

Community Based Landslide Vulnerability and Risk Assessment: Method and Tools

ICIMOD

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Concept: Vulnerability and Risk



$$\text{Risk} = f(\text{Hp} * \text{Dp})$$
$$\text{Vulnerability} = f(\text{E} * \text{S} / \text{A}) \text{ or } \text{Dp}$$
$$f(\text{E} - \text{A}) * \text{S}$$

Hp = hazard probability, Dp = Damage probability, E = Exposure, S = Sensitivity, A = Adaptive capacity

Livelihood vulnerability

Exposure

- Life
- Properties
- Infrastructure
- Livelihood support system
- Environmental resources

Capacity

- Assets/wealth
- Information
- Technology/skills
- Access/ equity
- Service infrastructures
- Institutions

Sensitivity

- Food
- Health
- Education
- Transportation and communication
- Infrastructure services - market

- **Risk-hazard approach** (Hazard of a place and exposure)
- **Political economy approach** (Assess to resources and decision making processes)
- **Resilience approach** (Propensity of social and ecological systems to suffer harm from external stresses and shocks).
- **Livelihood approach** (Access to physical, natural, social and financial capital or assets)
- **Integrated approach** (Risk-hazard and the political economy approach combined : the hazard-of-place or the hazards of place with the social profile of communities)

Why CBDRM?

- Local communities are both the primary victims and the first to respond to emergencies when disasters strike.
- Provides opportunities to participate in identifying and evaluating risk and formulate and implement measures to reduce risk
- It eventually empowers communities with self-developed and culturally acceptable ways of coping

Participatory Rural Appraisal (PRA) Processes

- Gathering of scattered stakeholders and groups
- Collection of information and data
- Cross-checking and triangulation of information
- Identification of the main problem and preparation of action plans

Participatory Rural Appraisal (PRA) tools

1. Social/ resources/ physical/ hazard/ institutional mapping
2. Prioritization of problems/ interests/ needs
3. Wellbeing ranking
4. Seasonal calendar
5. Trend line/ timeline
6. Problem tree analysis
7. Cause and effects analysis
8. Key informants interview
9. Structured or semi-structured questionnaire survey
10. Transact walk
11. Group discussion

Hazard Identification and Mapping

| Description | Methods | Tools |
|-------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Inventory and mapping of landslide hazard | Group Discussion | Checklist/mapping guidelines |
| Causal factors of landslide | Group Discussion, Key Informant Interview | Problem tree |
| Landslide hazard ranking | Group Discussion | Pair-wise ranking matrix |
| Frequency, magnitude and recurrence interval of landslide hazard (occurrence probability) | Key Informants Interview and Group Discussion | Historic timeline |
| Temporal distribution of landslide hazard | Group Discussion and Records | Seasonal calendar of the occurrence of hazard |
| Landslide hazard mapping | Social hazard mapping | Mapping guidelines |

Exposure Assessment

| Description | Methods | Tools |
|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------|
| <p>Elements exposed to hazards: type and quantity of resources, livelihood assets and infrastructure within hazard prone area</p> | <p>Household Survey, Group Discussion,</p> | <p>Questionnaire and Checklist</p> |
| | <p>Group discussion</p> | <p>Seasonal calendar of agricultural crops, livestock grazing, socio-cultural events</p> |
| | <p>Social mapping – resource mapping</p> | <p>Mapping guidelines</p> |
| | <p>Social mapping: Exposure mapping</p> | <p>Mapping guidelines</p> |

Sensitivity Assessment

| Description | Methods | Tools |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Cause and effect analysis | Group Discussion | Problem tree |
| Historical damage of properties and infrastructure from hazards | Group Discussion, Key Informant Interview, Household Survey and review of loss record in the past | Checklist, Questionnaires Historical timeline |
| Assess to basic needs (self sufficiency in food, availability of clean drinking water and energy, availability of health services, availability of communication services | Group Discussion and Household Survey | Checklist and Questionnaires |

Adaptive Capacity, Vulnerability and Risk Assessment

| | Description | Methods | Tools |
|-----------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------|
| Adaptive Capacity | Socio-economic and demographic profile | Group Discussion, Household Survey Institutional Mapping (formal and informal) | Questionnaire, Checklist, Mapping guidelines |
| Vulnerability | $V = (E \times S) - A$ | Vulnerability Index | Calculation |
| Risk | Hazard probability* Damage probability (Relative ranking) | Group Discussion, Checklist | Risk Pair Ranking Matrix |
| Disaster Risk Management Planning | Identification of structural and non-structural measures | Group Discussion and Key Informants Interview | Checklist and Mapping Guidelines |

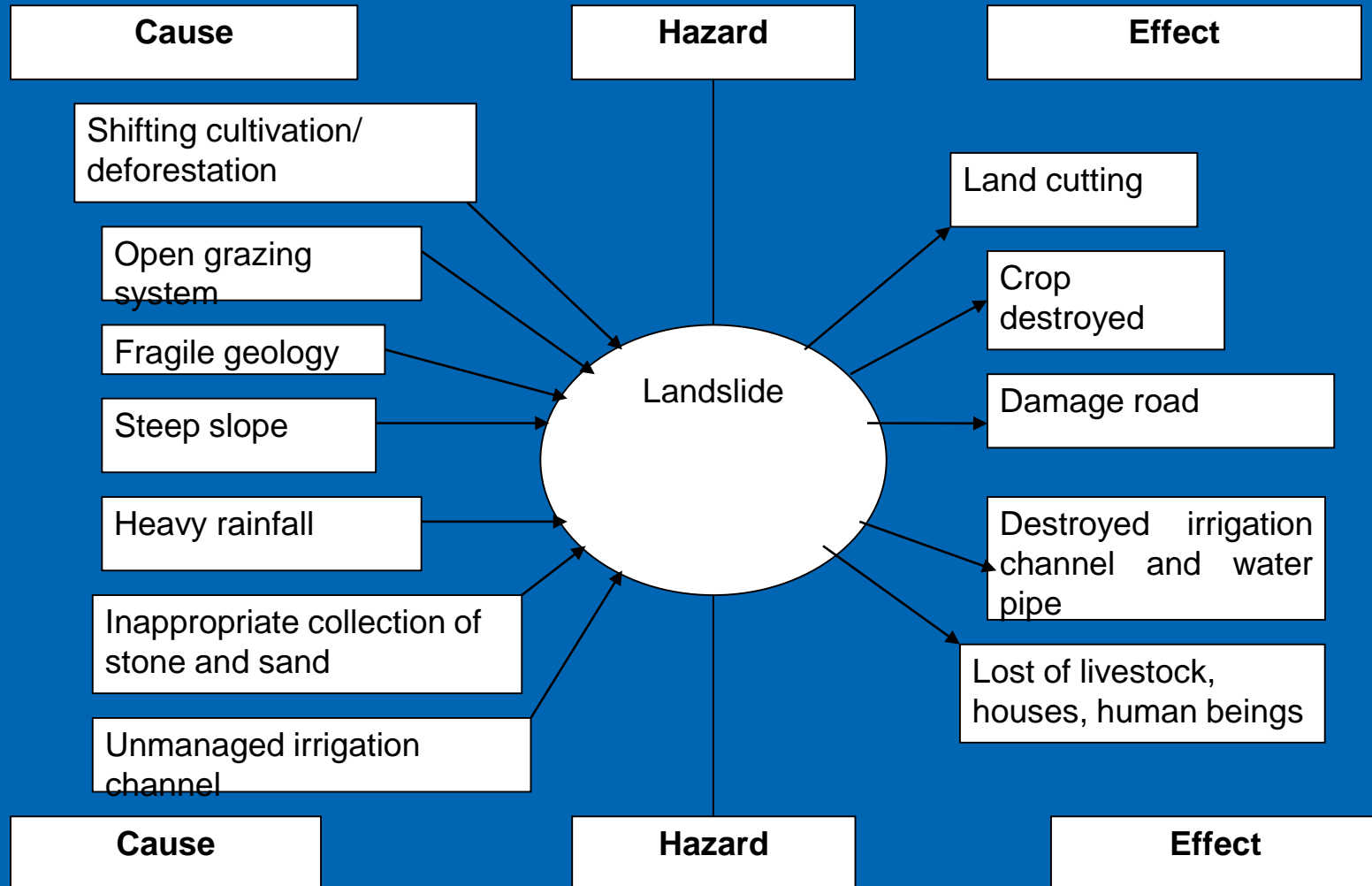
Example: Pair wise Ranking of Hazard for Prioritization

प्रकीर्ण स्तरीकरण "रसुवा"

| | पहिरो | आगजनी | रतडेरी | अशिता | भयानक | हानापुरी | हिमपात | खण्डशृष्टि |
|------------|-------|-------|--------|-------|-------|----------|--------|------------|
| पहिरो | X | | | | | | | |
| आगजनी | X | X | | | | | | |
| रतडेरी | X | X | X | | | | | |
| अशिता | X | X | X | X | | | | |
| भयानक | X | X | X | X | X | | | |
| हानापुरी | X | X | X | X | X | X | | |
| हिमपात | X | X | X | X | X | X | X | |
| खण्डशृष्टि | X | X | X | X | X | X | X | X |
| जम्मा | ८ | ६ | ५ | ५ | ९ | ५ | ६ | ६ |
| प्राथमिकता | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ |

रसुवा धुम्बे

Cause and Effect Analysis



Historical Timeline

| वर्ष | वर्ष | समय | कारण | उत्तर | उपाय |
|------|------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|------|
| 2024 | 2024 | जुनमा फादी उपे प्रो. गण्डा अरेको | → काटि राखेको उर उडेको (१२-१३-२०२४) | २५० जतिवाला | |
| 2026 | 2026 | अहिरी सैय फादी होइना अरेको गण्डा अरेको | → ४ टोट सुनला, ४-६ बिटा (४०) शुक्रा, ४०-६० टोट सुनानी जतेको जता अरु स-सता कीटविरुवा अरेको | → सुर्खे मिलेर आजा तिभाखे ५-१२०० जतिवाला | |
| 2028 | 2028 | वादी सैय अगडा अरेको | → चैत, लकुरी उडेको, १ जना | → सुर्खे मिलेर तिभाखे | |
| 2032 | 2032 | | → १ जना चाइते अरेको अहिरी कीटविरुवा अरेको (तिले) | → " " | |
| 2034 | 2034 | अरेको अरु गड अरेको अरु गड अरेको अरु गड | → जीठ (१) जतेको, गुगा लडा, शुध दी अरेको अडाकुडा अरेको अरेको, अरेको अरेको | → केहि अरेको | |
| 2036 | 2036 | अरेको अरेको अरेको अरेको | → १६ बटा अरेको, १ जना अरेको, घर (१) जीठ जतेको, घरको अरेको सामा जतेको अरु सुनला अरेको, | → आजा तिभाखे अरेको अरेको अरेको | |
| 2038 | 2038 | अरेको अरेको अरेको अरेको | → अरु घर र अरेको जतेको | → | |
| 2040 | 2040 | अरेको अरेको | → अरु घर र अरेको अरेको अरेको जतेको (अरेको, लडा, अरेको), १५ बटा अरेको, ५ २०००- | → रेडकले अरेको अरेको अरेको र अरेको अरेको अरेको अरेको | |
| 2042 | 2042 | अरेको अरेको अरेको अरेको | → अरेको अरेको (अरेको- अरेको) | → अरेको अरेको अरेको अरेको अरेको | |
| 2044 | 2044 | अरेको अरेको अरेको अरेको | → अरेको अरेको अरेको, अरेको अरेको अरेको अरेको अरेको, ६ पासी अरेको अरेको, अरेको अरेको अरेको अरेको अरेको, | → सुर्खे मिलेर अरेको अरेको अरेको | |
| 2046 | 2046 | अरेको अरेको अरेको अरेको | → अरेको अरेको, ५०-६० बटा अरेको, १ जना अरेको अरेको अरेको अरेको, | → अरेको अरेको | |

Risk Matrix Using Pair Ranking

| CONSEQUENCES | Catastrophic | | | | | |
|--------------|---------------------|----------------------------------------------------|----------|----------|--------|----------------|
| | Major | | | | | |
| | Moderate | | | | | |
| | Minor | | | | | |
| | Very Minor | | | | | |
| | | Rare | Unlikely | Possible | Likely | Almost Certain |
| LIKELIHOODS | | | | | | |
| | Extreme Risk | Immediate Action is Needed without any delay | | | | |
| | High Risk | Immediate Action needed with proper consultation | | | | |
| | Medium Risk | Frequent observation and measures needed | | | | |
| | Low Risk | Annual observation needed, measures could be taken | | | | |

Participatory Risk Mapping Approaches and Steps

Collection and production of base map and preparation of other logistics



Consultation with stakeholders



Familiarization of the area and rapport building



Familiarization with the base map



Preparing the legend for mapping



Putting community information on the map



Putting hazard information on the map

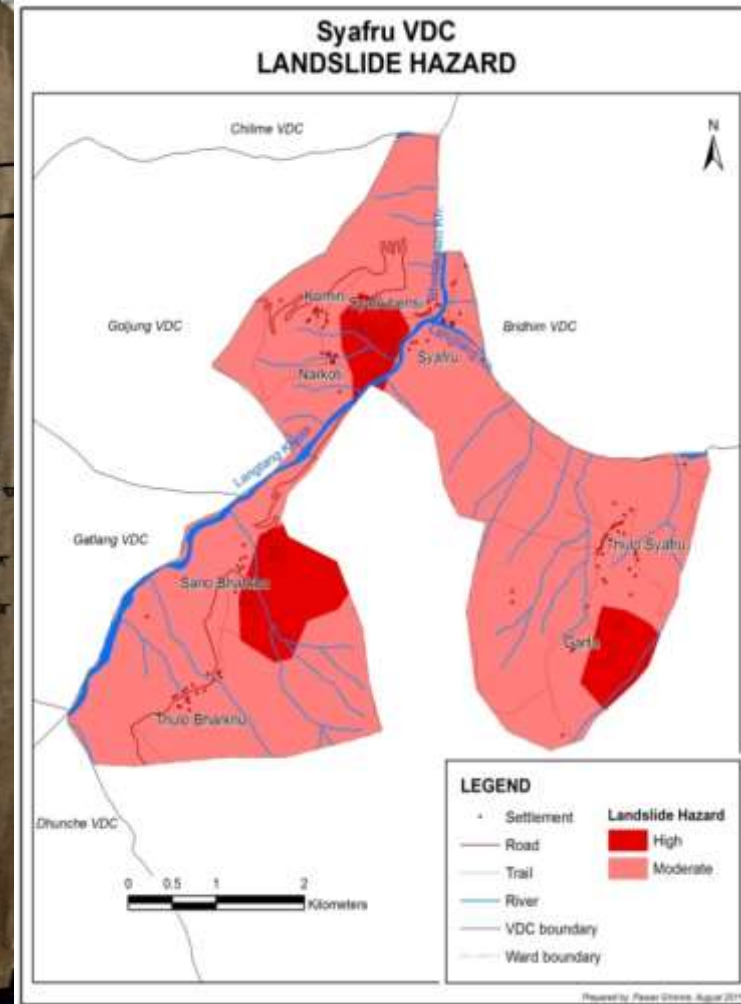
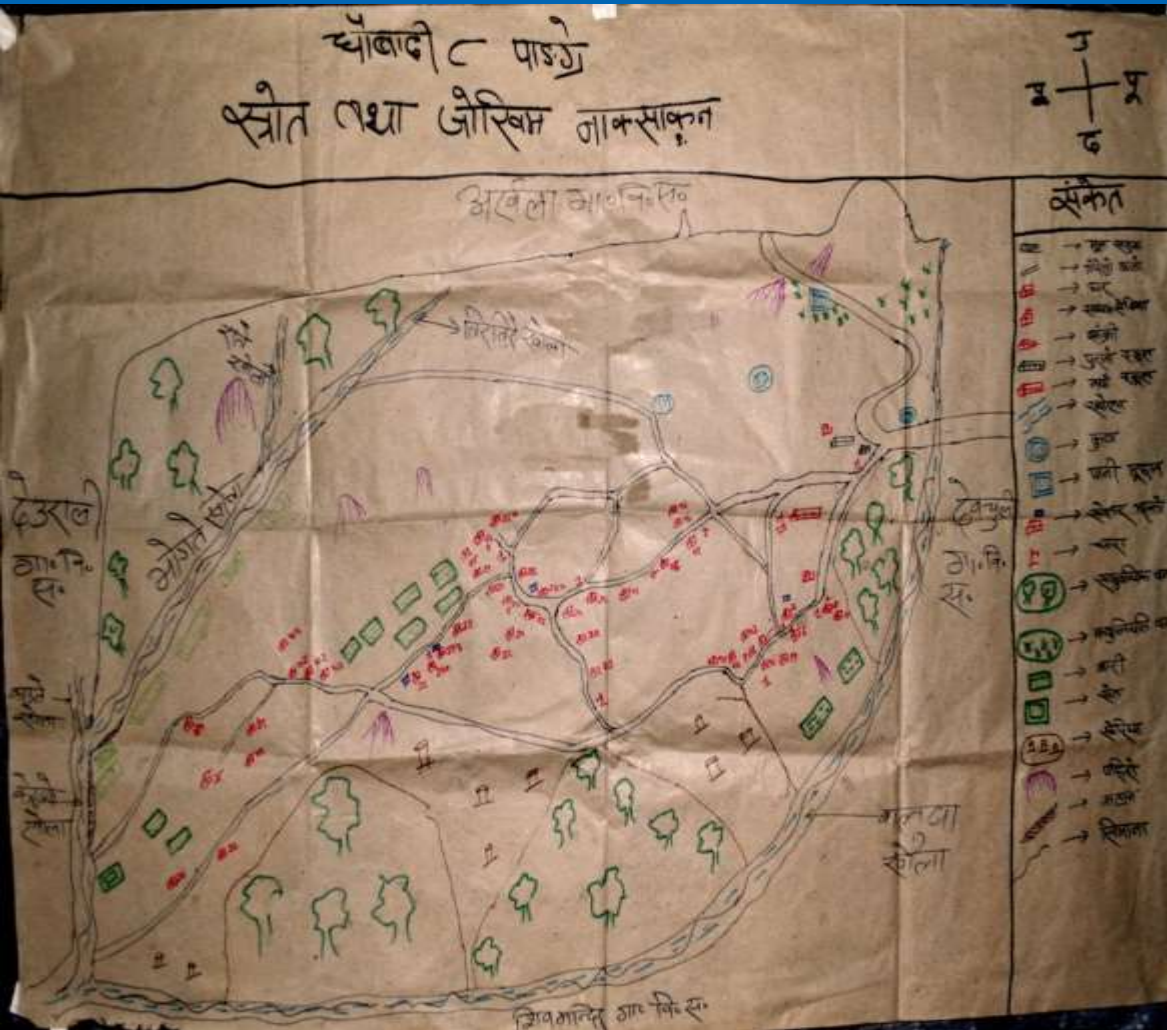


Planning for Disaster Risk Reduction



Integrating data into Geographic Information System (GIS)

Participatory Hazard Map



Thank you

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