



Willamette, Mt. Hood, and Deschutes National Forests  
Burned Area Emergency Response Summary – Lionshead Fire  
October 21, 2020

Lightning sparked the Lionshead Fire on August 16, 2020 at 10:45 pm in Lionshead Canyon on the Confederated Tribes of Warm Springs Reservation approximately 14 miles west of the Warm Springs community. An historic windstorm on Monday, September 7, caused rapid fire spread west onto the Willamette, Deschutes, and Mt. Hood National Forests.

The Lionshead Fire heavily impacted several communities in the Santiam drainage and Breitenbush River area, including the loss of 264 residential homes in Detroit, several buildings at the Breitenbush Hot Springs Resort, and 71 recreation residences located on Forest Service property near the resort. Highly valued natural and cultural resources were also threatened or damaged.

The fire burned areas on the Confederated Tribes of the Warm Springs, Sisters Ranger District on the Deschutes National Forest, Clackamas River Ranger District on the Mt. Hood National Forest, and the Detroit Ranger District on the Willamette National Forest. The fire (as of 10/10/2020) encompassed 204,469 acres. The vast area of the fire offers several subsets of fuel types and climate induced moisture levels. Eastern extremes are semi-arid pine with brush understory, transitioning west into subalpine, true-fir, and lodgepole pine with areas of heavy dead and down on the Cascade crest, then further transitioning to mixed conifer dominated closed canopy stands.

The Forest Service assembled a Burned Area Emergency Response (BAER) team on September 28, 2020. This team of experts in soils, geology, hydrology, engineering, botany, recreation, archaeology, wildlife, fisheries, and GIS began assessing the post-fire effects to critical values on U.S. Forest Service (FS) managed lands. The team developed a Soil Burn Severity (SBS) map to document the degree to which soil properties had changed within the burned area. Fire damaged soils have low strength, high root mortality, and increased rates of water runoff and erosion. Using the SBS map, BAER team members ran models to estimate changes in stream flows (hydrology) and debris flow (soils and geology) potential. The models compared pre-fire conditions to predicted post-fire conditions to determine relative changes, which are then used to determine the relative risk to different critical values and recommendations to address those things determined to be an emergency. Following is a summary of the findings of each resource area.



## SOILS

Soil burn severity (SBS) is the primary characteristic driving post-fire soil erosion response and sediment delivery. When combined with other factors like slope gradient and shape, remaining surface cover, potential for surface cover recruitment, vegetative recovery, natural and fire-induced water repellency, and local climatic factors, we can make predictions about landscape response and soil loss. On the Lionshead Fire, high and moderate SBS were found on 47% of the FS lands. The highest concentrations of high SBS are found within drainages feeding the mainstem and South and North Forks of the Breitenbush River, within the Upper Mill Creek sub watershed southwest of Olallie and Monon Lakes, along the western portions of Whitewater Creek, and in the Coopers Ridge area south of Highway 22. Much of the high SBS overlaps with areas mapped with severe soil erosion hazard ratings. Modeled post-fire erosion potential for a five-year storm event (20% probability of occurring in any year) ranges from 9.3 tons/acre to 14.4 tons/acre in heavily burned sub watersheds.



Figure 1 - High soil burn severity surrounding intermittent channel and culvert on Forest Road 1003

## GEOLOGY

We 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. The fire removed vegetation that helps keep slopes and drainages intact, changed the structure and erosiveness of the soil, and altered the stability of the landscape. 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.

Assessment of these areas included identification of critical values in and downstream of the burned area, identification of pre-fire slope failures and pre-fire slope and channel failure deposits, measurements of slopes, identification of geological units, field verification of soil burn severity, notes of observations, and photography. In addition to ground and air reconnaissance, we also conducted a review of published geologic maps and articles, and a study of aerial photography and lidar imagery. We 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.



Forest Service

Burned Area Emergency Response





The conclusion of our field observations is that whether the primary post-fire process is rock-fall, debris slides, debris flows, or sediment-laden flooding, the cumulative risk of various types of slope instability, sediment bulking, and channel flushing is high along a majority of slopes and drainages in and below the burn area following the Lionshead Fire. Based on this, special attention and caution is recommended in areas where people are living, traveling through, working, or recreating in or below burned areas during and after storm events.

In order to reduce risk to life, it is our recommendation to coordinate warning notifications with the National Weather Service, post warning signs, and enforce administration closures. Specific areas to be notified are the community of Detroit, Breitenbush Resort, and Stahlman recreation residences if rainfall intensities would reach a threshold of 0.75-inch/hour in a short duration storm.

## **HYDROLOGY**

The Lionshead Fire mostly burned within the Breitenbush River, Headwaters of the North Santiam River, and Upper Clackamas River watersheds, with large areas of high severity burn in the Devils Creek drainage and reburn of areas in the Whitewater Creek drainage. The 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 into Detroit Reservoir; and debris flows. These responses will likely lead to increased water quality concerns for municipal and domestic drinking water providers within and downstream of the fire. Modeled post-fire peak streamflow responses range from 1-3.5x pre-fire levels, depending on the proportion of moderate and high severity burn in the analyzed drainages. Watershed responses are dependent on the occurrence of rainstorm and rain-on-snow events and will likely be greatest with initial storm events. Disturbances will become less evident as vegetation is reestablished, providing ground cover that reduces erosion and increases surface roughness to slow flow accumulation and increase infiltration. Treatment recommendations to mitigate potential risks to life and safety, property, and water quality include maintaining closures at areas of high risk, posting signage to inform forest visitors about flood risks at campgrounds and gathering places, improving and maintaining road drainage structures on important roadways, such as the 4600, and coordination and collaboration with the Army Corps of Engineers and water quality stakeholders, among other partners.

## **ENGINEERING**

The Lionshead Fire includes 1,277 miles of FS roads. Post-fire conditions, in combination with the expected watershed response, indicate there will be an increased risk of road failure due to rock fall, debris flow and drainage structure failure. Roads in this fire that are critical values contain culverts that were melted or severely damaged. Forest Service roads 4600, 2231, 2231-870, 2234-100, 1003 and 4220 are all routes that either access private land or have high risk of impacting water quality or infrastructure. Recommended



treatments include modifying 34 culverts, installing 3 armored dips, strengthening drainage on 21 miles of road for storm proofing, and performing inspections on roads after storms. We also recommend sites for 24 road hazard signs, and on 12 additional roads that had unsafe, limited or no access, road closure is the recommended treatment. The Hwy 46 corridor (Breitenbush River corridor) also had approximately 7,000 feet of guardrail that was either damaged or destroyed and that will need to be replaced.

## RECREATION

For the recreation resources in the Lionshead area we discovered significant damage to the areas we were able to assess. Within Lionshead Fire perimeter area there are 28 miles of trail with moderate to high soil burn severity, 22 trailheads, 18 campgrounds, 3 day-use areas, and a historic guard station. Closures of the areas to prevent the public from entering areas with hazard tree danger and debris flow damage are necessary until hazards can be fully removed or signage can be placed to indicate the hazards present.



Figure 2 - Burned recreation site, the James Potter Memorial Theater

For the area within the fire perimeter we are suggesting restricting public access until the proper hazard tree mitigation has been completed. Areas that the public will be able to access outside of road closures will be posted with warning signs and hazard trees removed. Every location with restrictions in road access will be closed for the winter and will be reassessed in the spring.

## BOTANY

Native plant communities that were burned at moderate to high severity are threatened by the introduction and spread of noxious weeds. This threat is due to the likelihood that some noxious weed seeds were brought into the area by fire equipment and suppression activity as well as from known noxious weed locations within the area. Several threatened and endangered plant species occur within the burn area



Figure 3 - False Brome along Forest Service Road 2234

including Gorman's aster, Calamagrostis breweri, and white bark pine, as well as several species of listed non-vascular plants and survey and manage fungi. The slow natural regeneration of these native plant communities following severe burns leaves some areas at risk, including the Mt Jefferson Wilderness. Most documented weed populations occur along roadsides and are expected to aggressively compete with native species for space and nutrients in adjacent burned areas. Early detection and rapid response inspections are recommended for approximately 93.4

miles of roads, 22 miles of trails, and 248 miles of fire suppression line across the Willamette, Mt. Hood, and Deschutes National Forests.

## FISHERIES

Streams and rivers affected by Lionshead Fire support runs of federally listed Upper Willamette spring Chinook salmon (threatened), Upper Willamette steelhead trout (threatened) and bull trout (threatened). Critical habitat for federally listed fish occurs in select river drainages. Potential post-fire effects in select tributaries within the North Santiam River, Breitenbush River, and Metolius River include:

- increase in peak flows laden with debris potentially leading to increase in accelerated channel scour and hillslope erosional processes;
- increase in fine sediment leading to direct mortality of eggs and fry and decrease of habitat elements such as pools;
- and increase in the likelihood of other negative effects to habitat from increased flow interaction with infrastructure.

Catchments or drainages of note which may see higher peak and debris flows 1-2 years post-fire include Breitenbush River (above Detroit Lake), Devils Creek, and North Santiam River (above Detroit Lake). There is probability of fine sediment or a debris flow reaching streams and rivers. It is anticipated that these events could be both broad and/or focused due to the nature and extent of burn severities on FS lands. Therefore, the magnitude of consequence to federally listed fish and critical habitat resulting from this fire range from minor to moderate. These river systems provide habitat for migration, foraging, spawning and rearing.



Forest Service

Burned Area Emergency Response



During the BAER assessment, road and recreation site, road failure via previously performed high aquatic risk ratings, and in-stream diversion intakes are potential impacts on occupied rivers and tributaries and designated critical habitat. They represent key elements of risk to critical fisheries values. Geologic and hydrologic analyses determined that potential sediment delivery and failure of roads and other related infrastructure resulting from modeled precipitation events would have potential to contribute to levels of erosion generated within the burned area. As such, the BAER team identified several emergency treatments, which are outlined in the hydrology, and engineering specialists' reports. Of these emergency treatments and with specific regard to fisheries resources, it's recommended the following watersheds be prioritized to implement corresponding actions as soon as possible:

- Breitenbush River above Detroit Lake (including Devils Creek, NF Breitenbush River and other contributing drainages with large proportions of high and moderate burn severities)
- North Santiam River above Detroit Lake

## CULTURAL RESOURCES

A total of 23 cultural sites within the fire area were identified as at risk during this BAER assessment. Cultural resource types included traditional use areas, pre-contact lithic scatters, pre-contact and historic trails and travel routes, historic structures, 20<sup>th</sup> century mines and camps, and a 19<sup>th</sup> century railroad camp. Many

sites were severely burned or damaged by the fire itself, while others face threats from post-fire threats such as looting, vandalism, erosion, and hazard trees. After evaluating the risks to critical cultural resource values, the probability of damage or loss was found to be high or very high for five sites. A suite of treatments such as road and trail closures, mulching, and hazard tree falling were recommended by the BAER team archaeologist.



Figure 4 - Remains of an oven feature from a 19th century railroad camp

## WILDLIFE

The fire burned within the current range of Northern Spotted Owl (NSO), a species that is listed as threatened under the Endangered Species Act. In critical habitat (CH) for the NSO, 9,056 acres burned with high severity (26% of the CH in the fire area), and 8,719 acres burned with moderate severity (25% of the CH in the fire area).



Forest Service

Burned Area Emergency Response





Threats include additional loss of habitat in the fire area due to blowdown, mass soil movement, flooding, and insects and disease. Each of these threats could result in additional mortality to remaining live trees and further reduce NSO suitable habitat and usable critical habitat and threaten the viability of nesting territories. A secondary issue includes determination if the proposed BAER stabilization treatments could affect spotted owl nest sites or result in disruption of nesting if conducted during the critical breeding season from March 1-July 15. There are no landscape scale treatments that would reduce the risk of the potential loss of additional habitat. During treatment implementation, timing restrictions for NSO and Bald Eagles will be overlaid with proposed treatments to determine any potential conflicts.

## **CONCLUSION**

The BAER team has identified imminent threats to values at risk based on a rapid scientific and engineering assessment of the area burned by the Lionshead Fire. While taking significant precautions to minimize exposure to COVID-19, the assessment was conducted using the best available methods to analyze the potential for flooding and debris flows. The findings provide the information needed to prepare and protect against post-fire threats. The recommended BAER treatments in this report are not yet approved or funded. The U.S. Forest Service will continue to provide information and participate in inter-agency efforts to address threats to public and private values at risk resulting from the Lionshead Fire.

