Silver King Fire Burned Area Summary

Burned Area Report

Fire Background

The lightning caused Silver King Fire was first detected on July 5th approximately 8 miles northwest of Marysvale, Utah on the Beaver Ranger District of the Fishlake National Forest. The fire rapidly grew to the south and east, burning approximately 10,100 acres during the first two days following detection. Modest daily growth of 800 to 1,700 acres occurred from July 8th through July 13th, after which the rate of spread moderated to a few hundred acres per day.

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 for the Silver King Fire on July 19th. 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 increased geologic hazards. Field evaluations and modeling

Figure 1: BAER Team member assessing soil burn severity in Bullion Canyon

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 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). 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 (12%), Moderate (48%), Low (36%), and Very Low/Unburned (4%) (see map on 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. The burned area is located on the east side of the Tushar Mountains, a very steep mountain range that is dominated by volcanic geology. The three canyons that drain the burned area have evidence of past and active landslides, high rates of hillslope erosion, and steep stream channel networks which have produced numerous flood events in recent years. The burned watersheds are expected to be highly responsive to high-intensity rainfall events

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 USGS Post-fire Debris Flow Hazard Model estimates a moderate to high debris flow hazard across the burnscar in response to a peak 15-minute rainfall intensity of 32mm/hour (see map on page 8). This rainfall intensity is equivalent to the accumulation of 0.32" of rain in 15 minutes during a high intensity thunderstorm. This rainfall event has a 1-year recurrence interval in the burned area, meaning it is a very likely event that has a 100% probability of occurring on any given year.

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.

A rapid hydrologic assessment suggests that there will be an extreme hydrologic response to relatively modest high-intensity thunderstorms. A 2-year rainfall event (50% chance of occurrence on any given year) is expected to result in 10-year flood event. The Pine Creek (Bullion Canyon) and Beaver Creek subwatersheds have modeled post fire flow increases of 381% and 421% respectively. The volume of these runoff events will be further bulked with sediment, rocks, and floatable debris.

Figure 2: Moderate and high soil burn severity above Miners Park in Bullion Canyon

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 has established an early warning alert plan for areas that are potentially at risk from these events. The BAER team recommends general warning signs and communications to travelers on any National Forest System roads and trails within or directly adjacent to the fire. These will be installed at major motorized and non-motorized entry points into the burned area.

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 debris racks, 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. Treatments for the protection of these roads include storm proofing of existing drainage features, new drainage dip installations, culvert basin enlargements, culvert upsizing, and regular storm inspection and response during or immediately after high intensity rainfall.

Recreation

National Forest System recreation infrastructure includes campgrounds, trails, and day use areas. Most of the recreation assets within the Silver King Fire burned area related to motorized and non-motorized trail systems. Similar to roads, recreation infrastructure could be damaged in post-fire storm events.

Within the Silver King Fire, all of the threatened motorized trails have been designated on existing road alignments. The previously described road treatments will serve to reduce risks to the motorized trail network from post-fire storm damage. Short segments of the non-motorized trail system were found to be at risk, however treatment opportunities are limited and not cost-effective.

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, dispersed camping areas, and trails throughout the burned area. However, the burned area creates conditions for invasive species to outcompete native plants. The team recommends a treatment of Early Detection, Rapid Response (EDRR) to monitor for noxious weed infestation and expansion in areas disturbed during fire suppression activity. During implementation of this treatment, crews will survey the fire control lines, spike camps, helispots, and safety zones for new or expanding populations of invasive plants, document the findings, and apply herbicide.

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. The primary area of concern for the Silver King fire is the Miners Park interpretive site located adjacent to Pine Creek in Bullion Canyon. This site contains numerous artifacts that have been collected from the larger Ohio Mining District and is threatened by post-fire flooding and debris flows. This site is not eligible for listing on the National Register of Historic Places, however it is an important interpretive site for the Forest Service and the local community. The team recommends protection of artifacts that are too large or fragile to be relocated away from Pine Creek and temporary removal of the remaining artifacts.

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.

Figure 3: Three early warning weather stations have been deployed in the burn scar by the National Weather Service and Utah Department of Transportation.

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.

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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 Silver King 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 are not yet approved or funded. Because of the emergency nature of BAER, initial requests for funding of proposed BAER treatments are supposed to be submitted by the Forest Supervisor to the Regional Office within 7 days of total containment of the fire. The Regional Forester's approval authority for individual BAER projects is limited. Approval for BAER projects exceeding this limit is forwarded onto the Washington Office.

BAER treatments cannot prevent all the potential flooding or soil erosion impacts, especially after a wildfire has changed the landscape. It is important for the public to stay informed and prepared for potentially dramatic increased run-off events. The watersheds within the burned area were already hydrologically responsive to rainfall and prone to erosion and sediment transport prior to the fire and will likely be even more responsive due to post-fire conditions. However, vegetation recovery is anticipated to be rapid with ground cover approaching pre-fire conditions within 3-5 years, which will attenuate most 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 Silver King Fire. Fire information can be found on-line at https://inciweb.wildfire.gov/incident-information/utfif-silver-king-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.

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References:

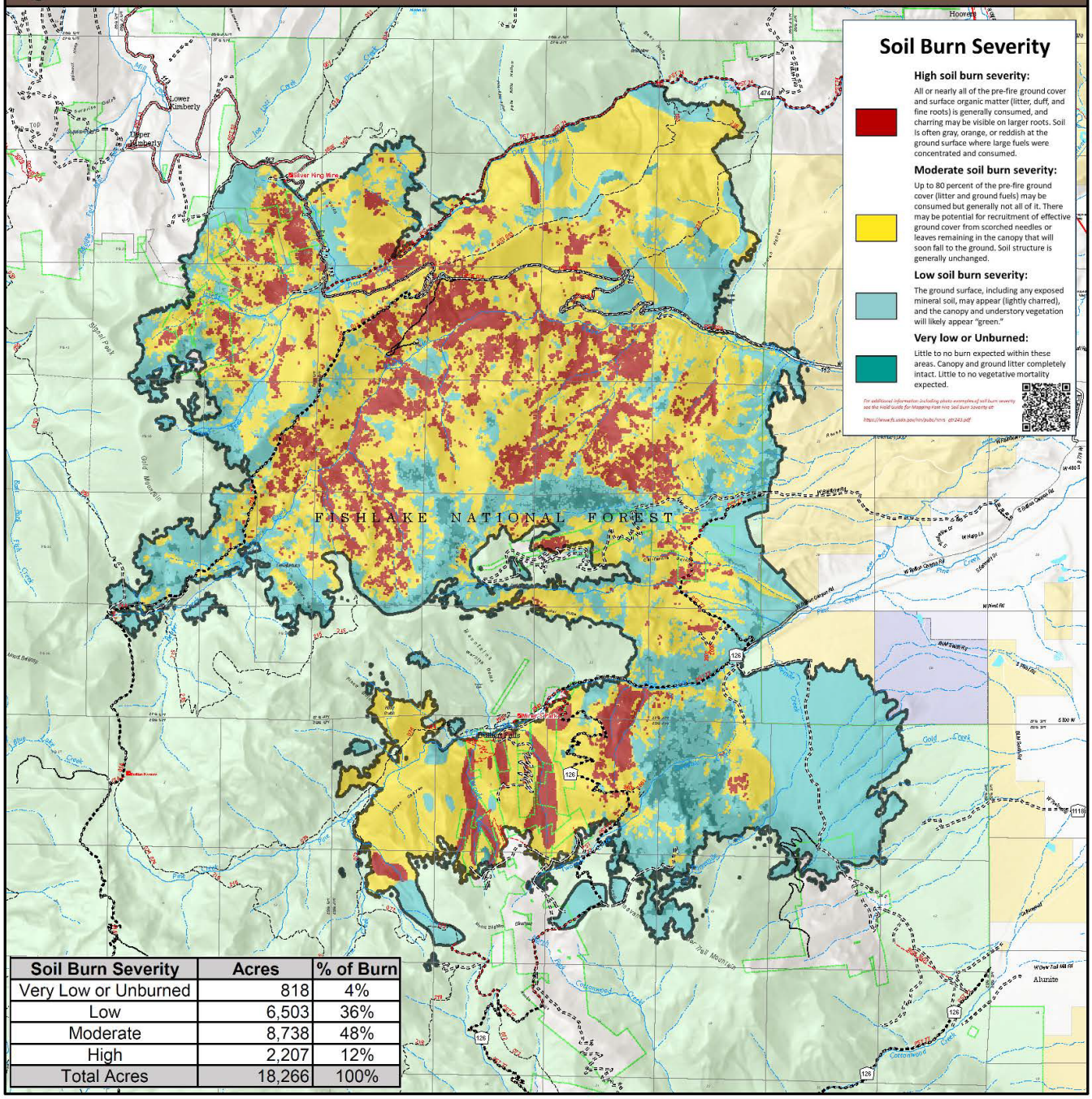
Parson, Annette; Robichaud, Peter R.; Lewis, Sarah A.; Napper, Carolyn; Clark, Jess T. 2010. Field guide for mapping post-fire soil burn severity. Gen. Tech. Rep. RMRS-GTR-243. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 49 p. (https://www.fs.usda.gov/rm/pubs/rmrs_gtr243.pdf)

USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Intermountain Region | Fishlake National Forest
Beaver Ranger District

Soil Burn Severity Map - Silver King Fire

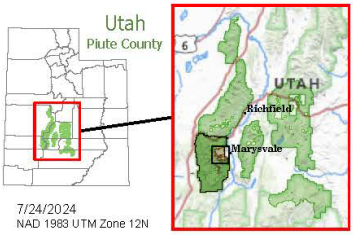
Silver King BAER



Soil Burn Severity	Acres	% of Burn
Very Low or Unburned	818	4%
Low	6,503	36%
Moderate	8,738	48%
High	2,207	12%
Total Acres	18,266	100%

0 ½ 1 Miles

Fire Permeter
Recreation Site
ML 3 - Suitable For Passenger Cars
ML 2 - High Clearance Vehicles
ML 1 - Basic Custodial Care (Closed)
Motorized Trails
Non-Motorized Trails
Primary Highway
Secondary Paved Road
Secondary Dirt Road
National Forest Boundary
National Forest
State Public Lands
Other State Lands
Bureau of Land Management Lands
Ranger District Boundary



7/24/2024
NAD 1983 UTM Zone 12N

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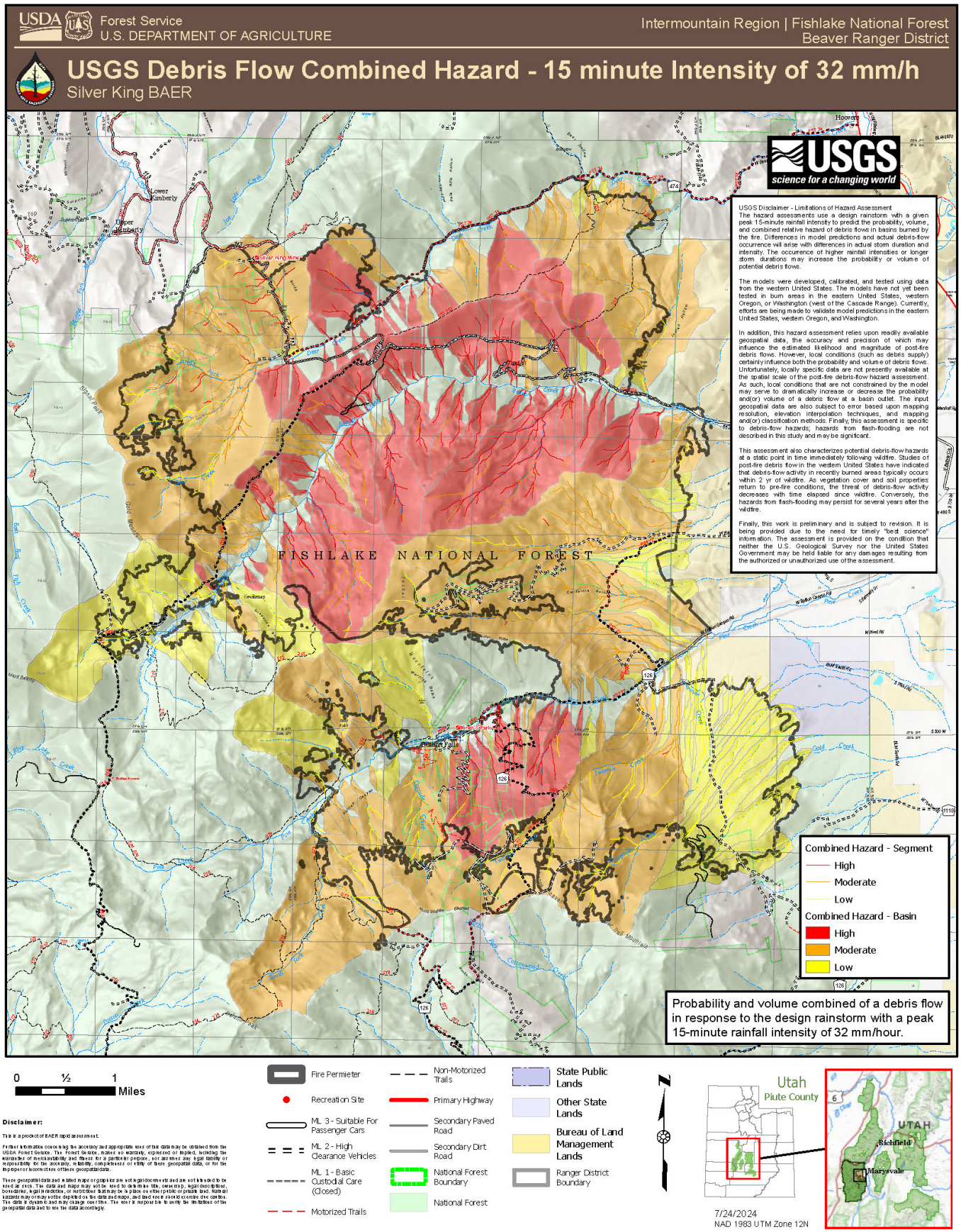
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USGS Debris Flow Combined Hazard - 15 minute Intensity of 32 mm/h
Silver King BAER
USGS
science for a changing world
USGS Disclaimer - Limitations of Hazard Assessment
The hazard assessments use a design rainstorm with a given peak 15-minute rainfall 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.
FISHLAKE NATIONAL FOREST
Combined Hazard - Segment
High
Moderate
Low
Combined Hazard - Basin
High
Moderate
Low
Probability and volume combined of a debris flow in response to the design rainstorm with a peak 15-minute rainfall intensity of 32 mm/hour.
0 ½ 1 Miles
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