Geophysical Research Abstracts
Vol. 13, EGU2011-11444, 2011
EGU General Assembly 2011

Guidelines for the design and implementation of landslide Early Warning Systems

Emanuele Intrieri (1) and Farrokh Nadim (2)

(1) Università di Firenze, Italy (emanuele.intrieri@unifi.it), (2) International Centre for Geohazards/Norwegian Geotechnical Institute), Norway (farrokh.nadim@ngi.no)

In landslides prone areas, implementation of risk mitigation measures often faces problems related to economical resources, environmental impact and logistic issues. This is particularly true for structural counter-measures, which aim at reducing the risk by reducing the probability of failure, preventing the landslide from reaching the elements at risk, or reinforcing existing buildings in the path of potential slides. On the other hand early warning systems (EWS) are a cost-effective means to reduce the risk by reducing the exposure of the population at risk and have a low environmental and economical impact.
However, a well-functioning EWS is difficult to design because it requires good understanding of mechanical processes causing slope instability, a performing monitoring system with redundancy, reliable forecasting of the time of failure, coordination among stakeholders, dissemination of understandable warnings, the involvement of the public within the system and other important social issues.
To produce guidelines for monitoring and EWSs in Europe is one of the aims of the SafeLand project, a large, integrating European project in the 7th Framework Progamme that started on 1 May 2009. SafeLand involves 27 partners from 12 European countries and is coordinated by the International Centre of Geohazards in Norway.
One of the main problems in developing this kind of guidelines is that EWSs are extremely site-specific and may greatly vary depending on the scale, type of landslide, element at risk, etc. Therefore the guidelines must be simple and flexible, favouring straight-forward, graphic methods that lead the end-user towards the most suitable EWS.
However some design criteria valid in general can be pointed out. These criteria represent some of the primary needs of an EWS, such as:
• communication, both among the stakeholders and with the public;
• simplicity, fundamental in emergency cases;
• reliability, that is the capability of catching real events and avoiding false alarms;
• earliness, since time sufficient for possible evacuation must be granted.
Defining these general criteria should be the first step of the design process since it allows the development of a coherent system and assists in the choice of the most suitable EWS.
The characteristics of an EWS (such as the monitored parameters, the instruments, the type of thresholds, etc.) are determined by the boundary conditions of the site, which act as constraints. By studying and decomposing many EWSs operating throughout the world into their features and constraints, the basic ingredients for designing an EWS for landslide have been identified. The following four methods were developed in order to help the end-user to choose the most important features for his EWS, depending on the constraints encountered:
1) Flow chart-based guideline: by following a flow chart the end-user is asked about some information concerning the landslide, the element at risk, etc. Depending on the answers this graphic-based method indicates what instruments, procedures, etc. should be introduced in the EWS. Flow chart-based methods can easily be implemented as interactive software.
2) Tables of suitability: a few tables provide the end-user with what parameters (so-called geo-indicators), instruments, etc. are more or less suitable (fuzzy logic approach) depending on the scale, budget, type of landslide and so on.
3) Constraint table: a table that suggests what should be done and what are the pitfalls for each of the most common constraints that may occur.
4) Descriptive list: it provides comprehensive comments for the most common features to be possibly included inside an EWS, explaining in which cases they are best used.
The use of one of these guidelines will provide the end-user, even inexperienced ones, with a simple and versatile means to design a landslide EWS in most circumstances.