Landslide Hazards: A Stealth Threat to the Nation

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Landslides after Wildfires

or…..

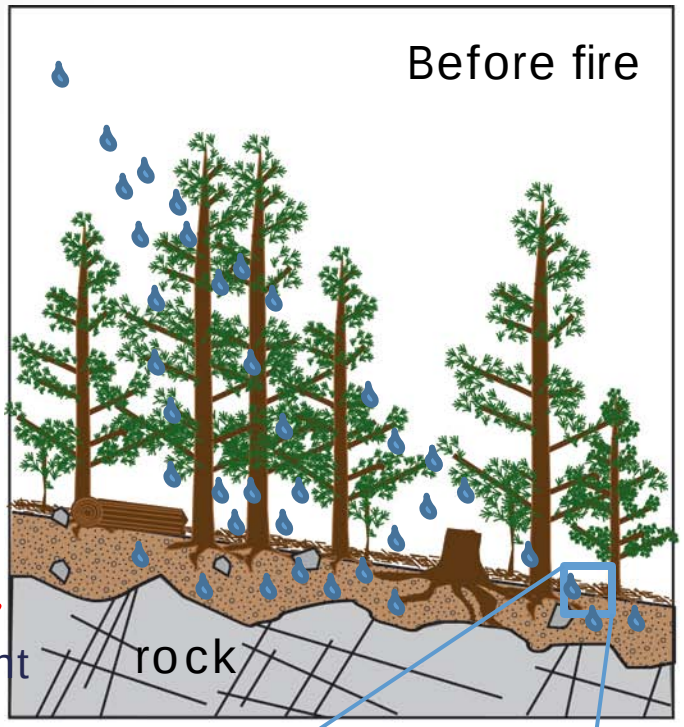
It's not over once the smoke clears

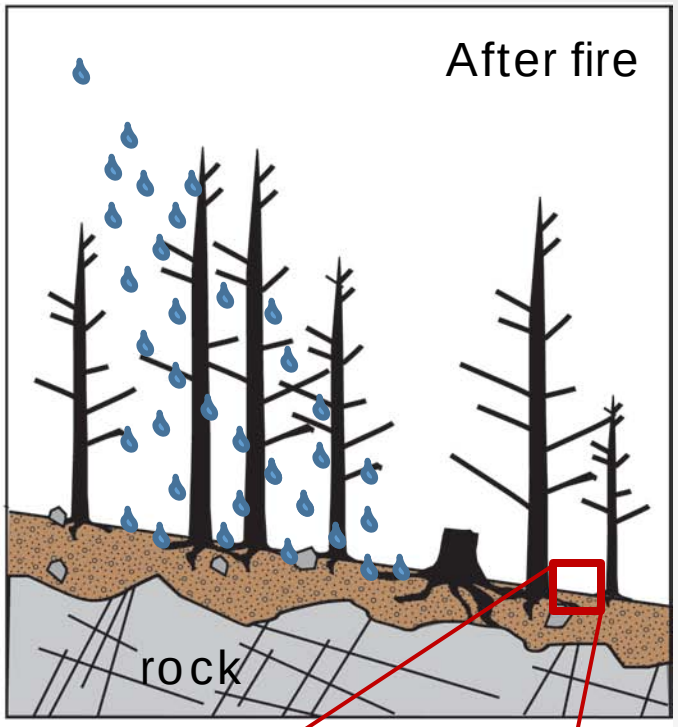
Fourmile Canyon fire, 2010, Boulder, CO

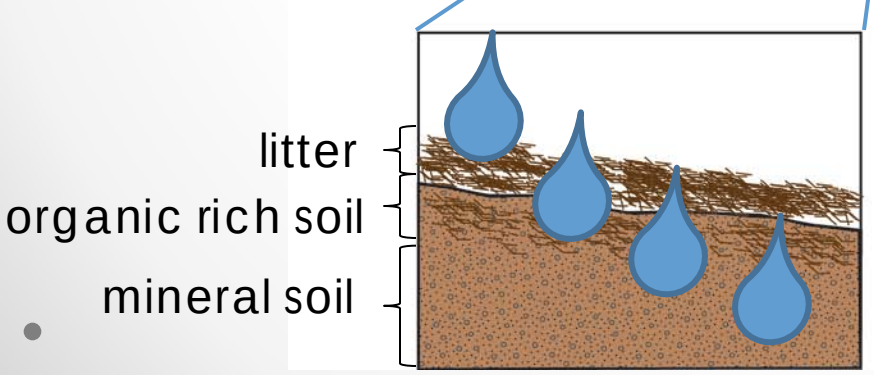
Hydrologic Impacts of Fire

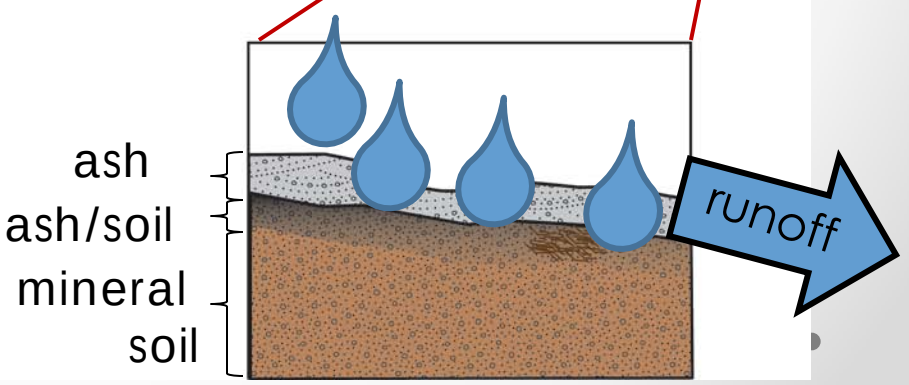
Changes

- **Interception**
  - Canopy
  - Litter/duff
- **Storage**
  - Canopy/litter
  - Soil
- **Infiltration rates**
  - Clogging
  - Structure loss
  - -Roughness
  - -Water repellent soils









Hydrologic Impacts of Fire

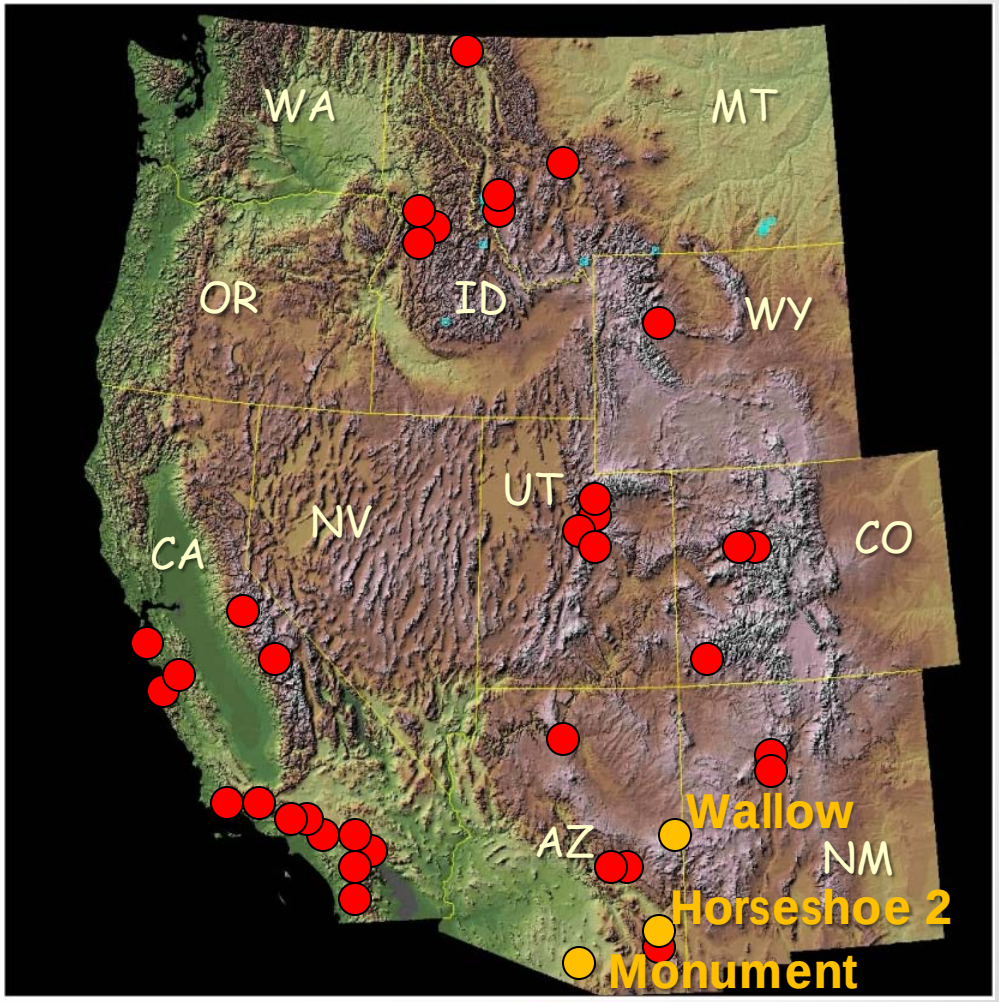
Debris flow generated through runoff-dominated erosion of material from hillslopes and channels

Debris flow!!!

Debris Flows after Fires

Steep, recently-burned hillslopes throughout the western U.S. can be susceptible to debris flows after wildfires

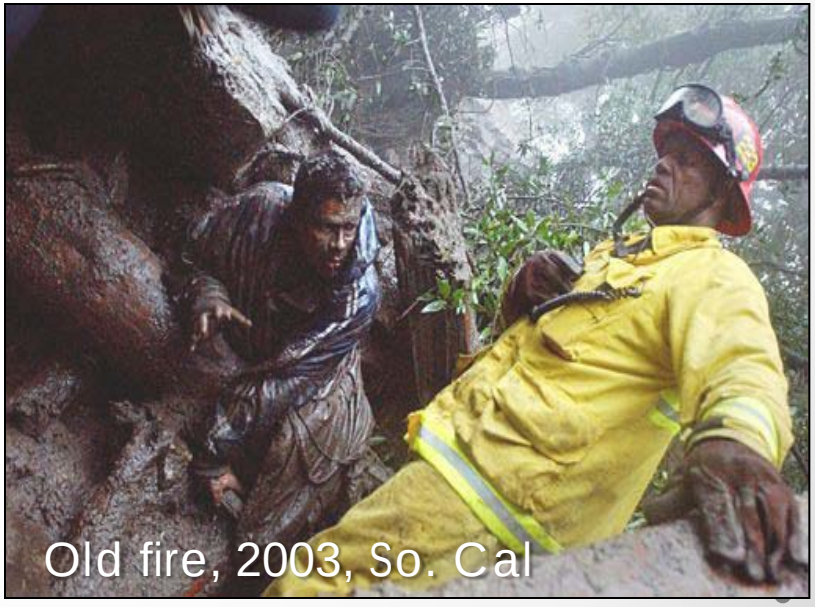
- Known post-fire debris flows
- Currently burning areas of concern



Debris Flows after Fires

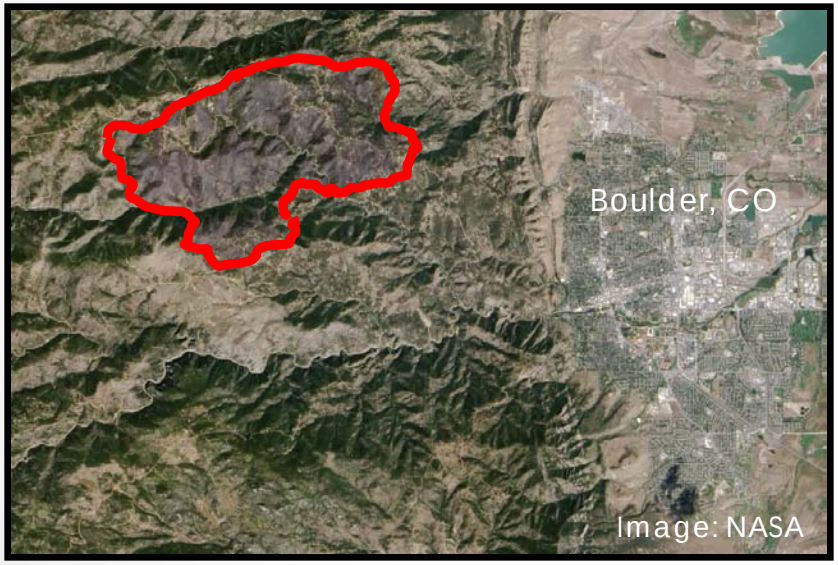
- Fast-moving
- Travel long distances from fire perimeter
- Movement difficult to control
- Triggered by very little rainfall, and often in response to the first storm after a fire
- Occur in places where they have not occurred in the past
- Pose significant hazards to life and property

Old fire, 2003, So. Cal


Old fire, 2003, So. Cal

Debris Flows after Fires

Risk is high in the intermountain west, where homes and infrastructure are scattered throughout wooded terrain in the Wildland Urban Interface (WUI)



Fourmile Canyon fire, 2010
6200 acres

1 fatality
169 homes destroyed
$314 million in losses

Debris Flows after Fires

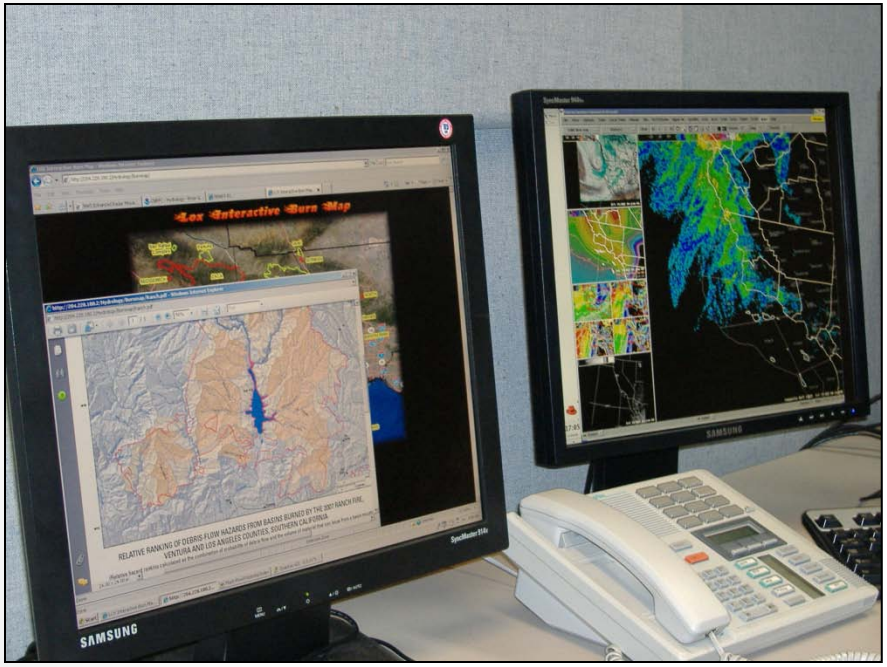
Post-fire debris-flow risk is also high in southern California, where large populations exist adjacent to steep, rugged terrain

2009 Station fire in So. Cal.

- 160,000 acres burned
- 58 homes lost in fire
- 73 homes lost to debris flows
- No human fatalities
- 1,000,000 yd^3 of sediment removed from debris basins
- Disposal = ??

Debris Flows after Fires

Joint NOAA-NWS-USGS Warning System for Post-fire Floods and Debris Flows in southern California



NWS compares rainfall forecasts, radar coverage and real-time rainfall measurements with USGS information to issue Watches and Warnings

Watches and Warnings are issued to the public, media, emergency-response agencies, flood control districts, public works departments, etc.

Debris Flows after Fires

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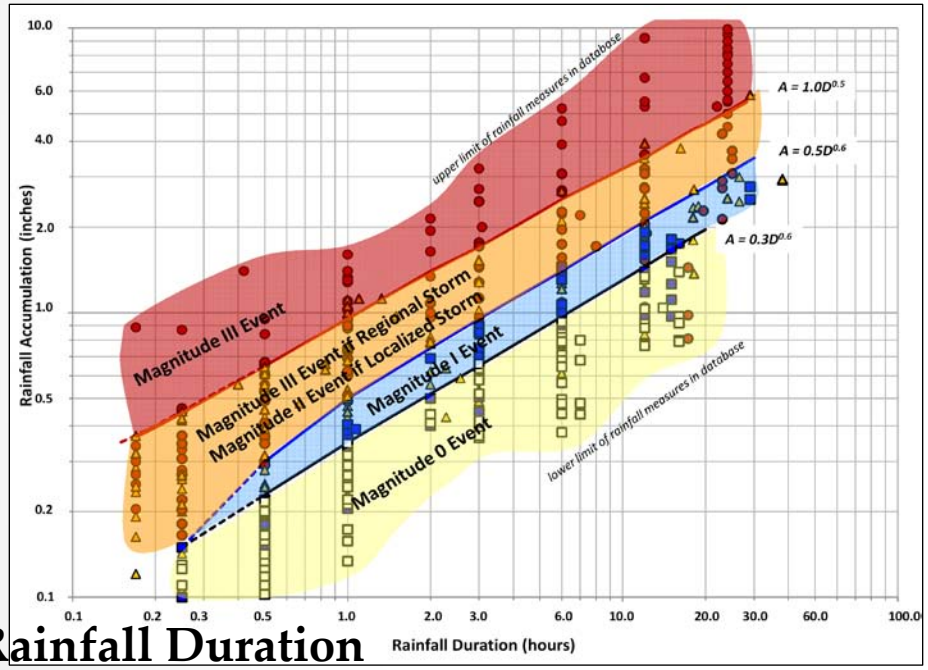

USGS-defined rainfall intensity-duration thresholds for different magnitude debris flows, San Gabriel Mountains, southern California

USGS provides information on triggering rainfall conditions, hazard maps, and field instrumentation

Triggering Rainfall: Used by NWS to identify when Watches and Warnings should be issued

Debris Flows after Fires

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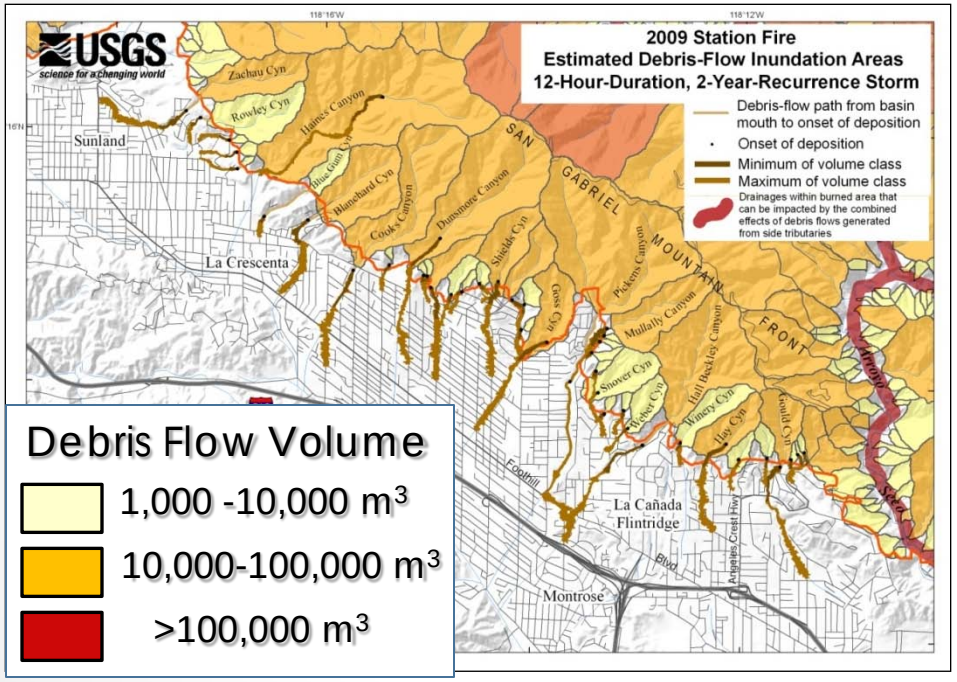


USGS post-fire debris-flow hazards map for portion of the Station fire, San Gabriel Mtns, southern California.

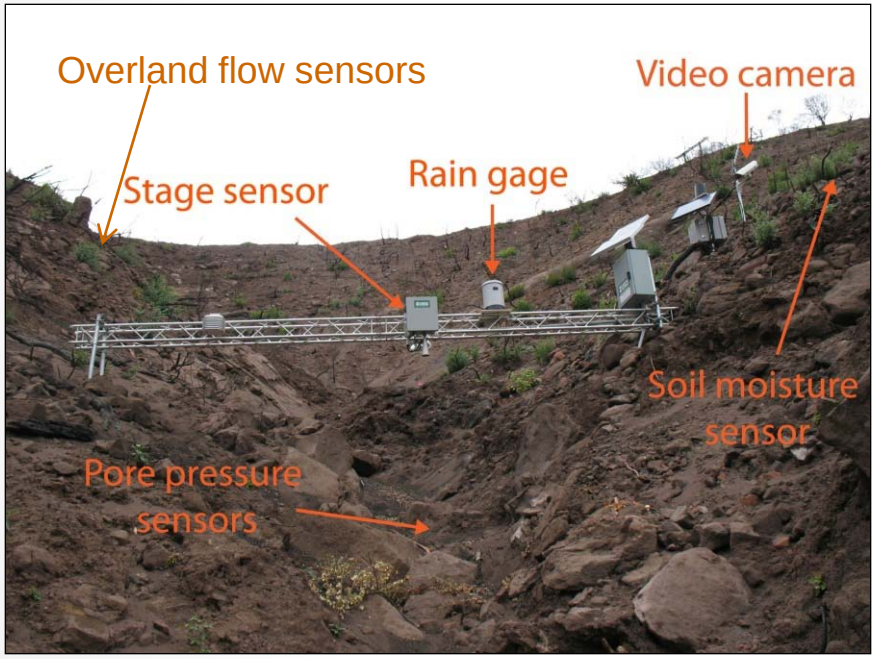
Hazard maps:

- Probability of debris flow
- Volume of debris flow
- Area inundated by estimated volume

Used by NWS to identify specific areas of high hazard in Watch and Warning statements

Debris Flows after Fires

Joint NOAA-NWS-USGS Warning System for Post-fire Floods and Debris Flows in southern California



Near- real time USGS monitoring array in the area burned by the Station fire, San Gabriel Mtns, southern California.

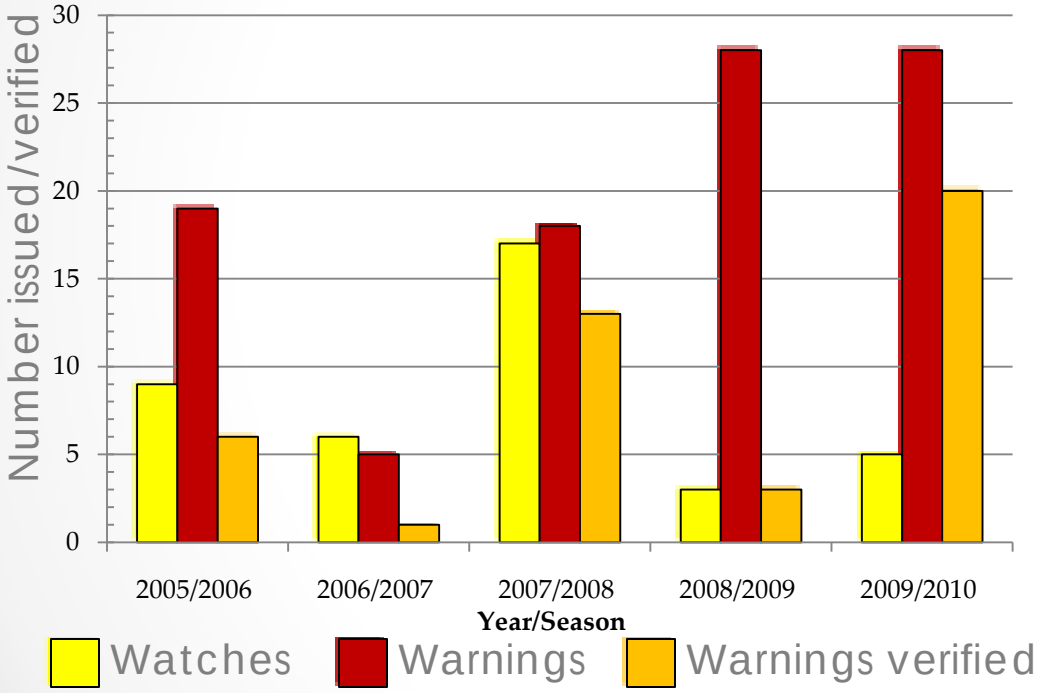
Field Instrumentation:

- Identifies and quantifies physical response within burned areas
- Provides critical information on timing and generation processes of debris flows

Used by NWS and by USGS for research project

Debris Flows after Fires

Joint NOAA-NWS-USGS Warning System for Post-fire Floods and Debris Flows in southern California

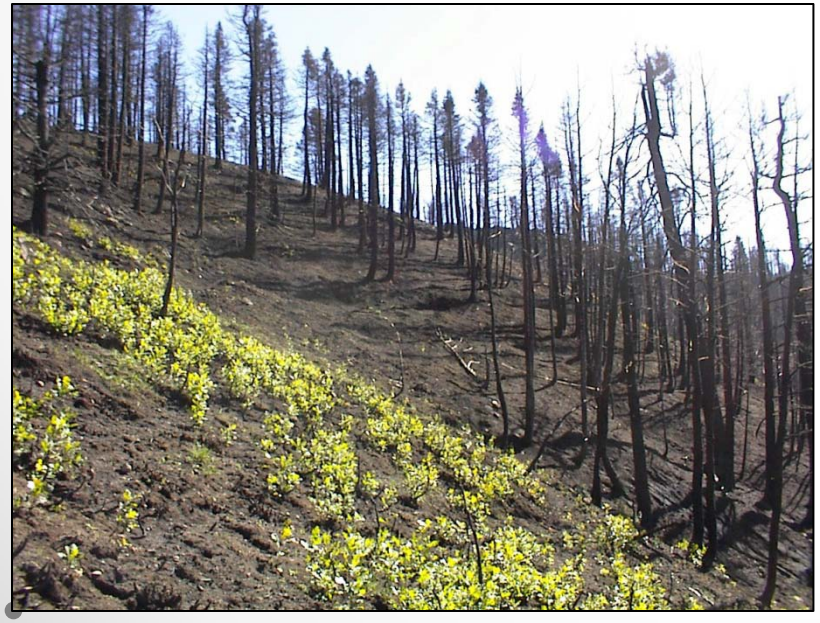


Summary of 5 years of Watches and Warnings issued for debris flows from recently burned areas in southern California

- First few years: did better with Watches than with Warnings
- 2007-08 and 2009-10: 72% Warning verification rate

Debris flows after Fires

- Pose significant hazards to life and property
- USGS has developed a four-prong hazard approach that answers fundamental predictive questions (when, where, how big and how far?)
- Are a continuing, and increasing, problem with expectation of more large fires throughout western US



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