Geophysical Research Abstracts
Vol. 15, EGU2013-5335, 2013
EGU General Assembly 2013

Integrated Earthquake Risk Assessment in the Kathmandu Valley – A Case Study

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Rapid urban growth is a process which can be observed in cities worldwide. Managing these growing urban areas has become a major challenge for both governing bodies and citizens. Situated not only in a highly earthquake and landslide-prone area, but comprising also the cultural and political capital of Nepal, the fast expanding Kathmandu Valley in the Himalayan region is of particular interest. Vulnerability assessment has been an important tool for spatial planning in this already densely populated area.

The magnitude 8.4 earthquake of Bihar in 1934 cost 8600 Nepalis their lives, destroyed 20% of the Kathmandu building stock and heavily damaged another 40%. Since then, Kathmandu has grown into a hub with over a million inhabitants. Rapid infrastructure and population growth aggravate the vulnerability conditions, particularly in the core area of Metropolitan Kathmandu.

We propose an integrative framework for vulnerability and risk in Kathmandu Valley. In order to move towards a more systemic and integrated approach, we focus on interactions between natural hazards, physically engineered systems and society. High resolution satellite images are used to identify structural vulnerability of the building stock within the study area. Using object-based image analysis, the spatial dynamics of urban growth are assessed and validated using field data. Complementing this is the analysis of socio-economic attributes gained from databases and field surveys. An indicator-based vulnerability and resilience index will be operationalized using multi-attribute value theory and statistical methods such as principal component analysis. The results allow for a socio-economic comparison of places and their relative potential for harm and loss.

The objective in this task is to better understand the interactions between nature and society, engineered systems and built environments through the development of an interdisciplinary framework on systemic seismic risk and vulnerability. Data from incidences of large-scale Himalayan earthquake disasters will form the basis for a multi-temporal analysis. By analyzing different time slots we identify development paths and building integrity shifts in the light of dynamic urbanization processes. Hereby, future trends and spatial scenarios can be developed. We suggest a goal oriented indicator evaluation process to compare different development scenarios. This serves as an orientation for spatial planning strategies for local and international stakeholders.