CONFERENCE PROCEEDINGS

ABSTRACTS AND SPEAKER PROFILES

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FIRE IMPACTS ON GEOLOGIC HAZARDS – THE BIRCHER FIRE AT MESA VERDE NATIONAL PARK

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The Bircher Fire began on July 20, 2000 and ultimately burned over 23,000 acres, including over 19,000 acres in Mesa Verde National Park. The fire impacted over seven miles of the Park entrance road, in addition to the Morfield campground and sewer lagoons. The U.S. Department of Interior Southern States Burned Area Emergency Response (BAER) Team assessed fire impacts and prepared a plan to mitigate the effects of the fire to protect human life, property and critical cultural and natural resources. A geologic-hazard assessment and response were elements of that plan.

Wildfire causes loss of vegetation, alters soil and rock properties and impacts the hydraulic response of drainage basins. Each of these factors tends to increase the frequency and severity of geologic hazards within a burned area. Geologic hazards assessed for the Bircher Fire included debris/sediment flows, rockfall and landslides. Precipitation influences each of these hazards, and Mesa Verde's peak visitor and staff populations coincide with the highest-intensity rainfall season in late July and August.

The post-fire response of drainage basins presents one of the greatest hazards to humans, property and resources. Loss of vegetation, increased peak and total runoff flows, hydrophobic soils, increased erosion rates and the potential for debris and sediment-rich flows can result in potentially destructive runoff events. The nature and potential severity of the processes must be evaluated using a combination of geologic and hydrologic methods.

Geologic methods include evaluating the geometry, deposits and landforms of the basins and alluvial fans. Parameters that can be measured and described include slope and basin angles and areas, degree of channel incision, the nature of the source and fan deposits and evidence of slope instability within the basin. Hydrology methods include estimating peak and total runoff volumes based on slopes, areas, soil types and climate data. In addition, hydrologic methods must incorporate the effects of the fire, including loss of vegetation and the water-repellency or hydrophobicity of burned soils.

The geologic-hazard assessment for basins within the Bircher Fire area determined the likelihood of potentially destructive debris flows, based on evidence of existing debris deposits and the slopes and available source material within each basin. Fortunately, at Mesa Verde, the major debris-flow deposits are found in remote areas generally closed to the public. The debris fans of primary concern in the Bircher Fire area included a fan at Morfield campground, one at the west portal of the tunnel and a fan above the sewer ponds. Basin areas, slopes, soil types, burn severity were analyzed and potential sediment volumes were estimated. Based on these volumes and the potential impacts, storage and diversion structures were sized and constructed.

Much of the Park Entrance Road lies below steep slopes and cliffs. Fire-impacted rockfall hazards were evaluated using a combination of field observations and measurements and computer simulation of rockfall events. Suspect rocks were identified and rated using a standardized rockfall rating system. The rating system considers rock size, slope angle, slope height, catchment area and motorist visibility. Fire effects such as heat-induced spalling and fracturing, loss of vegetation and the potential for erosion beneath boulders on steep soil slopes were also considered. One area of particular concern was the steep, severely burned slope above the east portal of the tunnel due to limited motorist visibility when exiting this unlit tunnel. Another area of concern was a steep slope where blasted rocks from a former road alignment were leaning against trees burned by the fire. The rockfall mitigation program resulted in controlled removal of about 20 rocks in five areas and scaling of four roadcuts.

The geologic-hazard assessment identified four active or recently active landslide areas within the burned area that may affect the road. Loss of vegetation and altered surface and subsurface moisture conditions may adversely impact unstable slopes. Slope failures are usually slow, non-life-threatening processes. However, repairs and stabilization can be very costly. Mitigation for the landslide areas focused on low-cost preventative measures including aerial seeding in the upper portions of potentially unstable areas and maintaining and improving roadway drainage systems.

Two monsoon seasons have nearly passed and the geologic hazard mitigation efforts appear successful thus far. Park maintenance crews have removed about 200 cubic yards of sediment from the roadway shoulder at the west portal. Smaller amounts have been removed from the Morfield campground and east portal. Rockfall events triggered by rain have been limited to small rocks from roadcuts, most of which do not reach the travel lanes. Seeding efforts were very successful and the vegetation is recovering rapidly, especially gambel oak and meadow grasses.

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Thanks to Sue Cannon, (USGS), Bob Kirkham, (CGS), Dave Trautner (Lambert & Associates) and Rick Andrew (Yeh & Associates) for ideas, comments and input.