Grizzly Creek Wildfire

Roaring Fork Conservancy, February 25, 2021

Steve Hunter, PE,PH

Presentation Outline

- 2020 Drought & Wildfire Season
- Grizzly Creek Wildfire Statistics
- Three Phases of Post Wildfire Restoration & Recovery
  - Suppression Repair
  - Burned Area Emergency Response (BAER)
  - Long-Term Restoration and Repair

  (Post Wildfire Science, Watershed Response)
- Ongoing Research, Restoration & Monitoring

2020 Drought

- Average Snowpack
- Low Soil Moisture
- Above Average Temperatures
- Below Average Precipitation
- Inactive North American Monsoon
- Colorado Recorded 3rd Warmest Summer on Record
- CA, NV, AZ, NM, UT, and CO all Recorded Warmest August on Record
- Moderate La Nina Developed in August

2020 Wildfire Season

- Colorado saw 3 of the State's largest wildfires (Megafires)
- Cameron Peak Fire – 208,913 acres
- East Troublesome Fire – 193,812 acres
- Pine Gulch Fire – 139,007 acres
- Mullen Fire - 178,878 acres (WY/CO)

Grizzly Creek Wildfire

- One the nations top priorities (critical infrastructure)
- Size: 32,631 acres
- Date: August 10, 2020
- Cause: Human
- Location: 1 mile east of Glenwood Springs, CO
- Infrastructure: Homes, I-70/CDOT, Union Pacific Railroad, Shoshone PP, Powerlines, Natural Resources, Recreation, Water Supply
- Cost: $36,000,000

Three Phases of Post Wildfire Restoration and Recovery

Suppression Repair

Accounts for all fire line activity repair including:

- Handlines
- Dozer (Cat) lines
- Staging areas
- Drop points & LZ
- Safety zones
- Camps
- Roads & Trails

Suppression Repair Impacts

- Altered drainage paths
- Loss of vegetative cover & duff
- Erosion
- Sedimentation of streams & other water bodies
- Soil compaction
- Soil contamination
- Retardant drops near/in water bodies

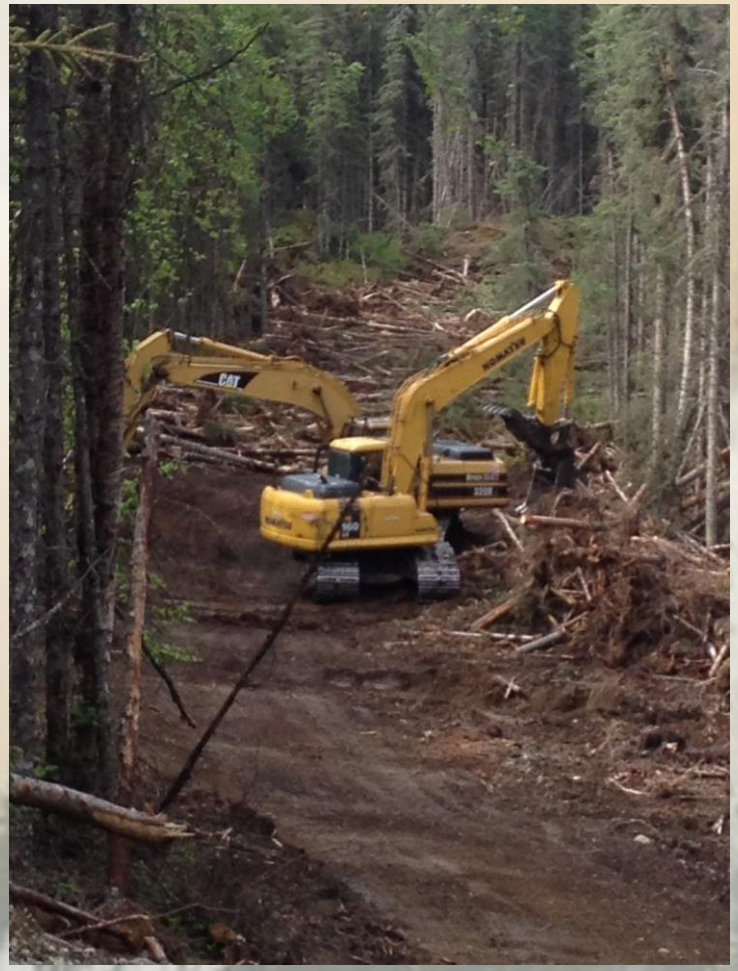
Suppression Repair Plan

- Developed by Resource Advisors (READS), agency administrators, and IMT
- Plan outlines recommendations for fire suppression, repair & rehabilitation
- READS monitor rehabilitation efforts
- READS provides guidance during the implementation of rehabilitation activities
- Coordinate with local specialists to identify potential impacts

Suppression Repair Goals

- Minimize & mitigate suppression impacts
- Minimize erosion and sediment transport
- Maintain & restore historic drainage paths
- Avoid & protect key watershed areas
- Protect, repair, and/or mitigate damage to forest infrastructure.

Suppression Repair



Burned Area Emergency Response

Burned Area Emergency Response (BAER)

A program to identify imminent post-wildfire threats to human life, safety, property, and critical natural or cultural resources on NFS lands and take immediate actions to manage unacceptable risks

When Does BAER Happen?

- Fires > 500 acres
- Critical values present (natural resources, infrastructure, etc.)
- BAER Team in place as fire is winding down, typically between 60-70% contained
- Assessment must be completed, and funding requested within 7 days after fire containment.

BAER Team

- Team Lead
- Hydrologists
- Soil Scientists
- Civil Engineers
- Biologists/Ecologists
- Archeologists
- Recreation
- GIS

BAER Process

Step 1. Identify **“Critical Values”**

Step 2. Assess for **“Threats”** to those values

Step 3. Evaluate **“Risk”**

Step 4. Develop **“Treatment Prescription”** to mitigate risk

Step 5. **“Implement”** the strategy

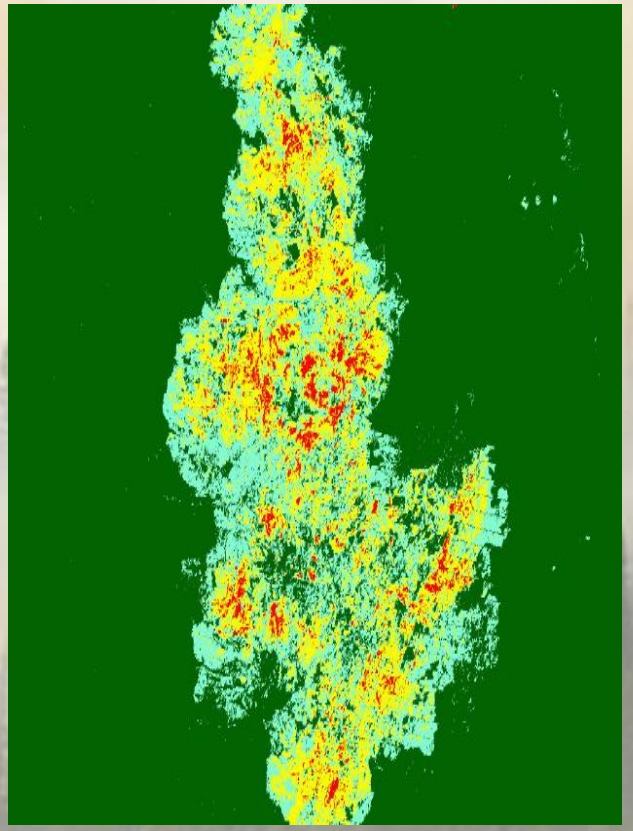
BAER Terminology

- **Critical Values:** Life & Safety, Historic or Cultural Resources, Property & Infrastructure, and Natural Resources
- **Threats & Risks:** Determined during analysis examples include flooding, erosion, sediment, debris flows, invasive plant communities

Probability of Damage or Loss	Magnitude of Consequences		
	Major	Moderate	Minor
	RISK		
Very Likely	Very High	Very High	Low
Likely	Very High	High	Low
Possible	High	Intermediate	Low
Unlikely	Intermediate	Low	Very Low

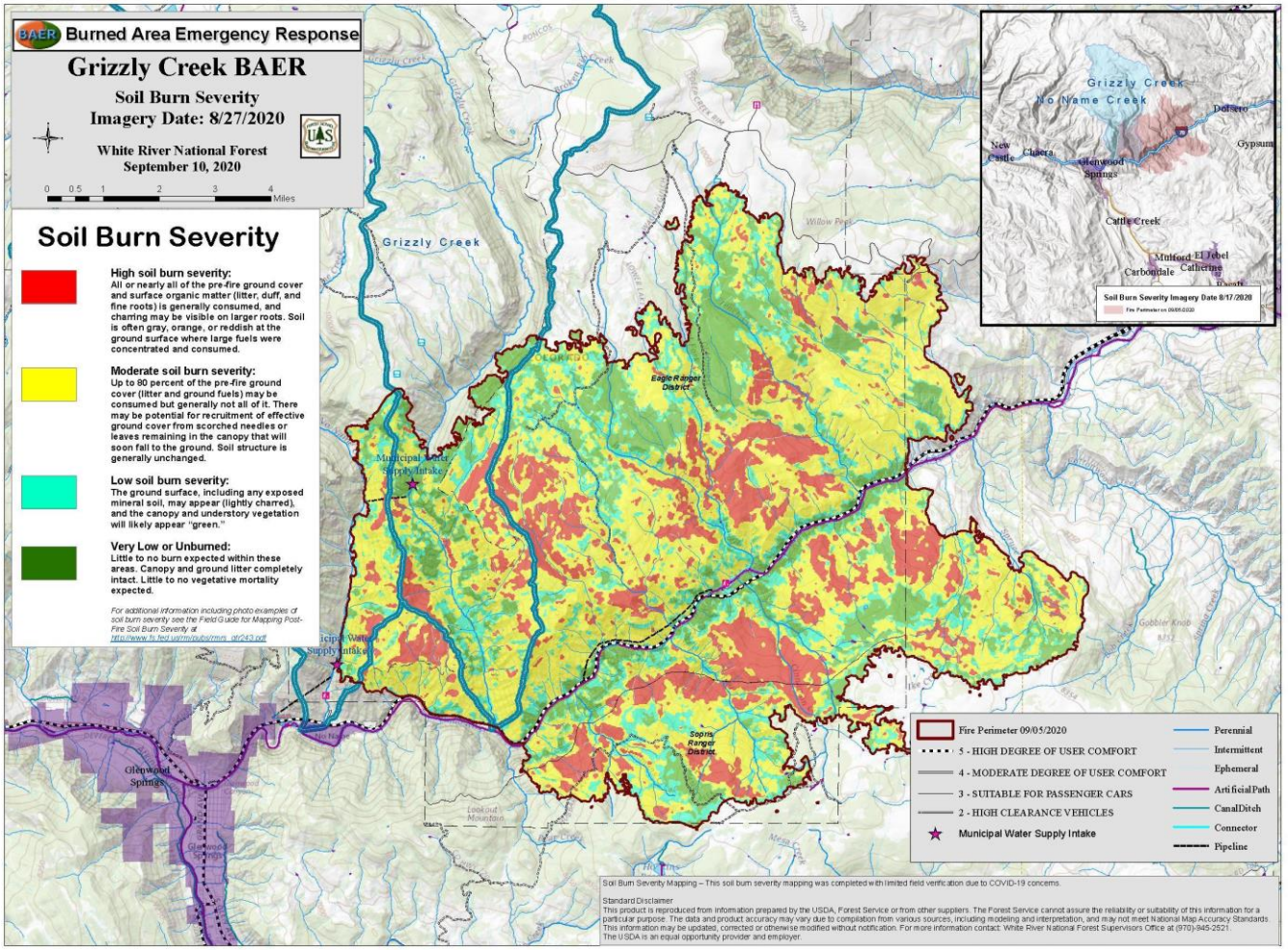
BAER Analysis

- One of the 1st BAER tasks is to create a Soil Burn Severity Map using Burned Area Reflectance Classification (BARC) data provided by the BAER imagery support program (validate)
- Identify Values at Risk (VAR)
- Hydrologic/Debris Flow Modeling
- Field Evaluations & Specialist Reports
- Treatment Recommendations



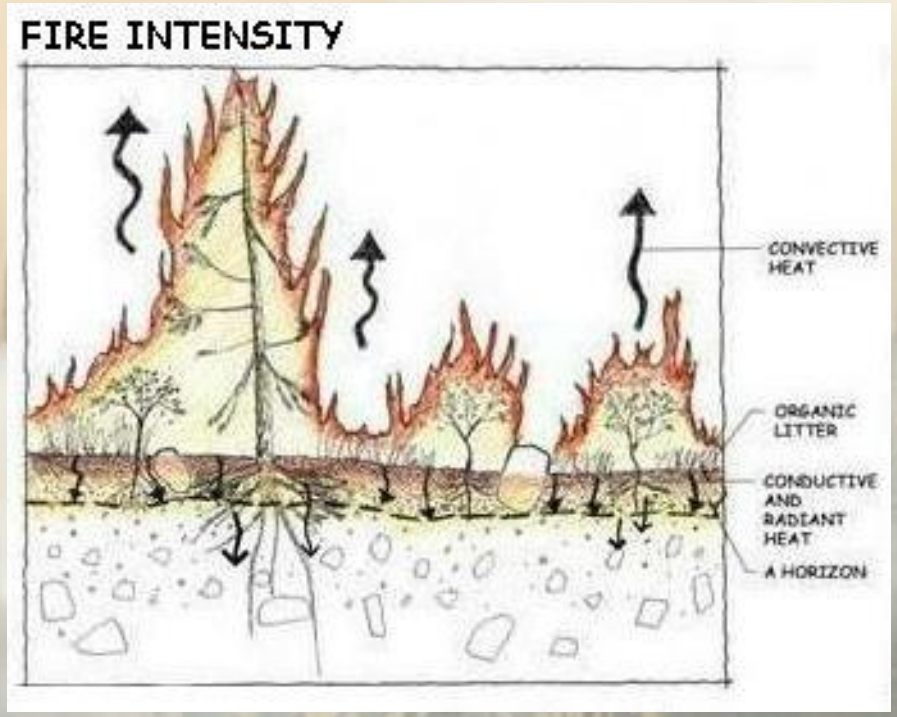
Burned Area Reflectance Classification to Soil Burn Severity

- 12% High
- 43% Moderate
- 33% Low
- 12% Unburned



Fire Intensity & Soil Burn Severity

Fire intensity = energy or heat release during the consumption of organic matter.



Does not always indicate fire effects on soils.

BAER Analysis- Soil Burn Severity

Unburned – High root density, 100% soil cover

Assessing Soil Burn Severity

High – Thick ash, surface structure destroyed, soil cover completely consumed, roots consumed

Soil Burn Severity determines

- Flood risk
- Rates of erosion
- Vegetative recovery
- Geologic response
- Threats to downstream values at risk

Hydrophobicity

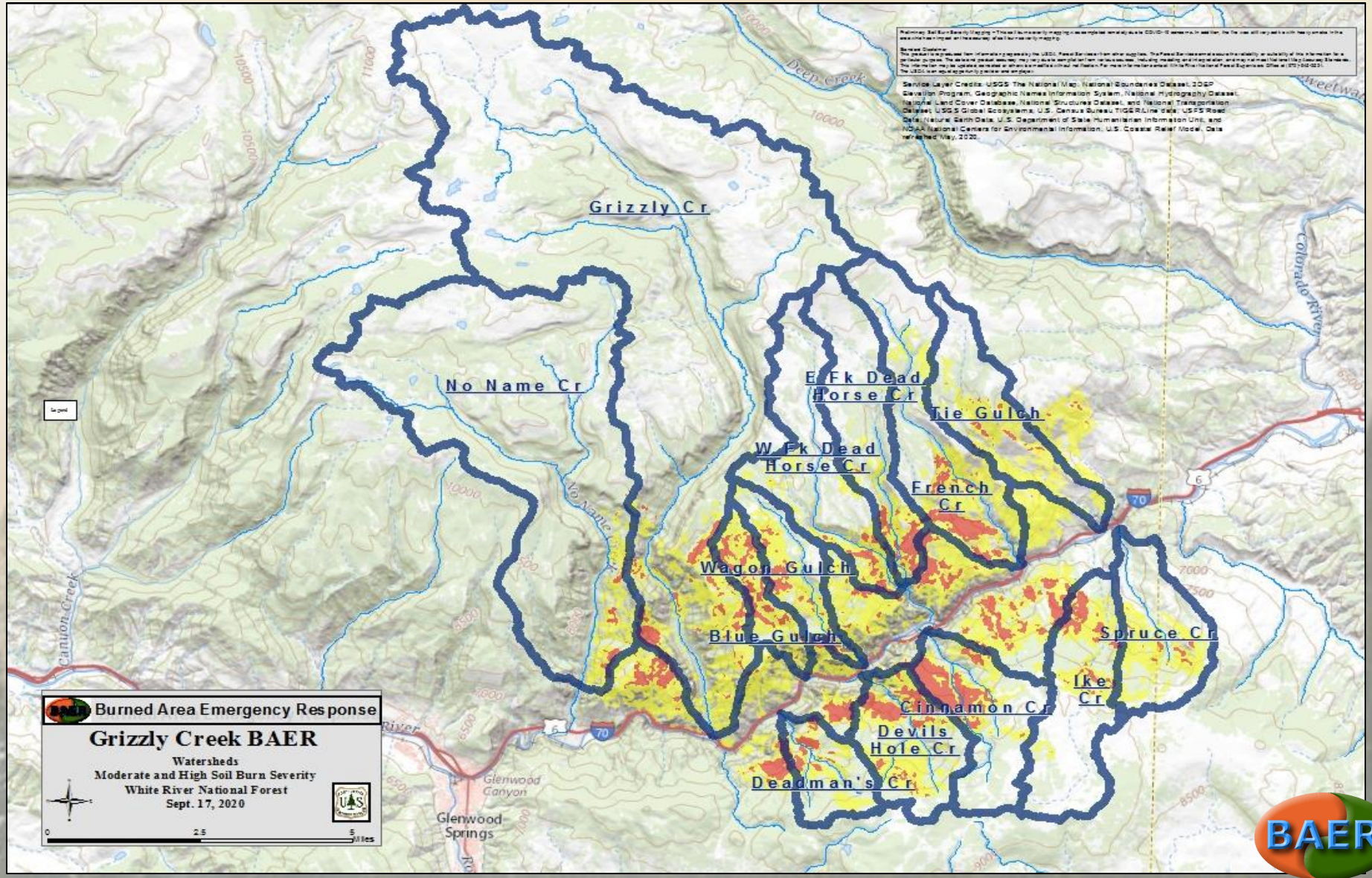
Hydrologic Modeling & Runoff

- 14 modeled watersheds
- 1,134 acres (Blue Gulch) to 24,952 acres (Grizzly Creek)
- Colorado River headwaters & tributaries
- Grizzly Creek ~ 14% Burned
- No Name Creek ~ 8% Burned
- Other catchments ~ 40% Burned

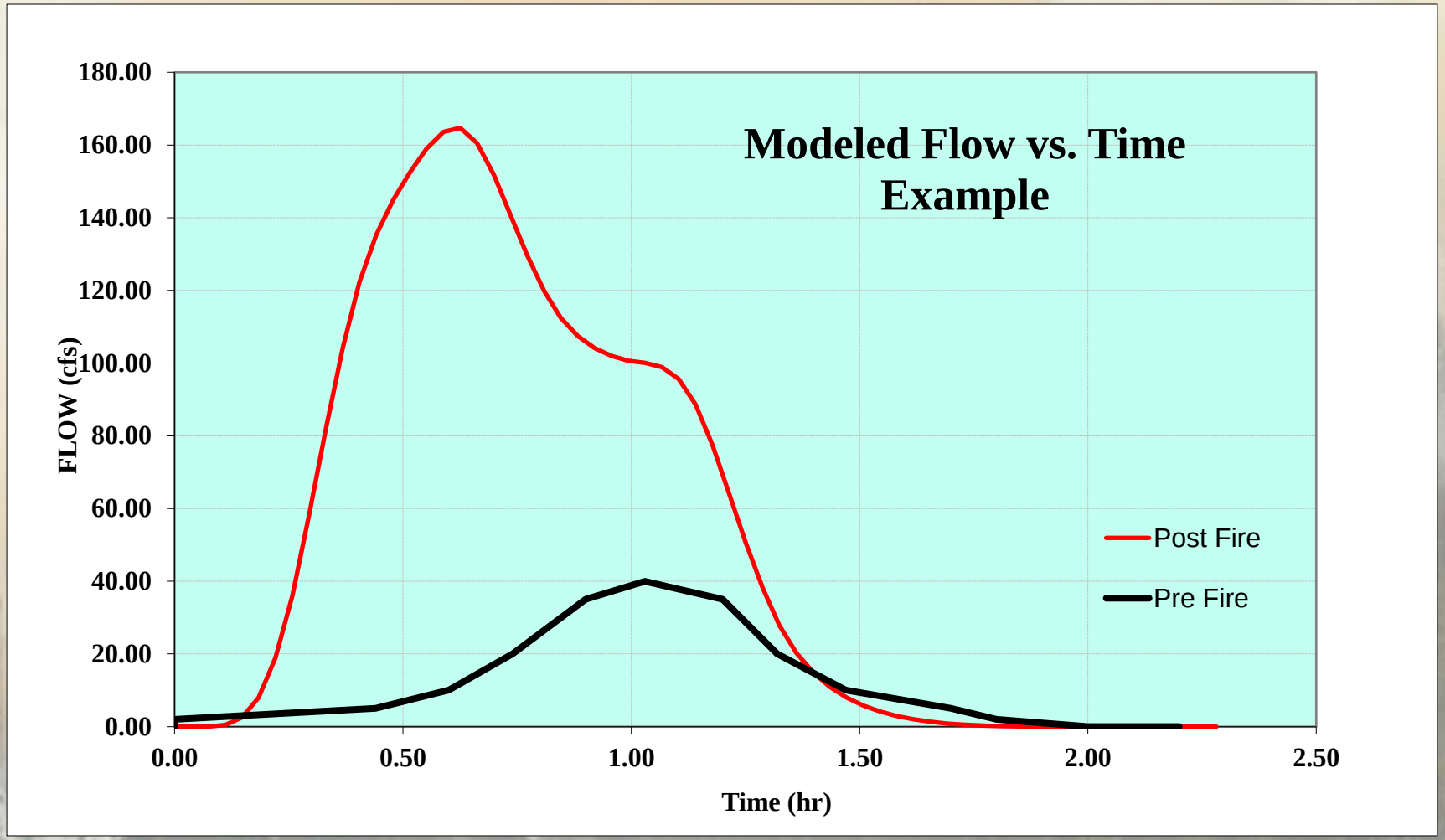
Hydrologic Modeling & Runoff

- Modeled for Snowmelt & Convective Thunderstorms of Various Durations & Intensities (2 yr. 15 & 60 min. / 5 yr. 15 & 60 min.)
- All Burned Watersheds Indicated an Increase in Post Fire Rainfall Runoff Response
- Watershed Response is Driven by Percent Burned Area in the Moderate & High Soil Burn Severity
- 2, 25, 100 Year Peak Flows Indicate Increased Volumes with Reduced Time of Concentration

Hydrologic Modeling & Runoff



Hydrologic Modeling & Runoff



BAER Implementation - Develop Response Strategy

1. Natural recovery
2. Closures/warnings
3. Treatments
   - Proven effectiveness
   - Substantially reduce risk in first year
   - Minimal action
   - Cost is economically justified
   - Can be completed before damage is expected

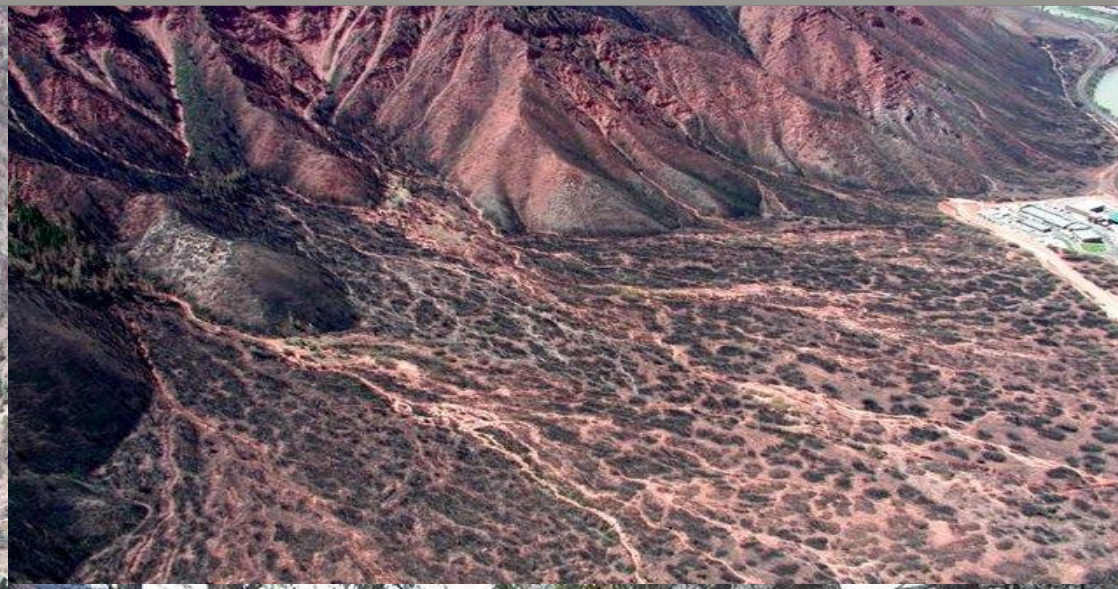
BAER Proposed Treatments

- Land Treatments – Noxious weeds/early detection/rapid response (EDRR)
- Roads & Trail Treatments –Treatments will reduce the risk of damage from elevated post-fire runoff on trails and roads by improving the number and efficiency of drainage features along segments within and below areas of moderate and high SBS
- Protection & Safety – Road & trail hazard/warning signs, recreation signs, rockfall mitigation above Hanging Lake
- Monitoring

Post-fire debris-flow potential in the area burned by the Grizzly Creek Fire, Colorado

Dennis M Staley, Jaime Kostelnik, and Jason W. Kean

U.S. Geological Survey, Golden CO USA



Key Points

1. Post-fire debris flows have been generated multiple times in this area at modest rainfall intensities.

2. The U.S. Geological Survey provides estimates of debris-flow likelihood, magnitude, combined hazard, and rainfall threshold.

3. Steep, burned watersheds in Glenwood Canyon and its tributaries, No Name Creek, and Grizzly Creek may have elevated debris-flow susceptibility for several years following wildfire.

USGS
science for a changing world

Significant Events: South Canyon fire (1994)

1 September 1994: 22:30 MDT after 3 storms in ~12 hours.

17 mm (2/3”) of rainfall over 24 hours in Glenwood Springs, much more intense rainfall in the affected watersheds.

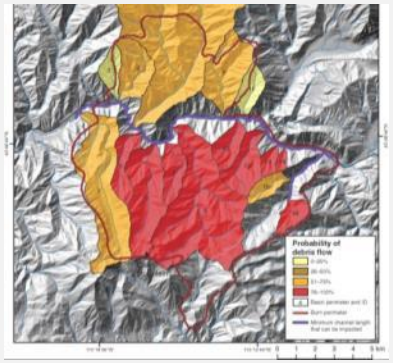
Multiple flows covered I-70, 30 cars buried

USGS science for a changing world

U.S. Geological Survey Hazard Assessment

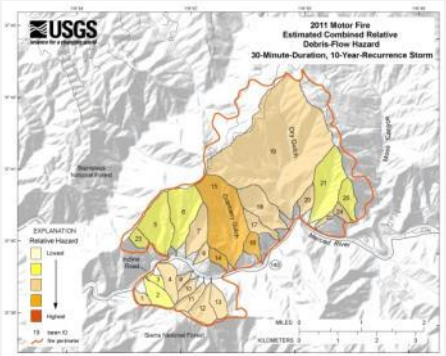
Likelihood Model

Where?



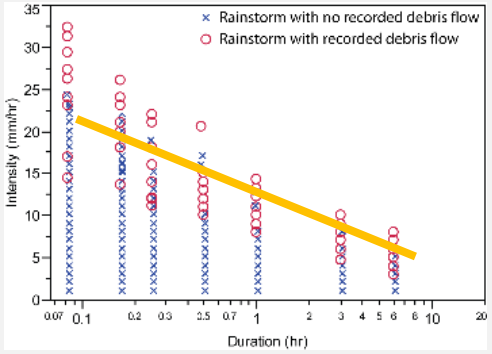
Magnitude Model

How Big?



Rainfall Thresholds

When?



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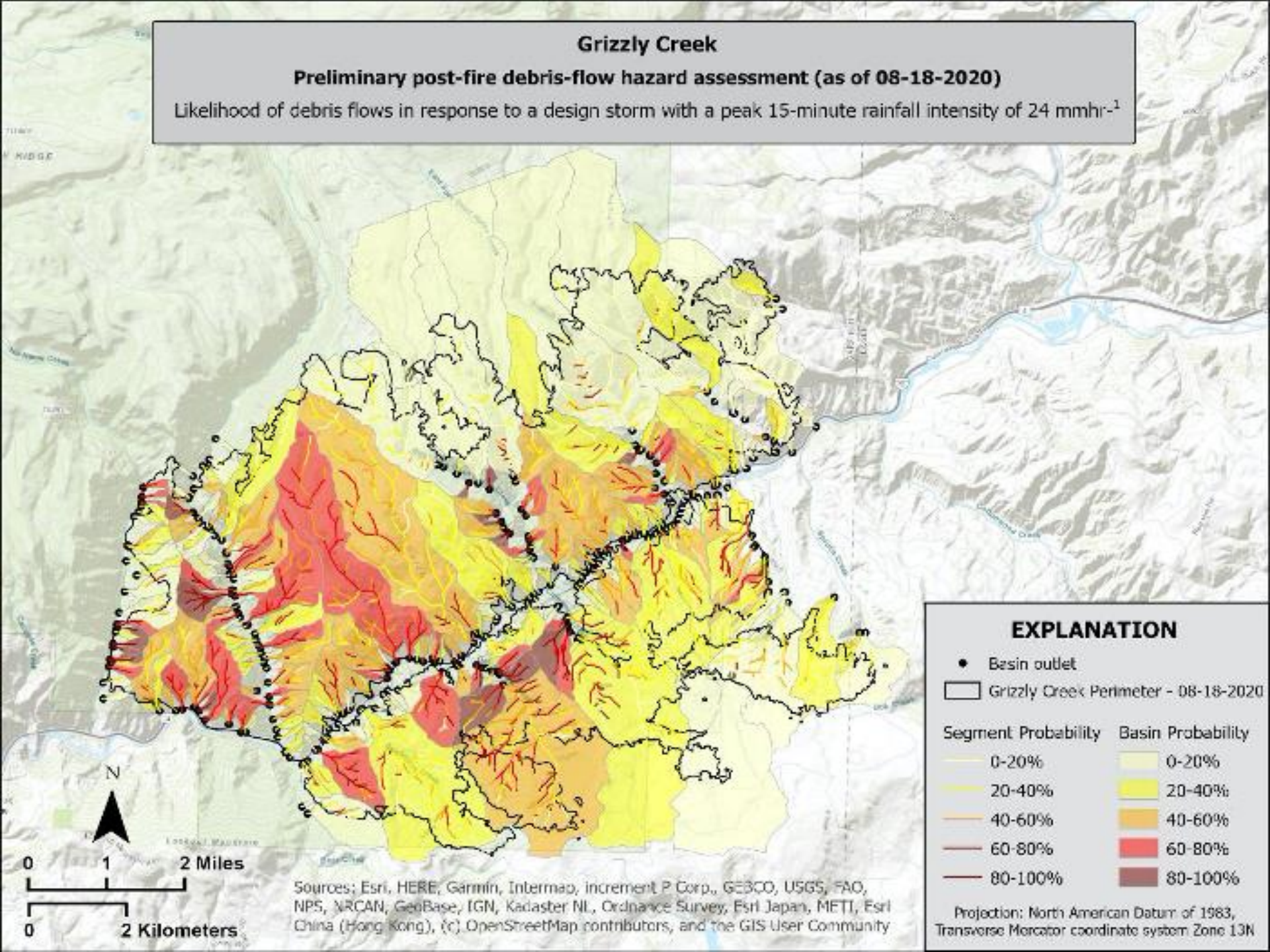
Grizzly Creek

Preliminary post-fire debris-flow hazard assessment (as of 08-18-2020)

Likelihood of debris flows in response to a design storm with a peak 15-minute rainfall intensity of 24 $mmhr^{-1}$



EXPLANATION

- Basin outlet
- Grizzly Creek Perimeter - 08-18-2020

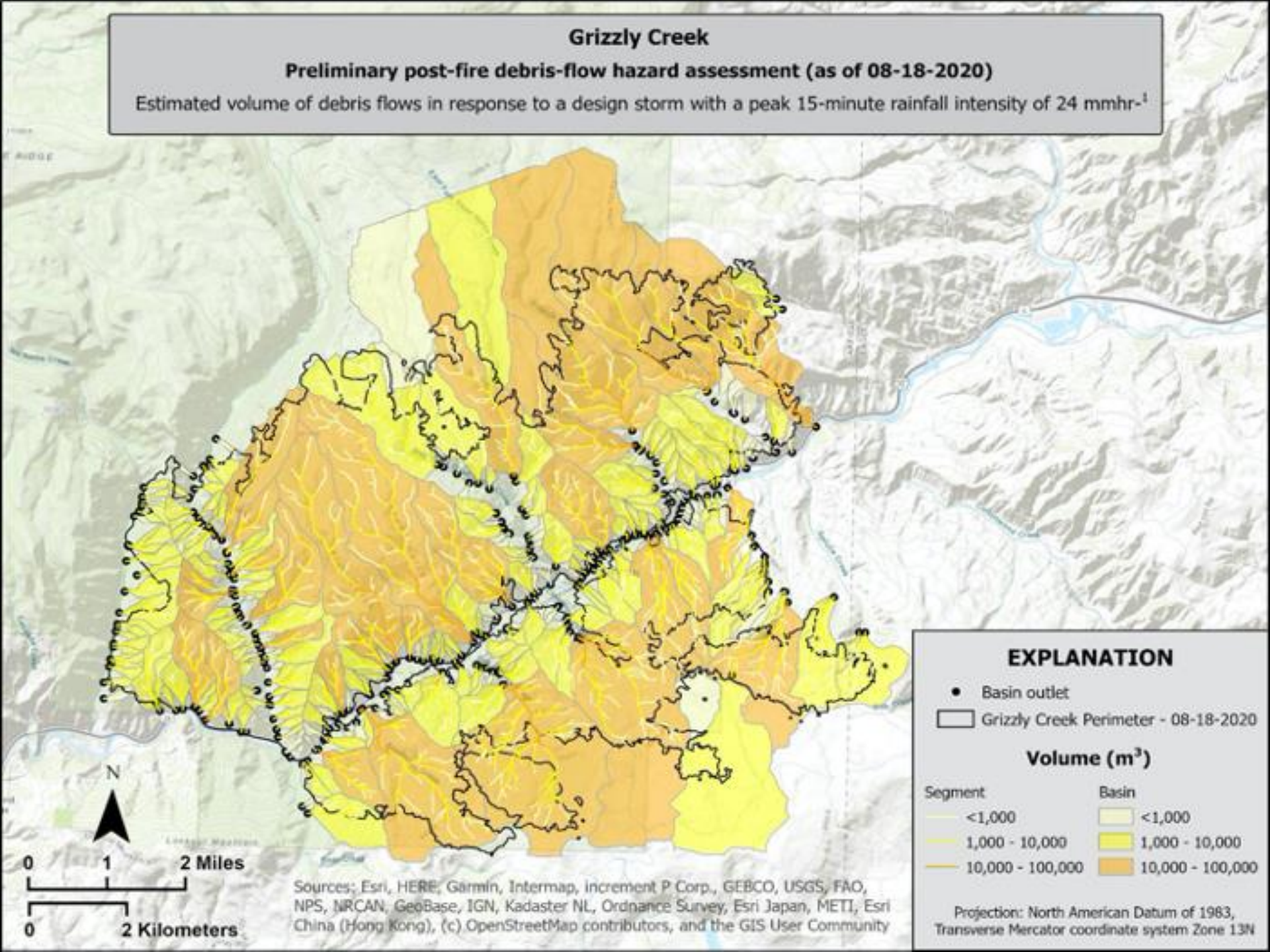
Segment Probability	Basin Probability
0-20%	0-20%
20-40%	20-40%
40-60%	40-60%
60-80%	60-80%
80-100%	80-100%

Projection: North American Datum of 1983, Transverse Mercator coordinate system Zone 13N

Grizzly Creek

Preliminary post-fire debris-flow hazard assessment (as of 08-18-2020)

Estimated volume of debris flows in response to a design storm with a peak 15-minute rainfall intensity of 24 $mmhr^{-1}$

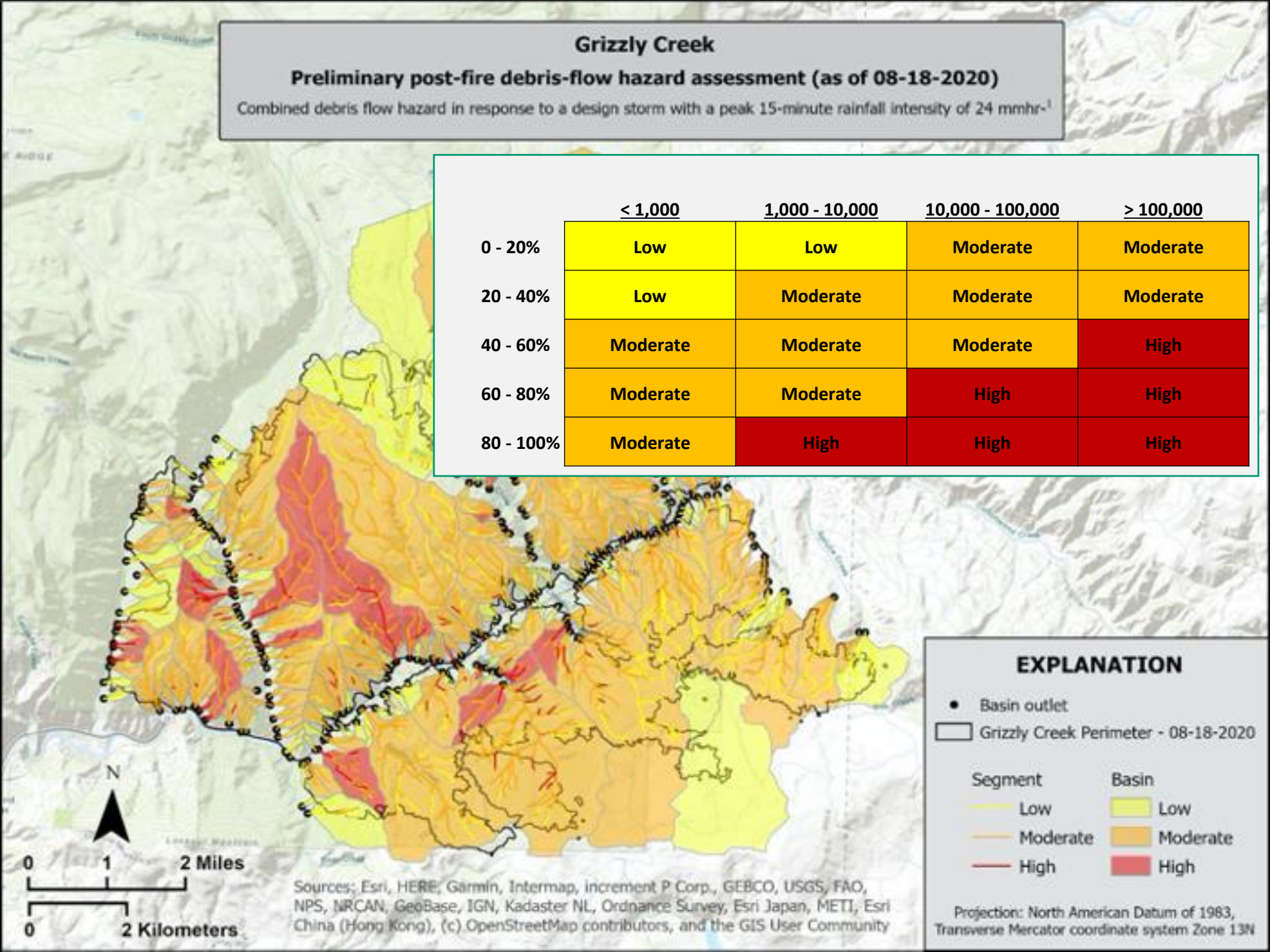


Grizzly Creek

Preliminary post-fire debris-flow hazard assessment (as of 08-18-2020)

Combined debris flow hazard in response to a design storm with a peak 15-minute rainfall intensity of 24 mmhr^{-1}

	< 1,000	1,000 - 10,000	10,000 - 100,000	> 100,000
0 - 20%	Low	Low	Moderate	Moderate
20 - 40%	Low	Moderate	Moderate	Moderate
40 - 60%	Moderate	Moderate	Moderate	High
60 - 80%	Moderate	Moderate	High	High
80 - 100%	Moderate	High	High	High



EXPLANATION

- Basin outlet
- Grizzly Creek Perimeter - 08-18-2020

Segment	Basin
Low	Low
Moderate	Moderate
High	High

Projection: North American Datum of 1983, Transverse Mercator coordinate system Zone 13N

Take Home Messages

1. Post-fire debris flows can occur within minutes of intense rain, and repeatedly after fire. Elevated hazard can persist for several years following the fire.

2. This region has a history of producing dangerous debris flows at modest (i.e. 1-year recurrence interval) rainfall intensities.

3. The U.S. Geological Survey provides estimates of debris-flow likelihood, potential magnitude, and rainfall threshold to collaborators in order to improve situational awareness and reduce public risk. Data are/will be available at: ftp://ftpext.usgs.gov/pub/cr/co/golden/Staley/GrizzlyCreek/ and https://landsides.usgs.gov/hazards/postfire_debrisflow/

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Additional Post Wildfire Resources

COLORADO EWP

Emergency Watershed Protection Program

The EWP progam is managed and administered by USDA's Natural Resources Conservation Service (NRCS) and is designed to relieve imminent hazards to life and property caused by hurricanes, floods, fires, windstorms, and other natural disasters.







NRCS

USDA is an equal opportunity employer, provider, and lender.

September 2020

Who Does EWP Help

- EWP applies to all non-Federal lands (private property, state, municipal, & tribal lands)- Utilized by Town of Basalt for Lake Christine Wildfire & City of Glenwood Springs for Grizzly Creek Wildfire
- EWP requires local eligible sponsor
- Eligible sponsors include:
  - ✓State & local Governments
  - ✓Indian tribes & tribal Organizations
  - ✓Other special government entities

EWP Provides

- 75% of Construction Costs
- Technical Assistance
  - ✓Planning & Environmental Compliance
  - ✓Project Design
  - ✓Construction Management & QA

Typical Recovery Measures

- Upland Erosion Control
- Flood Diversions
- Structure Protection
- Sediment Control
- Debris Removal
- Streambank Protection

Long-term Restoration
Managing for Natural Recovery

USFS Monitoring

- Stream Health
- Soil Health and Recovery
- Grass and Forb Communities
- Invasive Vegetation
- Trail/Road Conditions
- Ecosystem Health

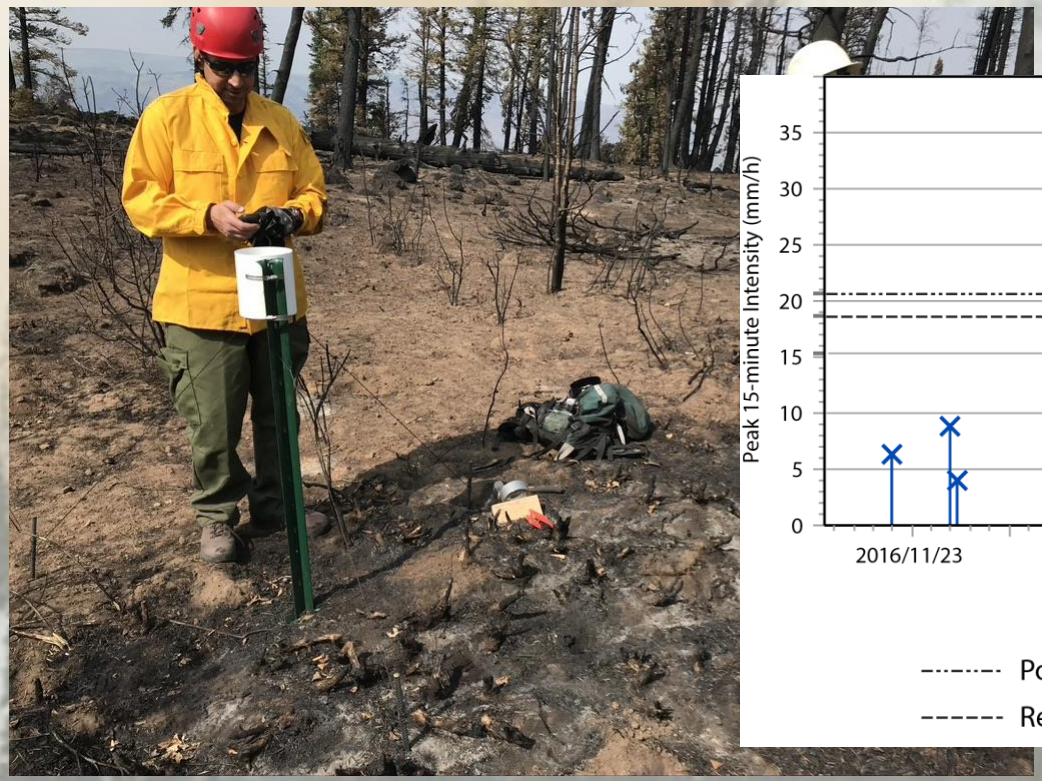
Research

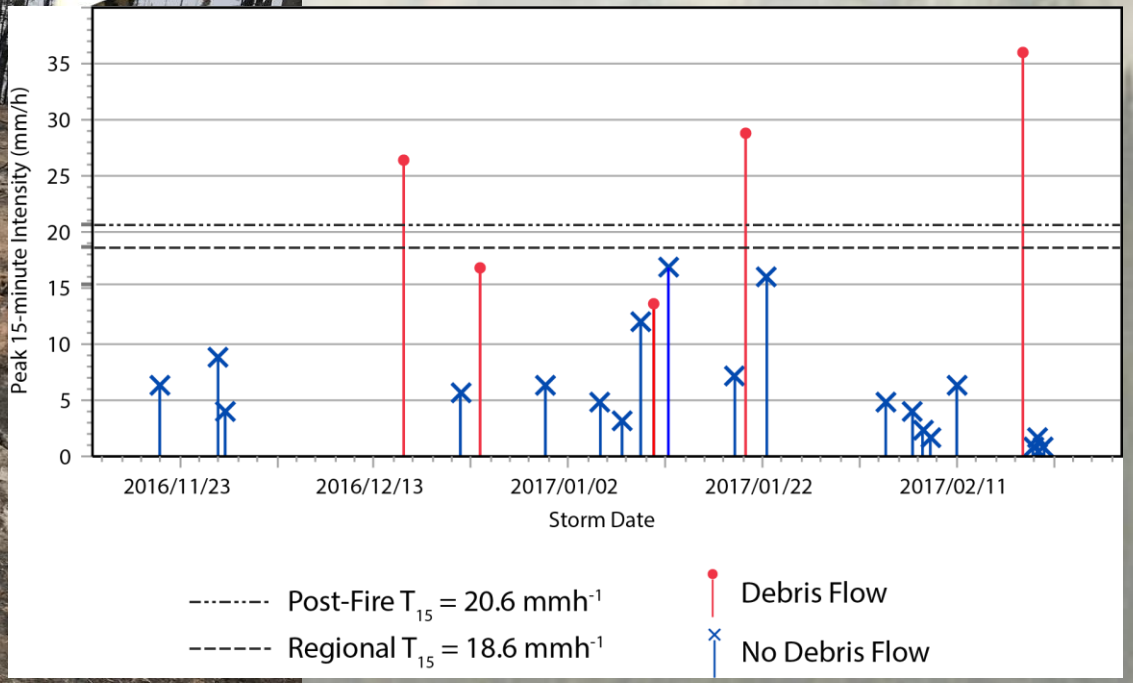
- US Geological Survey – Landslides Hazards Program, Golden, Colorado

- Utah State University – Utah Water Research Laboratory, Logan, Utah

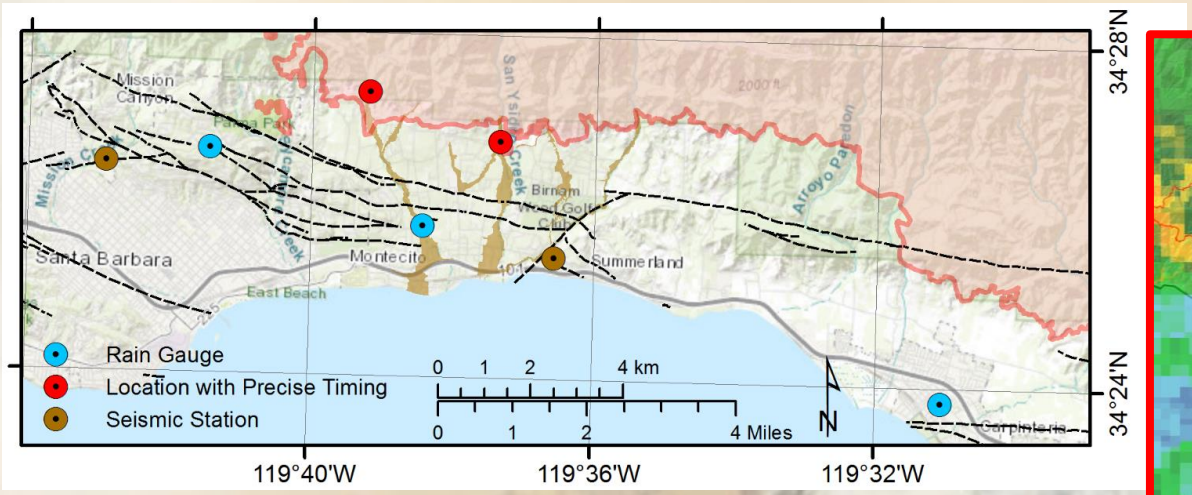
USGS Research

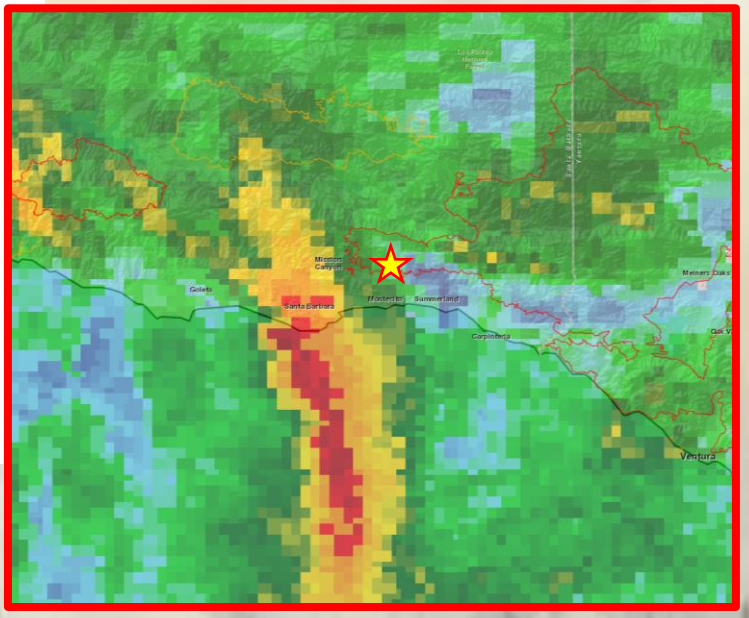
Monitoring for early warning support and advancement of post-wildfire debris flow science





Advanced EWS: Monitoring, Forecasting and Prediction





Threshold Duration (min)	Threshold Intensity (mmh^{-1})
15	21.8
30	16.3
60	12.4

"An integrated system of:

- ***Hazard monitoring, forecasting and prediction,***
- ***Disaster risk assessment,***
- ***Communication and preparedness activities, systems and processes***

that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events."

Utah State Researchers

Monitoring and modeling watershed-scale post-wildfire streamflow response through space and time

- Improve Understanding & Prediction of Post-Wildfire Rainfall-Runoff Responses Across a Watershed
- Explore Fundamental Hydrologic Processes after a Wildfire
- Model & Assess Post-Wildfire Sediment Dynamics

Research Questions

- Q1. How does the post-wildfire rainfall-runoff response vary across a burned watershed?
- Q2. How does the at-a-site rainfall-runoff response evolve through time, beginning immediately following an upstream wildfire?
- Q3. What underlying scale-dependent watershed and burn characteristics affect the response in both space and time?

Summary

- Grizzly Creek Fire affected many people and communities
- Many of those are working on post-fire efforts
- Burn scar may produce flash flooding, debris flows and rockfall in the coming years
- This was not inclusive all the work that is occurring and will continue to occur on this fire

Special Thanks

- Firefighters & Support
- Liz Roberts - WRNF
- Michael Braudis – WRNF
- Jim Genung – UCR FIRE
- Cara Farr - USFS
- Dennis Staley – USGS
- Stephen Jaouen – NRCS
- Belize Lane – USU
- Haley Canham - USU

Questions?