UNIVERSITÀ DEGLI STUDI FIRENZE
DST
DIPARTIMENTO DI SCIENZE DELLA TERRA

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Program of the courses to be delivered by UNIFI within WP3

Work Package 3: Development. Capacity Building of EG academic staff through training workshops and staff mobility to EU partner universities

14 January 2022

Key aspects of WP 3.1-3.2 courses

UNIFI will deliver a course within the framework of WP 3.1 composed of two modules for a total of 21 hours and a course within the framework of WP 3.2 composed of a single module for a total of another 21 hours.

The first course, "Geohazards as geological sources of danger for cultural heritage", will cover theoretical aspects some of the most relevant geohazards for cultural heritage, aided by real life examples. It will be held from the 2nd to the 3rd of May 2022 in Florence (Italy). If, due to the ongoing pandemic, there will be travel restrictions to Italy or unsafe conditions or in case of positivity of one or more teachers or attendees, the course or part of it will be delivered online or in dual mode (simultaneously in presence and online).

The second course, "Protecting cultural heritage: remote sensing and in situ measurements for geohazards mitigation", will deal with more technical aspects concerning instruments and software and it will show what are some of the existing tools and methods to deal with cultural heritage preservation, with the aid of practice sessions. It will be held from the 23rd to the 26th of May 2022 in Egypt. If, due to the ongoing pandemic, there will be travel restrictions to Egypt or unsafe conditions or in case of positivity of one or more teachers, the course or part of it will be delivered online.

All the teaching material will be provided by UNIFI to all the attendees. The courses held in presence will be carried out following all the necessary countermeasures against the COVID-19 pandemic, most importantly the full vaccination of all the participants (using EMA approved vaccines), the correct use of FFP2 masks, and a proper ventilation.

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WP 3.1 Course:
Geohazards as geological sources of danger for cultural heritage

The importance of preventing or mitigating damage to tangible, as well as intangible heritage, has been highlighted by the UN General Assembly, the Human Rights Council and UNESCO. The Sendai Framework for Disaster Risk Reduction 2015-2030 recognizes as a priority for attention the role of traditional knowledge and practices along with the role of their bearers in the development and implementation of disaster risk reduction plans and mechanisms. The present challenge is to generate models and tools that might allow us to operationalize these principles.

General structure

Module 1: Geohazards threatening cultural heritages: theory and examples
Module 2: Tools and techniques for the preservation of tangible and intangible cultural heritage: theory and examples

Timetable programming

	Duration	Time
Module 1	12 hours	2-3 May 2022
Module 2	9 hours	3-4 May 2022

Module 1 Geohazards threatening cultural heritages

Topics	Duration	Teachers
1.1. Slope instabilities Landslides are mass-movements that include displacements of a mass of rock, debris, or earth down a slope with the ability to modify and shape the morphology of a territory and, in the most significant cases, to cause relevant damages and casualties to people and property. They are a type of "mass wasting," which denotes any down-slope movement under the direct influence of gravity. Numerous triggering factors of natural or anthropic types, and numerous predisposing factors intrinsic to the material or external to it can contribute their probability of occurrence. Unlike other risks, local systems can have a high influence on the triggering of these failures. Regardless of the source of the problem these events act locally, at the scale of the phenomenon, but when occurring result in one of the major disasters causing loss of world's cultural and natural history. Cultural heritage is vulnerable to the adverse impact of landslide and the knowledge of the processes can allow to implement the best strategies for its sustainable defense. In this context the preservation of the local intangible cultural heritage value can play a fundamental role to help the process of the territory conservation.	2 hours	Stefano Morelli
1.2. Land subsidence Subsidence is defined as a gradual settling or sudden sinking of the Earth's surface due to removal or displacement of subsurface earth materials. The principal causes are either natural or anthropogenic activities and can include: i) aquifer-system compaction associated with groundwater withdrawals, ii) drainage of organic soils, iii) underground mining, and iv) natural compaction or collapse, such as with sinkholes or thawing permafrost. Land subsidence due to natural and anthropogenic causes represents a serious areal environmental problem for cultural heritage from a local to the basin scale. Problems can arise from differential subsidence, rapid and sudden movements (or accelerations), proximity to the shoreline at altitudes close to sea level and other local effects. Subsiding ground level can be efficiently monitored by conventional geodetic measurement techniques or by advanced remote sensing techniques.	2 hours	Silvia Bianchini
1.3. Floods Most frequent type of natural disaster that occur when an overflow of water submerges land that is usually dry and anthropized are flooded. Floods can cause widespread devastation, resulting in damages to personal property, infrastructure and cultural heritage. Flood-related impacts represent one of the most frequent, serious and	2 hours	Fabio Castelli

damaging threats to cultural heritage conservation. Damage to cultural heritage is often considered after economic or human impacts. However, damage may be irreversible as floods can also destroy items, which contribute to keeping alive our collective memory.		
1.4. Seismic activity The frequency and strength of earthquakes represents the seismic hazard of an area. The consequences of a potential damage deriving from dangerous seismic events that may occur on a certain territory in a given period of time define the seismic risk of an area. In all this, the physical cultural heritage can be a structurally fragile element in the face of such natural manifestations. The impact on the population can also affect the maintenance of intangible cultural heritage over time. The cultural heritage preservation from the expected future seismic events is very important and requires an effective policy of seismic risk prevention and a specific plan of preventive and programmatic protection of cultural heritage.	2 hours	Veronica Pazzi
1.5. Coastal dynamics Coastal areas have always favored human settlement and along the coasts there are important archaeological sites, some of which had to fight against the attack of the waves and the rise in sea level since the beginning of their history. Today, while this latter phenomenon is accelerating and the sedimentary input to the coasts has been reduced due to anthropogenic interventions in the catchment areas, the erosion of the coasts is accelerating more and more, exposing at a high risk a heritage of immense value. The knowledge of the processes reshaping the coasts and of the different coastal defense techniques allow those who must manage the archaeological heritage to implement the best strategies for its sustainable defense.	2 hours	Enzo Pranzini
1.6 Climate Change and Cultural Heritage Cultural heritage is a precious and non-renewable resource that requires continuous monitoring to ensure its sustainable use and at the same time protect it from the consequences of climate change. Climate change and related changes in temperature, precipitation, atmospheric moisture, wind intensity and desertification identified by UNESCO as threats to cultural heritage will be described. In addition, possible future impacts based on regional scale projections of future changes in the climate system will be presented.	2 hours	Michela Maione

Module 2 Tools and techniques for the preservation of tangible and intangible cultural heritage

Topics	Duration	Teachers (tentative)
2.1. How geohazards can damage intangible cultural heritage A large part of architectural cultural heritage is made of stone elements. Their vulnerability is influenced by several aspects related to intrinsic characteristics of the materials and external factors. Therefore, it is necessary to know the geological context in which they were located, the construction events and the environmental conditions (i.e., weathering). All these factors influence the evolution of decay phenomena that can lead to detachment and fall of portions of material, even of large size. The detachment and fall of material represent a risk both for the Cultural Heritage itself and for the safety of people. Since these decay processes often affect public structures where cultural events take place, representing a risk also for the integrity of intangible Cultural Heritage.	2 hours	Carlo Alberto Garzonio
2.2. How intangible cultural heritage practices can mitigate geohazards The historical transformation of the hilly and mountainous environmental has produced high value cultural landscapes. The modern transformations of agricultural activity and the abandonment have led to several environmental degradation phenomena and slope instability. In particular, the slope instability caused by the abandonment of the old hydraulic-agrarian managements, such as the system of dry-stone walls and stone water channels (*acquidocci*), is increasingly widespread.	2 hours	Carlo Alberto Garzonio
2.3. Laboratory tests for the characterization of stones in cultural heritage A stone placed in different environmental conditions (pressure, temperature, etc.) from those where it formed tends to reach new conditions of equilibrium through changes in its characteristics, which means that the stone begins to degrade. This depends on its lithological characteristics that can be measured with a set of tests and analyses.	1 hour	Teresa Salvatici
2.4. Pigments and stones in Ancient Egypt Ancient Egyptian artists and craftsmen are known for developing a wider range of materials for their art. This started early in the history of the Egyptians and continued throughout the time using materials that were both local and imported. The pigments used were mostly mineral, but some dyes were used. The binding medium used in painting is not fully known, but egg tempera and various gums and resins have been identified. Egyptians worked extensively with limestone from the cliffs of the Nile Valley. Alongside this they used other soft rocks such as sedimentary sandstone and greywacke and metamorphic schist. They also made use of harder rock such as the sedimentary diorite and	2 hours	Maria Letizia Amadori

granodiorite, igneous granite and basalt, and metamorphic quartzite. All these were used for statues, temples, tombs, stelae and temple furniture. The main pigments, dyes and stones used in art and architecture will be presented.		
2.5. Creation of a digital archive for sites managing The management of Cultural Heritage implies the handling of a lot of multidisciplinary data. Information shall be easily accessible and meaningful for analysis and monitoring purposes, with a view to optimal data integration and re-use of knowledge. Through a suite of business intelligence, reporting, and data visualization tools and services, it is possible to harness data and gain insights, quickly build graphs and reports, and share information.	2 hours	Irene Centauro

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WP 3.2 Course:
Protecting cultural heritage: remote sensing and in situ measurements for geohazards mitigation

Protection of natural and cultural heritage is encompassed by the United Nations' 2030 Agenda for Sustainable Development. Many new digital technologies can be fruitfully used in the field of Cultural Heritage for preventing and mitigating the shaping forces of geohazards (cultural heritage protection) and also carrying out educational and awareness raising interventions (cultural heritage training and education).

General structure

Single module: theory and practical applications.

Timetable programming

Duration	Proposal
21 hours	23-26 May 2022

Module main program

Topics	Duration	Teachers
1.1. Space-borne techniques • Synthetic Aperture Radar, Interferometric InSAR • Multi-temporal InSAR • Sentinel-1 and the continuous streaming services • Mapping ground deformation • Active Deformation Areas detection	3 hours	Federico Raspini
1.2. Ground-based InSAR • Ground-based InSAR • interferograms and cumulated maps • time series • time-to-failure evaluation • Applications to structures and cultural heritage	1 hour	Emanuele Intrieri
1.3. Non-Destructive techniques in situ measurements • Overview of NDT methods in protection of Cultural Heritage • equipment description and operating condition • analysis of instability of stone elements	1 hours	Emanuele Intrieri

1.4. Thermal infrared remote sensing ● Infrared thermography basic principles ● Infrared thermographic surveying (from field to processing) ● landslide mapping and characterization in anthropized areas ● benefits and limits in cultural heritage protection	2 hours	William Frodella
1.6. On-site optical remote sensing ● Working principles of total stations ● Photogrammetry: theory and software ● Working principles of laser scanner ● Case studies	3 hours	Jacopo Vitale
1.7. Geographic Information Systems (GIS) ● Data managing on Open-Source GIS (QGIS) ● Introduction to QGIS ● Case study ● Practical training	4 hours	Jacopo Vitale
1.8. Building Information Modelling (BIM) ● What is BIM ● International regulations on data management ● BIM potential as Retro BIM or HBIM (Heritage BIM) ● Case study	3 hours	Jacopo Vitale
1.9. Investigations on architectural heritage in Egypt. ● Degeneration processes, natural and anthropic hazard, integrated methods for knowledge, recognition and diagnostics ● The Pharaonic architectural heritage. Case studies in Upper Egypt ● The mamluk architectural heritage. Case studies in Cairo	2 hours	Michele Coppola
1.10. integrated techniques of surface and subsurface survey ● Use and applications of the Global Navigation Satellite System (GNSS) ● Advanced and experimental integrations for high resolution surveys (GNSS, ER tomography, Muon Transmission Radiography, satellite Interferometric Synthetic Aperture Radar and others)	2 hours	Stefano Morelli