

 National Society for Earthquake Technology-Nepal (NSET)

International Training Workshop on Earth Sciences

28 October – 1 November 2013 NCDR, Taipei, Taiwan


Urban Risk Atlas

“A Tool for Disaster Risk Reduction Planning at Local Governance Level”

 Gopi Krishna Basyal
Geographer

National Society for Earthquake Technology – Nepal (NSET)
www.nset.org.np

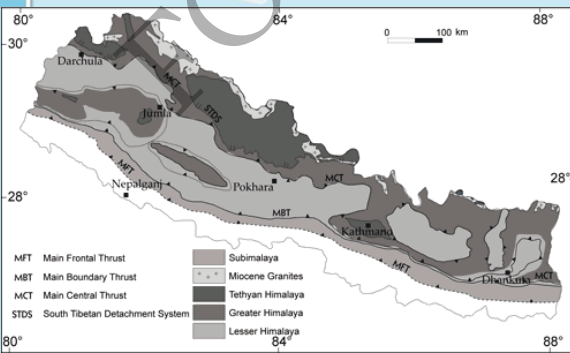
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Geology of Nepal Himalaya

Gansser 1964

- Sub Himalaya
- Lesser Himalaya
- Greater Himalaya
- Tibetan Himalaya



Nepal: a product of continental collision between the Indian Continent and Eurasia Plate

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Seismic Hazard of Nepal

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Peak Ground Acceleration (m/s^2)

Earthquake Hazard Map of Nepal

100 Year Return Period (Intensity of Peak Ground Acceleration on Subsoil Type II)

Intensity Level

Low

Medium

High

Scale: 0 to 100 km

Source: UNISDR/EMSC (2008/2009)

Nepal Epicentral Map

Legend

ISO_earthquake Magnitude

1.0-2.9

3.0-3.9

4.0-4.9

5.0-5.9

6.0-6.9


Scale: 0 to 100 km

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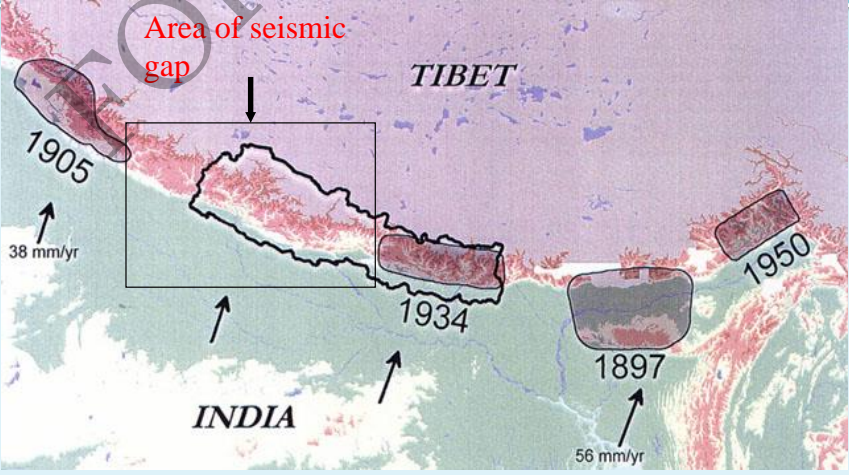
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Seismic Hazard of Nepal



The map illustrates the seismic hazard of Nepal, showing the country's location between **TIBET** to the north and **INDIA** to the south. The map highlights several major earthquake zones and a seismic gap area. The zones are labeled with their respective years: **1905**, **1934**, **1934**, **1897**, and **1950**. The seismic gap area is indicated by a red shaded region and labeled "Area of seismic gap". Arrows indicate the direction of plate movement, with rates of **38 mm/yr** and **56 mm/yr** shown.

Map Source: Department of Mines and Geology, Government of Nepal

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Geography of Nepal

- Tremendous geographic diversity
 - 68m elevation in Terai to 8848m Mt Everest
- Variation in climate
 - Subtropical, Warm Temperate, Cold zone, Subartic and Artic
- Major rivers.
 - Koshi, Karnali and Mahakali
 - More then 6000 river and streams

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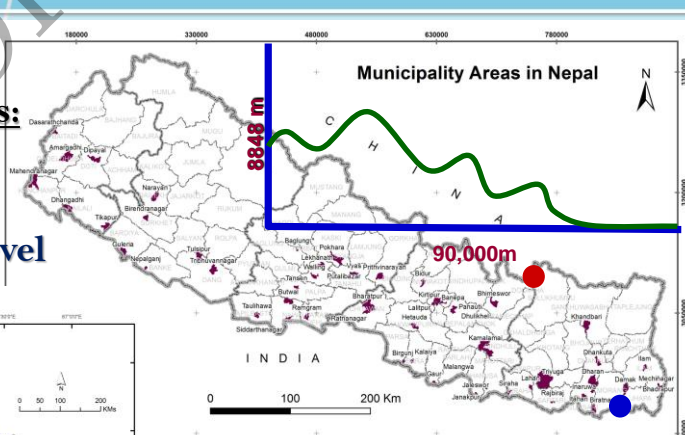
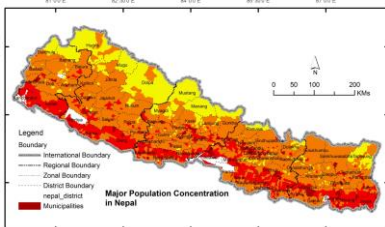
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Why High Hazard & RISK ?

Prime Factors:
Geography
Geology
Awareness Level

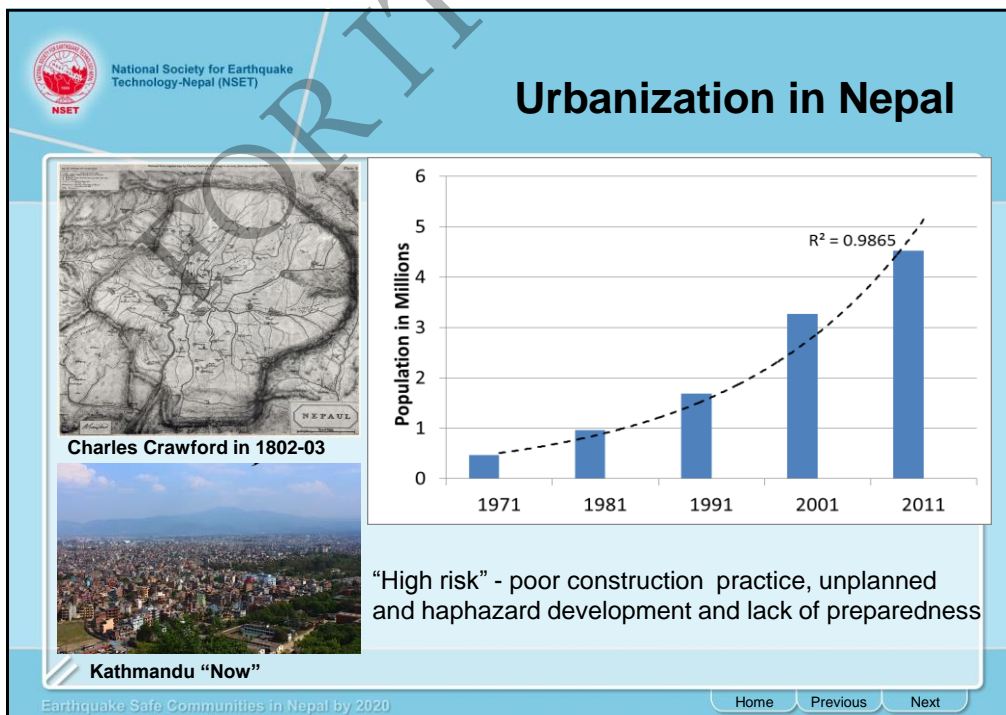
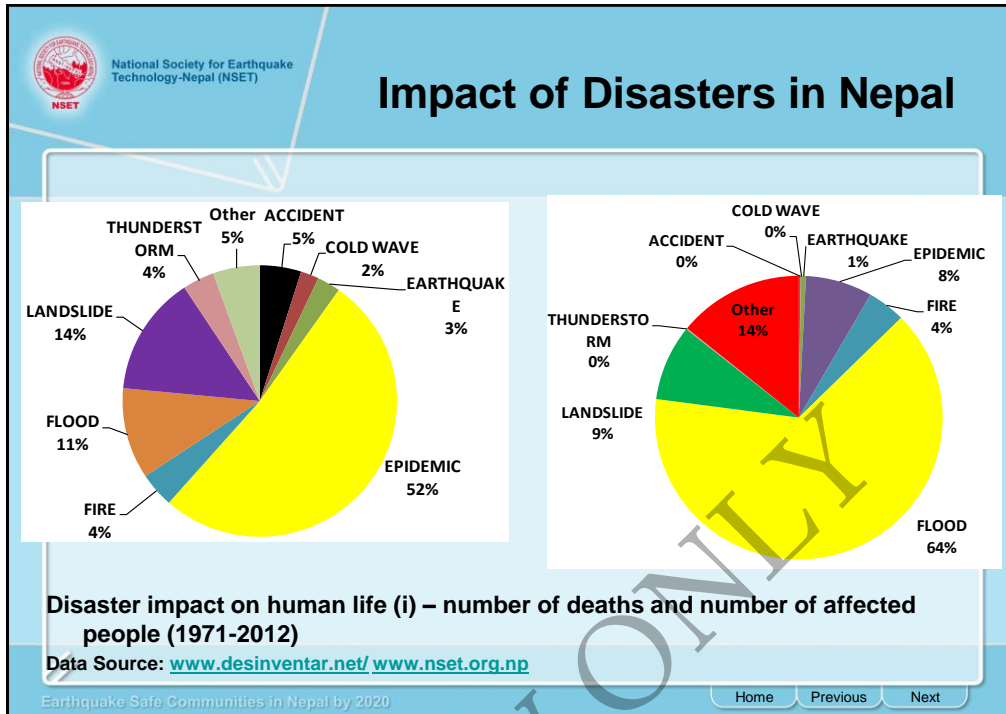



$$R = \frac{H \cdot V}{C}$$

6

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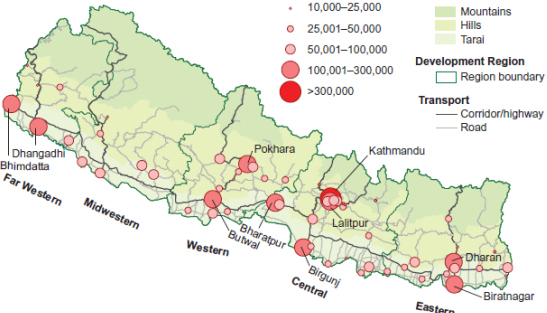
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People at Risk Area

Map 2.2 Development Regions, Corridors, and Urban Centers, 2011 Population



Population of Urban Centers

- 10,000–25,000
- 25,001–50,000
- 50,001–100,000
- 100,001–300,000
- >300,000

Ecological Zones

- Mountains
- Hills
- Tarai

Development Region

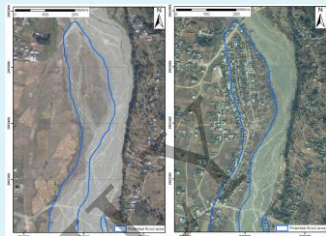
- Region boundary

Transport

- Corridor/highway
- Road

Source: Based on 2011 population census data (CBS 2012).
Note: Kathmandu refers to Kathmandu Metropolitan City; Biratnagar, Birgunj, Lalitpur, and Pokhara refer to the sub-metropolitan cities; and all other urban local governments are referred to as municipalities.


An example from Dharan Municipality in Eastern Nepal



Google Earth 2004 Ikonos, 2009
©Sudmeier-Rieux, 2009

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Understanding Risk: Making Urban Earthquake Risk Atlas

Kathmandu Valley Earthquake Risk Management Project (1998)

- Around 100,000 Death
- Around 300,000 Serious Injuries
- Critical Facilities and Hospital damage >50%

Other Urban Area: Dharan, Panauti, Ilam

1934 Earthquake

Understanding Risk:

- Awareness rising
- Building code implementation

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Risk Communication

This Atlas envisions:

- making citizens, media, local and national authorities aware of existing earthquake risks
- improving knowledge of possible disasters, and potential impacts;
- *help decision makers to incorporate natural hazard in the development process.*

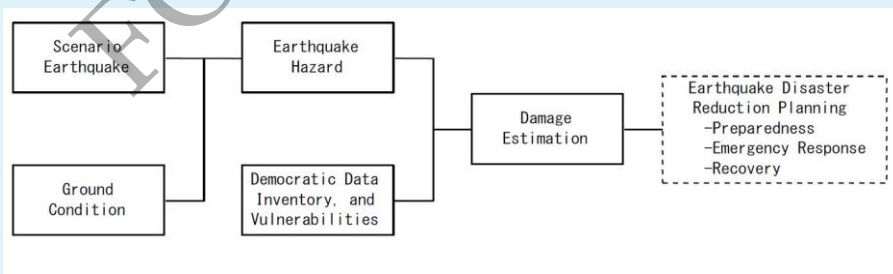
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Risk Assessment



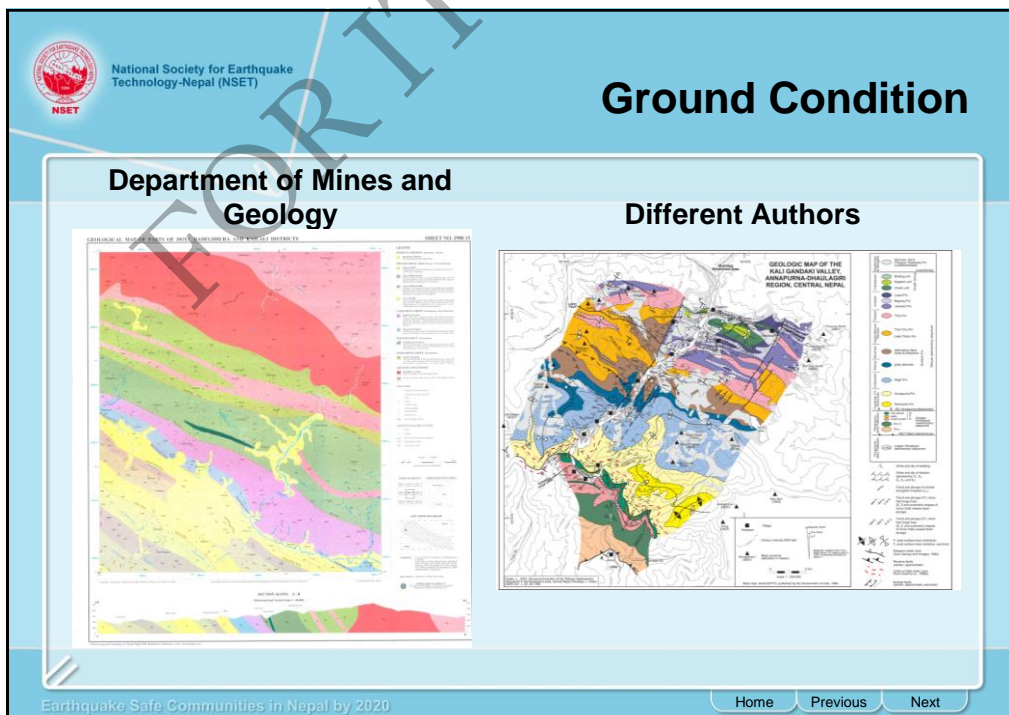
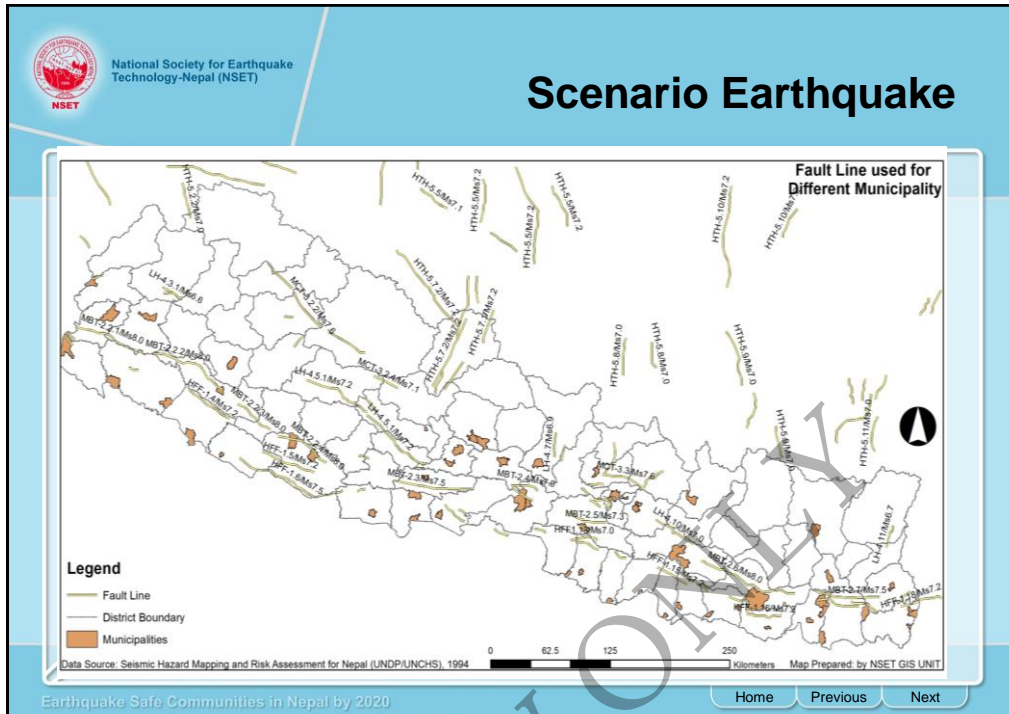
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graph LR
    A[Scenario Earthquake] --> B[Earthquake Hazard]
    C[Ground Condition] --> B
    B --> D[Damage Estimation]
    E[Demographic Data Inventory, and Vulnerabilities] --> D
    D --> F[Earthquake Disaster Reduction Planning  
-Preparedness  
-Emergency Response  
-Recovery]
  
```

Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters (RADIUS) Launched by IDNDR, United Nations (KENJI OKAZAKI 1996)

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Data for URA

Physical Data

- Base Maps
- Major Infrastructure
- Buildings
- Critical infrastructure
-


Socio-economic Data

- House Hold Information
- Population Information
- Building Typology Information
-

Major source of information: NSET, Department of Urban Development and Building Construction, Municipalities, Central Bureau of Statistics, Reports, Profiles and others

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RADIUS Environment

Ghorahi Municipality

Building Distribution Map

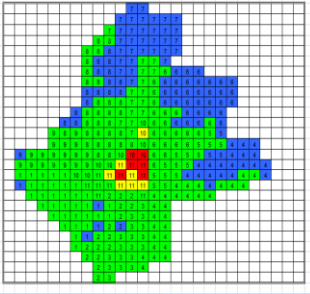
Figure (City) Name	Tribe/Neighbourhood	Color ID	Automatic Range	Manual Range
Total Population Count: 55107	1	0	64	64
	2	64	128	64
	3	128	192	128
	4	192	256	192

Building and Population Summary

The total building count are 15571

Sl No	AreaID	Area Name	Blg. Count	Pop Count	Pop Density
1	1	1	2110	3312	15.70
2	2	2	1055	2447	23.19
3	3	3	1103	2335	21.17
4	4	4	1784	3136	17.58
5	5	5	951	1530	16.09
6	6	6	1410	3194	22.65
7	7	7	951	2122	22.32
8	8	8	1022	2060	20.16
9	9	9	1153	1580	13.71
10	10	10	1086	2647	24.38
11	11	11	1986	3429	17.27
Summary Information			15571	34861	65107

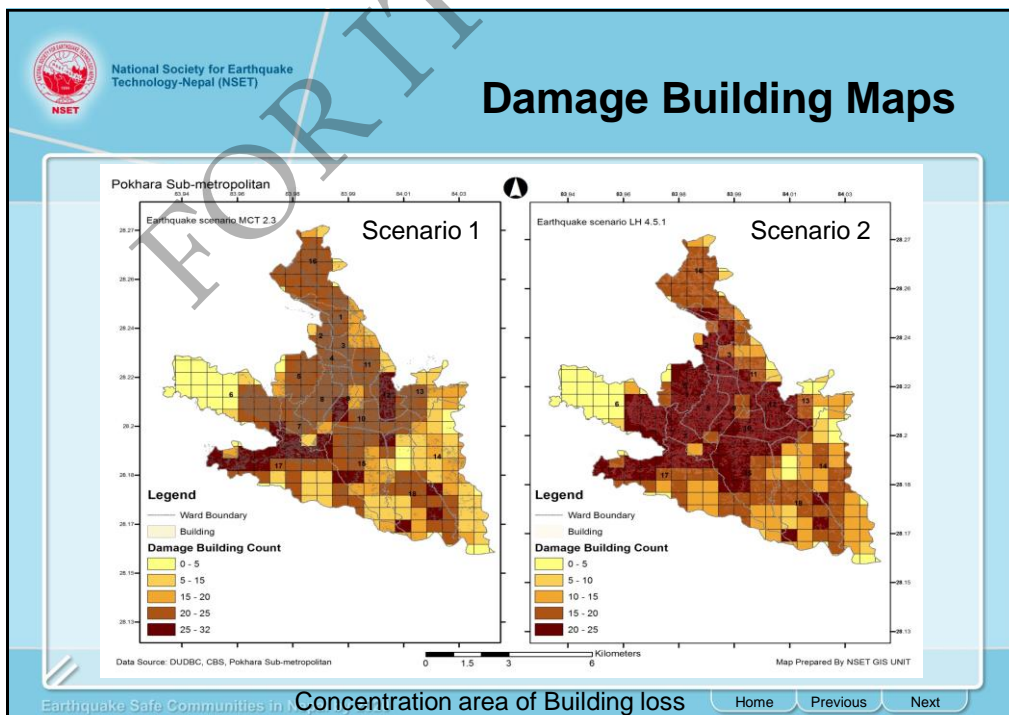
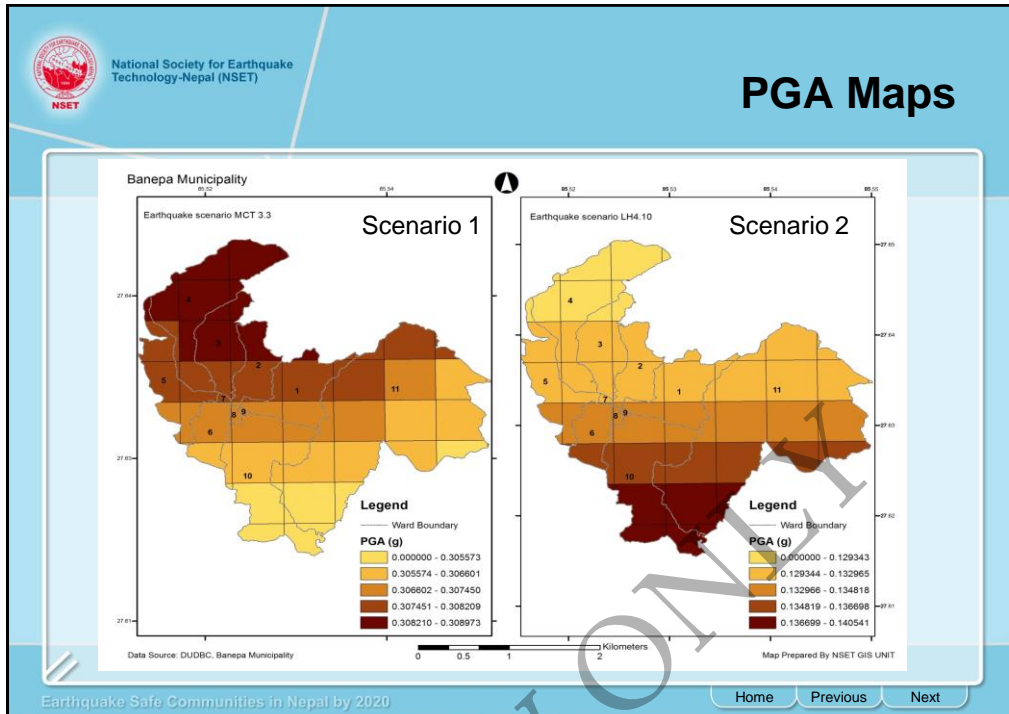
Map Using Manual Range (Cell characters show AreaID)

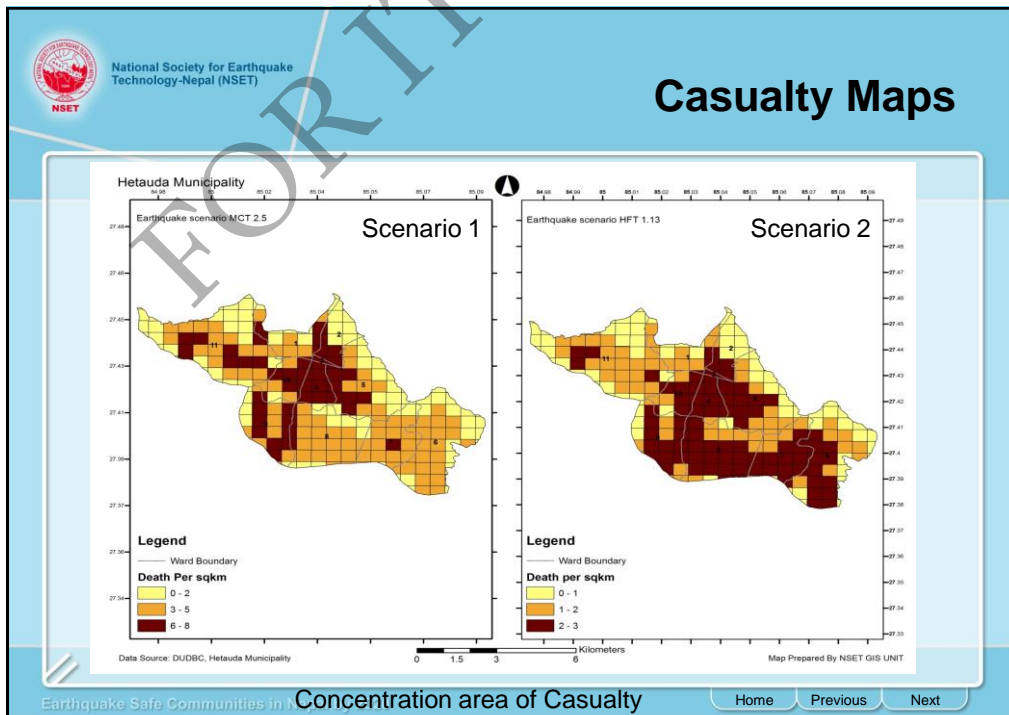
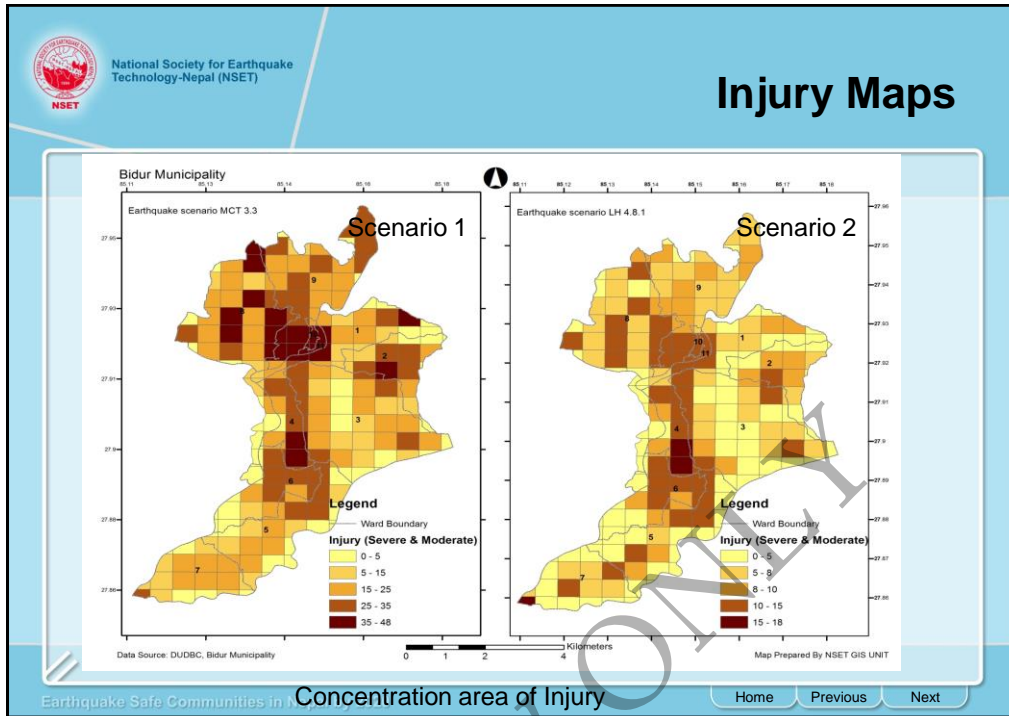


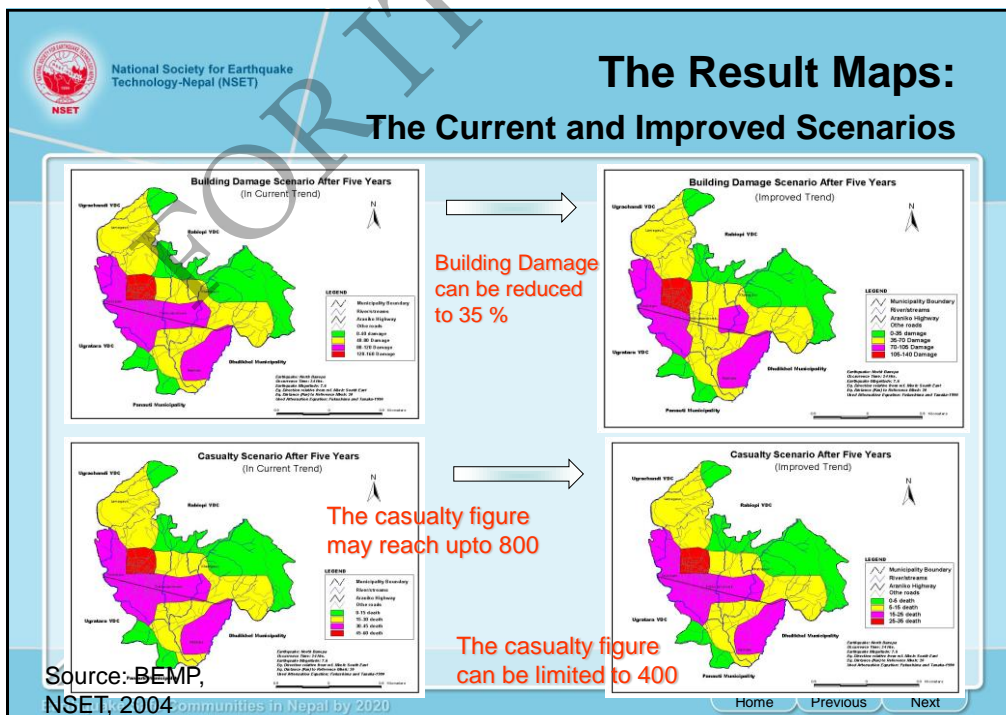
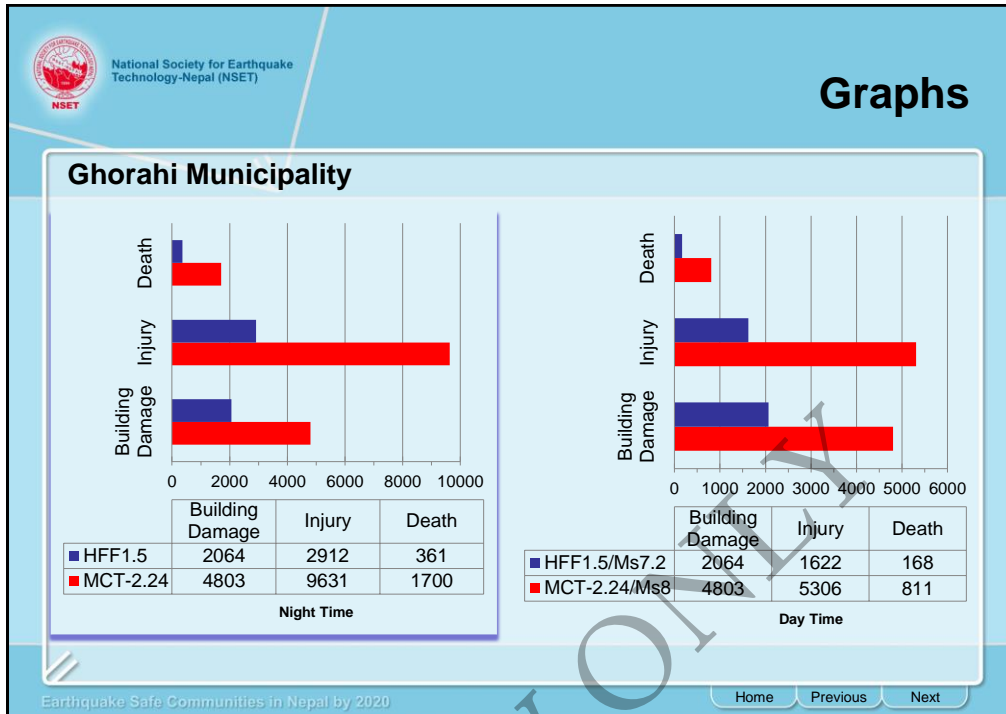
- In order to use RADIUS three variables are needed: target area, population and amount of buildings in target area.


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Tables

Lahan Municipality

Building Information				Casualty Information			
Ward	Bld Count	Damage Count	MDR%	Ward	Night Pop Counts	Death	Injury
1	1298	362	27.9	1	6678	50	555
2	556	159	28.7	2	3080	22	267
3	1577	421	26.7	3	8215	54	655
4	649	182	28.0	4	2585	25	240
5	325	95	29.2	5	1436	14	137
6	417	117	28.1	6	1871	15	176
7	371	104	28.0	7	2271	13	191
8	371	106	28.6	8	2092	14	186
9	510	156	30.6	9	1568	27	167
10	1298	372	28.6	10	5964	52	555

Total building count are 7373 and around 28% damaged
Total population counts are 35759 and around 8% injured

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Table of Contents (Abridged)

- Methodology
- Physical and Socio-economic Parameters
- Geology, Geomorphology and Climatic Condition
- Landuse and Landcover
- Exposure Data
 - Building Stocks and Type
 - Lifeline Inventory
- Hazard Data
- List of Maps of Each Municipality

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Conclusion

- URA expected as significant document for awareness raising addressing each sector of the local communities for hazard, vulnerability and risk analysis
- Municipal Authorities and GoN could timely plan and manage the future program and looks for the resource and make proper use of them in case of Earthquake disaster.








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Thank you !

Your Suggestions and Questions

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