Date of Submission	

IPL Project Proposal Form 2025

(MAXIMUM: 3 PAGES IN LENGTH)

1. Project Title:

The extraordinary monitoring plan for Italian cultural heritage: landslides and risk management in a context of climate change

Select one of the two below.

(1) New project

2. Main Project Fields

(1) Technology Development

A. Monitoring and Early Warning, B. Hazard Mapping, Vulnerability and Risk Assessment

3. Name of Project leader

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Core members of the Project

Veronica Tofani UNIFI, UNESCO Chair on Prevention and Sustainable Management of Geo-hydrological hazards, University of Florence

Silvia Bianchini, UNESCO Chair on Prevention and Sustainable Management of Geo-hydrological hazards, University of Florence

Gabriele Leoni ISPRA

4. Objectives: (5 lines maximum; what you expect to accomplish?)

The project's main objective is to assess the current potential of satellite radar interferometry combined with ground monitoring systems for the evaluation of risk conditions, both natural and anthropogenic, that threaten Italy's natural and cultural heritage sites.

5. Background Justification: (10 lines maximum)

In recent years, the assessment of ground deformations (and their interaction with heritage structures) through satellite radar interferometry has become one of the most widely used remote and low-impact technique worldwide. Along with satellite imagery with increasingly higher spatial-temporal resolution, processing techniques capable of defining millimetric displacements over decades have been refined.

This technique allows for continuous and preventive monitoring of the immense natural and cultural heritage for the purpose of preventive management and maintenance policies.

The staff of the UNESCO Chair, involved in the proposal, has extensively worked in recent years in projects related to the protection and conservation of cultural heritage sites affected by natural and anthropogenic hazards, also through projects in collaboration with UNESCO headquarters.

6. Study Area: (2 lines maximum; where will the project be conducted/applied?)

The natural and cultural heritage study areas are selected across the entire national territory based on their typology, exposure to natural and anthropogenic hazards, site relevance, availability of remote and in situ monitoring data, and the extent of the deformations measured.

7. Project Duration: (1 line maximum)

To fully accomplish the proposed objective, the expected duration of the project is of 36 months

Resources necessary for the Project and their mobilization

Personnel, Facilities, and Budgets

The two - year project was initially funded by the Italian Ministry of Culture, with a budget of approximately €350,000. This specific satellite monitoring of cultural heritage from landslides involved a research team from the University of Florence and a team from the Italian Geological Survey of Ispra.

8. Project Description: (30 lines maximum)

The project involves the selection of dozens of sites throughout the country based on their type, exposure to natural and anthropogenic hazards, site significance, and availability of active or previous in-situ monitoring data. For this IPL project, we have selected only those subject to landslides and geohazards (landslide, seismic, and volcanic hazards). Specifically, we have chosen the following case studies: the Morgantina Archaeological Park and Villa Romana del Casale in Piazza Armerina (EN); the Roman Baths and the underwater park of Baia (Campi Flegrei); the historic center of Civita di Bagnoregio (VT); the Paestum and Velia Archaeological Park (SA); the historic center of Volterra (PI); the Baratti and Populonia Archaeological Park (LI); the historic center of Rieti; and the historic center of Pienza. A landslide risk analysis is planned for all sites, supported by satellite interferometric techniques, aimed at defining the activity of potential and ongoing phenomena and their interaction with the natural and cultural heritage structures.

9. Work Plan/Expected Results: (30 lines maximum; work phases, milestones and publication) including the contribution plan of articles on the IPL project (progress/result) to the Open Access Book Series P-LRT in the coming few years.

The project includes the following work plan:

Work Package 1 – Satellite Data Processing and Hazard Mapping (Year 1)

During the first year, all available satellite datasets covering the selected sites will be collected, harmonized, and processed using advanced remote sensing techniques. The primary objective is to generate high-resolution, multi-temporal datasets capable of detecting ground deformation, slope instabilities, and other surface changes. The main outputs will consist of:

- Detailed deformation maps showing both the extent and rate of ground movement.
- Potential displacement maps to identify areas at risk of future instability.
- Comprehensive landslide activity maps highlighting spatial patterns, temporal trends, and degrees of activity.

These products will establish a robust baseline for subsequent hazard and risk analyses, ensuring a scientifically sound foundation for decision-making.

Work Package 2 – Integrated Risk Assessment (Year 2)

The second year will focus on the integrated risk assessment of the selected study sites. This will involve:

- Combining the hazard data produced in Work Package 1 with information on the vulnerability and exposure of built-up areas, infrastructure, and populations.
- Applying quantitative and qualitative risk assessment methodologies to identify priority zones where risks are highest.
- Producing risk maps and reports that clearly communicate the likelihood and potential impact of slope failures and other ground movements.

This stage will provide a decision-support framework that links physical hazards with socio-economic

consequences, ensuring a holistic understanding of risks.

Work Package 3 – Mitigation Strategies and Monitoring (Year 3)

The third year will also focus on the development of tailored mitigation measures for the most critical areas. This will include:

- Proposing structural and non-structural measures aimed at reducing vulnerability and exposure.
- Designing and implementing in-situ monitoring plans to complement the satellite-based observations, enabling near-real-time tracking of ground movements.
- Recommending policy and planning tools to integrate the findings into local and regional risk management strategies.

The goal is to provide practical, evidence-based measures that enhance the resilience of communities and infrastructure to ground deformation and landslide hazards.

The results of the activities carried out in the WPs will be published in the Open Access Book Series P-LRT as well as presented during the yearly ICL/KLC conferences. Yearly reports on activities will be submitted to ICL secretariat.

10. Project Beneficiaries: (5 lines maximum; who directly benefits from the work?)

The beneficiaries of this IPL project will undoubtedly be all communities that manage cultural heritage sites, both nationally and internationally. The examples produced can serve as guidelines and references for all IPL community experts addressing the protection, conservation, management, and preventative maintenance of heritage sites threatened by landslides.

11. References (Optional): (6 lines maximum; i.e. relevant publications)

- Iadanza C., Leoni G., Spizzichino D., Trigila A., Margottini C., Osanna M., de Nigris B., Martellone A., Costantini M., Francioni E., Trillo F., Minati F. Instability Processes and SAR Data Analysis in the Pompeii Archeological Park. In: El-Qady, G.M., Margottini, C. (eds) Sustainable Conservation of UNESCO and Other Heritage Sites Through Proactive Geosciences. Springer Geology. Springer, Cham. https://doi.org/10.1007/978-3-031-13810-2_31.
- Russo, A., Giovampaola, I.D., Spizzichino, D., Leoni, G., Coletta, A., Virelli, M. (2023). The Project of Parco Archeologico Del Colosseo and the Italian Network of Archaeological Parks: From Satellite Monitoring to Conservation and Preventive Maintenance Policies. In: El-Qady, G.M., Margottini, C. (eds) Sustainable Conservation of UNESCO and Other Heritage Sites Through Proactive Geosciences. Springer Geology. Springer, Cham. https://doi.org/10.1007/978-3-031-13810-2_34.

Note: Please fill and submit this form by 15 August 2025 to:

KLC secretariat <klc2020@landslides.org> and ICL Network <icl-network@landslides.org>