Logan Fire Burned Area Summary

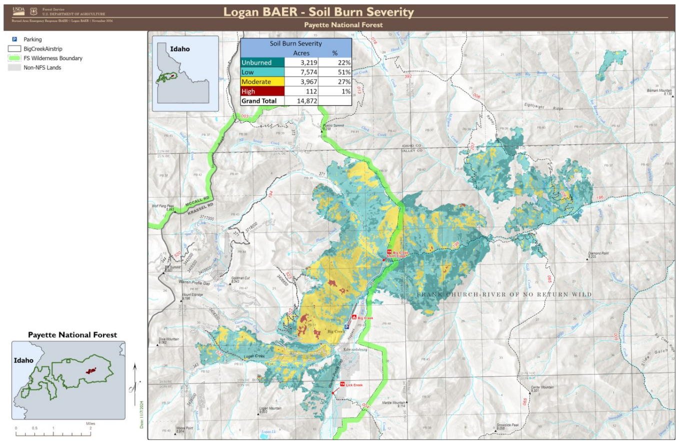
Burned Area Report

Fire Background

The Logan Fire was started by lightning on September 8th, 2024, and burned 14,872 acres on the Krassel Ranger District of the Payette National Forest, including 7,207 acres of the Frank-Church River of No Return Wilderness (FCRONRW). Between September 8th and October 3rd, the Logan fire remained within a 400-acre footprint on a south facing hillslope in the Logan Creek subwatershed. On October 4th, a frontal passage impacted the fire area, creating a wind-driven fire event that burned over 8,000 acres in one day. The fire burned over nine miles during the event, moving quickly through the canopy.

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 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 post-fire 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 September 22nd, 2024, for the Logan 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 a soil burn severity (SBS) map 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.



Logan Fire 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) Field Guide for Mapping Post-fire Soil Burn Severity. 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 (1%, 112 acres), Moderate (27%, 3,967 acres), Low (50%, 7,574 acres), and Unburned (22%, 3,219 acres). For a detailed SBS map see 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.

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.

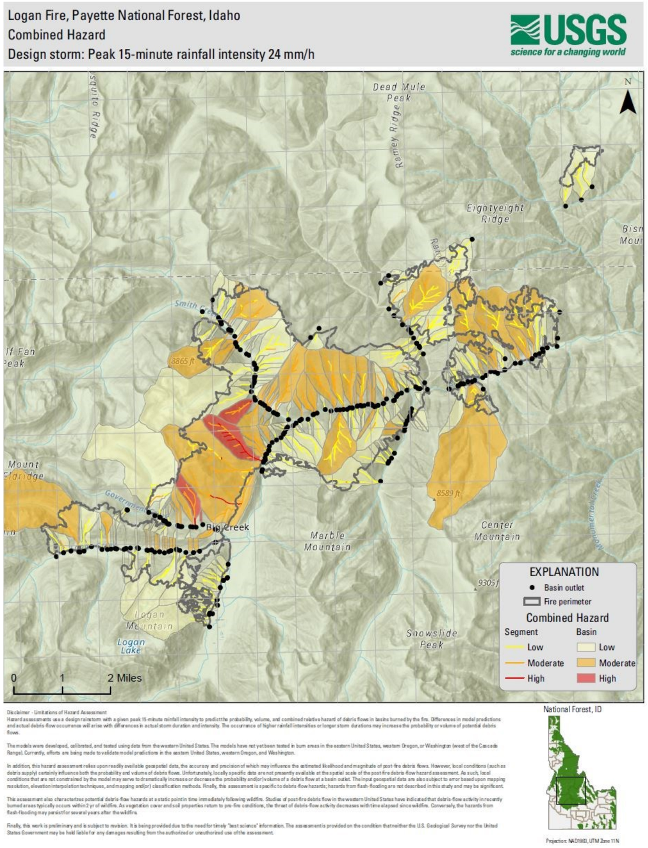
There are two types of granitic geology within the fire area. Border zone granitics, which are metamorphosed igneous rocks, and granodiorites both typical of the Idaho Batholith.

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 debris flow hazard assessment uses a design rainstorm with a given peak 15-minute rainfall intensity to predict the probability, volume, and combined relative hazard of debris flows in basins burned by the fire.

Differences in model predictions and actual debris flow occurrence will arise with differences in actual storm duration and intensity. The occurrence of higher rainfall intensities or longer storm durations may increase the probability or volume of potential debris flows. Post-fire debris flow activity in recently burned areas typically occurs within 2 years of wildfire. As vegetation cover and soil properties return to pre-fire conditions, the threat of debris flow activity decreases with time elapsed since wildfire.

Debris flow hazards from a given basin can be considered as the combination of both probability and volume. For example, in a given setting, the most hazardous basins will show both a high probability of occurrence and a large, estimated volume of material. Slightly less hazardous would-be basins that show a combination of either relatively low probabilities and larger volume estimates or high probabilities and smaller volume estimates. The lowest relative hazard would be for basins that show both low probabilities and the smallest volumes.

The majority of basins and channel segments within the Logan Fire have a low or moderate combined hazard for debris flows. Basins located above USFS BAER critical values mostly have a moderate combined debris flow hazard. For a detailed debris flow hazard map see page 8.



Logan Fire debris flow combined hazard rating map

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.

Post-fire hydrologic response was modeled for five small stream basins due to the moderate to high soil burn severity and expected post-fire response and location above NFS property and infrastructure. The five stream basins include: (1) McCorkle Creek, (2) a tributary to McCorkle, (3) a tributary to Big Creek, (4) a tributary to Government Creek, and (5) a tributary to Smith Creek.

Due to the late season timing of this fire, more common longer duration storms were used to model post-fire flows. The two design storms used were a 2-year and 10-year reoccurrence interval 24-hour storm that would produce 1.86in and 2.5in of precipitation respectively. Post-fire flows are modeled to increase between 191% and 557% for the different streams. The responses are expected to be most pronounced during the first 3 to 5 years after the fire and will become less evident as vegetation and soil-hydrologic function recover.

The anticipated increase in stream flows and the associated flush of ash and sediment across the burned area will likely lead to increased water quality concerns for domestic drinking water users within and downstream of the fire.

Forest Service Critical Values

The BAER Team assessed the burned area to determine whether imminent post-fire threats to human life and safety, property, and critical cultural and natural resources on National Forest System lands exist. The assessment took into consideration the nature and magnitude of impacts and the likelihood of damage. Emergency treatments are recommended for identified Forest Service critical values where the risk and probability of success for treatment is high and cost effective.

Human Life and Safety

The biggest risk to human health and safety in the burned area is the potential of falling trees, rolling rocks, flooding and debris slides, especially during high winds, heavy rains, and winter storms.

The BAER team recommends placing general warning signs on National Forest System lands along major roads when entering the Logan Fire burned area. The signs will contain language specifying items to be aware of when entering a burn area such as falling trees and limbs, rolling rocks, and flash floods. Signs will be removed once hazards have subsided.

National Forest Roads

There are 12.2 miles of National Forest System (NFS) roads and 8.4 miles of non-NFS roads in and downstream of burned areas at risk of damage due to post-fire conditions. The most likely threat due to the fires is undersized culverts unable to pass elevated post-fire flows and clogging of culverts from the higher levels of floatable debris from 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.

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.

The 12.2 miles of NFS roads and related drainage features were identified as BAER Critical values needing protection from post-fire flooding and debris flows. Emergency road treatments include storm proofing and drainage dip construction to establish proper road drainage as well as storm inspection and response to monitor drainage features and road surfaces and complete repairs as needed.

Elk Creek Summit Road post-fire, a non-NFS Road maintained by Valley County under a FRTA agreement

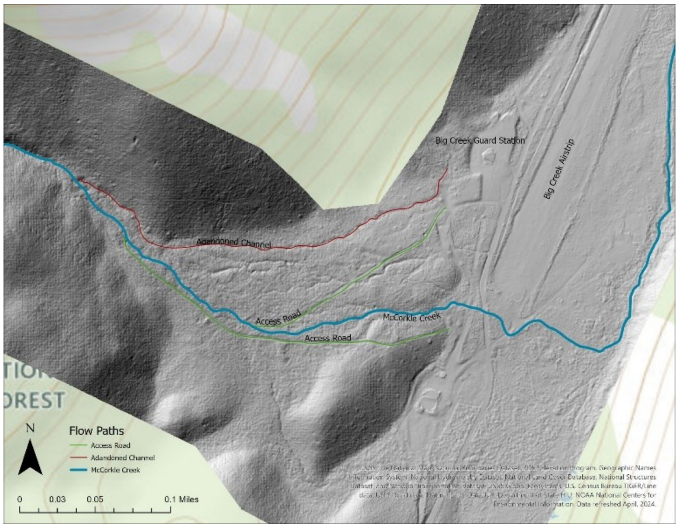
National Forest Property - Big Creek Guard Station and Facilities, Campground and Airstrip

There are several NFS properties identified as BAER critical values at risk from post-fire debris flows and flooding within the McCorkle Creek watershed. The Big Creek Guard Station is an actively used historical administrative site and includes five structures: the Guard Station, two cabins, a washhouse, and a barn. Associated facilities include irrigation and potable water systems with diversion structures on McCorkle Creek and a potable system sourced from a spring within the McCorkle drainage. The Big Creek Airstrip Campground, airstrip and parking area are located near McCorkle Creek and were not directly impacted by the fire.

The McCorkle Creek drainage terminates at a large alluvial fan that is approximately 1,500 feet long from the fan apex to the apron and 1,900 feet wide at the fan apron. Alluvial fans are prominent depositional landforms created where steep high-power channels enter a zone of reduced stream power and serve as a transitional environment between an erosive upland area and downslope depositional lowland. The shape of an alluvial fan resembles a cone with concave slopes where the slope decreases as the stream exits valley confinement and spreads out into the broader valley below.

The McCorkle Creek watershed burned with moderate and high soil burn severity and has a moderate debris flow combined hazard with the exception of the lower McCorkle Creek stream segment having a high combined hazard as it exits valley confinement and enters onto its large alluvial fan. Due to the large and abundant post-fire down wood across the fan, it is estimated that a debris flow deposition would be contained in the upper fan area.

Modeled post-fire hydrologic response for McCorkle Creek could increase discharge up to 371% from a modest 2-year, 24-hour storm event. The stream channel's location on an alluvial fan presents the potential for McCorkle Creek to abandon its current stream channel during a flood event. Stream diversion potential could occur at many locations along McCorkle Creek due to the lack of channel incision and low bank heights. Big Creek NFS properties are all located on the broad alluvial fan of McCorkle Creek and are at risk to post-fire flooding.



LiDAR map showing McCorkle Creek current location and many potential diversion points and flow paths during high flows

The BAER team recommends streambank armoring for McCorkle Creek at potential diversion locations to reduce impacts from increased peak flows. Stream armoring involves placement of locally available rock, log, and soil to maintain streambank stability during flooding and would be implemented before the first high flows in the Spring. Emergency road treatments could also reduce post-fire flood impacts to NFS property and includes storm proofing, drainage dip construction, and storm inspection and response to monitor drainage features and road surfaces and complete repairs as needed.

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 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 spread of noxious weeds would adversely affect multiple resources including native plant communities which in turn affects threatened and endangered species habitat for wildlife, fisheries, and plants. In addition, noxious weeds can alter native plant communities in eligible wild and scenic river corridors.

The team recommends a treatment of Early Detection, Rapid Response (EDRR) to monitor for noxious weed infestation and expansion in disturbed burned areas prone to new noxious weed infestations. Newly discovered occurrences of weeds species adjacent to existing infestations along roads and trails would be treated utilizing backpack sprayers and chemical herbicide mixed with water and indicator dye.

Trails

National Forest System recreation infrastructure includes 16.4 miles of Forest Service non-motorized trails within the Logan Fire and located within the Frank-Church River of No Return Wilderness. There are 7.3 miles of trail located below burn areas that are susceptible to damage from post-fire debris flows and flooding.

The BAER team recommends the Payette National Forest consider the Forest Service Burned Area Rehabilitation (BAR) program for funding the reestablishment of the trail systems once the trail risk has stabilized.

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 cross administrative boundaries, additional threats exist for assets not owned or managed by the Forest Service. Post-fire emergency response is a shared responsibility. Several Federal, State, and local agencies have emergency response responsibilities or authorities in the post-fire environment. The BAER team has contacted interagency partners to facilitate consideration of off-Forest values covered through other programs with the relevant responsible entities.

Partner agency contacts:

Bruce Sandoval, NRCS Emergency Watershed Protection: bruce.sandoval@usda.gov

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Valley County Emergency Management, Juan Bonilla: juan.bonillla@donnellyfire.net

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 Logan 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 were approved on November 25th, 2024.

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. The Forest Service will continue to provide information and participate in interagency efforts to address threats to public and private values resulting from the Logan Fire.

Local Forest Service Leadership

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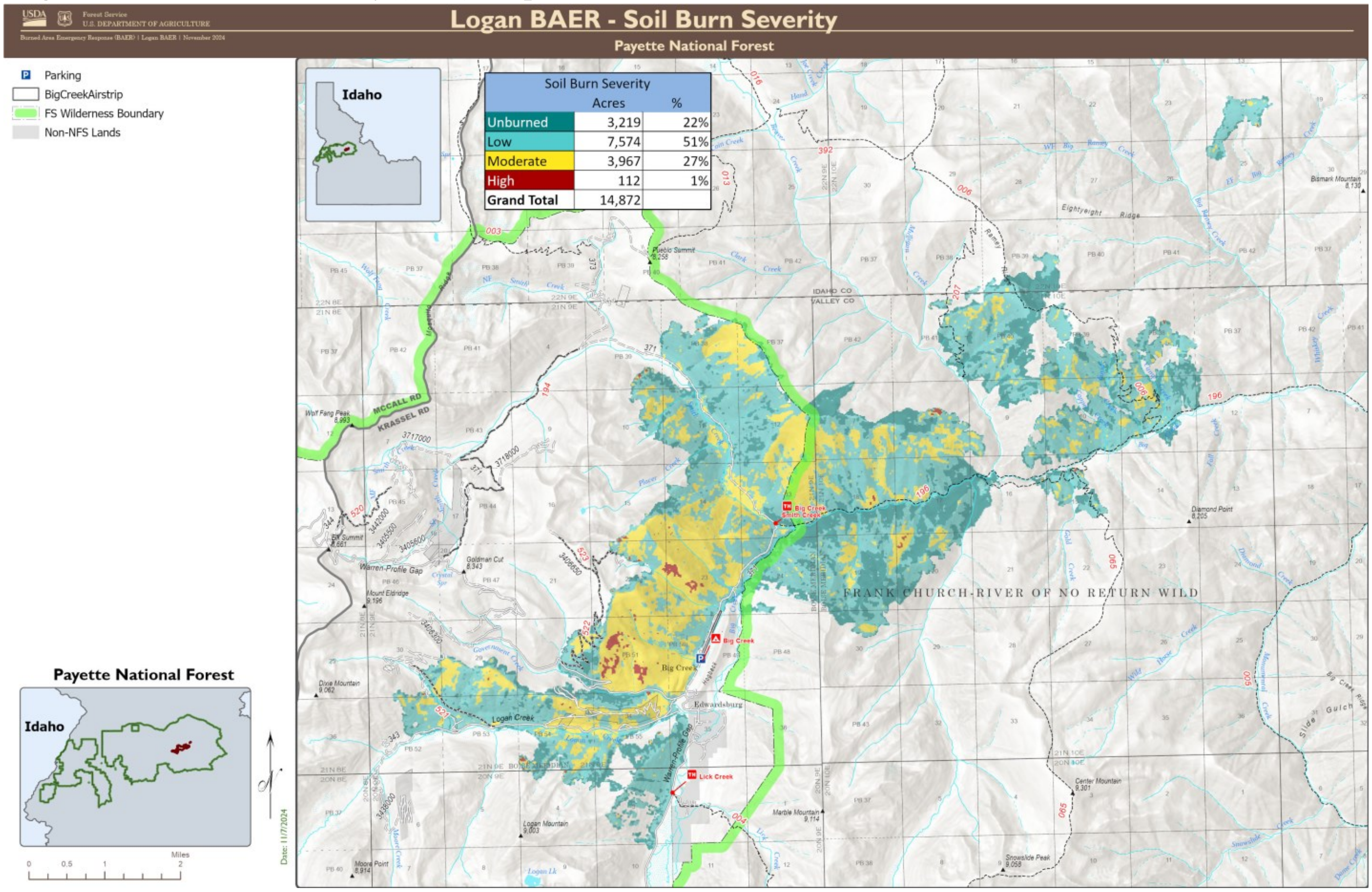
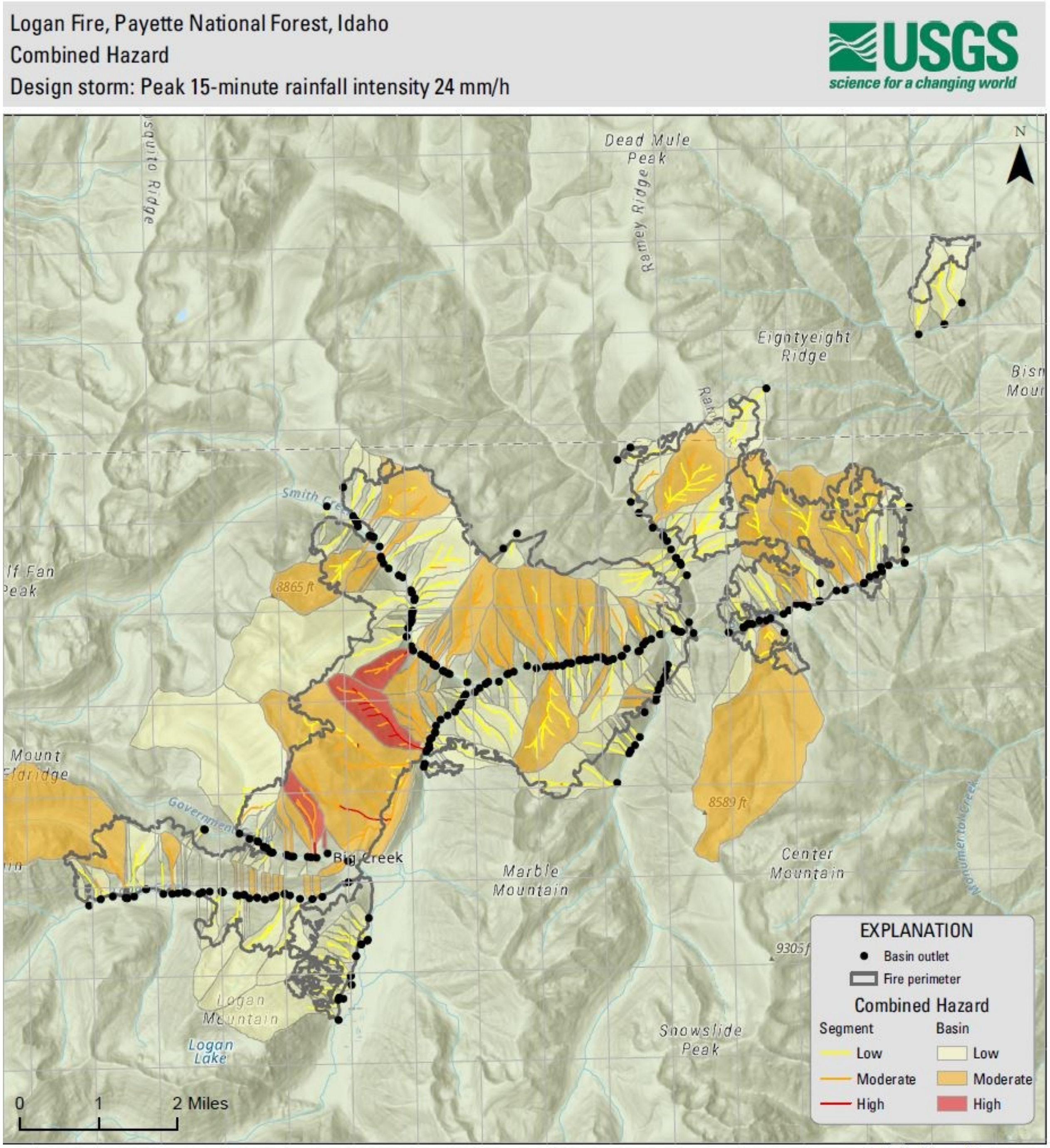
References:

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) Field Guide for Mapping Post-fire Soil Burn Severity

Logan Fire Soil Burn Severity (SBS) Map



Logan Fire debris flow combined hazard rating map



Disclaimer - Limitations of Hazard Assessment

Hazard assessments use a design rainstorm with a given peak 15-minute rainfall intensity to predict the probability, volume, and combined relative hazard of debris flows in basins burned by the fire. Differences in model predictions and actual debris-flow occurrence will arise with differences in actual storm duration and intensity. The occurrence of higher rainfall intensities or longer storm durations may increase the probability or volume of potential debris flows.

The models were developed, calibrated, and tested using data from the western United States. The models have not yet been tested in burn areas in the eastern United States, western Oregon, or Washington (west of the Cascade Range). Currently, efforts are being made to validate model predictions in the eastern United States, western Oregon, and Washington.

In addition, this hazard assessment relies upon readily available geospatial data, the accuracy and precision of which may influence the estimated likelihood and magnitude of post-fire debris flows. However, local conditions (such as debris supply) certainly influence both the probability and volume of debris flows. Unfortunately, locally specific data are not presently available at the spatial scale of the post-fire debris-flow hazard assessment. As such, local conditions that are not constrained by the model may serve to dramatically increase or decrease the probability and(or) volume of a debris flow at a basin outlet. The input geospatial data are also subject to error based upon mapping resolution, elevation interpolation techniques, and mapping and(or) classification methods. Finally, this assessment is specific to debris-flow hazards; hazards from flash-flooding are not described in this study and may be significant.

This assessment also characterizes potential debris-flow hazards at a static point in time immediately following wildfire. Studies of post-fire debris flow in the western United States have indicated that debris-flow activity in recently burned areas typically occurs within 2 yr of wildfire. As vegetation cover and soil properties return to pre-fire conditions, the threat of debris-flow activity decreases with time elapsed since wildfire. Conversely, the hazards from flash-flooding may persist for several years after the wildfire.

Finally, this work is preliminary and is subject to revision. It is being provided due to the need for timely "best science" information. The assessment is provided on the condition that neither the U.S. Geological Survey nor the United States Government may be held liable for any damages resulting from the authorized or unauthorized use of the assessment.

Projection: NAD1983, UTM Zone 11N