

Date of Submission	<u>November 15, 2015</u>
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IPL Project Proposal Form 2016

(MAXIMUM: 3 PAGES IN LENGTH)

1. Project Title: Towards Improved Landslide Mapping and Forecasting

2. Main Project Fields

Select the suitable topics. If no suitable one, you may add new field.

(1) Technology Development

A. Monitoring and Early Warning

(3) Capacity Building

B. Collating and Disseminating Information/ Knowledge

(4) Mitigation, Preparedness and Recovery

A. Preparedness, B. Mitigation

3. Name of Project leader: Fausto Guzzetti

Affiliation: CNR-IRPI, Director

Contact: CNR-IRPI, Via Madonna Alta 126, 06128, Perugia, Italy; tel: +390755014402, fax: +390755014420, mail: fausto.guzzetti@irpi.cnr.it

Core members of the Project

Names/Affiliations:

Nicola Casagli (Earth Science Department, University of Florence, Italy)

Mario Parise (CNR-IRPI, Bari, Italy)

Pasquale Versace (Laboratory of Environmental Cartography and Hydraulic and Geological Modeling, University of Calabria, Italy)

Giovanna Capparelli / CAMIlab, DIMES, University of Calabria

4. Objectives:

We propose an ICL project initiative (i) to review past and existing operational landslide forecasting and warning systems, (ii) to propose recommendations for the design, the implementation, and the validation of operational landslide forecasting and warning systems, (iii) to identify the best procedure for decision making when information from different source are available. We propose to limit the project to the evaluation of systems aimed at predicting rainfall induced landslides and their consequences.

5. Background Justification:

Landslides are present in all continents, and play an important role in the evolution of landscapes. They also represent a serious hazard in many areas of the world. In many regions, there is mounting interest

towards the operational forecasting of landslides, and chiefly of rainfall induced landslides. A limited number of regional / national-scale forecasting and/or warning systems has been, or are, operational. The systems use different methods and tools (local and areal monitoring system, simulation models, rainfall nowcasting) to prepare the forecasts and to issues the warnings, and cover areas of very different extent, from single sites to entire nations. The systems also differ for the frequency of the forecasts (daily to hourly) and their operation history, with only a limited number of systems that have been operational for several years. The aims of the systems also vary, with some of the system designed for civil protection purposes and other systems to provide information or advice to private business. The differences make it difficult to compare the systems and to relate and evaluate their performances.

6. Study Area:

Two different levels. At very large scale, data collection all over the world. At the local scale, three monitored areas in Italy (Calabria, Umbria, Toscana).

7. Project Duration:

3 years.

8. Resources necessary for the Project and their mobilization

Personnel, Facilities, and Budgets

The project involves about 15 people, and internal resources from the involved institutions (CNR, University of Florence, and University of Calabria). The project also involves instrumentation for field survey and experimental and representative sites.

9. Project Description:

Designing an operational landslide forecasting and/or warning system is a challenging task that requires interdisciplinary skills and expertise. A typical forecasting system has many components, including landslide and meteorological data, forecasting models and tools to define their uncertainties, adequate SW and HW, and criteria and tools for validation of the forecasts and to deliver the warnings. It is critical that all components are robust, because a chain has the strength of its weakest element, and that the single components and the entire system rely on sound science, to be credible to the users.

For the Italian National Department for Civil Protection, the Institute of Research for the Hydrological Protection of the National Research Council of Italy (CNR IRPI) has designed and operates since 2010 a national system to forecast the possible occurrence of rainfall-induced landslides in Italy. The Department of Earth Sciences at the University of Florence, and the Laboratory of Environmental Cartography and Hydraulic and Geological Modeling at the University of Calabria, both long-term members of ICL, have consolidated experience in the design and the implementation of operational landslide forecast / warning systems, and are directly involved in this project proposal. Further, the proposal is open to all ICL partners, and intends to build on the specific expertise of many of the ICL partners as well as on the lessons learned from other landslide experts.

10. Work Plan/Expected Results:

The first phase of the project will consist of reviewing past and existing operational landslide forecasting and warning systems, highlighting their distribution in the different countries/continents, their level of accuracy during past events, the effective adoption of the systems by local authorities and the forensic aspects during the operation phase. This phase will allow to have a clear framework of the world situation on the topic, and will be mandatory for the implementation of the second phase. During this latter, recommendations for the design, the implementation, and the validation of operational landslide forecasting and warning systems will be proposed, based upon the outcomes derived from the first phase. The application of these recommendations will be applied during the running of the Italian experimental sites. In particular, the project will be limited to the evaluation of systems aimed at predicting rainfall induced landslides and their consequences.

11. Deliverables/Time Frame:

At the end of the first year, a first report depicting the past and existing operational landslide forecasting and warning systems for which documentation has been found will be prepared. The report will represent the basis on which to build the second year work, essentially consisting in critical evaluation of the warning systems, aimed at highlighting their positive elements, and their drawbacks as well. Further, a classification of different kind of warning system will be developed. Eventually, at the end of the third year issuing guidelines for the development of early warning systems for the prediction of rainfall-induced landslides at different operational scales will represent the main final outcome of the project.

12. Project Beneficiaries:

The project is addressed to all those governmental and administrative bodies in charge of the land management and dealing with civil protection issues. These could use the project outcomes, in direct co-operation with scientific bodies, to design, implement, and validate landslide early warning systems, personalized in function of the main physical and meteorological characters of their own areas of study/interest.

13. References:

- Brunetti M.T., Peruccacci S., Rossi M., Luciani S., Valigi D. & Guzzetti F. (2010) - Rainfall thresholds for the possible occurrence of landslides in Italy. *Nat. Hazards Earth Syst. Sci.*, 10, 447–458.
- Brunetti, M.T., Peruccacci, S. et al. (2015) - Catalogue of Rainfall Events with Shallow Landslides and New Rainfall Thresholds in Italy. In: *Engineering Geology for Society and Territory*, 2, 1575–1579. Springer International Publishing. DOI:10.1007/978-3-319-09057-3_280.
- Rossi M., Peruccacci S., Brunetti M.T et al. (2012) - SANF: National warning system for rainfall induced landslides in Italy. *Proc. 11th Int. Symp. Landslides, Banff (Canada)*, 3-8 June 2012, 2, 1895-1899.