Terrain visibility can affect landslide data collection

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INTRODUCTION

- Landslide inventories are fundamental
- Bias in inventories → Bias in final product
- Inventories can be done by different approaches

INTRODUCTION

Classical available databases

- Photo-interpretation
- Legacy/Historic data collection
- Field-work

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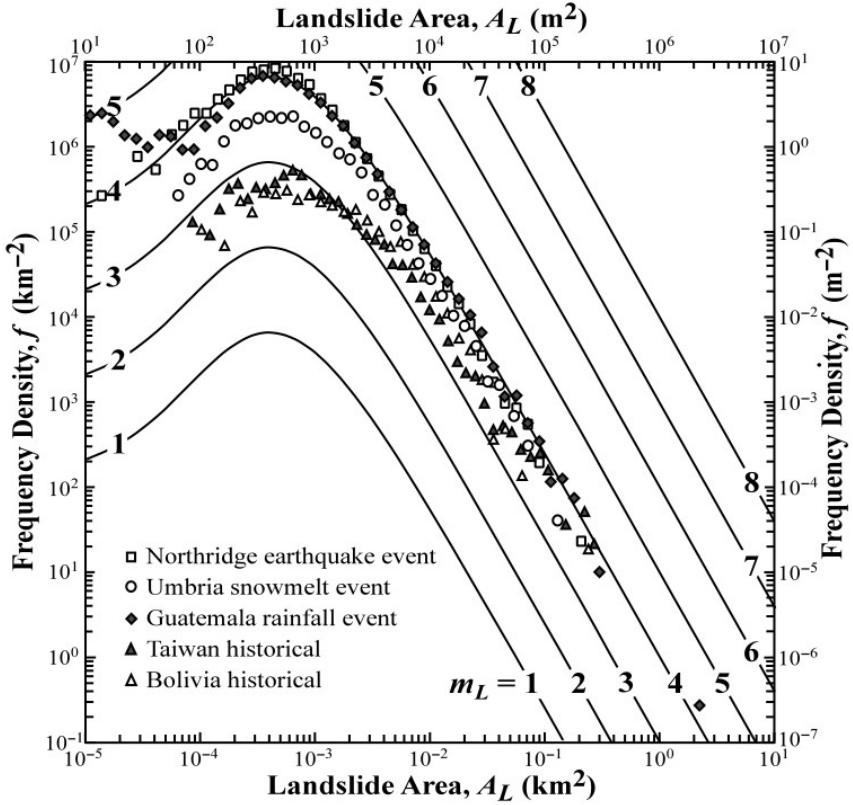
variable Capacity of Landslide Mapping (CoLM)

"*The variability of the working conditions during the data collection*"

INTRODUCTION

HOW CAN WE ASSESS OUR INVENTORY?

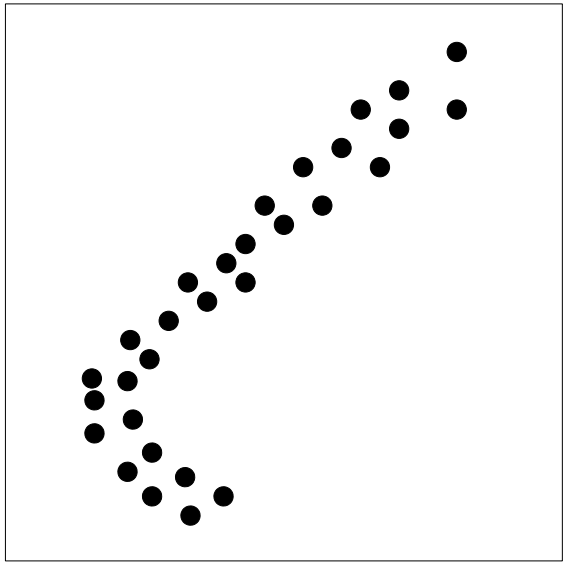
INTRODUCTION

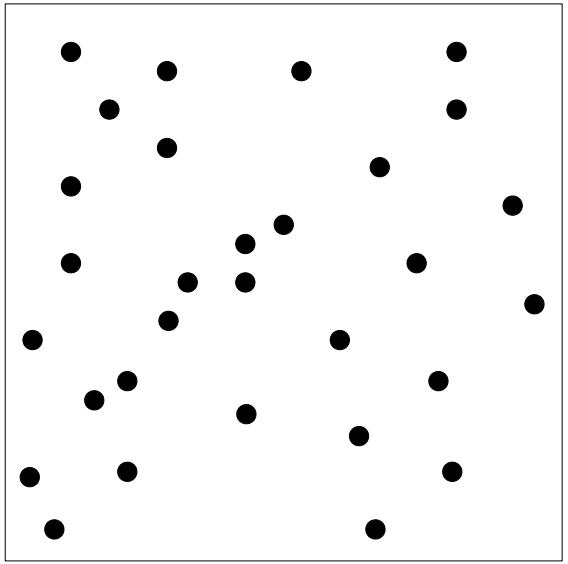


Frequency Area Distribution curve
FAD curves

Malamud et al., 2004

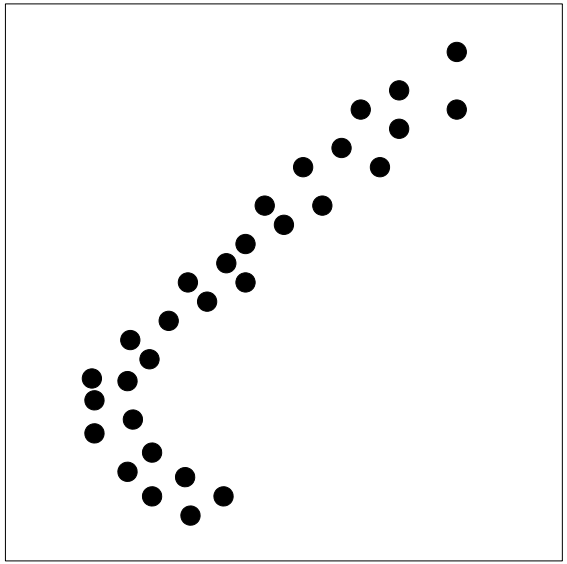
INTRODUCTION

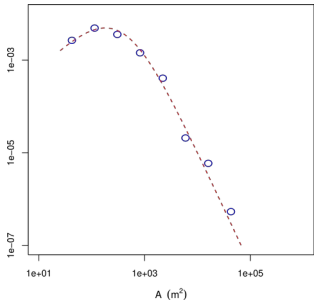


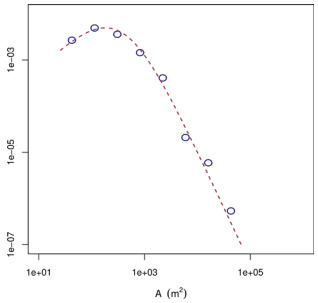


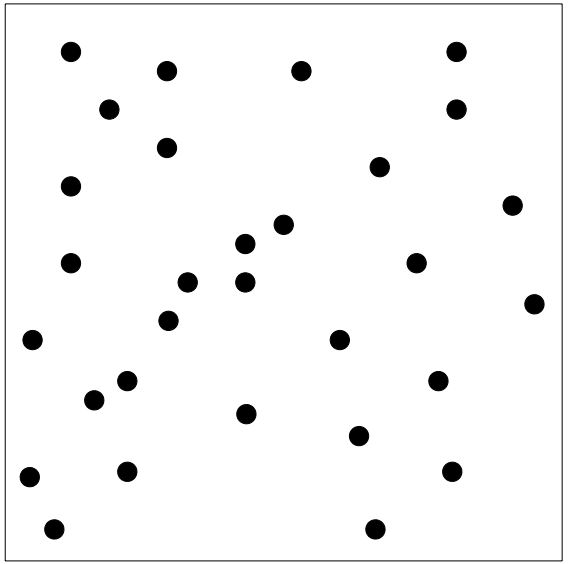
INTRODUCTION

FAD curves









It assumes a uniform CoLM

HYPOTHESIS

We believe that the CoLM is related to the terrain visibility

OBJECTIVES

- This study presents a framework to assess the uniformity in CoLM, and hence the quality/completeness of the inventory
- The method is based on the concept of “estimated visibility” (EV)
- We tested the proposed framework using different inventories available for the Darjeeling district (north-east of India)

Study Area

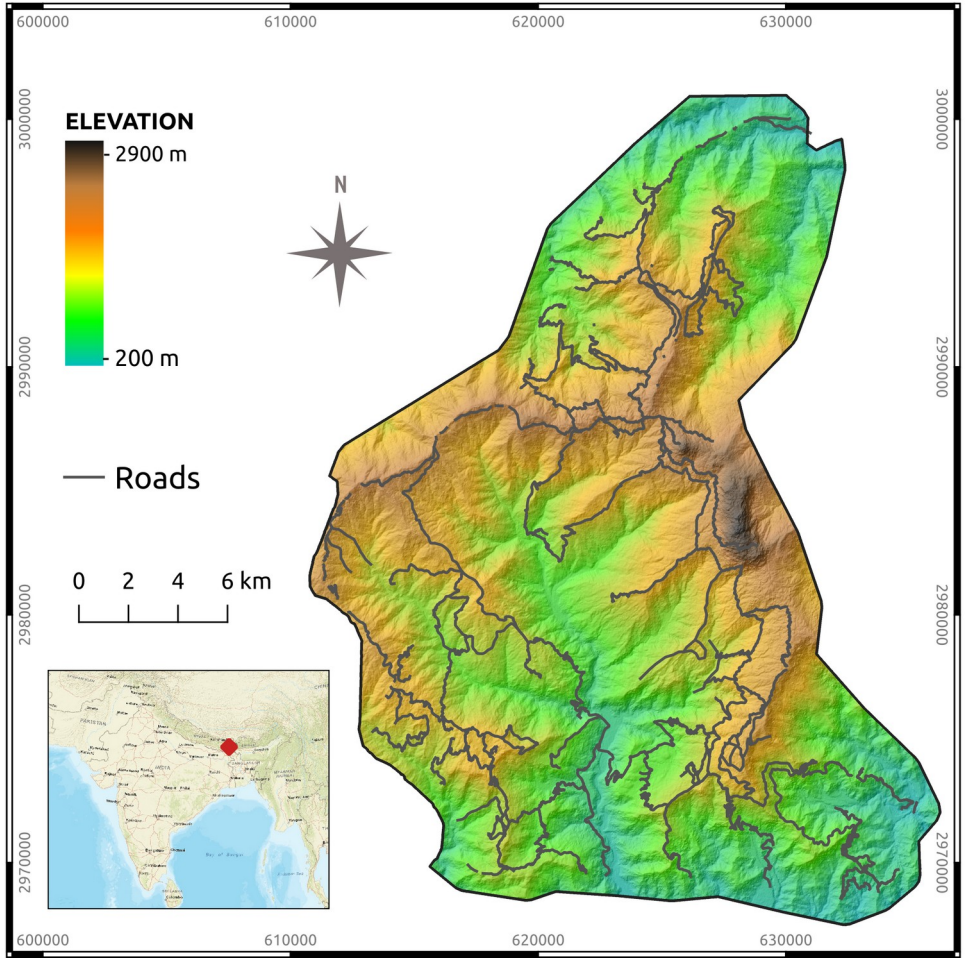
West Bengal (India)

~ 513 km²

~ 48% with 15° and 30° slope

Altitude range 200 - 2900 m a.s.l.

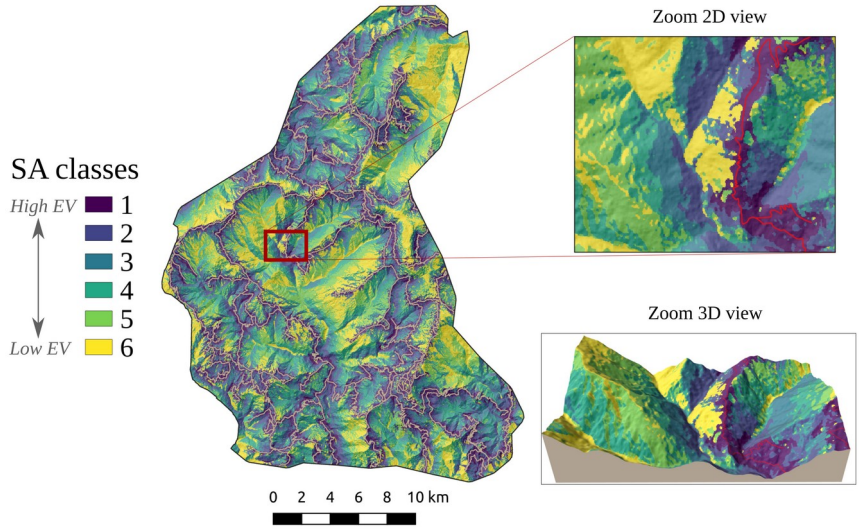
Monsoon rain between June and September



METHODS

- We simulated the terrain visibility from roads using **r.survey** → Wed, 25 May, 18:18-18:24 Room 0.16 (GM2.3)
- It calculates the Solid Angle (SA) of an object in the terrain respect to the observation point (i.e. from the roads)
- We classify the terrain in 6 SA classes:

  from highly visible → poorly visible



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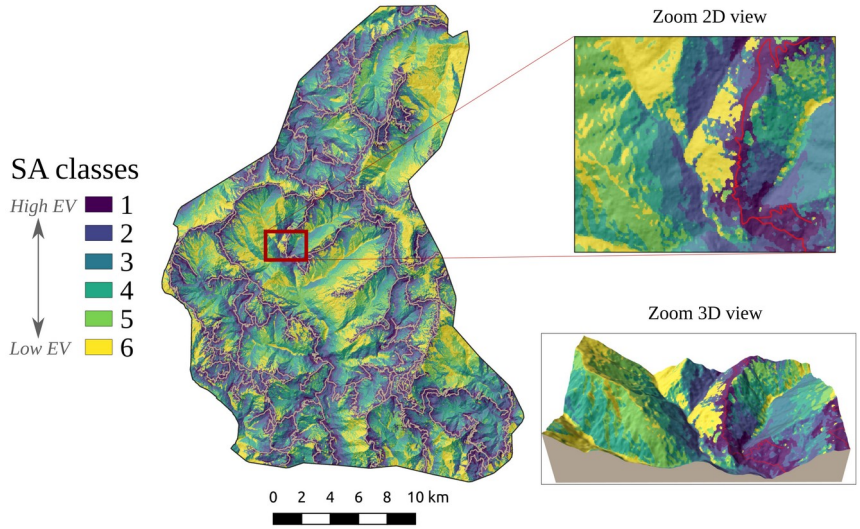


Estimated Visibility Map

METHODS

We measured the density of landslides within each EV class

We used the Normalized Landslide Count (NLC)

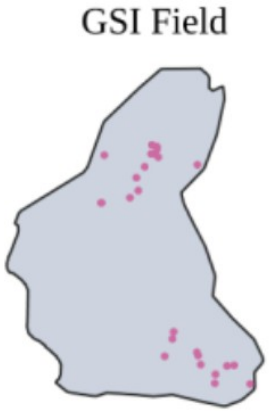
$$NLC_i = n_i / n_t$$

where $n_i \rightarrow$ number of landslides in the SA class i and

$n_t \rightarrow$ represent the total number of landslides

METHODS

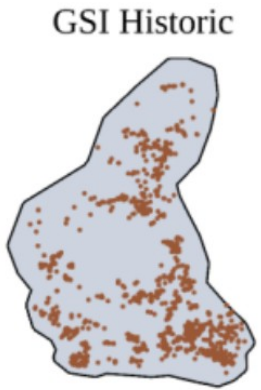
INVENTORIES



Field based inventory n=25

METHODS

INVENTORIES



GSI Historic Sat n=600

GSI Historic Others n=640

METHODS

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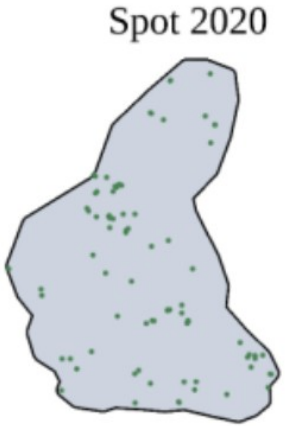

Photo-interpretation n=82

Pre-image March 2019

Post-image April 2020

RESULTS

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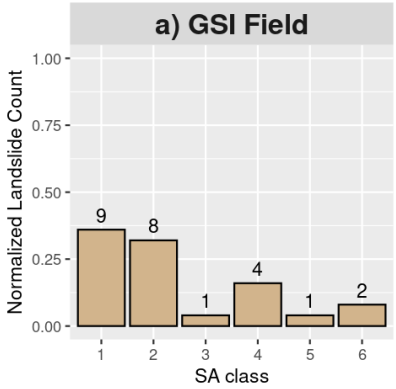
NLC plots



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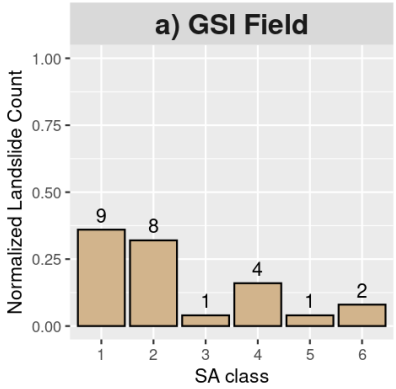

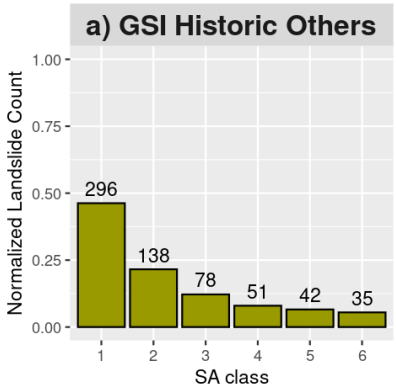

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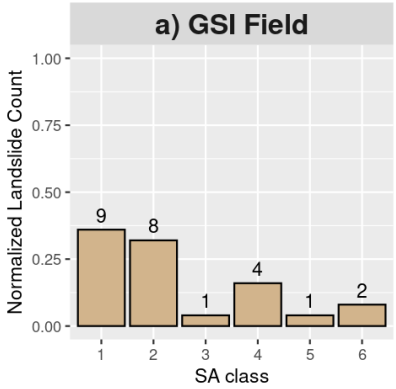

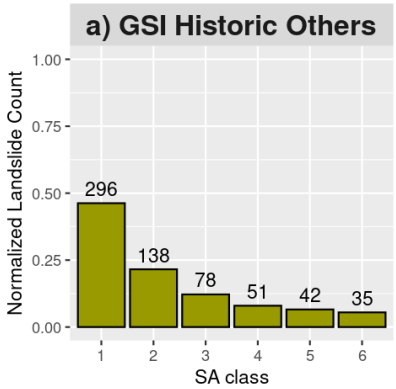

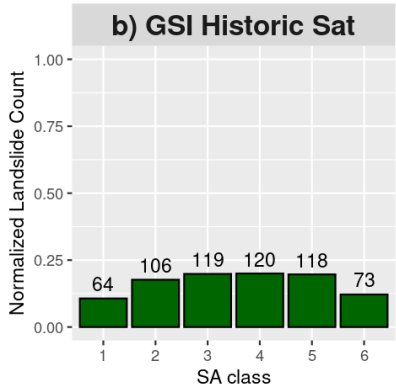

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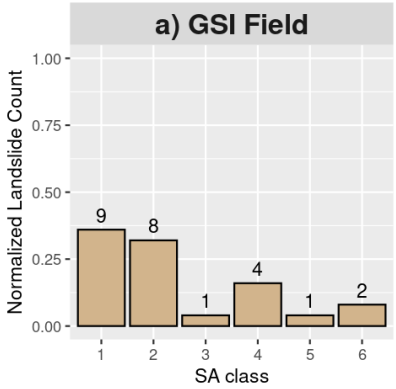

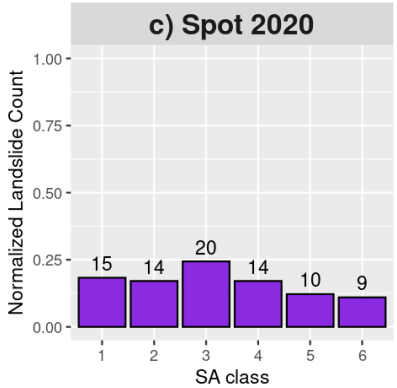

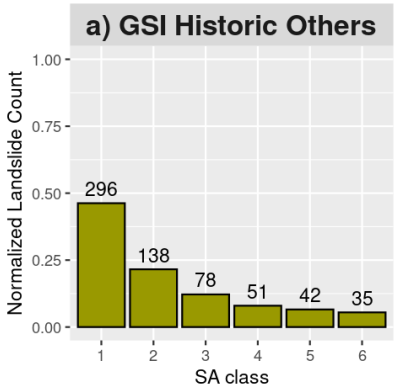

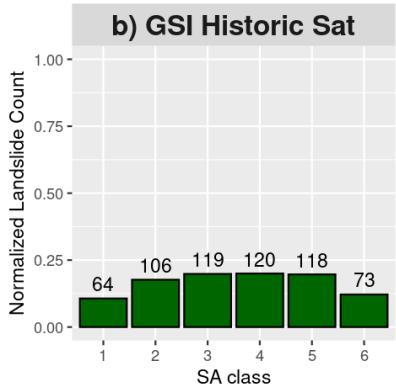

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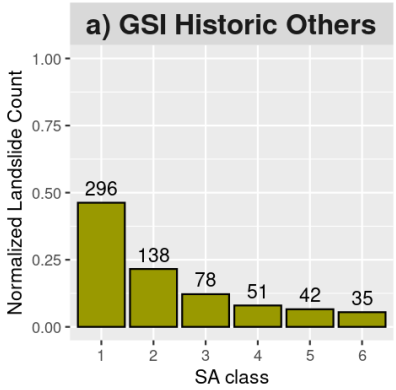
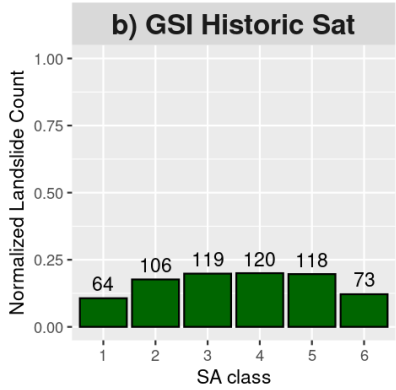
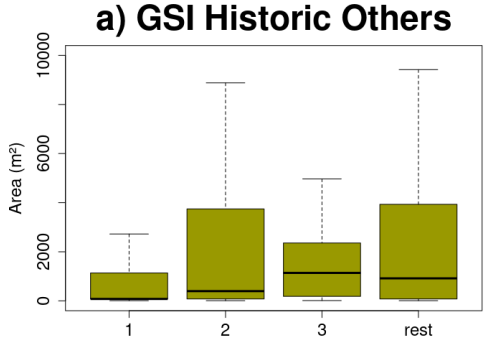
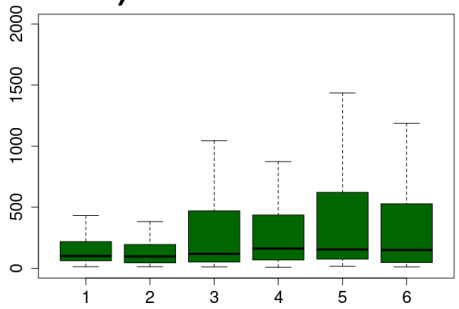




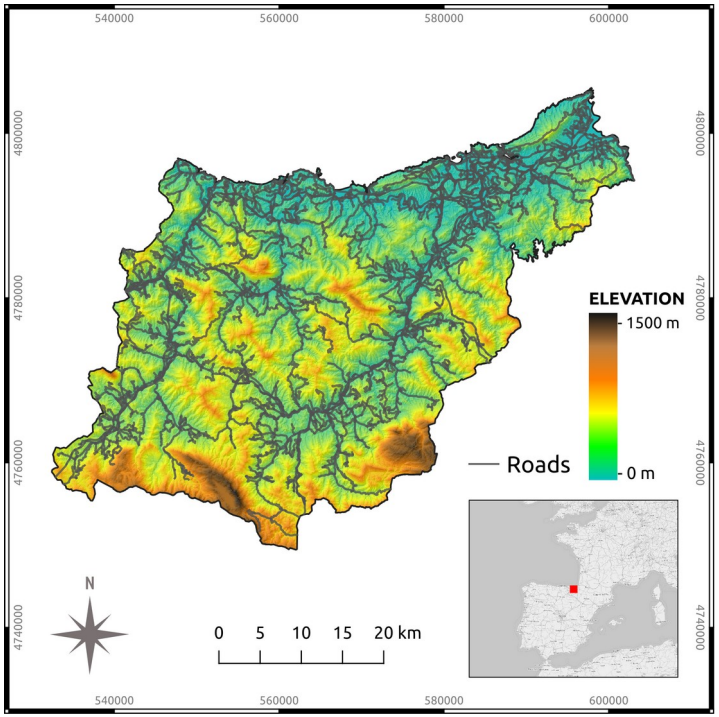
Landslide Areas





RESULTS

Verification with external data



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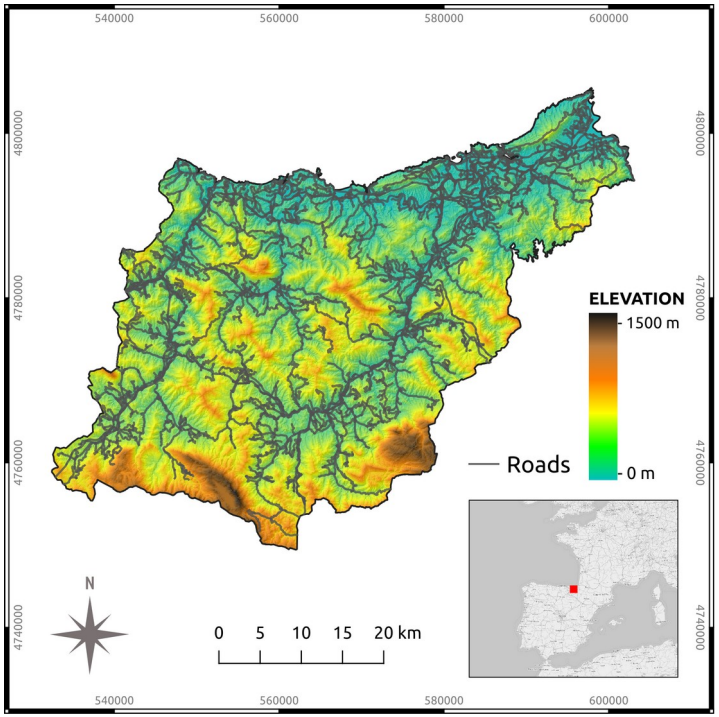

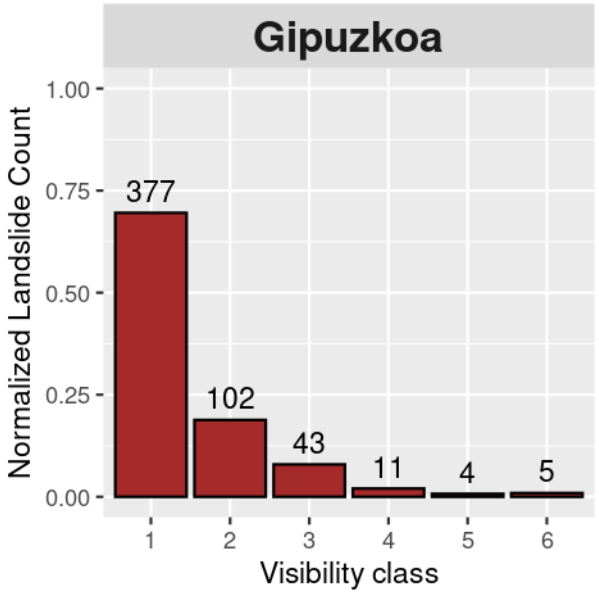

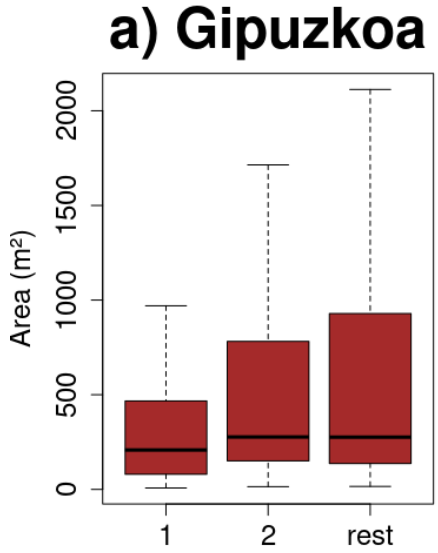

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CONCLUSIONS

- Inventories prepared using **field survey** and/or **historic legacy data**, showed a marked **in-homogeneity in CoLM**
- Inventories based in **photo-interpretation** of remote sensing images showed a **uniform CoLM**
- Our method allowed us to assess **the CoLM** and its **spatial representation** through a map
- We think that the procedure and methods presented in this work can be used, in other study areas, to:
  - Test whether the information in existing inventories (especially those created by fieldwork) is affected by a scarce CoLM (and therefore completeness) uniformity,
  - Identify portions of land where landslide density information is larger with respect to other areas and can be more properly used to train susceptibility, hazard and risk models,
  - Identify portions of land where landslide inventories need improvement,
  - Plan exhaustive field mapping campaigns.

THANK YOU VERY MUCH

QUESTIONS ?