COURSE: GEO-INFORMATICS IN EARTH SCIENCE, TECTONIC HAZARD AND INFRASTRUCTURE MANAGEMENT

LECTURE 11 – Hazard and Disaster Mitigation and Management Practices

Lecturer: Dr. Tingneyuc Sekac, Ph.D. PNG University of Technology

What is Hazard

Three (3) Definitions:

Those elements of the physical environment, harmful to man and caused by forces extraneous to him"

Source: Burton et al 1978.

A source of potential harm or a situation with a potential to cause loss.'

Source: Standards Australia (2000)

A natural event that has the potential to cause harm or loss.

Source: ADPC

Source: Asian Disaster Preparedness Center (ADPC), Module 2

What is Hazard

A Hazard is a threat. A future source of danger. It has the potential to cause harm to:

- People - death, injury, disease and stress
- Human activity – economic, educational etc.
- Property - property damage, economic loss of
- Environment - loss fauna and flora, pollution, loss of amenities.

Source: Asian Disaster Preparedness Center (ADPC), Module 2

What is Hazard

Examples of hazards are:

- Earthquakes,
- volcanic eruptions,
- cyclones,
- floods,
- landslides, and other such events.

Source: Asian Disaster Preparedness Center (ADPC), Module 2

Hazard Events and Disaster

- Environmental events become hazards once they threaten to affect society and/or the environment adversely.
- A **physical event,** such as a volcanic eruption, that does not affect human beings is a **natural phenomenon** but not a natural hazard.
- A natural phenomenon that occurs in a populated area is a **hazardous event.**
- A hazardous event that causes unacceptably large numbers of fatalities and/or overwhelming property damage is a **natural disaster.**
- In areas where there are no human interests, natural phenomena do not constitute hazards nor do they result in disasters.

Source: Asian Disaster Preparedness Center (ADPC), Module 2

Hazard Events and Disaster

- The level of harm is governed by:

- ✓ Magnitude of the hazard
- ✓ Frequency of hazard or recurrence
- ✓ Intensity at the impact point

Source: Asian Disaster Preparedness Center (ADPC), Module 2

Classification of Hazards

There are many different ways of classifying hazards. One is to consider the extent to which hazards are natural.

I. Natural hazards: such as earthquakes or floods arise from purely natural processes in the environment.

II. Quasi-natural hazards : such as smog or desertification arise through the interaction of natural processes and human activities.

III. Technological (or man-made) : hazards such as the toxicity of pesticides to fauna, accidental release of chemicals or radiation from a nuclear plant.

These arise directly as a result of human activities.

Source: Asian Disaster Preparedness Center (ADPC), Module 2

Classification of Hazards

1a. Atmospheric

Single element

- ✓ Excess rainfall
- ✓ Freezing rain (glaze)
- ✓ Hail
- ✓ Heavy snowfalls
- ✓ High wind speeds
- ✓ Extreme temperatures

1b. Atmospheric

Combined elements/events

- ✓ Hurricanes
- ✓ 'Glaze' storms
- ✓ Thunderstorms
- ✓ Blizzards
- ✓ Tornadoes
- ✓ Heat/cold stress

Source: Asian Disaster Preparedness Center (ADPC), Module 2; Hewitt and Burton (1971)

Classification of Hazards

2. Hydrologic

- ✓ Floods – river and coastal
- ✓ Wave action
- ✓ Drought
- ✓ Rapid glacier advance

3. Geologic

- ✓ Mass-movement
- ✓ Landslides
- ✓ Mudslides
- ✓ Avalanches
- ✓ Earthquake
- ✓ Volcanic eruption
- ✓ Rapid sediment movement

Source: Asian Disaster Preparedness Center (ADPC), Module 2; Hewitt and Burton (1971)

Classification of Hazards

4. Biologic

- ✓ Epidemic in humans
- ✓ Epidemic in plants
- ✓ Epidemic in animals
- ✓ Locusts

5. Technologic/Man-made

- ✓ Transport accidents
- ✓ Industrial explosions and fires
- ✓ Accidental release of toxic
- ✓ chemicals
- ✓ Nuclear accidents
- ✓ Collapse of public buildings

Source: Asian Disaster Preparedness Center (ADPC), Module 2; Hewitt and Burton (1971)

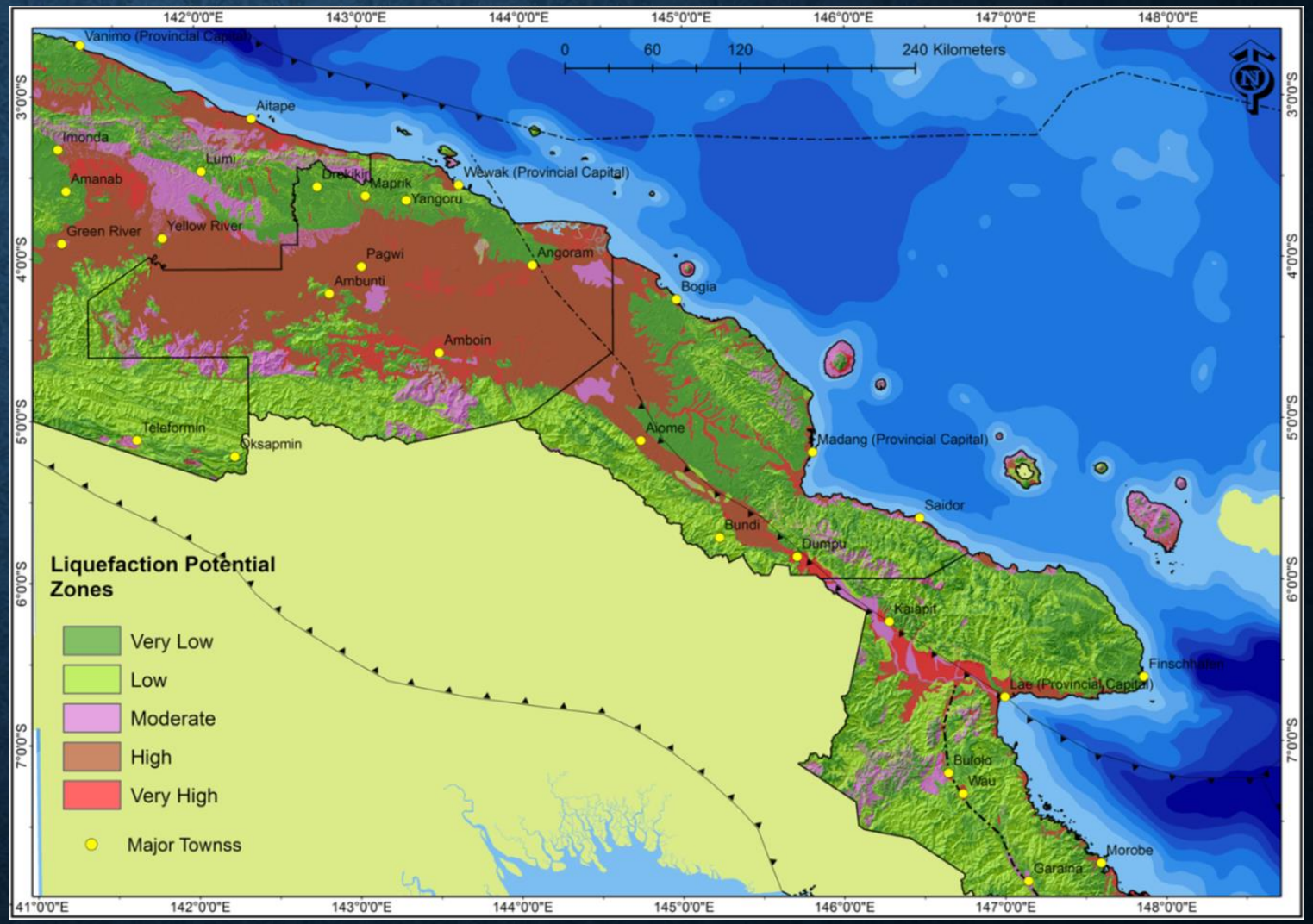
Event and Site Parameters of Selected Hazards

Natural Hazard	Event Parameter	Site Parameter
Cyclone	Wind speed - km/h	Area affected
Earthquake	Magnitude –Richter Scale	Intensity –Modified Mercalli Scale
Flood	Area flooded – km2 Volume of water – m3 Speed	Depth of flood water - meters
Landslide	Volume of material dislodged Area affected	Ground displacement - meters

Source: Asian Disaster Preparedness Center (ADPC), Module 2

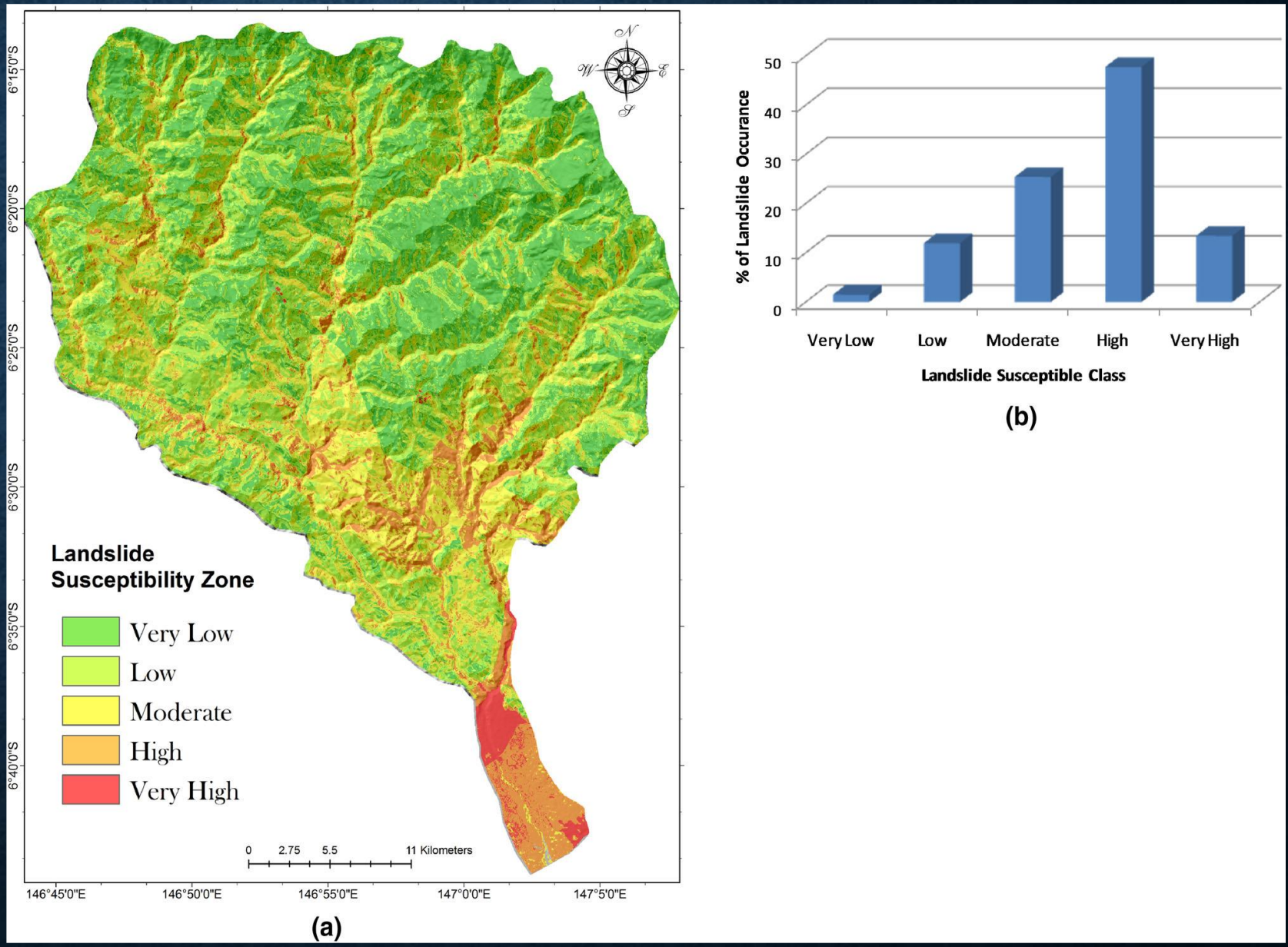
Hazard Mapping

- This is the process of establishing geographically where and to what extent particular phenomenon is likely to pose a threat to people, property, infrastructure and economic activities.



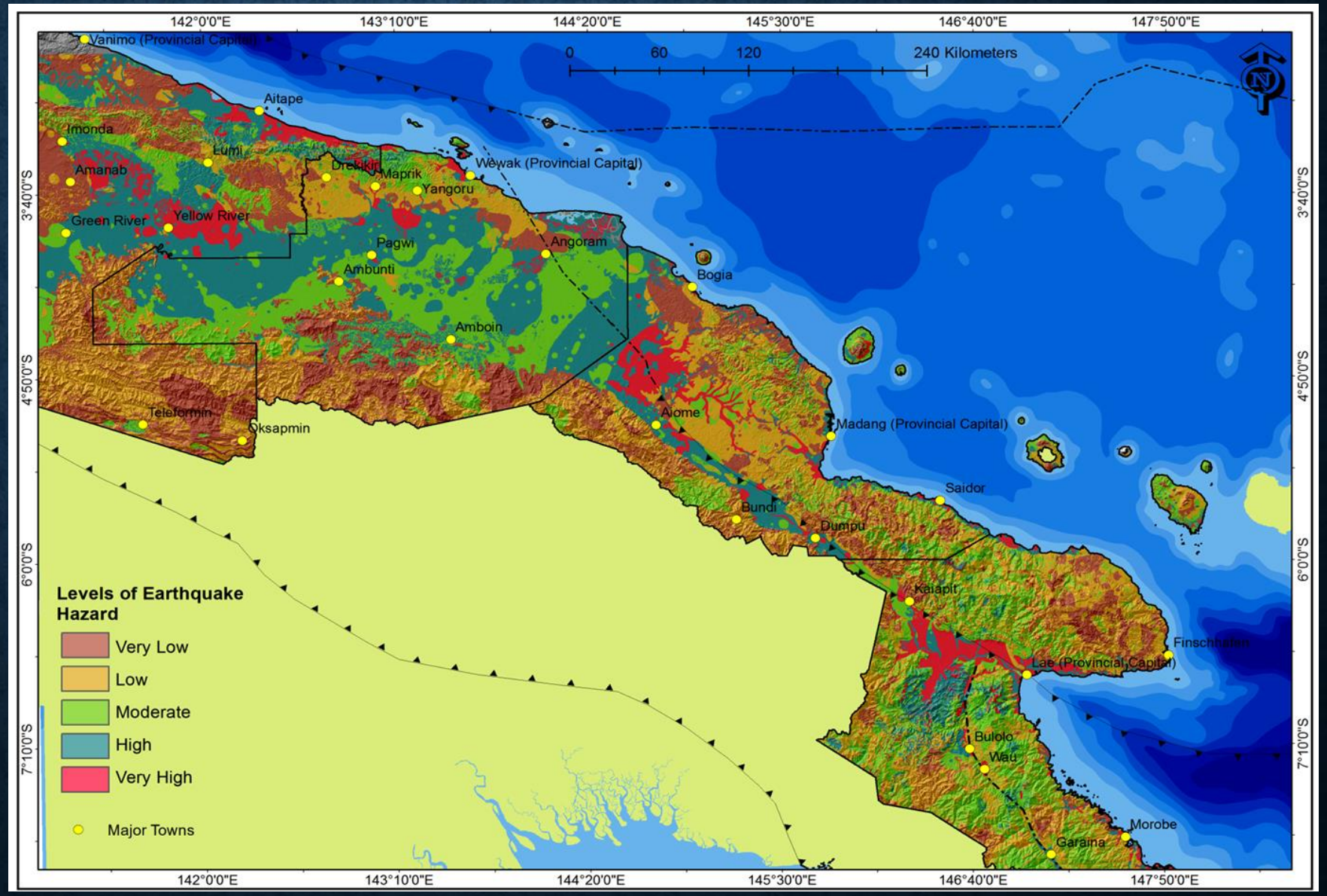
Hazard Mapping

- Landslide Hazard Identification and Vulnerability mapping



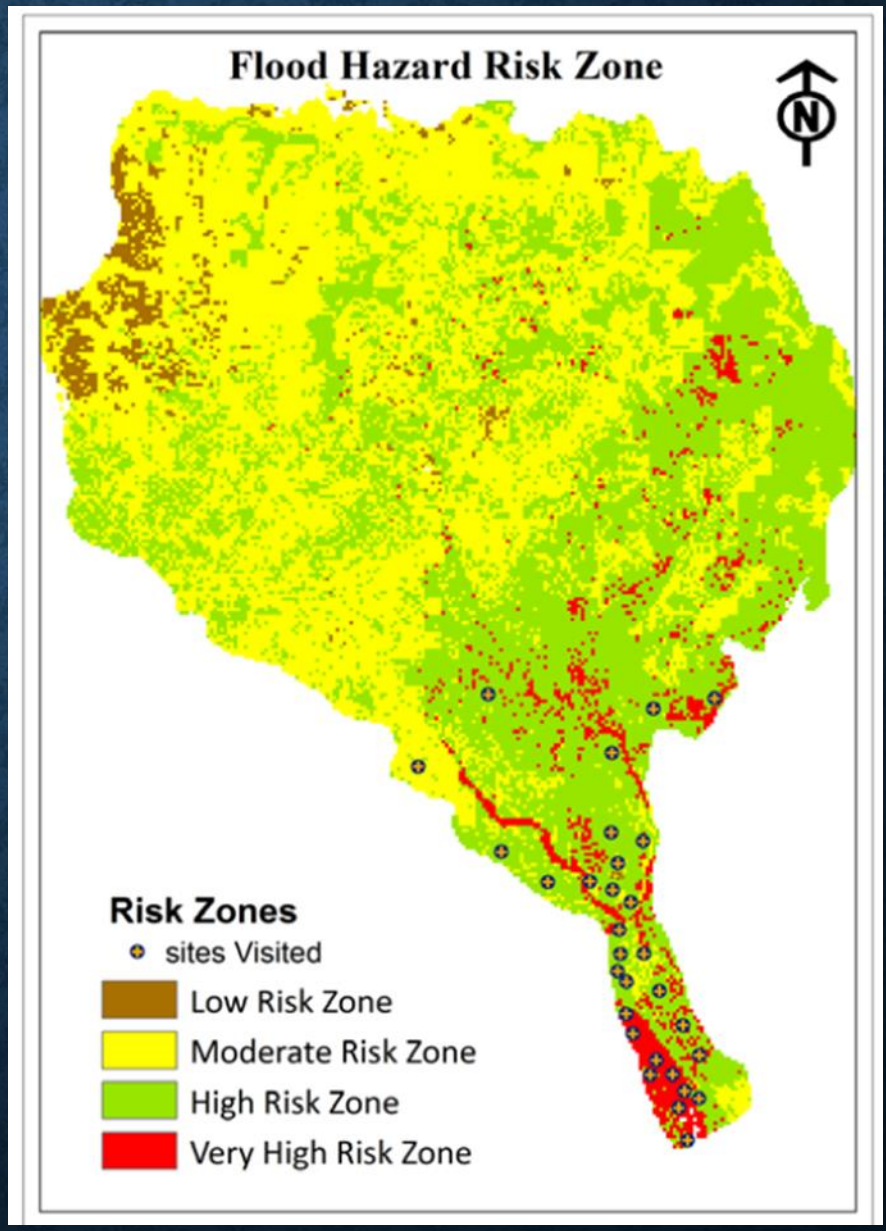
Hazard Mapping

- Earthquake Hazard Identification and Vulnerability mapping



Hazard Mapping

- Flood Risk or Hazard Identification and mapping. Busu River Catchment, PNG



Hazard Mapping

- Probability of hazard occurrence varies from place to place.
- The use of mapping to synthesize data on natural hazards and to combine these with socioeconomic data facilitates analysis.
- It improves communications among participants in the hazard management process and between planners and decision-makers.

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Hazard Mapping

- Two important techniques in use are;
- ✓Multiple hazard mapping and
- ✓Critical facilities mapping

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Vulnerability/Susceptibility to Hazard

- Vulnerability is a condition or a predisposition.
- It applies to individuals, groups of individuals or communities, but it can be also used when referring to physical structures or the environment in general.

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Vulnerability/Susceptibility to Hazard

Vulnerability is about Susceptibility and Resilience under threat of a hazard event.

Susceptibility:

- Proximity and exposure to an event. It is the potential to incur harm or avoid loss.

- It is the fact of being exposed.

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Vulnerability/Susceptibility to Hazard

- You can be susceptible but not vulnerable.
- E.g. a landslide is threatening a house but the owners have built a wall to protect it and to divert the landslide. Susceptibility is easy to assess.

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Vulnerability/Susceptibility/Resilience to Hazard

Resilience:

- Access to resources and capacities which determines the ability to recover from the impacts of to a hazard event.

- It is the ability to adjust and recover.

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Vulnerability/Susceptibility/Resilience to Hazard

Resilience:

E.g. the owners of the house threatened by a landslide have a second house in town.

They reside there during the rainy season.

One can be susceptible, but if he/she is resilient, one is not vulnerable.

Resilience has many components: It implies access to;

- ✓ resources,
- ✓ individual skills,
- ✓ beliefs, etc.

Compared to susceptibility, it is more difficult to assess.

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Risk Definition

- **Risk** is the likelihood or probability of a hazard event of a certain magnitude occurring. Risks are measures of the threat of hazards.
- **Risk** is the actual exposure of something of human value to a hazard. Often regarded as the product of probability and loss.

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Risk & Hazard

- **Risk** and **Hazard** are two concepts that are different from each other.
- The ocean is a hazard (deep water and large waves).
- If one attempts to cross the ocean in a small rowboat, a great risk (probability of capsizing and drowning) is incurred.
- In general, risk may be diminished by increasing safeguards but never eliminated unless the hazard itself is removed.

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Element at Risk

Physical

Infrastructure

- ✓ Roads
- ✓ Railway
- ✓ Bridges
- ✓ Harbour
- ✓ Airport

Critical facilities

- ✓ Emergency shelters
- ✓ Schools
- ✓ Hospitals and Nursing Homes
- ✓ Fire Brigades
- ✓ Police

Utilities

- ✓ Power supply
- ✓ Water supply

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Element at Risk

Economic

- ✓ Business and trade activities
- ✓ Access to work
- ✓ Impact on work force
- ✓ Opportunity cost

Source: Asian Disaster Preparedness Center (ADPC), Module 3

Element at Risk

Societal

- ✓Vulnerable age categories
- ✓Low income group people
- ✓Gender

Environmental

- ✓Loss of biodiversity
- ✓Damaged landscape
- ✓Physical and chemical changes
- ✓in the surroundings

Source: Asian Disaster Preparedness Center (ADPC), Module 3

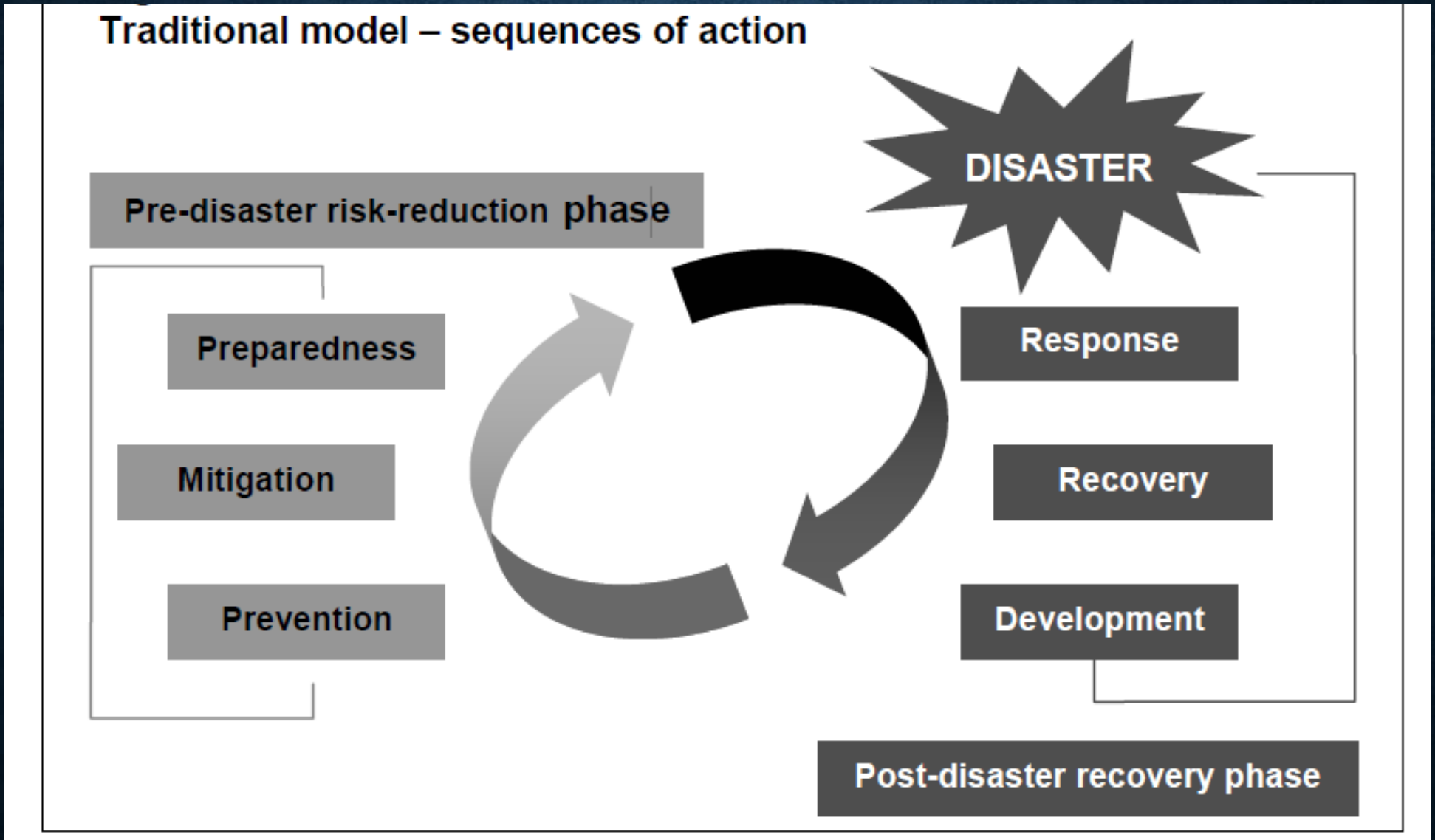
Disaster Management

- Disaster management includes administrative decisions and operational activities that involve;

- ✓ Prevention
- ✓ Mitigation
- ✓ Preparedness
- ✓ Response
- ✓ Recovery and
- ✓ Rehabilitation.

Source: Asian Disaster Preparedness Center (ADPC), Module 3

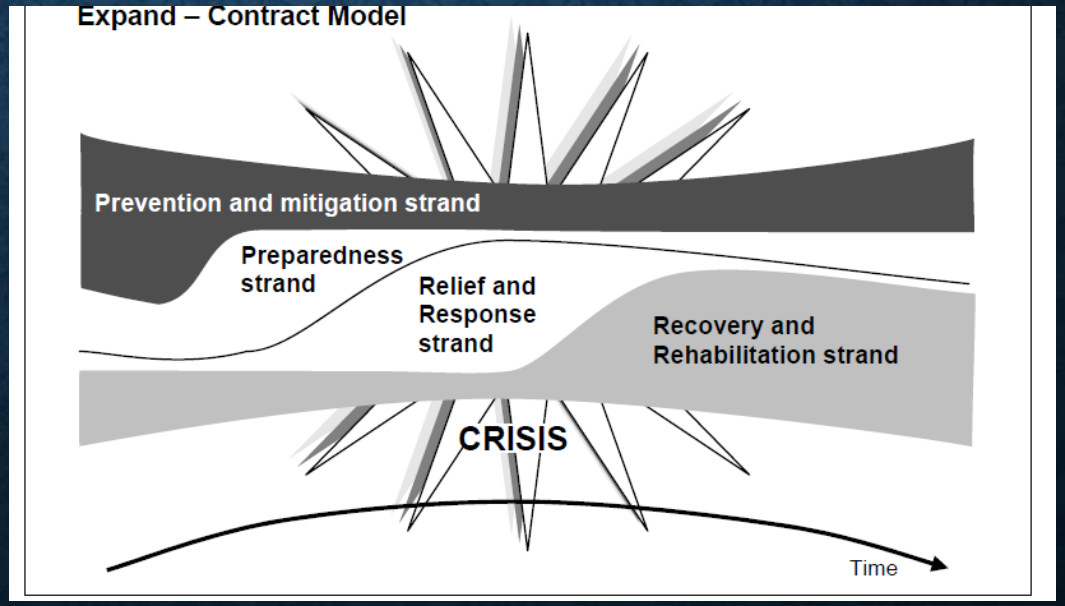
Disaster Management Cycle



Source: Asian Disaster Preparedness Center (ADPC), Module 3

Disaster Management Cycle

- Mitigation and preparedness precede a disaster.
- Pre-disaster management is called Risk Management.
- In this model, disaster management is seen as a continuous process.
- There is a series of activities that run parallel to each other rather than as a sequence.



Source: Asian Disaster Preparedness Center (ADPC), Module 3

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