Geohazards following wildfire

California
Department of Conservation
California Geological Survey

Information for Emergency Management

After wildfire, communities may face new risks. This guide describes when and where postfire geohazards may be present, hazard identification and mitigation strategies, and resources available to communities at risk.

Floods

Primarily water

Debris floods

Mostly water with some sediment and wood

Photo: M. Thomas, USGS

Debris flows

Mixture of water, sediment, wood, and other materials

Photo: USGS

Increasing sediment concentration

Floods are the most common postfire runoff response and can pose a significant risk to homes, property, and infrastructure along river and stream channels.

Debris floods are more hazardous than floods and can cause major impacts (e.g., burying homes and vehicles in sediment). They behave more like floods than debris flows.

Debris flows are the most severe geohazard following wildfire. They move like fast flowing concrete and can suspend boulders, trees, and other large debris and knock homes off their foundations.

Other geohazards in recently burned areas include:

- **Landslide** hazard increases around five years postfire as roots killed in the fire begin to decay, reducing slope stability.
- **Rockfall** along steep embankments and cliffs is more likely due to loss of vegetation and decay of supporting roots.
- **Increased erosion** rates are common during postfire storm events due to loss of vegetation and other groundcover.
- **Toxic dust** from naturally occurring toxic minerals and metals can be present at high levels following wildfires.
- **Water quality** may be impacted following wildfire due to increased introduction of sediment and contaminants.
- **Mined areas** pose risks to water quality when increased postfire erosion causes mine waste to enter waterways.

"Mudslide" and "mud flow" are commonly used in the media to describe a wide range of postfire runoff responses from muddy flows to landslides that are not necessarily debris flows.

Muddy water following rainfall after the 2021 Dixie Fire.

Rockfall in Trinity County, California.

What triggers postfire floods and debris flows and where do they occur?

- Postfire flash floods and debris flows are triggered by intense rainfall—like during a thunderstorm.
- Triggering rainfall may be as little as 0.2 inches in 15 minutes, but thresholds vary across California.
- Postfire debris flows typically occur due to rapid runoff and erosion during storms. Debris flows can also initiate from landslides triggered by prolonged rainfall.

Image made with assistance from generative AI

How can you identify postfire geohazards?

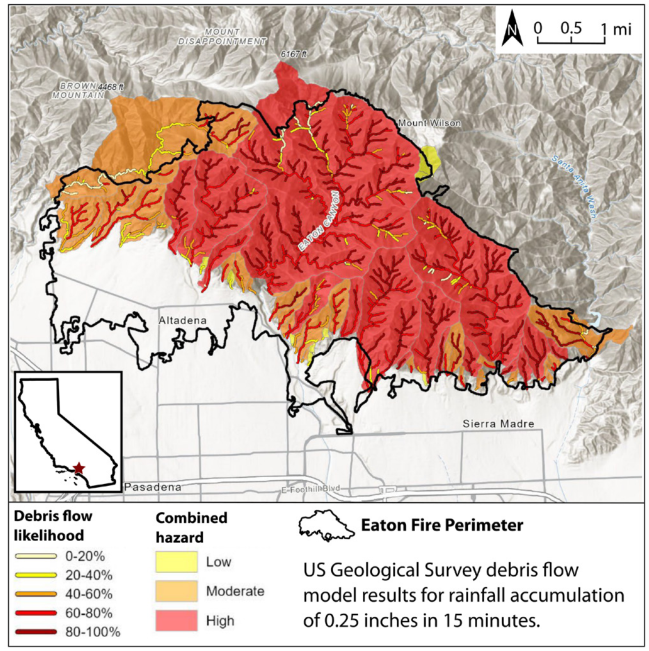
Watershed Emergency Response Team (WERT) reports identify geohazard risks to life, property and infrastructure after wildfires on non-federal land. WERT reports are completed by CAL FIRE and the California Geological Survey (CGS).

WERTs are completed if there is moderate or high potential for impactful postfire geohazards.

For information about requesting a WERT assessment, please contact the CGS Burned Watershed Geohazards Program: bwg@conservation.ca.gov.

Burned Area Emergency Response (BAER) reports are similar to WERT but focus on federal land.

Click here for WERT reports:
https://www.conservation.ca.gov/cgs/bwg/wert



Map showing modeled debris-flow likelihood and combined hazard results for the 2025 Eaton Fire for a common storm. Combined hazard considers both debris-flow likelihood and volume.

How are postfire geohazards predicted?

Rainfall Thresholds included in WERT reports are used by the National Weather Service to issue weather alerts. When rainfall thresholds are exceeded, geohazards are more likely to occur.

Several models are available to assess postfire flood and debris-flow hazards.

- **Flood** models predict changes in postfire runoff and flood hazard.
- **Likelihood and volume** models estimate likelihood of a debris flow and volume of material mobilized in a basin for a given rainfall intensity. Used for rapid assessment of postfire debris-flow potential after a wildfire and development of rainfall triggering thresholds.
- **Inundation and runout** models estimate the inundation extent and depth of a debris flow for a given rainfall intensity. Used to identify homes, property, and infrastructure most at risk for flood- and debris-flow impacts and the potential severity of impacts.

How do you mitigate postfire geohazards?

Options exist to mitigate postfire geohazard risks to life, property, and infrastructure. A California-licensed Professional Geologist (PG) or Professional Engineer (PE) can help assess risk and recommend mitigation options.

Click here for info on modeling, mitigation, and more:
https://www.conservation.ca.gov/cgs/bwg/resources

Temporary barriers deflect flow and debris.

Debris nets stop rock and debris.

Debris racks stop rock and debris. Photo: Matt Griffin.

How long do postfire impacts last?

5+ years

- Rainfall-triggered landslide potential may increase relative to unburned areas as roots decay
- Runoff and erosion return to normal
- Debris flow and flood potential return to normal

0 days

- Fire alters soils and incinerates vegetation
- High runoff and erosion
- Debris flow and flood potential immediately elevated

Typical postfire recovery cycle in California

Recovery rates vary for different landscapes, but substantial recovery is usually achieved in 3 to 5 years. Drought can delay recovery.

Image sequence made with assistance from Google Gemini

3 to 5 years

- Substantial recovery
- Runoff and erosion returning to normal
- Debris flow and flood potential returning to normal

1 to 3 years

- Moderate recovery
- Runoff and erosion still elevated but decreasing
- Debris flow and flood potential still elevated but decreasing

0 to 1 year

- Recovery begins
- High runoff and erosion
- Debris flow and flood potential remain elevated

The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Geological Survey. This material is based upon work supported by the U.S. Geological Survey under Grant Agreement No. G25AP00232.