Landslide and mudflow warning systems

Challenge: Disaster preparedness **Adaptation response:** Early warning

Description

Landslide and mudflow warning systems produce a warning when there is danger of a landslide or mudflow event in an area, improving disaster preparedness and minimizing event risks. These events often result in heavy material damage with high clean-up costs, and are threats to human safety. The systems receive either real-time or periodic monitoring data from rain gauges and slope-movement sensors on site. The data is coupled with data from mathematic models calibrated with local topography, geo-physical characteristics, land use and forecasted meteorological data to determine the risk of a landslide or a mudflow. If there is a substantial risk, a warning is issued among system managers and local decision makers. Today landslides and mudflows are increasingly likely due to unpredictable weather patterns resulting from climate change. This technology is therefore important for climate change adaptation efforts in regions at risk.

Implementation

Prior to implementation, geo-indicators (local geological and meteorological conditions) should be identified and established. Implementation involves setting up gauges and sensors at potential landslide sites that send data to a local control centre. Relevant mathematical models and forecasting systems should be part of control centre database. Training is an important factor in determining the success of the systems. Local staff should be trained in system operation and local populations should be informed of risks and warning responses.

Environmental Benefits

- Timely prevention can help mitigate damage to ecosystems.

Socioeconomic Benefits

- Strengthens community preparedness, response and recovery.
- Minimizes human fatalities, injuries and health risks, as well as infrastructure damage.
- Reduces post-disaster rehabilitation and rebuilding costs.

Opportunities and Barriers

Opportunities:

- Technological advances have allowed citizens to receive data directly from the warning systems on their smartphones, improving dissemination speed and reach
- Provides climate change adaptation benefits and improves disaster preparedness
- It is implemented at local and regional scales and can reach all societal groups, including those that are particularly vulnerable
- Expensive relief efforts can be significantly reduced.

Barriers:

- Information and warning dissemination efficiency is reliant on communication network access. System efficiency and reliability could be reduced due to limited telecommunication networks, particularly in remote regions of developing countries
- The warning carries a degree of uncertainty, which could lead to false alarms.

Implementation considerations*

Technological maturity:	2-3
Initial investment:	3-4
Operational costs:	3-4
Implementation timeframe:	2-3

* This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:
Technological maturity: 1 - in early stages of research and development, to 5 – fully mature and widely used
Initial investment: 1 – very low cost, to 5 – very high cost investment needed to implement technology
Operational costs: 1 – very low/no cost, to 5 – very high costs of operation and maintenance
Implementation timeframe: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity
This assessment is to be used as an indication only and is to be seen as relative to the other technologies included in this guide. More specific costs and timelines are to be identified as relevant for the specific technology and geography.

Sources and further information

ADB (2014). Technologies to Support Climate Change Adaptation. Asian Development Bank.

Intrieri, E., Gigli, Sasagli, N. and Nadim, F. (2013). Landslide Early Warning System: toolbox and general concepts. Natural Hazards and Earth System. Sciences, 13, pp. 85–90. Available at: http://nat-hazards-earth-syst-sci.net/13/85/2013/nhess-13-85-2013.pdf

IOSB (2016). ELDOWAS- Early Landslide Detection and Warning System. Fraunhofer Institute of Optronics, System Technologies and Image Exploitation. Available at: http://www.iosb.fraunhofer.de/servlet/is/44405/

Mercy Corps and Practical Action (2010). Establishing Community Based Early Warning System: Practitioners Handbook. Available at: http://www.preventionweb.net/files/19893_19866cbewspractionershandbooktraini.pdf

NOAA-USGS (2005). NOAA-USGS debris-flow warning system— Final report. NOAA-USGS Debris Flow Task Force. U.S. Geological Survey Circular 1283, 47 p. Available at: http://pubs.usgs.gov/circ/2005/1283/pdf/Circular1283.pdf

Spaceappschallenge.org (n.d.) Landslide- EWAS- Early Warning System. National Aeronautics and Space Administration (NASA). Available at: https://2014.spaceappschallenge.org/project/landslide-ewas--early-warning-system/