# Heritage at Risk and Pedagogical Approaches: Training Professionals in Digital Documentation for UNESCO World Heritage Sites Under Threat at the Saint-Sophia Cathedral Complex in Kyiv, Ukraine

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**Abstract**

This paper presents a tailored pedagogical approach to digital heritage documentation in contexts where heritage is under threat. It was developed during the July–August 2024 UNESCO/ICOMOS mission to Kyiv, Ukraine, within the UNESCO/Japan Funds-in-Trust project “Support for Ukraine in Culture and Education through UNESCO / Emergency response for World Heritage and cultural property: damage assessment and protection,” in relation to the UNESCO World Heritage property “Kyiv: Saint-Sophia Cathedral and Related Monastic Buildings, Kyiv-Pechersk Lavra.” The mission focused on the Metropolitan’s Residence and the Bell Tower of the Saint-Sophia Cathedral Complex. In parallel with the production of documentation for emergency preparedness and future conservation assessment, the mission implemented a dedicated capacity-building programme for the staff of the National Conservation Area “Sophia of Kyiv.” The paper discusses five interconnected components of this training programme: preparation before the mission, structure and content of the sessions, training activities and didactic material, learning outcomes and targeted competencies, and adaptive responses to a conflict-affected environment. The case study shows that integrating training into an active documentation workflow can strengthen both the immediate value of the records produced and the longer-term capacity of local professionals to support conservation, monitoring, and risk preparedness at World Heritage sites under threat.

## 1. Introduction

### 1.1 Background

Armed conflict poses severe threats to cultural heritage, not only through direct damage to historic fabric, but also through the disruption of site management, conservation workflows, and the continuity of technical knowledge. In such contexts, heritage documentation becomes essential for recording the state of conservation of historic places, supporting emergency preparedness, and informing future assessment, intervention, and monitoring. Documentation is therefore not only a technical operation for data capture, but also an instrument for conservation decision-making and long-term site management. This is particularly evident in Ukraine, where the armed conflict that began in 2022 has made the protection and documentation of cultural heritage integral to broader frameworks of emergency response, recovery, and long-term conservation planning.

This understanding has been widely emphasized in the field of heritage recording, where the production of reliable and repeatable records is linked to conservation, risk preparedness, disaster risk management, and the responsible transmission of information over time (Burns, 2004; Stovel, 1998; Letellier et al., 2007; UNESCO et al., 2010; Parks Canada, 2010; Historic England, 2017; Waldhäusl and Ogleby, 1994). UNESCO has also highlighted the broader scale of damage affecting cultural assets in Ukraine and the need to support documentation, protection, and recovery as part of a longer-term response framework (UNESCO, 2026).

Recent work in digital heritage documentation has shown that the value of recording lies not only in the production of measured outputs, but also in the capacity to make workflows understandable, usable, and sustainable for local professionals. In this sense, training and capacity-building should not be considered as secondary activities added to documentation missions, but as integral components of their conservation purpose. This is particularly relevant for World Heritage properties under threat, where professionals and site staff remain the principal actors responsible for monitoring, maintenance, and continuity once international missions have ended.

### 1.2 Heritage documentation, risk, and capacity-building

Within heritage documentation, the integration of recording and training has become increasingly relevant in contexts marked by limited access, restricted resources, or emergency conditions. Previous pedagogical experiences have shown the importance of tailoring content to participants’ knowledge, combining theory and practice, and defining realistic learning outcomes according to the time available, technical means, and operational constraints in the field. Skill assessment, modular teaching, and adapted workflows have proven useful in supporting capacity-building while maintaining the conservation purpose of documentation activities over time (Eppich and Chabbi, 2007; Letellier et al., 2007; Parks Canada, 2010; Reina Ortiz et al., 2021).

In conflict-affected environments, however, these pedagogical questions acquire additional urgency. Security-related interruptions, limited time on site, restricted use of equipment, rapidly changing field conditions, and multilingual communication affect not only what can be recorded, but also how knowledge can be transferred in practice. Under such circumstances, a documentation mission must often serve two objectives simultaneously: to produce useful records of the site and to strengthen the local capacity required to continue conservation, monitoring, and preparedness activities after the mission. This was the case in Ukraine, where the pedagogical approach had to respond not only to operational constraints, but also to the challenges of multilingual exchange throughout the mission.

This paper presents a tailored pedagogical approach to heritage documentation in contexts where heritage is under threat, developed during the July–August 2024 UNESCO/ICOMOS mission in Kyiv under the UNESCO/Japan Funds-in-Trust Project "Support for Ukraine in Culture and Education through UNESCO / Emergency response for World Heritage and cultural property: damage assessment and protection." It examines how a training programme in digital documentation was structured and delivered for a World Heritage site under threat and discusses its relevance for other contexts where heritage documentation must respond simultaneously to conservation needs, risk preparedness, and capacity-building.

## 2. Case Study and Mission Context

### 2.1 The Saint-Sophia Cathedral Complex in Kyiv, Ukraine

The case study of this paper is the UNESCO World Heritage property “Kyiv: Saint-Sophia Cathedral and Related Monastic Buildings, Kyiv-Pechersk Lavra,” with a focus on the Saint-Sophia Cathedral complex in Kyiv, Ukraine (Figure 1). The mission focused on emergency documentation and preparedness for the World Heritage site, with attention to two components: the Metropolitan’s Residence and the Bell Tower. In addition, selected contextual recording of the site, including the South Entrance and adjacent areas was undertaken in response to local priorities and requests from the partner institutions.

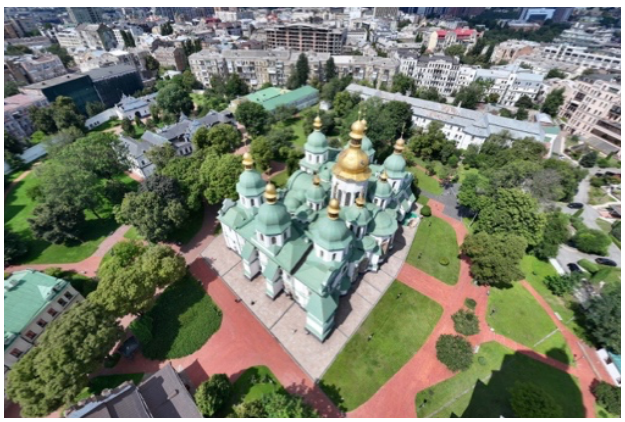

Figure 1. Aerial view of the Saint-Sophia Cathedral Complex.

The objective of the documentation was to capture the current state of conservation of the selected structures and their immediate surroundings in support of emergency preparedness and future conservation assessment. To that end, the site was documented through an integrated methodology combining GNSS and total station surveying, terrestrial laser scanning, aerial and terrestrial photogrammetry, and panoramic photography. These methods were selected according to the required level of detail, the physical conditions of the site, and the operational restrictions of working in an active conflict environment, following discussions with the staff of the National Conservation Area “Sophia of Kyiv” and the emergency preparedness specialist involved in the mission. The expected outputs included a control network, point clouds, ortho-corrected images, and measured drawings of plans, sections, and elevations.

### 2.2 The UNESCO/ICOMOS mission in 2024: documentation objectives and training framework

The mission took place in July and August 2024 within the framework of the UNESCO/Japan Funds-in-Trust Project "Support for Ukraine in Culture and Education through UNESCO / Emergency response for World Heritage and cultural property: damage assessment and protection." It was organized in cooperation with UNESCO, ICOMOS, and the Ministry of Culture and Strategic Communication of Ukraine and built upon a prior UNESCO/ICOMOS/ICCROM training course held in Ukraine in July 2023 on documentation for State of Conservation reporting and disaster risk management for World Heritage properties (UNESCO, 2023).

Guided by experts from the ICOMOS International Scientific Committee on Heritage Documentation (CIPA-HD) and the International Scientific Committee on Risk Preparedness (ICORP), the mission laid the foundation for developing guidelines for an emergency response and preparedness plan for the World Heritage site, in line with broader frameworks for disaster risk management at World Heritage properties (Stovel, 1998; UNESCO et al., 2010) (Figure 2).

Figure 2. Group photograph taken during training activities.

During the field mission in Kyiv, the team worked with staff of the National Conservation Area “Sophia of Kyiv” and documentation staff from the UNESCO Antenna Office in Ukraine through a combined programme of planning, on-site acquisition, production of outputs, consultations, technical assistance, and online follow-up. These collaborators were involved throughout the process, from theoretical instruction and methodological discussion to field practice and the review of outputs. The field campaign lasted nearly two weeks on site in Kyiv and was followed by processing and dissemination work undertaken remotely in Canada, Portugal, and Ukraine.

Within this framework, the training component was not conceived as an isolated educational activity, but as part of the documentation workflow itself (Figure 3). In that sense, the mission sought not only to generate usable digital records, but also to equip professionals with an understanding of documentation principles, recording methods, and processing workflows relevant to conservation, monitoring, and risk preparedness. This pedagogical dimension, supported by live translation, was central to the mission and helped enable the National Conservation Area staff to continue documentation activities beyond the duration of the international campaign.

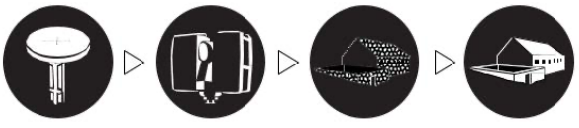

Figure 3. Documentation workflow
(Planning, Acquisition, Processing, Dissemination).

## 3. Five Components of the Training Programme

This paper discusses five interconnected components of the training programme developed during the mission. These include: (1) the preparation of training contents before travel, including the use of a “Heritage Documentation Skill Assessment Form”; (2) the structure and content of the sessions, centred on documentation principles, conservation standards, and risk preparedness; (3) training activities and didactic material, combining customized live-translated lectures, field demonstrations, and hands-on tutorials on digital photography, photogrammetry, 3D scanning, total station surveying, and the production of ortho-images and point clouds; (4) learning outcomes, targeting competencies such as understanding the role of digital data in conservation, recognizing the strengths and limitations of recording techniques, and applying introductory workflows for decision-making; and (5) the challenges of working in a conflict-affected environment, including restricted drone windows, interruptions due to air-raid alarms, limited time on site, and the need to adapt workflows continuously to ensure both safety and the quality of training outputs.

### 3.1 Preparation of training content before the mission

The preparation of the training was guided by the need to adapt its content to the background and operational realities of the participants. Ahead of the mission, a “Heritage Documentation Skill Assessment Form” was used to evaluate participants’ digital literacy, previous experience with heritage documentation, and familiarity with surveying instruments, photography, CAD and 3D modelling software, graphic software, and related equipment. Based on a self-assessment scale, the form provided a preliminary understanding of the participants’ technical profile and informed the scope and level of the training.

The assessment indicated limited previous experience with several of the tools and workflows proposed for the mission. In response, the training was deliberately structured to provide foundational knowledge in site recording principles rather than advanced technical specialization. The objective was not to produce expert users in each technique within a short field campaign, but to create a coherent introductory framework through which participants could understand the role of documentation in conservation practice, recognize the potential and limitations of different methods, and begin to engage with the logic of integrated digital workflows. This approach also responded to the limited timeframe of the training and the need to maintain a close relationship between the pedagogical activities and the documentation work undertaken on site.

### 3.2 Structure and content of the sessions

The sessions were designed to connect theoretical foundations with practical application in the field (Figure 4). Their content was centred on heritage documentation principles, conservation standards, and the role of digital information in emergency preparedness and site management. As in previous training experiences, the objective was to introduce participants to a broad range of methods while emphasizing that the selection of a documentation technique depends on the conservation question, the required level of detail, the site conditions, and the resources available on site (Burns, 2004; Letellier et al., 2007; Parks Canada, 2010; Historic England, 2017).

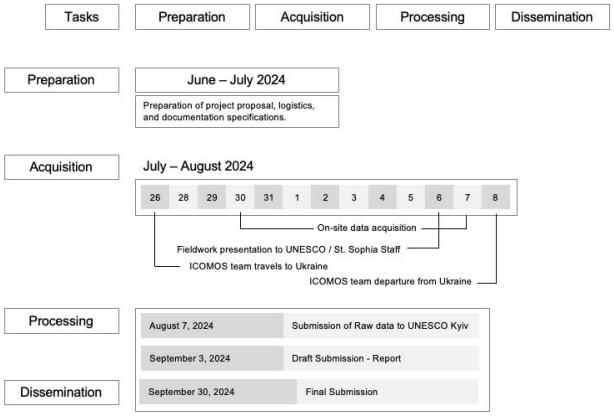

Figure 4. Training planning and workflow.

The sequence of the sessions moved from general concepts to more specific tools and workflows. Initial discussions addressed the role of documentation in conservation, the purpose of heritage records, and the relationship between data acquisition, interpretation, and future decision-making. Subsequent sessions introduced conventional and advanced recording methods relevant to the case study, including digital photography, total station surveying, photogrammetry, 3D scanning, and panoramic imaging. Given the local context, the sessions also addressed risk preparedness and the practical constraints of recording a site under threat. The training was delivered through customized live-translated lectures and adapted examples so that the technical content remained accessible and directly connected to the mission objectives.

### 3.3 Training activities and didactic material

The training combined lectures, field demonstrations, and hands-on tutorials. This pedagogical structure was intended to connect theoretical instruction with the documentation tasks carried out during the mission, particularly those related to the Bell Tower and the Metropolitan’s Residence. The fieldwork included planning, on-site acquisition, production of measured documentation outputs, and follow-up consultations. The constraints of working in an active conflict environment required a flexible documentation strategy, in which GNSS and total station surveying, terrestrial and aerial photogrammetry, 3D laser scanning, and panoramic imaging were combined and adapted to the specific conditions of the site in order to capture the required data within a limited and uncertain timeframe (Figure 5).


Figure 5. Equipment used for the heritage documentation work.

Participants were introduced to workflows for recording historic structures and processing collected data into graphic records, including ortho-images, point clouds, and line drawings. In this sense, the training was conceived in direct relation to the documentation campaign rather than as a separate activity. Particular attention was given to the relationship between data capture, control networks, geometric reliability, and the production of records that could later support conservation

assessment and the development of the risk management plan (Figure 6). The didactic material was therefore not limited to software or equipment instruction but also emphasized the purpose of each method within the broader conservation workflow.

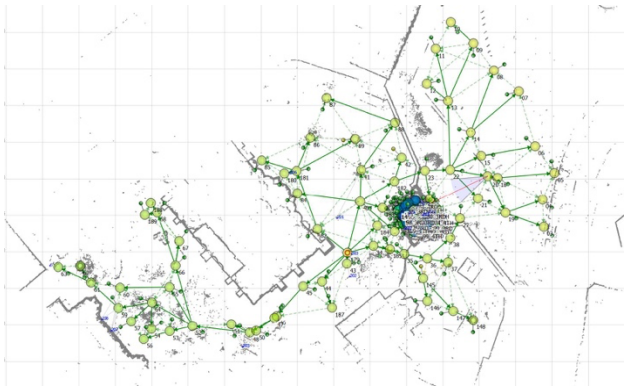

Figure 6. Exterior scan positions and registration outcome.

The deliverables produced during the mission were adjusted in situ in response to security conditions, logistical limitations, and local conservation priorities (Figures 7–12). These included ortho-corrected images, plans, sections, elevations, point clouds, and a panoramic tour. These outputs supported the pedagogical dimension by showing how different records can be combined and interpreted for conservation purposes. In this sense, the training provided not only instruction, but also exposure to a documentation cycle: planning, acquisition, processing, and dissemination.


Figure 7. Ortho-corrected image of the Saint-Sophia complex.


Figure 8. Elevation of the Metropolitan’s Residence.


Figure 9. Point cloud of the Metropolitan’s Residence.

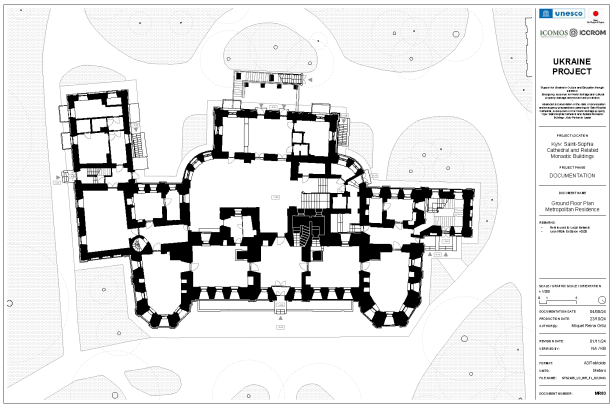


Figure 10. Traced floor plan from point cloud data.

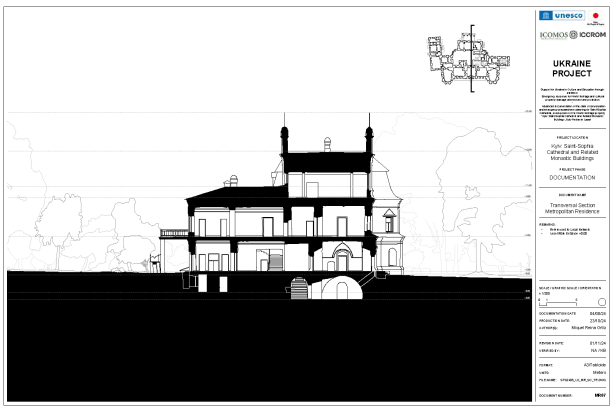


Figure 11. Traced section from point cloud data.

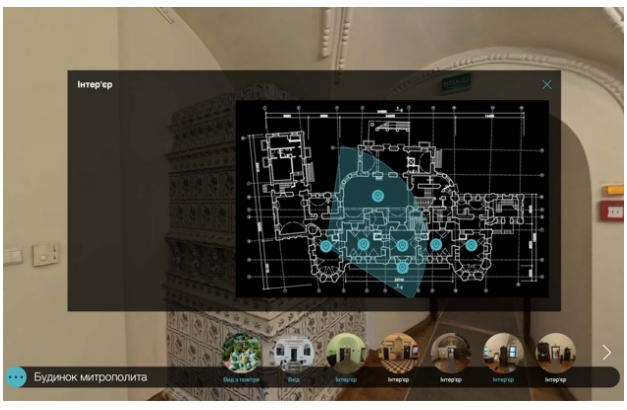


Figure 12. Panoramic tour of the Metropolitan’s Residence.

### 3.4 Learning outcomes and targeted competencies

During the field mission in Ukraine, ICOMOS developed and delivered a capacity-building programme for the staff of the National Conservation Area “Sophia of Kyiv,” in direct relation to the documentation of the Bell Tower and the Metropolitan’s Residence. Framed by UNESCO requirements, the programme was intended to strengthen participants’ understanding of how heritage documentation can support conservation practice, risk preparedness, and site management in a World Heritage property under threat.

The pedagogical component introduced essential concepts, structured workflows, and digital tools to ensure that participants understood both the theoretical foundations and the practical procedures of the selected documentation techniques (Burns, 2004; Eppich and Chabbi, 2007; Historic England, 2017; Letellier et al., 2007; Parks Canada, 2010; Waldhäusl and Ogleby, 1994).

The learning outcomes targeted a set of introductory but coherent competencies in digital heritage documentation. Participants were expected to:

- explain the role of information and digital data in the conservation of historic places in relation to national and international standards;
- identify the strengths and limitations of different heritage recording and documentation techniques;
- demonstrate basic competency in selected documentation methods, both as practitioners and informed users;
- design preliminary documentation and site analysis plans using appropriate recording techniques;
- recognize the relationship between documentation processes and sound conservation decision-making;
- appreciate the importance of coherent data integration and presentation for conservation purposes; and
- explain the need for structured technical reporting to support heritage conservation strategies.

Throughout the mission, emphasis was placed on the relationship between documentation, informed conservation decision-making, and coherent data presentation. Through expert-led instruction and in situ demonstrations, participants gained practical insight into how integrated documentation strategies can support conservation assessments, interventions, and the long-term management of historic places under threat. In this sense, the mission emphasized the role of local staff not only as future documentation practitioners, but also as informed users of digital records in conservation practice.

### 3.5 Challenges and adaptive responses in a conflict-affected environment

The documentation mission at the Saint-Sophia complex was carried out under significant operational constraints directly related to the conflict context. These conditions affected the scope, pace, and reorganization of both the documentation work and the training activities. Restricted drone windows, variable weather and lighting conditions, limited time on site, and the need for continuous adaptation all influenced the field campaign. The methodology therefore had to remain flexible enough to respond to field realities while maintaining the overall conservation objectives, an approach that is particularly relevant in crisis contexts where emergency documentation and capacity-building must support both immediate response and longer-term recovery (Tandon, 2018).

Technical resources nevertheless enabled meaningful documentation despite these constraints. The availability of a high-precision terrestrial laser scanner allowed detailed recording of selected architectural elements, while drone-based photography enabled rapid coverage of larger areas of the site. However, drone operations were limited by restricted flight windows, regulatory approvals, the need for supervision by a military authority due to security requirements, and variable weather and lighting conditions. These limitations required careful planning and underscored the value of carrying out a more comprehensive aerial and terrestrial documentation campaign once conditions allow greater flexibility and a higher standard of metric documentation.

Fieldwork logistics were further affected by security-related interruptions. Frequent air-raid alarms required the suspension of on-site activities, significantly reducing uninterrupted working time and making daily schedules unpredictable. Activities were often interrupted several times per day, with delays ranging from short pauses to periods of more than one hour. Limited access to the site therefore necessitated ongoing adjustments to workflows, with constant prioritization of safety while safeguarding the quality of documentation and training outputs. In this environment, the pedagogical programme also had to remain adaptive: while scanning and other outdoor activities were suspended, some theoretical sessions and methodological discussions continued in the shelter. This experience highlighted the importance of flexible methodologies for documentation training in high-risk environments.

Constraints related to data processing, georeferencing, and long-term coordination also shaped the mission’s outcomes. Temporary access to additional equipment, including GNSS/RTK resources and drone batteries, proved highly valuable, while also highlighting the need for dedicated institutional resources beyond short-term arrangements. Processing time was insufficient to develop all datasets into comprehensive deliverables, pointing to the need for additional funding to extend processing, provide further training to Ukrainian site staff, or support collaboration with specialized academic or professional institutions. The absence of a standardized geodetic reference system across the site further reinforced the importance of establishing shared technical frameworks to support future documentation efforts in similarly challenging environments.

## 4. Discussion

### 4.1 The pedagogical value of integrating documentation and emergency preparedness

This case study shows that, in conflict-affected contexts, documentation and training should not be conceived as separate undertakings. The Saint-Sophia mission demonstrates that a documentation campaign can at the same time generate records for emergency preparedness and create a pedagogical framework for local capacity-building. This is particularly important at World Heritage sites under threat, where the long-term usefulness of the records depends in part on the ability of local professionals to understand, manage, update, and mobilize them in future conservation activities.

The mission also illustrates the value of a pedagogical model based on realistic expectations. In a short and constrained field campaign, the objective was not advanced specialization in each digital technique, but the development of a coherent

understanding of heritage documentation as a process linked to conservation, monitoring, and preparedness. The use of a skill assessment form, the combination of theory and practice, and the emphasis on integrated workflows were all important in aligning the training with the participants’ needs and the mission’s operational context. In that sense, the mission confirms the relevance of adaptable and modular teaching approaches in digital heritage documentation.

A further contribution of the mission was the integration of multiple fields of expertise within a common training framework. In this case, heritage documentation was not treated as a technical exercise alone, but as part of a broader dialogue linking conservation practice, site management, and risk preparedness. The collaboration between UNESCO and ICOMOS (CIPA-HD and ICORP) reinforced this approach by bringing together perspectives from heritage management, documentation, and emergency planning. In pedagogical terms, this made it possible to situate digital recording methods within a wider understanding of how cultural heritage can be assessed, managed, and protected in contexts of risk and conflict.

### 4.2 Transferability to other World Heritage sites at risk

While the pedagogical approach described here was developed for the Saint-Sophia mission, several of its components may be transferable to other World Heritage sites at risk. These include the use of preliminary skill assessment, the integration of training within an actual documentation workflow, the articulation of learning outcomes around conservation use rather than technical specialization alone, and the need to adapt the programme continuously to field constraints. The five-component structure presented in this paper may therefore serve as a useful reference for future documentation missions in contexts of emergency, conflict, or severe operational limitation.

At the same time, transferability should not be understood as the replication of a fixed model. Each heritage site presents different conditions of significance, scale, access, staff experience, available equipment, and security. What we propose to transfer is an approach in which training in digital documentation is adapted to the specific heritage place, the conservation questions being addressed, and the institutional capacity of the actors involved. This also requires working within multidisciplinary teams, where documentation, conservation, site management, and risk preparedness are addressed together rather than as separate concerns. Equally important are the communicative conditions of the mission, since live translation and multilingual exchange can significantly affect the pace of theoretical sessions, practical demonstrations, and the overall sequencing of the training. From this perspective, the Saint-Sophia experience suggests that meaningful capacity-building can be developed even under severe constraints, provided that the programme remains coherent, realistic, and closely tied to the conservation purpose of the documentation.

## 5. Conclusion

This paper presented a tailored pedagogical approach to heritage documentation developed during the 2024 UNESCO/ICOMOS mission to the Saint-Sophia Cathedral complex in Kyiv, Ukraine. Conducted in the framework of emergency documentation and preparedness for a World Heritage site under threat, the mission combined digital recording with a dedicated capacity-building programme for the staff of the National Conservation Area “Sophia of Kyiv.” The discussion was structured around five interconnected components of this training programme: the preparation of contents before travel, the structure of the sessions, the training activities and didactic material, the intended learning outcomes, and the adaptive responses required by a conflict-affected environment.

The case study shows that digital documentation missions in high-risk contexts can serve not only to produce measured records, but also to strengthen the local knowledge needed to support conservation, monitoring, and emergency preparedness over time. The pedagogical value of the mission lay in linking documentation techniques to their conservation purpose, adapting the training to the background of the participants, and situating it within the documentation workflow itself. At the same time, the mission demonstrated the importance of flexibility in contexts marked by security interruptions, limited access, logistical constraints, and multilingual communication.

Further work should build on this experience by supporting additional training, expanding data processing and management capacity, and consolidating technical frameworks for future documentation campaigns. In this way, the records produced and the knowledge transferred may contribute not only to the immediate needs of the site, but also to the longer-term development of emergency preparedness and risk management strategies for World Heritage properties under threat (Figure 13).

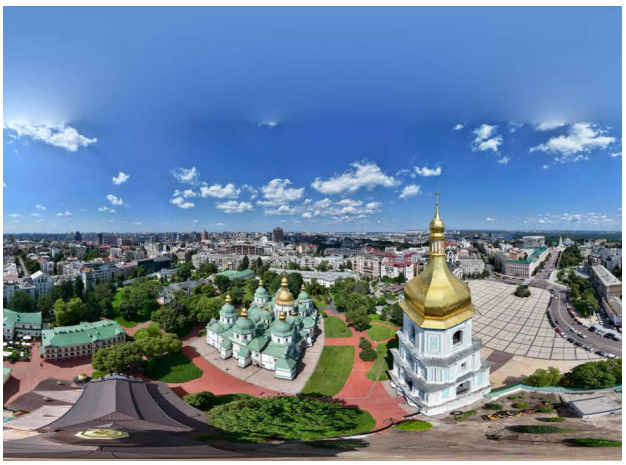

Figure 13. Aerial panorama of the World Heritage Site Saint-Sophia Cathedral and Related Monastic Buildings.

## 6. Acknowledgements

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