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Unplanned roads impacts assessment in Phewa Lake watershed, Western region, Nepal

Geoffroy Leibundgut (1), Karen Sudmeier-Rieux (2), Sanjaya Devkota (3), Michel Jaboyedoff (4), Ivanna Penna (5), Anu Adhikari (6), and Rajendra Khanal (7)

(1) ISTE, University of Lausanne, Lausanne, Switzerland (geoffroy.leibundgut@gmail.com), (2) ISTE, University of Lausanne, Lausanne, Switzerland (karen.sudmeier@gmail.com), (3) Institute of Engineering, Department of Civil Engineering, Tribhuvan University, Lalitpur, Nepal (devkotasanjaya@gmail.com), (4) ISTE, University of Lausanne, Lausanne, Switzerland (Michel.Jaboyedoff@unil.ch), (5) ISTE, University of Lausanne, Lausanne, Switzerland (Ivanna.Penna@unil.ch), (6) IUCN, Nepal (Anu.ADHIKARI@iucn.org), (7) IUCN, Nepal (Rajendra.KHANAL@iucn.org)

This work describes current research being conducted in the Phewa Lake watershed, near Pokhara in Nepal's Siwaliks/Middle hills, a moist sub-tropical zone with the highest amount of annual rainfall in Nepal (4,500 - 5,000 mm). The watershed lithology is mainly siltstone, sandstones and intensively weathered rocks, highly prone to erosion and shallow landslides (Agrawala et al., 2003). The main purpose of this study is to focus on the impact of unplanned earthen road construction in the Phewa Lake watershed as part of land use changes over 30 years in one of Nepal's most touristic regions.

Over the past three decades, the road network has expanded exponentially and a majority of rural earthen roads are often funded by communities themselves, with some government subsidies. They are usually constructed using a local bulldozer contractor with no technical or geological expertise increasing erosion processes, slope instabilities risk and impacts to settlements, forests, water sources, agriculture lands, and infrastructure. Moreover, these human-induced phenomena are being compounded by increasingly intense monsoon rains, likely due to climate change (Petley, 2010).

Research methods were interdisciplinary and based on a combination of remote sensing, field observations and discussions with community members. The study compared 30 year-old aerial photos with current high resolution satellite images to correlate changes in land use with erosion and slope instabilities. Secondly, most of the watershed's roads were surveyed in order to inventory and quantify slope instabilities and soil loss events. Using a failure-characteristics grid, their main features were measured (location, size, type and extension of damage areas, etc.) and a GIS data base was created. We then estimated economic impacts of these events in terms of agriculture lands losses and road maintenance, based on field observations and discussions with affected people.

Field work investigations have shown that unplanned road excavations are producing mainly embankment failures and/or gullying which affect primarily roads themselves, wiping them out and blocking vehicle circulation, and secondly, destroying or burying agriculture lands. Initial results of the remote sensing analysis demonstrate that there is high probability of a correlation between the expansion of the road network and increased erosion/deposition in the watershed. Finally a few deep-seated and potentially very destructive failures were observed in the watershed, in large part triggered by road construction. All phenomena present economic impacts for communities due to costly interventions for clearing roads and losses of crop production.

References:

Agrawala, S., et al. (2003). Development and Climate Change in Nepal: Focus on Water Resources and Hydropower. Paris, OECD: 64pp.

Petley, D. N. (2010). On the impact of climate change and population growth on the occurrence of landslides in Asia. Quarterly Journal of Engineering Geology and Hydrogeology, 43 (4), 487-496.