California
Department of Conservation

California Geological Survey Studies

August 2, 2022

Briefing to the Effectiveness Monitoring Committee

California
Department of Conservation

California Geological Survey Studies

EMC-2016-003

Lidar Differencing Eldorado National Forest and Nearby Private Lands

Current Participants and Investigators

- Bill Short
- Matt O’Connor
- Michael Fuller
- Peter Roffers

Except Matt O’Connor, all participants are staff of the California Geological Survey, Department of Conservation

Acknowledgements

- Effectiveness Monitoring Committee
- Eldorado National Forest
- The Sierra Nevada Conservancy
- CalFire via Climate Change Investments
- US Geological Survey

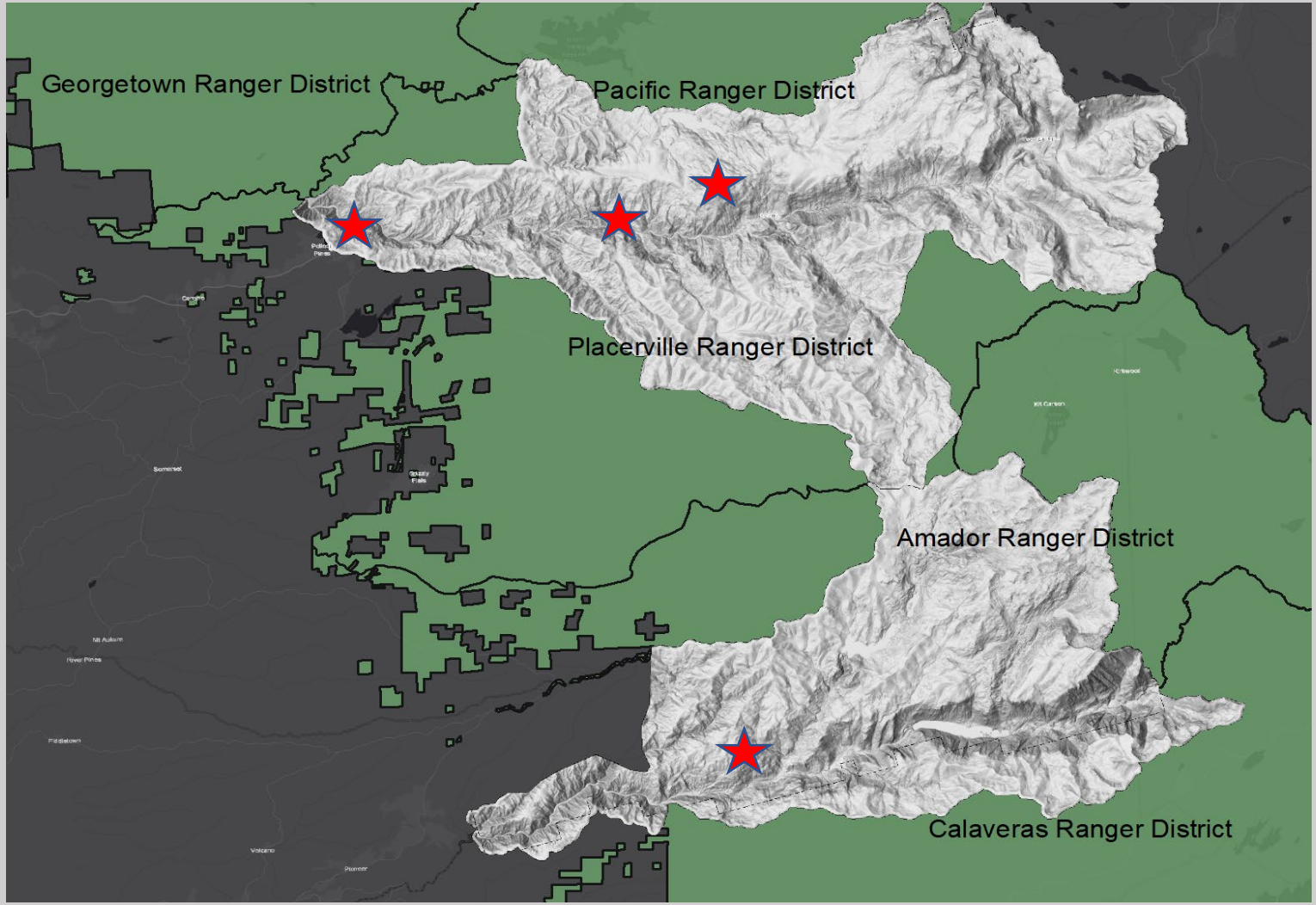
Broad Purpose

- Be prepared to conduct an efficient and unbiased study of erosion during a future regionally significant disturbance across timberlands.
  - Test multitemporal lidar as a study method
  - Develop technical capacity
  - Realistic expectations
  - Define necessary technical specifications for post-event lidar

Advantages over Alternate Approaches

- Consistent identification of unstable areas across a landscape
- Reduced sample bias due to access factors
- Improved detection across visibility factors
- Explanatory variables can be evaluated statistically
- Patterns of land use, ownership, and natural phenomena can be evaluated separately
- Improved resolution & consistency in delineating landslide activity

Location


Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Amador Ranger District
Calaveras Ranger District

Current & Pending Activities

- Lidar differencing
- Field sites selection
- Analyses
- Conference presentation

Current & Pending Activities

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Abstract #383259

STORM INDUCED MASS WASTING ON DISTURBED SLOPES ACROSS A THIRTY-FOUR YEAR TIMELINE

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Over decades, the Eldorado National Forest landscapes have experienced multiple disturbances including numerous events of wildfires, flooding, atmospheric river drenching, and rapid snowmelt which have promoted landslide activity over a palimpsest of forest management activities and post-fire recovery.

Eldorado Study Goals

- Improve our technical understanding of the requirements, limitations, and advantages of comparing a time-series of lidar data which…
- may serve as an important remote-sensing tool used in landscape-scale effectiveness monitoring studies

Eldorado Study Relevance

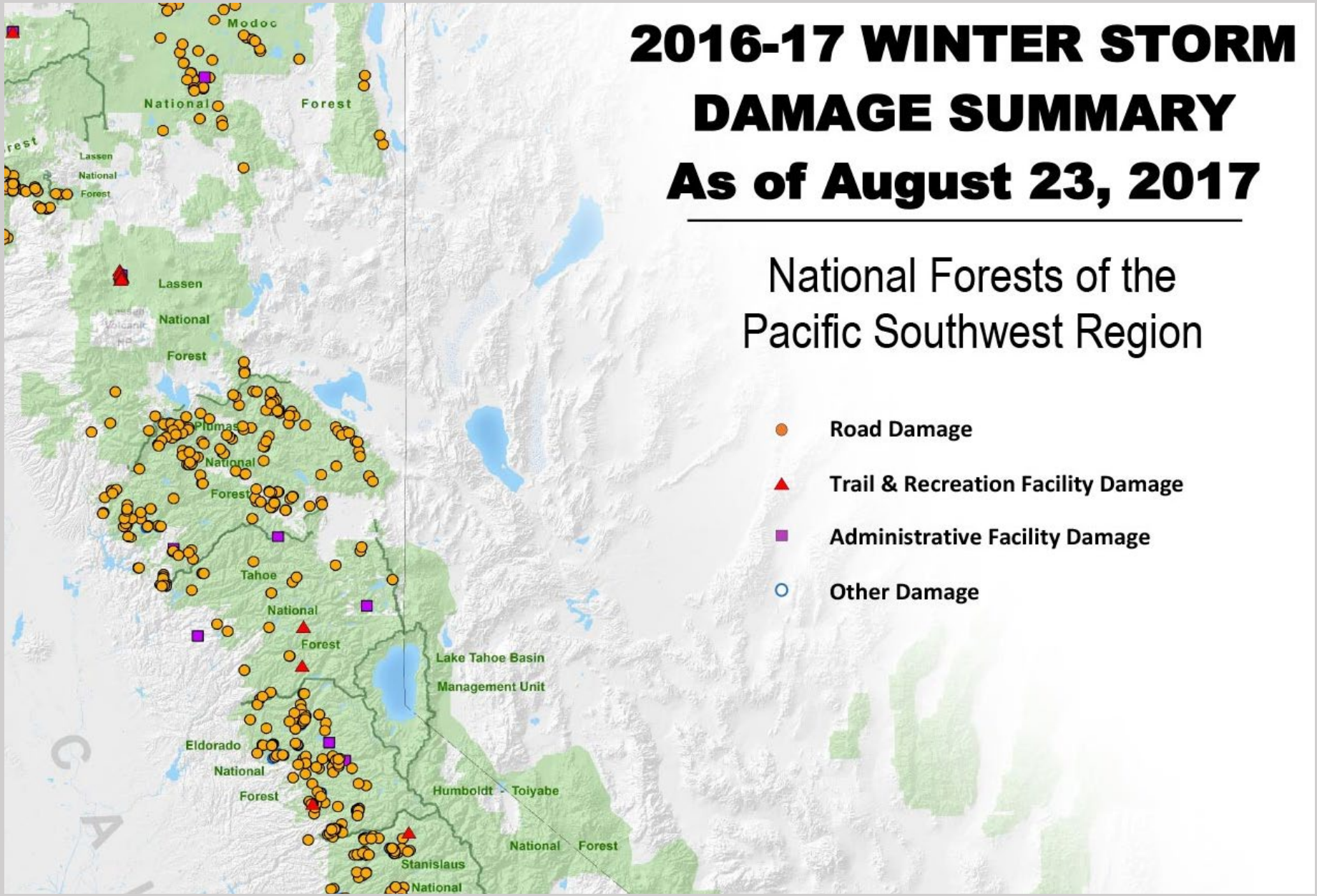
- Improve understanding of potential long-range effects of climate change, drought, forest health and increased wildfire severity
  - by including these factors as potential stressors that may influence accelerated mass wasting rates across managed timberlands.
- Declining forest health (tree mortality or reduced vigor in response to drought, disease, and insect infestation) may increase the potential for slope instability
  - due to a reduction in root reinforcement and reduced evapotranspiration.

Eldorado Study Relevance

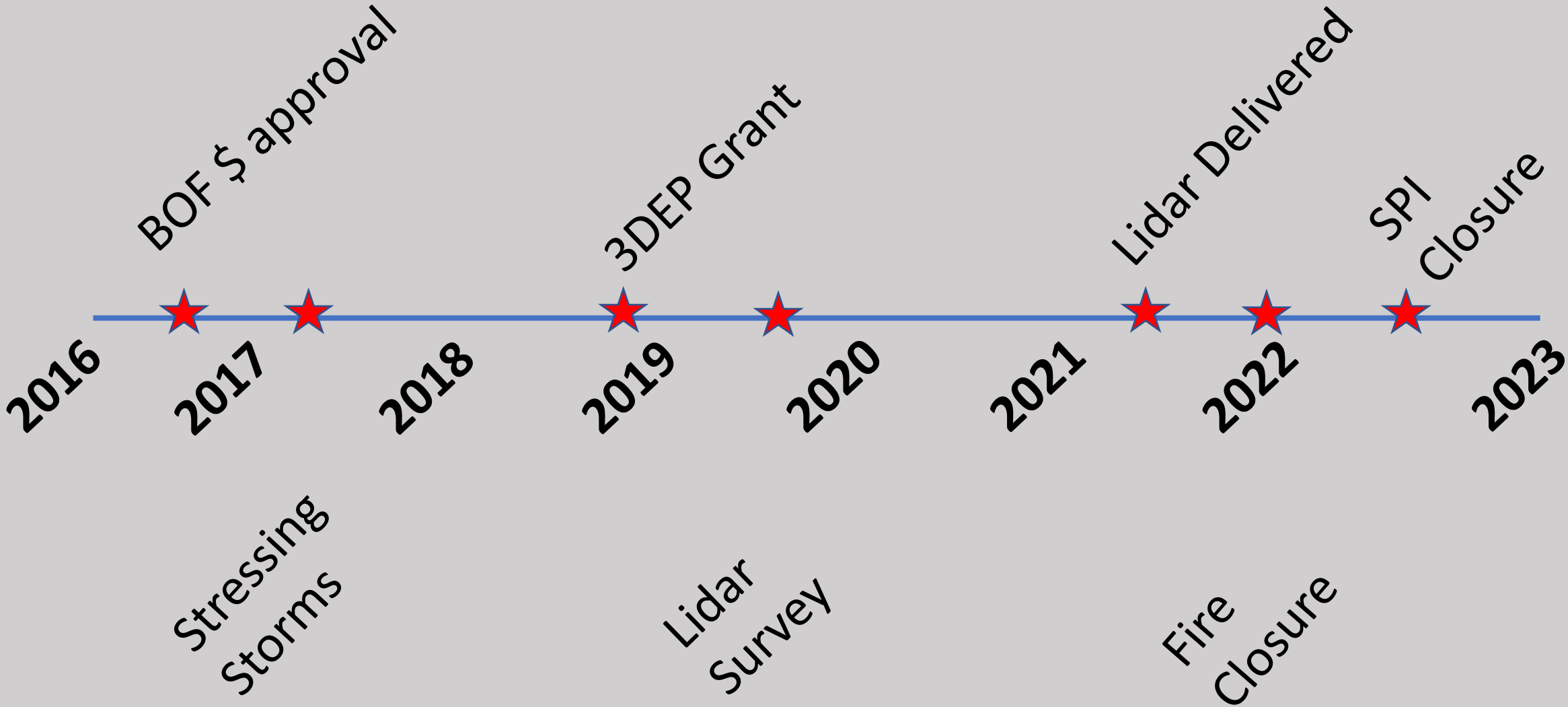
- As a result, elevated soil moisture may increase the likelihood of a triggering event.
- Similarly, wildfire is expected to increase the potential for landslides. Landscape response to wildfire would also provide an opportunity to evaluate the effectiveness of site-specific protection measures
  - implemented within fire-scarred WLPZs and logging areas to promote slope stability, reduce sediment delivery to channels, and promote LWD delivery to channels.

Background

- Varied disturbance timeline
- Regional storm damage in 2017
- 4-year span of before & after lidar


2016-17 WINTER STORM
DAMAGE SUMMARY
As of August 23, 2017
National Forests of the
Pacific Southwest Region
Road Damage
Trail & Recreation Facility Damage
Administrative Facility Damage
Other Damage
Modoc
National
Forest
Lassen
National
Forest
Plumas
National
Forest
Tahoe
National
Forest
Lake Tahoe Basin
Management Unit
Eldorado
National
Forest
Humboldt - Toiyabe
National Forest
Stanislaus
National

Timeline


BOF $ approval
3DEP Grant
Lidar Delivered
SPI Closure
2016
2017
2018
2019
2020
2021
2022
2023
Stressing Storms
Lidar Survey
Fire Closure

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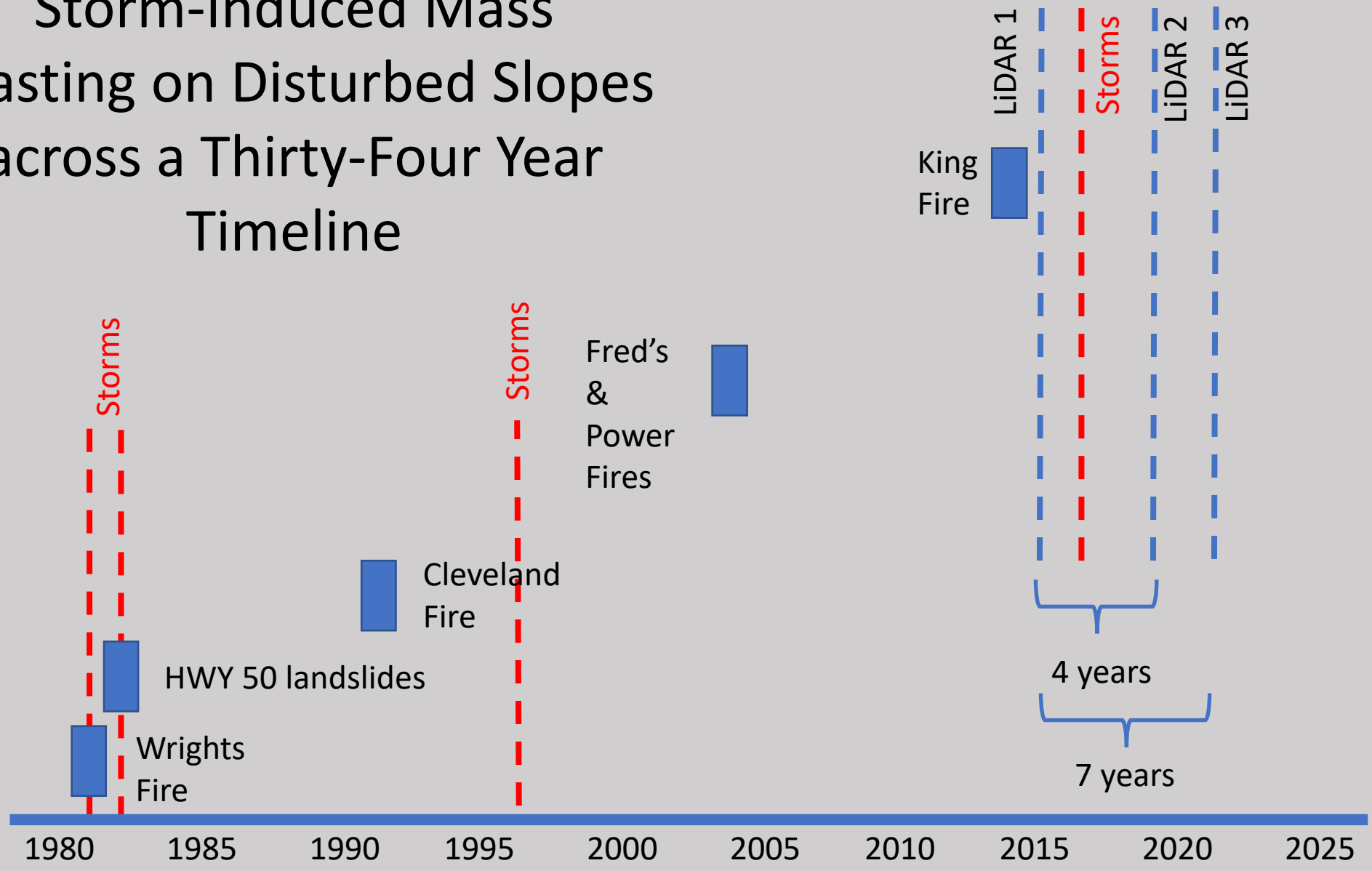
Storm-Induced Mass Wasting on Disturbed Slopes across a Thirty-Four Year Timeline



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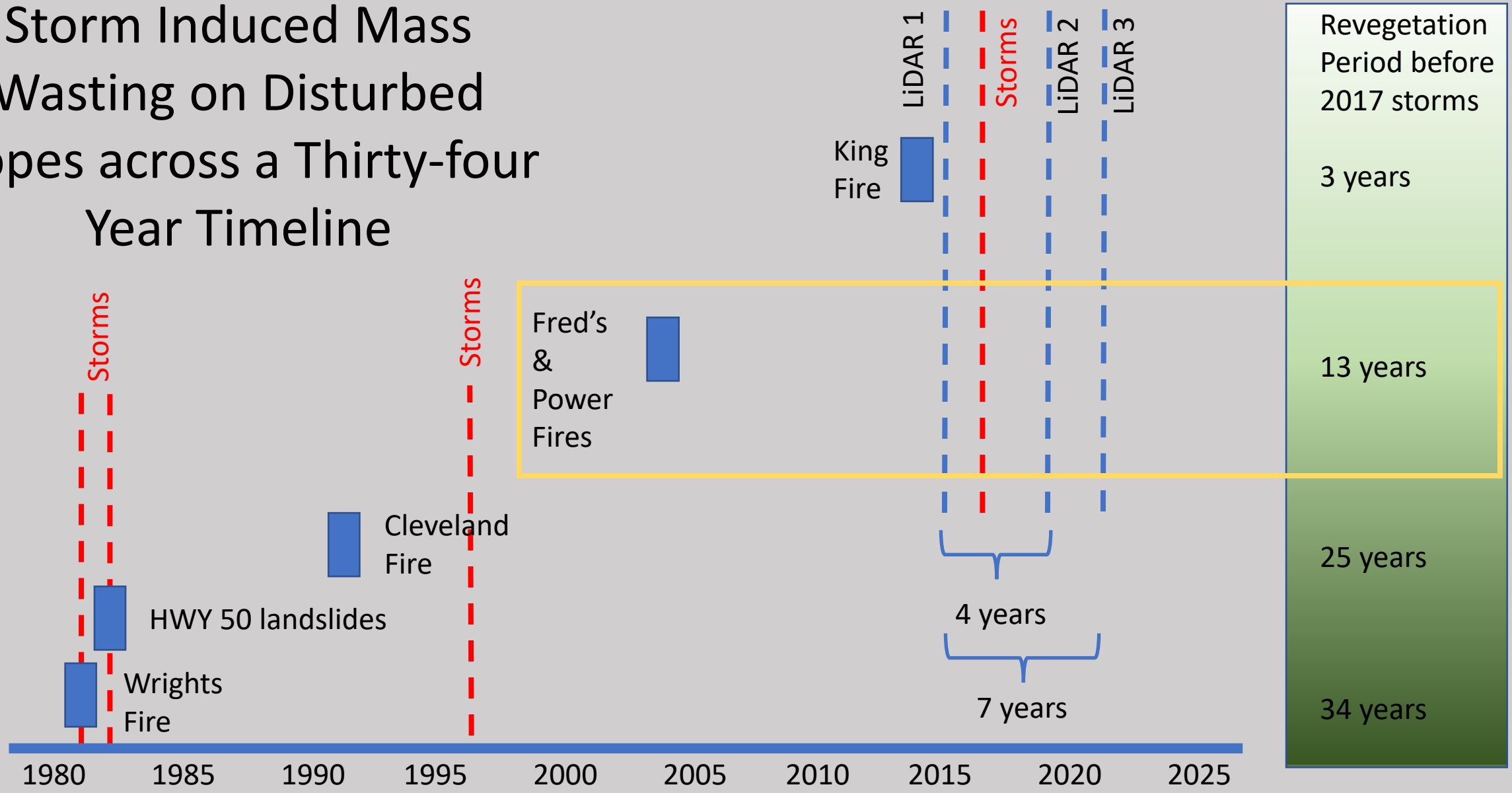
Storm Induced Mass Wasting on Disturbed Slopes across a Thirty-four Year Timeline



Examples of Preliminary Results

- 2017 storm-induced landslide activity in burn scars
  - 2014 King Fire
  - 2004 Fred's and Power Fires
  - 1992 Cleveland Fire

2004 Fred's Fire

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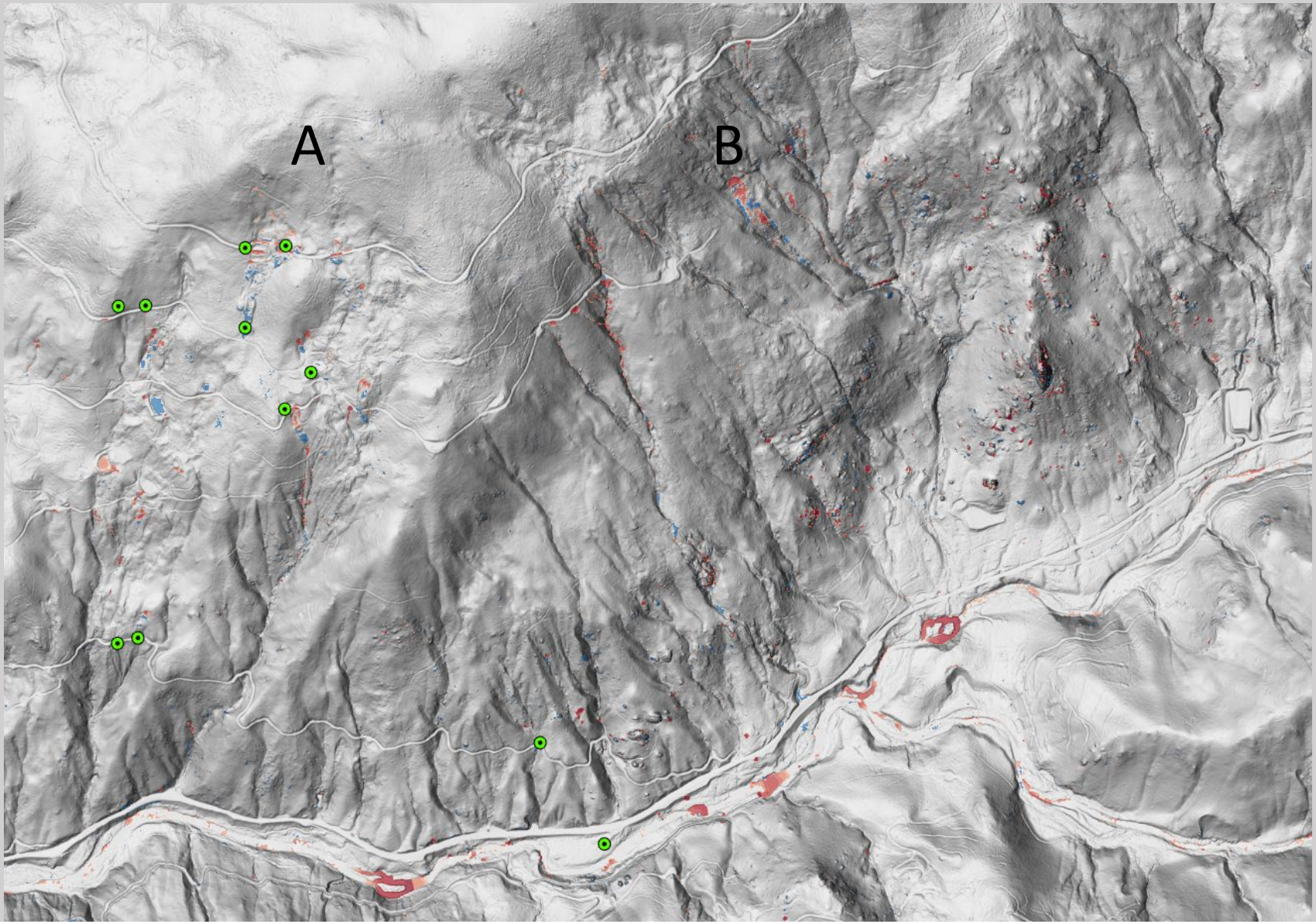
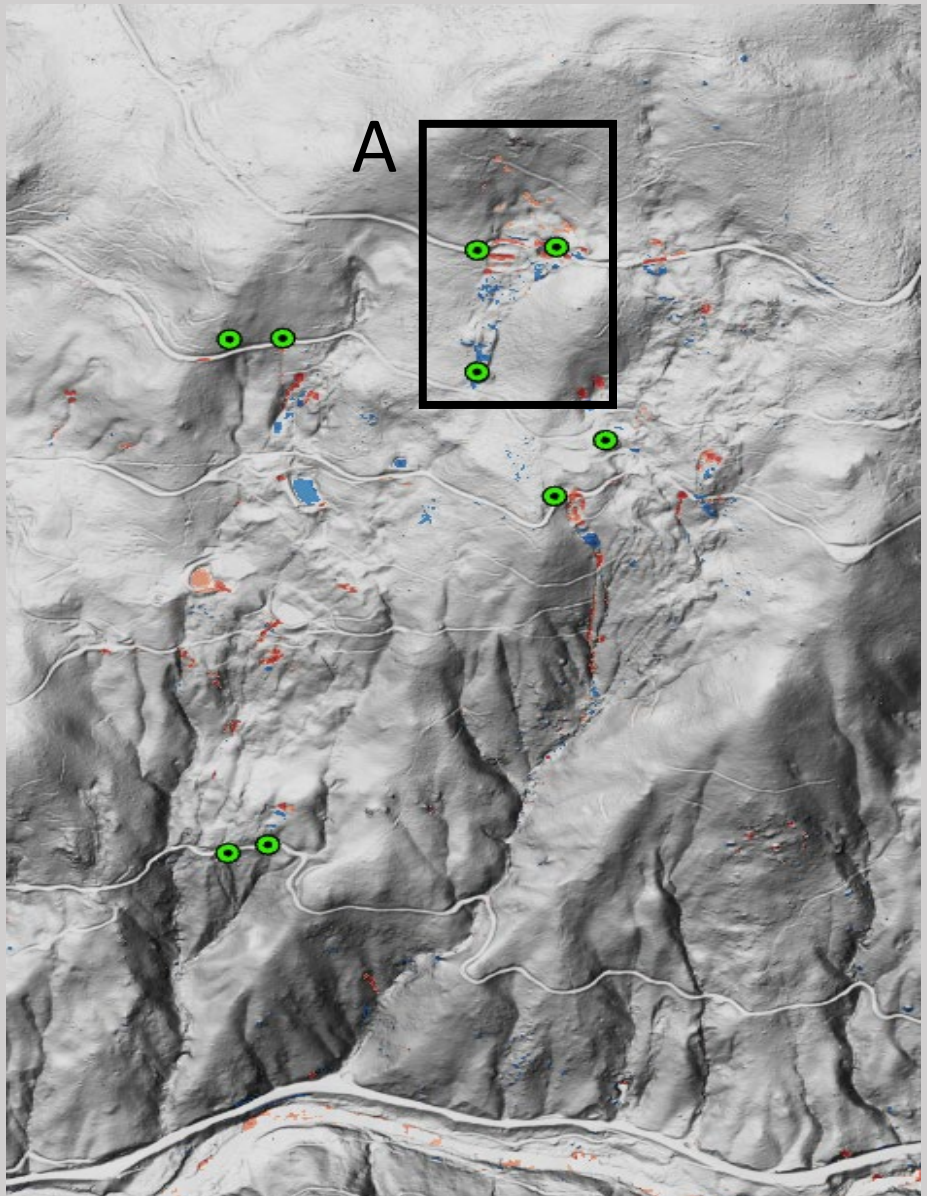
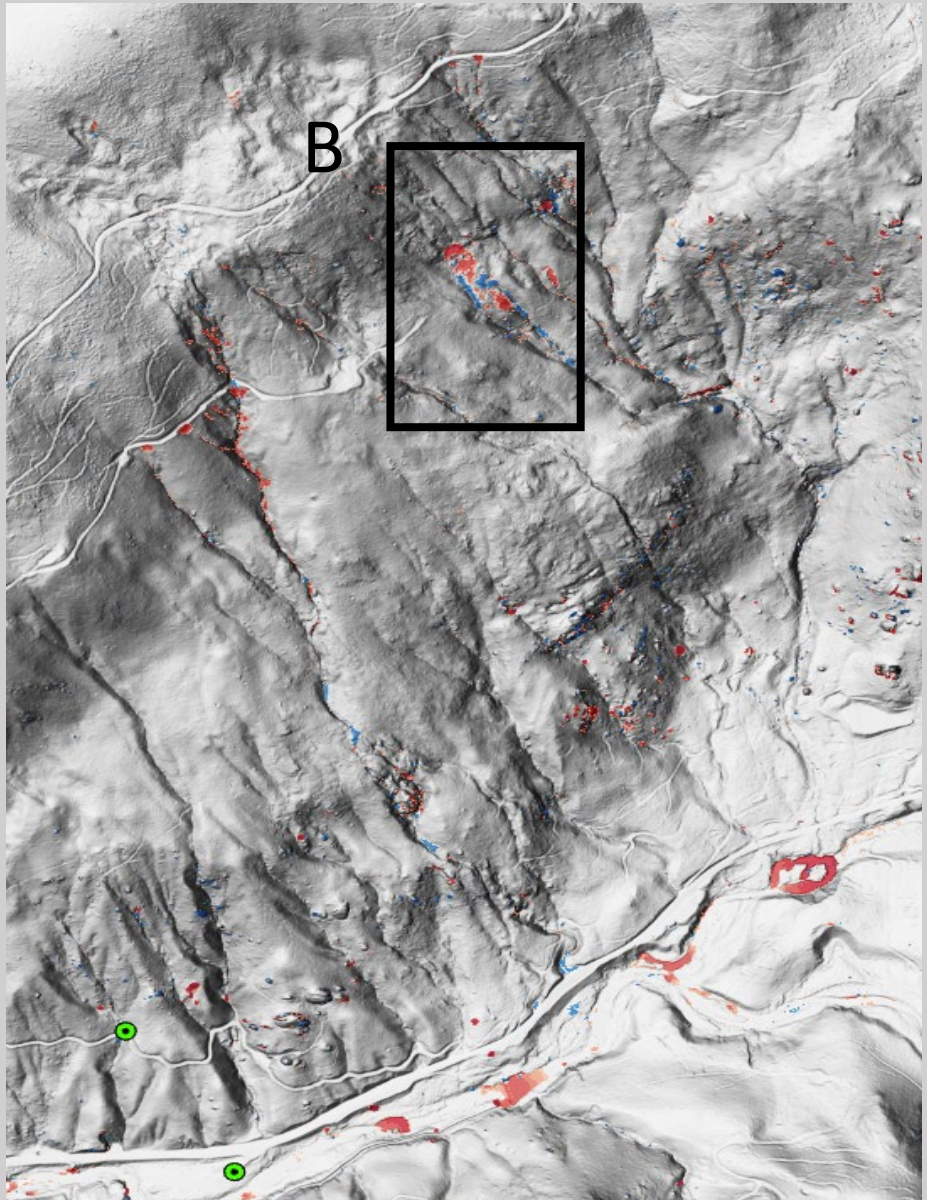


South Fork American River & Highway 50 near Kyburz

2004 Fred's Fire

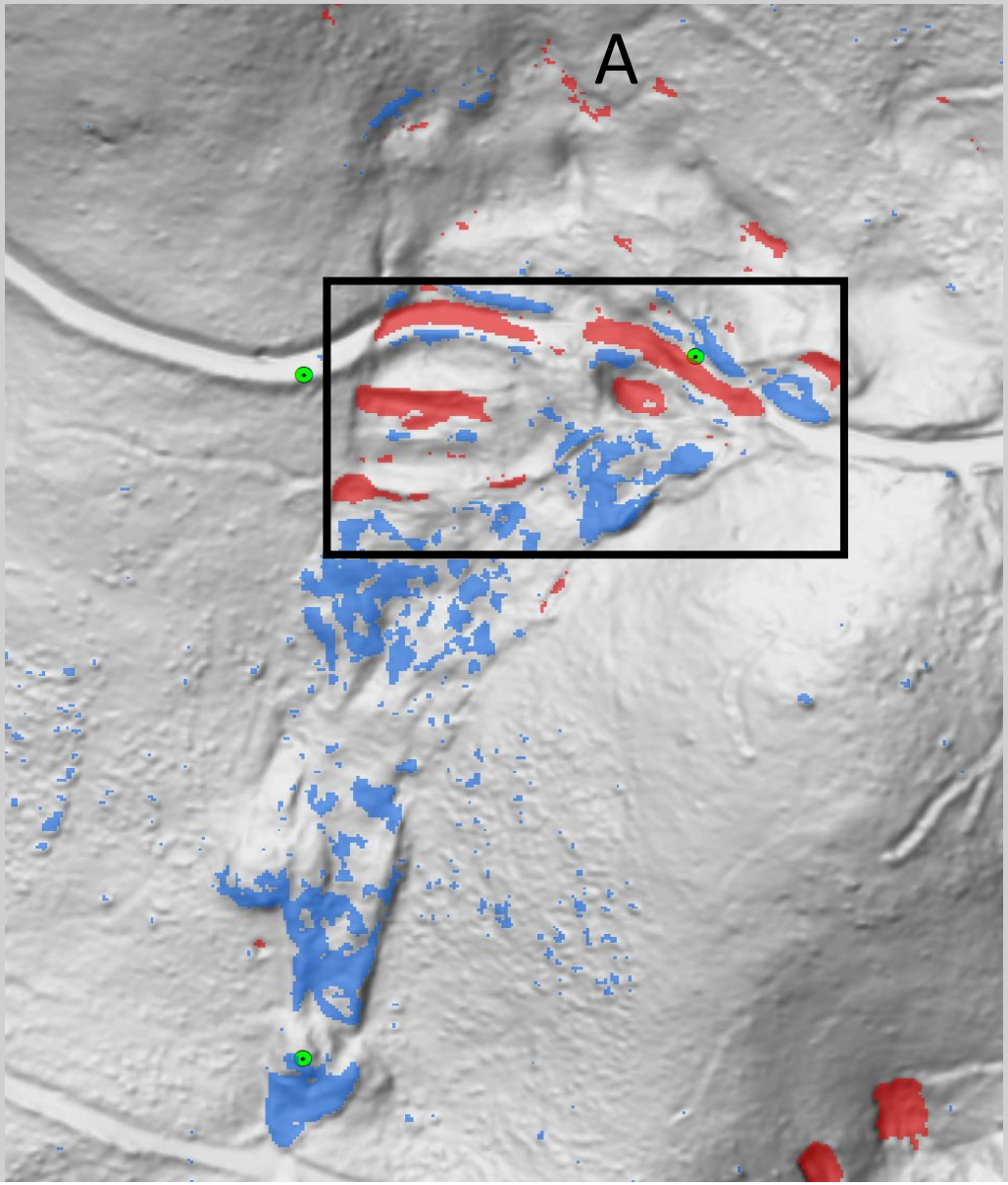
California Department of Conservation

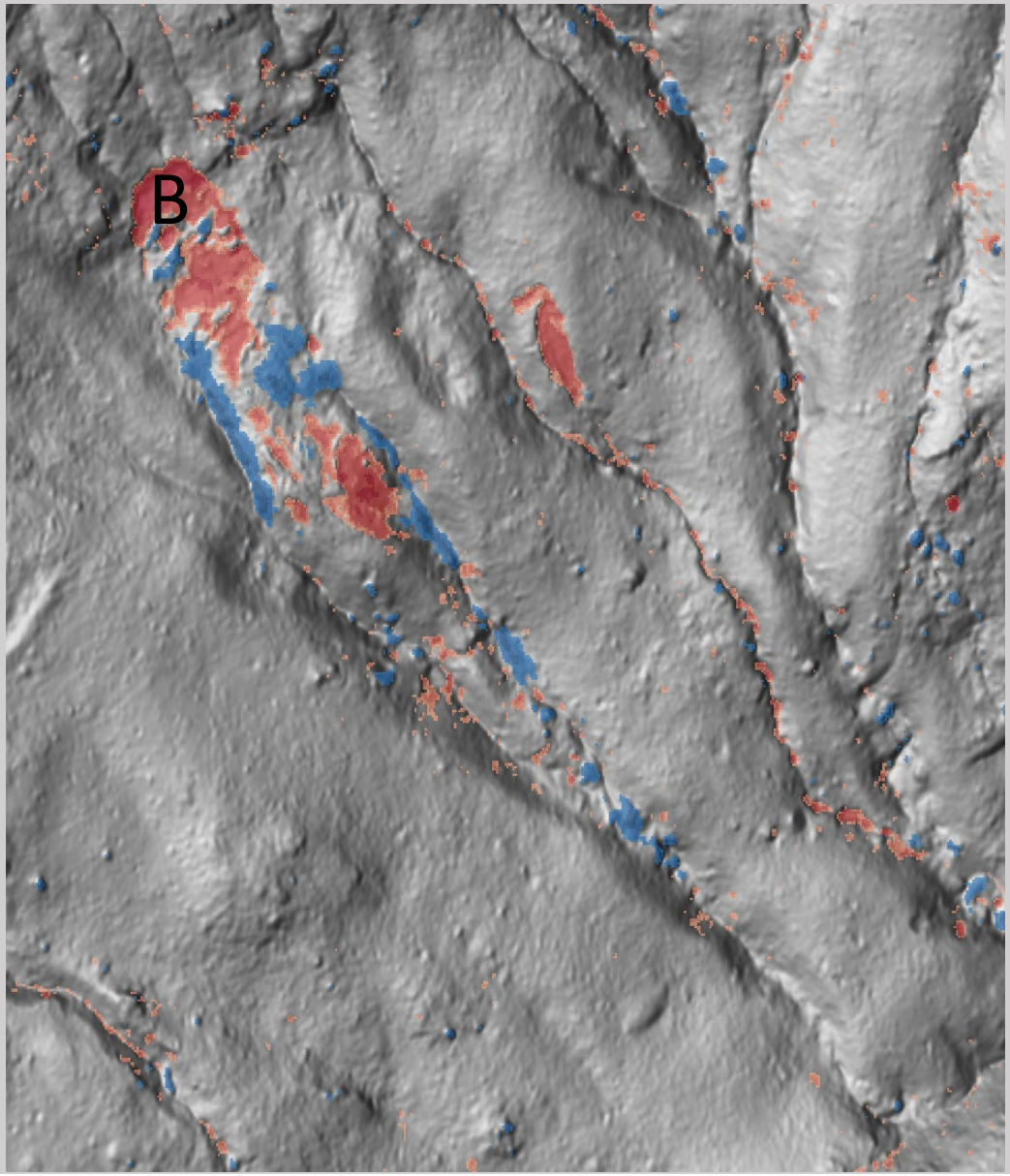




South Fork American River & Highway 50 near Kyburz

2004 Fred's Fire





Granite Springs Road

2004 Fred's Fire

Granite Springs Road

2004 Fred's Fire

Granite Springs Road

2004 Fred's Fire

Granite Springs Road

2014 King Fire

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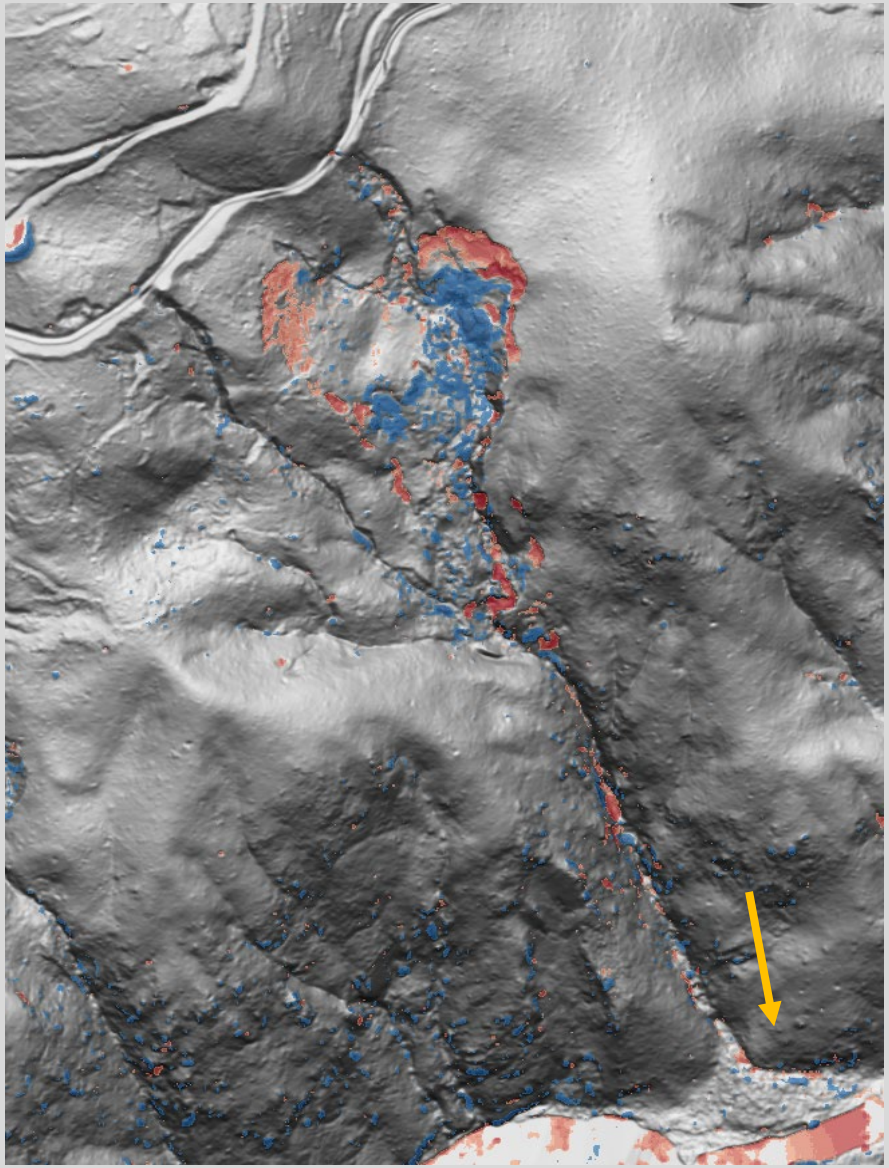

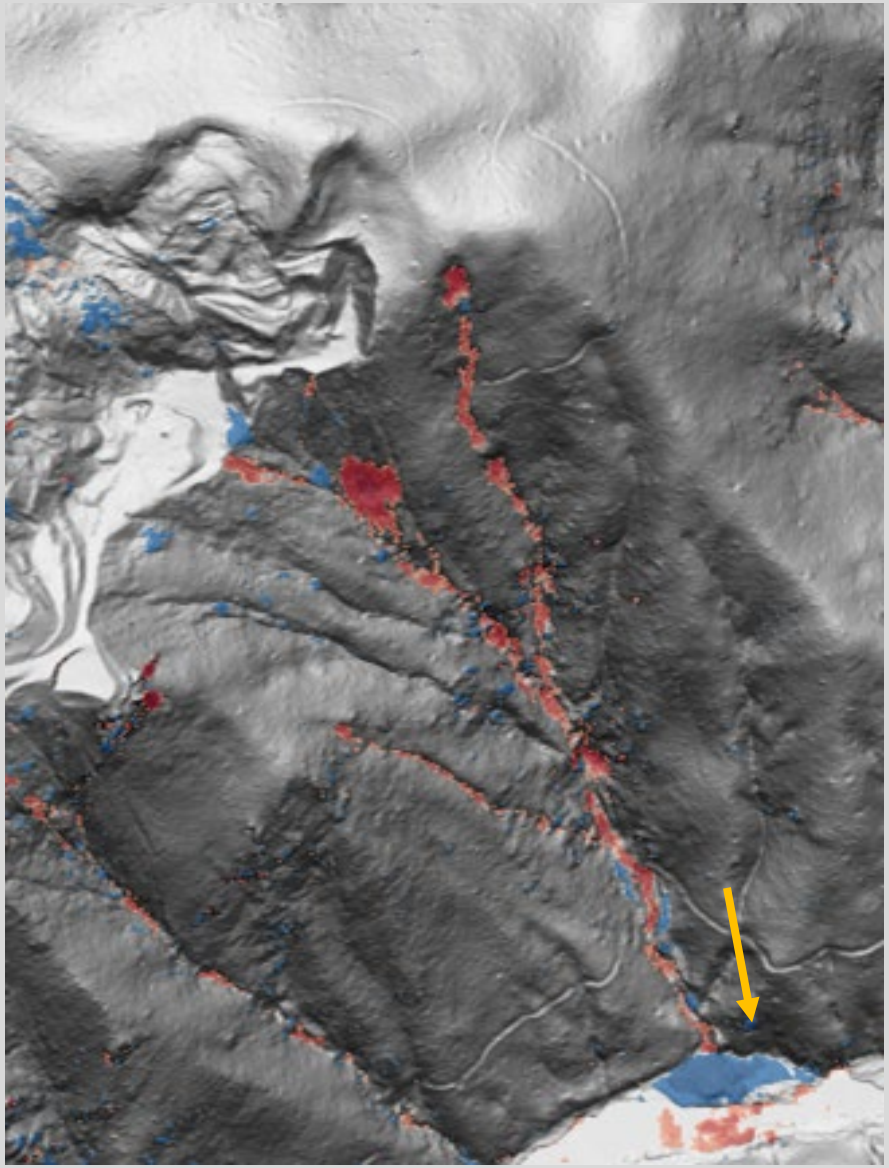

South Fork American River & Highway 50 near Pollock Pines

2004 Power Fire

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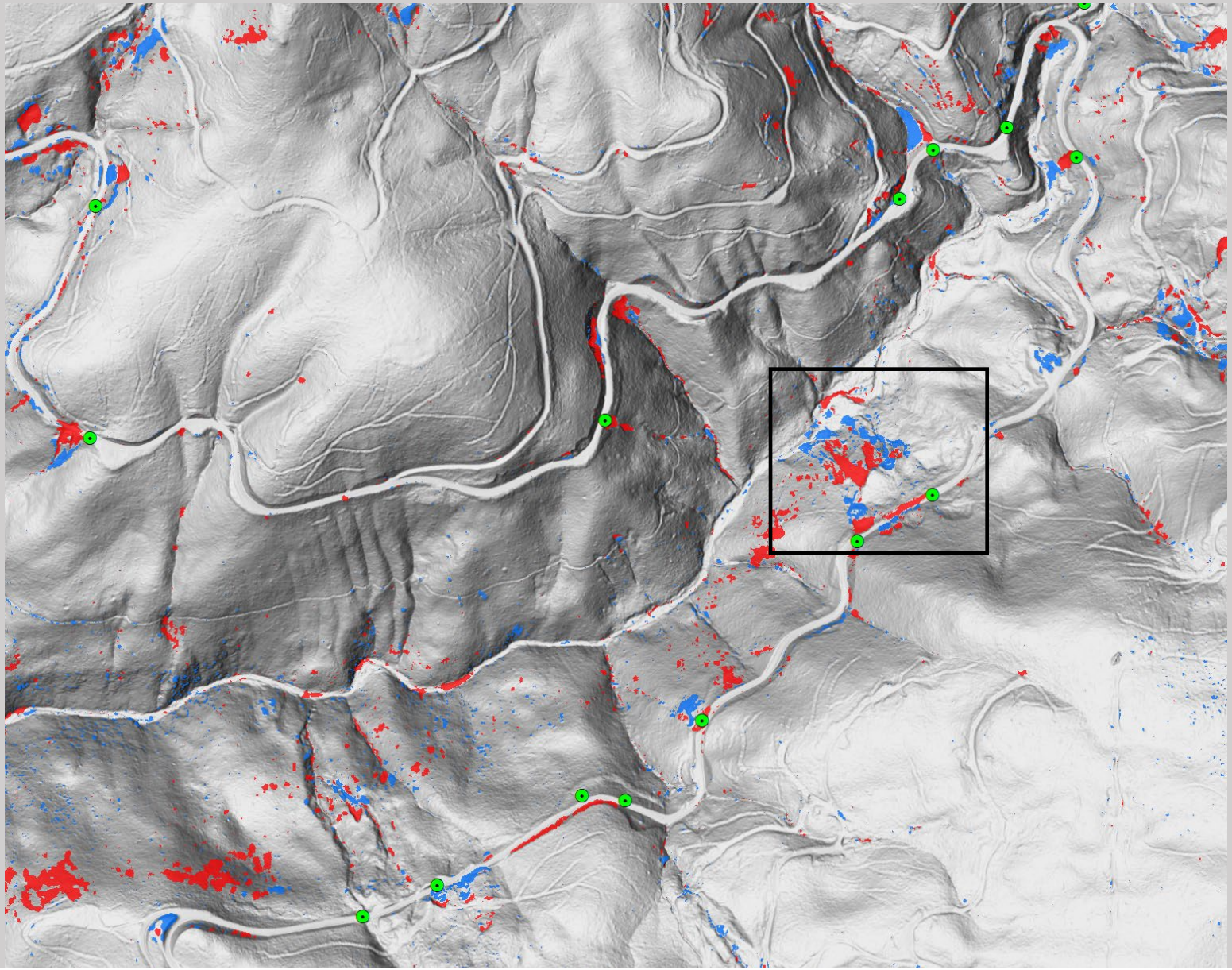
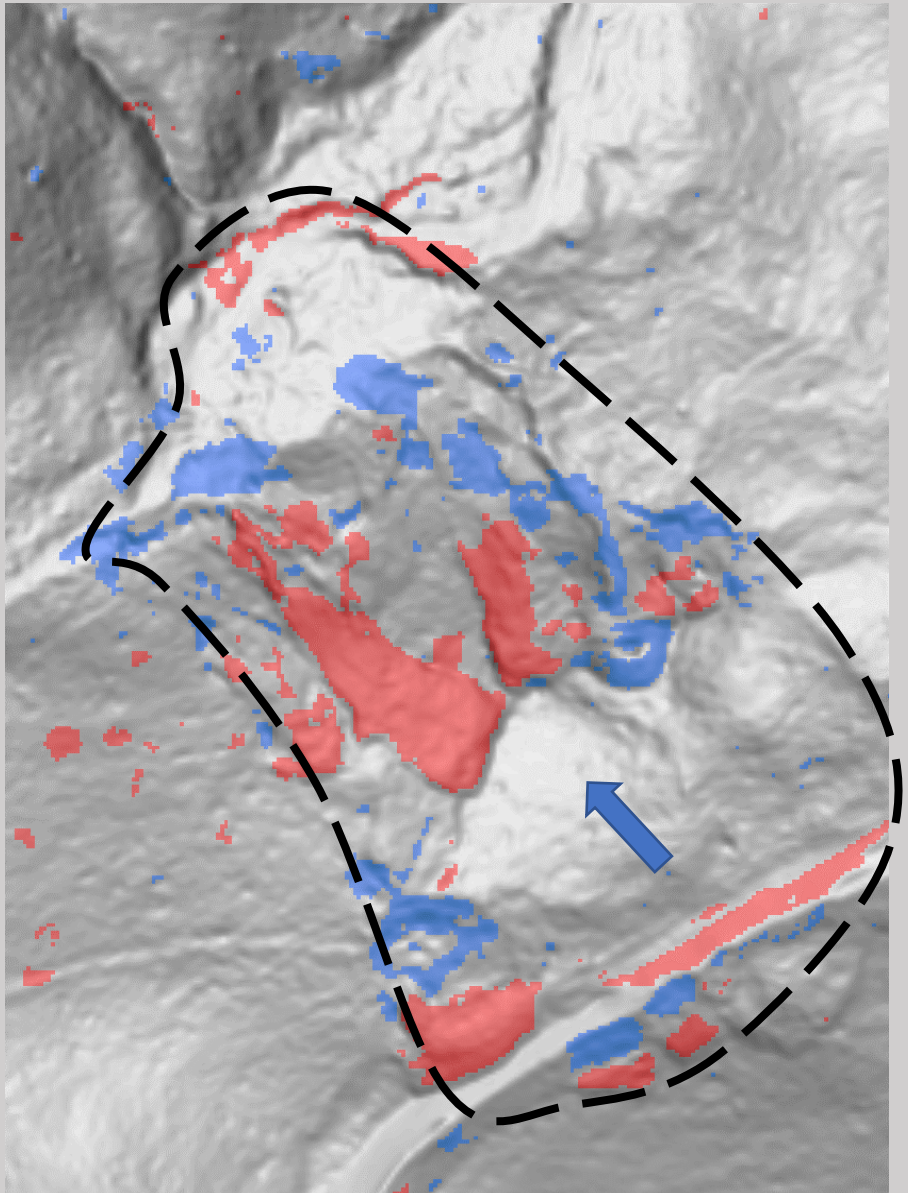


Panther Creek

2004 Power Fire



Panther Creek

1992 Cleveland Fire

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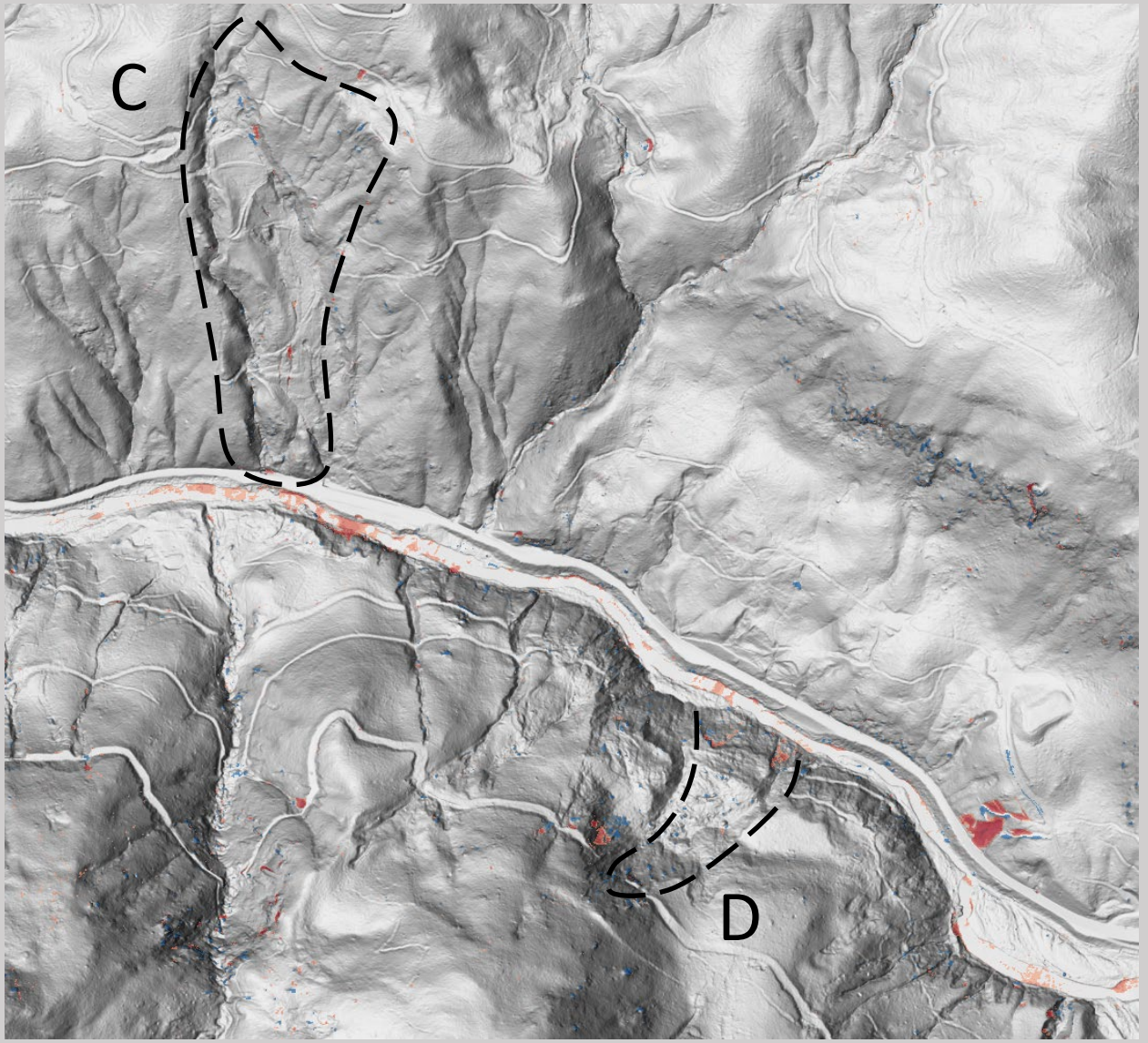
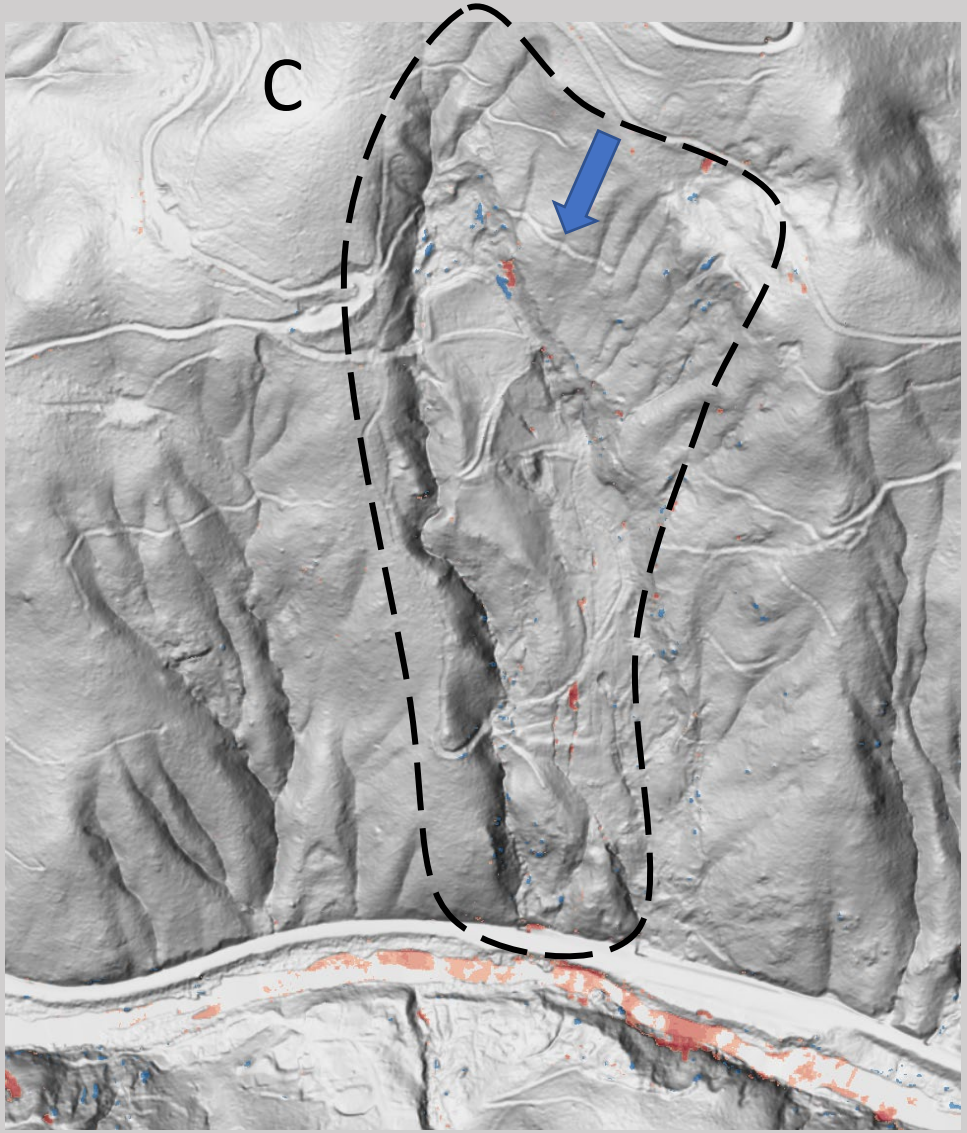
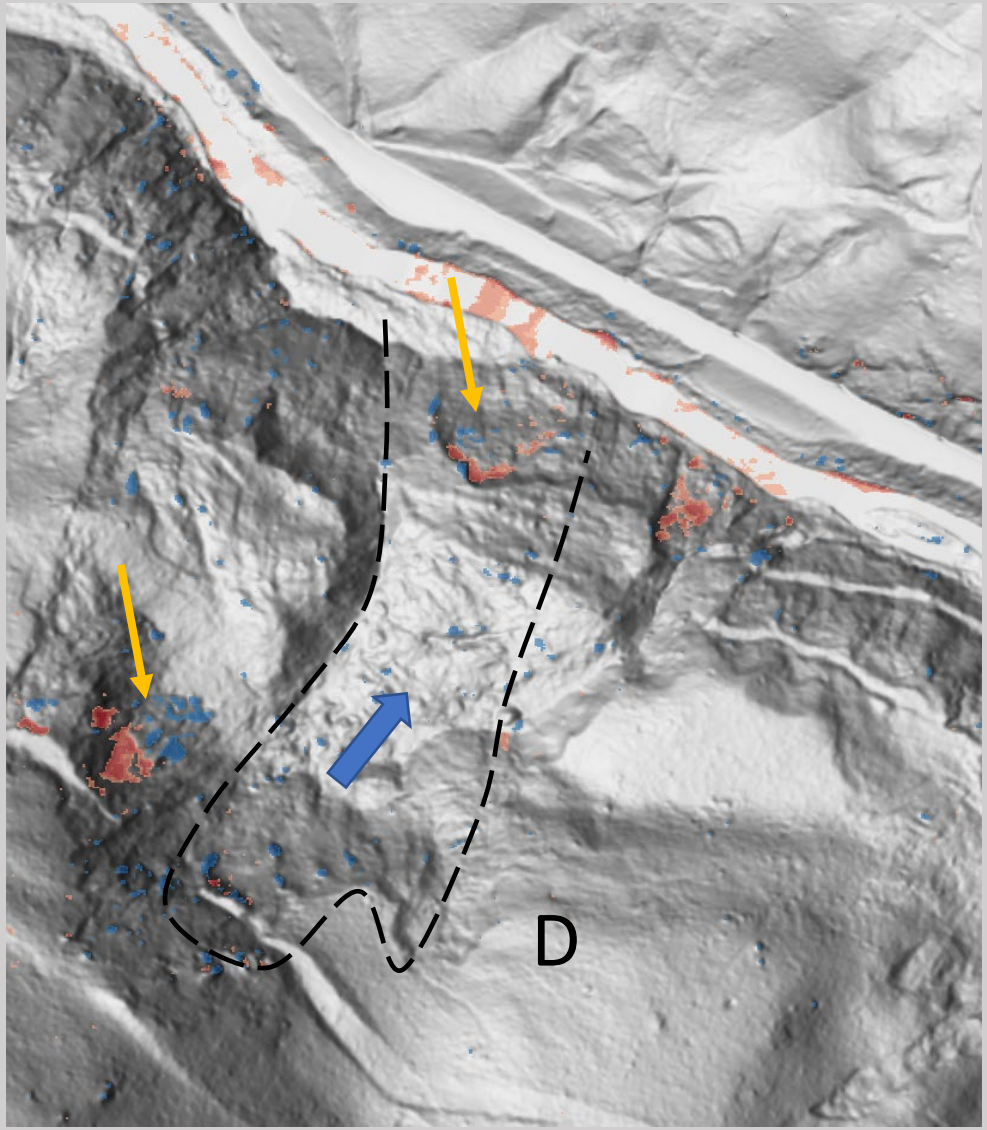


South Fork American River & Highway 50 near Whitehall

1992 Cleveland Fire

California Department of Conservation





Mill Creek Landslide 1997 & 1983 “Pony Express Lake” Landslide

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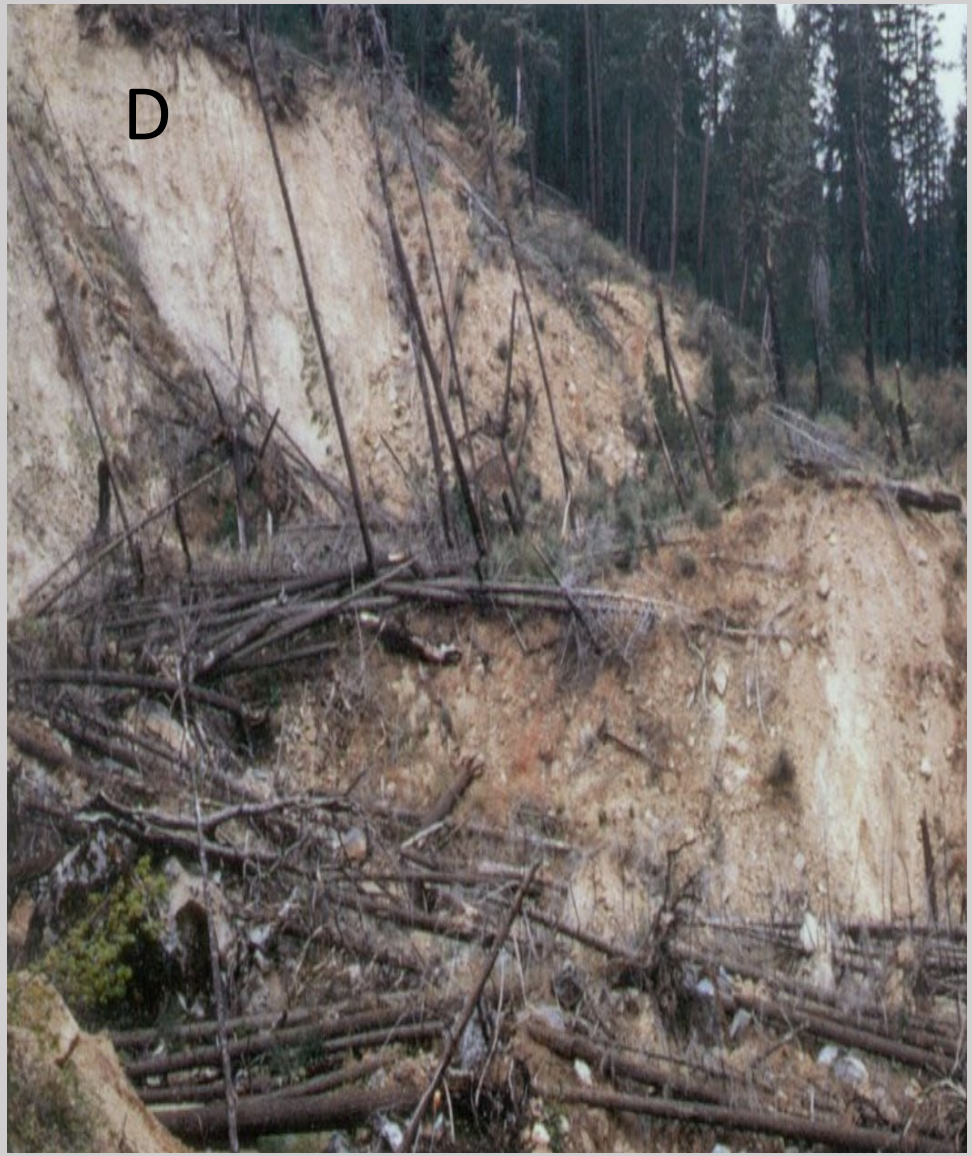
1992 Cleveland Fire



Mill Creek Landslide 1997 & 1983 “Pony Express Lake” Landslide

Recap

- Lidar differencing has a place in post-event erosion studies.
- Preliminary results indicate an estimated vertical resolution of 2 feet.
- Many factors impact resolution.
- More intensive processing may improve resolution.
- Site visits will help differentiate geomorphic change from other factors.
- The results of this study will inform future lidar differencing projects.

Questions?