



## Changing pattern of landslide risk in Europe – The SafeLand project

F. Nadim and B. Kalsnes

Norwegian Geotechnical Institute / ICG, Oslo, Norway (Farrokh.Nadim@ngi.no)

The need to protect people and property with a changing pattern of landslide hazard and risk caused by climate change and changes in demography, and the reality for societies in Europe to live with the risk associated with natural hazards, were the motives for the project SafeLand: "Living with landslide risk in Europe: Assessment, effects of global change, and risk management strategies."

SafeLand is a large, integrating research project under the European Commission's 7th Framework Programme (FP7). The project started on 1 May 2009 and will end on 30 April 2012. It involves 27 partners from 12 European countries, and has international collaborators and advisers from China, India, USA, Japan and Hong Kong. SafeLand also involves 25 End-Users from 11 countries. SafeLand is coordinated by the International Centre for Geohazards (ICG) at Norwegian Geotechnical Institute in Norway. Further information on the SafeLand project can be found at its web site <http://safeland-fp7.eu/>.

Main results achieved in SafeLand include:

- Various guidelines related to landslide triggering processes and run-out modelling.
- Development and testing of several empirical methods for predicting the characteristics of threshold rainfall events for triggering of precipitation-induced landslides, and development of an empirical model for assessing the changes in landslide frequency (hazard) as a function of changes in the demography and population density.
- Guideline for landslide susceptibility, hazard and risk assessment and zoning.
- New methodologies for physical and societal vulnerability assessment.
- Identification of landslide hazard and risk hotspots for Europe. The results show clearly where areas with the largest landslide risk are located in Europe and the objective approach allows a ranking of the countries by exposed area and population.
- Different regional and local climate model simulations over selected regions of Europe at spatial resolutions of 10x10 km and 2.8x2.8 km. These simulations were used to perform an extreme value analysis for trends in heavy precipitation events, and subsequent effects on landslide hazard and risk trends.
- Guidelines for use of remote sensing techniques, monitoring and early warning systems.
- Development of a prototype web-based "toolbox" of innovative and technically appropriate prevention and mitigation measures. The toolbox does a preliminary assessment and ranking of up to 60 structural and non-structural landslide risk mitigation options.
- Case histories and "hotspots" of European Landslides have been collected and documented. Data for close to fifty potential case study sites have been compiled and summarized. Most of the case study sites are located in Europe (Italy, France, Norway, Switzerland, Austria, Andorra, and Romania); but they also include one site in Canada and one in India. Almost every type of landslide and every type of movement is represented in these sites.
- Research on stakeholder workshops and participatory processes to involve the population exposed to landslide risk in the decision-making process for choosing the most appropriate risk mitigation measure(s).