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Nature Based Solutions applied to road infrastructure in Nepal, a vehicle for development.

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This article describes research undertaken in the Panchase Region of Western Nepal as part of the “Ecosystems Protecting Infrastructure and Communities” (EPIC) project 2012-2017, where three community-led bio-engineering demonstration sites were established along roadsides. The topic of Nature Based Solutions (NBS) and Eco-DRR/CCA is explored adopting interdisciplinary research methods, spanning both social and physical sciences, and citizen science alongside state-of-the art high resolution erosion monitoring and remote sensing. We examine the nexus between infrastructure design (traditional roads vs green roads) and landslides. Investigations included a watershed study of land use changes over time and erosion rates associated with road construction in the Phewa Lake Watershed (Kaski district, Western Nepal), an analysis of the effectiveness of vegetation in reducing erosion rates using LIDAR and drone measurements, and a cost-benefit analysis of conventional “grey” versus bio-engineered roads, or “eco-safe roads”.

Results of the watershed study indicate a trend from erosion due to open grazing thirty years ago to increased erosion by new roads; Land IDAR measurements show that vegetation has been effective in reducing erosion rates. The cost benefit analysis (CBA) explores the net benefit of grey vs eco-safe roads using different time horizons and precipitation distributions associated to monsoonal activity and climate change trends. The CBA results demonstrate that initial costs in installing the bio-engineered eco-safe road are higher than for the “grey” road, however the bio-engineered road rapidly becomes more cost-effective, especially when factoring in avoided damages and multiple co-benefits to the population. Findings from this work have led to policy recommendations promoting and upscaling a more sustainable approach to bio-engineering for rural road construction in Nepal as well as methodological recommendations for replicating and up-scaling similar studies elsewhere.