Structuring a Bayesian belief network using expert knowledge for landslide hazard assessment

Shreyasi Choudhury[1], Bruce D. Malamud[1], and Amy Donovan[2]

[1]Kings College London, Department of Geography, London, United Kingdom (shreyasi.choudhury@kcl.ac.uk)
[2]University of Cambridge, Department of Geography, Cambridge, United Kingdom

Landslide hazard assessment in India using historical data faces three challenges: (i) difficulty of obtaining systematic landslide occurrence data; (ii) under-representation of small-scale landslides; (iii) lack of recording of the physical/anthropogenic influences on landsliding. Here we show development of a Bayesian Belief Network (BBN) for a multi-hazard landslide assessment using experts' judgements. Experts were chosen based on their experience on landslides and/or in Darjeeling Himalayas. A BBN produces a probability estimation of possible events and is a graph containing a set of variables (nodes) and conditional (in)dependencies between the nodes (arcs).

To better understand the relative weighting of potential causes of landslides in our case study area -Darjeeling Himalayas- we carried out four steps. (**Step 1**) We reviewed 29 peer- and grey-literature sources to list 13 physical/anthropogenic variables that might influence landsliding. (**Step 2**) We interviewed 11 experts about the importance of these 13 variables and asked for additional potential variables (resulting in 35 variables). (**Step 3**) We used interviews plus questionnaire to ask 16 experts to rate each of the 35 variables (scale 1-10) as to their potential to influence landsliding. The experts also added 7 more variables (resulting in 46 variables). (**Step 4**) Based on the ratings and interviews, we chose 35 out of 46 variables as our BBN nodes and from these the BBN arcs. Examples of these variables include rainfall, wildfires, geological weathering, planned infrastructure loading, cultivation (planned/unplanned), railway/road construction changing slope angle (planned), relief, slope, soil cohesion. Based on this study, we found that judgement of local people/academicians/technical experts can be of help whilst developing a BBN structure, allowing us to calculate probabilistic relationships between the nodes in a BBN. This process, therefore, can be utilised for landslide-based multi-hazard assessment in low data regions.