A Cloud-based Open-Source Platform for Multi-hazard Risk Assessment

Dr. Manzul K. Hazarika, Ph.D.

Director, Geoinformatics Center Asian Institute of Technology (AIT), Thailand
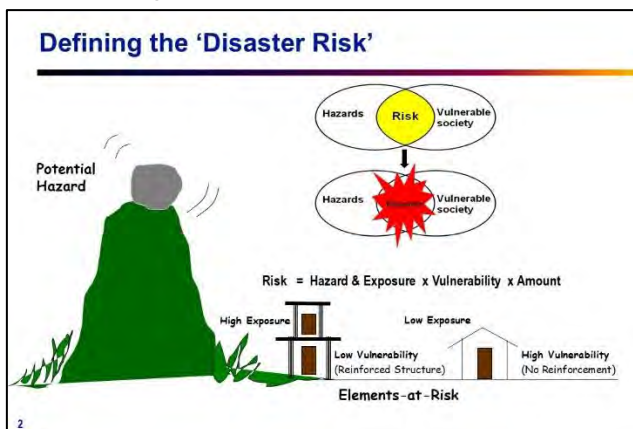
● Title

Thank you very much. Thank you for inviting me to this important conference.

Today, my presentation is "A Cloud-based Open-Source Platform for Multi-hazard Risk Assessment".

● Defining the 'Disaster Risk'

- Disaster risk is a function of hazard, exposure, and vulnerability. Disaster risk is normally expressed as the probability of loss of life or destroyed or damaged assets in a given period of time.

- Hazard refers to hazardous events such as floods, storms, droughts, and earthquakes.

- Exposure refers to the location of people or economic assets in hazard-prone areas.

- Vulnerability is used to refer to their susceptibility to suffering damage and loss.

- Spatial Representation of Disaster Risk

Spatial Representation of Disaster Risk
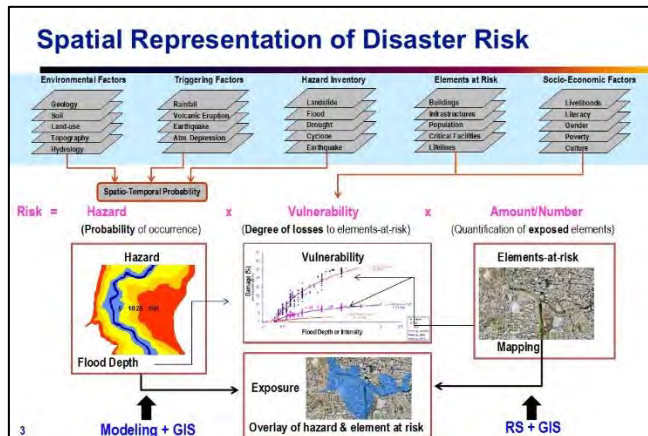
- - Hazards maps are prepared using models showing the extent and intensity of a hazard for a given return period.
- - Vulnerability functions show the level of damage for a given hazard intensity
- - Exposure shows the elements-at-risk such as people, infrastructure, housing etc. located in hazard-prone areas.

- Quantitative (Absolute) Risk Assessment - Asset

Quantitative (Absolute) Risk Assessment - Asset
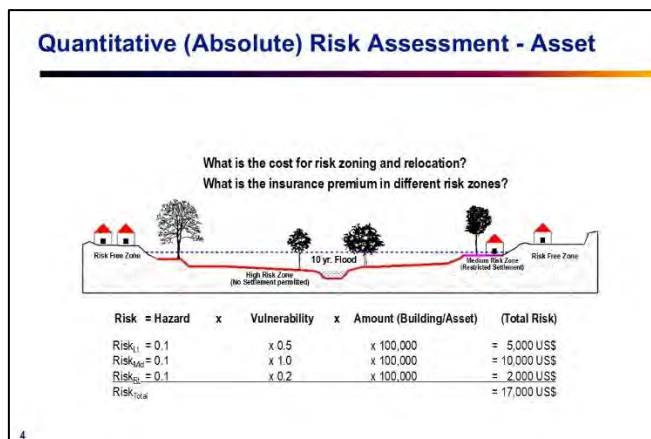
- - Risk = Hazard x Vulnerability x Amount of exposed elements-at-risk
- - Risk mitigation measures could be adopted based on the risk level and the cost of mitigation measures.

- Quantitative Risk Assessment - Probabilistic
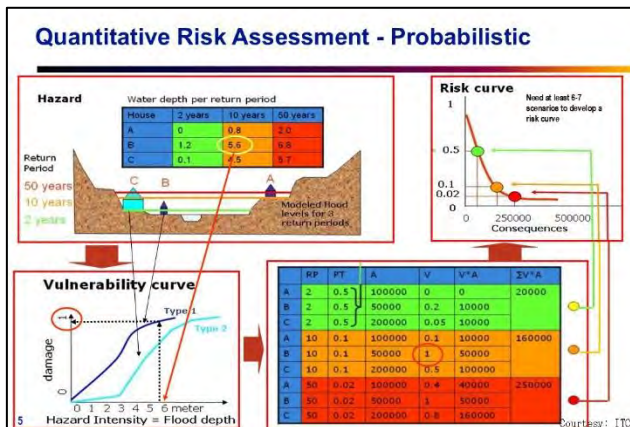
- Risk is dynamic, and it depends on hazard intensities, exposures, and vulnerabilities.
- Risk is expected to get worse due to climate change as we can expect extreme rainfall or drought conditions.
- To accommodate the effect of climate change and other factors, risk is estimated in a probabilistic manner.

● Multi-Hazard Risk Assessment
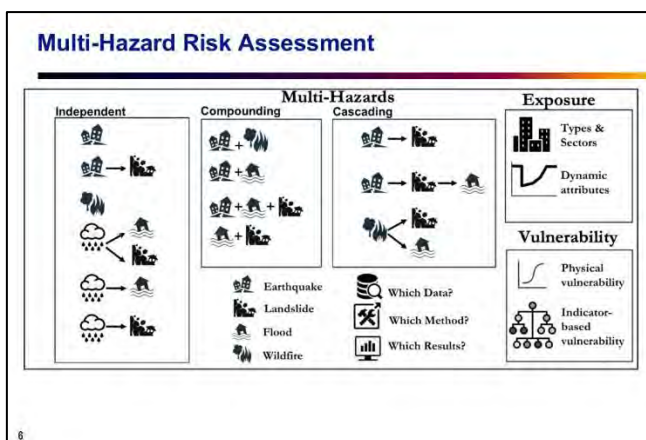
- Hazards may be independent (single), compounding (combined), or Cascading (sequential).
- Multi-hazard means a specific context where hazardous events may occur simultaneously, cumulatively, or cascadingly over time, taking into account the potential interrelated effects

- Multi-Hazard ~ Analyze the risk for multiple natural hazards and their interactions.
- Multiple Assets ~ Analyze the risk for multiple asset types with varying spatial characteristics.
- Vulnerability Database ~ Inbuilt database of vulnerability curves.
- Multi-User ~ Different users can work on the same project.
- Compare Risk ~ Current risk can be compared with future scenarios and planning alternatives

● A Case Study on Debris Flow, Flood and Landslide
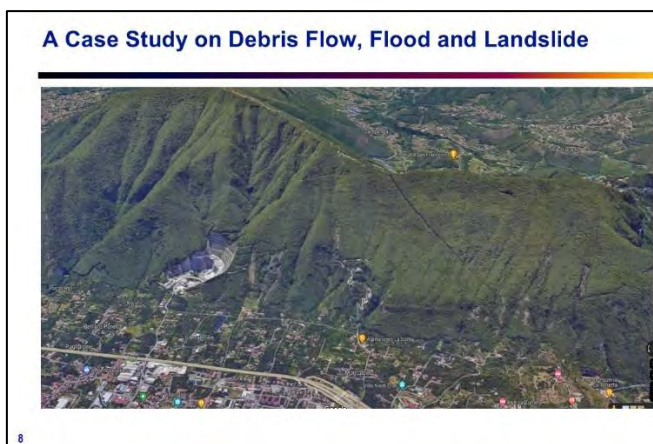
This case study shows the risk from debris flow, flood and landslide and amount of risk reductions from various risk reduction measures
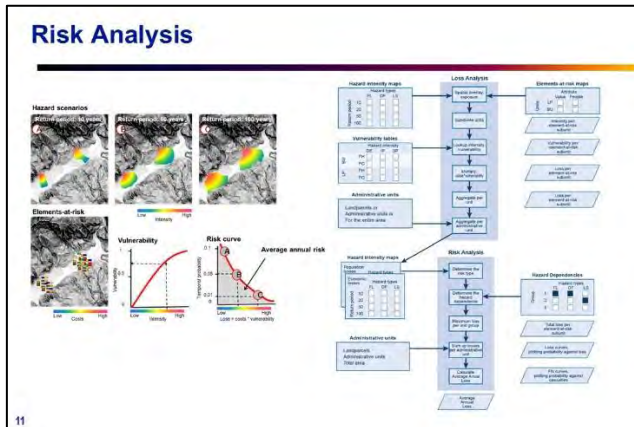
● Elements at Risk
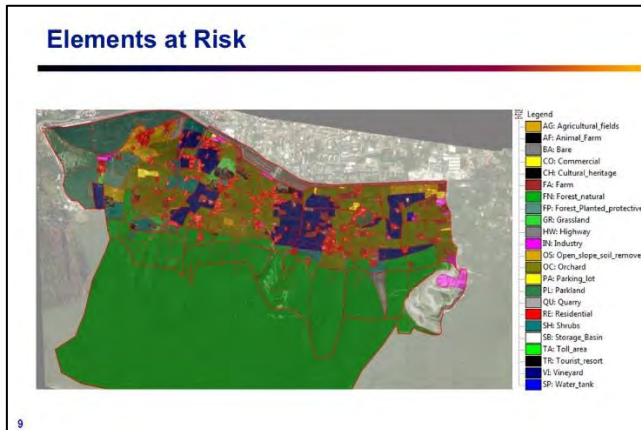
This map shows the elements at risk in terms of land parcels such as agriculture lands, forest areas, residential areas, commercial areas, cultural heritage areas etc.
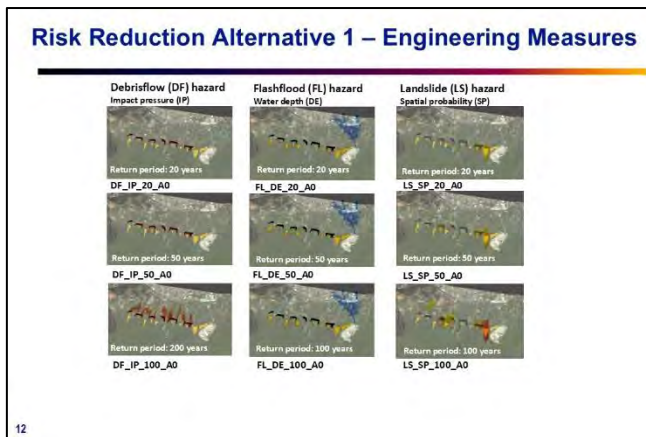
- Vulnerability Functions
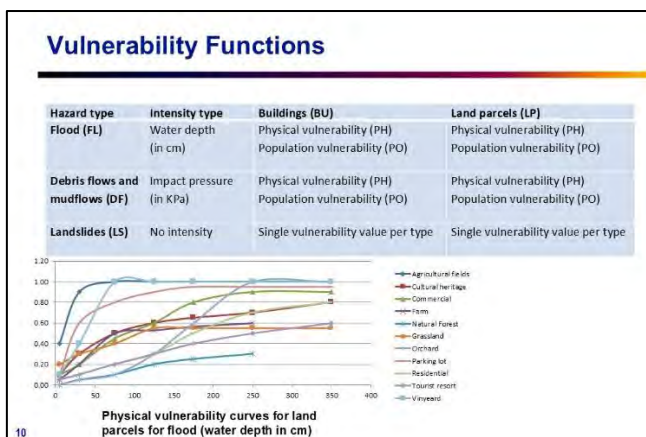
Physical vulnerability curves for differed land parcels. The graph shows the vulnerability from floods.
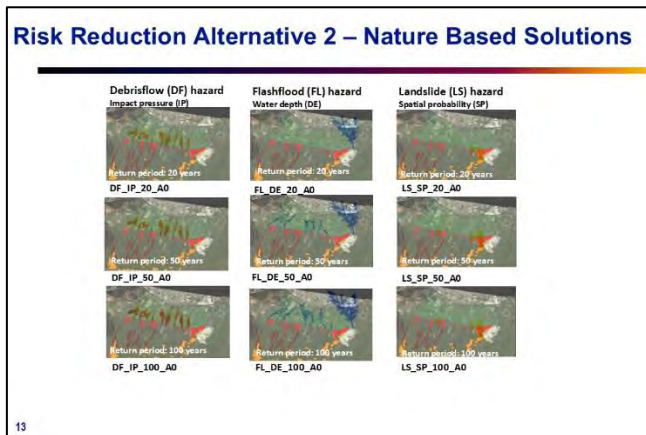
- Risk Analysis

For multi-hazard risk assessment, loss from each hazards are estimated, and then aggregated to estimate the risk in terms of annual average loss.

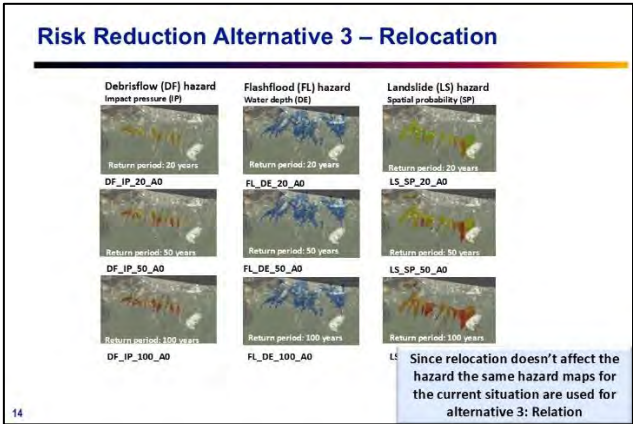- Risk Reduction Alternative 1 – Engineering Measures

Engineering measures for risk reduction

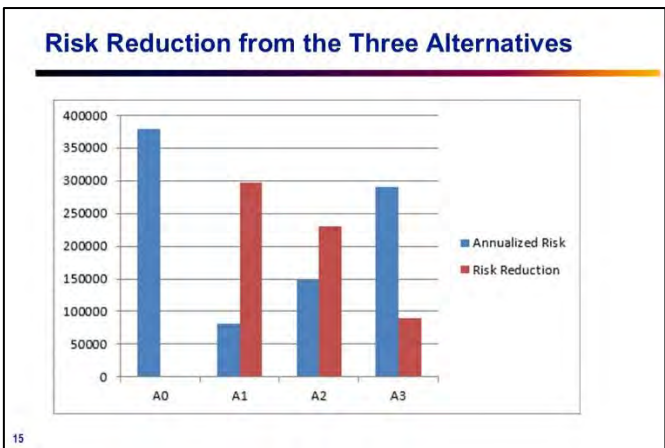- Risk Reduction Alternative 2 – Nature Based Solutions

Nature-based solutions for risk reduction

- Risk Reduction Alternative 3 – Relocation

Relocation of settlement to avoid the risks.

- Risk Reduction from the Three Alternatives

Risk reduction accomplished from the three alternatives.

- Conclusions

- The multi-hazard risk assessment is a holistic approach to understand risk at a given location.
- RiskChanges is an open-source platform for multi-hazard risk assessment at the local level.
- It is a spatial decision support tool to help decision makers to compare available risk mitigation alternatives and select the risk mitigation measures.

Thank you very much.