Yellow Lake Fire Burned Area Summary

Burned Area Report

Fire Background

The Yellow Lake Fire began on September 28th, 2024, and reached 33,045 acres. The Yellow Lake Fire is located 10 miles Southeast of Francis, UT. The fire originated near Yellow Lake, east and south of Mill Hollow Reservoir on the Heber-Kamas Ranger District of the Uinta-Wasatch-Cache National Forest. Roughly two thirds of the Yellow Lake Fire is located within the Uinta-Wasatch-Cache National Forest, with the other third on the Ashley National Forest.

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 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 October 25th, 2024, for the Yellow Lake 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

Photo 1. BAER Soil Scientist assessing soil burn severity.

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.

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 SBS 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 SBS 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%), Moderate (14%%), Low (64%), and Very Low/Unburned (22%) (see map on Page 6). Soil burn severity within the Yellow Lake burn scar was driven by the vegetation types found in the area. Many of the mixed conifer stands were previously impacted by beetles which killed the trees 10-20 years ago. These stands experienced moderate to high fire intensity due to fuel and weather conditions when the flame front impacted the standing dead trees. However, SBS was low in many of these areas due to short fire residence time from the relatively thin duff and litter layers on the forest floor. Areas with thicker duff layers prior to the fire resulted in moderate SBS. Areas within the aspen, shrub, and grassland areas were all dominated by fine fuels that burned quickly resulting in predominately very low and low SBS. Additionally, aspen communities typically grow in wetter soils, which in turn help reduce the amount heat transferred to the soil.

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. Hillslope erosion was minimal pre-fire; however, post-fire erosion is anticipated to increase throughout the burned areas The sediment delivery within these systems is efficient, where most eroded sediment is anticipated to be transported into the stream systems. 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.

The Yellow Lake Fire area is composed of Mesozoic sedimentary rocks and Tertiary deposits of igneous lava, breccia, and tuff. Numerous faults extend through the area and karst formations (e.g., caverns, sinks, and sinking springs) have altered some of the landscapes associated with limestone rocks in the Soapstone Basin area. Some paleolandslides occur within the area. Landforms in this area are primarily tectonic mountains; stream canyons; glacially scoured canyons, uplands, and moraines; structurally controlled shale; plateauland; landslides; and mountain foothills.

The team provided SBS 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 an elevated risk (>40%) for post-fire debris flows within Rhoades Canyon, Dry Hollow, and the Wolf Creek drainage for a 1- and 2-year storm event, as well as areas in Neeley Basin, Lambert Hollow, hillslopes along Cold Springs Road, and hillslopes in the North Fork of the Duchesne drainage for a 2-year storm event (see map on Page 7).

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 SBS. 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.

There are three main drainages affected by the Yellow Lake Fire: Provo River, the South Fork Provo River, and the West Fork Duchesne River. A rapid hydrologic assessment suggests that given the low percentage of moderate and high SBS, overall watershed response will be low in most watersheds. In the watersheds with higher debris flow potential, dormant channels may be reactivated in these post-fire runoff events. This, along with the mass wasting events, will likely lead to short-term, episodic, and temporary impacts to water quality. With limited long-term effects, hydrologic function is not expected to be impacted.

Photo 2. BAER Hydrologists assessing road culvert downstream of the burned area.

Critical Values

The first critical value BAER teams assess is always human life and safety on National Forest System lands. During and after heavy rainstorms, Forest Service employees and visitors to National Forest System 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 recommended general warning signs and communications to travelers on any National Forest System roads and trails within or directly adjacent to the fire.

Photo 3. Landscape view of a fire-retardant line and the mosaic pattern of the Yellow Lake Fire within conifer and aspen stands in Soapstone Basin.

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 rip rap, 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. Recommended treatments for the protection of these roads include cleaning the inlet and outlets of culverts, installing rolling drainage dips, installing lead out ditches, using rip rap to protect fill slopes, and removing stump holes that the road prism.

Recreation

National Forest System recreation infrastructure includes campgrounds, trails, and day use areas. Most of the recreation assets within the Yellow Lake Fire burned area relate to dispersed campgrounds, hiking trails, ATV trails, and winter snowmobile trails. Similar to roads, recreation infrastructure could be damaged in post-fire storm events.

The team proposed 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.

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, campgrounds, and trails throughout the burned area. However, this is an area with a large amount of unique habitat and the burned area creates conditions for invasive species to outcompete native plants. The team recommended a treatment of Early Detection, Rapid Response (EDRR) to monitor for and treat noxious weed infestation and expansion in areas disturbed due to mechanical suppression activity and burned areas prone to new noxious weed infestations. New infestations will be treated chemically in the spring and fall and monitored to determine the effect of the treatments.

Photo 4. BAER Hydrologists and Engineers assessing a road culvert below a burned area.

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 team and treatments proposed as necessary to protect these values from post-fire threats.

Anticipated Vegetation Recovery

Post-fire recovery varies greatly based on climate, vegetation types and burn severity. It is typical for grass and shrub recovery to take between 1-3 and 3-5 years, respectively, 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.

Photo 5. Moderate soil burn severity within a conifer stand.

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.

Photo 6. BAER Team assessing soil burn severity.

Partner Agency Contacts:

Kathy Holder – State Hazard Mitigation Officer and Utah Post Wildfire Team Lead – Utah Department of Public Safety, Division of Emergency Management

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 Yellow Lake 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.

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. Hillslope erosion was minimal pre-fire; however, post-fire erosion is anticipated to increase throughout the burned areas The sediment delivery within these systems is efficient, where most eroded sediment is anticipated to be transported into the stream systems. However, vegetation recovery is anticipated to be rapid with ground cover approaching pre-fire conditions within 1-5 years for grasses and shrubs, 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 Yellow Lake Fire.

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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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)

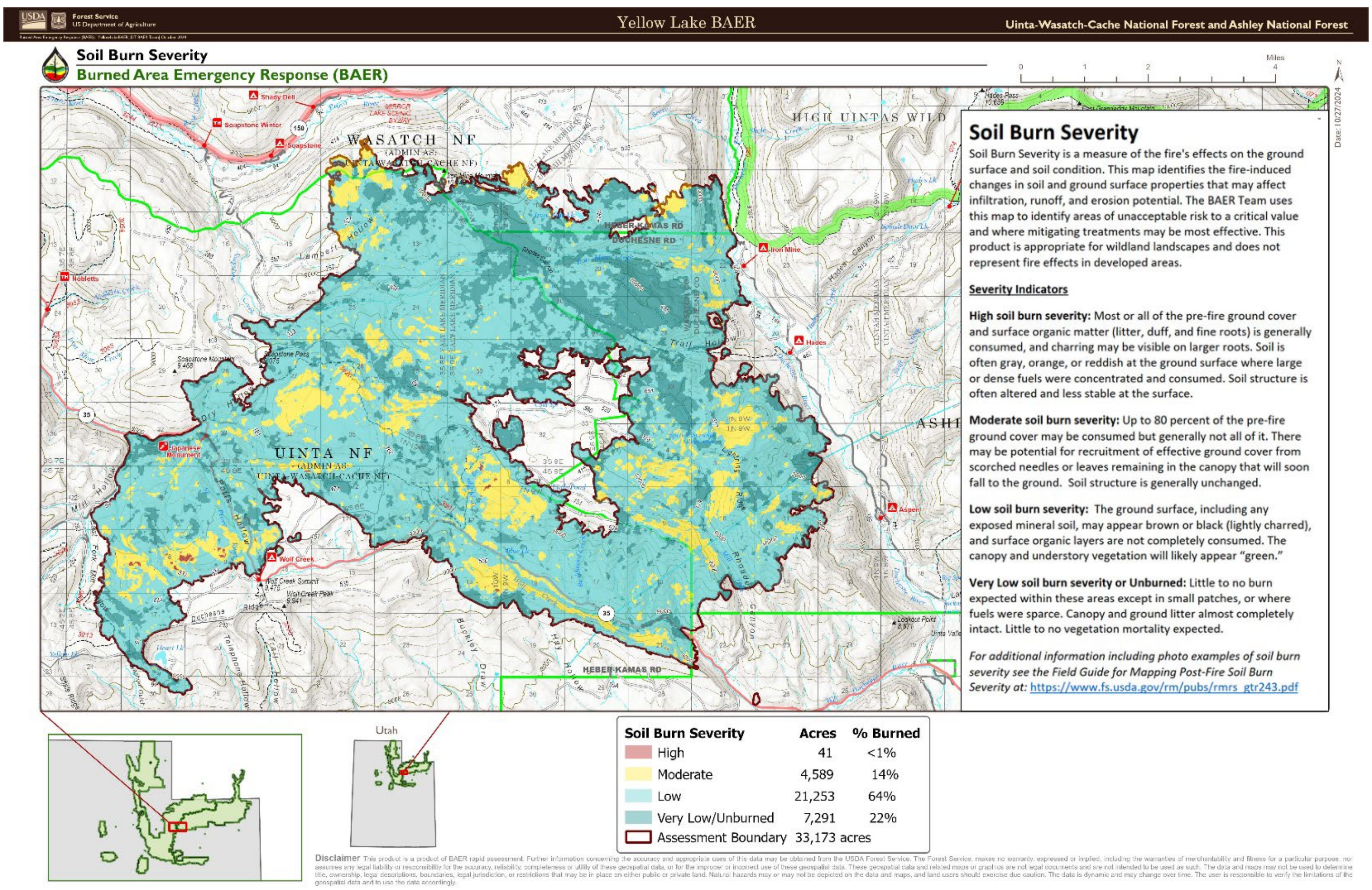

Photo 7. Soil burn severity map for the Yellow Lake Fire.

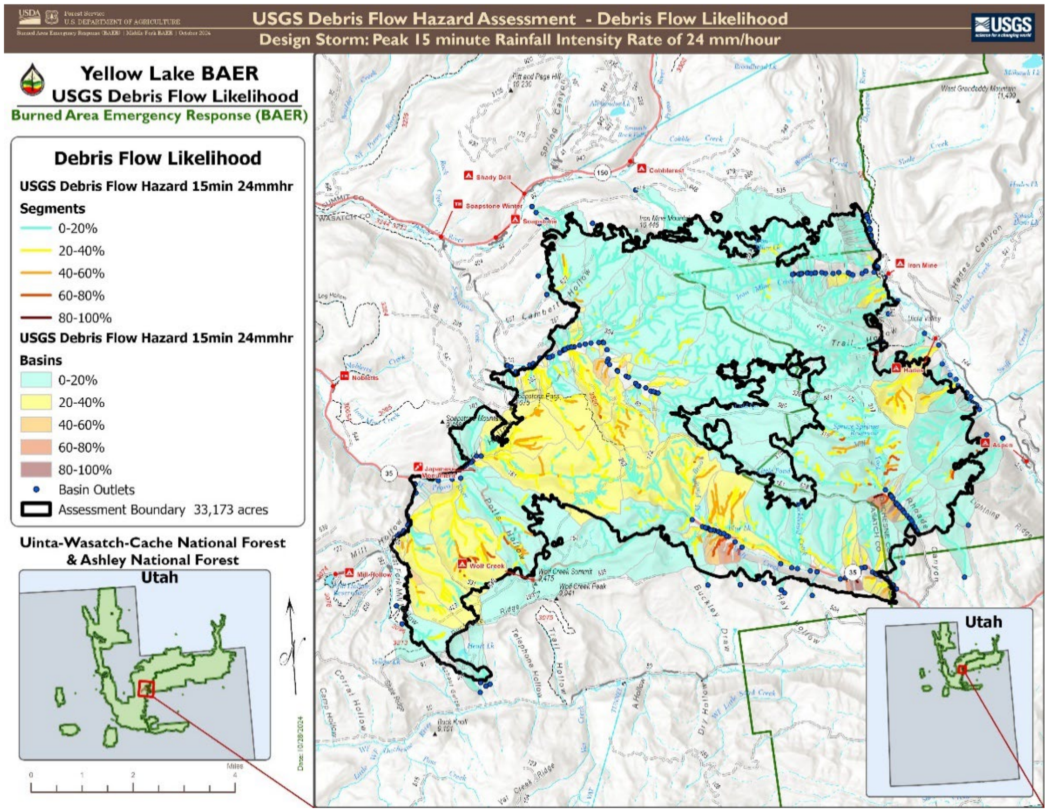

Photo 8. Debris flow likelihood of a 1-year storm event for the Yellow Lake Fire.

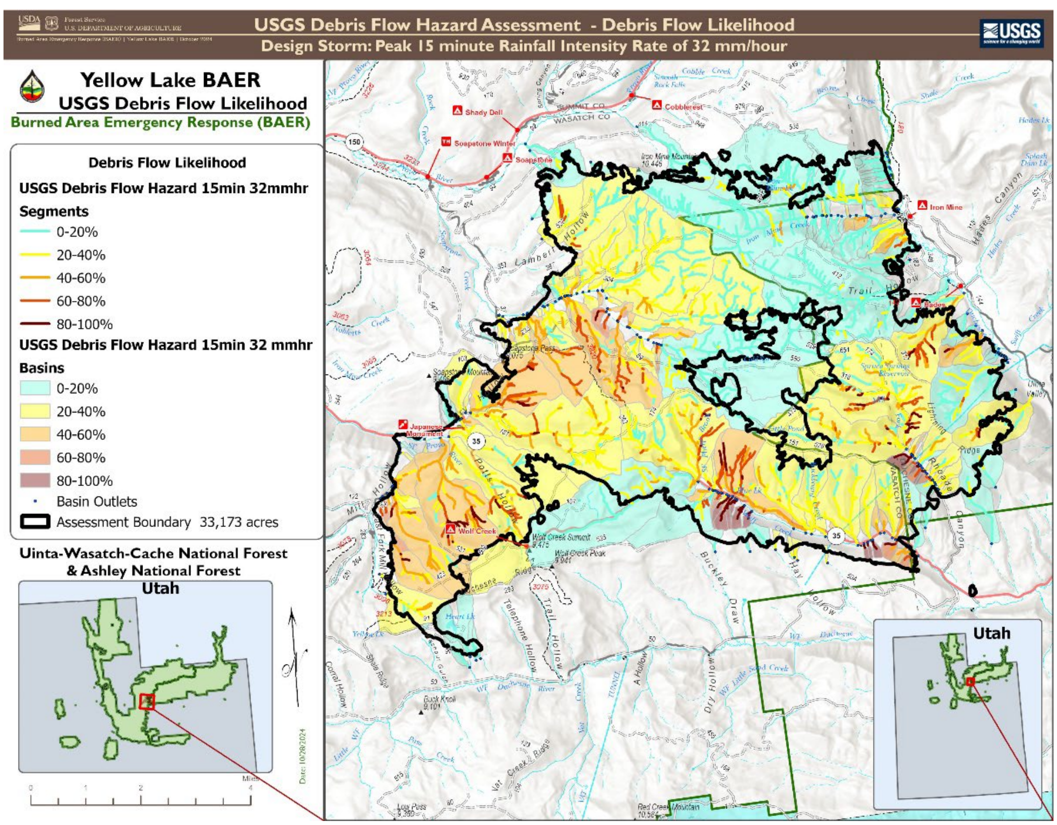

Photo 9. Debris flow likelihood of a 2-year storm event for the Yellow Lake Fire.