



7th International Conference On Debris Flow Hazard Mitigation Colorado School Of Mines, Golden, and Visit to USGS



United State of America

08th to 18th June 2019

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CONTENT



1. PURPOSE OF VISIT
2. NATURE OF THE VISIT
3. THE CONFERENCE
4. FIELD VISITS
5. TECHNICAL TRAINING ON LANDSLIDE MONITORING INSTRUMENTATION
6. MEETING/DISCUSSION WITH USGS
7. THINGS TO LEARN
8. ACKNOWLEDGEMENT

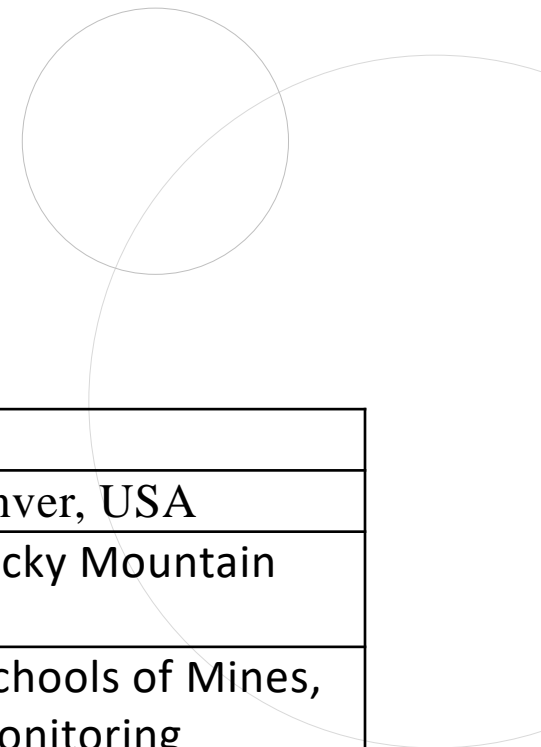
PURPOSE OF VISIT

In December, 2018, the USGS and NBRO formalized this partnership with a signed Letter of Agreement (LOA).

This LOA outlined the details of training, research cooperation and specific invitational travel for NBRO staff members to the USGS office and attend the conference.

To ensure success of the USGS-NBRO collaboration and fulfill terms of the funding agreement with USAID/OFDA, USGS has invited four NBRO Officials to visit Colorado.





NATURE OF THE VISIT

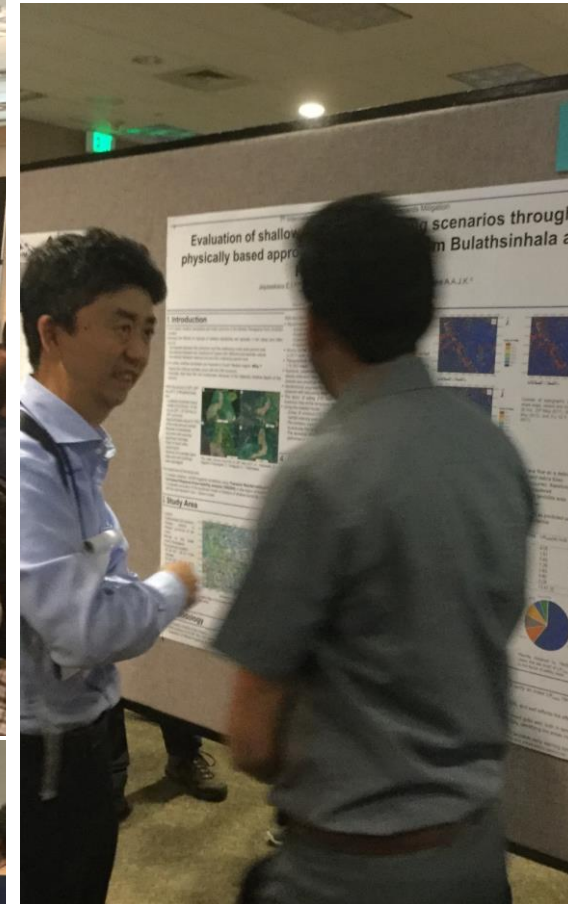
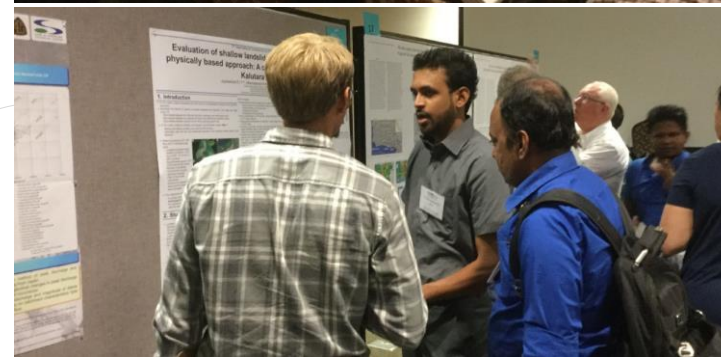
Date	Activity
08/06/2019	Traveling to Denver, USA
09/06/2019	Field visit 1 – Rocky Mountain Debris Flow site
10/06/2019-13/06/2019	Conference at Schools of Mines, Colorado and Monitoring instrument installation training at USGS center
13/06/2019-14/06/2019	Field Visit 2 – Chalk Cliff Debris flow monitoring site
17/06/2019	Meetings with USGS
18/06/2019	Return to Sri Lanka





THE CONFERENCE

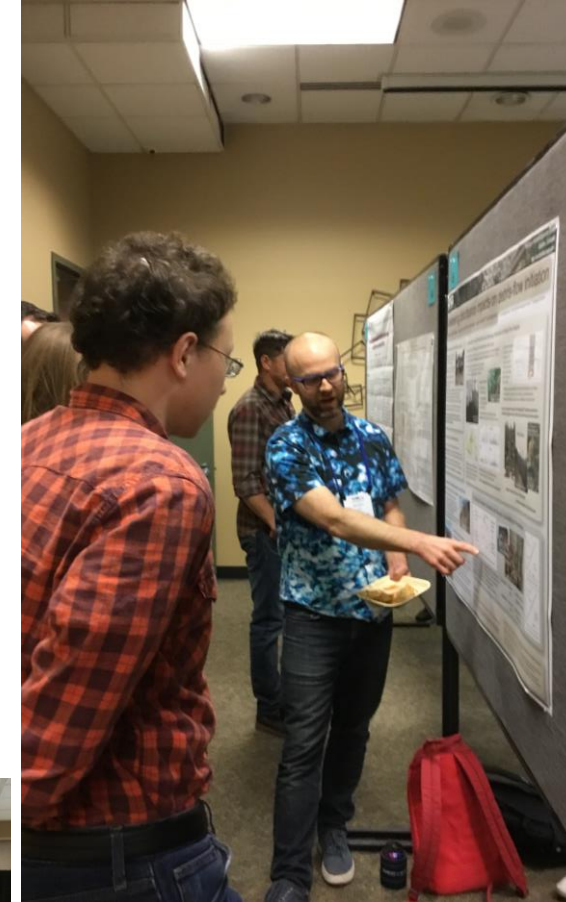
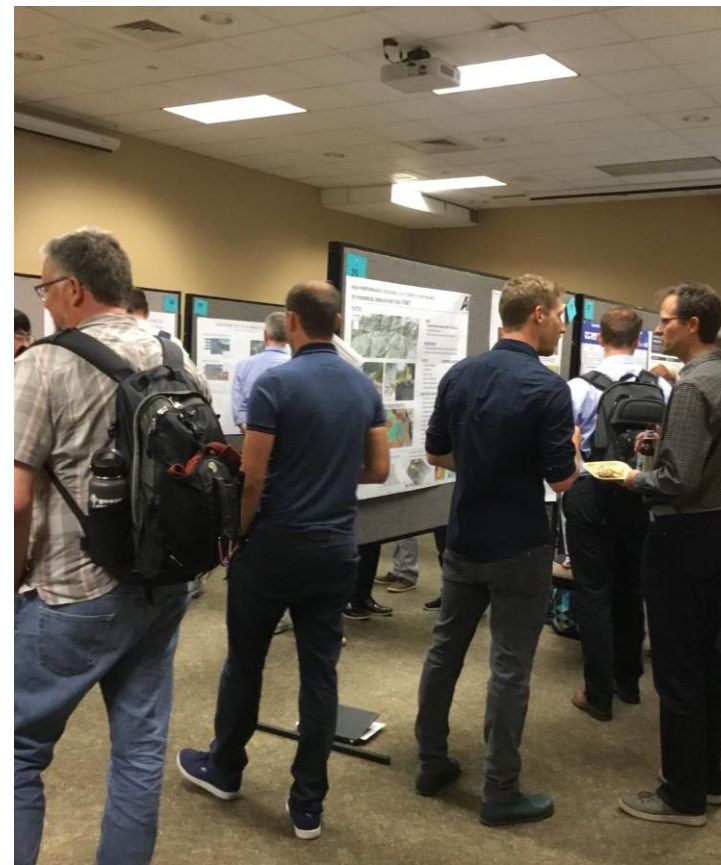
- The 7th International Conference on Debris-Flow Hazards Mitigation was held June 10 - 13, 2019 in Golden, Colorado, USA on the campus of Colorado School of Mines.
- DFHM7 aims to promote international cooperation, communication and exchange of knowledge among researchers and practitioners.
- The first DFHM Conference was held in San Francisco, USA (1997) and subsequent Conferences were held in Taipei, Taiwan (2000), Davos, Switzerland (2003), Chengdu, China (2007), Padua, Italy (2011), and Tsukuba, Japan (2015)





The purpose of this conference was to provide a forum for international researchers, engineers, and policy makers to:

- Exchange ideas and transfer knowledge between scientists, engineers, and policy makers
- Promote scientific advancement of debris-flow hazards, response, and mitigation
- Promote communication related to the outstanding needs for decreasing risk from debris flows

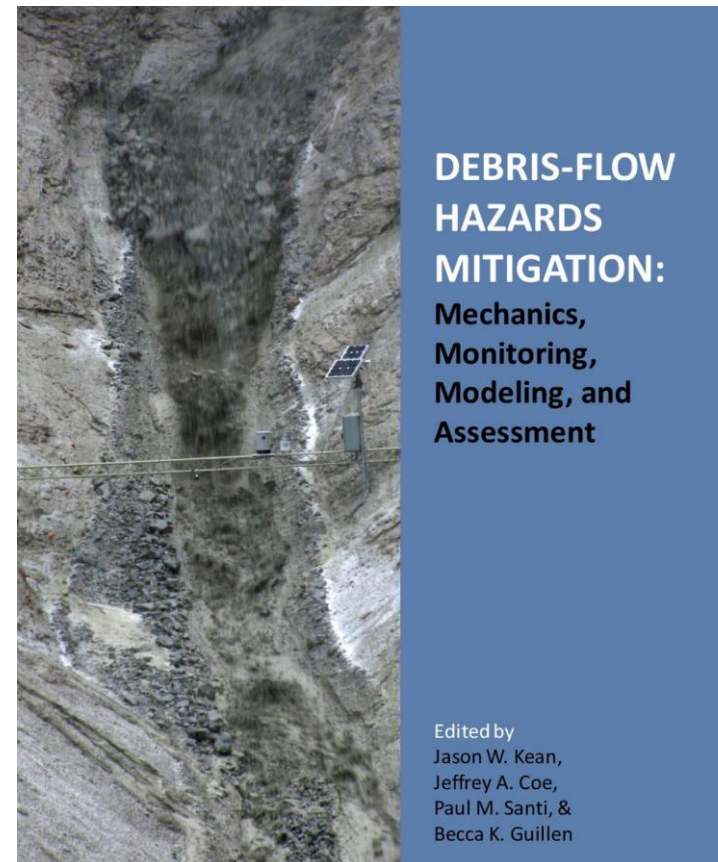




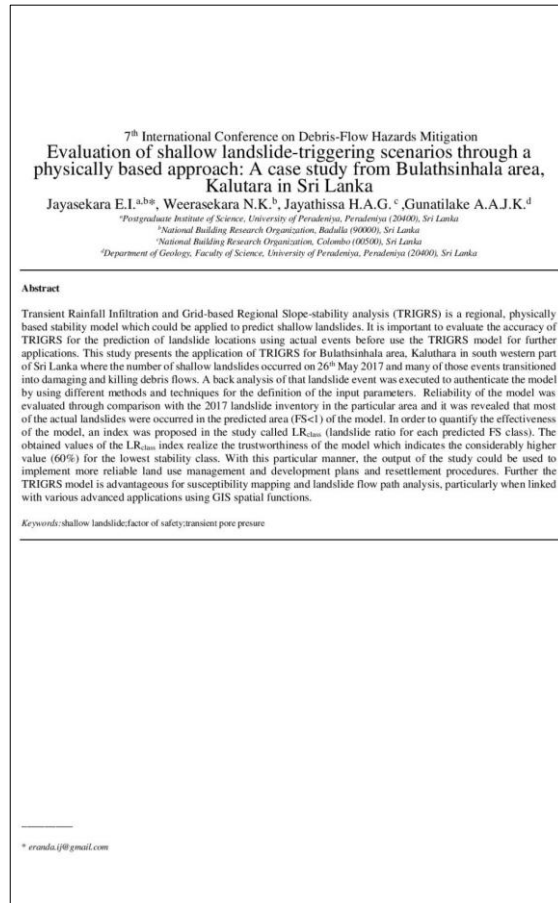
The delivered presentations have covered following major themes

- Debris-flow initiation
- Mechanics of debris-flow growth
- Debris-flow mobility
- Debris-flow deposits and fan morphology
- Physical and numerical modeling of debris flows
- Debris-flow monitoring and alert systems
- Applications of new technologies
- Forensic case studies of debris flows
- Prediction and assessment of debris-flow hazards and risk
- Emergency planning and response
- Debris-flow mitigation
- Role of disturbance in debris-flow initiation and mobility
- Data integration and sharing
- Needs of local government end users

Presented a poster on “Evaluation of shallow landslide-triggering scenarios through a physically based approach: A case study from Bulathsinhala area, Kalutara in Sri Lanka”.



<https://dfhm7.csmSPACE.com/>





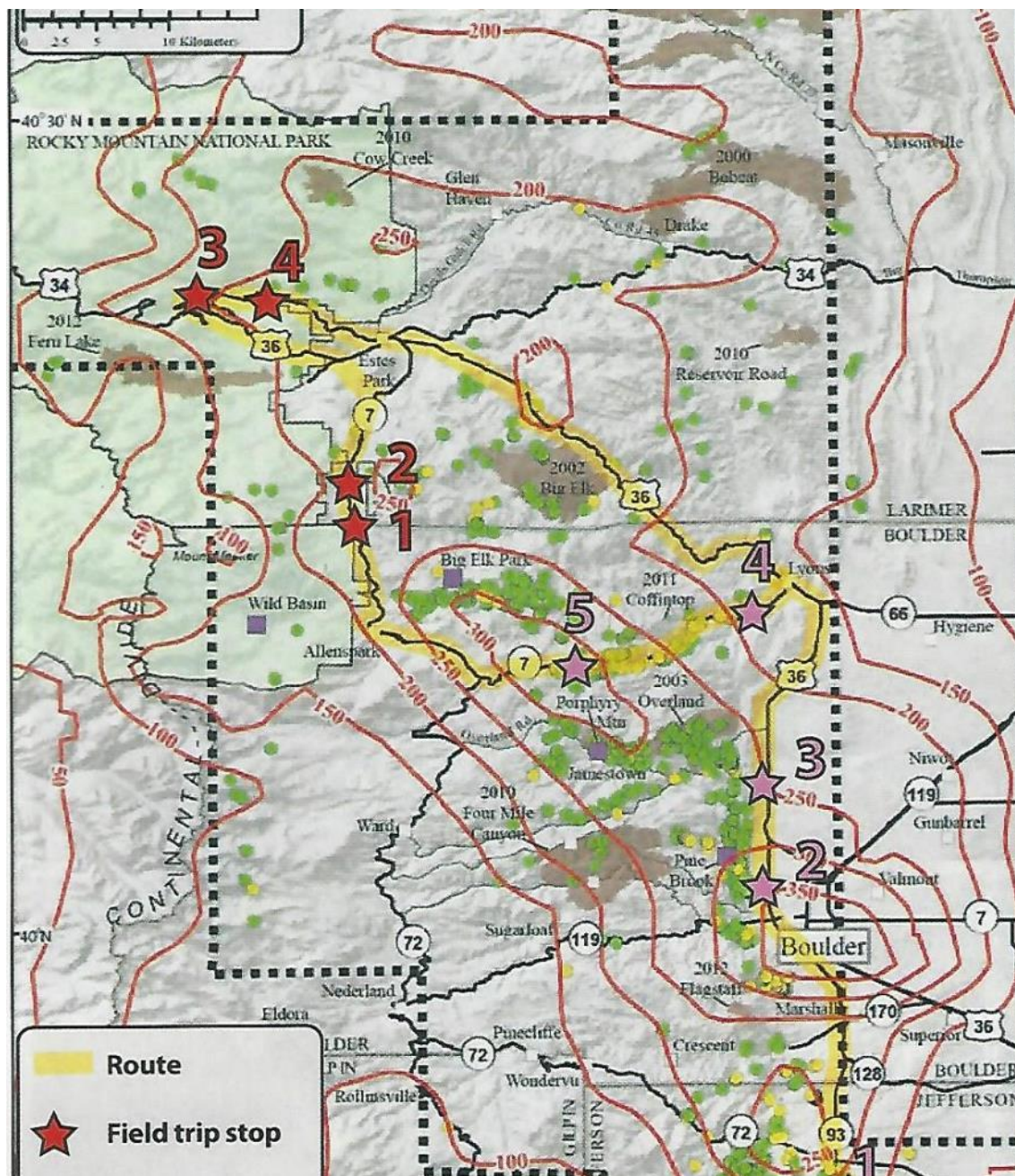
THE FIELD VISIT

Field trip 1

Rocky Mountain National Park, June
9 ,2019

Field Trip 2

The chalk cliffs, June 13 – 14 ,2019



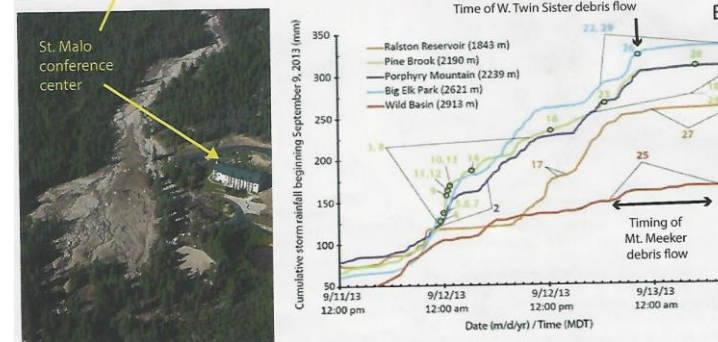
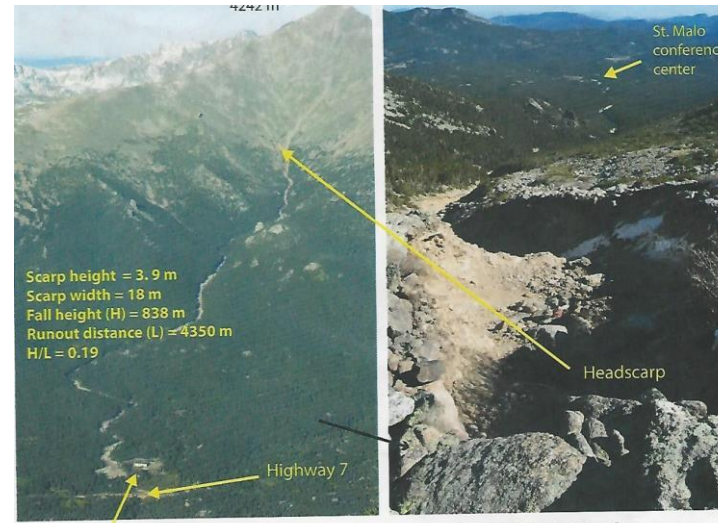
1. ROCKY MOUNTAIN NATIONAL PARK

Diagram showing debris flows triggered by Sept.2013 rainfall. (A) Map of debris – flow locations (as well as rock, earth, and debris slides) overlain by cumulative rain fall from 10 sept.at 6.p.m to 13 Sept. at 6. p.m. Number of mapped debris flows was 1138.Number of mapped rocks, earth and debris slides was 212.

At the this filed trip, we were visited;

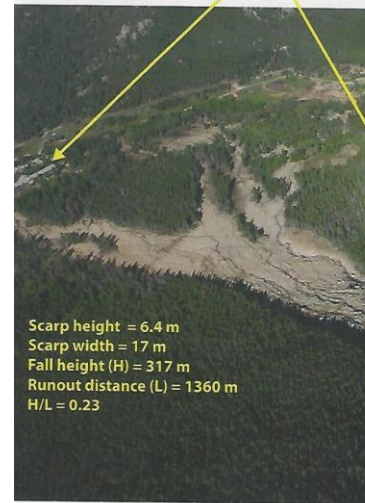
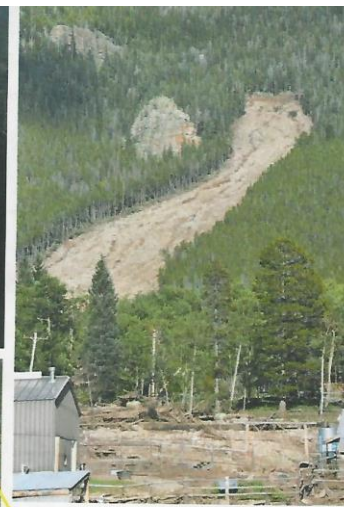
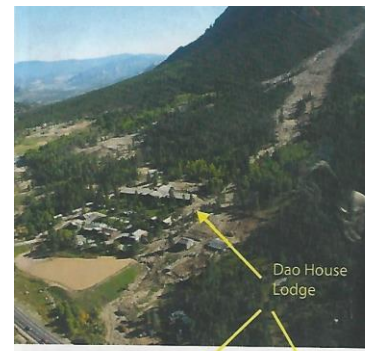
- Mount Meeker debris flow
- West Twin Sisters debris flow
- Hidden Valley

MOUNT MEEKER DEBRIS FLOW





WEST TWIN SISTERS DEBRIS FLOW



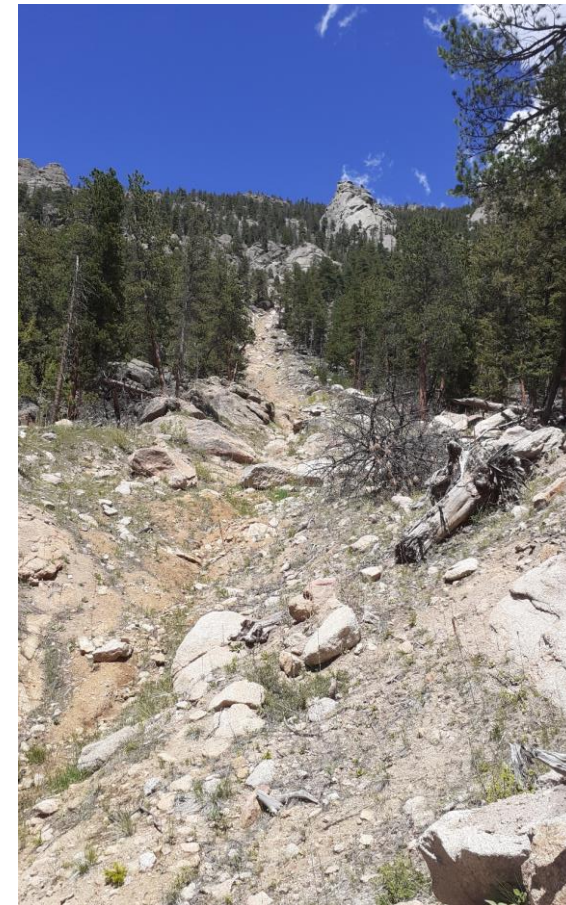
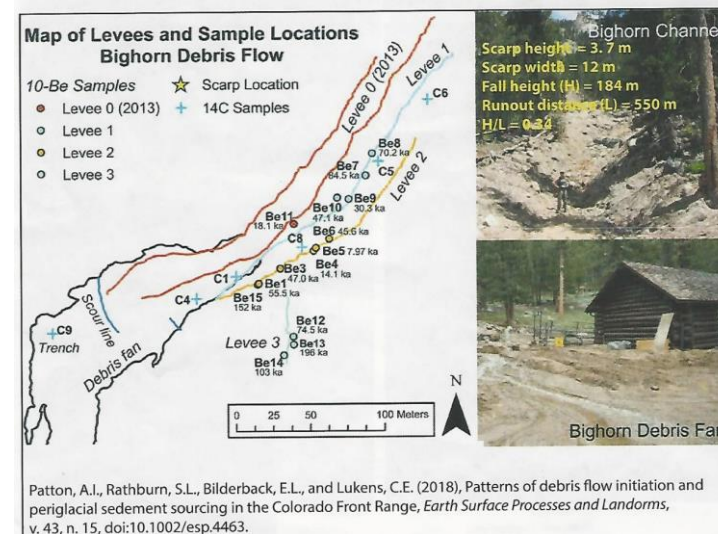
Scarp height = 6.4 m
Scarp width = 17 m
Fall height (H) = 317 m
Runout distance (L) = 1360 m
 $H/L = 0.23$

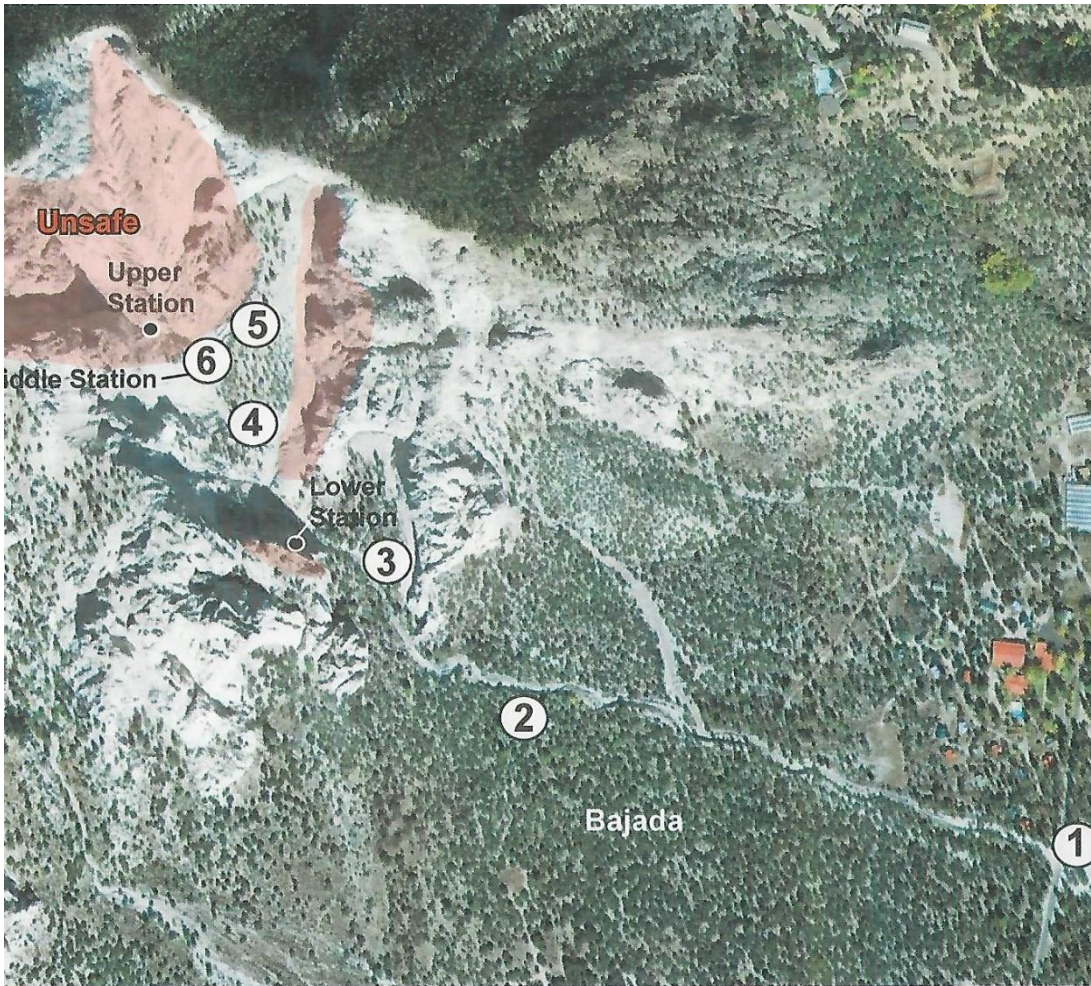


HIDDEN VALLEY



Stop 4: Bighorn debris flow





pick up (bus leaves at 2 pm!)

stratigraphy

discussion, safe zone (in case of rain)

⑤ Basin overview at camera station, steep

⑥ Middle Station, active talus slopes

⑦ Active fan and stratigraphy at Chalk Cree

CHALK CLIFFS DEBRIS FLOW SITE

- The chalk cliffs are located at the southern base of Mount Princeton in the Swatch Range of the Rocky Mountains, in central Colorado.
- Chalk Creek, whose headwaters are located at the continental Divide, runs parallel to the cliffs in the valley between Mt. Princeton and Mt. Anterro before draining into Arkansas River.
- The USGS began research activities at the basin in 2002 and established a monitoring network in the upper reach of the catchment (0.06 km²) in May 2004.
- Currently, there are multiple stations in the watershed and on the fan dedicated to debris – flow process monitoring.



CHALK CLIFFS DEBRIS FLOW SITE





MEETING/DISCUSSION WITH USGS



Research will emphasize key priority topics in Sri Lanka using USGS research techniques and technology:

- Improving regional thresholds for landslide initiation and issuing warnings
- Developing hazard assessments of landslide inundation and mobility
- Collecting perishable data following landslide disasters to advance research priorities.



Specific point discussed at the meeting and future benefits

- Mapping landslide features and deposits ,Workshop on mapping with lidar in Sri Lanka (WA-DNR)
- Modeling runout – regional applications of LAHAR-Z
- Technical exchange between USGS Menlo Park/Golden and NBRO in Colombo
- Empirical re-analysis of existing threshold in different regions
- Hydrological monitoring and thresholds ,USGS visit to install new monitoring site near Aranayaka landslide
- Applications of TRIGRS for regional susceptibility assessments
- Possible technical training and analysis workshop for using ARC Collector on tablets



TECHNICAL TRAINING ON LANDSLIDE MONITORING INSTRUMENTATION



THINGS TO LEARN

- Rainfall estimation with Radar
- Recent vs. Antecedent Rainfall Index (ARI)
- Index of Rainfall Thresholds with Landslides
- Spatially Variable Triggering Condition
 - Soil Properties
 - Vegetation
 - Topography
 - Climate
 - Other environmental factors

Empirical rainfall thresholds not readily transferrable across geographical regions



FUTURE CHALLENGES AND RECOMMENDATIONS

- ❑ NBRO research capacity should be improved to international standard .
- ❑ NBRO scientists should be trained internationally with the overseas experts such as,
 - United State Geological Survey
 - Eidgenössische Technische Hochschule (ETH) Zürich
 - China Mountain Research
- ❑ Research fields should be expanded to following paths
 - Modeling (computer / dynamic)
 - Runoff calculation
 - Instrumentation for Landslide initiation and runoff modeling
 - Specific threshold value calculation for regional base
 - Updating / modification of existing landslide hazard zonation procedure



ACKNOWLEDGEMENT

- The government of Sri Lanka, Ministry of Disaster Management and National Building Research Organisation for granting approval and providing necessary facilities to attend this conference and technical field visits.
- United State of America and our hosts United State Geological Survey (USGS), specially, USGS Colorado.
- All international presenters and participants of 7th DFHM, for sharing their experience, knowledge and thoughtful ideas in subject domain.



THANK YOU

