California Geological Survey Studies

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Briefing to the Effectiveness Monitoring Committee
California Geological Survey Studies

EMC-2016-003
Lidar Differencing Eldorado National Forest and Nearby Private Lands
Current Participants and Investigators

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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
Current & Pending Activities

• Lidar differencing
• Field sites selection
• Analyses
• Conference presentation
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
Storm-Induced Mass Wasting on Disturbed Slopes across a Thirty-Four Year Timeline

- HWY 50 landslides
- Cleveland Fire
- Fred’s & Power Fires
- King Fire
- LiDAR 1
- LiDAR 2
- LiDAR 3

Revegetation Period before 2017 storms:
- 3 years
- 13 years
- 25 years
- 34 years
Storm Induced Mass Wasting on Disturbed Slopes across a Thirty-four Year Timeline

- HWY 50 landslides
- Cleveland Fire
- Wrights Fire
- Fred’s & Power Fires
- King Fire

Revegetation Period before 2017 storms:
- 3 years
- 13 years
- 25 years
- 34 years
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

South Fork American River & Highway 50 near Kyburz
2004 Fred’s Fire

South Fork American River & Highway 50 near Kyburz
2004 Fred’s Fire

Granite Springs Road
Granite Springs Road

2004 Fred’s Fire
Granite Springs Road
2014 King Fire

South Fork American River & Highway 50 near Pollock Pines
2004 Power Fire

Panther Creek
2004 Power Fire

Panther Creek
1992 Cleveland Fire

South Fork American River & Highway 50 near Whitehall
1992 Cleveland Fire

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