Projects of International Programme on Landslides
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2.1 Background

The International Program on Landslides (IPL) was launched in 2002 as an initiative of the International Consortium on Landslides (ICL). The main goal of the program is to conduct cooperative research and capacity building on landslide risk mitigation, with particular emphasis on developing countries. Within this framework the different projects carried out under the IPL umbrella aim to contribute to the International Strategy for Disaster Reduction (ISDR).

The IPL Global Promotion Committee was established within the 2006 Tokyo Action Plan. The Committee consists of ICL members and ICL supporting organizations and convenes annually during the ICL Board of Representatives meetings, and occasionally during other international events. The main objectives of the committee are to conceive the strategies for promoting the 2006 Tokyo Action Plan, and to manage the IPL global cooperation fields, the topics that are considered by IPL as the most relevant for promoting international research, cooperation and capacity building on landslide risk mitigation. Since its establishment IPL has supported over 60 projects worldwide (Fig. 2.1).

2.2 The Global Cooperation Fields

In the initial stages of the IPL several global cooperation fields (GCFs) have been identified as priorities. These can be modified in the future, following new technological developments or changing global scenarios. The global cooperation fields were identified in the 2006 Tokyo Action Plan which is attached in the end of Chapter 1 “Progress of the International Programme on Landslides – Objectives of IPL and WLF and the World Landslide Forum-” of this book.

2.3 Overview of IPL Projects

In total, over 60 projects have been carried out within the IPL community. Each year new projects are proposed, ongoing projects are sustained and completed projects are brought to a close. A comprehensive overview of the status of all IPL projects is listed in Annex 2.1. Projects have regarded many different areas of landslide research and engineering, creating opportunities of communication and collaborative work between scientists and researchers from five continents (Fig. 2.2).

The geographic distribution of projects can also be analyzed based on the countries involved (Fig. 2.3). At least 23 nations have participated in IPL projects. In cases of special interest, such as the Machu Picchu Citadel in Peru, many international consortiums have teamed up to analyze all aspects of...
landslide risk, leading to a concentration of projects in these areas of particular societal value.

The IPL Promotion committee will continue working on encouraging scientists and researchers all around the world to apply for landslide-related projects, and continue its scientific and financial support of these initiatives.

The IPL Promotion committee will also work towards the definition of global strategies for landslide research with an aim to help bringing different actors together for the benefit of landslide research, engineering, and best practices.

Brief descriptions of the Coordinating projects and of some Member projects follow.

Some projects were terminated as IPL projects in 2007 and restarted as New IPL projects managed by the IPL Global Promotion Committee in 2008. Those are presented as 2002/2008.

Coordinating projects

Project no: C100
Project title: Landslides: Journal of the International Consortium on Landslides
Leader: Kyoji Sassa
Period: 2002/2008–
Status: In progress
Main Project field: (3) Capacity Building (B. Collating and Disseminating Information/Knowledge)
Description: The aim of the journal Landslides is to be the common platform for the publication of integrated research on landslide processes, hazards, risk analysis, mitigation, and the protection of our cultural heritage and the environment. Landslides are gravitational mass movements of rock, debris or earth. They may occur in conjunction with other major natural disasters such as floods, earthquakes and volcanic eruptions. Expanding urbanization and changing land-use practices have increased the incidence of landslide disasters. Landslides as catastrophic events include human injury, loss of

![Fig. 2.1](image1)  
Worldwide distribution of IPL projects. Yellow stars mark countries with at least one project

![Fig. 2.2](image2)  
Distribution of IPL projects. International projects are those with a global outreach
life and economic devastation and are studied as part of the fields of earth, water and engineering sciences. The journal publishes research papers, news of recent landslide events and information on the activities of the International Consortium on Landslides. The main topics are:

- Landslide dynamics, mechanisms and processes
- Landslide risk evaluation: hazard assessment, hazard mapping, and vulnerability assessment
- Geological, Geotechnical, Hydrological and Geophysical modeling
- Effects of meteorological, hydrological and global climatic change factors
- Monitoring including remote sensing and other non-invasive systems
- New technology, expert and intelligent systems
- Application of GIS techniques
- Rock slides, rock falls, debris flows, earth flows, and lateral spreads
- Large-scale landslides, lahars and pyroclastic flows in volcanic zones
- Marine and reservoir related landslides
- Landslide related tsunamis and seiches
- Landslide disasters in urban areas and along critical infrastructure
- Landslides and natural resources
- Land development and land-use practices
- Landslide remedial measures/prevention works
- Temporal and spatial prediction of landslides
- Early warning and evacuation
- Global landslide database

**Project no:** C101-1  
**Project title:** Landslide investigation and capacity building in Machu Picchu – Aguas Calientes area.  
**Leader:** Kyoji Sassa  
**Period:** 2002/2008–  
**Status:** In progress  
**Main Project field:** (2) Targeted landslides: mechanism and impacts (B. Landslide threatening heritage sites)  
**Description:** The objectives of the project are to assess the landslide risk in the in Machu Picchu – Aguas Calientes area and to build human capacities and expertise in landslide risk management in order to educate people to protect themselves and to reduce the landslide risk using landslide monitoring and early warning system.

The area of Machu Picchu – Aguas Calientes is very dangerous, being often affected by landslides, debris flows and rock falls. Many of poor people are working in the Machu Picchu areas because of recent rapid development of tourism. They do not have enough knowledge and experience on landslides and their risk reduction measures.

The Project will be carried out through the installation of landslide monitoring system at the toe of Machu Picchu slope and of debris flow detectors in two debris flow torrents in Aguas Calientes area.

Furthermore education of residents and officers of the Municipality of Machu Picchu will be done. A workshop in the Peruvian Embassy in Tokyo will be organized in order to disseminate the achieved results to wider public.
Project no: C101-1-1
Project title: Low environmental impact technologies for slope monitoring by radar interferometry: application to Machu Picchu site
Leader: Claudio Margottini
Status: Completed
Main Project field: (2) Targeted landslides: mechanism and impacts (B. Landslide threatening heritage sites)
Description: The project proposes the application of an integrated package of advanced technologies for remote slope monitoring. Synthetic aperture radar interferometry (SAR), implemented from satellite and ground-based installations, is the core of this integrated package, which also comprehends GPS, optical/satellite image interpretation, field surveys and geological/geomorphological investigations. The proposed techniques are particularly suitable for archaeological sites due to their remote sensing nature, their low environmental impact, and the possibility of investigating surface movements over large areas without direct access to the unstable sites.

All the activities which have been carried out during the project are:
- collection and survey of basic data (geology, geomorphology, etc.) on the large Inca Park area (32 km²);
- development of remote sensing monitoring by means of satellite radar interferometry; calibration with GPS network;
- geomorphological hazard map of the large Inca Park area;
- application of ground based radar at a specific site, selected on the base of task 3 and local specific needs; calibration with GPS network;
- geomorphological hazard and risk map for local site (Machupicchu hill);
- definition of low environmental impact mitigation strategies.

Project no: C101-1-2
Project title: Expressions of risky geomorphologic processes in deformations of rock structures at Machu Picchu
Leader: Vit Vilimek and Jiri Zvelebil
Status: Completed
Main Project field: (2) Targeted landslides: mechanism and impacts (B. Landslide threatening heritage sites)
Description: The objectives are:
- Evaluation of recent geomorphologic processes as well as paleogeographical evolution of the area of Machu Picchu Sanctuary. Multihazard analysis.
- Dilatometric monitoring of displacements of rock outcrops;
- extenzometric monitoring across main Plaza.
- Hydrogeological investigations (reveal the role of water in destruction of some structures in the archaeological area)
- Weathering analysis and relative dating.
- General field research of debris flows in the surrounded area of the archaeological site.

Project no: C101-1-3
Project title: Shallow geophysics and terrain stability mapping techniques applied to the Urubamba Valley, Peru: Landslide hazard evaluation
Leader: Romulo Mucho and Peter Bobrowsky
Status: Completed
Main Project field: (2) Targeted landslides: mechanism and impacts (B. Landslide threatening heritage sites)
Description: The objective of this project is to apply a suite of shallow geophysical techniques at Machu Picchu in order to evaluate the nature and character of overburden and bedrock at this World Heritage Site. The methods are all non-destructive and non-invasive and provide a good three-dimensional expression of the subsurface which can then be used by archaeologists, geologists and engineers for slope stability analysis and mitigation.

The aim of this collaborative work is to establish the presence or absence of shear planes, failure planes and/or significant faults at the site and determine their importance in potentially triggering landslides. This work is important because the nature of this site limits the possibility of using subsurface drilling methods for confirmation of models. The shallow geophysical results will be the only evidence available for assessing the subsurface and proving/disproving the landslide potential theory.
Project no: C101-2
Project title: Landslides monitoring and slope instability at selected historic sites in Slovakia
Leader: Jan Vicko
Period: 2002–
Status: In progress
Main Project field: (1) Technological development (A. Monitoring and early warning)
Description: The objectives are to clarify deep seated deformations mechanism including preparatory factors on selected historic sites with the help of advanced monitoring techniques, including monitoring of thermomechanical rock behavior and methods reliable to predict the slope movement behavior.

The studies carried out in project proved that volume change of the rock is irreversible and brings permanent thermal deformation to the rock or rock mass. In order to better understand these processes the project will focus our attention to the study of thermo-mechanical behavior of rocks or rock mass which form the subgrade of several historic sites in Slovakia. The combination of in situ monitoring techniques and laboratory tests will provide quantitative data which will serve as input for modeling of the slope failure mechanism and thus to create the prediction models of slope failure development in space and time and should serve as a practical tool for the recommendation of effective remedial measures.

Project no: C101-3
Project title: The geomorphological instability of the Buddha niches and surrounding cliff in Bamiyan valley (Central Afghanistan)
Leader: Claudio Margottini
Period: 2002/2008–
Status: In progress
Main Project field: (2) Targeted landslides: mechanism and impacts (B. Landslide threatening heritage sites)
Description: The project it is aimed at (i) investigating major processes occurring on the niches and cliff, natural and consequence of explosion, (ii) defining a feasibility project for the complete restoration of the cultural heritage site, (iii) defining some practical emergency intervention, considered as part of the general master plan, (iv) concluding the complete restoration of the site.

The Bamiyan valley is located in central Afghanistan, in a mountainous region, in a dry part of the world, which experiences extremes of climate and weather. The explosion of March 2001, apart the collapse of statues, produced a deterioration of the stability conditions, mainly in the shallower part of the niches.

In the small Buddha niche, apart the collapse of statue, three minor rock falls occurred in the top of it. In the mean time the blasting produced a degradation of the upper-right part of the niche, where a stair-cave is located inside the cliff and the sect between the stairs and the niche is quite thin (about 30–50 cm). This part is presently the most critical for future stability. The left side, as consequence of the existing buttress, did not suffered substantially. Only in the upper part a rock fall occurred and some instabilities are now evident.

In the great Buddha major effect were the collapse of statue and the consequent instability of the back side of the niche. A small rock fall occurred on the top of the niche, left side. Probably, the large thickness of sect between the stairs going up into the cliff and the niche (about 1 m), did not allow a large propagation of the effects of blasting and than a severe damage.

A feasibility project (master plan) for the entire consolidation of the niches and cliff was prepared. This include mainly control of water circulation on the top of the cliff, nails, anchors and grouting, exhibiting low environmental impact on the site.

Project no: C101-4
Project title: Stability assessment and prevention measurement of Lishan Landslide, Xian, China Valley
Leader: Qing Jin Yang
Status: Completed
Main Project field: (2) Targeted landslides: mechanism and impacts (B. Landslide threatening heritage sites)
Description: Lishan’s landslide is located in Lishan National Forest Park, in the south of Huaqing pool. The landslide directly threatens Lishan National Forest Park and Huaqing, the venerable cultural remains and the famous beauty spots to monitor the landslide for a long time, knowing the distortion of it, and the taking the corresponding defence.
The landslide has widely been monitored. The main methods include: measured the inclined change in vertical holes, measured the level change by GTS, measured the ground stretch, and measured the 3D form change in level bores. After analyzed the results of measure, we found there were obvious distortions in II area of the landslide.

**Project no:** C101-5  
**Project title:** Environment protection and disaster mitigation of rock avalanches landslides and debris flow in Tianchi Lake region and natural preservation area of Changbai Mountains, Northeast China  
**Leader:** Binglan Cao  
**Period:** 2002–2007  
**Status:** Completed

**Main Project field:** (2) Targeted landslides: mechanism and impacts (B. Landslide threatening heritage sites)  
**Description:** The objectives of the project are:

- To study the properties and formation conditions of avalanche, landslide and debris flow.
- To analyze the activities and the formation mechanism and activity regularity of avalanche, landslide and debris flow.
- Stability analysis of some special slope, as well as to predict the hazard of rock avalanche and landslide.
- To study the types and distribution of debris flow, as well as to evaluate the risk degree of debris flow.
- To put forward the measurement and strategy of the reserved area.

During the project various kinds of tests, including normal regular tests and ring-shear tests, have been conducted on weak volcanic rocks and have been investigated types and formation conditions of rock avalanches, landslides and to evaluate and to simulate the key mount slope, meanwhile to analyze the stability of slope by calculating debris flows. Furthermore suggestions for disaster risk mitigation have been suggested.

**Project no:** C102  
**Project title:** Assessment of global high-risk landslide disaster hotspots  
**Leader:** Farrokh Nadim  
**Period:** 2002–2004  
**Status:** Completed

**Main Project field:** (1) Technological development (B. Hazard mapping, Vulnerability and Risk Assessment)  
**Description:** The objective of this project is to develop global hazard and risk maps for landslides and avalanches in order to identify the most exposed countries. Allocating resources for natural hazard risk management has high priority in development banks and international agencies working in developing countries. Based on the global datasets of climate, lithology, earthquake activity, and topography, areas with the highest hazard, or “hotspots”, were identified. The applied model was based on classed values of all input data. The model output is a landslide and avalanche hazard index, which is globally scaled into nine levels. The model results were calibrated and validated in selected areas where good data on slide events exist. The results from the landslide and avalanche hazard model together with global population data were then used as input for the risk assessment. Regions with the highest risk can be found in Colombia, Tajikistan, India, and Nepal where the estimated number of people killed per year per 100 km2 was found to be greater than one. The model made a reasonable prediction of the landslide hazard in 240 of 249 countries. More and better input data could improve the model further. Future work will focus on selected areas to study the applicability of the model on national and regional scales.

**Project no:** C103  
**Project title:** Global Landslides Observation Strategy  
**Leader:** Kaoru Takara and Nicola Casagli  
**Period:** 2004/2008–

**Status:** In progress

**Main Project field:** (1) Technological development (A. Monitoring and early warning)  
**Description:** This project seeks better methodologies for monitoring and forecasting landslides in many hazardous areas in the world by using earth observation systems including satellite, airborne and ground-based remote sensing techniques, and facilitate focused pilot studies by providing new in situ instrumental and mapping support.

The project will:

(1) Advocate integration of InSAR technology into landslide disaster warning and prediction systems. The ERS (European Remote Sensing) and Envisat missions of the European Space Agency
(ESA) have pioneered these applications and shall be continued for global, long-term applications. As part of this effort, facilitate efficient exploitation of data from Japan’s upcoming Advanced Land Observation Satellite (ALOS) with PALSAR, an L-band SAR sensor (spatial resolution of 10 m).

(2) Utilize other high-resolution optical sensors relevant to landslide monitoring and detection, such as QUICKBIRD and IKONOS (1 m), ALOS’s PRISM (2.5 m) and AVNIR-2 (10 m), and terra/ASTER (15 m). A passive-microwave capability would help in determining soil moisture repeatedly over broad areas.

(3) Facilitate the development and sharing of critical airborne sensors and capabilities, such as hyperspectral sensors, high-resolution infrared sensors, synthetic aperture radar (SAR) and LiDAR.

(4) Facilitate the development and sharing of remote sensors using ground-based platforms such as SAR, infrared cameras, laser scanners and hyper-spectral sensors.

(5) Advocate systematic expansion of landslide zonation maps, Geographic GIS and GPS as critical tools for managing spatial information for disaster management, including precision topography, mapping support, and deformation monitoring, as well as geolocation for search and rescue operations.

(6) Facilitate ongoing capacity building activities, with a focus on transferring technologies and best practices: dissemination of real-time information and early warnings to end users and the public, in concert with efforts by UNESCO and WMO to expand and improve sediment- and flood-related initiatives.

To date a global landslide database does not exist. In the 90’s two major projects were carried out: the World Area Slope Stability Server (WASSS) and the World Landslide Inventory (WLI) but in both cases they failed to obtain a complete worldwide coverage. Several national databases exist which, in most cases, are very accurate but often they are not homogenous at a national level and their criteria are not comparable across nations. Today, new technologies on on-line information management, satellite imagery, geolocalization and mapping services could allow us to organize a trans-national database with the continuous inbuilt updating system.

The world landslide database will be carried through the preparation of a standard and simple data collection and the selection of relevant information sources. Furthermore a continuous and automatic collection of information using web-syndication systems will be set up together with a web distributed database. An appropriate mapping service platform will be selected and implemented.

Project no: C104
Project title: World landslide database
Leader: Hiroshi Fukuoka and Nicola Casagli
Period: 2006/2008–
Status: In progress
Main Project field: (3) Capacity Building (B. Collating and Disseminating Information/Knowledge)
Description: The objectives are: (i) to create a global landslide database of major events considering only those which have caused fatalities; (ii) to register them in a standard data-format on-line; (iii) to represent them on a global map service on the web.

The project will develop a feasible and effective monitoring system suitable for landslides in Asian countries. Using satellite data and landslide susceptibility map will be made and time prediction of landslide initiation will be developed based on rainfall data, meteorological forecast, and landslide monitoring using extensometers and others.

Spatial prediction based on ring shear test and computer simulation will be carried out, and the methodology will be improved.

Furthermore disaster risk mitigation policy and governmental administration will be examined including the population shifts and vulnerability change due to urban development.
**Project no:** C106-1  
**Project title:** Landslide museum in Civita di Bagnoregio  
**Leader:** Claudio Margottini  
**Period:** 2006/2008–  
**Status:** In progress  
**Main Project field:** (3) Capacity Building B. Collating and Disseminating Information/Knowledge  
**Description:** The objectives is to increase awareness in the field of landslides, through the spectacularisation of recent and historic mass movements, as well as to show methodologies and tools for managing landslides hazards.

Civita di Bagnoregio lies in a hilly area surrounded by steep valleys intensively eroded by two torrents presenting an E-W direction. Due to the particular geological and geomorphological features, large and frequent slope instability phenomena occur: in the clayey formation landslides are represented by mudflows, debris-flows and rotational slides, while in the upper portion of the volcanic cliff, due to a retrogressive mechanism of erosion, rock-falls, toppling and block-slides are the common landslide typologies.

In the last decade many landslides have affected the northern border of the cliff of Civita largely increasing the risk conditions of that area of the town. ENEA and other partners, starting from two decades of monitoring results, have presented an innovative project of consolidation that takes into account properly the geological dynamics acting on the town as well as the particular historical and environmental context of the area.

The present museum will be an exhibition for landslide phenomena but also the main portal to the real museum that is outside, on the cliff and valleys. The visitors will find in the museum many scenic spot that are presented from a “Landslide” point of view but, in the mean time, they will be encouraged to visit the real site and to touch by hand the reality.

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**Project no:** C106-2  
**Project title:** International Summer School on Rockslides and Related Phenomena in the Kokomeren River Valley, Tien Shan, Kyrgyzstan  
**Leader:** Alexander Strom  
**Period:** 2008–2010  
**Status:** In progress  
**Main Project fields:** (3) Capacity Building B. Collating and Disseminating Information/Knowledge  
**Description:** The aim of the International Field Summer School is to demonstrate to students and young landslide researchers various types of bedrock landslides and basic methods of their identification and study directly at the rockslide sites. Analysis of the relationships between rockslides, active tectonics manifestations, evidences of river valley inundation and outburst flooding will promote better understanding of bedrock slopes failure causes and of rockslide hazard assessment.

Numerous rockslides and rock avalanches of various types ranging from few millions to more than 1 billion cubic meters in volume are concentrated in the Kokomeren River valley (Central Tien Shan) within a limited area of about 40 × 40 km at a one-day trip distance from Bishkek city – capital of Kyrgyzstan. Most of them are located near a road along the Kokomeren River connecting villages in the Suusamyr and Djumgal depressions. Sites in tributary valleys without motorways require only a few hours of hiking to reach them.

Besides rockslides and landslides, the study area is extremely rich in the expressive manifestations of Neotectonics and Quaternary tectonics such as active faults, one of which had been ruptured by 1992 M7.3 Suusamyr earthquake, and numerous examples of tilted and folded pre-Neogene planation surface.

The annual ICL International Summer School has been organized since 2006. It was attended by participants from Czech Republic, Italy, USA and Kyrgyzstan. In 2008 it is planned to organize similar ICL training course focused basically on the geological and geomorphic features typical of large rockslides in rugged terrain. It will be supplemented with the training course organized within the frames of the EU Specific Support Action “International Working Group on Natural Hazards in the Tien Shan” (NATASHA) that will be focused more on the geophysical and geotechnical methods of rockslide field studies.

**Member projects**

**Project no:** M101  
**Project title:** Areal Prediction of Earthquake and Rain Induced Rapid and Long-Traveling Flow Phenomena (APERITIF)
Leader: Hiroshi Fukuoka  
Period: 2002/2008–  
Status: In progress  
Main Project fields: (1) Technology Development  
B. Hazard Mapping, Vulnerability and Risk Assessment  
Description: The objective is to develop a practical method for site prediction and movement assessment of rapid and long run-out landslides. Among various landslide types, the rapid, and long run-out landslides, especially those that occur in urbanizing areas often cause catastrophic damage to the community.

APERITIF project consists of following 3 sub-projects.

1. Mechanism of rapid long-runout landslides triggered by earthquakes and heavy rainfall:

   This sub-project uses the new ring shear apparatus with a special sample box visible from outside for research on the mechanisms of generation of sliding-surface liquefaction, funded and developed by the 2001-2003 APERIF project. Undrained torque-controlled/speed-controlled ring shear tests, triaxial tests, and flume tests will be conducted for the study of fluidization mechanism. Portable ring shear apparatus and vane-type apparatus for in-situ measurement of grain-crushing susceptibility will be developed and a new index for sliding-surface liquefaction will be proposed.

2. Research on process and areal prediction of flowslides:

   This sub-project uses a large flume for real-scale flowslides in a large-scale rainfall simulator, and middle size flume in Tsukuba to conduct tests on heavy rainfall induced flowslides. The study will focus on processes and mechanisms of landslide mass fluidization. Development of a new and sophisticated flowslide movement simulation program is being developed for the purpose of practical areal prediction of landslide runout. Ball and rectangle element DEM simulation approach for fluidization mechanism is conducted.

3. Integrated study for prediction of landslide hazards in urbanized areas:

   Applying new techniques developed by the previously noted two sub-projects, with all researchers cooperating on establishing the methodology for producing practical landslide hazard maps for the three sites in the urbanized residential areas of urbanizing area of big cities.

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Project no: M103  
Project title: Capacity building on the management of risks caused by landslides in Central America countries.  
Leader: Farrokh Nadim  
Status: Completed  
Main Project fields: (3) Capacity building A. Enhancing Human and Institutional Capacities  
Description: The objectives of the project are (i) to improve the knowledge and skills of professionals from a selection of relevant organizations in the region who are dealing with landslide hazards, (ii) to create a forum and network where representatives from the Central America countries can exchange experience, derive common methodologies and assist each other on practical issues when needed, and (iii) to create mechanisms that secure dissemination of knowledge and methodologies generated in the capacity building program to a larger audience.

One week training program with 18 participating middle managers from Costa Rica, Panama, Nicaragua, Honduras, El Salvador and Guatemala was executed in April 2005 at University of Costa Rica with NGI/ICG as facilitator. The training program included 24 technical presentations, 3 sessions with group discussions and one day with field work studying possible landslide mitigation measures and use of early warning system for a debris flow threatened community outside the capital city.

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Project no: M106  
Project title: A best practices handbook for landslide hazard mitigation  
Leader: Lynn Highland and Peter Bobrowsky  
Status: Completed  
Main Project fields: (3) Capacity Building B. Collating and Disseminating Information/Knowledge  
Description: This handbook will be distributed worldwide, and will be published in English, French, Spanish, Chinese, and other languages as needed, and as funds become available. It is a small, “pocket-book” size, with a spiral binding for durability, and
Project no: M110
Project title: Capacity Building in Landslide Hazard Management and Control for Mountainous Developing Countries in Asia
Leader: Hideaki Marui
Status: Completed
Main Project fields: (3) Capacity building A. Enhancing Human and Institutional Capacities
Description: The objective is to improve the knowledge and skills of professionals and officials of the academic institutions as well as implementing organizations in South and Central Asian Countries in Landslide Hazard Management and Control through the enhancement of capacities of those institutions/individuals by the organization of training courses and seminars on the proposed field.

The Project M110 has played a certain role according to the direction of the capacity building activity proposed in the Tokyo Action Plan in 2006. Annual meetings in the framework of the M110 project were organized every year since 2003 in Niigata and Kathmandu. Major agenda discussed throughout the annual meetings are as follows:

- Present education on Landslide hazard management and control in Southern and Central Asian Countries
- Existing data base of landslides in those countries
- Primary areas to be focused for the training courses and seminars in those countries
- Responsible institutions for the landslide management and control in those countries
- Possible cooperation from various national and international organizations

Through the discussions necessary contents and curriculum for training courses are clarified. Although practical training courses were not realized until now because of financial problem, basic framework for implementation of training courses is formed.

Project no: M111
Project title: Detail study of the internal structure of large rockslide dams in the Tien Shan and the International field mission “Internal structure of the dissected rockslide dams in Kyrgyzstan”
Leader: Alexander Strom
Status: Completed
Main Project fields: (2) Targeted Landslides: Mechanisms and Impacts B. Catastrophic landslides
Description: The objective of the project was to focus on comprehensive study of rockslides that had been completely dissected by subsequent erosion. They are considered as analogues of existing rockslide dams. Such investigations allow studying internal structure and geotechnical parameters of rockslide deposits in such detail that is practically inaccessible at most of the present-day (and future) natural dams. Thus, results for these investigations can be used for natural dams hazard assessment and for blast-fill dams design. Another goal of the Project was to acquaint International community of landslide researchers with very interesting case studies from the Tien Shan Region.

An important part of the Project was to collect reliable data on grain-size composition of rockslide debris, especially from those parts of rockslide bodies that were strongly comminuted. To be able to deal with debris containing fragments up to first decimetres in size we collected several large samples from 40 to more than 100 kg. Large verity of rockslides and rock avalanches that are located in the Kokomeren River valley, which was the key region for this Project makes it an excellent place for students’ training in various methods of rockslide identification, mapping, dating and detail study.

Project no: M122
Project title: Inka Cultural Heritage And Landslides: Detailed Studies In Cusco And Sacred Valleys, Peru
Leader: Raul Carreno
Period: 2004–2007
Status: Completed
Main Project fields: (2) Targeted Landslides: Mechanisms and Impacts B. Landslides Threatening Heritage Sites
Description: The objectives of the project are:

- To contribute to the preservation and rational exploitation of the Inka cultural heritage.
- To identify and to evaluate the instability phenomena threatening or destroying inka cultural heritage.
- To propose monitoring programs and appropriate remediation projects for the critical cases.
The project point to identify, understand and evaluate the instability processes that are menacing the cultural heritage. Neither geological nor geodynamic detailed studies of the archaeological heritage exist. The conservation-restoration programs carried-out by the entities in charge of this task don’t consider the geological risks, so they become very relative to protect this heritage. Excluding Machu-Picchu, the IPL M-122 is the first systematic project in this field carried out in Cusco region.

The results of the project must be useful to improve the conservation activities and to plan a sustainable exploitation of this cultural-tourist resource, the main (almost the only) development possibility for the Cusco region.

The project includes detailed geological and geomorphologic studies, the active and potential instability phenomena characterization and evaluation, the evaluation of conjugated dangers, and the geotechnical analysis of the critical cases. Starting from this information different monitoring systems and remediation programs have been proposed for each case.

**Annex 2.1 Status of IPL Projects**

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<th>Coordinator</th>
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<td>C101-1-1</td>
<td>Low environmental impact technologies for slope monitoring by radar interferometry: application to Machu Picchu site</td>
<td>Claudio Margottini</td>
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<td>C101-1-2</td>
<td>Expressions of risky geomorphologic processes as well as paleogeographical evolution of the area of Machu Picchu</td>
<td>Vit Vilimek, Jiri Zvelebil</td>
<td>2002–2007</td>
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<td>C101-1-3</td>
<td>Shallow geophysics and terrain stability mapping techniques applied to the Urubamba Valley, Peru: Landslide hazard evaluation</td>
<td>Romulo Mucho, Peter Bobrowsky</td>
<td>2004–2006</td>
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<td>C101-1-4</td>
<td>A proposal for an integrated geophysical study of the Cuzco region</td>
<td>Daniel Nieto Yabar</td>
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<td>C101-1-5</td>
<td>UNESCO-Italian-ESA Satellite monitoring of Machu Picchu</td>
<td>Paolo Canuti, Claudio Margottini, Fabio Rocca</td>
<td>2004–2006</td>
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<td>C101-2</td>
<td>Landslides monitoring and slope stability at selected historic sites in Slovakia</td>
<td>Jan Vlcko</td>
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<td>C101-3</td>
<td>The geomorphological instability of the Buddha niches and surrounding cliff in Bamiyan valley (Central Afghanistan)</td>
<td>Claudio Margottini</td>
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<td>C101-4</td>
<td>Stability assessment and prevention measurement of Lishan Landslide, Xian, China</td>
<td>Qing Jin Yang</td>
<td>2002–2007</td>
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<td>C101-5</td>
<td>Environment protection and disaster mitigation of rock avalanches landslides and debris flow in Tianchi Lake region and natural preservation area of Changbai Mountains, Northeast China</td>
<td>Binglan Cao</td>
<td>2002–2007</td>
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### Annex 2.1 (continued)

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<th>Project Code</th>
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<td>C101-7</td>
<td>Cultural and natural heritage threatened by landslides in the region of Iassy, Romania</td>
<td>Nicolae Botu</td>
<td>2005–2007</td>
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<td>C102</td>
<td>Assessment of global high-risk landslide disaster hotspots</td>
<td>Farrokh Nadim</td>
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<td>C103</td>
<td>Global landslide observation strategy</td>
<td>Kaoru Takara, Nicola Casagli</td>
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<td>C104</td>
<td>World Landslide Database</td>
<td>Hiroshi Fukuoka, Nicola Casagli</td>
<td>2006/2008–</td>
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<td>Early Warning of Landslides</td>
<td>Kyoji Sassa</td>
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<td>C106</td>
<td>Capacity building and outreach</td>
<td>Claudio Margottini, Alexander Strom</td>
<td>2008–</td>
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<td>C106-1</td>
<td>Landslide museum in Civita di Bagnoregio</td>
<td>Claudio Margottini</td>
<td>2006/2008–</td>
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<td>C106-2</td>
<td>International Summer School on Rocksides and Related Phenomena in the Kokomeren River Valley, Tien Shan, Kyrgyzstan</td>
<td>Alexander Strom</td>
<td>2008–2010</td>
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<td>M101</td>
<td>Areal prediction of earthquake and rain induced rapid and long-travelling flow phenomena (APERITIF)</td>
<td>Hiroshi Fukuoka</td>
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<td>M102</td>
<td>Disaster evaluation and mitigation of the giant Jinnosuke-dani Landslide in the Tedori water reservoir area, Japan</td>
<td>Tatsunori Matsumoto</td>
<td>2002–2004</td>
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<td>M103</td>
<td>Capacity building on management of risks caused by landslides in Central American countries</td>
<td>Farrokh Nadim</td>
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<td>M104</td>
<td>A global literature study on the use of critical rainfall intensity for warning against landslide disasters</td>
<td>Haakon Heyerdal</td>
<td>2002–2004</td>
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<td>M105</td>
<td>Hurricane-flood-landslide continuum: a forecast system</td>
<td>Randall Updike</td>
<td>2002–2006</td>
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<td>M106</td>
<td>A best practices handbook for landslide hazard mitigation</td>
<td>Lynn Highland, Peter Bobrowsky</td>
<td>2002–2007</td>
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<td>M108</td>
<td>Disaster evaluation and mitigation of landslides in the Three-Gorge water reservoir area, China</td>
<td>Renjie Ding</td>
<td>2002–2005</td>
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<td>M109</td>
<td>Recognition, mitigation and control of landslides of flow type in Greater Kingston and adjoining parishes in Eastern Jamaica, including public education on landslide hazard</td>
<td>Rafi Ahmad</td>
<td>2002–2006</td>
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<td>M110</td>
<td>Capacity Building in Landslide Hazard Management and Control for Mountainous Developing Countries in Asia</td>
<td>Hideaki Marui</td>
<td>2002–2007</td>
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<td>M111</td>
<td>Detail study of the internal structure of large rockslide dams in the Tien Shan and international field mission</td>
<td>Alexander Strom</td>
<td>2002–2006</td>
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<td>M112</td>
<td>Landslide mapping and risk mitigation planning in Thailand</td>
<td>Saowanee Prachansri</td>
<td>2002/2008–</td>
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<td>M113</td>
<td>Zone risk map: Towards harmonized, intercomparable landslide risk assessment and risk maps</td>
<td>Yasser Elshayeb</td>
<td>2002–2005</td>
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<td>M115</td>
<td>Establishment of a regional network for disaster mitigation, disaster education, and disaster database system in Asia</td>
<td>Ryuichi Yatabe</td>
<td>2003–2007</td>
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<td>M116</td>
<td>Standardization of terminology, integration of information and the development of decision support software in the area of landslide hazards</td>
<td>Catherine Hickson</td>
<td>2003–2006</td>
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<td>M117</td>
<td>Geomorphic Hazards from landslide dams</td>
<td>Oliver Korup</td>
<td>2003–2006</td>
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<td>M118</td>
<td>Development of an expert DSS for assessing landscape impact mitigation works for cultural heritage at risk</td>
<td>Giuseppe Delmonaco</td>
<td>2003–2007</td>
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<td>M119</td>
<td>Slope instability phenomena in Korinthos county</td>
<td>Nikos Nikolaou</td>
<td>2002–2005</td>
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<td>M120</td>
<td>Landslide hazard zonation in Garwal using GIS and geological attributes</td>
<td>Ashok Kumar Pachauri</td>
<td>2003–2004</td>
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<td>M122</td>
<td>Inka cultural heritage and landslides: detailed studies in Cusco and Sacred Valleys, Peru</td>
<td>Raul Carreno</td>
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<td>M123</td>
<td>Cusco regional landslide hazard mapping and preliminary assessment</td>
<td>Raul Carreno</td>
<td>2004–2007</td>
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<td>The influence of clay mineralogy and ground water chemistry on the mechanism of landslides</td>
<td>Viktor Osipov</td>
<td>2004–2007</td>
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<td>M125</td>
<td>Landslide mechanisms on volcanic soils</td>
<td>Carlos Edusrdro Rodriguez</td>
<td>2004–2007</td>
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<td>M126</td>
<td>Compilation of landslide / rockslide inventory of the Tien Shan mountain system</td>
<td>Alexander Strom</td>
<td>2004–2007</td>
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<td>M127</td>
<td>Development of low-cost detector of slope instability for individual use</td>
<td>Ikuo Towhata</td>
<td>2004–2007</td>
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<td>M131</td>
<td>Technology development for landslide monitoring in China</td>
<td>Yueping Yin and Peter Bobrowsky</td>
<td>2006–2007</td>
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<td>M132</td>
<td>Research on vegetation protection system for highway soil slope in seasonal frozen regions</td>
<td>Wei Shan, Fawu Wang</td>
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<td>M133</td>
<td>Establishment of rainfall-soil chart for erosion induced landslide prediction</td>
<td>Roslan Abidin</td>
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<td>M134</td>
<td>Large-scale rockslides in coarse-bedded carbonate rocks in the Apennines (Italy), Caucasus (Russia) and Zagros (Iran): evaluation of possible triggers and hazard assessment</td>
<td>Alexander Strom</td>
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<td>M135</td>
<td>Landslide hazard assessment in Changunarayan hill of Kathmandu, Nepal - Geotechnical investigation and preventive plan-</td>
<td>Ryuichi Yatabe</td>
<td>2008–</td>
<td>In progress</td>
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<td>M136</td>
<td>Shear behaviour and mechanics of Megaslides and their nearby faults in Hittian Balla, Pakistan and Shaolin, Taiwan</td>
<td>Kazuo Konagai, Kyoji Sassa</td>
<td>2008–</td>
<td>In progress</td>
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<td>M137</td>
<td>Italian Landslide Inventory (IFFI Project)</td>
<td>Alessandro Triglia</td>
<td>2008–</td>
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<td>M139</td>
<td>Development of low-cost early warning system of slope instability for civilian use</td>
<td>Ikuo Towhata, Taro Uchimura</td>
<td>2008–</td>
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<td>M140</td>
<td>Landslide and multi geohazards mapping for community empowerment in Indonesia</td>
<td>Dwikorita Karnawati</td>
<td>2008–</td>
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<td>M141</td>
<td>Geo-Risks Management for Third World Countries - Mapping and Assessment of Risky Geo-factors for Land Use (e.g. in Ethiopia)</td>
<td>Jiří Zvelebil</td>
<td>2008–</td>
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Note: All projects as IPL by ICL were completed in 2007. New projects by IPL Global Promotion Committee started either in 2007 or in 2008. Some projects restarted under the same or a slightly revised title in the same project number.
Landslides - Disaster Risk Reduction
Sassa, K.; Canuti, P. (Eds.)
2009, XVIII, 650 p.,
ISBN: 978-3-540-69970-5