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Developing the conceptual framework for a prototype government-led regional Landslide Early Warning System in India

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The LANDSLIP (LANDSLide multi-hazard risk assessment, Preparedness and early warning in South Asia) research project commenced in 2016 with the aim of developing a prototype regional landslide forecasting and early warning system to help build resilience to hydrologically related landslides in two case study regions of India, the Nilgiris and Darjeeling. Here we present our pathway and reflections on the development of the LANDSLIP prototype LEWS (landslide early warning system) and its component parts, which includes a decision-support information dashboard and prototype daily landslide forecast bulletin.

Central to the LEWS was a common and shared understanding of its conceptual framework. In other words, what were the components of the LEWS and how did they interact? To develop our LEWS conceptual framework we engaged a LANDSLIP interdisciplinary team which consisted of a range of researchers and practitioners from the British Geological Survey, Kings College London, Amrita University, Consiglio Nazionale delle Ricerche, Practical Action, UK Met Office, and Newcastle University. We developed the conceptual framework in collaboration with in-country partners (e.g. Save the Hills, Keystone, National Centre for Medium Range Weather Forecasting (NCMRWF) and District Management Authorities). As the nodal agency for landslides in India, the Geological Survey of India (GSI) partnered with the project and provided a focal point for the prototype LEWS.

The result of our final conceptual framework for the LEWS consisted of: (A) Dynamic forecast modelling data products, (B) semi-static landslide data layers feeding into (A), and (C) additional data sources. (A) to (C) then feed into (D) a LEWS information dashboard (data and physical models display). Finally, our conceptual framework included the communication flows, operating procedures and guidance documentation surrounding these communications. The aim of the conceptual framework was to help ensure that the prototype LEWS would create insight from the data and models and lead to behavioural change by recipients of the daily landslide forecast bulletins (i.e. District authorities).

The development of the LEWS conceptual framework occurred, not by design but out of necessity. At the start of the project, it was assumed all partners in the consortium had a shared vision for the LEWS. However, it quickly transpired that there were slightly different interpretations and

nuances to this vision, which resulted in disparate working and a degree of disenfranchisement. By acknowledging this, and exploring it through a series of discussions and workshops, the consortium developed a shared and common conceptual framework for LANDSLIP's prototype LEWS. This common framework helped guide the project and enabled all partners to realise how everyone contributed to the overall vision of the project. This session will cover some of the challenges, processes, outcomes and learning encountered through developing a conceptual framework for LANDSLIP's prototype LEWS.

LANDSLIP project partners: George Adamson, Christian Arnhardt, Mirianna Budimir, Claire Dashwood, Amy Donovan, Saibal Ghosh, Ramesh Guntha, Phillip James, Rabisankar Karmakar, Raj Kumar M, Sumit Kumar, Alessandro Mondini, Akshaya Kumar Mishra, Robert Neal, Anshu Ogra, Praful Rao, Maneesha V. Ramesh, Hemalatha T, Ramesh, Helen Reeves, Joanne Robbins, Mauro Rossi, Gargi Singh and KR Viswanathan.