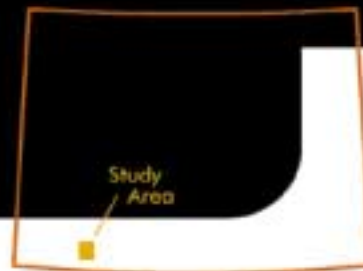


Colorado



Geologic Maps Identify Post-Wildfire Hazards

Vince Matthews (Colorado Geological Survey)
and David Gonzales (Fort Lewis College)

Defining the Problem

Wildfires, such as the Missionary Ridge fire that burned for more than a month in 2002 near Durango, Colorado (Fig. 1), and their **aftermath** can cause subsequent property and environmental damage. Many areas denuded by the **fire** are now susceptible to **rapid erosion** during heavy precipitation with resulting debris flows, or “mudslides.”

The Geologic Map

Geologic maps are tools for **evaluating** post-fire, debris-flow **hazards**. The geologic map (Fig. 2) shows the distribution of rock types and surface deposits in relation to topography. The darker yellow pattern (Q_{fy}) shows the location of alluvial fans created by historic **debris flows**. The areas most susceptible to post-fire erosion are the glacial moraine (Q_m, A), colluvium (Q_c, A), and Cutler Formation (P_c, A).

Applying the Geologic Map

The Missionary Ridge fire illustrates how **geologic** maps can be used to assess and predict natural hazards. Although this 73,000-acre fire was extinguished in July 2002, emergency managers are still planning for, and coping with, post-fire debris flows. Digital mapping capabilities produced color copies of the geologic map soon after the fire for researchers and emergency response teams to use in identifying high-risk debris-flow areas. The digital map also could be added as a layer in a user’s GIS database.

Mapping in 2002 shortly after the fire **revealed** a sequence of older debris flows exposed in the incised channel of a modern, fire-induced debris flow that formed after the Missionary Ridge fire (Fig. 3). Associated charcoal layers dated by C14 methods showed a record of **repeated** fire followed by debris flows extending back 4300 years. The cycles of major fires in the Durango area correlated well with a fire sequence established in Yellowstone National Park, hinting at a broader geographic extent of repeated wildfires and debris flow **events**.

Conclusion

Geologic maps are useful in identifying areas that may be affected by post-wildfire debris flows. **Land-use planners** use these maps to identify potential hazards in areas that are proposed for development and to develop mitigation strategies. The maps can also focus post-wildfire emergency planning on the areas with the highest **likelihood** of debris flows. It is cheaper to avoid or mitigate problems than to repair damage.

Fig. 1.
Homeowners
and emergency
managers are
still coping with
debris flows and
the aftermath
of the 2002
Missionary Ridge
wildfire near
Durango, CO.



Missionary Ridge
wildfire

geologic map

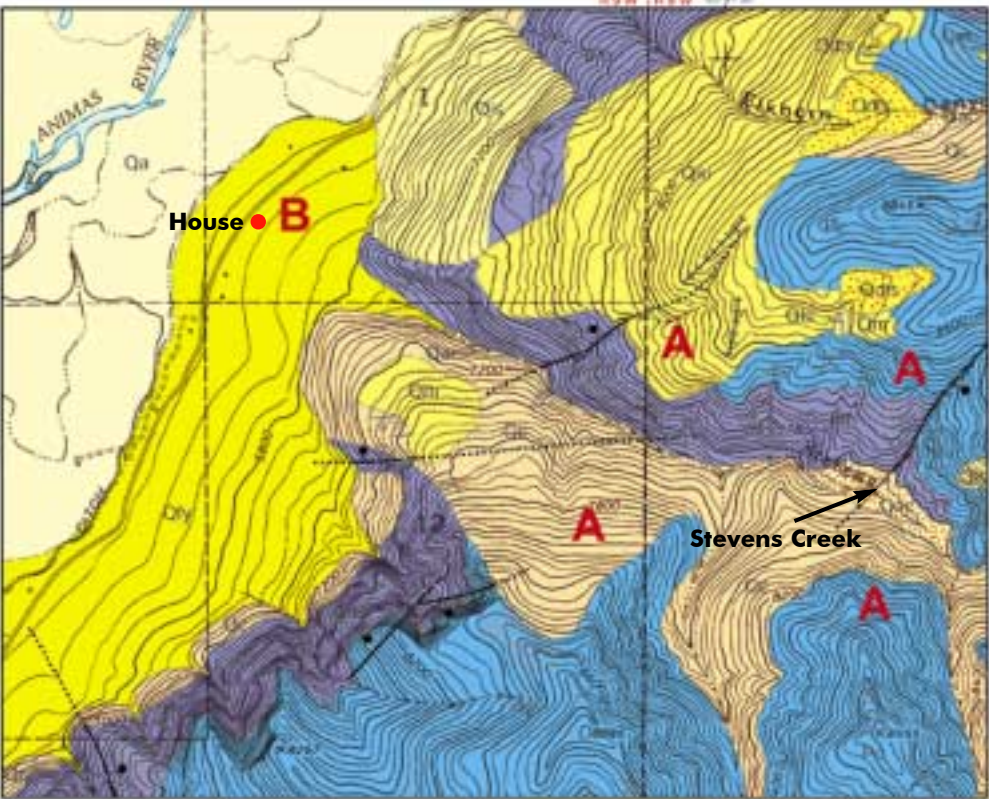


Fig. 2. This part of the Hermosa geologic quadrangle map covers the burn area around Stevens Creek. The darker yellow pattern (Qfy) shows debris fans mapped in 2001. The fan marked B at the mouth of the creek suffered major debris flow activity after the Missionary Ridge fire (Fig. 3). Units particularly susceptible to erosion are the glacial moraine (Qm, A), colluvium (Qc, A), and Cutler Formation (Pc, A).

Qa	Stream-channel, flood-plain, and low terrace deposits
Qc	Colluvium
Qd	Landslide deposits
Qfy	Younger fan deposits
Qm	Alluvium and colluvium, undivided
Qts	Dammed tributary sediments
Qm	Glacial moraine and till, undivided
Pc	Cutler Formation (Sandstone & shale)
Hm	Hermosa Group (Sandstone & shale)

Fig. 3. Aerial view looking up Stevens Creek at burn area of the 2002 Missionary Ridge wildfire and the debris fan at the mouth of the creek. After the fire, the house, which was built on an ancient debris fan, was engulfed by a debris flow (see map and photos).



house after fire in 2002



house engulfed by post-fire debris flow



historic debris fan

post-fire debris fan 2002