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Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

*Climate Resilient Land Governance and Disaster Resilience: Safeguarding Land Rights*



## Integrating Machine Learning and Community-Based Approaches for Enhanced Early Warning Systems in Cascading Hazard Zones: A Case Study from Melamchi, Nepal

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## Background

- DRR & EW is guided by:
  - Sendai Framework of DRR (2015) four priorities area:
    - Understanding Risk,
    - Strengthening Disaster Governance,
    - Investing in Disaster Risk Reduction for Resilience,
    - Enhancing Disaster Preparedness for Effective Response
- To achieve the target action taken by Nepal government:
  - Nepal Disaster Risk Reduction Policy (2018): focus on integration of DRR into Development & planning
  - National Disaster Risk Reduction Strategic Action Plan (2018-2030): Road map
  - Disaster Risk Reduction and Management Act (2017): Roles and Responsibilities of government
  - Local Disaster and Climate Resilience Plans (LDCRP): Community based approach
  - Nepal Risk Reduction Consortium (NRCC): Multi-stakeholder Platform



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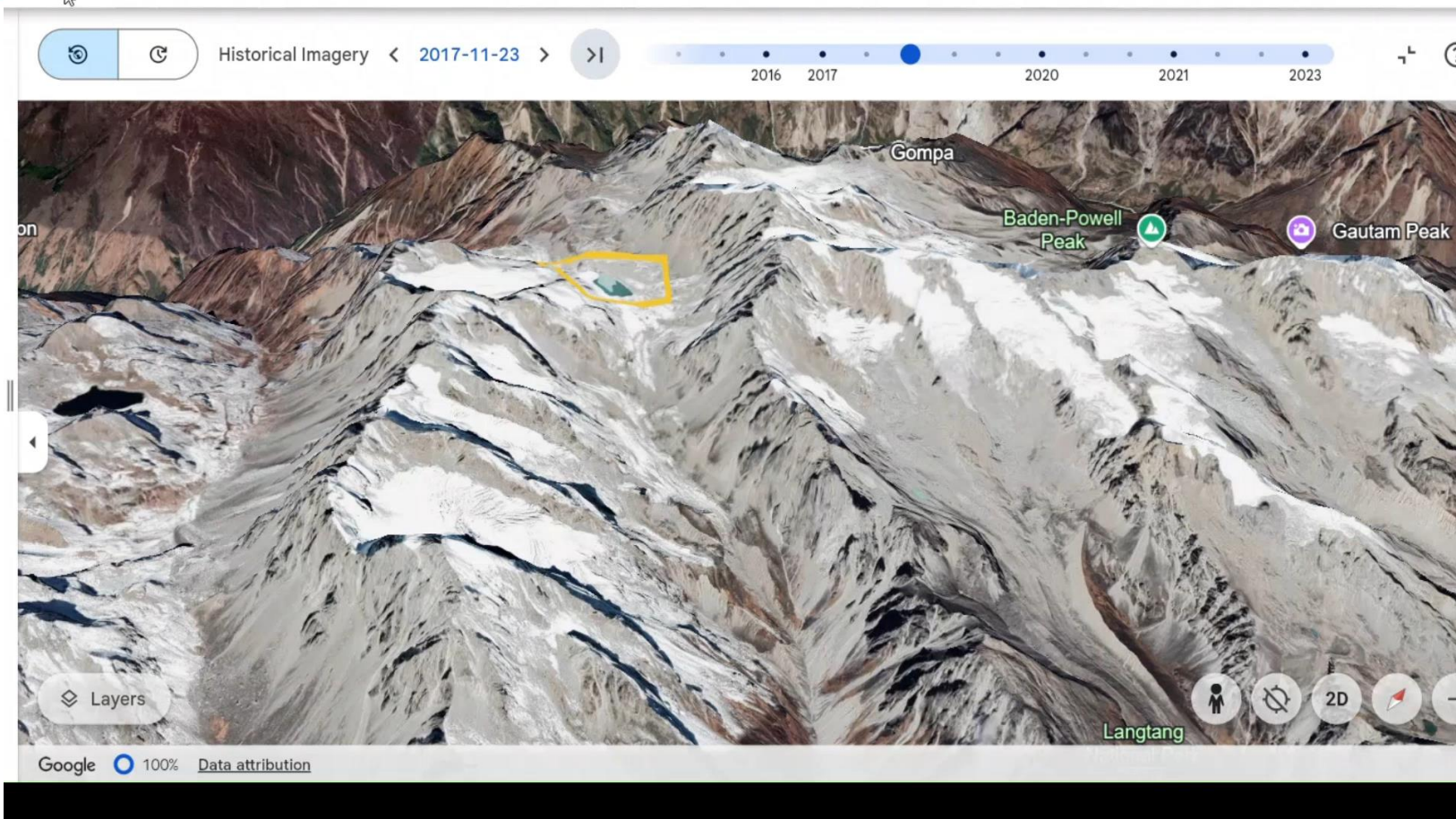
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## Study Area

- Cascading hazard in Melamchi river:
  - Heavy rainfall cause rapid Snow melt
  - Landslides
  - River bank erosion
- Occur in June 15,2021
- Reasons for this study:
- Complex Topography
- High precipitation
- Vulnerable community
- Data scarcity
- Local people willingness to cope such a disaster



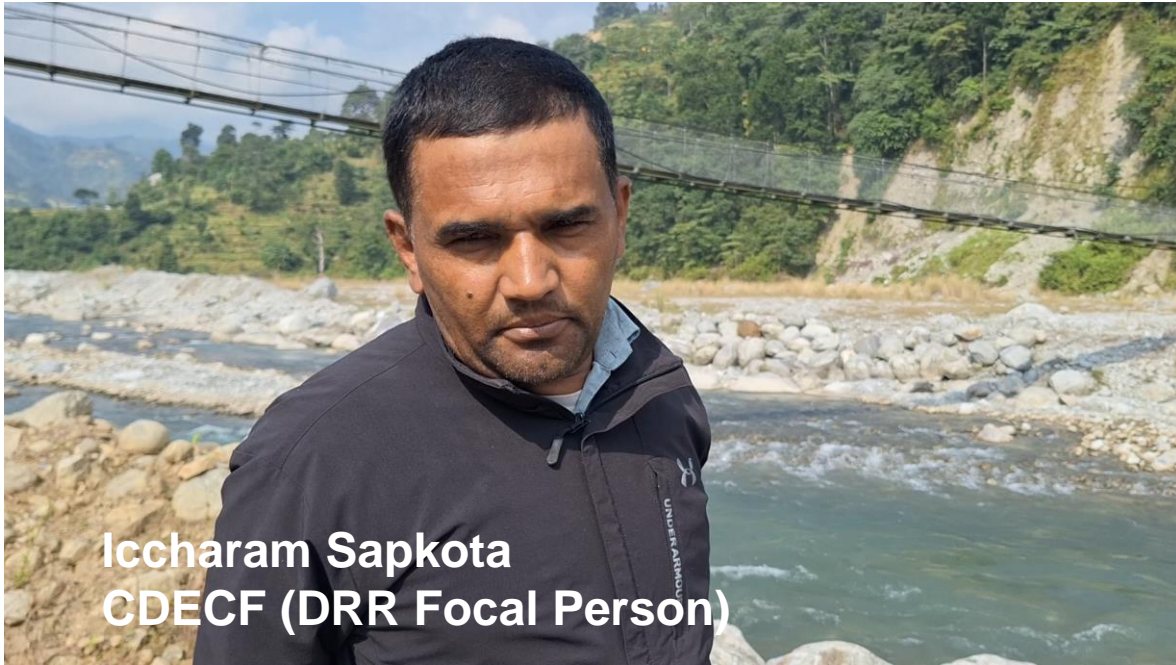
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## Community based Approach



Iccharam Sapkota  
CDEC (DRR Focal Person)



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## Community based Approach

- Explain the way this work
- Communication from Upstream
- Siren will be played



Local Person  
(Helambu)

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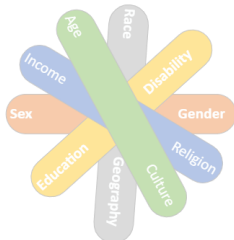
## Community based Approach for risk mapping

Step 1: Survey Design and Data Collection:



Capacity and resources mapping  
Hazard mapping  
Vulnerability mapping

Step 2: Engagement of Diverse group of Citizens



Step 3: Data Validation and Risk Mapping



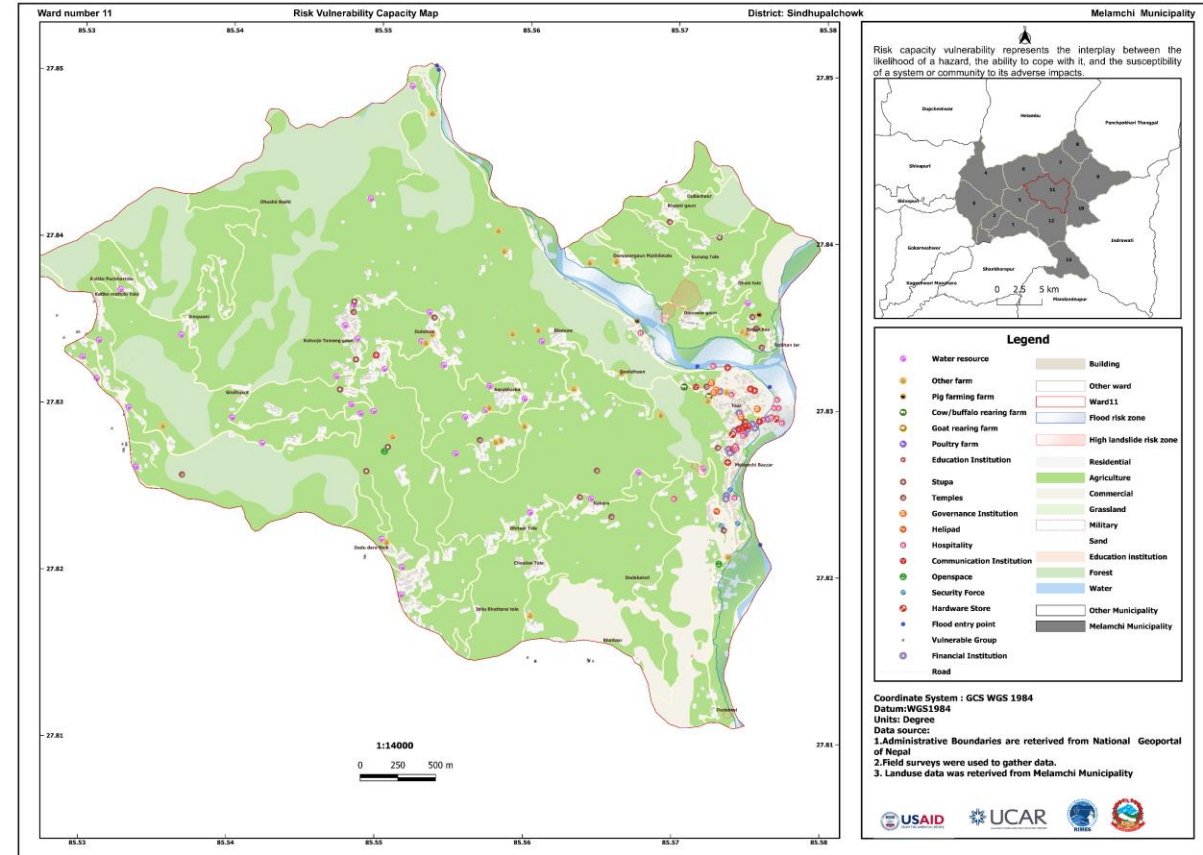
Validating collected data  
Mapping risk based on questionnaire

Step 4: Finalizing Map



Capacity Resource Map  
Vulnerability Map  
Risk Map  
Combined Map

### Under review in Community Science Journal



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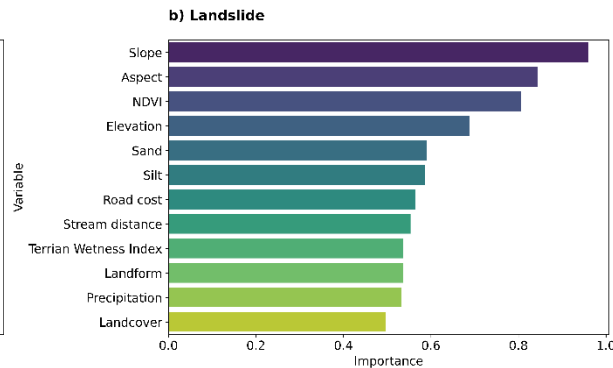
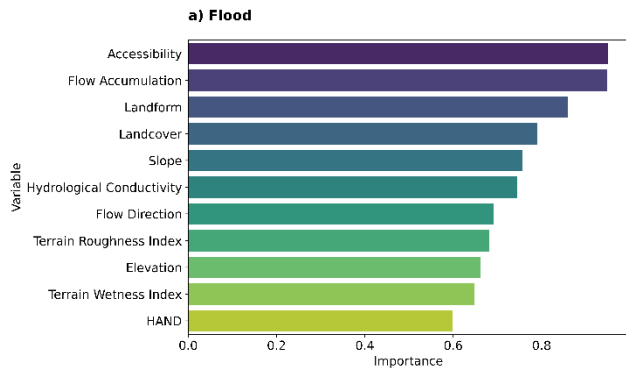


## Machine learning model with citizen risk zonation

$$f(x) = \frac{1}{B} \sum_{b=1}^B fb(x)$$

$B$  is the number of trees

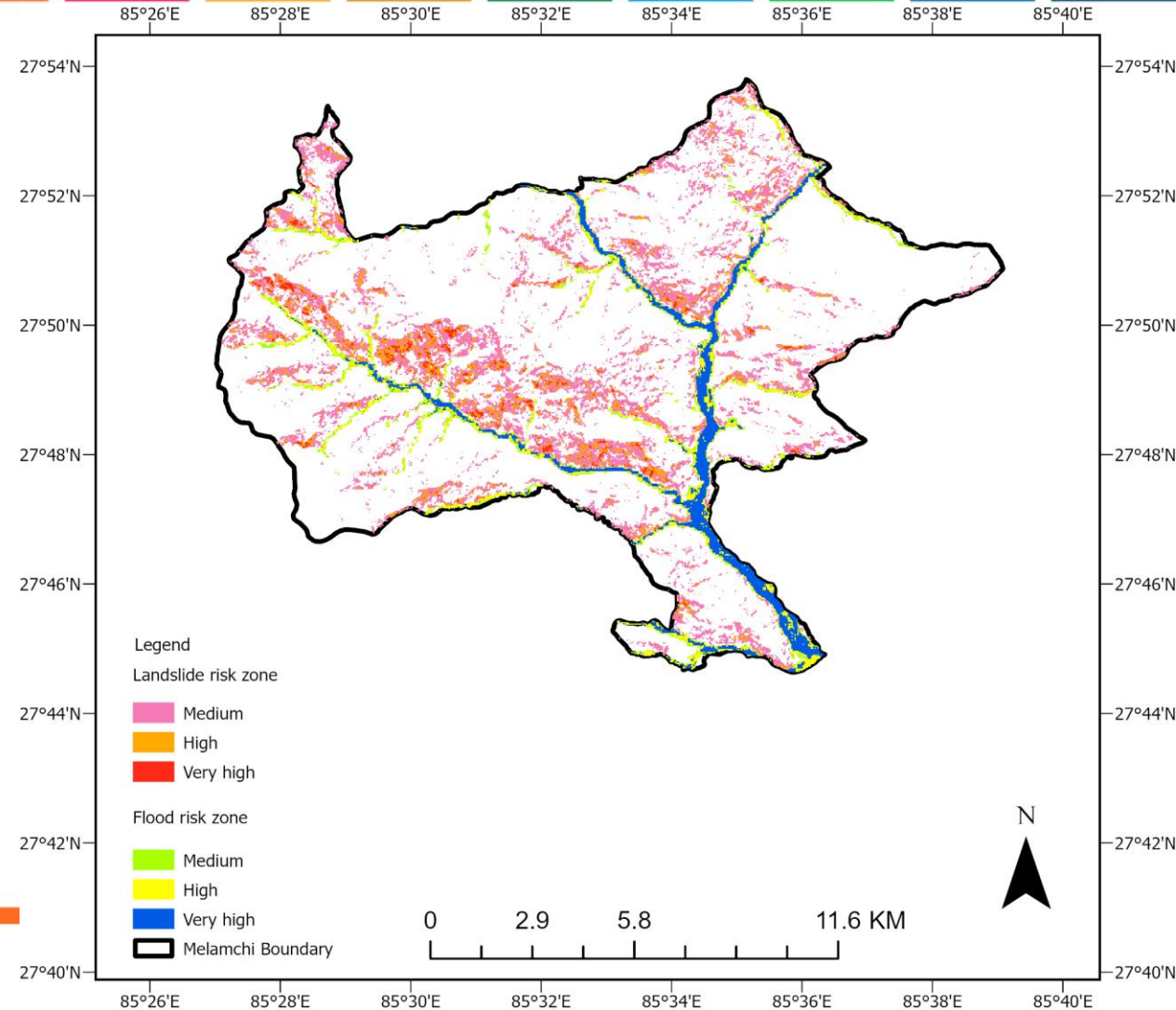
$fb(x)$  is the prediction of bth individual trees based on the number of Parameters





## Result:

- Focus on all the priorities area of Sendai Framework
- Citizen Science approach empower the local communities
- Communication framework helps the local people for effective communication during the flood event which protect life
- Machine learning model result helps in long term spatial planning and development





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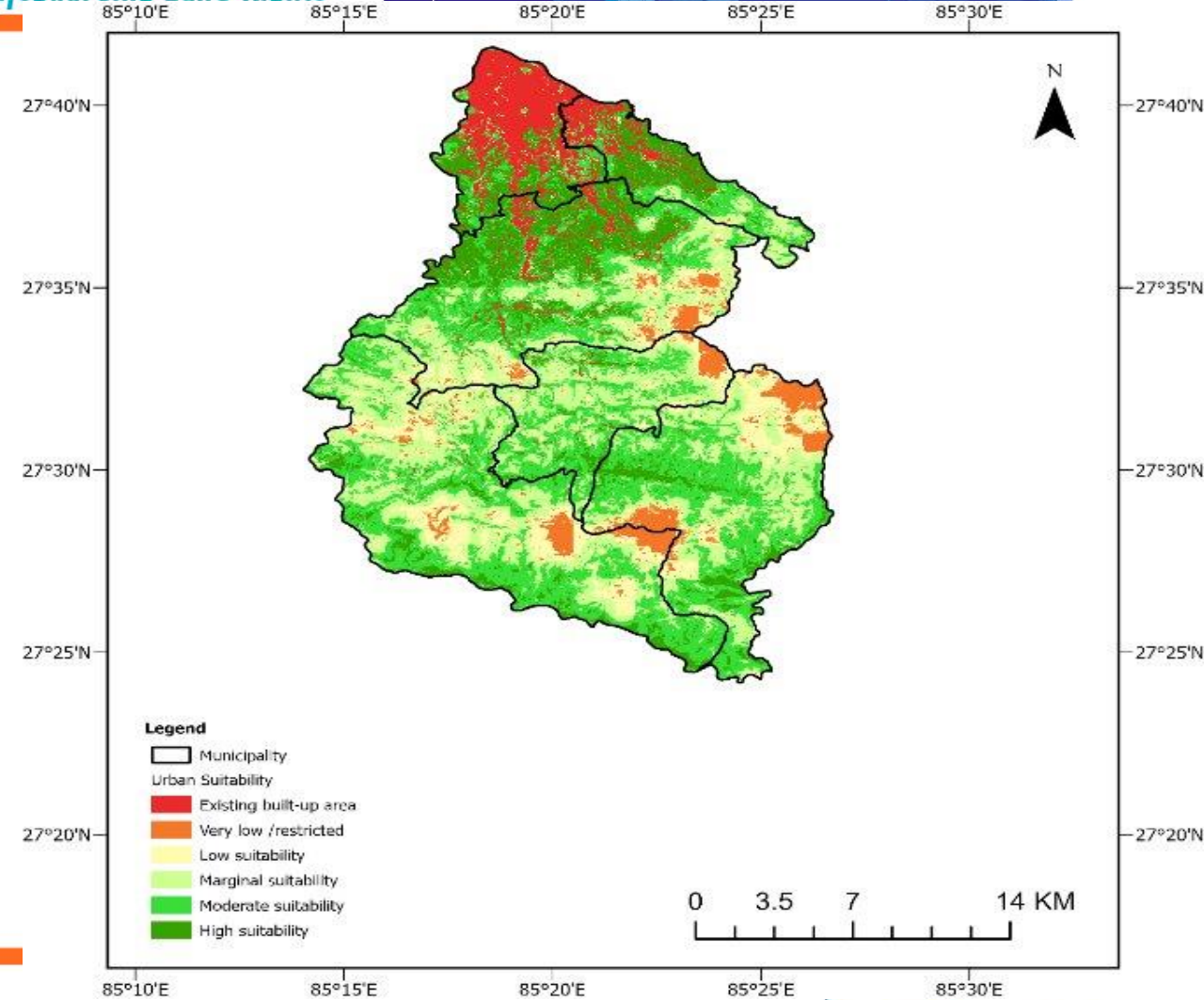


## How long term spatial planning :

Parameter used in this study:

- Land cover
- Proximity to Brick kilns
- Flood severity
- Population density
- Access to facilities
- Slope, DEM
- Night light data

Under review on city and Built-environment Journal



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Way forward will be to develop model which helps to achieve the target of SDGS and Sendai Framework of DRR in context of NEPAL which incorporate all the discussion

Thank you



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