



# Surveying cultural heritage: summer school for conservation activities

Cristiana Achille<sup>1</sup> · Francesco Fassi<sup>1</sup> · Alessandro Mandelli<sup>1</sup> · Fausta Fiorillo<sup>1</sup>

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## Abstract

Since 2011, the 3DSurvey Group of Politecnico di Milano organises an annual summer school programme entitled ‘Laboratory of Places, Ghesc and surroundings, history, survey, evolution’. This activity is patronised by the International Council on Monuments and Sites (ICOMOS) Italia and developed in collaboration with the Canova Association. This is a non-profit organisation founded in 2001 in the mediaeval village of Canova (Oira di Crevoladossola, Italy) and it is an institutional member of ICOMOS Italy since 2010. Its primary goal is the preservation and enhancement of rural, mediaeval stone architecture. From 2017, the summer school is also sponsored by ISPRS society. The case study of the course is the charming, abandoned mediaeval village of Ghesc, located in the hamlet of Montecrestese, Domodossola (Italy). There, the Laboratory aims to create a workspace where students, freelancers, teachers and members of the association can work to the documentation of the ancient village and actively contribute to its rediscovery and conservation. In particular, the research activity carried out in recent years by 3DSurvey Group and Canova Association deals with all the historical and architectural artefacts in the Ossola territory, even if they do not belong to the category of monumental bounded works. The general rural architecture also includes suburban complexes made up of buildings that do not have unique architectural values by themselves but considered together represent the construction tradition of the Ossola Valley.

**Keywords** Cultural heritage · Lifelong learning course · Summer school · Advanced survey · Conservation · Valorisation

## Introduction: education and training process in the Italian framework

The safeguard and the valorisation of cultural heritage (CH) require professional figures owning a wide range of knowledge and skills. In Italy, schools and universities provide the base and specific training of the qualified personnel operating in this field.

The Italian encyclopaedia Treccani (Treccani [n.d.](#), [www.treccani.it](http://www.treccani.it)), in the last 2017 release, defines the cultural heritage as goods that compose the national cultural heritage framework. It comprehends various aspects: historical, artistic, archaeological, architectural, environmental, ethnoanthropological, archival, librarian and others that bring a historical and cultural value. The term also includes the cultural activities, which aim to build and spread cultural and artistic expressions. In Italy, the term ‘cultural heritage’ is used since the institution of the related ministry (1975), replacing the former and more restrictive one ‘Antiquities and fine arts’. Speaking about the definition of cultural heritage, it is clear that the education path has to ensure reliable basic training about both the general contents and methods and the specific professional skills about cultural heritage. The study programme has to provide not only tools for the conservation project, but also procure resources and engines for the valorisation and fruition of the data through innovative workflows (digitalising, fruition, sharing, new media and more).

The actual assets of the Italian University System (D.M. 509/99 [n.d.](#); D.M. 270/04 [n.d.](#)) are derived from a series of

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✉ Cristiana Achille  
cristiana.achille@polimi.it

Francesco Fassi  
francesco.fassi@polimi.it

Alessandro Mandelli  
alessandro.mandelli@polimi.it

Fausta Fiorillo  
fausta.fiorillo@polimi.it

<sup>1</sup> 3D Survey Group, Department of Architecture, Built Environment and Construction Engineering (ABC), Politecnico di Milano, Milan, Italy

changing that make it more similar to the one agreed upon the other European Countries. Summarising, the current university system (Lavoro e Formazione n.d., <https://www.lavoroeformazione.it>) aims to (i) shorten the times to obtain the degree, (ii) reduce the dissertations, (iii) organise the cultural-methodological competences with a professional training, (iv) incentivise and simplify the national and international students' mobility and (v) arrange a system hosted on two levels of degree. Currently, the university courses provide a '3 + 2 years' formula, in other words, a first- and a second-level degree (Fig. 1).

The first-level degree lasts 3 years and intends to ensure to the student an adequate competence about the scientific methods and contents in general, plus the acquisition of specific professional knowledge. After the 3-year period, gained 180 university formative credits (CFU), the students are ready to enter the labour market or to attend first-level master's (at least earning 60 CFU) and post-graduate schools. Otherwise, with the second-level degree, organised in 2 years, the scholars receive advanced training for high qualification activities in specific fields (the student will collect, at the end of his path, 180 cfu + 120 cfu = 300 cfu). After the master degree, it is possible to continue studying by choosing among second-level master's, PhD courses (3 years) or advanced post-graduate schools. Probably, the main innovation introduced by the university reform is the system based on the university's formative credits (*Crediti Formativi Universitari*); they measure the overall working load of the student (lessons, individual study, seminars, laboratories and more). Each exam corresponds to some credits that identify more or less lofty formative goal reached. Every year, on average, a student can dedicate to the university studies some hours that correspond to 60 credits. The study programme offers key activities, organised in monographic courses or integrated laboratories, according to the lists that define the degree classes' directives of the different universities.

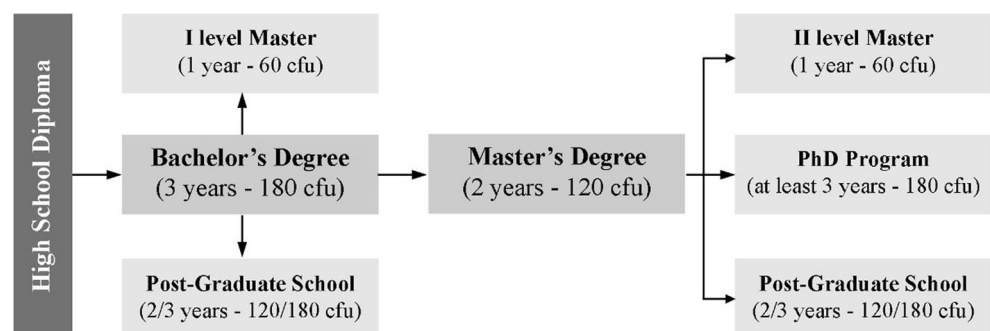
In Italy, there are 79 universities (CeStOr n.d., [www.cestor.it](http://www.cestor.it)), to which corresponds a high number of degree courses, in all the disciplines. Among these categories, the bachelor's that deal with cultural heritage (MIUR n.d., [www.miur.it](http://www.miur.it)) are the Class L01 Degree in Cultural Heritage and Class L43 Degree in Technologies for the

Conservation and Restoration of Cultural Heritage. On the other hand, speaking about the master degree, the classes are as follows: Class LM10 Master Degree in Conservation of Architectural and Environmental Heritage, Class LM11 Master Degree in Conservation and Restoration of Cultural Heritage, Class LM45 Master Degree in Museology and Cultural Heritage (including on-line bachelor degree Università telematica Internazionale UniNettuno, n.d.). In the alternative, the University of the Study of Turin proposes a single-cycle Master Degree LMR/02, in agreement with Fondazione Centro Conservazione e Restauro dei Beni Culturali 'La Venaria Reale' (Suscor n.d., [www.conservazionerestauro.campusnet.unito.it](http://www.conservazionerestauro.campusnet.unito.it); Venaria Reale n.d., [www.centrorestaurovenaria.it](http://www.centrorestaurovenaria.it)). Also in Florence, the Scuola di Alta Formazione e di Studio releases a diploma that has the same value of a single-cycle master degree diploma in Conservation and Restoration of Cultural Heritage, LMR/02 (Opificio delle Pietre Dure n.d., [www.opificiodellepietredure.it](http://www.opificiodellepietredure.it)).

The target of these degree programmes is to cater to the national and international need of professional figures that operate in a modern perspective for safeguard, conservation and valorisation of cultural heritage (AIB n.d., [www.aib.it](http://www.aib.it), Istituto per le Tecnologie Applicate ai Beni Culturali (n.d.)). The graduates of this field can work inside restoration laboratories and companies, the Ministry of Cultural Heritage and Activities appointed to safeguard of cultural heritage (government supervision departments, museums, libraries, archives and more), the professional associations of the field, the public and private institutions and research authorities. Alternatively, whoever wants to deepen his knowledge or increase his specialisation level after the graduation can follow other study path or attend other course as master, PhD programmes, post-graduate schools and training courses.

Masters are post-graduated bachelor's courses (first-level masters) or post-graduate master courses (second-level master), organised in partnership with other public or private institutions or companies, to give the students a scientific improvement and high training (Master in cultural heritage websites (n.d.)). They offer professional, technical-operative or design skills. The admission is close to a restricted number of participants, as long as the didactic support of teachers and

**Fig. 1** The Italian University System. Source: Lavoro e Formazione n.d., [www.lavoroeformazione.it](http://www.lavoroeformazione.it)



tutor is guaranteed. To complete the master, it is necessary also to conclude an internship among companies or institutions (master programme websites).

On the other hand, the PhD programme lasts 3 years, and it is possible to attend it after achieving the master's degree. It aims to give the theoretical and practical knowledge, necessary for the research activities. At the end of the course, the candidate has to produce an elaboration summarising the results of their operations (PhD programme websites). The PhD courses about cultural heritage has to provide a wide range of knowledge and skills, through a multidisciplinary approach combining traditional, humanistic disciplines and the scientific ones. The courses are different but integrated, where each field (architecture, archaeology, survey, maintenance, conservation, history, multimedia and more) presents its characteristics as the theory, the methodologies and the survey tools available (PhD Programs in Cultural Heritage (n.d.)).

Another possibility is to attend the advanced post-graduate schools (SIRA n.d., [www.sira-restauroarchitettonico.it](http://www.sira-restauroarchitettonico.it)). The Post-Graduate School of Architectural and Environmental Heritage (Italian acronym S.S.B.A.P.) trains high-profile specialists for the study, safeguard, restoration, maintenance and valorisation of architectural and environmental heritage. The aim is to give a specialised critical-historical, technical and professional competence integrating the university skills and to provide a more extensive knowledge of the methods and operational techniques for the management of the cultural patrimony. The S.S.B.A.P. in Italy are inside: Politecnico di Bari, Università degli Studi di Firenze, Università degli studi di Genova, Politecnico di Milano, Università degli Studi Federico II di Napoli, Università di roma 'La Sapienza', Politecnico di Torino and IUAV Università di Venezia.

There are also other training opportunities, as the 'lifelong learning courses', which comprehend formative activities for employed or non-employed people, who need a professional-technical or cultural upgrade (Lifelong learning websites (n.d.)). All the citizens of every age, culture and professional or social condition can attend lifelong learning courses. The target is to ease the learning, growing and the training of professional and cultural capacity useful for their entire lifecycle. In fact, the term is not only referred to employment goals, but also to personal, social and civic ones (lifelong learning websites).

As explained so far, the proposal for the training in the cultural heritage field in Italy is vast and varied, confirming the growing need of professionals operating on the built heritage. To testify this statement, the latest International Council on Monuments and Sites (ICOMOS) recommendations (ICOMOS 2017) contain a series of proposals:

- (i) planning, promoting and strengthen the collaboration with the public research institutions, universities, post-graduate schools and the schools and institute of each order and grade. In this way, it is possible to guarantee

the introduction, of the knowledge and tests of the vulnerability and risks, associated with the integrated conservation of cultural heritage, promoting the 'prevention culture';

- (ii) planning and realising training/information actions, collaborating with other entities, firstly ICCROM and professional orders;
- (iii) collaborating with the entities predisposed to identify new professional figures;
- (iv) promoting fundraising and participating in an innovative research project about the safeguard of cultural heritage.

Even the permanent Observatory on Learning and Training, Europe 2020 (ISFOL n.d., [www.isfol.it](http://www.isfol.it)), based on the recommendations of Agenda 2020, underlines the centrality of the activities and education paths that the European Union countries will be able to launch. All the citizens should be able to reach a higher level of instruction and training than the actual ones, being involved in professionalising and formative paths.

In this framework, the European countries take care of the accessibility of the population to the educational activities among the entire life cycle, to the phenomena connected to the lack of participation of specific target to working and training paths and to innovative modalities of knowledge dissemination through both the working environment and less structured learning context.

The relevance of the topic 'training and cultural heritage' is evident. The interest of the scientific community confirms the necessity to organise study paths better structured, towards theoretical and practical learning. The project 'Laboratory of Places', combined with Politecnico di Milano and Canova Association, moves in this direction. It is a lifelong learning course (4 CFU), aimed at those who want to deal with the knowledge survey of cultural heritage. In this way, it is guaranteed training and professional updating to students, graduates, administrators, public functionaries and professionals, completing the formative offer of the university.

## Laboratory of Places—GHESC and surroundings—history, survey, evolution

### The partnership with the 'Canova Association'

The summer school 'Laboratory of Places 2017—Ghesc and surroundings—history, survey, evolution' is organised by the 3D Survey Group (ABC Department of Politecnico di Milano) and Canova Association. The school offers different activities that integrate the university teaching and concur to the training of professional roles operating in the safeguard, conservation and valorisation of CH. The summer school is

international because of the strong need for training in this sector both in Italy and abroad.

The coordinators considered mandatory to organise the course in close cooperation with Canova Association, referring to the ICOMOS suggestions (ICOMOS 2017). Canova Association resides on the territory and promotes a shared knowledge supporting local projects. Canova Association is an international non-profit organisation founded in 2001 in the mediaeval village of Canova, Oira di Crevoladossola, Italy. Canova is an institutional member of ICOMOS Italy since 2010. The principal goal of Canova Association is the preservation and enhancement of rural mediaeval stone architecture. Canova Association presents large programme of events each year; some are reserved for members only but the majority are open to the public. These occasions are meant to increase the involvement of people dedicated to the continuation and protection of European and our local heritage of ancient rural stone architecture. Art and architecture intertwine, stimulating research and debate, revolving around the conviction that old stone construction can offer adequate if not superior models in our search today for sustainable human dwelling solutions. The continuing insensitivity to this fact is resulting in indiscriminate demolition and renovation, forever erasing the precious heritage of rural stone architecture in Italy and Europe. Intentions and goals of the Canova Association are to reverse this tendency, by carrying out activities aimed at sensitising both public and private sector. For over 10 years, the Canova Association organises field school regarding the theme of architectural restoration in collaboration with Italian and foreign universities. The participants are followed by a master builder, having the opportunity to know and learn the techniques of typical Ossola architecture from the best perspective, the one that sees them engaged directly. In recent years, the summer schools take place in the suggestive mediaeval abandoned village of Ghesc. It is a village across the river from Canova. Large trees grew up living within the walls of the houses, and the place exudes a charming air of mystery. Ghesc is the ideal stage for what we like to call the ‘infinite laboratory’ and is a playing field of the International Canova Field School program (Canova Association n.d., [www.canovacanova.com](http://www.canovacanova.com); Achille et al. 2017). The cooperation between University and Canova Association is fundamental as they both consider CH not only as archaeological, architectural, artistic and archival heritages but also as a whole of assets including oral, practical and local traditions. CH represents a shared resource, and their conservation and valorisation are possible only respecting local cultures. The collaboration with the ‘living’ Canova Association permits to know and appreciate how to sustainably intervene (times and modalities) in the Ossolano territory.

Cultural heritage code has widened the meaning of ‘cultural heritage’ not only regarding the chronology but also considering the goods types (tangible and intangible). For this

reason, it is necessary to prepare new scientific and professional competences, which can handle the knowledge, safeguard and valorisation through multidisciplinary paths. Thus, the summer school ‘Laboratory of Places’ offers a training project aimed to deepen geometric survey, conservation and valorisation. The course forms scholars and professionals able to deal with methodological and practical issues with a critical approach and research capabilities applying national and international standards.

The summer school guarantees the achievement of a series of targets. The first one is the learning of the primary disciplines and methods linked to the analysis of CH, such as geometric survey, material identifications and more. The second aim of the school is the attainment of capabilities obtained through the practical exercise on the field. This methodology allows to become familiar with the full range of topographical and photogrammetric instruments and with the best practices applied on CH. Moreover, a strong collaboration with the Canova Association combines the ‘local knowledge’ and ‘traditional approach’ with the most innovative data elaboration and fruition tools (web/GIS, new media, digital repositories, information systems and others). In this way, it integrates necessary competencies and helps development of professional skills operating in safeguard, conservation and valorisation. In fact, standard and advanced knowledge, understandings and awareness of environment are fundamental to deal with CH projects. The participants face problems with a multidisciplinary approach independently. For this reason, it is necessary to apply their competencies to intervene correctly. Working on a real case study lets them test what has been learnt and verify the reachability of the settled targets.

### Lifelong learning course: activities and aims

The activities of the summer school take place in Ghesc. Ghesc is a small mediaeval village, uninhabited for more than 100 years. The encroaching forest has gradually embraced its buildings and terraces, creating a highly evocative and fascinating environment. Hidden between the Swiss alpine border and the narrow Ossola Valley, Ghesc is located in the municipality of Montecrestese. Thanks to its relative isolation, the Ossola Valley has kept its secrets well hidden. It is an area of extraordinary natural beauty with an abundance of undiscovered stone villages. Ghesc is essentially composed of seven houses, only one of which still conserves its original stone roof, and the rest are in varying states of neglect. The village’s equipment also counts a bread oven and a watermill for grinding flour, both of which are existing but non-functional. An analysis of the surrounding landscape illustrates nature’s steady march in reclaiming its original territory. The weather conditions seriously compromised the retaining stone walls of the stream, and terracing once cultivated with vineyards, rye and hay is now home to chestnut and beech forest. Historical

documents referring to Ghesc are rare but those that do exist apparently demonstrate its ancient origins. A document dating back to 1411 attests to the payment of tithes owed to the Municipality of Montecrestese, referring to the then-current name of Gexo. Both the Teresian cadastral maps of 1722 and the Rabbini maps of 1863 identify the area in more recent times. The surroundings of the village of Ghesc are particularly rich in historical and architectural sites. Many terraces, relatively well conserved, encircle the nucleus of houses. In the little valley below the village, there is a mill house built for grinding rye as well as two lime kilns for the production of lime mortar, a fundamental material in the traditional building trade. The presence also of an ancient tomb-like enclosure built in the terracing and a ‘balma’ (a large room created by excavating beneath a giant boulder), as well as the Celtic site of Castelluccio a short distance away, is a testimony of the area’s long history of human habitation (Achille et al. 2017; Quaderni di Ghesc 2010).

The summer school is organised into four parts:

- (i) introductory ‘best practice’ and theoretical lectures;
- (ii) survey activities in Ghesc;
- (iii) processing of the acquired data;
- (iv) research and discovery of the territory.

The maximum number of participants is 12, and for the selection process, it is mandatory to send a CV with a motivation letter. The VI edition of the summer school took place from the 26th July to the 4th August 2017. Over the years, the participants were as follows: university students (architecture, engineering, history and more); professionals (surveyors, architects, archaeologists, photographers, public employees); employees of university institutes—a heterogeneous group of scientists that, for various reasons, work or would like to work in CH field.

The difference in the geographical, cultural origins, ages, competencies and personal experiences makes the team activities interdisciplinary and helps to understand various methods to approach CH. A common language becomes obligatory to work together as a team. The summer school aims to enable students to know how to use tools and methods after proper theoretical preparation and then to be able to process the collected data critically.

The teaching activity of the summer school is focused on three-dimensional surveying techniques (laser scanning and photogrammetry) and subsequent digital restitution of the acquired data. The next phase regards the recognition of materials and their state of degradation. Obviously, these training activities do not cover all aspects necessary for a complete cultural heritage conservation project (seismic analysis, structural calculation, economic evaluations...). The choice of the topics developed is related to the duration of the course (10 days).

The main scopes of the course are as follows (Achille et al. 2017):

- (i) encourage the learning of modern and innovative survey methods: topographic instruments—survey and data processing. Laser scanner tools—acquisition and management point clouds, elaboration of plans, sections, profiles, 3D models. Photogrammetric survey—digital camera, UAV, on-site calibration, image matching, orthophoto, 3D model. Structured light scanner—survey of small object, mesh processing, 3D model;
- (ii) promote learning of methods to investigate and recognise materials (material survey, study the state of decay, cataloguing, the collection of samples, analysis);
- (iii) build capacity for the ‘virtual design’ of interventions based on the collected data (develop hypotheses project from plans, sections and 3D models);
- (iv) promote the dissemination of user-friendly and low-cost technologies: broadest diffusion of the necessary tools for documenting, conserving and monitoring of cultural heritage. Encouraging the use of new tools and techniques so that they support the various phases of conservation process, tools as means and not as the ends, enhance the use of digital technologies to promote the site, even from the touristic point of view. Processing the data while keeping in mind its future potential employment, not only for the necessary conservation work but also for the dissemination via web at various user levels. Creating 3D models and movies viewable/accessible through the internet;
- (v) develop data-sharing procedures with online platforms to provide and ensure access to useful information for conservation practices (share platforms and tools for the dissemination of knowledge acquired). Through the use of shared platforms, one can aspire to bridge the technologic gap between experts-technologists and conservatives, between managers and end users of data and information;
- (vi) promote knowledge about the territory and its peculiarities by offering lectures to the students about the history of the Ossola Valley as well as guided tours to places of interest, thus gaining a broad and coherent awareness of the local culture. Summer school also represents an opportunity for revitalisation and rediscovery of forgotten places;
- (vii) actively contribute to the conservation process through dissemination of best practices through ongoing dialogues between scientific and local communities, to avoid duplication of effort; help to establish guidelines that ensure compliance of conservation practices;
- (viii) the disciplines of geomatics and restoration by their nature require teamwork. It is, therefore, necessary to learn to work together, encouraging multidisciplinary cooperation and dynamic inter-change among the summer school participants.

## Learning of modern and innovative survey methods

The survey methods include observation, measurements and critical analysis of the built heritage. Compared to the traditional survey methods adopted in the CH field, the modern survey instruments allow getting complete and adequate data in a relatively shorter time.

Nowadays, the difficulties are not during the survey activities, but during the data elaboration. The main difficulty is not the correct use of the survey tools but the correct data elaboration. A good survey needs theoretical and practical skills that can be obtained only through study and practical experience on the field. During the summer school, the participants spend most of the time using topographic and photogrammetric instruments. They have to plan and accomplish a survey after attending some necessary theoretical lectures.

The techniques adopted and subsequent elaborations are different, according to the final purpose. The methodologies depend on the restitution scale (details), characteristics of the investigated object (dimensions, shape, position, materials) and the surrounding environment. It is possible to mix different methodologies and instruments and use them simultaneously to achieve a final ‘hybrid’ product, which meets the set requirements. Moreover, the combination of various techniques permits to optimise the acquisition and elaboration stage taking advantage of the best characteristics and performances of each instrument (Remondino 2011).

Through the years, the summer school also used tethered balloons (2012) and UAV (from 2013 to 2017) for the aerial survey, until the latest edition (2017) where the scholars had the chance to employ the most modern laser scanner technologies, as the Leica portable scanners BLK 360 and Pegasus Backpack (Fig. 2).

For the didactic purposes, tutors design the survey to allow each participant to use and compare all the different survey techniques and instruments. The campaign contemplates a topographic network to support all the following laser scanners and photogrammetric, both close range and UAV, activities. The students elaborate the data (Fig. 3) to produce

three-dimensional models and classical bi-dimensional drawings (plans, prospects and sections). Usually, the representation scale settled is 1:50 that is the ‘minimum’ required in the architectural field. However, where necessary, it is possible to use multi-scalar representations, integrating some specific details at a bigger scale. The choice of scale ratio depends on the following criteria: correct hierarchy of information, legibility, measurability of the elements and clarity in the detail’s description.

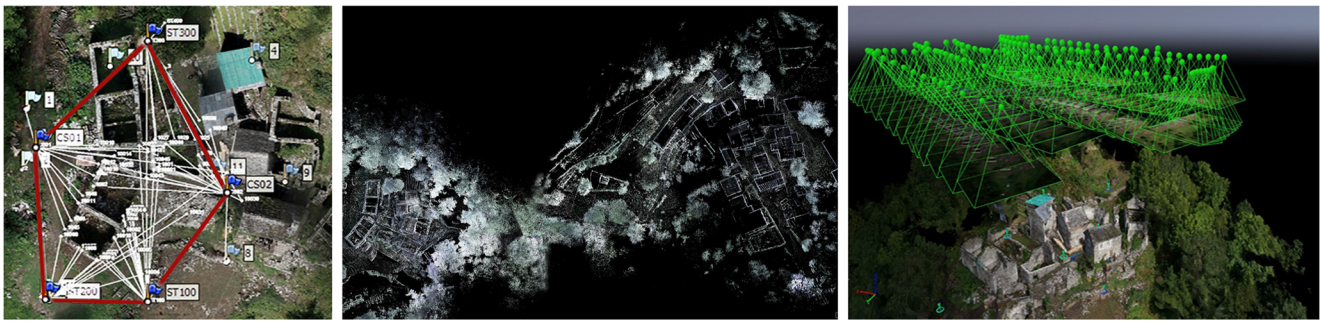
It is clear that a 10-day course does not let to acquire an in-depth knowledge regarding the survey tools, but this is not the scope. The aim is to inform about the existence of these methodologies, highlighting the positive aspects and the limits and focalising the attention on metrological fundamentals that, nowadays, are often disregarded blindly trusting automatism and greater ease of use of the instruments. In this way, the operators of CH field will be able to decide if and when a type of instrument is necessary, considering the expected results, the time and the available budget. Knowing the possible means and their kind of products permits a better communication between different professionals that have to operate on cultural heritage.

## Learning of methods to investigate and recognise materials

It is necessary to have at disposal not only geometrical data but also information about the material’s consistency, to arrange an adequate conservation project. Once the attendants complete the survey and the restitution (bi-dimensional drawings in DWG format and orthophotos at 1:50 scale) of the architectural shapes, they proceed with the analysis of the materials. This kind of investigation and the consequent decay’s one represent the first phase of the studies needed to obtain an overall knowledge of the features and conservation state of a building. This step uses the macroscopic observation, made with the naked eye, of the visible architectural surface. At the end of this survey, it is possible to proceed with the instrumental inquiries, even invasive, and samples where it is necessary (Achille et al. 2011). At this stage,



**Fig. 2** Starting from the left: (i) tethered balloon; (ii) UAV; (iii) Leica Pegasus Backpack; (iv) Leica BLK360



**Fig. 3** The image shows some of the rough data concerning (from the left): (i) the topographic campaign; (ii) Leica Pegasus Backpack; (iii) aerial photogrammetric survey

it is essential to take care of the communication’s modalities; in particular, the graphics restitution has to transmit the information making them crystal clear to anyone that has to operate in the next project phases.

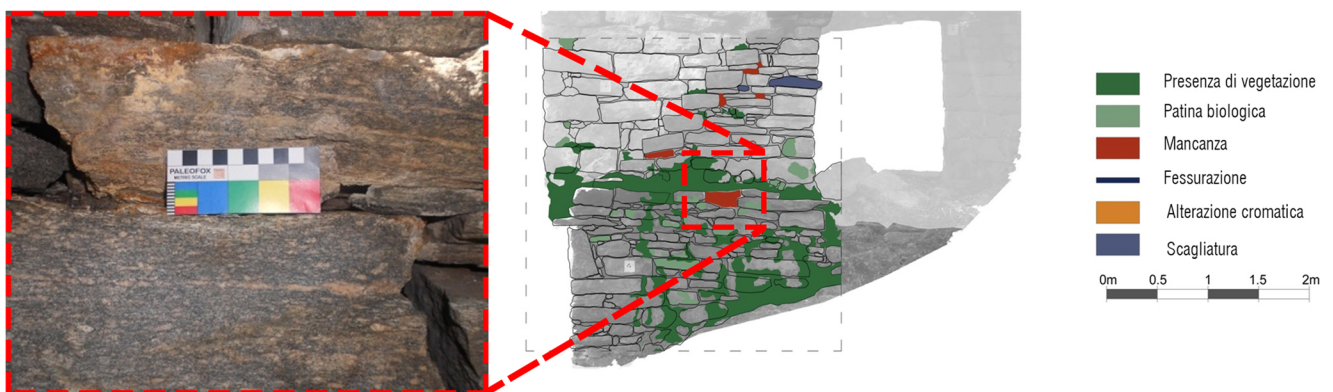
For this reason, the students have to represent the identification of the materials, the decay analysis and the methodology of interventions with opportune graphics symbols (Fig. 4). In Italy, the NorMaL commission (Normativa Manufatti Lapidari (NorMaL)) wrote the NorMaL language former 1/88, today UNI 1182 (UNI 11182, n.d., UNI NorMal, n.d.). This code regards the decay representation of the surfaces, allowing the description of stones materials’ alterations and the degradations. The norm views both the natural (rocks) and artificial (mortar, plaster, ceramics) stones. In this way, it answers to the need to adopt standardised and repeatable methods to guarantee the comparison between results. The progressive spread of this NorMaL language brings to the production of elaborations that referred to the same vocabulary.

Another reference ‘dictionary’ is the one by ISCS (International Scientific Committee for Stone (ISCS)) of ICOMOS. ‘In studies on stone deterioration and conservation, terminological confusions lead to major communication problems between scientists, conservators and practitioners. In this context, it is of primary importance to set up a common language; if degradation patterns can be shown, named and

described, then they can be recognised and compared with similar ones in a more accurate way in further investigations. The ISCS glossary constitutes an important tool for scientific discussions on decay phenomena and processes. It is also an excellent basis for tutorials on stone deterioration. It is based on the careful examination of pre-existing glossaries of English terms. It does not aim at replacing these glossaries, often set up originally in a language other than English, and for most of them done to a high standard (ICOMOS-ISCS 2008)’. Also, in this case, the target is to learn a workflow and be aware of the reference regulations. It is essential to comprehend how to handle the knowledge acquired during the course to participate in the planning and evaluating of the safeguard and maintenance interventions of cultural heritage, with critical spirit and availability to interdisciplinary teamwork. This experience will help the professional to work in also different landscape by the Ossolano’s, replaying a working pipeline based on the study, the comparison and the critical analysis of the data, starting from the national and international rules.

**Virtual design of interventions: 3D modelling**

The survey technologies satisfy the documentation requirements of cultural heritage and open new research scenery,



**Fig. 4** Example of a decay analysis drawing

starting from a geometrically correct and complete database, usable in sectors until now separated, such as—for example—project simulation of conservation and reuse interventions.

The accurate and georeferenced geometric survey ensures the correlation of all the analysis conducted and constituted the indispensable basis for any project. The redundancy of the data produced by surveying instruments (laser scanners or digital cameras) eliminates the phase of information selection during acquisition and allows the production of models with different characteristics, for different needs.

Therefore, the survey activities and the subsequent representation phases are connected to the questions about the interpretation of the phenomena observed on the existing building and their representation on the 3D models.

Today, many software offer exciting solutions for the three-dimensional modelling for the building of the assumptions about the history of the investigated object, as regards the project hypotheses. Visual communication is the most common use of 3D digital models in the context of cultural heritage. The dissemination happens through both passive video (such as animations, which do not provide for the intervention of the user) and active type (such as installations interactive multimedia or virtual navigation systems, which require user intervention).

In the case study of Ghesc, the objective of virtual reconstructions is to give a measure to the hypotheses about the original structure of the buildings and to make simulations on possible conservation/reconstruction interventions (Figs. 5 and 6). The students can hypothesise the original consistency of the buildings of the village, starting from the collected data (geometric data, historical sources, observations and analysis produced on the materials and more (Fassi et al. 2016)).

During the course, tutors introduce the methodologies of 3D modelling (direct and parametric), including the building information modelling (BIM) approach. Today, the use of BIM processes (Fig. 7) is spreading also for projects involving the existing building, so it is necessary to present this theme. Compared to traditional methods, the

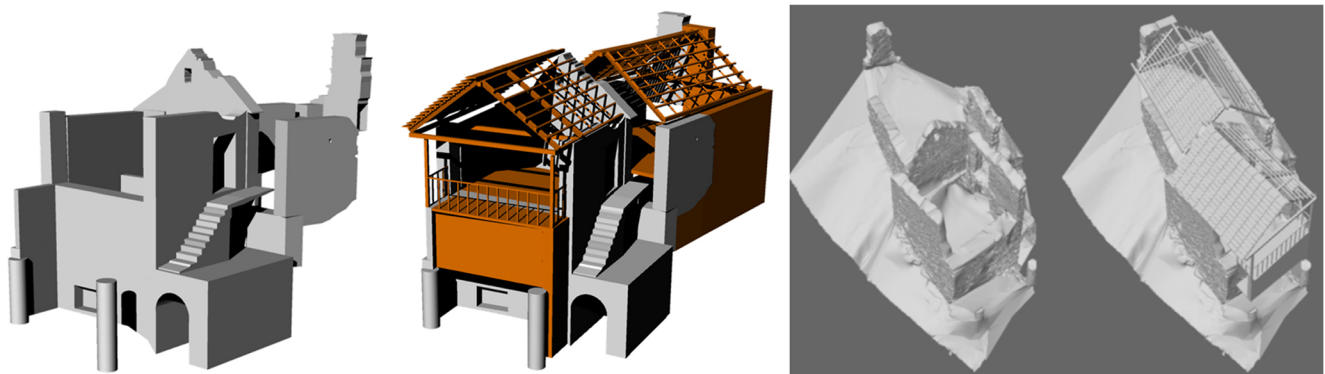
creation of models according to the BIM logic has become more interesting for the study of the sequence of works required for the conservation and reuse projects. Hypothesis and evaluations can be made that take into account both time and costs.

Furthermore, three-dimensional virtual models offer new opportunities in communication, diffusion and training. In fact, these models allow the users to communicate effectively and quickly and with ‘repeatable’ information on locations, environments and objects that still exist but are not easy to reach or are disappeared. The integration of objectives in their proper contexts allows (to students, scholars, tourists and others) a correct reading of the present, the past and the future.

### Promoting the dissemination of user-friendly and low-cost technologies and enhancing the use of digital techniques

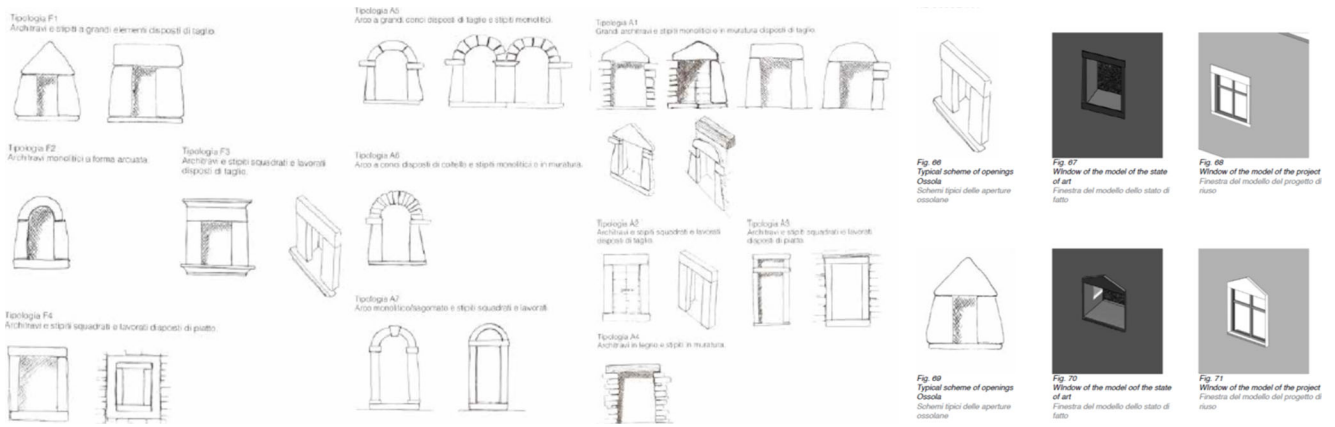
Modern digitalisation techniques, shared data platforms, three-dimensional simulation/prediction/reconstruction practices and design of friendly interfaces for data access offer new ways of using and transmitting knowledge. In general, the production of 3D digital models (Fig. 8) is useful in many areas (from the most diffuse documentation to the conservation and restoration, teaching activities, research project and more) but it is necessary to first establish the goal that the model must respond to ensure the proper results. The choice of objectives is vital for the subsequent study and interpretation processes that can be implemented on three-dimensional models.

Among the possible uses of digital models, there is the possibility of making reality-based replicas. Today, there are several sensors (in particular scanners) and tools that allow to acquire the shape of small- and medium-sized objects with high accuracy. The use of these devices, some of which have low cost, leads to the production of digital models that are nothing but accurate copies of the scanned objects. In the world of cultural heritage, these replicas can be used to exhibit an object (if the original is not available), to permanently or



**Fig. 5** Hypothesis on the original shape of the ‘column building’ in Ghesc: 3D modelling from survey data (software used: Rhinoceros 5.0, SketchUp 2015)





**Fig. 6** Study of the typical scheme of openings in Ossola buildings; freehand sketches and 3D modelling from survey data (software used: Revit 2013)

temporarily replace original works, for the construction of educational paths for blind people and for merchandising activities and more.

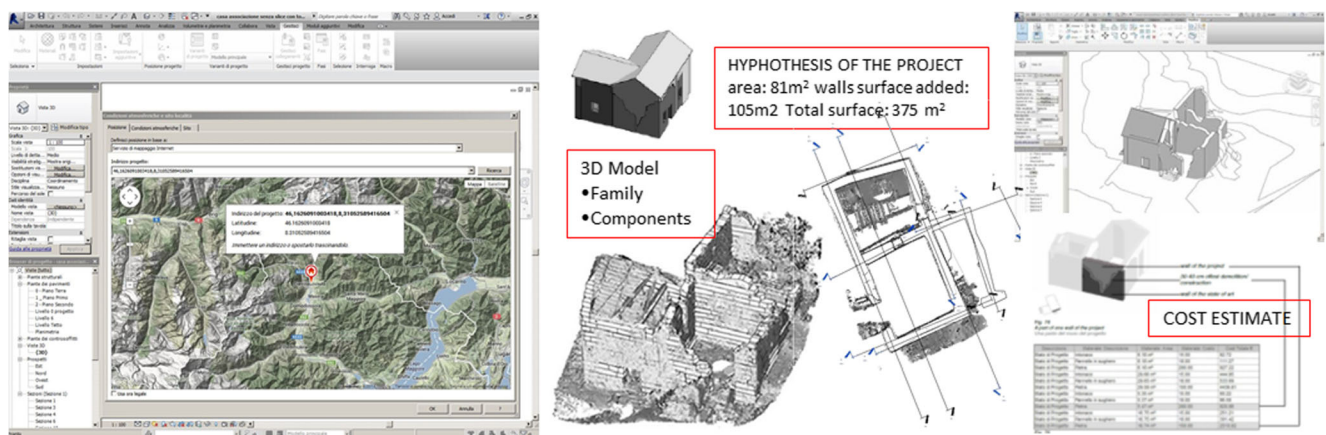
Another application concerns the possibility of contributing to restoration. Thanks to 3D printing technologies, it is possible to design and reproduce the missing parts of a work, to offer the public a more useful explanation of the original structure of the object.

During the summer school in Ghesc, in collaboration with the Rosminiano Museum of Domodossola, the participants surveyed some objects preserved in the Museum. The goal of the activity was to create digital models to physically replicate them through 3D printing. The 3D survey and printing technologies offer exciting opportunities to museums and cultural institutions to enhance the visibility of their collections. In addition to the use of 3D copies in the integrative restoration or tactile set-up, 3D models can be used to create three-dimensional digital archives of artefacts for dissemination purposes to develop online museums or virtual reality tourist applications.

### Developing of data-sharing procedures

At the end of the survey activities (geometric, material, historical and others), the problem is the management of different data (texts, historical documents, images, 2D representations, 3D models, numerical data and more). It is necessary (or better indispensable) to make the data accessible to the restoration managers in an integrated environment (Rechichi et al. 2016) to guarantee complete access to the analyses and thus allow the control of the activities in progress, comparing the object before restoration with all kind of interventions used in the field/implemented (Fig. 9). Most of the collected data refer to different spatial locations on the building, and digital 3D models can be the ideal mean of viewing, storing and correlating all this information. A great deal of time is devoted to the sharing of data collected through online platforms to provide and ensure access to useful information in conservation practice.

It is essential to consolidate the use of share platforms and tools for dissemination of knowledge to overcome cultural inequalities and make information genuinely accessible.



**Fig. 7** Uploading of the geographic coordinates of Ghesc; model of the case study starting from a point cloud using the 'InPlace Family' in Revit 2013. Source: Corda 2014



**Fig. 8** Starting from the left: (i) 3d printing of photogrammetric models; (ii) the real object and its printed copy; (iii) and (iv) sharing high-resolution 3d models of small objects in an online visualisation system (BIM3DSG)

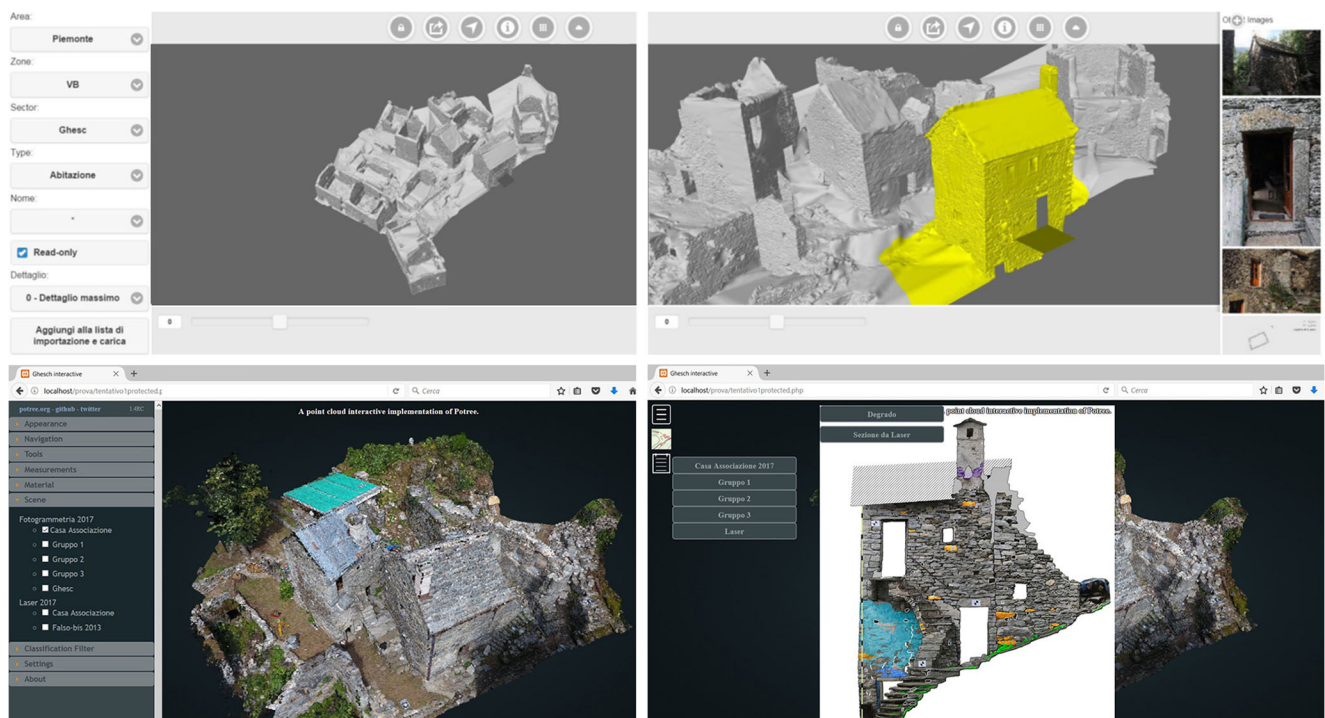
The summer school aims to give priority to the use of so-called user-friendly and low-cost technologies to ensure spreading of the tools especially created for documentation, conservation and monitoring of cultural heritage (Fig. 10). The promotion of online tools and platforms' development democratically provides access for referencing standards and procedures in the practice of preservation of cultural heritage (ICOMOS 2014).

### Promoting the territory's knowledge

The summer school is also an occasion for revitalising and rediscovering forgotten places. During their stay in Ghesc, students take part in lessons and guided tours in Ossola territory (Fig. 11), thus gaining a broad and coherent vision of

local culture. The 'heritage sites' (sites, landscapes) can take different values for multiple communities associated with them, and the process of value identification must be taken into account by each group. It is necessary to set up separate levels of cooperation networks among the various stakeholders, to take on heritage issues and create new value sequence through innovative synergies, employing dynamic and adaptable processes of involvement. The assets of the long-term social impacts of heritage conservation planned interventions help to recognise the link between communities and their heritage, respecting the right of local communities to identify the values and knowledge systems rooted in their culture.

It is necessary to reactivate a development on a 'human scale', as a basis for bottom-up creative approaches, and to create a link between heritage conservation and local and



**Fig. 9** The informative system BIM3DSG used to visualise, collect and share surveyed data, 3d models, images and information



Fig. 10 A proposal for a website page and an online 3d virtual tour of Ghesc village

sustainable economic development (ICOMOS 2014). In this sense, the summer school actively contributes to the discovery of the Ossolan territory through guided tours organised by the Canova Association. For this reason, the close-knit relationship between the university and the Canova Association is strategic; the ‘education-training’ on the themes of the landscape, the environment and cultural heritage is useful when you know what you want to protect and enhance.

### Actively best practices

From the world of work, the need for interdisciplinary training to complexity or, better, the attitude to multidisciplinary work come to light more frequently.

The educational and training path cannot exclude the understanding of the interlocutors as well as the context in which they live, move and develop experiences and relationships.

It follows that any education and training offer cannot be repeated immutably and everywhere: it is necessary to give a methodological and theoretical system, referring to the

context, to the necessity and demands encountered for carrying out of the educational and training activities.

In the framework of coherent and coordinated planning aimed at conservation, the professional must be able to analyse the data (constitutive materials, construction technique, state of preservation); plan and direct the interventions; and coordinate with the other operators performing complementary activities.

Promoting ‘best practices’ means (i) developing guidelines for interdisciplinary research in order to bridge the technological and cultural gap between technologists and conservators and between managing authority (systems and techniques) and users of data and information (ICOMOS 2017); (ii) actively contributing to the widespread exchange of best practices in the conservation process through debate and discussion in the scientific community, also in order to avoid duplication of efforts; (iii) facilitating standardisation and simplification of procedures and tools; and (iv) developing methods and tools that are internationally recognised and applicable, in order to ensure accuracy, reliability and verifiability of the results.



Fig. 11 Guided tours in Ossola territory

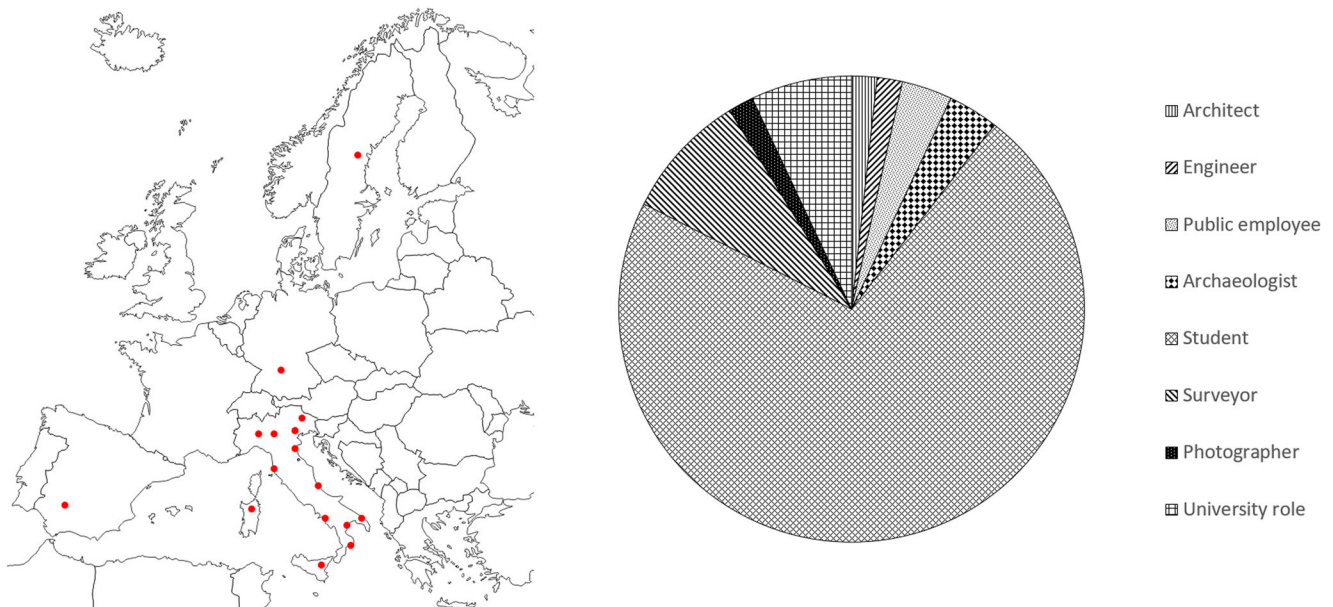


Fig. 12 Participants' country of origin and occupation

### Teamwork

The cultural heritage field is extraordinarily extended and presents a wide variety of possible professional applications; for this reason, it requires not only diversified and specialised professional figures, but especially people with an aptitude for teamwork and able to confront each other.

The necessary skills to work in CH field obviously concern the specific theoretical/technical skills, and these are also required to understand and interpret different languages (different professional figures) to accurately work in the field of conservation and enhancement of the cultural landscape entirety.

It is therefore evident that the activity to be carried out on the 'cultural heritage field' involves the intervention of many professional figures, the training of which is carried out through a series of course of study designed to provide skills in specific disciplines and technologies.

Furthermore, the management of cultural heritage involves a variety of participants, some of them public (superintendencies,

local authorities, universities, research institutes), other individuals or associations of various kinds (Fig. 11). The summer school wants to actively contribute to the training of professionals who must be able to dialogue with each other and who can confront critically and constructively.

In this meaning, teamwork obliges for a continuous discussion; team speaks about times and ways to carry out the activities, and the different education paths and birthplaces of the participants produce a constant exchange of opinions and counsels (Figs. 12 and 13). The course ends each year with the presentation of the results and a public discussion of the issues that have emerged. Participants should illustrate the methodological approach followed for field survey and subsequent data processing. The comparison and debate are particularly useful for those participants who come from 'classical' survey experiences where the selection of significant information comes first before the conduct of field activities.

The summer school employs modern survey techniques that reverse this practice by postponing the moment of



Fig. 13 Some teamworking and discussion moments

interpretation/synthesis to the processing phase on the already acquired three-dimensional data. In this way, the different participant involved work at the same time on an ‘only one’ 3D model that contains in itself all the information necessary for the various analyses. Therefore, the use of shared vocabularies and the ability to communicate data and reports from different specific sectors become indispensable.

## Conclusions

The Italian cultural, artistic and environmental heritage are one of the widest of the world, and a lot of people think that they can be a progress launcher and an employment occasion. However, often, both the political initiatives and even more the commercial ones focus on the emergencies/excellence. It is mandatory to re-evaluate the significant ad the role of the ‘minor’ heritage instead, often neglected as essential identity element and as a building factor of the landscape and organisation of the territory. The possible actions should start from recognising this patrimony and its documentation, from the historical context and also the normative one and from the development of the knowledge. The aim is to reach the safeguard, the valorisation and the promotion activities, shared with the citizens, public bodies and the financial and social operators (Italia Nostra 2017). Starting from this statement, the lifelong learning ‘Laboratory of Places’ intent is to transmit these values, through a multidisciplinary approach in the conservation process, maintaining a close collaboration with the local community. To do this, the means of the school is the ‘objective’ survey of the existing constructions, to represent the geometric shapes and quantities, to be aware of the materials’ integrity and consistency and to know the state of health of the buildings. In this way, the in-depth knowledge of the architectural aspects strengthens the local cultural values. In fact, the constant partnership with the Canova Association helps the participants to live the territory, discovering local history and traditions. For this reason, the preservation in the case of Ossolano territory is a right balance between traditional innovative cultures, knowledge, materials and technologies, transmitting to the future generations the physical integrity of the built environment.

The positive feedback of each edition is due to the capability of the course to always present the latest methodologies and tools, showing a complete working method, useful both for the career and as a life experience.

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