Importance of Geohazard investigation for sustainable risk reduction in the Nepal Himalaya

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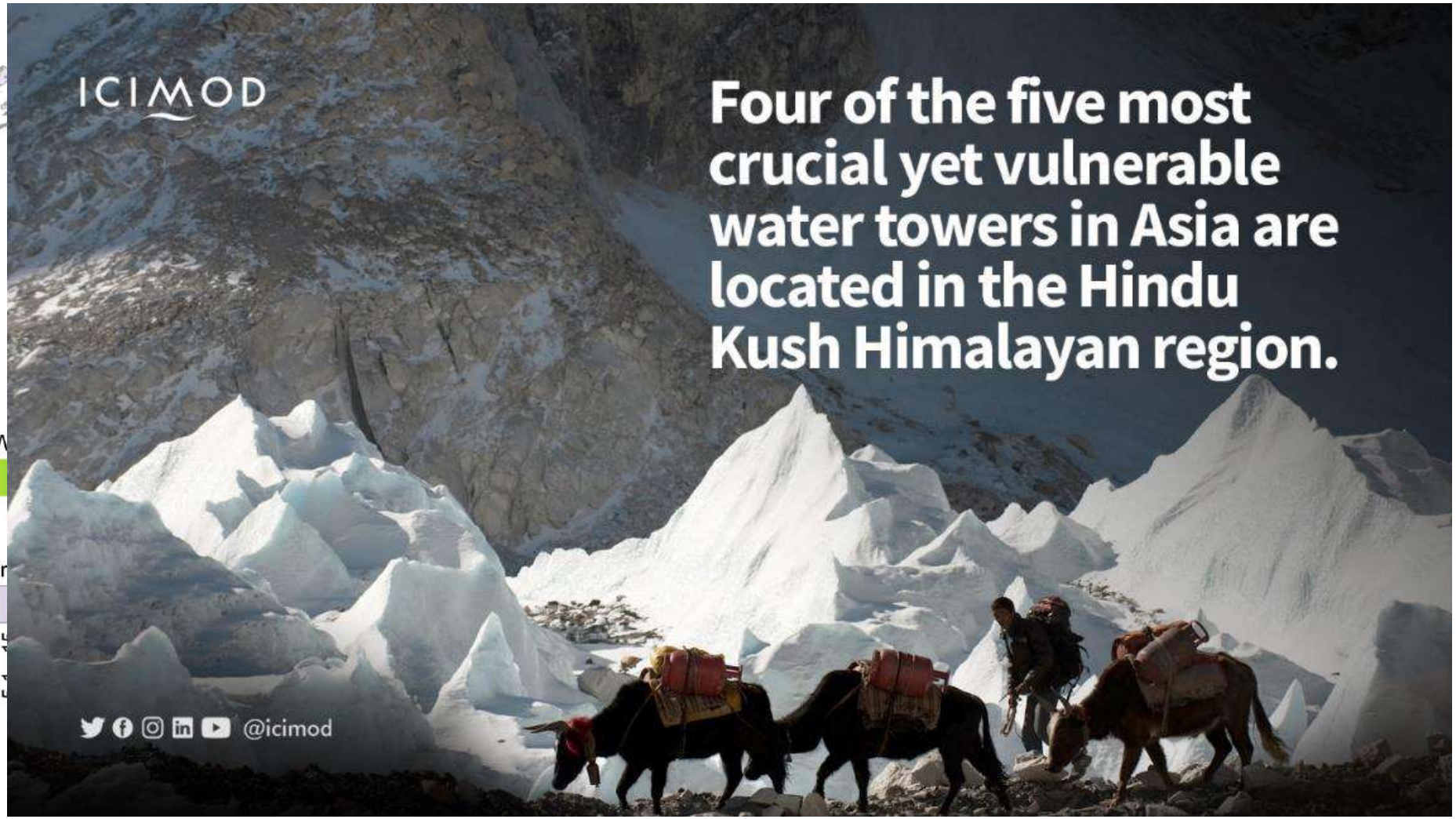
Geohazards in the Nepal Himalaya

- Strong monsoons with erratic rainfall and long dry winter
- Regular seismic destabilization
- Climate extremities
- Thawing of permafrost
- Forest fire
- Anthropogenic activities.

Vanishing Ice in the Himalaya

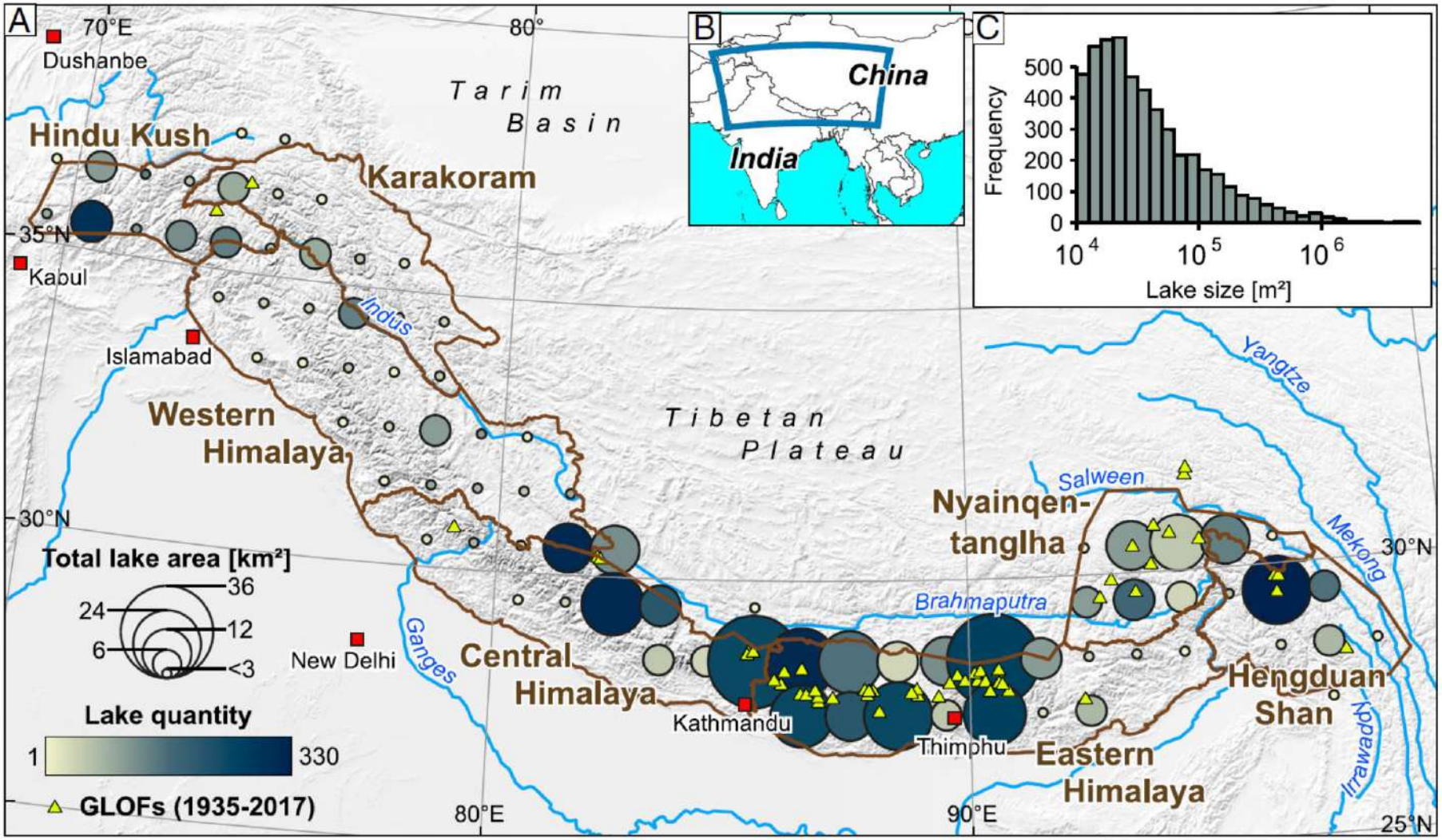
The Imja glacier in Nepal (1950s top, 2007 bottom) is retreating at an average rate of 74 metres a year as the Imja lake grows. Photograph: Erwin Schneider/Alton Byers/The Mountain Institute

Water towers in the HKH region



Immerzeel et al. 2019

Glacial lakes in HKH

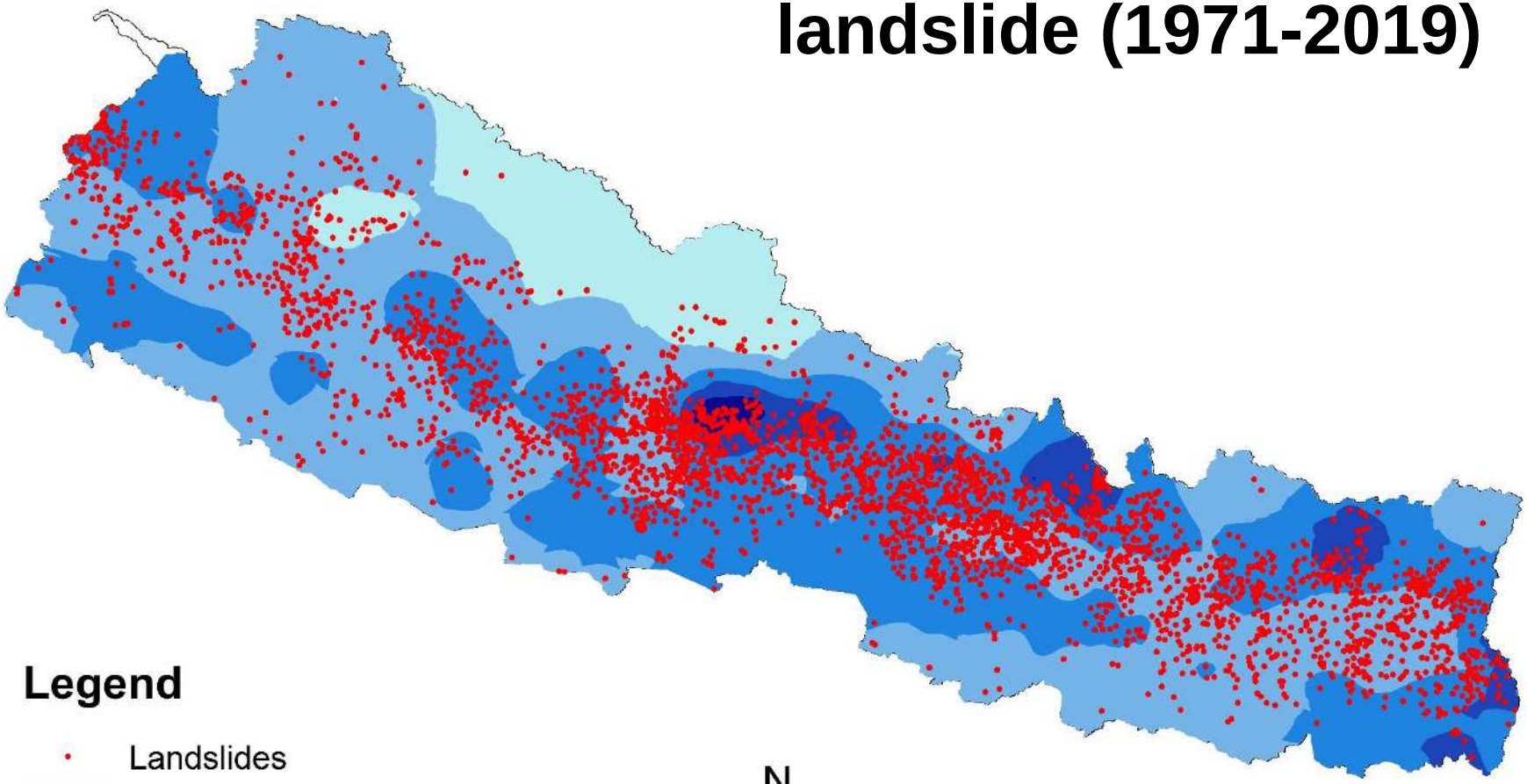


Veh et al., 2019

Glacial lakes in HKH

Veh et al., 2019

Spatial distribution of landslide (1971-2019)



Legend

- Landslides
- 0 - 1000 mm
- 1000 - 2000 mm
- 2000 - 3000 mm
- 3000 - 4000 mm
- 4000 - 5000 mm

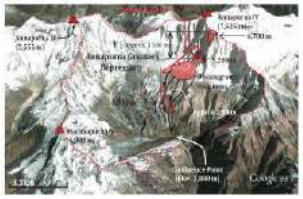
N

0 70 140 280 km

Adhikari et al. 2022

Recent large scale events

Seti Flood, Nepal (2012):



https://www.ndtv.com

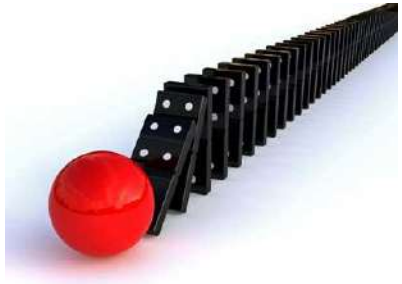
Bhandari et al. 2012

Melamchi debris flow, Nepal (2021):

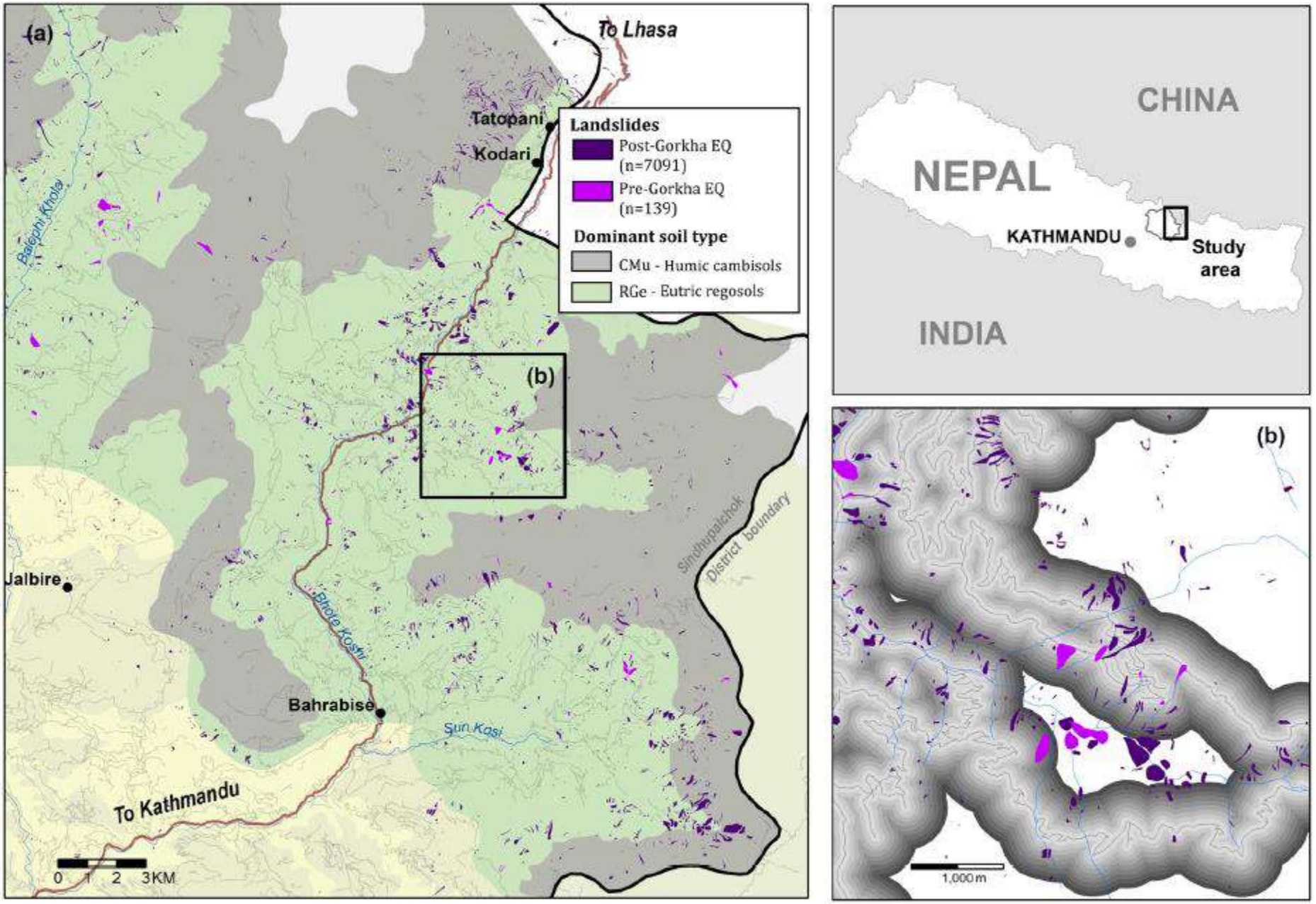
Photo: Dorze Ghale

Photo: Geovation Nepal

The cascade effect



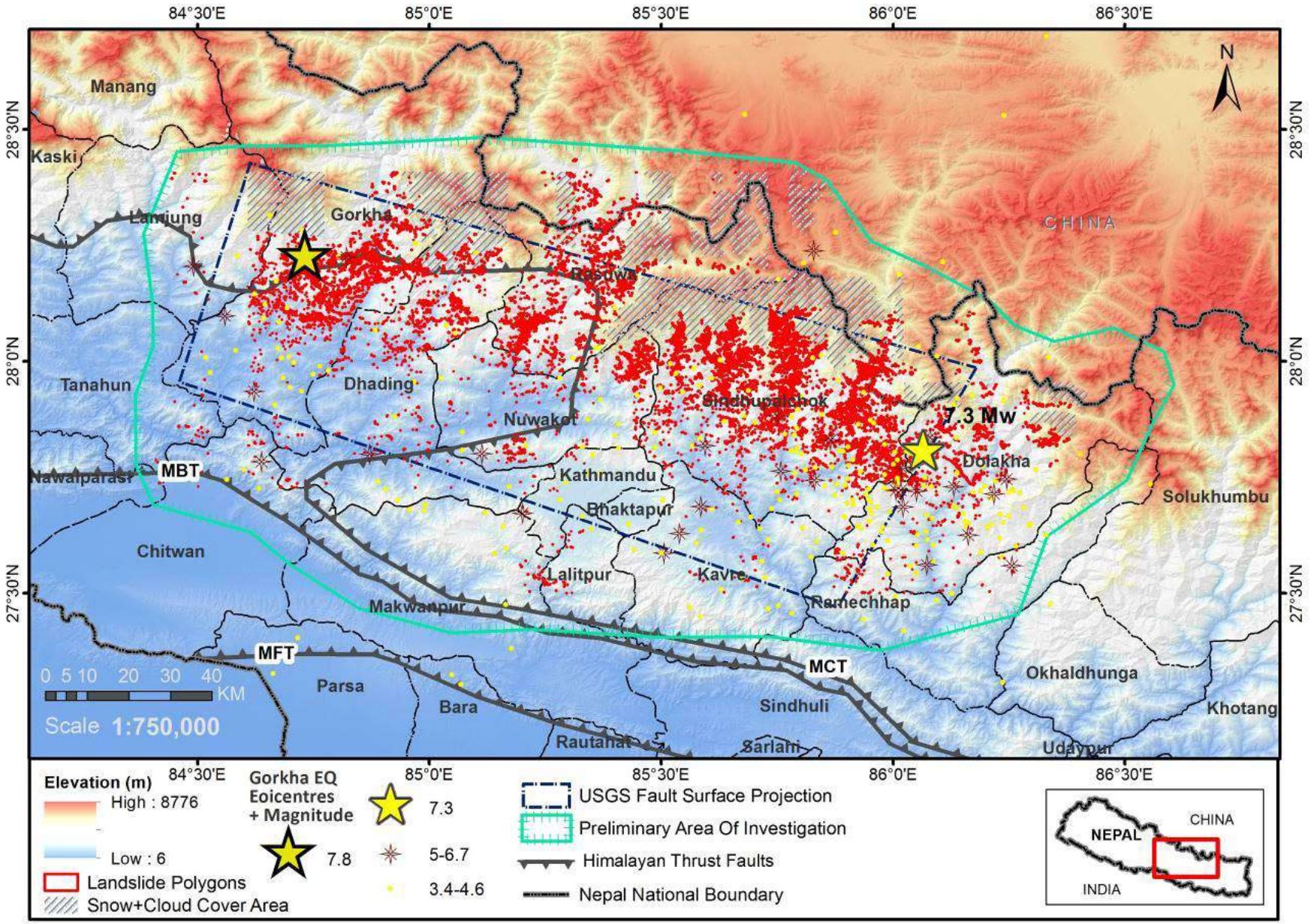
Geohazard investigation



The rainfall-triggered landslides are more than twice as likely to occur within 100m of a road than the landslides generated by the earthquake.

B. G. McAdoo et al., 2018

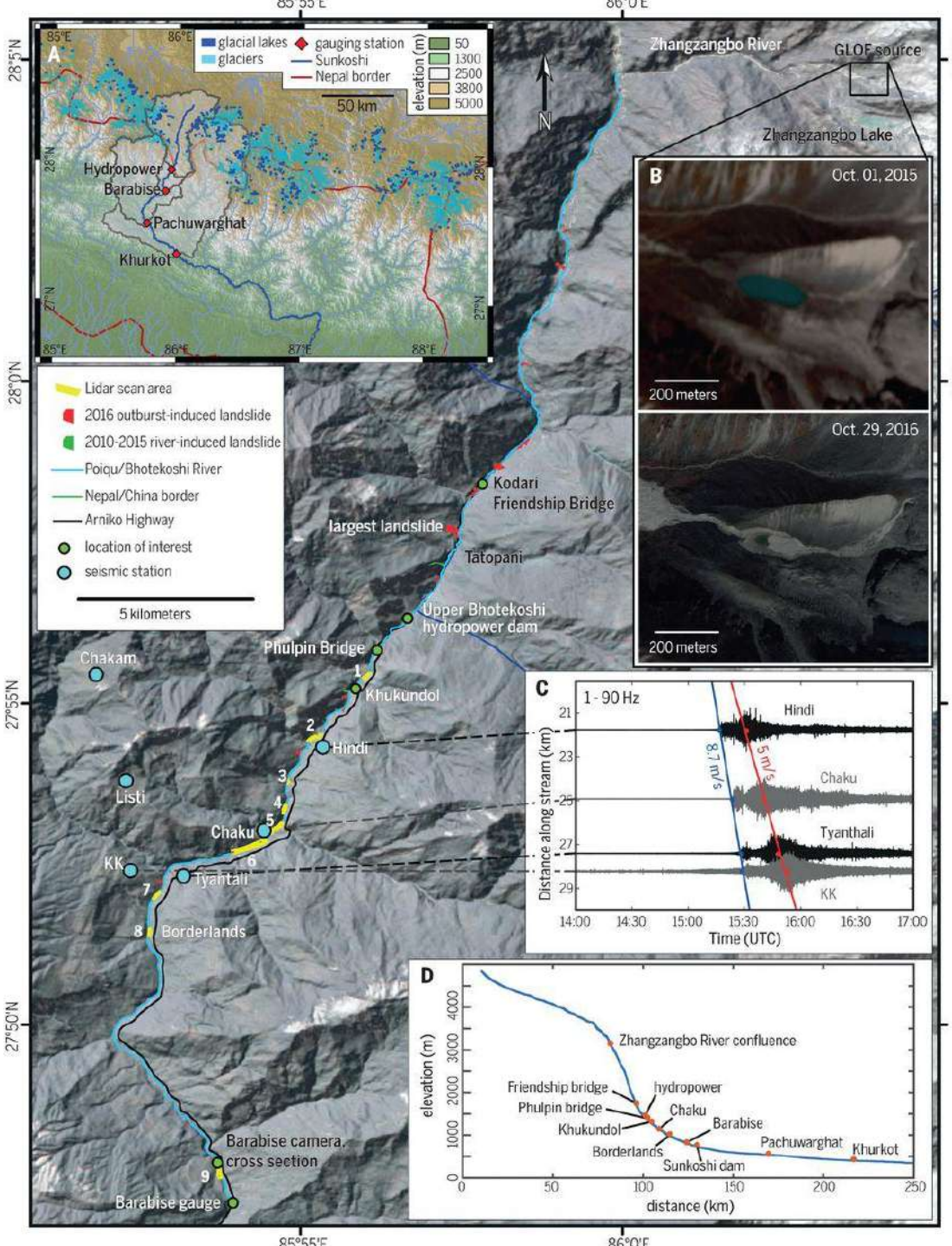
Co-seismic landslides



Gnyawali and Adhikari, 2015

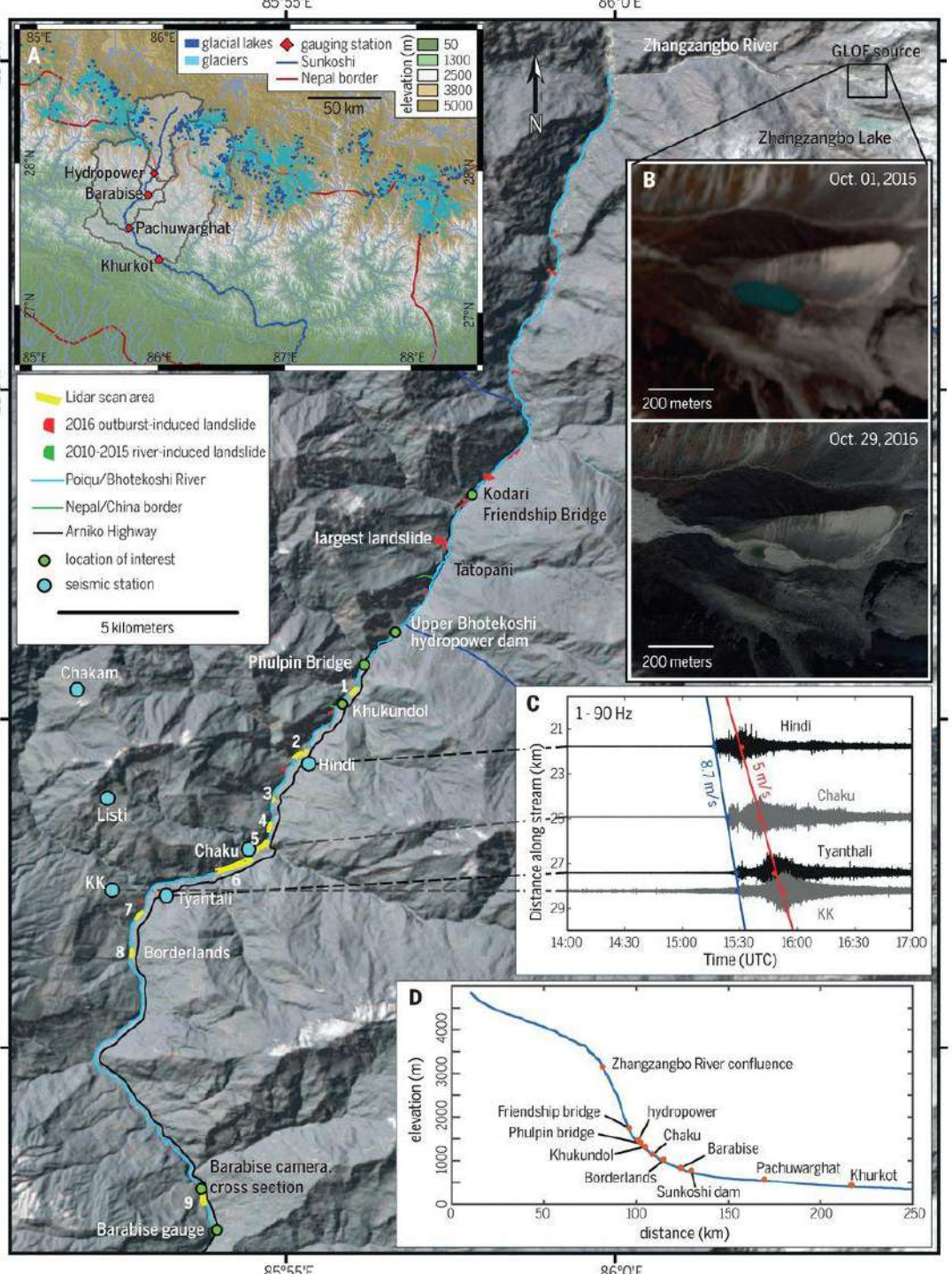
GLOFs hazards

Bhotekoshi, 2016



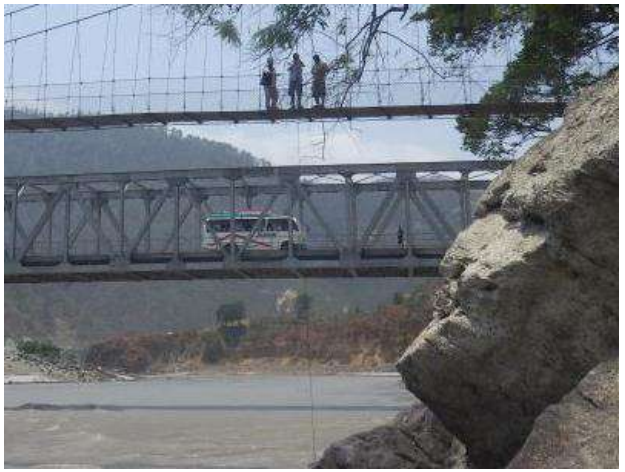
Seismic monitoring

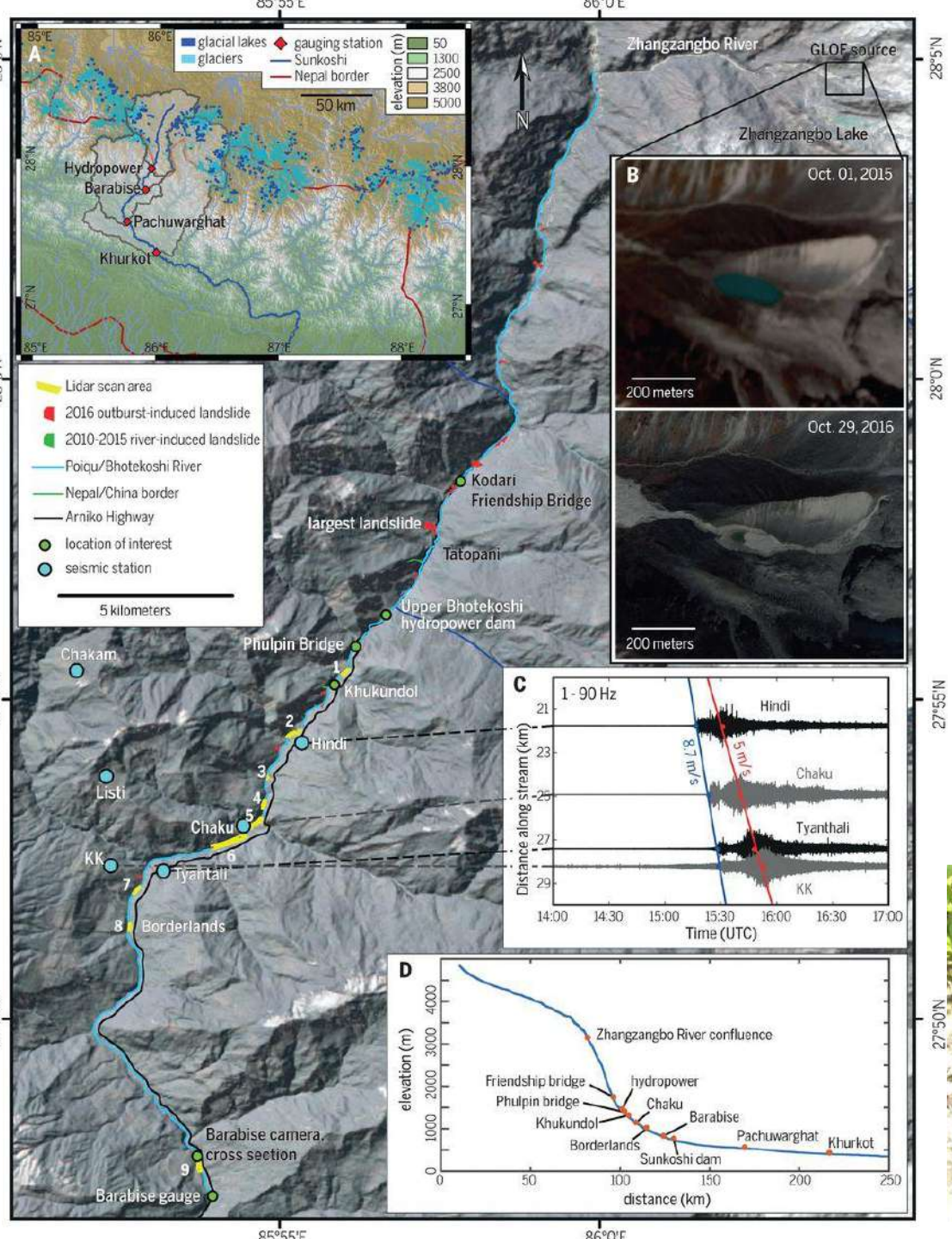
Terrestrial Lidar



Time lapse camera

Suspended sediment concentrations





Discharge calcualtion


10 June 2015
Bushnell
Camera Name 865.8mb
39°C
06-10-2015 11:53:34

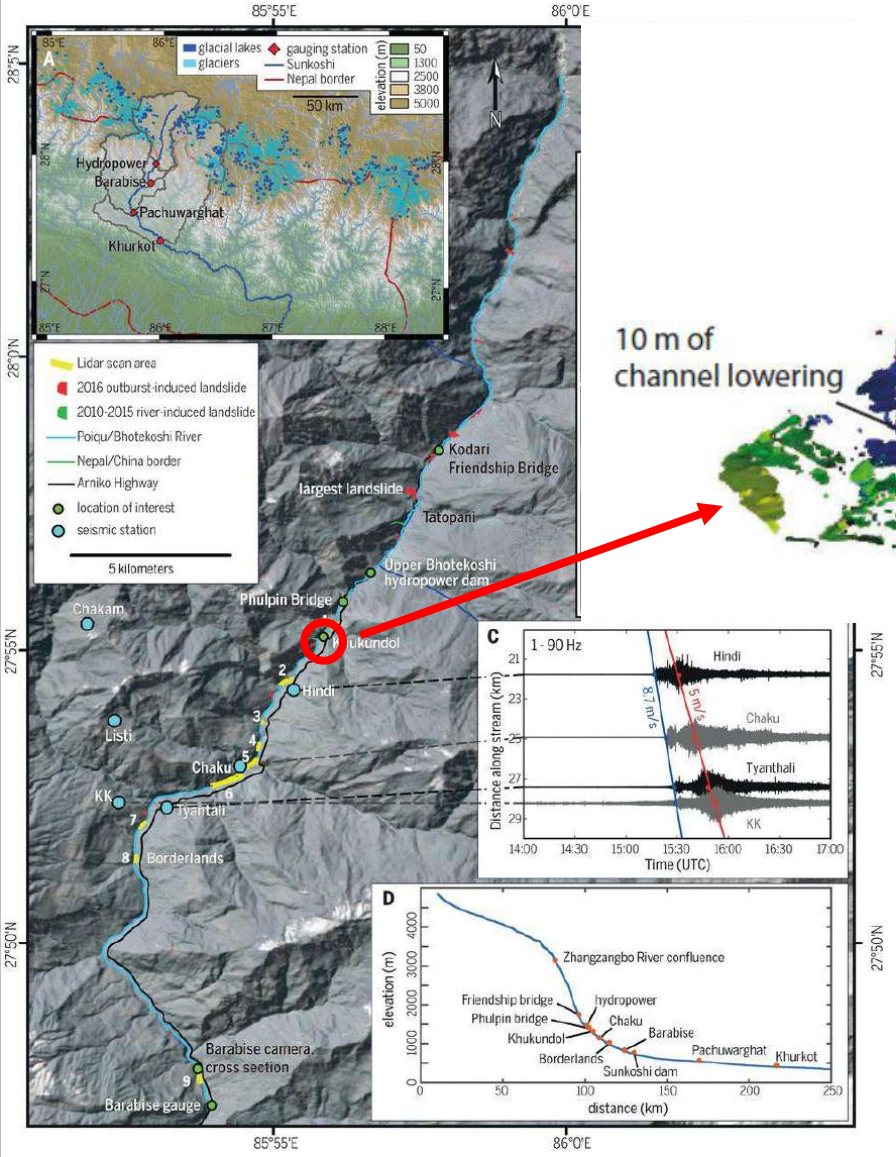

06 June 2016
06-15-2016 11:00:01

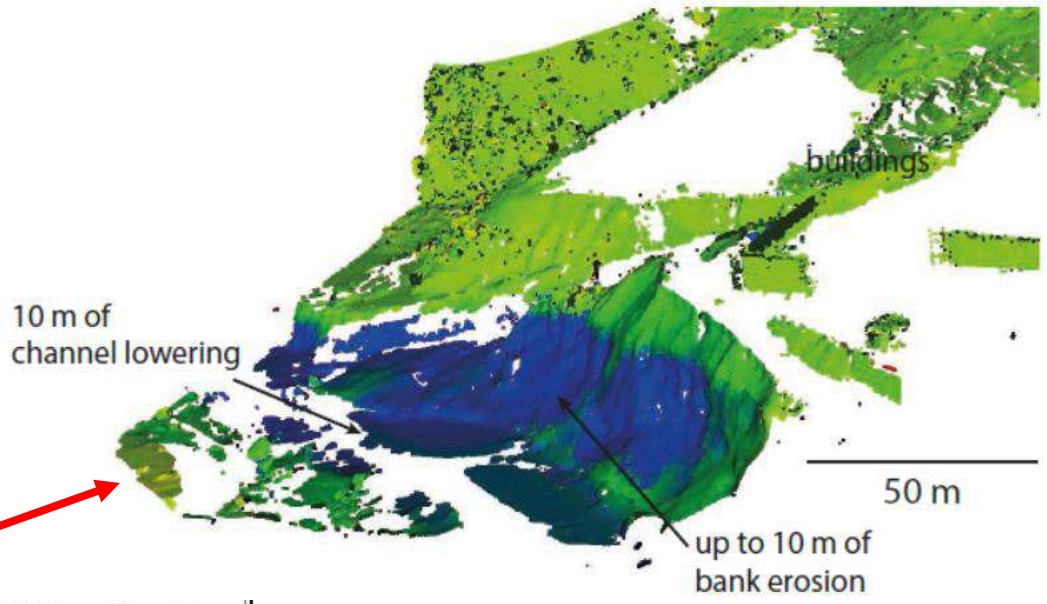
5 kilometers

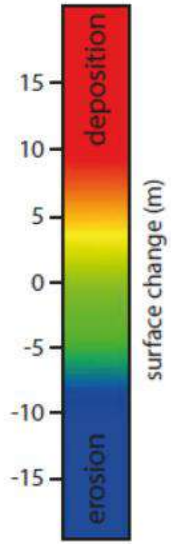

05 July 2016, 18:00
07-05-2016 18:00:01


06 July 2016, 6:00
07-06-2016 06:00:02

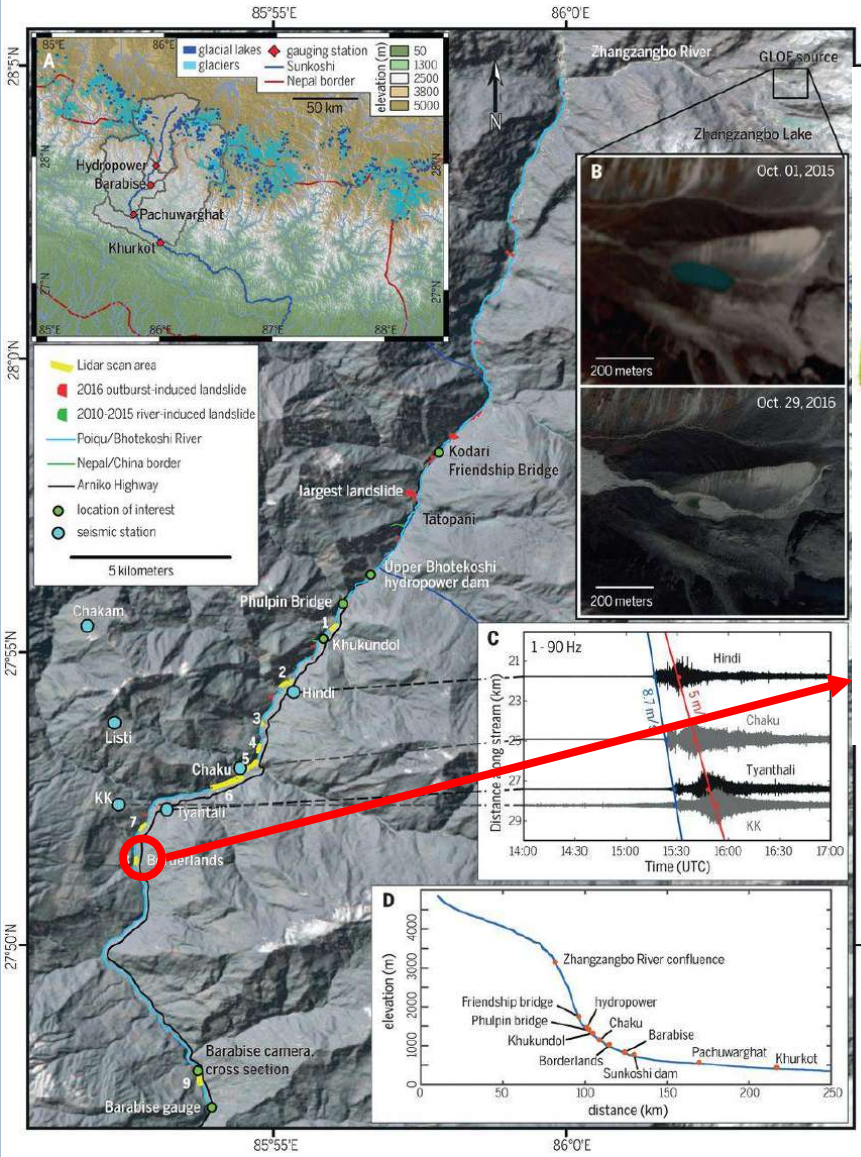
Channel Erosion

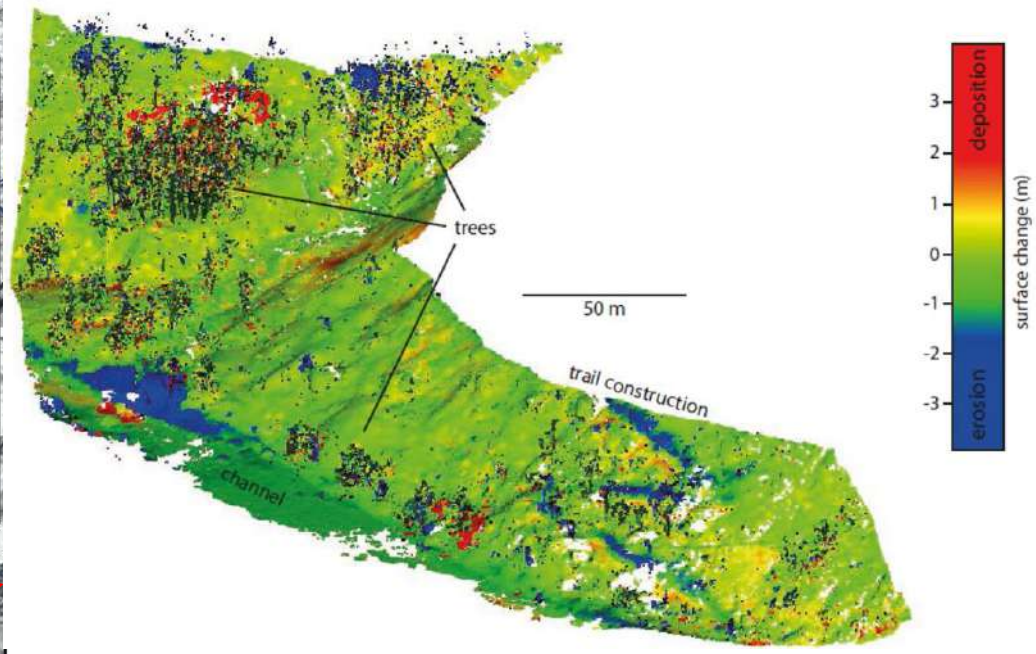






Channel Erosion

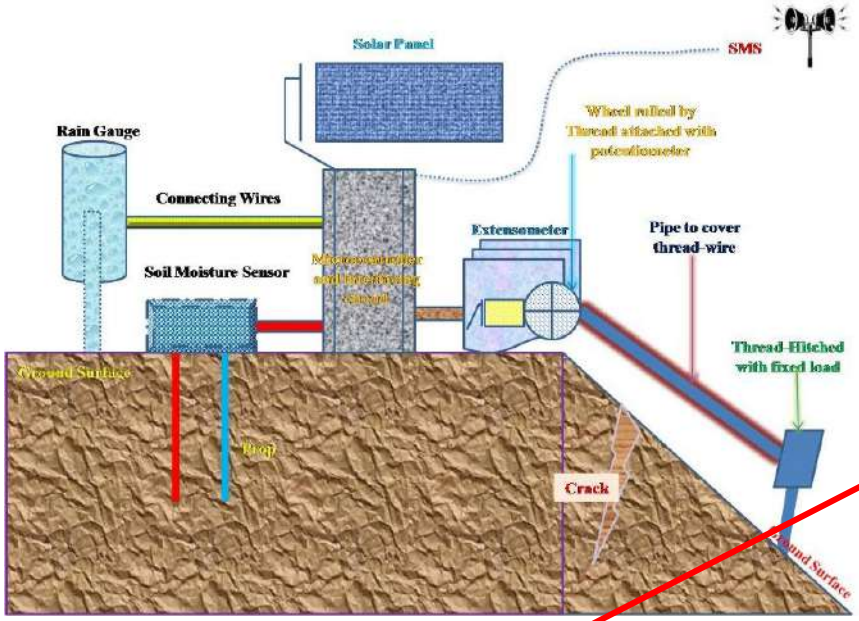


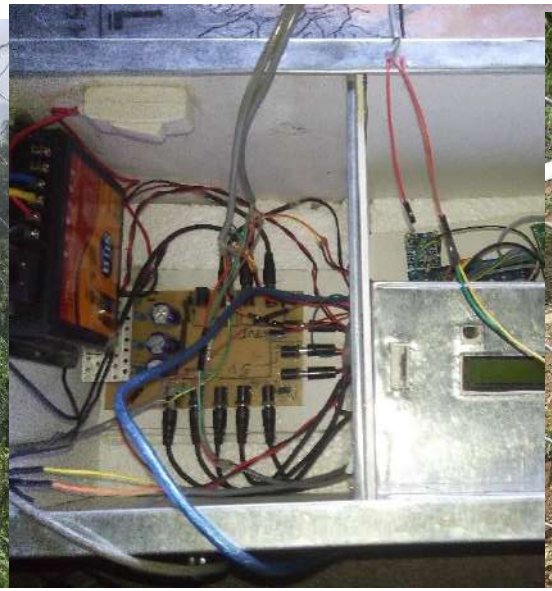


Landslide Early Warning System

Thapa and Adhikari, 2019

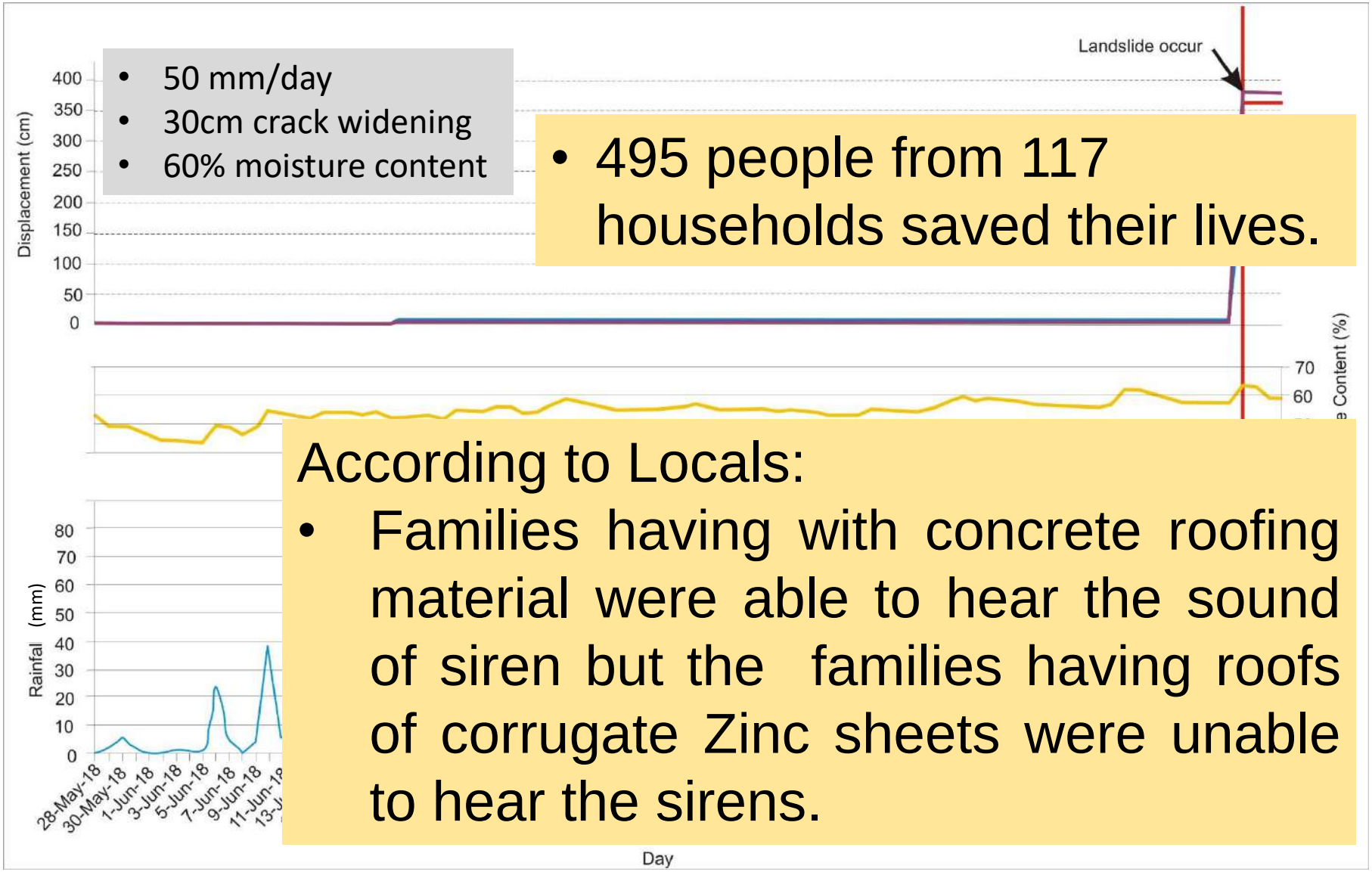
Landslide Early warning system





Thapa and Adhikari, 2019

Landslide Early warning system



- 50 mm/day
- 30cm crack widening
- 60% moisture content

- 495 people from 117 households saved their lives.

According to Locals:

- Families having with concrete roofing material were able to hear the sound of siren but the families having roofs of corrugate Zinc sheets were unable to hear the sirens.

Thapa and Adhikari, 2019

A way forward…….

- Establishment of hydro-meteorological stations at the high altitude (>3000m) in the Nepal Himalaya
- Multi-hazard risk assessment considering cascading impacts.
- Monitoring and threshold calculation for Early Warning System (EWS)
- Preparation of Impact based multi-hazard forecast system.
- Implementation of Risk-sensitive Land Use planning considering all possible risk scenarios.

Thank you

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