Past - Present -?
Risk evolution in New Zealand

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1. Motivation

Assessing risk associated with natural hazards is generally based on a static approach. Commonly, risk levels are calculated for a particular moment in time, while past risk levels are unknown. But risk today and in the future depends on the *dynamics* of its two main contributers: the geosystem and the social system. In New Zealand, changes in both systems have been dramatic over the last 150 years. Addressing these changes in terms of risk holds the potential to understand the relevant processes and helps to identify trends in risk development.
Therefore this project focusses on two aspects still under-represented in risk assessment: the factor of time and an interdisciplinary perspective.

2. The Aim of the project is ...

... to reveal the temporal change, i.e. the evolution of risk associated with natural hazards, focussing on landslides.

Risk is defined as a measure of the probability of adverse effects on health, property and society, resulting from exposure to a hazard of a given magnitude, within a certain time and area (Smith, 2001). An internationally established method of calculating risk is the risk equation by Varnes (1984): R = Hazard (H) x Elements at Risk (E) x Vulnerability (V), as shown in figure 1.

Fig. 1: Example of a risk equation. A landslide in Wellington city serves as the natural process, imposing a hazard on its urbanised environment. Buildings, infrastructure and ourselves are elements at risk, each characterised by our own set of characteristics, defining our levels of vulnerability.

3. Guiding research questions are ...

- To what extent do both, the geosystem and social system, change through time and space?
- Are geosystem and social system interconnected (fig. 2)?
- If yes, in which way?
- Can we define positive or negative feedbacks?
- Is there one factor dominating risk level?

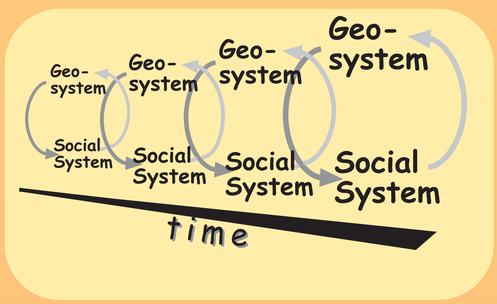

Fig.2: Interconnection through time

- If yes, is it more the geosystem changing or the social system?
- In which way will future developments be influenced by the current processes?
- Are the processes acknowledged by planning authorities?
- Are possible future risk levels acknowledged?
- Which are the best measures to reduce personal and economic loss in the future?

4. Objectives

1. The considered socio-physical processes, representing New Zealand's change through time, are: suburban sprawl (fig. 3), tourism, land use/rural development.
2. Chosen areas representing these changes: Western Hutt Hills (Lower Hutt), Mt. Cook/Aoraki Village, Waipaoa catchment (partly, Gisborne, North Island)
3. The chosen time span and time interval are:
   from 1941 until today, with a timeslice every 10 years.
4. for each area and time slice, risk is calculated:
   (R) = Hazard (H) x Elements at risk (E) x Vulnerability (V).

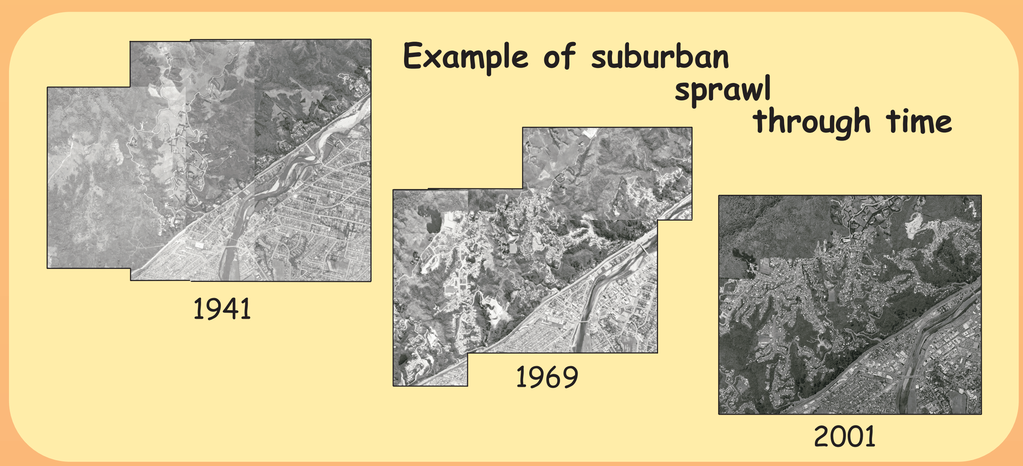

Fig.3: Time series Western Hutt Hills (Maungaraki - Melling)

5. Method

- The analysis is based on a GIS (Geographical Information System).
- All data layers are integrated and numerised within a raster format.
- Risk calculation is carried out for each raster cell, enabling tracking of spatial and temporal changes (fig. 4).

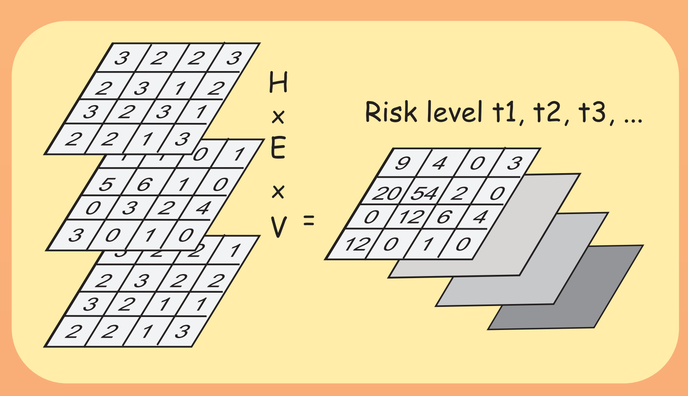

Fig.4: Raster-based approach for risk calculation

6. Data

For each area and time slice:

- Aerial photos: settlements and hazard (nr. of landslides/unit area)
- Statistics NZ: Building information: which type, age, material,...
- Statistics NZ: census data for vulnerabitliy
- distance to nearest to disaster relief centre and accessibility
- any type of historic information valuable for hazard calculation

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