

## Lecture Notes: Disaster Vulnerability and Resilience

### Session 3

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### Part 1: Disaster Management in Vanuatu: A Case Study

#### Introduction

- A. Technology-based approach (Hazard focus)
  - a. Intro to Vanuatu
    - i. Vanuatu is a group of 83 small islands located in the South West Pacific. This is an area where two plates collide where one plate is subducting under the other. These dynamics are what caused the development of the islands
    - ii. The country faces numerous hazards, such as earthquakes, volcanoes, tsunamis, cyclones, floods, landslides, etc.
  - b. Probabilistic hazard assessment
    - i. Earthquakes:
      - 1. Major earthquakes cause the entire globe to oscillate and can be measured globally.
      - 2. Earthquake magnitude is limited by plate size (corresponds to the size of the plate rupture)
    - ii. Modeling vs. Monitoring
      - 1. Modeling of meteorological catastrophes is primarily performed for insurers; mainly for cost-analysis.
      - 2. Monitoring of meteorological data. Done by satellite
    - iii. GSHAP (Global Seismic Hazard Assessment Program)
      - 1. Hazard implies: how much of the energy of an earthquake is felt on the ground?
      - 2. Global earthquake catalogues are all on the web
      - 3. Step 1: Statistical analysis looking at the dynamics of earthquakes in the past (Seismicity model)
      - 4. Step 2 (more critical): analysis to show how much of the ground motion is felt, such as soil conditions (Attenuation model)
        - a. Regions that don't have as much data are less well-served by the Attenuation model
      - 5. In Mexico City, which is surrounded by mountains, the shaking is reflected by the mountains.
        - a. One of the very few examples with a fairly good prediction system based on the oscillation of the original rupture (much faster, not much damage), they can predict when the oscillation that moves the ground (slower, more damage)

will come because it is so far from the earthquake centers (not on a fault-line)

6. Objectives:

- a. Main objective of analysis is to develop building code (a purely technical analysis).
  - i. Most buildings oscillate with only one frequency (only very complex buildings are different).
- b. Identification of structures most likely to collapse
- c. Long Term Emergency Planning

7. Limitations:

- a. No predictions are possible; the result is strictly probabilistic
  - i. Political decision makers must interpret the probabilistic data in order to make decisions
  - ii. Earthquake timing is very different from human timing (e.g. China earthquake occurred in an area considered safe because no earthquake had hit for 4000 years, but all the energy built up over that time and resulted in the worst earthquake ever).
- b. Results depend strongly on the quality of available data, so Western societies that have been collecting massive amounts of data over long periods of time are better served by the model.

iv. All-Hazard Databases

1. "Pacific Cities Project":

- a. GIS Data layers
  - i. Buildings and Infrastructure characteristics
  - ii. Earthquake Hazard Zonation (Microzonation): estimates of how the earth will oscillate during an earthquake
  - iii. Photograph of the area (orthophoto)
  - iv. Geology of the area (soil structure)
  - v. Digital Terrain Model
- b. Layers have two functions:
  - i. Modeling (i.e. digital terrain model)
  - ii. Bookkeeping (buildings and infrastructure)
- c. How effective is the bookkeeping?

- i. Model does not tell how many people will be affected, how building will be affected
      - ii. Only tells that building will flood.
    - d. Preparedness approach:
      - i. Residents given warning of approaching hazard (e.g. cyclone)
      - ii. Villages swept away
      - iii. Buildings are built as very temporary structures. Built so they shouldn't cause damage when they collapse.
        - 1. Few people die
        - 2. Material damage comparatively low
    - e. Assessments are powerful tools, but focus on specific questions, i.e. material damage. This is not the biggest priority in all locations
  - c. Multi-Risk database
  - d. Preparedness – an example

## B. Community-based approach (Vulnerability focus)

- a. Community vulnerability survey
  - i. Go to each house and interview residents about hazard and vulnerability, infrastructure assessments (info about material of house, number of people living there, road qualities, etc.)
  - ii. Objectives:
    - 1. determine the population's perception of risk
      - a. biggest concern is sea-level rise
    - 2. determine current management strategies (both on an individual/household level and on a collective/village level)
    - 3. Social development: the main component was that many communities from the outer island moved to the capital and tried to join into an existing village; has the village changed, is there a minority coming into the village that is not a part of the main village community, recent development of families (job, education, etc.), etc.
    - 4. Priorities for action: identify the main objectives for the individuals and community.
    - 5. Survey: sold by consultant, people are saturated with surveys on these islands. Consultants have a big discussion going on about how to design these surveys and coordinate them.

- iii. Priority areas:
  - 1. Some of them are quite obvious (water supply, drainage problem)
    - a. Islands don't have large supplies of clean water
    - b. Tanks are supported on flimsy structures that are highly vulnerable to natural hazards
    - c. Waste is not well managed
  - 2. Relocation (surprising due to a strong village mentality)
    - a. Mostly based on viewing a tsunami simulation of the village (does not show the low probability of the occurrence (1/100,000 in 1000 years – guess))
- b. Institutional appraisal
  - i. Talking to NGOs, local organizations, infrastructure management organizations, etc.
- c. Community Risk Mitigation Planning Workshops:
  - i. Held by consultants in Mele, Maat and Blacksands (peri-urban communities around Port Villa), participants present project ideas and discuss with local organizations.
  - ii. Objectives:
    - 1. Present the results of the survey
    - 2. Form working groups for the identified priority areas
    - 3. Discuss ideas for project proposals
    - 4. Vote for representatives to go to Community Risk Seminar (reps supposed to present ideas of the whole community).
- d. Community Risk Seminar
  - i. All villages have one person acting as disaster manager
  - ii. 2 day conference including all stakeholders
  - iii. Objective: finalize concrete project proposals
  - iv. Bias lies in the choice of the communities
    - 1. Mele is birthplace of first president (more outspoken than other villages); not the most vulnerable community
    - 2. Great deal of conversation about which communities should be chosen.
      - a. In many of the poorest places, people didn't have the time/attention to attend workshops
    - 3. Participants
      - a. Community members selected at Planning Workshops
      - b. Most organization representatives selected by the organization.
    - 4. Project proposals written by consultants
- e. Participation – a success story?
  - i. How are communities selected? Are the right communities selected? Very rarely do studies go out to the outer islands and

the needs there are very different (communication becomes an issue). Focus on communities near capital because the studies are easier to organize?

- ii. Manipulating outcomes: If you sit in a workshop that is not moving anywhere, consultants must push toward something.
- iii. Funding depends on donors (what happens in a community depends on the whims of the donors).
- iv. Science is applied in a manipulative manner; lots of data are easily misinterpreted (especially visual data) and often used for political purposes.
- v. Technology-based approach: method is not based on the appropriate priorities.
- vi. Technology-based approach is underused:
  - 1. software is U.S. made, expensive, not user-friendly
- vii. Existing inequalities among the three project villages were exaggerated by the project outcomes.