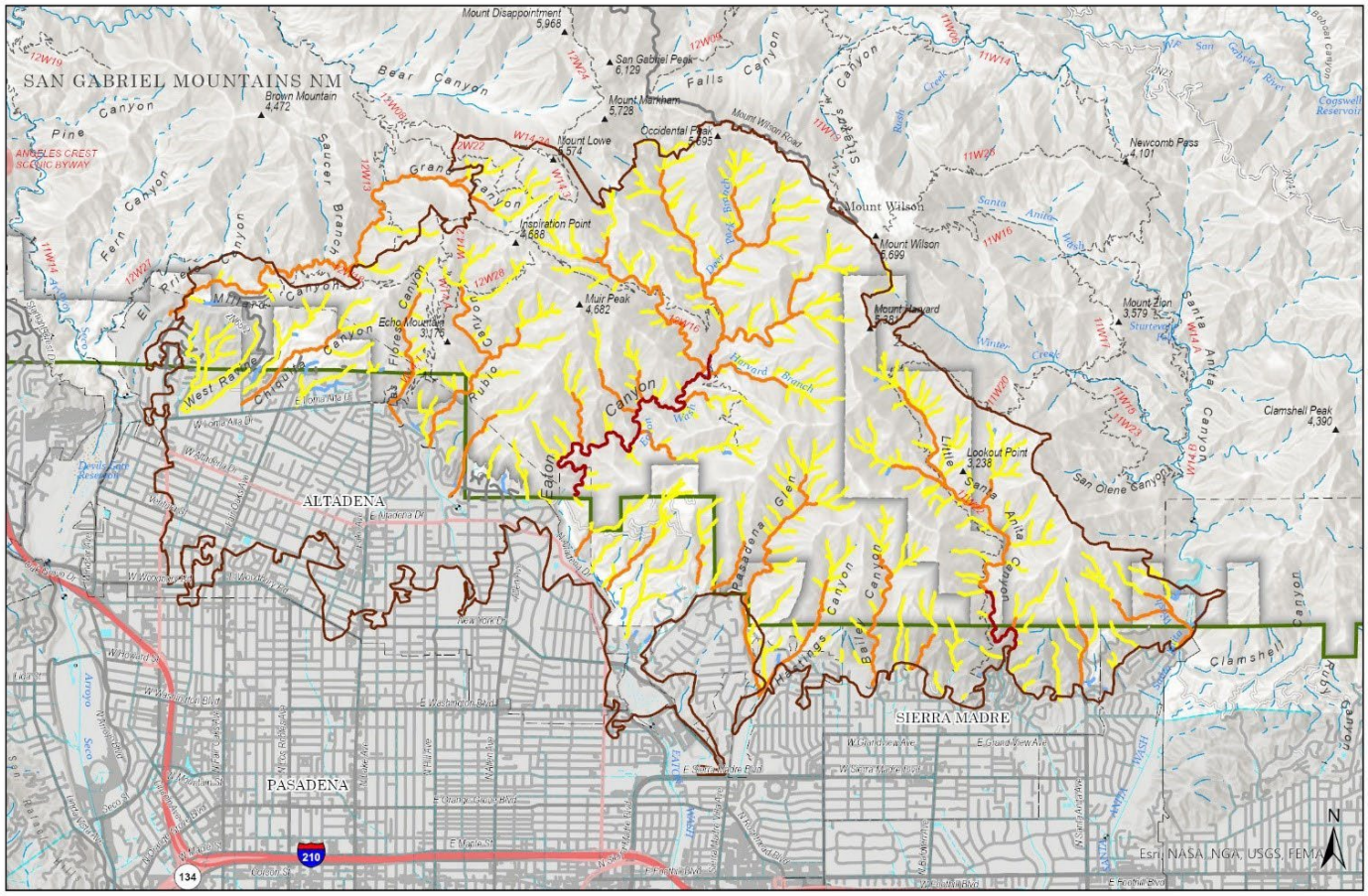
Data Creation Date: 01/9/2025
Incident Date: 01/07/2025



Soil Burn Severity
- High
- Moderate
- Low
- Unburned / Very Low
- Unevaluated Urban Areas

BAER Perimeter

Soil Burn Severity	USFS	Non-FS	Total Acres
Unevaluated Urban Areas	3	2,795	2,798
Unburned / Very Low	282	253	535
Low	1,184	775	1,959
Moderate	5,985	2,506	8,490
High	364	85	448
Total Acres	7,817	6,414	14,231



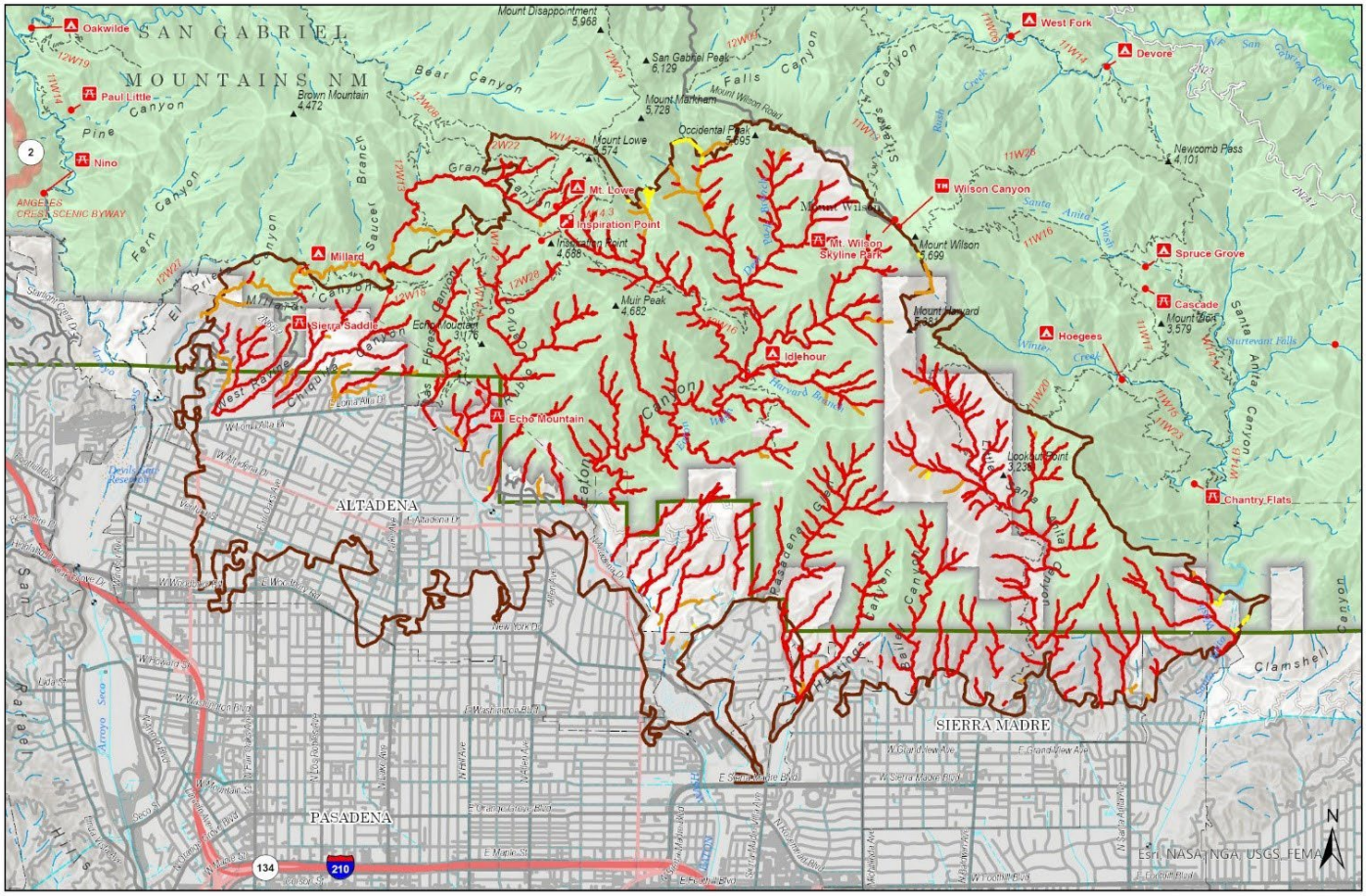
Debris Flow Volume Prediction
Eaton Fire - Angeles National Forest
January 2025

Peak 15 Minute Rainfall Intensity 40 mm/h rate

Burned Area Emergency Response (BAER)

Debris Flow Estimated Volume (cubic meters)

- <1,000
- 1,000-10,000
- 10,000-100,000
- >100,000
- BAER Perimeter



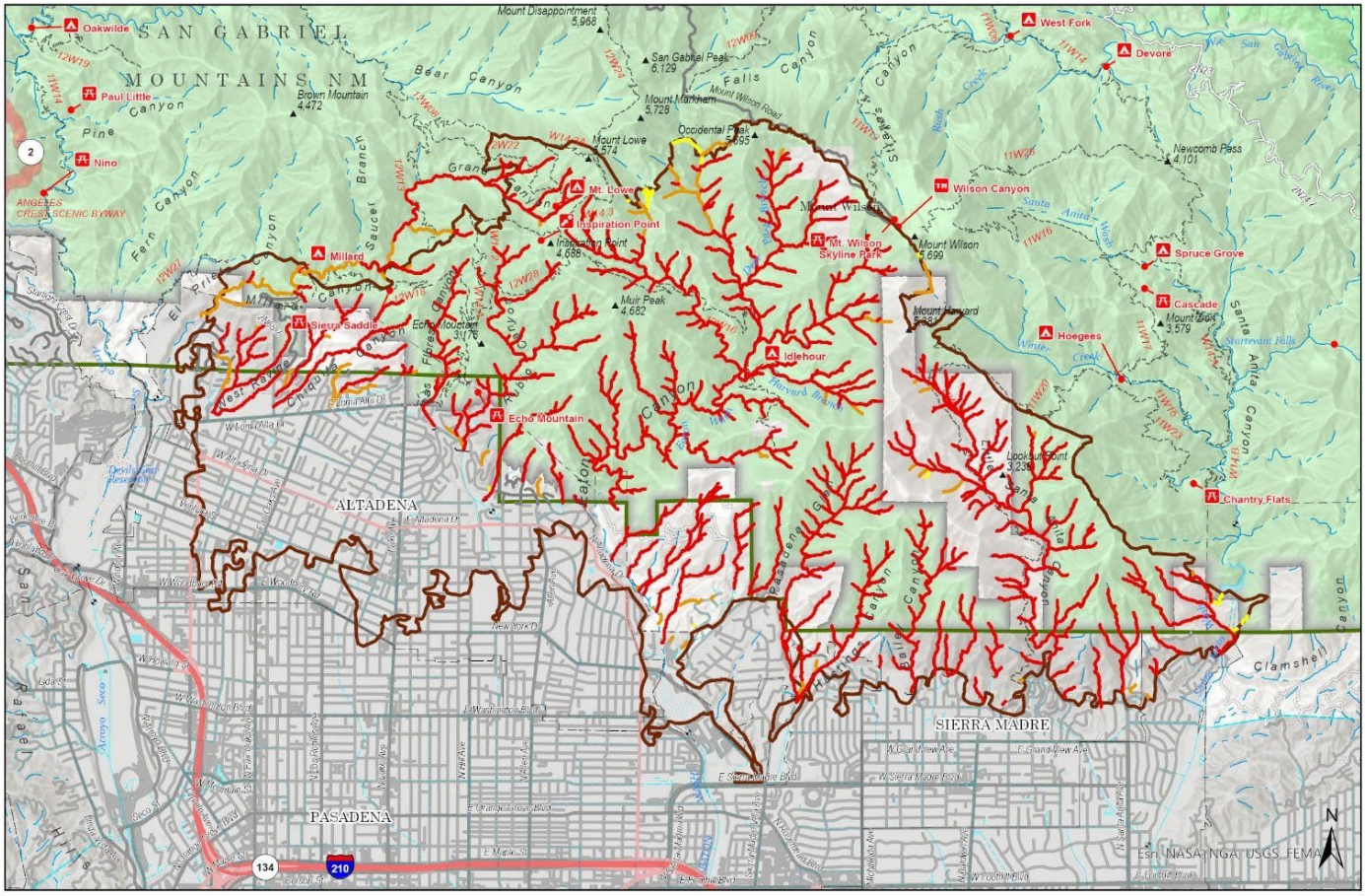
Debris Flow Combined Hazard
Eaton Fire - Angeles National Forest
January 2025

Peak 15 Minute Rainfall Intensity 40 mm/h rate

Burned Area Emergency Response (BAER)

Debris Flow Combined Hazard

- Low
- Moderate
- High
- BAER Perimeter



Debris Flow Combined Hazard
Eaton Fire - Angeles National Forest
January 2025

Peak 15 Minute Rainfall Intensity 40 mm/h rate

Burned Area Emergency Response (BAER)

Debris Flow Combined Hazard

- Low
- Moderate
- High
- BAER Perimeter

0 ½ 1 Miles