26th July 2021

Dear Sir/Madam,

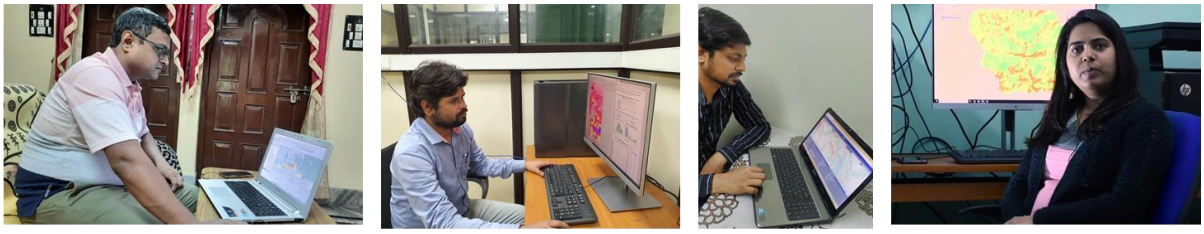
The year 2020 has been a challenging period for us all. We would like to thank you for your continued support and wish to send our very best wishes to you during this difficult time.

Notwithstanding the challenges of COVID-19, it is with great pleasure that we share with you an update on the UKRI (UK Research and Innovation) funded LANDSLIP project. Our project consortium members from across India, UK and Italy, have continued working to progress our prototype (experimental) landslide forecasting system in our study sites, the Nilgiris and Darjeeling Districts.

Given the impacts of COVID-19, the LANDSLIP project was granted an extension, with no additional funding, until March 2022. Our current focus is on legacy, capturing our collective project learning, and looking ahead to post-project sustainability and shared learning.

The project has progressed on several fronts since our last communication in June 2020.

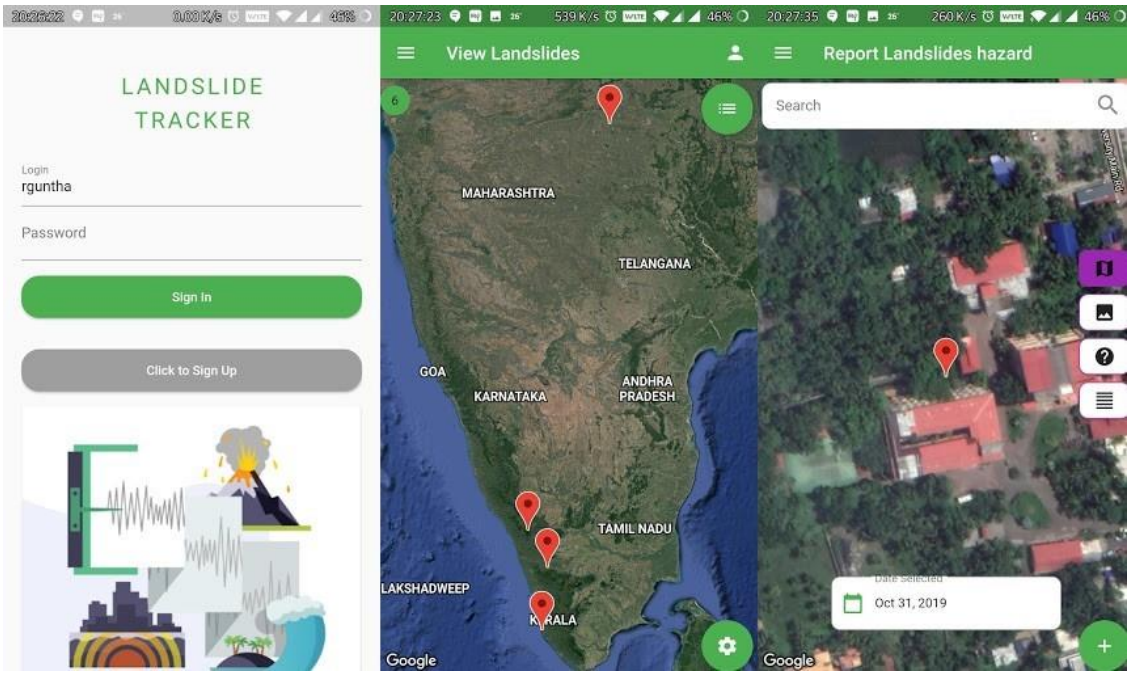
Daily forecast testing



Staff at the Geological Survey of India preparing the experimental daily landslide forecast bulletin.

Throughout the 2020 monsoon period in the Nilgiris and Darjeeling, the Geological Survey of India (GSI) and other LANDSLIP partners have been working closely together to trial the prototype landslide forecast models and develop experimental daily landslide forecast bulletins. Experimental forecasts will again be done for the 2021 monsoon, and once these are sufficiently robust and reliable (e.g. in 3-5 years), could be operationalised to support district management officials with their decision-making on a daily basis.

Landslide data collection



LANDSLIP members have been working with our community partner organisations (Save the Hills and Keystone Foundation) and Darjeeling/Nilgiris District officials to trial methods for recording landslide observations in our study sites during the 2020 monsoon periods. These methods include hard-copy recording (paper format), synthesis of relevant social media and newspaper reports, as well as the development and implementation of a mobile app for Android. The concept and software of the mobile application has been developed by Amrita University with the underpinning content developed by LANDSLIP project partners, and has seen now extensive use by local partners. It is available on Google Play Store for free, and at http://landslides.amrita.edu.

The data collected during the past year has been vital in providing better quality information on landslide occurrences and on a real time basis, which will support the team to evaluate and improve the landslide prototype model, and has provided approximately 500 landslides to the record of landslides in India.

Post-monsoon district stakeholder meetings

In December 2020 and March 2021, several members of the LANDSLIP consortium team, led by GSI, met virtually with the State, District and selected sub-District officials in Darjeeling and then the Nilgiris to discuss their experiences during the 2020 monsoon. The meetings were a vital source of feedback to GSI and the LANDSLIP team, which will inform further evaluation and development of the bulletin information, landslide and rainfall data collection methods, communication strategies, and assessing the quality of the forecast information.

GSI Landslide Forecasting Centre

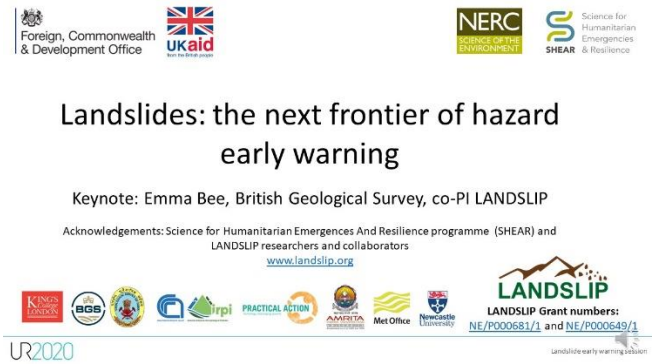
The Geological Survey of India is the nodal agency in India for landslide hazards and is mandated to develop and issue landslide early warning. Partially informed by the guidance of LANDSLIP experts, GSI is pleased to announce that soon there will be a state-of-the-art National Landslide Forecasting Centre based in Kolkata, India to carry out the future challenging tasks of experimental and operational regional Landslide Early Warning System (LEWS) programs in multiple provinces in India.

"LANDSLIP will be completing a full circle of research, development, prototype deployment, and transfer of legacy programs. LANDSLIP has helped support GSI in the development of its future roadmap for a National Landslide Forecasting Centre at Kolkata, ensuring a smooth and seamless legacy transfer." - Saibal Ghosh, Director (Geology), GHRM Centre, Geological Survey of India

Workshops to collect learning

Over the course of the last year, the LANDSLIP team have been meeting virtually through a series of online workshops to collectively reflect on and capture what we have learned through LANDSLIP. The knowledge outputs produced by these workshops will support and advance future work by GSI and others in India to develop the prototype forecasting system, and provide valuable information for other organisations globally who are interested in developing a regional landslide early warning system.

Sharing knowledge globally



LANDSLIP consortium members have presented their work at multiple high-profile global virtual conferences, including the *Understanding Risk Forum*, the *Global Dialogue Platform*, the *Sustainable Mountain Development Summit*, the *European Geosciences Union*, *LandAware MayDay* 'round-the-clock conference, and the (Amrita University hosted) *International Symposium on IoT and ML for Ecosystem Restoration and Multi-Hazard Resilience*. Further information on these events and details of the LANDSLIP presentations can be found on LANDSLIP's news page.

COVID-19

We are mindful that our team members, project partners, and stakeholders have all faced a challenging past year and in many countries COVID-19 infections are rising, with the threat of the pandemic remains extremely serious. This is understandably a very difficult time.

The LANDSLIP consortium is continually reviewing the impact of COVID-19 on team members, partner institutions and the project in India. The LANDSLIP team recognise the importance of strictly adhering to the India, UK and Italy government guidelines in order to prioritise the health, safety and well-being of its members and stakeholders. As a consortium, and with our local partners, we are adapting our plans on a periodical basis, to ensure that the LANDSLIP project continues to deliver impact, despite the current, extreme circumstances.

Over the past year, we have adapted to online meetings, workshops, writeshops and collaborations. The project has received an extension until March 2022 to partially compensate for the effects of COVID-19 on project achievements.

From all of us at LANDSLIP, we would like to thank you for your support and send you our very best wishes.

Next steps

The LANDSLIP consortium's next steps will be to continue engagement with the Indian State and District level authorities (along with relevant national authorities) with regards to our two study sites in Nilgiris and Darjeeling districts. We will share the processes and findings from the project and how the tools and learning from LANDSLIP can potentially be used beyond the project. The remaining time within the project will provide:

- LANDSLIP team support for Indian partners to be able to take forward the various forecasting models, products, systems, research and knowledge gained, beyond the end of the project, as well as support in the collection and analysis of landslide data over the 2021 monsoon.
- Capturing and sharing our knowledge with key stakeholders within India and to the wider global community. This will not only incorporate learning from the prototype system, but also from the wider research, including social media methodologies, PhD research outcomes, and research on cloudbursts in India.

These efforts will endeavour to ensure the legacy of knowledge and learning will continue to inform and influence researchers, practitioners and policy makers beyond the end of LANDSLIP.

Please feel free to share this newsletter with interested colleagues and others.

Best wishes,

Prof. Bruce D Malamud and Ms Emma Bee

Co-Leads of NERC/FCDO LANDSLIP project

LANDSLIP (Landslide Multi-Hazard Risk Assessment, Preparedness and Early Warning in South Asia: Integrating Meteorology, Landscape and Society) is a NERC/DFID funded India-UK Collaborative Project.

The LANDSLIP project has as overall objective the development of a pilot early warning system for landslides in India and more broadly South Asia, with two pilot case studies: (i) Darjeeling/East Sikkim, (ii) Nilgiris.

This multi-institutional project consortium has 36 natural and social science researchers from internationally well-known government, research/academia and not-for-profit organisations: three from India including Geological Survey India (GSI), Amrita University and Practical Action Consulting, one from Italy (CNR-IRPI) and five from the UK (British Geological Survey, UK MetOffice, King's College London, Newcastle University, Practical Action Consulting). We also work closely with Save the Hills in Darjeeling and Keystone Foundation in Nilgiris, and their support helps us carrying out our work.

This project is unique in its approach to landslide early warning systems as it combines landscape, meteorological and social dynamics.

Further information is available on our LANDSLIP website and the SHEAR website.