BAER Scientists and Specialists Assess the Oak Fire for Flooding and Debris Flow Risks

After a large wildfire, special actions are often necessary to provide for public safety and protect critical cultural and natural resources. Some fires create situations that require special efforts to prevent additional damage after the fire is contained. Loss of vegetation exposes soil to erosion; water runoff may increase and cause flooding, sediments may move downstream and damage houses or fill reservoirs and put endangered species and community water supplies at-risk.

A Forest Service Burned Area Emergency Response (BAER) team is assessing federal lands burned in the Oak Fire, with the goal of keeping visitors and employees safe while recreating and working in the Sierra National Forest (NF). BAER team assessments focus on emergency actions that are necessary to protect human life and safety, property, critical cultural resources, and critical natural resources such as soil productivity, hydrologic function, and water quality. Emergency actions are intended to minimize any further damage during rainstorm events.

BAER hydrologists, soil scientists, geologist, road engineers, recreation specialists, biologists, botanists, archeologists, and GIS specialists are currently assessing the condition and response of the watersheds within the Oak burned areas. These BAER scientists and specialists evaluate other critical values that could be at risk during major rainstorm events such as forest roads and trails, campgrounds, and other forest infrastructure.

BAER soil scientists evaluate the burned watersheds to determine post-fire effects to soil and watershed conditions. This includes testing whether the soil is hydrophobic – aka repels water. Post-Fire burned areas of hydrophobic (water repellent) soils can act as a "tin roof" by reducing infiltration capacity of soils, enhanced overland flow, and accelerated soil erosion.

This is important because the amount of hydrophobicity is an important component to determining how much increased water runoff we can expect after a fire. The hydrophobic layer is the result of a waxy substance that is derived from plant material burned during a hot fire. The waxy substance penetrates the soil as a gas and solidifies after it cools, forming a waxy coating around soil particles. Hydrophobicity repels water from soil and is considered when mapping watershed response to rainstorms after a wildfire.

Below, these three photos show Forest Service soil scientist Curtis Kvamme assessing soil hydrophobicity (water repellency) and changes to soil structure in a high soil burn severity (SBS) area of the Oak burned area. Curtis digs a trench and drops water on the soil at multiple depths to determine how deep and how strong the layer of water-repellant soil may be.

In the next two photos, Curtis captures high soil burn severity data in the Oak burned area using Survey 123 data collection program to evaluate and map the level of severity for this part of the fire.

In addition to the BAER team's ground surveys of the Oak burned area, air reconnaissance flights are sometime critical for the BAER specialists to see an aerial overview of the burn area.

The photo below is an aerial view of a portion of the Oak burned area that was taken by Forest Service Geologist Yonni Schwartz during an air reconnaissance flight. The photo shows gentle valleys and ridges formed by fluvial erosion processes which shaped a relatively smooth landscape that is devoid of instable geological features.

To prepare for his geology and debris flow hazards assessment, Yonni first examined the coverages of bedrock and geomorphology on the Sierra National Forest by looking at GIS maps, before conducting in-person field verifications. Yonni also reviewed geologic maps to identify pre-fire slope failures, pre-fire slope, channel failure deposits, measurements of

slopes, and geological units. His field verification of soil burn severity, notes of observations and photography were used for his geology assessment of the Oak burned area.

Yonni's photo below shows a channel that is loaded with a thick layer of mostly fine sediments, that are lacking any surface rocky materials that could produce a hyper-concentrated sediment flow during a major rainstorm event.

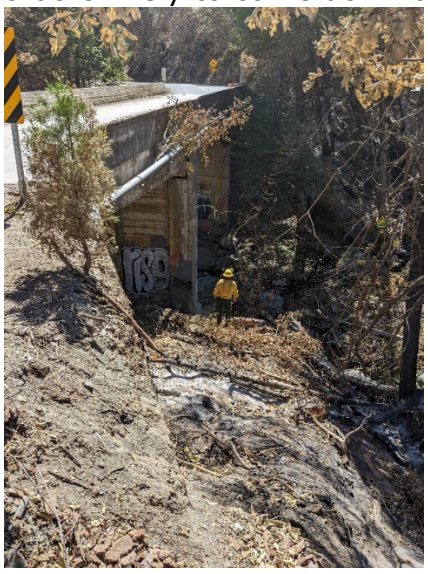
This photo below is of the lower end of Snow Creek that is loaded with unsorted, unconsolidated rocky materials that is available to be transported downstream as a destructive debris flow during a major rainstorm event.

BAER Engineers evaluated roads and bridges within the Oak burned area for potential threats from flash flooding, sediment flows impacting drainage crossings and the overall infrastructure due to increased erosion, sedimentation, and water flows. They also determine whether road culverts within the burned area have sufficient capacity to pass post-fire modeled increased water and debris flows—in particular, they look to see if they are clogged, collapsed, or could get clogged after major rainstorm events. Roads are BAER critical values that need to be assessed for these threats. The BAER team will recommend emergency stabilization treatments and actions to minimize those threats.

The photo below is an example of several critical drainage crossings identified by BAER assessment team road engineers, hydrologist and geologist. They inspected these crossings to prescribe the most effective BAER treatment to protect the road prisms from washing away during major storm events.

This photo below is an aerial view above Forest Service roads 5S24 and 4S33. Both roads are below a high soil burn severity area of the Oak Fire that is expected to have a potential significant increase in water run-off. Consequently, predicted debris flows could exceed the capacity of current road drainage features. BAER stabilization treatments will be recommended and implemented to protect these roads for Forest visitors and employees traveling in the Sierra NF.

In the next two photos below, Forest Service Transportation Engineer Marcos Rios is inspecting and evaluating risk at a Triangle Road bridge on Snow Creek. Marcos assessed the bridge to determine if it had capacity for potential increased stream and debris flows that is likely to come down the burned watershed during rainstorm events.



In the next two photos, Marcos Rios, BAER Team Leader Kendal Young, and Sierra NF Roads Manager Pablo Gonzalez, evaluate soil burn severity conditions along roads within the Oak burned area. The second photo shows Kendal and Marcos looking to determine if there is a BAER stabilization treatment that would prevent hazmat from a burned structure from reaching a creek.

Along with roads, trails are also a BAER critical value that need to be assessed for potential threats from flash flooding, debris flows impacting drainage crossings and the overall trail prisms and infrastructure due to increased erosion, sedimentation, and water flows. Forest Service Recreation Specialist Cori Hayth assessed trails within the Oak burned area.

The two photos below show portions of two trails Cori evaluated for the BAER team report and provided BAER emergency stabilization treatment recommendations to minimize threats from potential rainstorm threats.

This photo is of a rock wall and culvert built on the Skelton Creek hiking trail crossing over a small drainage in the Oak burned area.

This photo is an aerial overview of Windlass Ridge OHV trail that is within the Oak burned area.

BAER SAFETY MESSAGE: *Everyone near and downstream from the burned areas should remain alert and stay updated on weather conditions that may result in heavy rains and increased water runoff. Flash flooding may occur quickly during heavy rain events – be prepared to act. Current weather and emergency notifications can be found at the* ***National Weather Service*** *websites: www.weather.gov/sto/ and www.weather.gov/hnx/.*