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Science For Public Safety
USGS Response to 2007 Wildfires in Southern California

Once the smoke clears from a wildfire, the danger is not over. Other hazards, such as flash floods and debris flows (landslides), can be just as devastating, if not more so, than the wildfires themselves. Uncovering the impact on human health, biology and ecology are also important in helping to further reduce loss of life and property.

Science is critical to providing the information to help the public, policymakers and emergency managers prepare for and react to these natural hazards and build safer communities.

The U.S. Geological Survey (USGS) Multi-Hazards Demonstration Project team is coordinating a response to the Southern California wildfires around four public safety goals – assess and identify debris-flow danger, size and potential flows; estimate flood risk; assess biodiversity and ecological impacts; and assess surface water quality impact on human health.

Some tasks are required immediately for the wildfire response and also to prepare for the increased debris-flow hazard that will follow when the rains come and wash away slopes denuded by the wildfire – the second act in this disaster cycle. USGS scientists need to capture mission-critical information within the next several weeks before conditions change or the rains begin. The team also identified long-term recovery and mitigation efforts which may require several years to complete.

The four public safety goals and associated tasks are:

1. Assess debris-flow danger and identify size of potential flows.

- Create hazard maps for use in a debris flow warning system run cooperatively with the NOAA National Weather Service (NWS). Deliver to Burn Area Emergency Response (BAER) Teams, the Governor's Office of Emergency Services, FEMA, U.S. Fish and Wildlife Service, Bureau of Land Management, and affected counties.
- Use data from these fires and storm response to test and improve empirical models for debris flow and flood risk.
- Install numerous flood-hydrograph data collection sites for which stage-discharge relations can quickly and inexpensively be determined. Equip sites with web cams for visual confirmation. Install numerous rainfall data collection sites using inexpensive tipping-bucket gages and data loggers.
- Install quick-deployment, satellite-telemetered rain gages in burned basins in radar shadows for use by the USGS/NWS Early Warning System. (Applies to Goals 1&2)
- Acquire and deliver remote sensing data and imagery-derived products in support of emergency response, including ground control from GPS. (Applies to Goals 1-3)

2. Estimate increased flood risk due to altered runoff characteristics in burned basins.

- In order to quickly determine post-event peak-discharge data at ungaged sites, use indirect discharge-measurement methods together with less detailed, rapid-estimation methods. (This public safety goal is closely coordinated with BAER teams.)
- Determine whether LiDAR-derived topographic data can be used in conjunction with improved flood risk information to quickly produce reliable flood inundation maps.

3. Assess fire impact on biodiversity and local ecosystems.

- Deliver assessment to DOI partners to determine populations of species at risk from habitat loss from debris flows. Deploy biologists to survey the burned areas that are the known locations of endangered species populations.

- Assess impact of multiple burns over a few years in the large territory burned both in 2003 and 2007. Assess the probability of complete habitat loss to invasive species from loss of reproductive systems in multiple burns.
- Assess riparian habitat disturbance and impacts on ecological communities. Assess stream ecological health using bio-indicator organisms (e.g. fish, insect larvae and algae).
- This event provides a unique opportunity to better understand fire impacts on biodiversity with focus on species lost, ecosystem response, and the threat of invasive species.
- It also provides a unique opportunity to examine the significance of burn severity: How remote sensing measurements relate to ecosystem response and recovery and how fuel treatments and other fire-mitigation measures affect burn severity and fire progression.

4. Assess surface-water quality from ashfall and runoff and its potential impacts to human health.

- Sample and evaluate the composition of ash and burn products from wildland and urban fires before the first runoff of the rainy season and during the first runoff. (Applies to Goals 3&4)
- Establish a monitoring network to quantity the long-term impacts of large wildfires in urban and residential areas on water quality.

USGS also proposes to use certain highly vulnerable basins as special monitoring areas. Malibu Creek, site of the Canyon fire, has been identified as the top priority to match NOAA's requirements for joint Intensive Research Areas with both significant flood and debris flow risks but also especially suitable for chaparral studies and as the home of the last population of indigenous steelhead trout. NOAA is interested in additional areas, but USGS participation would require additional staff. Tasks include:

- Deploy hand-held LiDAR and acquire airborne LiDAR in highly vulnerable basins for erosion and sedimentation quantification and for evaluation of ecosystem impacts.
- Install instrumentation to monitor rainfall and surface runoff in the upper reaches of debris-flow susceptible catchments to constrain models of post-fire processes.

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