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PROCULTHER-NET 2
PROTECTING CULTURAL HERITAGE
FROM THE CONSEQUENCES OF DISASTERS - NETWORK

TECHNICAL BULLETIN

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ProCULTHER-NET 2
PROTECTING CULTURAL HERITAGE
FROM THE CONSEQUENCES OF DISASTERS - NETWORK

TECHNICAL BULLETIN

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Technical Bulletin

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From data interrelationships to capacity building and public awareness: the instance of Ravenna (Italy) and project SIRIUS - management strategies for cultural heritage at risk, Sara Fiorentino, PhD, Junior Assistant Professor, Tania Chinni, PhD, Technical-administrative sector, Marco Cornaglia, PhD, Research Fellow, Prof. Alessandro Iannucci, Full Professor, Prof. Mariangela Vandini, Associate Professor, University of Bologna, Italy

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Holistic Risk Management at the Prussian Cultural Heritage Foundation, Alke Dohrmann, PhD, and Almut Siegel, Project Managers of the SiLK, and Research Associates Holistic Risk Management, Rathgen-Forschungslabor, Staatliche Museen zu Berlin, Stiftung Preußischer Kulturbesitz, Germany

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THE PROJECT



PROCULTHER-NET 2

PROTECTING CULTURAL HERITAGE
FROM THE CONSEQUENCES OF DISASTERS - NETWORK

PROCULTHER-NET 2 is co-funded by the Directorate-General for European Civil Protection and Humanitarian Aid Operations - DG-ECHO under the European Union Civil Protection Mechanism - UCPM, and implemented by a Consortium led by the Italian Civil Protection Department (Italy) in collaboration with the Ministry of Interior-Disaster and Emergency Management Authority - AFAD (Türkiye), the German Archaeological Institute - DAI (Germany), the *Ministère de l'In-*

térieur - Direction Générale de la Sécurité Civile et de la Gestion des Crises (France), the *Fondazione Hallgarten - Franchetti Centro Studi Villa Montesca*, the Ministry of Culture and Tourism of the Region Government of Castilla y León (Spain), the Federal Agency for Technical Relief - THW (Germany), the University of Porto - UPORTO (Portugal) and the Suor Orsola Benincasa University - UNISOB (Italy).

Building on the experience and lessons learnt by the previous PROCULTHER EU-funded initiatives implemented under the framework of the Union Civil Protection Knowledge Network- UCPKN, PROCULTHER-NET 2 aims at implementing the pathway mapped out by the PROCULTHER-NET project to consolidate the inclusion of the protection of cultural heritage at risk in the Union Civil Protection Mechanism - UCPM processes and structures, so as to increase disaster preparedness capacities and knowledge at European and national levels.

The ongoing phase, running from January 2024 to December 2025, moves forward to consolidate and further expand the thematic community on the protection of cultural heritage at risk established within the UCPKN, namely for defining elements for its sustainable governance and functioning.

Join the KN and find out more on [PROCULTHER-NET!](#)



FOREWORD

By Fabrizio Curcio, Head of the Italian Civil Protection Department-Presidency of the Council of Ministers

As project coordinator of PROCULTHER-NET 2, I am delighted to introduce the new issue of the technical bulletin. This publication, alongside forthcoming issues, is designed to meet the growing demand for risk-informed approaches and to promote the cross-fertilization of technical and operational expertise essential for enhancing the protection of cultural heritage at risk.

The significant contributions featured in this issue highlight a paradigm shift occurring at the European level. However, the path towards the achievement of full recognition of cultural heritage protection as an integral part of civil protection is still long and PROCULTHER-NET is fully engaged towards the fulfilment of this objective. Indeed, it is no coincidence that all technical contributions stress the critical need to strengthen coordination among cultural heritage and disaster risk management actors and sectors.

The PROCULTHER-NET 2 goals were set to identify capacities, address needs and drive technical and technological innovation. Therefore, the knowledge presented lays the groundwork for fostering collaboration across cultural heritage, disaster risk management, scientific, research, humanitarian, military, and technology sectors pertaining to cultural heritage protection.

Moreover, the co-financing of initiatives, such as this one, by the Union Civil Protection Mechanism reaffirms its commitment to reinforcing cooperation among EU countries and the ten participating states on civil protection. Advancing the role of the Union Civil Protection Knowledge Network is pivotal for sharing knowledge and improving prevention, preparedness, and response efforts to reduce risk of disasters.

In the name of all of the Italian Civil Protection Department, we take pride in contributing to this significant achievement, which strengthens capacity-building processes, by leveraging the great potential for resilience inherent in cultural heritage to sustainably reduce the vulnerability of our communities at risk. For this reason, we express our sincere gratitude to all countries, cultural heritage and disaster risk management institutions, experts and reviewers, who are devoting their efforts to this important knowledge-sharing process.

We encourage you to make the most of this technical bulletin and engage with the PROCULTHER-NET community to further our collective goals.



INTRODUCTION

By Editorial Committee

Building on the foundations laid by PROCULTHER-NET, this third edition of the Technical Bulletins offers cultural heritage and disaster risk managers a new selection of articles on the protection of cultural heritage from the effects of disasters.

In order to contribute to enhance a broad and diverse thematic community on cultural heritage in crisis – one of the objectives of the Union Civil Protection Knowledge Network (UCPKN) – a Europe-wide call for contributions was launched for this issue through the UCPM Focal Points and the PROCULTHER-NET 2 network. This led to the opening of the Technical Bulletins to countries outside the project's Consortium. We are pleased to welcome articles from Hungary and Slovakia, as well as contributions from France, Germany, Italy, and Spain.

A new review system has been introduced to improve replicability and knowledge transfer. Following acceptance of a short concept note, authors were invited by the Editorial Board to submit a full article for review by at least two experts with complementary backgrounds. The reviewers were identified through the networks of the Consortium Partners, mostly outside their own organizations, thus further broadening the thematic community. We would like to warmly thank the reviewers from France, Germany, Italy, and Portugal, but also from Albania, Lebanon, and the USA for their constructive feedback.

The 3rd issue of the Technical Bulletin opens with two articles dedicated to **PREVENTION**. The SiLK Guidelines, a German online tool, is aimed in particular at small and medium-sized cultural organizations. Based on lessons learned from past disasters, this self-assessment tool contributes to raising awareness of the risks and hazards that threaten cultural heritage.



The field exercise during the PROCULTHER-NET training course, March 2023 © DPC

A concrete application of risk assessment tools and awareness-raising communication is offered by the Department of Cultural Heritage of the University of Bologna, which has implemented the SIRIUS project. Using the city of Ravenna as a case study, it assessed the territorial risks to the local cultural heritage and sought to develop a “risk culture” among the general public, with a focus on young people.

The **PREPAREDNESS** section brings forward several examples of efficient risk management and organizational strategies. The Hungarian National Museum presents an overview of the pilot projects it has launched in cultural heritage protection, ranging from establishing an extensive national and international network to disaster risk management planning.

These measures are echoed by the holistic risk management plan developed by the Prussian Cultural Heritage Foundation, which is in charge of five cultural institutions in Germany. Led by a Task Force Risk Management, it aims to enhance emergency planning across organizations, adapting to their specificities and collections.

Bringing this cooperation model to another scale, the German Preparedness Networks for the Protection of Cultural Property promotes the creation of local or regional networks of cultural institutions and civil protection agencies. Together, they pool resources and equipment and organize inter-institutional and cross-sectoral training, thus building capacities at a local level.

The **RESPONSE** section presents a series of articles on fire and its impact on movable and immovable heritage, a few months after the devastating example of the Borsen fire in Copenhagen.

An article co-authored by Blue Shield France and the Slovak Mining Archives tells the story of the fire in Banská Štiavnica and the emergency measures taken to evacuate the archives. It illustrates cross-sectoral and international cooperation.

Another example of dealing with a fire in a historical building is provided by the Territorial and Central Cell of the Unit for Risk Management and Emergencies in Cultural Heritage of the Junta Castilla y León (UGRECYL), which examines the case of the fire in the Trinity Church in Segovia in 2023, focusing on the event and the response intervention.

As a direct follow-up to the previous article, the **RECOVERY** section includes a complementary contribution from the Conservation and Restoration Centre of the Junta de Castilla y León, which presents the effects of the fire on three paintings recovered from the church and the following restoration process.

Moving on from movable to immovable heritage, an article from the Italian Ministry of Culture opens the **FOCUS ON** section and tackles the vast subject of debris management in a cultural heritage setting. In particular, it explores the classification and methodologies set up in Italy to sort and intervene in different types of debris. The article is divided into two parts: in this issue, it focuses on regulatory provisions and operational guidelines, while in the next issue a second contribution will complete the picture with some examples from the earthquake that hit Central Italy in 2016. The other contribution looks at virtual reality. Based on the results of the PROCULTHER-NET project, this article addresses the issue of better integration of cultural heritage in virtual reality tools and their application in sectors such as documentation, planning, training and restoration.

SiLK - Guidelines for the Protection of Cultural Property

Almut Siegel and Alke Dohrmann, PhD, Project Managers of the SiLK - Guidelines for the Protection of Cultural Property, Germany and Research Associates Holistic Risk Management, Rathgen-Forschungslabor, Staatliche Museenzu Berlin, Stiftung Preußischer Kulturbesitz, Germany

Introduction

The *SiLK guidelines* - **SiLK-Tool, English version** - are a free online tool for risk management and disaster preparedness. Using *SiLK*, cultural institutions can evaluate the potential risks for their collections and monuments and obtain guidance in dealing with possible threats. *SiLK* comprises introductory information, interactive questionnaires and a knowledge base for all issues concerning the protection



1. SiLK logo © SiLK

of cultural heritage in museums, libraries, archives, monuments and sites.

The guidelines help staff check their protection efforts, and provide tips and possible solutions. They include a wide range of information of interest to others in the field and raise awareness for the protection and conservation of cultural heritage in general.

Background

The acronym “*SiLK*” stems from the initial letters of the German title, “*SicherheitsLeitfaden Kulturgut*”, which means *Guidelines for the Protection of Cultural Property*. The *SiLK project (SiLK - SicherheitsLeitfadenKulturgut)* was initiated in 2006 by the German Conference of National Cultural Institutions (KonferenzNationalerKultureinrichtungen/KNK), a union of more than twenty outstanding cultural organizations in the former East Germany, after two devastating disasters hit institutions of the KNK: the fire of the Duchess Anna Amalia Library of The KlassikStiftung Weimar in 2004 and the flood of the Elbe river in 2002, which threatened several outstanding cultural heritage sites among those the Gartenreich Dessau-Wörlitz with its unique palaces and gardens as well as the Dresden “Zwinger” with the Old Masters Picture Gallery (Gemäldegalerie Alte Meister) and the Sculpture Collection up to 1800 (Skulpturensammlungbis 1800), both parts of the Dresden State Art Collections (Staatliche Kunstsammlungen Dresden).

After these terrible events, since 2005, the KNK has devoted itself to implementing security and disaster protection protocols for museums, archives and libraries. In October 2006, the KNK hosted an international conference on the topic. The participants discussed numerous aspects, including formal and legal requirements, disaster protection policies and preventive conservation measures. At the conference, the participating institutions expressed a need for more detailed information. The response was

the creation of an online database which serves as a comprehensive reference work and resource for information on all matters related to safeguarding the cultural assets in museums, libraries and archives.

Funding

From 2006 on the project was financed by the Federal Government Commissioner for Culture and the Media (Beauftragte der Bundesregierung für Kultur und Medien/ BKM). In 2015, the funding of SiLK was taken over by the Federal Office for Civil Protection and Disaster Assistance (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe/BBK), an executive agency of the Federal Ministry of the Interior and Community (Bundesministerium des Innern und für Heimat), responsible for matters related to civil protection and disaster assistance.

Structure

The SiLK guidelines assemble 14 chapters including the following topics:

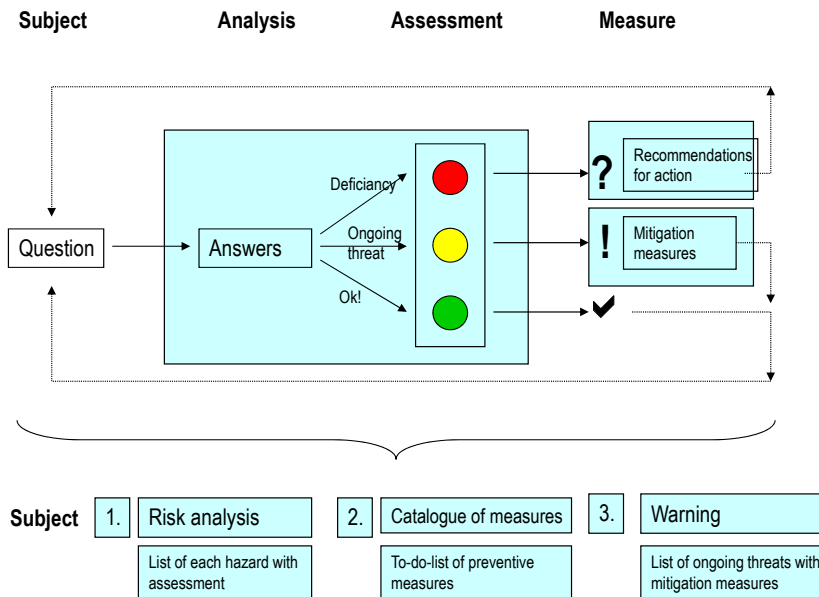
- | | |
|--------------------------------|--------------------|
| 1. security management | 8. climate |
| 2. fire | 9. light |
| 3. flood | 10. pests/mold |
| 4. theft | 11. pollutants |
| 5. vandalism | 12. severe weather |
| 6. accidents/malfunctions | 13. earthquakes |
| 7. deterioration/wear and tear | 14. violence |

Each chapter has an associated introduction, questionnaire and knowledge base (see below 2. Structure of the SiLK-chapters), with the questionnaire forming the core element.

Guidelines for the Protection of Cultural Property				
Subject	Structure	A. Introduction	B. Questionnaire	C. Knowledge base
		General explanations on each subject	Risk analysis / recommendations for action	Literature, links, contacts, examples, other documents
1. General		Introduction General	Quest. General	DB General
2. Fire		Introduction Fire	Quest. Fire	DB Fire
3. Flooding		Introduction Flooding	Quest. Flooding	DB Flooding
4. Theft		Introduction Theft	Quest. Theft	DB Theft
5. Vandalism		Introduction Vandalism	Quest. Vandalism	DB Vandalism
6. Accidents/malfunctions		Introduction Accidents	Quest. Accidents ...	DB Accidents/malfunct.
7. Deterioration/wear-tear		Introduction Deterio...	Quest. Deterioration ...	DB Deterioration/wear..
8. Climate		Introduction Climate	Quest. Climate	DB Climate
9. Light		Introduction Light	Quest. Light	DB Light
10. Pests / mold		Introduction Pests ...	Quest. Pests/mold	DB Pests/mold
11. Pollutants		Introduction Pollutants	Quest. Pollutants	DB Pollutants
12. Severe weather		Introduction Severe w.	Quest. Severe weath.	DB Severe weather
13. Earthquakes		Introduction Earthqua.	Quest. Earthquakes	DB Earthquakes
14. Violence		Introduction Violence	Quest. Violence	DB Violence

2. Structure of the SiLK-chapters
© SiLK

After answering all the questions, users obtain a “traffic light assessment”: if the minimum standard is not reached (“Red”) or if an ongoing threat exists (“Amber”), the assessment will include recommendations for action or mitigation measures (see below 3. Principle of the *SiLK*-questionnaire).



3. Principle of the *SiLK*-questionnaire © SiLK

The assessment can be saved as a PDF document and printed. After which, *SiLK* users not only obtain an evaluation result, but also practical advice on how to further work on the specific shortcomings in order to optimize the safety situation of their collections or monuments.

The introduction of each chapter provides general information on the topic and additional experts insights, explaining technical terms and specialised knowledge. This enables users to engage with the specific subject and understand the questions. The knowledge base contains further information on each topic, such as lists of specialist publications, applicable guidelines and standards, examples and reference material (e.g. emergency plans), definitions and links (mostly in German, some in English).

Principles and target group

SiLK is free of charge and accessible anonymously for everybody without registration, ensuring that no sensitive user data can be lost or abused. *SiLK* addresses all kinds of cultural institutions regardless of collection type, size, organisation and structure and all professionals as well as any interested individual. The main target

group are small and middle size museums, archives and libraries without any specialised personnel in the field.

The guidelines are easy to use and accessible to everybody regardless of prior knowledge. To achieve this aim, *SiLK* offers information at all professional levels: experienced and even specialized users may find further information in the knowledge base while untrained personnel can get necessary basic information by reading the introductory texts. Thus, the *SiLK-Tool* is an instrument for self-help for anyone interested in or entrusted with cultural heritage protection matters.

Prevention

By seeking to protect cultural heritage, *SiLK*'s primary objective is prevention: every effort should first be made to prevent an incident or to reduce the probability of its occurrence to the greatest possible extent. Prevention is the most effective and economically efficient solution in risk management and, therefore, a contribution to sustainability. Should emergencies or disasters strike nonetheless, the specified organizational, structural and technical protective measures will help to minimize the damage suffered. This approach also addresses hazards that cause or contribute to gradual deterioration over time, such as the use of archive materials or the wear and tear from museum visitors. The same applies to harmful environmental effects such as climate factors, light, radiation, pests, and pollutants. All the protective measures specified are intended to minimise these harmful effects.

Development and revision of *SiLK*

The *SiLK-project* was founded, created and is still managed by Almut Siegel (architect, specialist in cultural property protection) and Alke Dohrmann (social anthropologist, specialist in cultural property protection). To complete the specific chapters, the project managers established a team of experts, consisting of one or two specialists for each topic, including scientists, engineers, conservators, and other cultural heritage specialists. Among them are specialists in various fields, such as lightning experts (Chapter Light), fire protection officers (Chapter Fire), criminalists (Chapter Theft and Vandalism), engineers in technical building equipment (Chapter Accidents/Malfunctions), security specialists (Chapter Severe Weather), entomologists (Chapter Pests/Mould), building physicists (Chapter Climate), former military experts from the German armed forces (Chapter Violence), and many other experts.

The texts and questionnaires were put online in 2012 (with the first half already available in 2010). During the development process, the specialists were responsible for proposing the content of each chapter, while the *SiLK* team assisted with editing, choosing details, and held overall editorial responsibility.

All texts were discussed and tested in interdisciplinary workshops to ensure they were correct and comprehensive. The aim was to make all *SiLK* information easily accessible, even for non-experts in the field. Therefore, links between chapters connect information

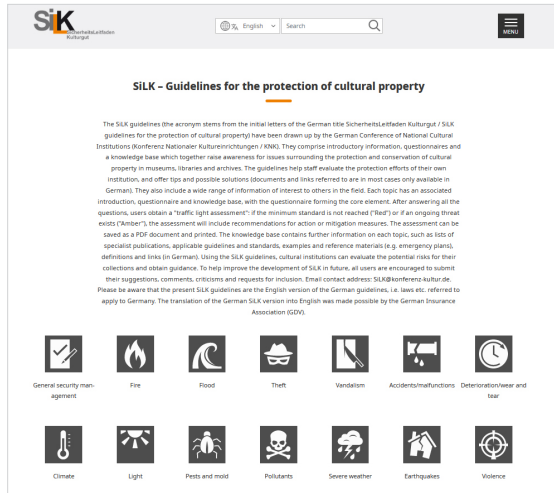
or provide additional material where helpful or necessary. Furthermore, the questionnaires include comments with additional explanations, which can be downloaded and read if needed. These comments address difficult questions, offer further information on the topic, explain technical terms, or provide basic knowledge on specific issues.

Relaunch in 2021

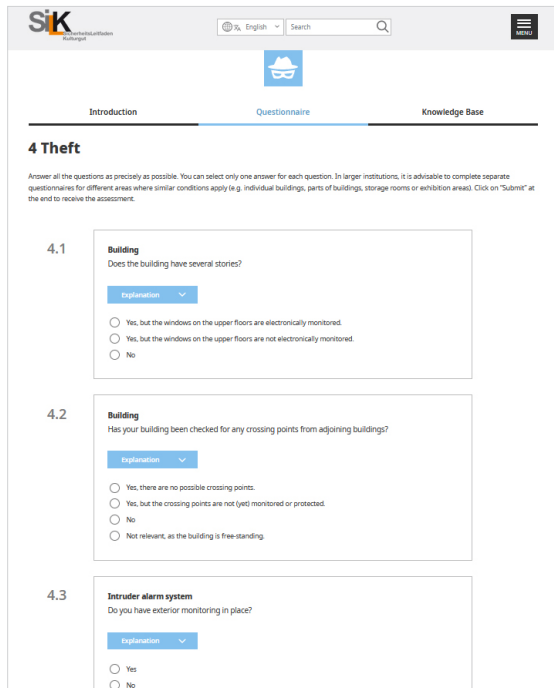
In 2021, *SiLK* was completely revised and relaunched in a new and more clearly arranged design.

Now, each chapter is symbolised by its own easily recognisable icon and colour scheme that guides users through the different parts of the website (Introduction - Orange, Questionnaire - Blue, Knowledge Base - Green). Furthermore, all texts have been carefully reviewed and updated to reflect the latest scientific knowledge and new technical standards.

The *SiLK* platform is managed and continuously updated to meet the latest standards and knowledge by the “*SiLK GbR*,” led by Almut Siegel and Alke Dohrmann. It is publicly funded, with current support from the Federal Government Commissioner for Culture and the Media. The project managers are working to transition from short-term funding to a long-term public financing model in collaboration with other public institutions. This approach aims to keep the platform ac-



4. Screenshot Website *SiLK*-Tool: cover page with risk icon © *SiLK*



5. Screenshot Website *SiLK*-Tool: Questionnaire Theft -English version © *SiLK*

cessible and relevant in the long term and to plan and implement further improvements and developments.

International relevance

The *SiLK Guidelines* were translated into English in 2016, thanks to funding from the German Insurance Association (Gesamtverband der Deutschen Versicherungswirtschaft/GDV). In 2019, an Arabic version of *SiLK* was produced in cooperation with the German Archaeological Institute (Deutsches Archäologisches Institut/DAI) and financed by the Federal Foreign Office (Auswärtiges Amt). *SiLK* is currently one of the most comprehensive tools available in the field of risk analysis and emergency planning. Several checklists and guidelines¹ pursue similar goals by providing questionnaires or lists aimed at indicating minimum standards or offering practical advice. Among these tools are “Be Prepared – Guidelines for Small Museums for Writing a Disaster Preparedness Plan” from the Collections Australia Network, the Swiss “Leitfaden für die Erstellung eines Notfallplans” from the Bundesamt für Bevölkerungsschutz (BABS) (in German), and the Dutch “Handleiding voor het maken van een calamiteitenplan voor collectie-beherende instellingen” from the Instituut Collectie Nederland.

The specificity from *SiLK* is that it offers interactive and individualised evaluation, with practical suggestions and detailed mitigation measures tailored to the specific situation of each cultural institution and its collections. Therefore, it serves not only as an evaluation tool but also as a personalised advisor for enhancing the institution’s security level. Additionally, it adopts a holistic approach, addressing all potential hazards.

Application of *SiLK*

The *SiLK-Tool* is well known in German-speaking countries and is used by many cultural institutions, associations, administration units, public and representative bodies, while the clientele is still growing: In 2023 *SiLK* counted almost 22,000 views, while the first half of 2024 shows almost 18,000. The most frequently visited page is the one on *general security management*. *SiLK* is most frequently used in Germany, followed by Saudi Arabia, Algeria, Morocco, Syria, Iraq, Jordan, Turkey and Libya.

SiLK is not only used for evaluating collections but also serves to facilitate planning processes and support teaching and research activities. For instance, the new

¹For example:

- Canadian Conservation Institute (ed.). *Emergency Preparedness for Cultural Institutions*. CCI Notes 14/1, 14/2. Ottawa 1995.
- W. C., Faulk, Getty Conservation Institute. *Preparing for your disaster: it is not a matter of “if” but when!*, November 2002.
- W. Hekman, (Hrsg.), ICMS/ICOM. *Handbook on emergency procedures*. 2010. [<http://icom-armenia.mini.icom.museum/wp-content/uploads/sites/28/2020/10/HANDBOOK-ON-EMERGENCY-PROCEDURES.pdf>].
- Heritage Preservation, National Institute for the Conservation of Cultural Property. *Emergency Response and Salvage Wheel*. Washington D.C. (USA), 2006.

building for the Historical Archive of the City of Cologne, which was constructed to replace the former building that collapsed in 2009, was planned with the help and information provided by the *SiLK-Tool*.

The feedback² of users shows that the information and advice gained by working with the *SiLK* database helps to improve the security level of collections and buildings by implementing recommended improvements. And it also shows general problems and raises awareness in the public sector and administration of cultural heritage.

Further improvements and projects

As *SiLK* offers a holistic approach in a very detailed and easily accessible way, there are plans to translate the *SiLK-Tool* into additional languages like French, Spanish and Portuguese in order to reach more interested users. Further improvements and extensions are planned for the *SiLK-Tool*, including the development of a simple risk ranking method. This feature will help users identify the most important threats affecting their specific situation, allowing them to choose the most relevant *SiLK* topics for their needs. However, all future activities are limited by the amount of funding that can be obtained for any developments ahead.

Additional tasks and activities

Besides the work on the guidelines, the *SiLK project* provides international conferences, lectures, workshops, publications, newsletters, and reports. Since 2006, every three years, the international *SiLK* conference *KULTUR!GUT!SCHÜTZEN!* is held including the publication of conference proceedings.

The *SiLK* team is involved in several regional, national and international committees and shares its knowledge by contributing in standardization working groups. The *SiLK* managers furthermore give lectures and teach in all kinds of training and study contexts such as conferences, universities, associations and agencies. They also pu-



6. International *SiLK*-Conference: *KULTUR!GUT!SCHÜTZEN!* 2018 in Leipzig, Germany © Karin Ries, BBK

² In order to protect sensitive data and information of the cultural institutions no individual detail or example can be published.

blish articles, books and brochures in professional and general media in order to raise awareness and share experiences in all fields of cultural heritage protection. In 2021, the introductory texts of the *SiLK Guidelines* were published as a hard cover book distributed already in second edition by the BBK.³

Since 2020, the *SiLK* team has additionally taken over the responsibility for the coordination of the *German disaster preparedness networks for cultural property protection (Notfallverbände Kulturgutschutz)*.⁴

Conclusion

With all its activities, *SiLK* has established a wide network of experts and professionals in all kinds of specialisations in cultural and scientific institutions, agencies, associations and professional fields. Thus, *SiLK* has become a platform for information and exchange on all topics related to the practical protection of cultural heritage in Germany as well as at international scale.



7. International SiLK-Conference: KULTUR!-GUT!SCHÜTZEN! 2018 in Leipzig, Germany

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³ [https://www.bbk.bund.de/SharedDocs/Downloads/DE/Mediathek/Publikationen/Kulturgutschutz/silk-sicherheitsleitfaden-kulturgut.pdf?__blob=publicationFile&v=2]

⁴ See in this same issue: A. Siegel, A. Dohrmann, *Preparedness Networks Cultural Property Protection in Germany*, p. 41ff.

From data interrelationships to capacity building and public awareness raising: the Ravenna (Italy) example and SIRIUS Project- management strategies for cultural heritage at risk

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Over the past few decades, the idea of risks affecting cultural heritage has gradually changed from post-World War II protection concerns and single-event response plans to the need for a managerial approach and integrated assessments.¹ More recently, prioritisation strategies in museums that combine preventive conservation of collections with the use of risk management cycles have emerged, providing the opportunity to incorporate risk assessment procedures, in a more thorough way, in site-planning activities.² Today, a variety of measures are being implemented by Nations around the world to protect cultural assets against disaster threats, based on the relevant conventions, regulatory frameworks, and recommendations.³ International disaster risk reduction frameworks, as the Sendai Framework for Disaster Risk Reduction and the Hyogo Framework for Action, acknowledge the connections between different aspects of culture, risk reduction, and resilience. Aside from having a significant impact on sustainable development, poverty reduction, and economic prosperity, cultural heritage can contribute to the resilience of impacted

¹ Jokilehto J., *Iccrom's Involvement in Risk Preparedness*. In: *Journal of the American Institute for Conservation*. 2013 (39): 173-179. Accessed 22 May 2024. [<https://doi.org/https://doi.org/10.1179/019713600806113275>]

Matiz Lopes P.J., *Integrated risk assessment for cultural heritage sites: a holistic support tool for decision-making*. Lucca: University of Lucca, 2016. [http://e-theses.imtlucca.it/195/1/Matiz_phdthesis.pdf]

² Michalski S., Pedersoli J.L., *The ABC Method: a risk management approach to the preservation of cultural heritage*. Ottawa: Canadian Conservation Institute, 2017. Accessed 5 July 2024. [https://www.iccom.org/sites/default/files/2017-12/risk_manual_2016-eng.pdf]

Tandon A., *Endangered heritage: emergency evacuation of heritage collections*. Paris: UNESCO, International Centre for the Study of the Preservation and Restoration of Cultural Property, 2016.

³ UNESCO, *Convention Concerning the Protection of the World Cultural and Natural Heritage*, [1972]. [<https://whc.unesco.org/en/conventiontext/>]

Preventionweb. 2005. *Kyoto declaration 2005 on Protection of cultural properties, historic areas and their settings from loss in disasters*. Accessed 22 May 2024. [<https://www.preventionweb.net/publication/kyoto-declaration-2005-protection-cultural-properties-historic-areas-and-their-settings>]

populations in post-disaster scenarios. Therefore, international frameworks offer supportive policy environment for mainstreaming disaster risk management to protect cultural heritage assets.

The paper discusses the methodological approach and preliminary results obtained within the SIRIUS project- strategies for the management of cultural heritage at risk.⁴ Led by the Department of Cultural Heritage of the University of Bologna, the project foresees a local adaptation of the recommendations promoted at an international level on disaster risk management, using the city of Ravenna as a case study. The project started in 2021 with the activation of a research line addressing the territory's needs. For the first two years of implementation, SIRIUS was supported by Fondazione Flaminia and the Municipality of Ravenna and, in 2023, it was integrated in the PNRR PE05 CHANGES "Cultural Heritage Active Innovation for the Next-Sustainable Society project. The team currently consists of three associate professors, two full professors, two junior assistant professors, and one post-doc from the University of Bologna. SIRIUS aims to support local bodies and institutions in improving the procedures for monitoring, preventing, and mitigating the risks to which cultural heritage is vulnerable, by developing cross-sectoral approaches and encouraging cooperation among disaster risk managers, cultural heritage actors, and knowledge holders to increase the resilience of civil society. The project intervenes in three areas: collection and interrelation of data on territorial risks; capacity building and knowledge transfer; communication and awareness raising among citizens.

Action 1. Toward a Risk Atlas linking data on territorial risks and cultural heritage

In order to further understand the territorial risks affecting the Ravenna area and how they relate to cultural heritage, the SIRIUS team, the Municipality of Ravenna, and the Territorial Office of Civil Protection collaborated closely to facilitate the collection and interrelation of pre-existing data.

A localised Risk Atlas was set-up as a preliminary, interoperable tool. It is a WebGIS platform that provides an overview of the natural hazards affecting the Ravenna area, specifically related to cultural heritage. The fundamental concept is derived from the "Carta del Rischio"⁵, an information system that offers administrative and scientific support to state and agencies tasked with protecting cultural heritage asset, The Risk Atlas, on the other hand, is set up as a locally scaled tool, which enables local operational bodies to consider the risks that affect Ravenna's region with greater precision.

Geodata from the WebGIS of the Cultural Heritage of Emilia-Romagna area, which

⁴ Alma Mater Studiorum Università di Bologna. 2024. RESTART-RESilienza e Sviluppo Territoriale: patrimonio A Rischio e Tutela. Accessed 22 May 2024. [<https://site.unibo.it/resilienza-patrimonio-culturale/it>]

⁵ Ministero della Cultura, Istituto Centrale del Restauro. 2004. Carta del Rischio. Accessed 22 May 2024. [<http://www.cartadelrischio.beniculturali.it/login>]

was created in 2012, when a severe earthquake occurred⁶, were used to map Ravenna's cultural heritage. Each cultural asset in the Risk Atlas is marked by a circular placeholder featuring a summary file that links up to the Ministry website, "Vincoli in Rete".⁷ For the data collection of territorial risks, the starting point was an in-depth analysis of the Municipal Civil Protection Plan of Ravenna.⁸ The Plan states that Ravenna, which is home to 98 buildings of historical interest and 8 monuments listed on the UNESCO Cultural Heritage List, is vulnerable to a wide range of risks, including those related to flooding, seismic activity, subsidence, heat waves, forest fires, transport of hazardous goods, electrical blackouts, industrial accidents. Although the Municipal Civil Protection Plan indicates cultural heritage as one of the most "relevant elements" in Ravenna's territory, a dedicated intervention strategy is still not in place.

Working in synergy with the Territorial Office of Civil Protection, the decision was made to focus on flooding, subsidence, and earthquakes because these were the main territorial risks that could be further explored through open, exportable, and interoperable datasets using the WebGIS system.

For the risk of flooding, the collection of data relating to the Ravenna area was carried out through the public portal of the Emilia-Romagna Region "Portale minERva".⁹ The collaboration with the Territorial Office of Civil Protection also allowed the retrieval of the most recent cartography available on the "2019 Floods Directive", an act of the European Commission for the prevention and management of flood risk, reviewed by the Emilia-Romagna Region through a co-participatory initiative in 2021.¹⁰ For the purposes of the project, the hazard maps relating to the Ravenna area were used, which show the areas presumably affected by floods according to three risk scenarios:

- a)** low probability of floods or "extreme events" (P1, low hazard);
- b)** infrequent floods (P2, medium hazard);
- c)** frequent floods (P3, high hazard).

⁶ Di Cocco I., Dalla lista dei danni alla mappa del tesoro. La creazione del database e dell'archivio cartografico GIS come opportunità per conoscere, organizzare, gestire il patrimonio culturale dei territori colpiti dal sisma. In: C. Di Francesco (Ed.), *A Sei Mesi Dal Sisma. Rapporto Sui Beni Culturali in Emilia-Romagna*. Bologna: Minerva Soluzioni Editoriali srl, 2014.

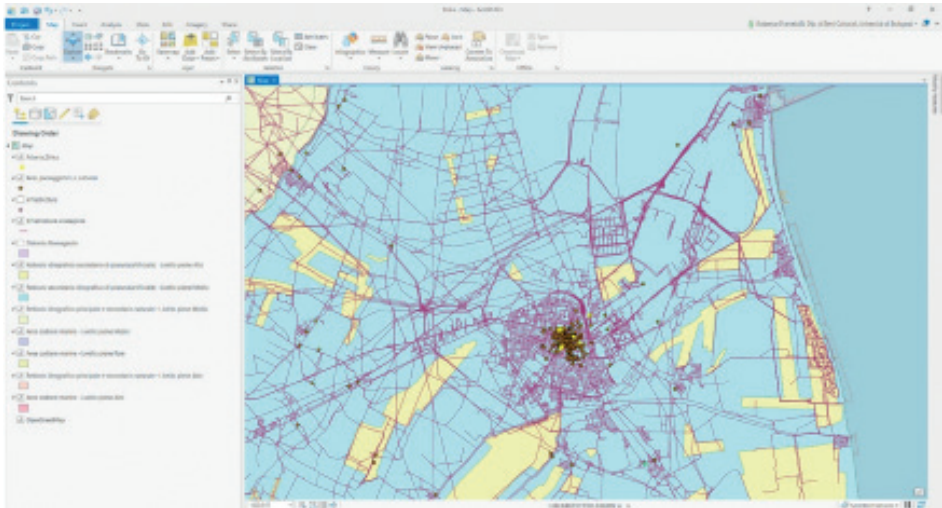
⁷ Ministero della Cultura. 2012. *VincoliInRete*. Accessed 21 May 2024. [<http://vincoliinrete.beniculturali.it/VincoliInRete/vir/utente/login>]

⁸ Comune di Ravenna. 2023. *Piano Protezione Civile Comunale*. Accessed 22 May 2024. . [<https://www.comune.ra.it/aree-tematiche/protezione-civile/piano-di-protezione-civile-comunale/>]

⁹ Regione Emilia-Romagna. 2017. *Portale minERva*. Accessed 21 May 2024. [<https://datacatalog.regione.emilia-romagna.it/catalogCTA/>]

¹⁰ Regione Emilia-Romagna. 2022. *Moka DIRETTIVA ALLUVIONI*. Accessed 2 May 2024. [<https://servizimoka.regione.emilia-romagna.it/mokaApp/apps/DA/index.html>]

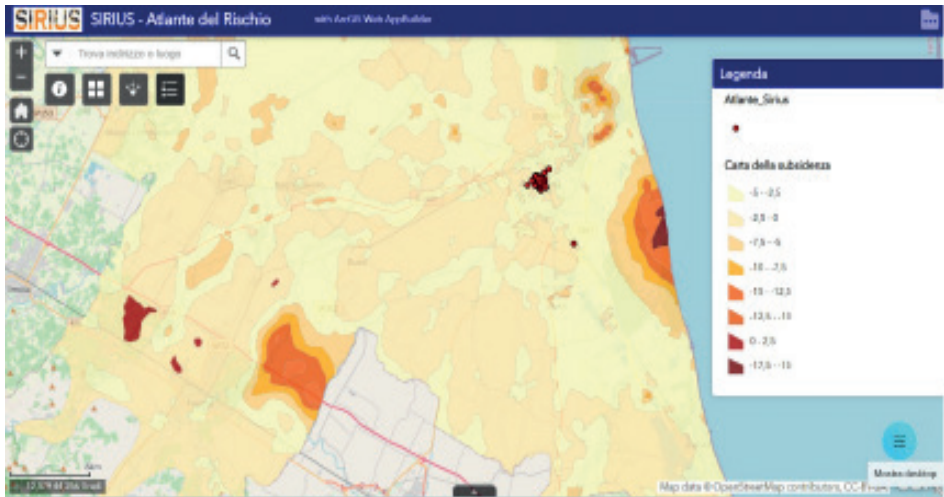
When the mapping of the components of cultural heritage is compared to the cartography related to the hydraulic risk, it is clear that they are all exposed to this risk factor (see image 1).



1. Screenshot from ArcGIS Pro Risk Atlas: maps of the areas of Ravenna that are at risk of flooding (light blue areas indicate lowland secondary hydrographic networks with medium flood levels and yellow areas indicate lowland secondary hydrographic networks with high flood levels), combined with the location of culturally significant sites (orange dots and yellow stars for UNESCO sites) © ALMA MATER STUDIORUM - University of Bologna, 2024

Data and technical reports related to subsidence were gathered through the public portal of ARPAE, the Emilia-Romagna Energy and Environment Prevention Agency¹¹, while subsidence maps were available on the “MinERva Portal”. Data show a trend towards stability of the phenomenon that historically affects the Ravenna area, currently estimated at - 2.5mm/year. By superimposing the geolocation of cultural heritage with the subsidence maps, every mapped cultural site is located in the area of the phenomenon’s relative stability (see image 2, p. 22).

¹¹ Regione Emilia-Romagna. 2017. Rilievo della subsidenza nella pianura emiliano-romagnola: prima fase. Accessed 21 May 2024. [<https://ambiente.regione.emilia-romagna.it/it/acque/norme-documenti/documenti/rilievo-della-subsidenza-nella-pianura-emiliano-romagnola/monitoraggio-2011-2016-prima-fase>]. See also: Regione Emilia-Romagna. 2018. Rilievo della subsidenza nella pianura emiliano-romagnola: seconda fase. Accessed 21 May 2024. [<https://ambiente.regione.emilia-romagna.it/it/acque/approfondimenti/documenti/rilievo-della-subsidenza-nella-pianura-emiliano-romagnola/seconda-fase>]



2. Screenshot from the Risk Atlas created with the ArcGIS Online Web AppBuilder: map of subsidence for the Municipality of Ravenna that integrates cultural assets mapping.

Note that the mapped elements of Ravenna's cultural heritage are situated in a region where the phenomena is stable, with ground subsidence rates predicted to range from -2.5 mm/year to 0 mm/year © ALMA MATER STUDIORUM - University of Bologna, 2024

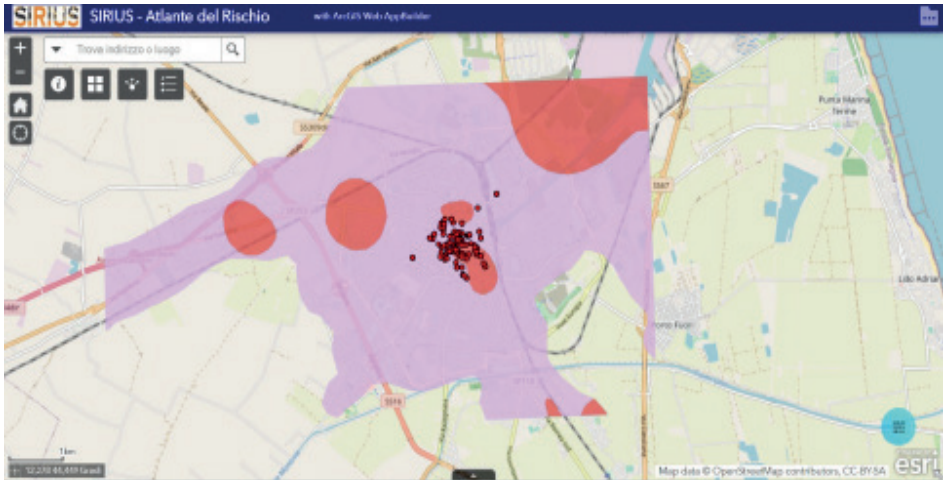
Despite having a lower seismicity degree than the nearby areas¹², Ravenna is not immune to the risk of earthquakes of a certain intensity, that could even cause extensive damage, especially on the numerous “sensitive elements” like monuments and historic structures. The local seismic response of the Ravenna territory was thoroughly analyzed and mapped in the Seismic Micro zonation Study performed in 2017¹³, where the factors of amplitude depending on the local geology and the soil liquefaction index were also assessed. Among the documents available on the website “National rescue program for seismic risk of Emilia-Romagna”¹⁴, the map with the data relating to the “worst case scenario” conceivable in the city area was selected. The map, with amplification factor calculated as Housner intensity in pseudo

¹² Regione Emilia-Romagna. 2023. *La classificazione sismica dei Comuni in Emilia-Romagna*. Accessed 21 May 2024. [<https://ambiente.regione.emilia-romagna.it/it/geologia/sismica/la-classificazione-sismica/la-classificazione-sismica-dei-comuni-in-emilia-romagna>]

¹³ Regione Emilia-Romagna. 2021. *Gli indirizzi per gli studi di microzonazione sismica in Emilia-Romagna per la pianificazione territoriale e urbanistica*. Accessed 21 May 2024. [<https://ambiente.regione.emilia-romagna.it/it/geologia/sismica/indirizzi-per-studi-microzonazione-sismica#autotoc-item-autotoc-13>]

¹⁴ Protezione Civile Regione Emilia-Romagna, Regione Emilia-Romagna, Servizio Geologico Sismico e dei Suoli. 2018. *Programma nazionale di soccorso per il rischio sismico dell'Emilia-Romagna*. Accessed 21 May 2024. [<https://geo.regione.emilia-romagna.it/schede/pnsrs/index.jsp?id=39014>]

velocity in the integration interval 0.5-1.0 s, highlighted two areas of higher localized instability near sites of cultural interest (see image 3).



3. Screenshot from the Risk Atlas created with the ArcGIS Online Web AppBuilder: level III seismic micro-zonation cartography with amplification factor calculated as Housner intensity in pseudo velocity in the integration interval 0.5-1.0s (FH0510) and location of the Ravenna cultural heritage. The areas with higher localized instability are marked in red © ALMA MATER STUDIORUM - University of Bologna, 2024

The interrelation of collected data showed that, from the standpoint of territorial risks, a uniform and stable situation affects the cultural heritage components. The Risk Atlas also highlights that, according to territorial risk maps, the potentially highest hazard for cultural heritage located in the city area is natural flooding. The analysis of the seismic micro-zoning maps also shows that cultural heritage insists on a low seismic territory; however, the geology of the soils demonstrates how localised liquefaction events could develop in a so-called “worst case” scenario, posing a risk to the population and the region’s historic heritage.

Action 2. Capacity building and knowledge sharing on cultural heritage at risk

Today cultural heritage is still not adequately taken into account when planning for disaster risk management, and it is still common practise to not include dedicated protection measures in national, regional, or local risk management strategies.¹⁵ As far as the

¹⁵ Spennemann D.H.R., Cultural heritage conservation during emergency management: luxury or necessity?. *International Journal of Public Administration*. 2007(22):745-804. See also: Graham K., Spennemann D.H.R., State emergency service local controllers’ attitudes towards disaster planning for cultural heritage resources. In: *Disaster Prevention and Management*. 2006, vol. 15, issue 5 :742-762.

Italian scenario is concerned, actions in the ordinary care and management of cultural and natural heritage are supervised by the Ministry of Culture, which acts through the Superintendencies, peripheral bodies of the Ministry with direct responsibilities on the local territory. In the event of a disaster, the Department of Civil Protection is given precedence for intervention. Locally, the Municipal Civil Protection Plan defines the operating procedures used by the Civil Protection Department, working in collaboration with the National Fire and Rescue Service, the Armed Forces, the State Forestry Corps, the National Technical Services, the National Scientific Research Groups, the Italian Red Cross, the National Health Service, and voluntary associations. Although actions and measures on cultural heritage are described in detail in directives valid on the national territory¹⁶, they refer primarily to recovery and safety interventions following the emergency event. There is, therefore, the need for cross-collaboration among all the operators called to intervene when emergencies arise on a local scale.

To meet this requirement by developing a constructive process of capacity building and knowledge transfer at a local level, the SIRIUS project is developing training sessions on cultural heritage management and risk intervention, using the national guidelines as a point of reference.¹⁷ To strengthen the role that cultural heritage can have as a tool for resilience and recovery from catastrophes, this project action works in tandem with the *RESTART-RESilienza e Sviluppo Territoriale: patrimonio A Rischio e Tutela* project,¹⁸ which was recently launched in response to the flood events that affected the Emilia-Romagna area in May 2023. The training foresees participation from local government officials and organisations in charge of intervening in emergency

¹⁶ Ministero della Cultura. 2016. Direttiva del 12 settembre 2016 prot.11807 recante "procedure di rimozione e recupero delle macerie di beni tutelati e di edilizia storica". Accessed 22 May 2024. [<https://www.beniculturali.it/comunicato/direttiva-del-12-settembre-2016-prot-11807-recante-procedure-di-rimozione-e-recupero-delle-macerie-di-beni-tutelati-e-di-edilizia-storica-rettifica-data-protocollo-dg-abap-servizio-iii>] See also: Ministero della Cultura. 2023. Decreto del Dipartimento della Protezione Civile 13 dicembre 2023 -Indicazioni operative per la gestione delle macerie a seguito di evento sismico". Accessed 22 May 2024. [https://dgspatrimonioculturale.beniculturali.it/wp-content/uploads/2024/02/Decreto-Dipartimento-Protezione-Civile-13_12_2023-Indicazioni-operative-per-la-gestione-delle-macerie-a-seguito-di-evento-sismico.pdf]

¹⁷ Ministero della Cultura. 2020. Circolare SG n. 22, 26 marzo 2020 - Gestione coordinata delle attività di messa in sicurezza e salvaguardia del patrimonio culturale in occasione di eventi derivanti da calamità naturali. Specificazioni. Accessed 22 May 2024. [https://dgspatrimonioculturale.beniculturali.it/wp-content/uploads/2020/08/Gestione-attivit%C3%A0-messa-in-sicurezza-e-salvaguardia-patrimonio-culturale-per-calamit%C3%A0-naturali-SG-Circolare-N.-22_26_03_2020.pdf] See also: Ministero della Cultura. 2016. Direttiva DG-APAB 12 agosto 2016 - Procedure di rimozione e recupero delle macerie di beni tutelati e di edilizia storica. Accessed 22 May 2024. [https://dgspatrimonioculturale.beniculturali.it/wp-content/uploads/2020/08/Procedure-rimozione-e-recupero-macerie-beni-tutelati-e-edilizia-storica-Direttiva-DG-ABAP-12_08_2016.pdf]

¹⁸ Alma Mater Studiorum Università di Bologna. 2024. *RESTART-RESilienza e Sviluppo Territoriale: patrimonio A Rischio e Tutela*. Accessed May 22, 2024. [<https://site.unibo.it/resilienza-patrimonio-culturale/it>]

situations, in addition to academics and university students. The objective is to foster capacity building and knowledge sharing to collaboratively operate in the prevention, management, and mitigation of threats impacting on cultural heritage. In terms of capacity building, a first pilot action was carried out within an educational laboratory targeted to students enrolled in the bachelor's degree programme in Cultural Heritage. An interactive, co-participatory activity based on "inSIGHT - a participatory game for enhancing disaster risk governance" was developed, that allowed participants to share and put their experiences into practise (see photo 4). inSIGHT was conceived in the framework of ICCROM's flagship programme on First Aid and Resilience for Cultural Heritage in Times of Crisis, and its capacity building project on Culture Cannot Wait: Heritage for Peace and Resilience.¹⁹ Combining theoretical knowledge with a practical learning method through risk scenario surveys, proved to be a significant experience from the "capacity building" perspective for professional experts who will work with cultural assets in the future. Thirty-one students, twenty to twenty-two years old, enrolled in the second year of the Cultural Heritage bachelor degree participated in the activities thus far. The workshop focuses on the topic of management and reduction of risks that threaten cultural heritage, in line with the international strategies and ac-



4. Projects prepared by students in Cultural Heritage during the inSIGHT simulation © Sara Fiorentino

¹⁹ Tandon A., Chmutina K., *inSIGHT: A Participatory Game for Enhancing Disaster Risk Governance*. Rome: ICCROM, 2020.

tion plans. The aim is to increase awareness on the ways in which cultural and natural heritage can mitigate natural and anthropic risks, thus reinforcing its position as a crosscutting element in the pursuit of sustainable development goals. Regarding the impact and results achieved, 75% of the workshop attendees observed that the topics covered were helpful in acquiring new skills in the Cultural Heritage risk management approach; 100% of participants indicated their will to learn more on the subject, and the same positive feedback emerged for the cooperative activities, found to be stimulating while also lowering the workload by a better distribution and teamwork.

Action 3. Promoting a “risk culture” through public engagement and awareness raising

To support the development of a comprehensive risk culture addressing everything, from the effects of human and natural hazards on individuals to the effects on cultural assets, SIRIUS aims at providing awareness-raising activities for a range of age groups, with a focus on young citizens.

The activity “I-CARE: Together for the Communication of the Cultural Heritage at Risk of Ravenna” was carried out in 2023 as part of the annual proposal for Pathways for Transversal and Orientation Skills, a project of the Italian Ministry of Education compulsory for all students in the last three years of high school. Involving a group of students from Ravenna’s Classical Studies Lyceum Dante Alighieri, I-CARE promoted collaborative and creative activities aimed to increase the civic values of young people and offer conceptual tools for the identification of potential risks impacting on cultural and natural heritage as well as encourage an active participation in the process of CH protection. The participants were stimulated to combine, in an attractive and communicative way, information and data on cultural heritage at risk. The students’ projects were shared with Ravenna’s residents during the European Researchers’ Night in 2023. Among them, the podcast “Racconti dall’Esarcato” deserves to be mentioned. Consisting of four episodes, it features the voices of high school students who relate stories about significant locations in Ravenna. The fundamental concept is straightforward, yet incredibly intuitive and expressive: the first step to comprehending and safeguarding the places we live in is learning about their past and memories.²⁰ Previously, in 2021, another initiative promoting active citizenship was an interactive exhibition on cultural heritage at risk named “Under a lucky star: together for protecting cultural heritage”. The event, framed within the European Researchers’ Night, aimed to inform and raise public awareness on the risks threatening our cultural heritage, with a focus on Ravenna. All related materials produced from Story Maps to videos, are accessible to the public on the SIRIUS project website.²¹

²⁰ Liceo Classico Statale Dante Alighieri di Ravenna. 2023. *Racconti dall’Esarcato. Un podcast su Ravenna, per Ravenna*. Accessed 31 May 2024. [<https://sites.google.com/view/raccontidallesarcato/home>]

²¹ Alma Mater Studiorum Università di Bologna. 2022. *Sotto una buona stella. SIRIUS-Strategie per la gestione del patrimonio culturale a rischio*. Accessed 22 May 2024. [<https://site.unibo.it/patrimonioculturalerischio/it/sotto-una-buona-stella>]

SIRIUS has also collaborated with Unijunior, the first example of a children's university in Italy, for the co-design of an Educational Laboratory for children aged 8 to 12.²² The Laboratory aimed to encourage children's engagement with the subject of cultural heritage at risk through games and interactive activities. Cooperative learning exercises and instructional games were conducted under the guidance of facilitators to familiarise children with the causes and effects that natural and man-made hazards can have on cultural assets. From a long-term perspective, these kinds of activities seek to help children better understand the potential effects that unfavourable events may have on their habitat, while also preparing them to respond more responsibly in an emergency situation.

Conclusions and further developments

To actively support, the implementation of management strategies for cultural heritage at risk, SIRIUS will continue working on the three planned lines of action in the coming years. In a more comprehensive scenario, such an approach will contribute to enhance knowledge and bridge those operational practise gaps identified by the state of the art. Regarding Action 1, SIRIUS is currently scaling up the ABC method, developed by ICCROM and CCI for museum collections, on the UNESCO monuments of Ravenna to prioritise the risk agents potentially affecting cultural heritage. By using the ABC method to determine the impacting risks' magnitude, it will be possible to prioritise and rank the risks based on the severity of the potential impact and required mitigating actions. Further attention is paid to the data management integrated in the Risk Atlas, by working to provide adequate accessibility and transparent interoperability. Through the implementation of cross-sectoral and co-creative workshops, Action 2 will foster capacity building and knowledge sharing to intervene in the prevention, management, and mitigation of threats on cultural heritage. Last, prospects for Action 3 development envision the establishment of a proper "risk culture" among citizens, as well as the promotion of a more active role in safeguarding cultural assets, with specific attention to young citizens and participatory activities at an urban level by developing dedicated data models and a risk assessment ontology.

²² Unijunior. 2024. Unijunior. Conoscere per Crescere. Accessed 31 May 2024 [<https://www.unijunior.it/>]

How to protect cultural heritage at risk – The Hungarian National Museum’s pilot projects for cultural heritage protection

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Both crime² and devastating disasters caused by natural hazards³ affecting cultural heritage are complex threats, often triggered by multiple reasons and actors, which cultural institutions are unable to manage on their own. According to Hungarian legislation, public collections need to create their own national defence action plan⁴ supporting the response to challenges of a military nature, while it is not mandatory to have a separate emergency management plan. Although many of the institutions have both plans, these usually tend to be separately managed and not properly coordinated with other interested parties – mainly because of the country’s fortunate position concerning natural hazards and the lack of effective cooperation between cultural institutions and the actors of the security and defense sector.

In order to overcome these shortcomings, the Hungarian National Museum (HNM) has recently started to address such issues through multiple, yet connecting paths. It is currently reshaping its approach towards various threats and establishing a special project to be able to plan and respond effectively by focusing on capacity building.⁵ Furthermore, it has joined national and international research and pilot projects, and started an interdisciplinary dialogue to properly redesign its disaster risk management (DRM) plans. Better understanding the already existing good practices, engaging in capacity building and awareness raising, and re-mapping the actors were the first, parallel and mutually supportive steps of this work.

¹ On April 28, 2024, the name and statues of the Hungarian National Museum were modified to establish the Hungarian National Museum Public Collection Centre. Starting July 1, 2024, five public collections will merge into this centre: the National Széchényi Library, the Museum of Applied Arts, the Hungarian Natural History Museum, the Petőfi Literary Museum, and the Hungarian Museum of Commerce and Hospitality.

² Examples include the deliberate destruction of cultural heritage during armed conflicts, illegal excavations, illicit trafficking of cultural goods, etc.

³ Examples are well shown on the website of the United Nations Office of Disaster Risk Reduction [<https://www.undrr.org/our-impact/campaigns/no-natural-disasters>]

⁴ According to EMMI Regulation 49/2016, all state or local government-owned public collections managing protected cultural assets must prepare a national defence action plan.

⁵ The main aim was to become acquainted with tools, techniques and best practices related to the DRM and the recovery of CH and the response to heritage crime. Amongst others, the HNM’s colleagues participated in courses like the International Training Course on Cultural Heritage and Disaster Risk Management [<https://rdmuch-itc.com/5715/>] (UNESCO Chair Programme) at the Ritsumeikan University’s Institute of Disaster Mitigation for Urban Cultural Heritage; and the UNESCO & ICCROM Summer School on Post-conflict Recovery of Cultural Heritage [<https://www.iccrom.org/news/summer-school-post-conflict-recovery>] based on the project Revive the spirit of Mosul, by UNESCO, ICCROM and Fondazione Santagata.

Realizing the loopholes, the HNM aimed to promote this dialogue and foster cooperation to protect cultural heritage in crisis situations – an initiative, which quickly began to outgrow itself. This pioneering dialogue fostered by the HNM created a new situation, promoting the linking of different sectors and inspiring many actors to welcome such co-operation.

Creating a network

As an initial step, the HNM has put in place an institutional strategy for cultural heritage protection and has reorganized the opportunities resulting from its various projects and roles along with it.

The HNM's main partner in protecting its collections is the Agency for the Protection of National Cultural Heritage (NKÖV), which is entrusted within the protection of cultural properties of outstanding national value belonging to the largest Hungarian public collections. Thus, the first talks about improving the museum's capacities in this field took place between these two institutions.

The HNM also joined the consortiums of EU Horizon Europe projects such as the AURORA⁶, which develops technical solutions to strengthen the fight against illicit trafficking of artefacts.⁷ The rationale for the HNM's involvement, which will be one of the end users of the protection tools, was to help include new aspects for the developers and the fact that HNM has long been involved in police consulting.⁸

Also, as the HNM has a leading role in archaeological activities in Hungary⁹, it launched a Community Archaeology program, joining together volunteers and archaeologists to prevent unlicensed¹⁰ metal detectorists working for private purposes.¹¹

Meanwhile, with the police's support, the HNM sent one of its staff members to the cultural heritage protection training of European Security and Defence College

⁶ Artwork Unique RecognitiOn and tRacking through chemicAl encoded data, miniaturized devices and blockchain alliance.

⁷ For detailed information on the project see the AMA (Art Media Agency)'s issue 359 [https://www.aurora-euproject.eu/wp-content/uploads/2024/04/ama-359-en_compressed.pdf]

on illicit trafficking of artefacts or visit the project's website: <https://www.aurora-euproject.eu/>
⁸ As such, the HNM collaborates closely with the police's Cultural Property Crime Unit to identify and verify smuggled artifacts seized by law enforcement, and to investigate questionable ownership where applicable.

⁹ The HNM is a historical and archaeological museum that collects, researches, and exhibits significant objects from the Neolithic Age to the present day. It manages extensive archaeological collections and associated knowledge, and conducts archaeological explorations. Through the HNM Archaeological Institute, it coordinates nationwide preventive archaeological excavations related to major investments, and supports research, teaching, and learning.

¹⁰ Metal detectors are legal in Hungary according to national heritage law and its applicable amendments.

¹¹ The programme's primary goal is to prevent the loss of both the objects and the information they carry, and to enhance their accessibility and promote their social utilization. The Hungarian National Museum opened exhibitions on its Community Archaeology programme and its major discoveries in 2020 and 2022.

(ESDC) and Krems University.¹² Inspired by the good examples learnt there, the HNM reached out to the Ludovika University of Public Service: the university responsible for the higher education of law enforcement, military officers and civil servants.¹³

Given that the Ludovika University was highly in favour of the idea of this collaboration, the HNM, the Ludovika University and the NKÖV jointly organized the first national conference on cultural heritage protection on 28th March 2023. This marked the starting point in the country of a wider dialogue between the actors of the cultural, humanitarian, military, law enforcement, and the national administration bodies to protect endangered cultural heritage.¹⁴ As a result of this dialogue, the HNM provided the venue besides actively participating in the national Expo on Security.¹⁵

The International Cultural Property Protection Conference co-organized by the HNM, the Ludovika University and the NKÖV in the HNM on 23-24 November, 2023¹⁶, opened this dialogue even further by engaging actors from the international field to raise awareness, exchange good practices, establish



1. International CPP Conference in the main hall of the Hungarian National Museum, November 2023 © HNM

¹² Cultural Property Protection Course Pilot by the European Security and Defence College and University for Continuing Education Krems [<https://www.donau-uni.ac.at/en/university/faculties/education-arts-architecture/departments/building-environment/centers/center-for-cultural-property-protection/study-programs/esdc.html>]

¹³ One of the long-term aims of this new co-operation between the HNM and the Ludovika is to integrate cultural heritage protection into the general higher education of law enforcement (police, customs, etc.) officers in Hungary. From a law enforcement perspective, the relatively small proportion of cases related to heritage crime makes this type of crime more challenging to handle, as general officers often lack specialized knowledge and routine to easily manage these cases. Involvement from the cultural sector can enhance their efficiency.

¹⁴ As a result, one of the archaeological inspectors attending the conference asked the HNM for assistance in establishing a pilot project aimed at training dogs to detect and indicate objects of archaeological significance hidden in vehicles or packages. The HNM joined the initiative, leading to the creation of the innovative ArcheoDogs Hungary pilot project.

¹⁵ BiztonságPiac. For more information visit its website: <https://biztonsagpiac.hu/>

¹⁶ Watch a short film about the conference [<https://www.youtube.com/watch?v=1UoCL-f15Eo&t=4s>] and all the lectures at the HNM's YouTube channel.

international professional networks, and to encourage future cooperation and joint projects. The objective was to discuss a series of issues on preparedness, risk management and emergency response, post-crisis recovery, the fight against illicit trafficking of artefacts, and general museum security.

As a result, the HNM redesigned its already existing ties with the Hungary Helps Agency¹⁷, the police, universities¹⁸, etc., while it also actively sought for new co-operations. An important step was to establish a common ground and language between the actors coming from different fields: to understand each other's goals, working method, knowledge and vocabulary.

The HNM thus became a promoter of a cross-sectoral approach, which was broadly encouraged by the positive feedback of every actor participating in the discussion and exchange on this issue. With the help of this constantly growing support from different fields (such as the military, the disaster management, the law enforcement, etc.) our long-term goal is to jointly construct an applicable comprehensive national strategy on cultural heritage protection in different emergency situations.

Disaster risk management planning

The need to specially deal with cultural heritage protection during crises and cultural heritage recovery-planning¹⁹ in post-crisis situations²⁰ originates from the growing urgency to integrate cultural heritage protection and recovery into larger recovery²¹ frameworks.²²

On the other hand, the idea of making heritage resilient has to encompass the successful DRM of cultural heritage and its recovery: a complex task, which every responsible cultural institution should consider. This is supported by the continuously growing and evolving good practices, guides²³, notes²⁴ and toolkits, which help these institutions to draft personalized DRM plans.²⁵

¹⁷ An independent government agency assisting victims of humanitarian crises and persecuted communities.

¹⁸ The Péter Pázmány Catholic University, the Budapest University of Technology and Economics.

¹⁹ CURE, UNESCO - World Bank Group 2018.

²⁰ Warsaw Recommendation, 2018.

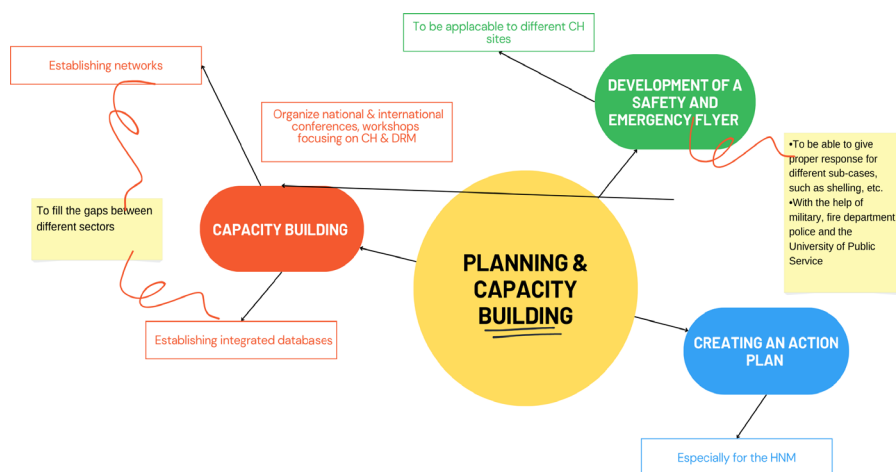
²¹ See e.g.: Urban Recovery Framework, 2022.

²² See e.g. the ICCROM's Heritage Recovery Programme in Mosul and its Summer School on Post Conflict Recovery of Cultural Heritage aiming to synthesis the Mosul program's good practices and lessons learned. [<https://heritageatrisk.net/>]

²³ A Guide. ICCROM - Canadian Conservation Institute, 2016.

²⁴ Guidance Note. OCHA-INSARAG, 2023.

²⁵ For more specialized guides see e.g. FAR-ICCROM. [<https://www.iccrom.org/programmes/first-aid-and-resilience-times-crisis-far/resources>]



2. The HNM's short-term goals regarding GPP designed by the author © HNM

The HNM is amongst the Hungarian institutions that already had such plans, but after realizing the need to revise these, it set up a core team: a project leader, a project manager and a risk manager were appointed to deal with these issues, while another project was set up to reveal the damage and losses in the HNM's collections and recover missing objects. The goals and activities of these two projects are coordinated, and the colleagues appointed to them collaborate closely in a teamwork approach, thereby establishing a specialized network within the institution. Some of these colleagues were also invited to join the OSCE-led Heritage Crime Task Force.²⁶

Participating in the UNESCO Chair Programme on Cultural Heritage and Risk Management ITC Course provided crucial help in revising the HNM's DRM plans. The learnt method particularly highlighted the importance of value assessment, expert mapping, risk analysis, key hazards, vulnerabilities and the institution's own disaster history, designing scenarios with multiple hazards, classifying them as primary and secondary hazards, designing mitigation and response measures, and paying attention to pre-disaster recovery planning embedded into larger-scale local recovery plans.²⁷ In the case of the HNM's mitigation and response measures creating data

²⁶ The Heritage Crime Task Force is a multi-stream programme addressing the looting of archaeological and cultural heritage sites, the illicit cross-border trafficking of cultural property, and its linkages to organized crime and terrorism financing, as well as cultural heritage protection in war zones and regions of crisis, set up by the Organization for Security and Co-operation in Europe (OSCE). For more information on the OSCE-led Heritage Crime Task Force see e.g. the report on the 2023 regional interactive workshop in Pula, Croatia. <https://www.osce.org/secretariat/551813>

²⁷ E. g. in the case of cultural heritage located in cities the integrated area-based approach (ABA) and urban profiling can be used.

sheets for artefacts in case of evacuation is an important part, while the pre-disaster recovery planning aims to create a more functional museum by a new space allocation.²⁸

This huge task of DRM planning is also supported by the Budapest Defense Committee²⁹ and the Heavy Urban Search and Rescue Team HUNOR - a specialized rescue team deployed internationally.³⁰ Both organizations joined this work as a result of the already mentioned interdisciplinary dialogue: as both of them might have to deal with cultural heritage sites during their everyday work, this kind of cooperation provides help for all parties by ensuring a better understanding of the needs and possibilities.



3. International CPP Conference in the main hall of the Hungarian National Museum, November 2023 © HNM

²⁸ To see the main steps of the plan check the course's proceedings [https://rdmuch-itc.com/wp-content/uploads/ITC2023_proceedings.pdf] by visiting the Ritsumeikan University's website.

²⁹ The Budapest Defense Committee provides valuable help for the HNM to successfully conduct a full risk assessment.

³⁰ The Heavy Search and Rescue HUNOR is the Hungarian National Organization for Rescue Services and as such works in accordance with the methodology of the UN and INSARAG guidelines. The HUNOR provides good examples for the HNM and the two organizations are currently in the middle of establishing their joint engagements.

Conclusion

In recent years, the HNM - uniquely among Hungarian public collections - has established pilot projects specifically focused on cultural heritage protection in crisis situations, which proved to be a self-stimulating process, creating an even stronger impact than originally planned.

Different sectors bring different perspectives and although these collaborations are still informal in many cases, the first step was taken: the actors were able to get to know each other also to the benefit of future joint work in the field. Filling the gap between these sectors relies on the 3Cs: communication, co-operation and coordination.

Though there is still much to do, the HNM is committed to keep on working and thus plan further conferences, targeted workshops and other projects to promote this cooperation - something, in which it is widely supported by the experts of other interested sectors.

This new cross-sectoral approach also serves as a basis for the Hungarian National Committee of the Blue Shield, currently under construction.

Holistic Risk Management at the Prussian Cultural Heritage Foundation

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Introduction

In 2017, the theft of the golden coin “Big Maple Leaf” from the Bodemuseum in Berlin, and the damage of sculptures with an oily substance in several museums of the Berlin Museum Island ensemble (Museumsinsel) in 2020 attracted much public interest eliciting the project *Holistic Risk Management* that is described as best-practice in this article.

All affected institutions are members of the Prussian Cultural Heritage Foundation (Stiftung Preußischer Kulturbesitz, SPK) located in Berlin. The SPK foundation with its museums, libraries, archives, and research institutes was established in 1957 by federal law directly responsible to the German government. It is financed by the German federal government (Federal Government Commissioner for Culture and the Media, *Beauftragte der Bundesregierung für Kultur und Medien*) and Germany’s sixteen states. It is the major and most important cultural institution in Germany. The SPK comprises five institutions: the National Museums in Berlin (Staatliche Museen zu Berlin) with 24 individual collections, the Berlin State Library (Staatsbibliothek zu Berlin), the Prussian Secret State Archives (Geheimes Staatsarchiv Preußischer Kulturbesitz), the Ibero-American Institute (Ibero-Amerikanisches Institut), and the State Institute for Music Research (Staatliches Institut für Musikforschung). It therefore features a great number of outstanding collections of art and culture including science and research and its activities often serve as a model for other cultural institutions in Germany.

Besides the above mentioned events in the SPK, several major emergencies had occurred in other institutions in Germany and throughout the world, i.e. the high floods of the river Elbe (Dresden State Art Collections, Gartenreich Dessau-Wörlitz, 2002), the fire in the historic Duchess Anna Amalia Library (Weimar, 2004), the collapse of the Historic City Archive of Cologne (2009) or the disastrous fires in the Museu Nacional da Universidade Federal do Rio de Janeiro (2018), and in the Notre Dame cathedral of Paris (2019).

The Task Force Risk Management

Following these events, in the SPK set up a *Task Force Risk Management*¹ in 2020

¹The *Task Force Risk Management* is conducted by Prof. Dr. Stefan Simon, director of the Rathgen-Forschungslabor of the National Museums in Berlin, the oldest museum’s laboratory in

which takes fundamental decisions on the objectives and measures of risk management and emergency planning. It acts as a disseminator to raise awareness of its mission within SPK's institutions and departments. It is also an interdisciplinary and comprehensive forum for discussion on the matter. In emergency or crisis, it can facilitate the decision-making process. The Task Force is responsible for all institutions of the SPK. It comprises all relevant departments of administration, preservation and science, i.e. one member of the foundation's board, the heads of the departments of personnel, budgeting, public relations and the media, information technology, construction and technical skills, and of the legal advisor. Furthermore, its members are representatives of the museums, archives, libraries, collections managers, conservators and risk commissioners. Since risk management is affecting all people and all institutional tasks, this multi-disciplinary approach is very important to create a resilient basis for the protection of cultural heritage. Gero Dimter, vice-president of the SPK, took over the patronage of the Task Force. As a result, there were no obstacles to introduce this task to the entire institution.

Since the heads of the mentioned departments cannot take over the daily work on risk management, it was decided to appoint one representative of every SPK-institution as risk commissioner. However, the work came to a halt just after two meetings due to the lack of coordination by both the *Task Force Risk Management* and the risk commissioners.

The Holistic Risk Management Project - Development, Tasks and Objectives

To strengthen the task of risk management and cultural heritage protection, the SPK started a project to establish a holistic risk management approach to support all museums, archives, libraries and institutes of the SPK to enhance their emergency planning and risk awareness. The project is financed by the Federal Government Commissioner for Culture and the Media (Beauftragte der Bundesregierung für Kultur und Medien, BKM); it started in August 2023 and will end in April 2025.² Almut Siegel and Alke Dohrmann, project managers of the *SiLK Guidelines for the Protection of Cultural Property (SiLK - SicherheitsLeitfaden Kulturgut)*, were employed at the Rathgen-Forschungslabor/National Museums in Berlin to run the project as the *Holistic Risk Management Team (HRM Team)*. They identified ten main tasks to be implemented by the project:

1. Risk analysis
2. Emergency planning
3. Coordination of the *Task Force Risk Management*
4. Coordination and cross-linking of the risk commissioners

the world, and Hans-Jürgen Harras, Head of the security department of the National Museums in Berlin. Since the retirement of Mr Harras, Uwe Heuer, Head of the department for construction, technical experts and inner services of the National Museums in Berlin, took his part.

² The SPK wishes to extend the project and make it a permanent task.

5. Documentation of (almost) emergency events
6. Emergency materials
7. Training and education
8. Representation of the museums of the SPK in the Berlin emergency preparedness network
9. Networking (emergency preparedness networks, *Round Table "Emergency Berlin"/Runder Tisch "Notfall Berlin"*, Berlin firefighters etc.)
10. Public relations and in-house communications



1. Meetings of the SPK's risk commissioners: training on CH emergency boxes (December 2023) and on risk analysis (March 2024) © Almut Siegel, SPK

When starting its work, the *HRM Team* revived the Task Force. Since the third meeting in May 2024 a kind of test phase has begun. Besides a professional exchange on emergency documentation, the members agreed on their tasks and discussed the future organisational chart. The Task Force acts as the decision maker, while the risk commissioners work at the operational level, with regular exchange between the two players. The Task Force is going to meet twice a year or according to need. Working groups will be established for special subjects when necessary. The test phase can be used to make organisational adjustments, if needed. In the long-run, the Task Force should be formally implemented into the SPK's structure.

The following two sections provide examples of the work of the *HRM Team* within the *Holistic Risk Management Project* to illustrate some of the above mentioned ten main tasks.

Risk Commissioners

The SPK's risk commissioners are the main partners of the *HRM Team* in the project work and function as multipliers of the task in their respective institutions. Every three months, there is a meeting of all the SPK risk commissioners and other heads of the security and construction departments. In these meetings, the participants are trained by the *HRM Team* on specific tasks.

Since the beginning of the project, three trainings have been given, one on the use and the contents of the SPK's Cultural Heritage emergency boxes, one on methods of risk analysis, and the third on the newly developed documentation system of (almost) emergency events. The next training will be on specific aspects of emergency planning and on the cooperation with the Berlin firefighters. The meetings are also important to strengthen the network and professional exchange of the risk commissioners throughout the SPK's institutions and to discuss relevant questions of their work.



2. Meetings of the SPK's risk commissioners: training on CH emergency boxes (December 2023) and on risk analysis (March 2024) © Almut Siegel, SPK



3. Discussions during an on-site visit in a deposit of the National Museums in Berlin © Almut Siegel, SPK

Risk Analysis

The support of the risk commissioners is essential, especially in the ongoing risk analysis process. The *HRM Team* aims at creating “a risk landscape” of the entire SPK, describing and assessing the major risks to the institutions and their different sites in the city of Berlin. To collect the necessary data, different methods are adopted:

1. Together with the risk commissioners, the *HRM Team* performs on-site visits to inspect and discuss the situation of deposits, archives, exhibition rooms, conservation labs etc.
2. The existing documentation of emergency events (see below) is evaluated.
3. A simple risk analysis is made for all institutions by multiplying the estimated probability of occurrence and the extent of loss. This analysis is implemented by the risk commissioners with other institutional staff of reference.
4. For particular institutions, additional risk analysis methods like the *ABC Method* according to Stefan Michalski and the *Cultural Property Risk Analysis Model (CPRAM)* according to Robert Waller, are conducted by the *HRM Team*.
5. The newly developed and not yet published method of *SiLK Risk Ranking (SiLK and R. Waller)* has already been used twice since the beginning of the project, for the entire SPK foundation. It can also be used for the single sites.
6. The most severe risk identified by the *SiLK Risk Ranking* can be further evaluated with the respective questionnaires of the *SiLK Guidelines for the Protection of Cultural Property*.
7. Some of the SPK's institutions have data of past risk analysis, mainly collected by students of local universities, which can be used for comparison.
8. Additionally, maps with data on extreme weather or floods are checked for all sites.

With all the quantitative and qualitative data collected, the risk landscape can be produced and appropriate prevention measures can be taken. For the remaining risks, emergency planning has yet to be implemented. The *HRM Team* supports and advises the institutions of the SPK in this already ongoing process.

Future Improvements - Documentation of (almost) emergency events

Some years ago, the museums and institutions of the National Museums in Berlin started to collect and document emergency events for statistical purposes. The aim was to get data-based insight and to adopt adequate prevention measures. The *HRM Team* now engages in this task to raise it to a higher level. Therefore, the emergency documentation system is currently being refined and linked to the collections database so that it can be easily used by all responsible users. All the other institutions of the SPK shall be included as well. To prepare at best, it is also important to consider and document minor events that haven't affected cultural heritage,

but which could have become worse, if they had not been detected and solved in advance (“almost emergency events”), hence tailored prevention measures can be practiced. Other cultural institutions in Germany have already indicated interest in using the developed method.

Future Improvements - Networking

Cultural Heritage Protection is a task that can only be dealt with successfully by working together as a team. Therefore, cross-institutional communication within the SPK is highly encouraged. Furthermore, the National Museums in Berlin are in the process of becoming a member of the Berlin emergency preparedness network of museums. The Prussian Secret State Archives are already a member of the Berlin emergency preparedness network of archives.

Another network at the Berlin city level is the Round Table “Emergency Berlin” (Runder Tisch “Notfall Berlin”), which brings together federal, state, and city administration, the Berlin firefighters, the Berlin police, and other Cultural Heritage Protection experts to discuss and improve joint Cultural Heritage Protection standards. The *HRM Team* recently became a member of this round table.

Strong ties with the firefighters are also essential for resilient emergency preparedness. Therefore, the *HRM Team* started communication with representatives of the Berlin fire department for organizational fire prevention and fire-fighting. The basis for a good communication is a mutual understanding of the organizational structures of the cultural institutions on the one hand and the fire-department on the other. Cultural heritage institutions should be integrated into the maps of the firefighters to make them aware of these special locations. An important ongoing task of exchange between the *HRM Team*, the SPK institutions and the fire department is to make simple maps by which firefighters are able to salvage cultural objects out of endangered buildings.

Conclusion

The cooperative work of the project *Holistic Risk Management* is a unique experience in Germany. It is hoped that the insights gained can become useful to other German and foreign cultural institutions as well. The key points are to involve all the relevant institutional departments. The head of the institution must be the first one to support this task. The people involved must be given a certain amount of working hours and have the necessary expertise. It is to be understood that risk management is a permanent task in Cultural Heritage Protection.

Preparedness Networks Cultural Property Protection in Germany

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Introduction

In the year 2002, the high floods of the river Elbe covered the historic city centre in Dresden and threatened the museums and collections of the Dresden State Art Collections (Staatliche Kunstsammlungen Dresden). The underground storerooms of the Old Masters Picture Gallery (Gemäldegalerie Alte Meister) in the historic Zwinger building were flooded and had to be evacuated in a rush. A little farther down the river, the historic landscape of the Gartenreich Dessau-Wörlitz with its historic gardens, parks and buildings, all under monumental protection, were flooded and damaged. In the course of this event, people engaged in cultural heritage protection activities in the neighbouring city of Weimar started thinking about how to best prepare for similar emergencies in their own town, with its rich cultural heritage. The idea was to locally connect the many museums, archives and libraries and establish a preparedness network for cultural heritage protection (Notfallverbund Kulturgutschutz). Unfortunately, the devastating fire in the historic Duchess Anna Amalia Library (Herzogin Anna Amalia Bibliothek) in Weimar in 2004 made it even clearer, that these networks were, and still are, needed.

Background

These networks on local or regional level, established through grass-root initiatives, are even more necessary since there are no structures or regulations at federal level in Germany preparing for emergency events taking place in cultural institutions. Furthermore, the cooperation between these institutions and the local firefighters or other emergency services has not yet been defined or is even fully lacking. This is why there was, and still is, a great need for the institutions to support themselves and each other. New emergencies occurring from time to time, like the disastrous collapse of the Historic City Archive of Cologne (Historisches Archiv der Stadt Köln) in 2009, are pushing the initiatives still further. So, over the last 20 years, about 70 preparedness networks have been established in various cities and regions in Germany, to work together in the field of cultural heritage protection and emergency preparedness, and the number of such networks keeps growing.

Collaborative approach

Members of museums, archives, libraries, and other collection institutions agree to support each other during emergency events (e.g., providing expertise, manpower, storage, and materials). They commit to collaboratively preparing emergency plans in

advance and organizing training sessions for such situations. Most of these networks are properly regulated in terms of cooperation among members and the management structure. Usually, a team of spokespersons organizes the work of the network and represents the network to the public. The networks meet on a regular basis (i.e. four times a year) to discuss current matters and plan future activities. Ideally, these meetings shift between the member institutions so that meetings can be combined with guided tours to become familiar with the organisations, buildings and collections.

Once a year, all the members of these networks meet in one of the cities to exchange on cultural heritage protection topics, to strengthen the networks, and to show their work and materials. Interested institutions in other cities are invited to participate and given advice on how to establish a network in their hometown. These meetings are organized and financed by the German Federal Office of Civil Protection and Disaster Assistance (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe, BBK) and its Academy (Bundesakademie für Bevölkerungsschutz und Zivile Verteidigung, BABZ), together with the local preparedness network and with support of the *SiLK* team (see photo 1 below).



1. Participants of the annual meeting of the German preparedness networks 2023 in Berlin
© HwaJa-Götz, MfN

How to establish a preparedness network

If a cultural heritage institution is planning to create a preparedness network in its own city or region, the following ten steps should be observed:

1. Raise awareness for the need to cooperate in a network inside the institution or, even better, in several neighbouring institutions.

2. Choose a known person of one of the institutions (e. g. Director) who acts as a mentor to spread the idea more easily, to find allies and to accelerate the funding process.
3. Establish a working group (2-5 persons) for the organisational tasks (e. g. collecting addresses, writing invitations, finding meeting rooms).
4. Organize a first meeting, ideally with a representative of an existing preparedness network giving a presentation on the network's work and experiences. Identify the partners of the network to be established.
5. Establish regular contacts with the local firefighters (professional and/or volunteer).
6. Train institutions personnel in cultural heritage protection.
7. Cultivate existing contacts and make new contacts; invite new people to the network meetings.
8. Work out an agreement for the preparedness network that regulates the activities and lays down legal regulations such as insurance matters etc. It is advisable to use existing agreements as examples.
9. Have the agreement draft checked by the legal departments of all member institutions. Process until consensus is reached. (Be patient.)
10. Sign the agreement and, by this, establish the preparedness network officially. Invite guests and the press. Enjoy the ceremonial occasion.

In the process described above, it is very important to connect with existing networks in other regions to acquire useful information and advice on how to establish and organize the collaborative work most effectively.

Website

To support the work of the preparedness networks in Germany the website **Notfallverbund.de** (only in German language) provides a number of helpful resources: templates and examples of network regulations, emergency and evacuation plans, contact data of existing networks, announcements of the yearly Germany-wide meetings, checklists available in case of emergency, information on risks and emergency materials, examples of emergency trainings, further readings and websites, and much more.

Examples of collaboration

The website of the preparedness networks provides many examples of their work, e.g. videos of training. Furthermore, material developed by one network is freely shared with others. Example are the handbook, roll-ups and illustrations available in cases of emergency provided by the emergency preparedness network of the city of Münster¹, or the Pocket Guide for emergencies of the emergency preparedness network of the city of Stuttgart.

¹ <https://notfallverbund.de/materialien/im-notfall>. Accessed 24 June 2024.

As always, it is difficult to measure the success of prevention efforts by preparedness networks. Were there more incidents in the past without them? What can be affirmed is that member institutions have improved their knowledge regarding emergency response. Small incidents are now handled in a much more coordinated manner. Even in the case of disasters, such as severe floods, the forecast lead time allows for preparation, significantly mitigating damage to collections.

An example of the effective impact of the work of emergency networks has been their effort to support museums, libraries and archives in the war-affected Ukraine. Within a short period of time, more than 40 tons of resources and equipment were donated and sent to Ukraine.

Equipment and training

Two aspects of critical importance for preparedness networks are the equipment used in emergencies and the training of operators and experts in emergency situations.

In cases of emergency, like leaking or damaged water pipes, quick action is needed. Boxes with materials like gloves, sponges, wrapping material, torches etc. to salvage cultural heritage assets should be easily accessible and located nearby; the personnel have to be trained how to use the materials and handle damaged objects. In addition to the “first aid boxes”, containers with larger amounts of material and technical equipment can be stored at a greater distance in the same or neighbouring institutions. Ideally, special equipment and further resources for cultural heritage protection is also readily available by the local fire brigade to be prepared for larger scale emergency events. Until this day, these special fire-fighting vehicles have been very rare in Germany, but currently the need for them has greatly increased and the funds ready to be provided.²

Being well-equipped for emergencies also means having properly trained operators working in cultural institutions. These training sessions can be at a basic level, such as learning how to use a fire extinguisher or testing the emergency telephone list. Very technical and laborious training, on the other hand, is required to ensure preparedness in more complex and large-scale disaster scenarios, like flooded archive rooms and huge amounts of wet paper due to broken water pipes requiring the intervention of many cultural heritage protection operators on site and firefighters.

Besides the fire brigades, collaboration with other civil protection institutions, like the police, is recommended. In Germany, the Federal Agency for Technical Relief (Technisches Hilfswerk, THW) is also an important partner for support in disasters. For example, this was the case in 2021, when the high floods of the river Ahr flooded the deposits of the city museum of Ahrweiler. Members of the THW, together with the

² U. Fischer, From vision to reality - the Cologne Container for the protection of cultural heritage, in PROCULTHER-NET Project. Technical Bulletin N. 1, March 2023, pp.24-29.

local firefighters, rescued the collections. The following recovery operations were carried out by the preparedness networks of Cologne, Weimar and others.

Challenges encountered

Looking at the map of preparedness networks in Germany, one can observe that they are not spread evenly throughout the country's regions since they all are grass-root initiatives. Among German states, the state of Thuringia deserves mentioning as it supports the establishment of preparedness networks in all of its parts to ensure a more consistent support.

The results of an extensive survey on preparedness networks in Germany, published in 2023 by the German National Academy of Sciences - Leopoldina [Die Deutsche



2. Discussion on external operations (externe Einsätze), coordination (Koordination), communication (Kommunikation) and other subjects (Sonstiges) at the annual meeting of the German preparedness networks 2021 © Sebastian Lörcher, BBK

AKademie der Naturforscher Leopoldina e. V. - Nationale Akademie der Wissenschaften), has given much insight in the current situation and tasks of these networks. It showed that there is great consciousness on the importance and need of preparedness networks, but there is still a lot of work to be done.

The main challenges for the work of preparedness networks are the following:

- Some institutions lack support by their directors so that they cannot actively participate and contribute.
- Quite often, the personnel has not enough time to engage in the network.
- Some networks do not have regular contacts with the local fire-brigade. Therefore, the preparation for emergency events is not sufficient.
- As preparation is quite laborious, some preparedness networks lack regular training.
- Not all institutions have enough

emergency material in order to adequately safeguard or rescue cultural heritage in case of an emergency.

- Another challenge is to keep the network alive when active members retire or change jobs.

These and further topics are at the core of discussions at the annual meetings as shown in the graphic recordings.

Perspectives

In 2020, the team of the *SiLK* Guidelines for the Protection of Cultural Property (*SiLK* - SicherheitsLeitfaden Kulturgut), a website to inform about risks to cultural heritage and an interactive evaluation tool for museums, libraries, archives etc., took over the coordination of the preparedness networks in Germany. They support the process of specialization of the networks as well the improvement of public relations and lobbying. Since the work of the preparedness networks has shown to be very efficient, the other German speaking countries Austria and Switzerland have implemented these networks in their own system of cultural heritage protection. Future tasks will be to establish and strengthen the structures of the existing preparedness networks, especially their role within the civil protection framework, and support the founding of new ones.



3. Discussion on external operations (externe Einsätze), coordination (Koordination), communication (Kommunikation) and other subjects (Sonstiges) at the annual meeting of the German preparedness networks 2021 © Sebastian Lörcher, BBK

Slovak Mining Archives during the fire in Banská Štiavnica in March 2023

Peter Konečný, PhD, Head of Slovak Mining Archives in Banská Štiavnica and Claire Leger, Director of emergency response, Blue Shield France

The disaster

On March 18th of last year, a quiet Saturday morning suddenly turned into one of the most dramatic scenarios in modern history for the town of Banská Štiavnica. Around 9:30 am several passers-by and residents of the town centre noticed thick smoke coming from the roof of Pischl's house. The smoke was visible all over the adjacent Town Hall Square and St. Trinity Square. From the perspective of the Slovak Mining Archive, this event was particularly alarming, as the building on fire is directly adjacent to our Town Hall Square (Radničné námestie) 16. The fire in the Pischl's house, where a private museum "Banka lásky" (Bank of Love) is located, probably broke out in the evening or early morning hours. After nine o'clock, the fire flared up to such an extent that it began to affect the attic spaces of the building. The fire rescue services alerted by observers, on the street, arrived on the scene within fifteen to twenty minutes. At first, it seemed that the fire would only affect the town hall itself. However, this assumption of many people present on site proved to be wrong, as shown in the final damage reported on several buildings in the town centre.



1. The situation shortly after the first firefighters arrived
© Peter Konečný

That morning, coincidentally, shortly after the fire broke out, the archive director arrived and witnessed the critical situation in front of the archive building. Aware of the impending danger, the director promptly informed the incoming firefighters about the great risk of fire spreading from the neighbouring building to the attic spaces of the mining archives, as they are separated only by a thin wall, just a few centimetres

thick. At the same time, the director accompanied them to the hydrants of the archive building, thanks to which the fire on the neighbouring building was also partially controlled. Subsequently the director alerted the employees of the archive, as the need to evacuate the archive documents from the building's northern wing became clear, due to the risk posed by both the fire and extinguishing water. Informing the superiors about the impending risks and the situation in progress was also necessary.

In the meantime, other employees of the archive also arrived at the workplace and began to move the most important archive documents to a less endangered part of the building as a precaution. The most valuable material managed by the SBA, namely the documents of the Main Chamber Count's Office in Banská Štiavnica from 1524 to 1919, was in immediate danger. It is important to mention that its mining maps and plans are included in the prestigious UNESCO register - Memory of the World.

The fire was still active an hour after the arrival of the firefighters, and continued to spread to the surrounding buildings, fuelled by the wind. The situation at the site was complex, and the tension was high, also among the archive workers, who could watch the rapid effects of the fire on other objects in the neighbourhood from the windows of their workplace. Because of this, the fear was that a similar fate would also befall our building. At that time, smoke was already penetrating some areas of the archive closely adjacent to Pischl's house - the map of the room and attic

Shortly before half past twelve, the wooden roof of the mining archive also caught on fire. However, thanks to an effective and, above all, quick intervention by the firemen lasting about an hour, the flames penetrating from the adjacent building were stopped, avoiding worse losses and damage, as was the case with other buildings. Thanks to the presence of the archive personnel, who directed the firefighters to the risky places at the beginning of the incident, the attic of the archive was monitored, and the firefighting equipment enabled quick intervention at the key moment, when the fire was spreading to the roof of our building.



2. Roof after the fire © Peter Konečný

Despite the firefighters' speedy and successful intervention, the building of the Slovak Mining Archives suffered several damages, caused not only by the fire, but also by the extinguishing water. It first flowed from the attic to the second floor, where it flooded the corner office, and then penetrated into the depots located on the first floor. Several archive boxes containing archival documents were damaged.

Even at the time of the persistent intervention in the attic of the building, a call to help

with the evacuation of the archives appeared on social media networks, thanks to which many people followed this extremely unfortunate event. Indeed, there was an acute threat of destruction of historically significant documents of incalculable value. Thanks to the call, about fifty volunteers from Banská Štiavnica and tourists came to the archive in the following 20-30 minutes.



3. Documents displaced during the fire © Peter Konečný

Such assistance greatly helped speed up the evacuation of hundreds of boxes and other documents of precious archival heritage from immediate danger to the relative safety of the opposite wing of the building. The archival documents, which had to remain in their place due to the spreading smoke, were protected by waterproof sheets. Shortly after, the evacuation of the building was announced due to the impending risk of an explosion of leaking gas in a neighbouring building.

Thanks to a combination of favourable circumstances, and mainly due to resourceful preventive preparation of the building, that is recent revisions of hydrants, fire extinguishers and a new electronic fire monitoring system with non-flammable cables, and thanks to the willingness of volunteers and the excellent response of firefighters, the valuable historical documents from many mining areas of Central Europe were saved from devastation by fire.



4. Documents displaced during the fire © Peter Konečný

The first help that the archives received immediately after the fire was extinguished and the building was secured, came from colleagues from the Slovak Na-

tional Archives and from Banská Štiavnica Mikovíni Art School. The head of the conservation department Alena Maková and her colleagues upon the archives director's request, arrived only a few days after the fire to assess the condition of the archive's premises and archival documents affected by the fire extinguishing water. To prevent the spread of mold (fungal invasion) to the paper with the help of other colleagues, the paper conservator at the archives, Lucia Hlaváčová, started a detailed check on the condition of the documents and their subsequent drying. The Mikovíni Arts School in Banská Štiavnica also gave a helping hand, and especially its teacher in the field of paper restoration and bookbinding Radovan Blaho. In the school premises, where some sterilization equipment is also available, the most severe hazards were under control. Based on the instruction of colleagues from SNA, some of the moist archive boxes were replaced. Subsequently the damaged premises could be restored in the following months and by the end of May 2024 all documents were returned to their original place. Fortunately, not a single document went missing during this crisis and nobody was injured during the rescue actions.

Prevention measures in place during the fire

Before drawing conclusions and remarks on prevention of such crisis events in the future, I would like to focus a little more on the fire prevention measures and firefighting infrastructure in place during the fire. Since the archives are situated in a historical building, which is also protected by its national monument and UNESCO site status, all devices in the building are only a compromise solution and do not provide an ideal protection for the valuable documents stored in it.

As per an active fire alarm system we had installed one in 2022. Just few months before the new electronic fire detection system was placed in the building. The problem however was, that its signal is not directed to a permanent monitoring site (police or firefighting department), but only to the director's mobile phone. On the other hand, the new fire detection system, unlike the old one, has fire proof cables, which especially in the wooden roof section proved to be crucial as the spreading of fire was slowed down. In the case of the former detection system, the old plastic cable covers would function as an igniter cord.

The active firefighting infrastructure in the building consists only of 32 dry powder fire extinguishers and 10 fire hydrants installed in the walls of the building since the last big renovation around 1992. Most of this infrastructure was implemented during the fire last year and recently underwent an operational inspection. The staff of the archives, which currently amounts to 12 members, is annually instructed on fire hazard procedures and building evacuation. Yet, this involves only a formal evacuation drill in case of fire. Since we have no back-up storage for documents, there were no drills in the past involving this kind of scenario.

Conclusion

What conclusions and instructions can we draw from these events? First, passive and active prevention measures cannot be stressed enough. Besides the infrastructure and monitoring systems, operational extinguishing equipment is necessary. The next necessary course of action would be to bring the crisis training and instruction of staff in cases of fire, water damage or terrorist attack to a higher standard and frequency. The Archive direction and staff are working on that, even though the circumstances in the country are not optimal. There is still a lack of coordination with all the responsible authorities during such crises. A visit from Claire Leger, an expert with Blue Shield France, helped to lay the groundwork for these discussions. Hopefully, the national committee of the Blue Shield in Slovakia, established only in 2021, can be of substantial help.

Finally, as a crucial long-term solution to avert many potential crisis situations, it would be necessary to build modern and secure buildings for our archives. After the fire last year, the archive direction started a campaign for bringing to attention the suboptimal building situation not only of the Slovak Mining Archives, but of all archives in Slovakia. There is probably not one archive building in the country up to date with current standards of safety and protection of archival documents. This needs to be discussed and worked on during the coming months and years.

Fire in the Church of the Holy Trinity of Segovia (Spain) - from response to recovery: an incident/disaster can be small... losses never are

Cristina Gomez Gonzalez, Territorial Culture Servicio/UGRECYL¹ Territorial Cell -Segovia and Cristina Escudero Ramirez, UGRECYL Central Unit, Spain

“The Fire Prevention and Extinction Service has indicated that in principle only the light box and a closet are affected. The priest is concerned, however, about the consequences that the smoke may have had on the works of art that are scattered around the church.”²

It is early morning on Saturday, January 21, 2023, in Segovia, an impressive city of great cultural value, which treasures history in its streets and buildings... the fire engine sirens are blaring; it is 7:00 am, a fire broke out in the Church of the Holy Trinity.

Segovia and the Church of the Holy Trinity: from international to local importance

Important monuments such as its famous Aqueduct, the Alcazar, dominate the city, along with numerous Romanesque churches located in the medieval quarters. These landmarks make Segovia a place of great cultural relevance, which was declared a World Heritage Site by UNESCO in 1985. In this context, the Romanesque Church of the Holy Trinity (12th century), designated as BIC (*Bien de Interés Cultural*)³ since 2003, is a significant site featuring works by Ambrosius Benson and Jacopo da Pontormo.

However, all this heritage wealth may seem secondary to the social and religious importance of the site, where the numerous ordinary and extraordinary liturgical celebrations are rooted in traditions of an intangible nature.

Chronicle of an incident

Unfortunately, as is common in many ecclesiastical buildings, the Church of the Holy Trinity is not equipped with a fire alarm. These parishes often argue that, even if the administration or another entity installs alarm systems, they cannot afford the maintenance costs, also believing that fires are unlikely to occur. Some churches do have burglar alarms, as they consider theft a more probable threat.

¹ Risk and Emergency Management Unit for Cultural Heritage of Castilla y León, dependent on the General Directorate of Cultural Heritage of the Junta de Castilla y León (regional government).

² <https://www.eldiasegovia.es/noticia/z44d4544a-ccee-e328-1e4afd578225e80f/202301/la-iglesia-de-la-trinidad-sufre-un-incendio-de-madrugada>.

³ Translator's note: in English "asset of cultural interest".

It should be noted that the building's electrical system was updated in 2015 and had annual maintenance and technical inspections, the last one taking place four months before the event.

We will briefly present the succession of the most significant events while carrying out the assessment of lessons learned:

- At 7 am, the smoke triggers the intrusion alarm.
- The Alarm Receiving Centre (ARC) notifies the Parish Priest, an elderly person, to verify that it is not a false alarm - he lives in the parish house in front of the church - when he goes out into the street, he sees smoke coming from the tower.
- He informs the ARC of a probable fire inside.
- ARC -following the due protocols- notifies the national police.
- The police notify the firefighters who arrive quickly on the scene.
- The priest provides the keys and the necessary information.
- The firefighters confirm that the fire occurred in the sacristy, specifically in the electrical box and the wooden closet in which he "hid it".
- They put out the fire.
- Two fire crews ventilate the area, remaining on site until 10:30 am.
- The community citizens (given the parish priest's failed attempts), notify the Heritage Delegation of the Bishopric of Segovia on the situation.
- The bishopric contacts the Head of the Territorial Service of Culture (TSC) who notifies the Directorate General of Cultural Heritage (DGPC), activates the local cell of the UGRECYL (Segovia) and alerts the central unit of the UGRECYL (Valladolid); resources of the bishopric that are made available at 12 on the same Saturday.
- The Scientific Police, in view of the situation, did not grant access to the building to carry out investigations.
- Meanwhile, the technical team consults all the information that could be of interest and that is kept in the community heritage database (PACU), such as plans, inventory of movable property with associated files or the BIC declaration file. This work was very useful, as it allowed the team to verify the importance of two of the paintings in the sacristy, and access important data such as recent images, measurements, state of conservation, etc.
- On Monday, at noon, the technical delegation of the Junta de Castilla y León, accompanied by the Heritage Delegation of the Bishopric of Segovia, performed the assessment of the temple's state⁴; apart from widespread damage

⁴ Expert members of the technical delegation: Ruth Llorente de Andrés -Head of the Territorial Service of Culture, Tourism and Sports of the Government of Castilla y León-, Marian Herrero Garcia -Architect of the Territorial Service, and Cristina Gómez González -Territorial cell of the UGRECYL and restorer of the Museum of Segovia, assisted by the parish priest and staff of

to the sacristy, damage was reported in three pictorial works that will be detailed later.⁵

Conclusion: although we are dealing with a monument that, due to the value and cultural importance of the building and the collections it houses, can claim the highest level of protection from the Spanish state (BIC) and is of international relevance; the intervention of the emergency services did not differ from any other emergency response action carried out in a non-cultural asset.



1. Resolution of the incident by emergency teams
© Antonio de la Torre-NORTEDECASTILLA

The intervention of the firefighters did not generate new damage to the movable assets, since it was a specific and local level intervention [see image 4. Situation Plan, p. 56] on the electrical panel using CO₂; thus, situations that would have damaged the assets even further were avoided, either due to wetting or the use of chemical powder.

However, there was no communication with the Cultural Heritage services of Segovia, which would have been essential for the assets to receive immediate attention and to have coordinated a quick and preventive evacuation of the affected paintings.

It is worth highlighting the work carried out by the fire service in terms of ventilation of the affected area and the church nave in general, essential to avoid the deposit of contaminating substances on the collections.

Likewise, this lack of communication and coordination also had an impact on the decisions, taken unilaterally by the police, preventing entry to the building until their investigation was completed. As previously noted, this delay extended the essential immediate assessment of the affected heritage by more than 48 hours.

Analysis of the causes and circumstances

At the time of the assessment, the team had the results of the investigation by the judicial police: the fire was ignited by a short circuit in the electrical panel, and spread to

the Bishopric: Alberto Espinosa Sarmiento and Antonio Franco Tejedor -delegate and subdelegate of Heritage of the Bishopric of Segovia, respectively.

⁵ See in this same issue Juan Carlos Martín García. "Fire in the Church of the Holy Trinity of Segovia: from re-sponse to recovery - restoration of three affected paintings" p. 63ff.

the wooden cupboard that concealed it, causing flames, a very high increase in temperature and a large amount of smoke; The volume and density of the smoke had triggered the security intrusion alarm.

Several elements of the incident were identified which prevented this incident from ending in a much worse disaster for the cultural heritage of the parish.

One of the determining factors was that, at the time of the short circuit, the two doors of the sacristy were closed (see image 4. Situation Plan, p. 56); both the access to the main sacristy - where many different types of movable heritage are displayed - and the access to the nave of the church, where artworks of great historical and artistic value are located. This prevented the fire from spreading to the adjoining rooms, containing the smoke and, therefore, the deposition of soot.⁶ The spreading of these combustion particles throughout the church and the rest of the outbuildings would have aggravated the situation of both the building and movable assets it contained.⁷



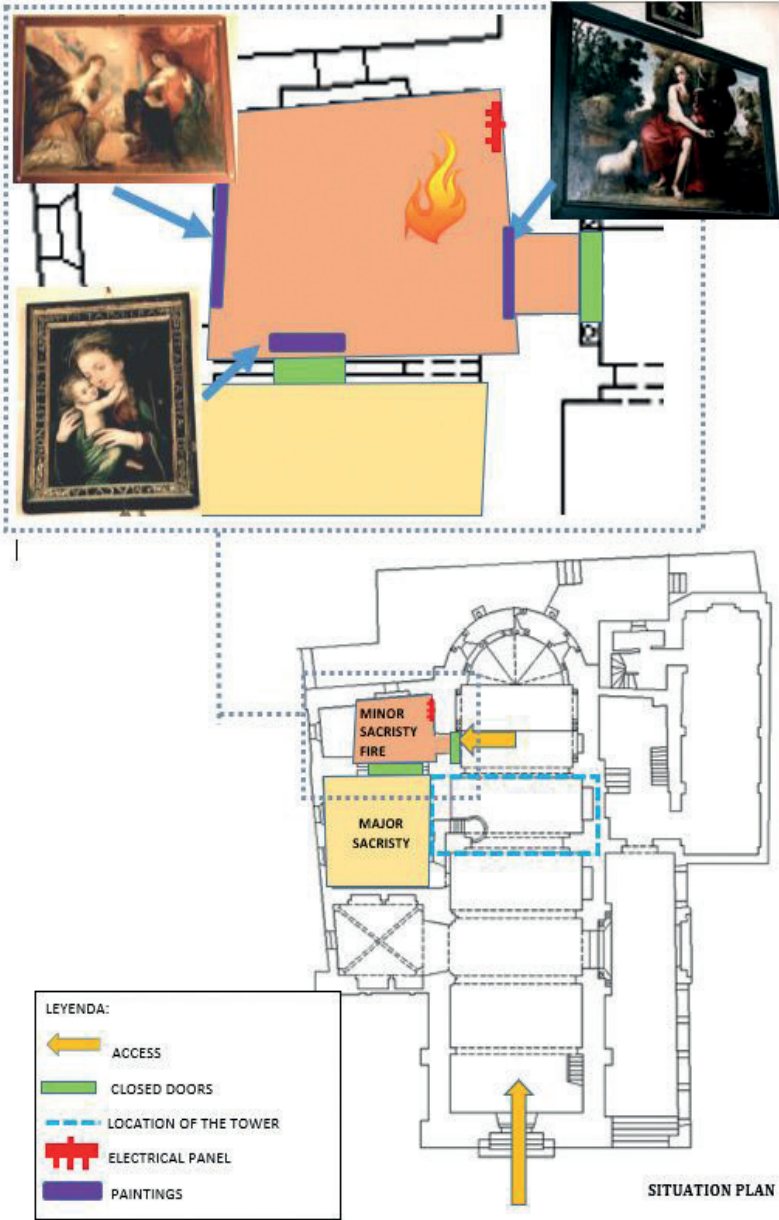
2. Origin of the fire: the electrical panel
© TSC/UGRECYL Territorial Cell



3. The sacristy after the fire © Antonio de la Torre NORTEDECASTILLA

⁶ The extensive soot deposition on surfaces (limestone, pictorial layers, metals, etc.) generates damage, since it is a chemical amalgam susceptible to reacting with materials; therefore, its removal/cleaning was a very urgent matter.

⁷ Soot is carbon dust formed by gas-phase decomposition of hydrocarbons during fire. It is composed of ultrafine particles (~2.5 microns) smaller than most pigments (2.5 to 10 microns). Depending on the fuel source and composition, gas-phase soot may contain polycyclic aromatic hydrocarbons and aliphatic carbons. Fine soot particles can penetrate interstices and become embedded in painted surfaces https://repository.si.edu/bitstream/handle/10088/87623/1008_264_TSANG_paper_final%208111.pdf.



The damage

The incident caused the suspension of all activity and services of the parish affecting ordinary and extraordinary worship and therefore the associated intangible heritage; as well as the enjoyment of tourists and visitors; disrupting the lives and causing discontent among the community, mostly consisting of very elderly people.

In terms of material damage, we highlight:

- Extensive soot deposit in the affected room, the walls and ceiling completely obscured by smoke and the plaster has come off.
- Poor state of conservation of the materials forming part of the wall that supported the electrical panel, focus of the fire:
 - The brick arch shows fire-induced vitrification processes.
 - The limestone ashlars, because of the intense heat reached and the sudden cooling during the fire extinguishing operations deteriorated, showing thermo-clastic effects (breaks in the form of large slabs and chipping) and rubefactions (changes in colour resulting from physical-chemical transformations of the rock induced by the heat) have occurred.



5. Damage to sacristy © TSC/UGRECYL Territorial Cell

- Damage of varying degrees to the cultural assets, the most serious being to two oil paintings on canvas ('Saint John' and 'The Annunciation') and an oil painting on wood panel ('Virgin and Child'). The situation of these works was worrisome, so the technical team proceeded to evacuate the three affected paintings to an adjoining room, to fulfil three objectives: to limit the blistering and lifting damage by placing them horizontally, to carry out the damage diagnosis and to clear the sacristy area to begin the recovery work there.

The analysis carried out shows that the damage was related to three factors:

- The location of the works in relation to the fire ignition point (see plan), whereby San Juan canvas was the most affected.
- The type of support: wood, a poorly conductive material, retained all the heat on the surface, which in turn affected the paint layer, while the canvas seemed to have allowed a certain degree of dispersion; thus, the panel of the 'Virgin and Child', despite its distance from the source, showed significant damage.
- The artistic technique of pictorial layers and varnishes: oil binders and resins are more sensitive to the temperatures reached.

The most important damages being:

- Deposit of soot on the surface.
- Initiation of calcination processes in some areas.
- Extensive vesiculation (blistering), indicative of the interaction of the high temperatures with the resinous and oily components of the polychrome and varnish layers.
- Dehydration of the components of the preparatory layers, which can worsen in a short time if not stabilised under climatic conditions, aggravating the damage.
- Shrinkage of the supports due to loss of humidity - wood and canvas - which causes cracking and loss of adhesion of preparations and pictorial layers.

To alleviate the negative effects of the alteration processes, the first action taken by UGRECYL was to vacuum the most superficial layer of soot using a HOOVER® equipped with a HEPA filter and controlled intensity. This approach aimed to prevent soot particles from penetrating the irregularities of the painted layer and adhering to it.



6. Detail: damage to the pictorial surface © Antonio Plaza, CCRBC

Decision making: towards a return to normality

Faced with this situation, several objectives were quickly established.

- Recovery of the parish's activity.
- Repair of building damage, including the replacement of its installations.
- Restoration of the damaged paintings.

The collaboration of the Junta de Castilla y León and the Bishopric was decisive in carrying out such operations as quickly and efficiently as possible.

Recovery of the activity

The bishopric was responsible for managing parish activities and worship. The “ordinary” worship services were relocated to the Parish House, located across from the Church, to avoid disrupting the community's religious practices. The most important celebrations that required a larger capacity, as well as those of an extraordinary nature, such as funerals, weddings, or baptisms, were moved to another church in the same neighbourhood. To guarantee the immaterial traditions linked to the worship of Saint Nicholas of Bari, which takes place every Monday, the image was transferred to the Parish House.

Repair of the damage suffered by the building, including the replacement of its installations⁸

The works needed were the cleaning of the areas blackened by the smoke and the replacement of the damaged elements (electrical installation, flooring and plastering).

Given the BIC status of the building, these interventions required mandatory authorisation from the TSC-Territorial Commission of Cultural Heritage. Consequently, the TSC expedited all procedures to ensure that the planned actions could be implemented as quickly as possible.

The TSC deployed its technical staff to manage the property and relied on UGRECYL for expert advice and to set the guidelines for actions on the affected cultural heritage. This included tasks such as removing soot from the walls and ceiling of the room, as it was crucial to eliminate toxic particles that could spread to other rooms and harm the artworks. To preserve the integrity and appearance of the historic walls, the UGRECYL's territorial cell conducted tests to determine the most appropriate procedure for action.

⁸ <https://cadenaser.com/castillayleon/2023/03/02/avanzan-las-obras-en-la-iglesia-de-la-trinidad-tras-el-incendio-sufrido-en-enero-radio-segovia>.

Restoration of the paintings

The damage to the paintings altered their appearance and made them difficult to read. These were active processes that, if not stabilized, would have worsened the situation and made recovery more challenging.

To address the most significant issues discussed, a scientific study is needed to determine the transformations caused by the high temperatures and the interaction of soot with the constituent materials of the paintings. These scientific studies and analyses are essential for assessing the potential for recovery, determining the extent of the restoration work, and identifying the appropriate treatment methods.

For all these reasons, it was decided to transfer these paintings to the *Centro de Conservación y Restauración de Bienes Culturales de la Junta de Castilla y León* (CCRBC),⁹ a centre equipped with laboratories to carry out the necessary studies and competent technicians to undertake this complex restoration, which is considered a research process.

The transfer was carried out by the territorial cell of the UGRECYL as quickly as possible, to prevent the progression of the detected alterations and processes, bearing in mind that this type of work requires appropriate safety measures so that the Cultural Heritage assets do not suffer any further damage during handling and transport, using materials and transport boxes suitable for this purpose.¹⁰

The decisions made for the transfer were:

- Despite the poor condition of the pictorial surface, no protective procedure is carried out, such as fixing blisters or wallpapering to protect the surface using adhesive material. This would have caused the fixation of soot and polluting substances, making their subsequent elimination difficult.
- The packaging, individual for each painting, was designed to separate the artwork without any material coming into contact with the surface layer and causing blisters to break, creating an air chamber above it.
- During transport and handling of the packaging, the horizontal position of the pieces is maintained.

⁹ <https://www.youtube.com/watch?v=82wilShQqvl>
<https://www.ccrbcsimancas.com/>

¹⁰ We would like to thank the Museum of Segovia for their collaboration, providing the necessary packaging and materials.

Lessons learned

Throughout this article, we have tried to convey how a small, fortuitous accident in an enclave of cultural heritage, with apparently few consequences, has more after-effects than it seems.

The incident halted the parish's activities and threatened the conservation of three pictorial works. If prompt intervention had not occurred, the recovery of these artworks would have been at risk.

The fire at the Church of the Holy Trinity highlights several issues in heritage management, including the high cost of alarm systems for small communities and the belief that such incidents are unlikely. Traditionally, cultural heritage protection has focused on 'everyday' risks, but there is a pressing need to incorporate the concept of 'extraordinary' risks into the sector's rules and regulations to prevent such incidents.

This event also demonstrates that, despite numerous initiatives to integrate cultural heritage into the framework of civil protection, there is still a need for this integration to be made real and effective. As seen in this incident, the lack of coordination and integration between the heritage sector and emergency responders delayed attention to the affected heritage by more than 48 hours.

The protection of cultural heritage by all sectors involved must be guaranteed in all cases, not only when it affects large complexes such as cathedrals or museums, the heritage of small enclaves like this one must also be addressed with the same diligence.

To achieve this, it is not enough to rely on the goodwill of citizens or communities. The protection of cultural heritage as a value and resource to be safeguarded must be incorporated into the regulations of all territorial contexts. For example, the Territorial Civil Protection Plan of the Segovia Municipality (2003)¹¹ does not address or even mention cultural heritage in its emergency response strategies, which underscores the need for its inclusion in future regulations.

Furthermore, while the Special Plan for the Historic Areas of Segovia (PEAHIS), drawn up in 2019, addresses the urbanistic and cultural organization of the city's central area - including the conservation of historical, cultural, and natural heritage, as well as the protection of archaeological and ethnological assets—it does not include provisions for emergency situations.

¹¹ <https://segovia.es/sites/default/files/Media/Files/2022-12/TEMA%20PLAN%20TERRITORIAL%20P.C%20DE%20SEGOVIA.pdf>

By way of conclusion

In addition to major-scale disasters such as earthquakes and floods, which cause widespread loss of life and extensive damage to cultural heritage, there are also smaller-scale 'disasters' like the fire at the small parish church described above.

How should cultural heritage damage be measured? By the number of works affected, their importance in terms of economic, historical, and artistic quality or their iconic-symbolic value? There is no easy or correct answer.

Each work, painting, monument, tradition... is the fruit of human ingenuity, in each time and place, and it achieves meaning by the relationship established over time with the communities and generations that interact with them, who consider them as their own, regardless of who they belong to, because they belong to their community, that is their identity.

Cultural heritage does more than recount HISTORY; it tells our personal stories, capturing the stages of our lives and the milestones of history that we pass on to those who come after us.

Fire in the Church of the Trinity of Segovia: from response to recovery - Restoration of three affected painting¹

Juan Carlos Martin Garcia, Painting and sculpture Conservator, Centro de Conservación y Resturacion de Bienes Culturales de Castilla y León - Ministry of Culture, Tourism and Sports - Junta de Castilla y León, Spain

Deterioration of cultural heritage assets resulting from disasters tends to be the most alarming, striking and, on many occasions, the most difficult effect of damage to treat. Without a doubt, the material alterations caused by fires in works composed of organic materials represent a challenge when undertaking studies and restoration work. The increase in temperature and combustion result in a series of alterations and deteriorations that involve significant modifications in the physical-chemical characteristics of cultural heritage assets, in addition to formal and aesthetic changes that are usually irreversible.

The fire that occurred in the sacristy of the Church of the Trinity of Segovia on January 21, 2023, caused the alarming and striking deterioration of, among other assets, three pictorial works located in the sacristy where the disaster originated. These works include two paintings on canvas: "Saint John the Baptist" (94 x 145 cm) and "The Annunciation" (115 x 156 cm); and one painting on a panel: "The Virgin with the Child" (44 x 30.5 cm), traditionally known as "The Virgin of Bethlehem".

The Center for Conservation and Restoration of Cultural Assets of Castilla y León (Centro de Conservación y Resturacion de Bienes Culturales de Castilla y León - CCRBC), aware of its obligations and functions of conservation and restoration of the cultural heritage of the region, that presents special conservation challenges, in close collaboration with the technical staff of the Territorial Service of Culture of Segovia and the diocese of Segovia, has undertaken the study and restoration work of the three paintings severely damaged by the recent fire. This center has a multidisciplinary technical team made up of conservators with various specializations, a carpenter-cabinet maker, a photographer, a physicist, and a chemist, along with extensive equipment for examination and analysis techniques.

The first priority was to establish collaboration and coordination among the parts. In Segovia, the restorer of the Segovia Museum, Cristina Gómez Gonzalez, carried out the first packing and preparation tasks for the transfer to the CCRBC. Despite the fragility of the works, it was decided that temporary protections should not be placed on the pictorial surfaces that could jeopardize the consequent conservation

¹For a comprehensive account of the interventions by the firefighters and the local police, as well as on the first damage assessment and securing of the damaged movable assets carried out on-site by the technical delegation, see in this same issue: C. G. González and C. Escudero Remirez, "Fire in the Church of the Trinity of Segovia: from response to recovery - a disaster can be small... losses never are", p. 52ff.

treatments, as well as the photographic documentation and the examination procedures with different ranges of the electromagnetic spectrum.

During those first days, the technical staff of the Segovia Museum and the Diocese of Segovia sought and provided all available documentation of the paintings, such as restoration reports carried out previously and photographic documentation prior to the fire.

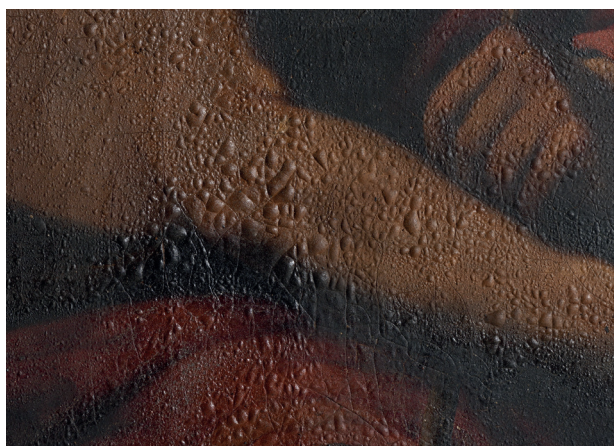
Once transferred to the CCRBC, they undergo inspection and a thorough organoleptic examination. Among the worst deterioration effects on the works were those affecting the aesthetic and plastic appearance, due to the extensive soot deposit from the smoke of the fire that masked and hid almost the entire pictorial surface.

A more in-depth examination of the works revealed the fragility of the stratigraphic system, which resulted dehydrated. Furthermore, in large areas of the painted layers, (excluding the preparatory layers), the works presented several blisters caused by the exposition to high temperature. These blisters were more evident in the areas of greatest filling with the highest concentration of oily binder.

Essentially, the damage affected the preparation, pictorial and surface varnish layers. The three artworks required a similar restoration methodology to address the damage inflicted by the fire.



1. *Virgin with Child*. State of conservation before restoration. Surveys of pictorial strata in the form of blisters © Alberto Plaza, CCRBC



2. *Saint John Baptist*. State of conservation before restoration. Surveys of pictorial strata in the form of blisters © Alberto Plaza, CCRBC

In order to document the state of conservation, before the restoration treatments, a detailed photographic scan was carried out, both on the front and the back, with different types of lighting in the visible range, and induced fluorescence images were also taken by ultraviolet (UV) lighting. This documentation was completed with the creation of detailed damage maps that graphically represented the deterioration on the artworks' surfaces.

Microsamples were taken from the system of preparation, pictorial and surface layers. In this sense, the assessments conducted have not provided significant data indicating changes in the chemical structure of the pigments and other elements that make up the works.

These works were restored a couple of decades before the disaster. In the two paintings on canvas, the restoration work consisted in re-lining them and, like the painting on wood panel, they included the removal of oxidized varnishes and chromatic reintegration of gaps. With absolute certainty, we can affirm that thanks to the re-linings carried out, the canvases withstood exposure to high temperatures without showing any deformations. Considering the degree of dehydration and state of conservation of the works on canvas, had they not undergone restoration prior to the fire, they would, most likely, be irretrievably damaged in the fire disaster.

Unfortunately, in the course of these past conservation treatments no samples were retrieved for the characterization of the materials and pictorial techniques. It would have been very interesting to compare the samples and reports from the analyses conducted before the fire and those performed now at the CCRBC. Furthermore, photographic documentation of the processes of the conservation works was scarce and of poor quality.

In this intervention methodology, it was established that the restoration processes would commence immediately following the evaluation of the state of the artworks once the fire was extinguished. All operations were coordinated by qualified technical personnel and the conditions, packaging and transportation systems were established in collaboration with the CCRBC.

Although it was clear that the primary priority of the restoration work was to address the deficiencies in the adhesion and cohesion of the pictorial layers and to manage the dehydration of the materials, it was also essential to ensure that the agglomerated black soot particles did not consolidate or adhere undesirably to the temporary protection of the paintings. This was a crucial step for effectively carrying out the subsequent treatments for fixing and consolidating the stratigraphic system. For this reason, it was decided to eliminate most of the soot through a meticulous first cleaning with a mixture of solvents with rapid evaporation and great penetration (Ethyl Acetate and Methyl Ethyl Ketone at 50 %) [see image 3. p. 66]. Thanks to this method, practically all of the soot was removed before proceeding with the usual protection, consolidation and fixing treatment of layers with rabbit glue.

Rabbit glue was selected as the adhesive material for the consolidation treatment because it has similar characteristics of the binder component used in the preparation of the works.

During the rehydration phase, the application of controlled temperature and pressure using thermal spatulas proved effective in restoring the painted layers to their original condition: it was possible to verify that the bubbles of the painted layer returned to their original disposition without the need for other alternative pressure and temperature systems.

As many of the soot particles as possible were removed from the backs by gentle mechanical means without damaging the supports.



3. *Virgin with Child. Soot particle removal process*
© Alberto Plaza, CCRBC

Once the tissue paper protections were removed, the cleaning and removal of surface varnishes was carried out, the gaps were coated with a filler similar to the original preparation one (calcium sulphate and animal glue) and chromatic reintegration with watercolor and varnish pigments with a discernible technique of vertical *tratteggio*, finishing the treatments with the application of protective varnish.

Thanks to this intervention, the material and aesthetic recovery of the works was successfully achieved, despite the fact that having suffered a fire disaster, the works seemed doomed. For this purpose, both the intervention criteria and the CCRBC's usual work methodology were followed.

We believe that interventions on these paintings can be considered successful for two reasons: the first, the coordination of the technicians involved in the intervention, and the second, the precaution of removing the soot from the pictorial surface of the works before proceeding with the necessary consolidation treatments. If this procedure had not been implemented, it would have been very difficult, practically impossible, to remove all the soot, as can be affirmed by observing the chromatism of the works noticeably modified.

Intervention on these paintings has highlighted the importance of having good quality photographic documentation in any conservation-restoration process because: although we managed to correct the surface deformations of the pictorial layers caused by the fire disaster, doubts remain regarding the completeness of the chromatic and aesthetic recovery of the artworks. Specifically, it is uncertain whether the exposure to the fire's environmental conditions and the interaction with soot components have fully accounted for the chromatic changes observed in these paintings.

This restoration intervention, like any other, has revealed the importance of the concurrence, coordination and collaboration of specialized technicians in conservation-restoration in various fields.

To conclude, we have to state that there is no great development and detailed publications on the conservation of paintings that suffered damage and deterioration derived from disasters such as fires.



4. *Virgin with Child*. State of conservation before restoration © Alberto Plaza, CCRBC



5. *Virgin with Child. Final state after restoration* © Alberto Plaza, CCRBC



6. *The Annunciation*. State of conservation before restoration
© Alberto Plaza, CCRBC



7. *The Annunciation*. Final state after restoration © Alberto Plaza, CCRBC



8. *Saint John the Baptist. State of conservation before restoration*
© Alberto Plaza, CCRBC



9. *Saint John the Baptist. Final state after restoration* © Alberto Plaza, CCRBC

Earthquakes debris of cultural interest: the Italian methodology for their management, selection and reuse (Part a. Regulatory provisions and operational indications)

Maria Agostiano, Sara Esposito, Giovanna Marrese - Ministry of Culture, Directorate General for Cultural Heritage Security, Italy

Introduction

To be, suddenly, deprived of an asset of cultural interest is something hardly acceptable by communities, whether the loss is caused by natural disaster (earthquakes, floods, landslides, etc.) or by human actions (theft, terrorist acts, war scenarios, etc.).

The emotional impact is not only perceived at national or international level (if architectural or artistic masterpieces are involved) but also at local level as it affects citizens and communities, due to the historical legacy and the strong identity value that some assets represent for a specific territory.

After the collapse of the bell tower in St. Mark's Square in Venice on 14 July 1902, there was a heated debate in Italy about its reconstruction. Experts and public opinion were divided between conservative positions, holding on to the “*where it was and how it was*” motto and the more progressive one of using modern design and structures.

This debate has been constant over the decades in Italy concerning every event that caused cultural heritage damage or irreparable loss, from the bombings during the First and Second World War (with the widespread reconstruction plans undergone by entire historic centres) to the devastating seismic events of recent years.

Consequently, the discussion on the recovery and possible reuse of what remains of the cultural heritage destroyed, the so-called “debris of cultural interest”, has also developed. This debate led to a specific methodology defined in detail after the devastating Central Italy earthquake of 2016-2017.

Regulatory and methodological framework

Until the shocking seismic disasters that affected Italian territory in recent years (1997-2017), the issue of managing debris of cultural interest was a primary concern for CH isolated buildings, mainly focusing on the recovery of elements bearing artistic value.

The devastating 2009 Abruzzo earthquake, which produced an estimated 5 million tons¹ of “waste”, marked a turning point. It caused widespread damage, affecting not

¹ The data relating to the monitoring of all the activities connected with rubble removal are reported on the website <https://www.maceriesisma2009.it/index.php?lang=it§ion=home>.

only CH buildings (mostly churches), but also entire historic centres, characterized by urban fabrics of high historical and cultural value, including L'Aquila and its surroundings. This event highlighted the importance of protecting "minor architecture" as an expression of local community identities, alongside major monuments. The local Superintendency², therefore, disclosed some specific operational indications in this regard.³

The Abruzzo earthquake also prompted the initiative of reducing overall rubble volume, to be disposed of through careful recovery of all reusable material for reconstruction.

The methodology developed in Abruzzo, was experimented following the earthquake that struck the Emilia Romagna region only three years later on 20 May 2012. In response, the Ministry of Culture, in collaboration with the Civil Protection Department, issued a specific Directive on the procedures for the management of activities for the safeguard and protection of cultural heritage in emergencies caused by natural disasters.⁴ Among the various topics (operational structures, command and

In order to avoid illicit activities in waste disposal, the selection, removal and transport of rubble are under the control and constant monitoring of the Special Offices for Reconstruction (USR) established within the Regional Administration (in this case USRA - Special Office for the Reconstruction of the City of L'Aquila and USRC - Special Office for the Reconstruction of the Municipalities of the Crater area).

² The Superintendency for Architectural and Landscape Heritage are peripheral office of the Ministry of Culture responsible for managing the cultural heritage of a specific city, province or region.

³ For the removal and preservation of culturally significant architectural elements was recommended:

- the recovery of all wall ashlar, moldings, bas-reliefs, and decorative elements;
- the selection of historic bricks and stones from wall facings, with at least one face measuring approximately 30 cm or more;
- the orderly storage of materials on pallets, protected with waterproof sheets, with clear labeling of their origin (street/square name and pertinent building name);
- the identification of suitable fenced and monitored spaces by local municipal administrations for storage and safekeeping of valuable stone elements.

At the same time, for the CH buildings (Basilica of Collemaggio, Church of Santa Maria Paganica, Church of the Anime Sante, etc.) they proceed with an archaeological method, with a dual purpose, on the one hand to recover the architectural and artistic elements in the best way and on the other hand to document and analyse the structural behaviour of each building during the earthquake. Since the collapses due to seismic shocks brought to light the oldest structures or decorative elements (e.g. many frescoes) covered by later renovation works, the activities carried out on rubble have also been an opportunity to increase knowledge on the different construction phases of the historic buildings.

⁴ Directive of the Minister of Cultural Heritage and Activities and Tourism (subsequently renamed Ministry of Culture), 12 December 2013 ("*Procedures for the management of activities for the safeguarding and protection of cultural heritage in the event of emergencies resulting from natural disasters*") and subsequent update Directive of the Minister of Cultural Heritage and Activities and Tourism, 23 April 2015. The Directive defines the governance for the pro-

control chain, actors involved, operating teams, procedures, etc.), the management of debris of cultural interest is also explained, formalizing the procedures tested in previous years.⁵

The Directive procedures were put to the test with subsequent earthquakes that devastated Central Italy between 2016 and 2017, involving 4 regions and over 100 municipalities. Unfortunately, on this occasion too, the extensive damage to aggregate buildings and urban centers created complex situations where culturally significant materials were mixed with ordinary debris and various types of waste (electrical and electronic equipment, vehicles, etc.).

The characteristics and procedures of rubble removal were, in particular, influenced by the emergency of the historic centres of Amatrice and Accumoli.⁶ The need to open the main streets to transit as soon as possible required balancing quick results with correct methodological approaches. It was therefore necessary to define a methodology that would allow the debris of cultural interest to be quickly identified, selected and managed, especially in the case of rubble relating to urban aggregates and mixed waste. Starting from a critical analysis of the experiences previously described, the Ministry of Culture introduced a classification system for

tection of cultural heritage in emergencies. It constitutes the integration and arrival point of all previous experiences, but also the basis for continuous updates and improvements. In accordance with the Directive, under the General Secretary of the Ministry is activated in the event of emergencies involving Cultural Heritage the Crisis Unit - National Coordination (UCCN-MiC). The UCCN-MiC ensures necessary coordination with all the Public Administration involved in emergency management, such as Civil Protection, National Fire and Rescue Service, etc. It also guarantees the coordination between central and peripheral structures of the Ministry. At the regional level, the UCCN-MiC activates the Crisis Unit - Regional Coordination (UCCR-MiC) that is coordinated by the Regional Secretary of Ministry and ensures the operative procedures concerning cultural heritage, including damage assessment, cataloguing, securing movable assets, temporary storage management, site security measures, debris management, relocation of movable assets, on-site restoration interventions, etc.

⁵ In particular, it is highlighted that Ministry of Culture officials have to supervise all activities concerning the removal of rubble which might include elements of cultural interest and provide the necessary operational indications. It is also recommended the use of adequate mechanical tools and machinery to avoid further damage due to incorrect handling; from an operational point of view, through a visual inspection, it must be done an initial selection of material of obvious interest such as large stones, worked stones, doors, works of art, ancient pottery, tiles, worked wood, worked metals, etc.; the selected materials of interest must be stacked on wooden pallets or, if they are very heavy, on metal carpentry platforms capable of supporting their weight; temporary protection with the use of suitable devices (barriers and sheets) is necessary; the selected elements have to be transported to suitable storage spaces, where a further selection could take place and, if necessary, some first aid interventions done; the recovered elements can be reused for restoration and reconstruction works or, otherwise, placed in a specific depot or museum area.

⁶ Severely damaged by the first seismic shock of 24 August 2016 and completely destroyed by the subsequent shocks of 26 and 30 October 2016.



1.a Amatrice, Corso Umberto, before Central Italy earthquake, 24 August 2016 © Google maps



1.b Amatrice, Corso Umberto, after Central Italy earthquake, 24 August 2016 © Maria Agostiano

rubble dividing it into three categories.⁷ Specific procedures were set out for each category, defining all activities from removal planning, selection, and inventory of each element to the characteristics of storage areas and indications for subsequent reuse.

The seismic events of Central Italy in 2016-2017⁸ highlighted the need for a closer collaboration between the different components of the Civil Protection System. Therefore, after the emergency phase was over, the Department of Civil Protection set up various inter-institutional tables to define shared procedures (damage survey and usability, inspections, information systems interoperability, etc.). In the specific case of rubble management, the results of the discussion among the various administrations led to the definition of the document “Operational indications for the management of rubble following a seismic event”⁹. The paragraph 5.1.10, in particular, deals with “Debris resulting from collapses and demolitions of protected assets and his-

⁷ Ministry of Culture, Directive of the General Directorate of Archaeology, Fine Arts and Landscape 12 September 2016, n. 11087, “Procedures for removing and recovering debris from assets of cultural interest and historic buildings”.

⁸ In compliance with the Directive of 23 April 2015 (see note 4) the Ministry of Culture was for the first time immediately involved in emergency activities.

⁹ Formally adopted by the Decree of the Head of the Civil Protection Department 13 December 2023, n. 4353. In the document it is put in evidence how the management of rubble caused by a seismic event represents a particularly delicate and important issue, both for the related health, social, environmental and economic implications, and for the technical critical issues associated with the movement of a big amount of materials. It therefore must find immediate application from the first phases of emergency management in order to guarantee: the opening of access points for people assistance; restoring the functionality of roads and public services; securing of unstable buildings and any other structure. This methodological regulatory provision collects and critically re-elaborates, in a single document, various experiences in the rubble management gained in Italy in the most recent seismic emergencies. All aspects are addressed in detail, providing indications for the adoption of the relevant emergency ordinances, starting from the identification of the initial producer/holder of the rubble, up to all the phases of the subsequent management.

toric buildings". Confirming and validating the specific methodological approach defined by the Ministry of Culture, with this last document the CH debris management has been included in the more general framework of coordinated management of all types of rubble and waste resulting from a seismic event.

In the next paragraphs, we will describe in detail the procedures defined in the aforementioned document. Due to the complexity of the topic and editorial constraints, this paper cannot be exhaustive. A potential future article will explore concrete cases from the 2016 Central Italy earthquake to delve deeper into the Italian methodology for managing, selecting, and re-use of earthquakes debris of cultural interest.

Debris of cultural interest classification

According to the *Operational indications*, cultural heritage debris is classified in:

- **type "A" debris:** debris resulting from the collapse or demolition of cultural heritage buildings or historical monuments.

This kind of debris includes artefacts of great historical and architectural interest as well as all types of decorative elements (columns, capitals, cornices, inscriptions, ornamental claddings, frescoes and wall paintings, mosaics, carved wood, crafted metal works, wall ashlar, etc.). Their reuse is strictly linked with the reconstruction of the building/monument, to which they refer and therefore it is very important to analyse the collapse process for the correct identification of the original position of each element.

- **type "B" debris:** debris resulting from the collapse or demolition of historic buildings (e.g., inside historical centres or urban/building aggregates).

This kind of debris includes stone materials, both of the wall system and of door and window jambs or thresholds, frames, any decorative elements, ceramics, carved wood, worked metals, tiles, etc. This type of debris can be used again in the subsequent reconstruction phase, contributing to the restoration of the identity of the places affected by the earthquake (e.g., stone elements to build or restore walls, tiles for roofing, etc.). Stone materials can also be used for production of mortars/plasters or other alternative uses (i.e. new urban design).



2.a Amatrice, Via Madonna della Porta, before Central Italy earthquake, 24 August 2016

© Google map



2.b. Amatrice, Via Madonna della Porta, after Central Italy earthquake, 24 August 2016

© Maria Agostiano

- **type “C” debris:** debris with no cultural interest (e.g., modern buildings material).

The only precaution is to avoid interference with type A and B debris, in particular if type A or B debris from adjacent buildings is disposed of as type C debris. This rubble is in many cases disposed of as waste or may be re used for various construction purposes (e.g., fillings).



3. Amatrice, S. Francesco Church, type A debris © Maria Agostiano



4. Amatrice, historic centre, type B debris © Maria Agostiano

Preliminary interventions

The classification and storage of a large amount of rubble is a logistical problem that inevitably involves several actors, each with specific competences.

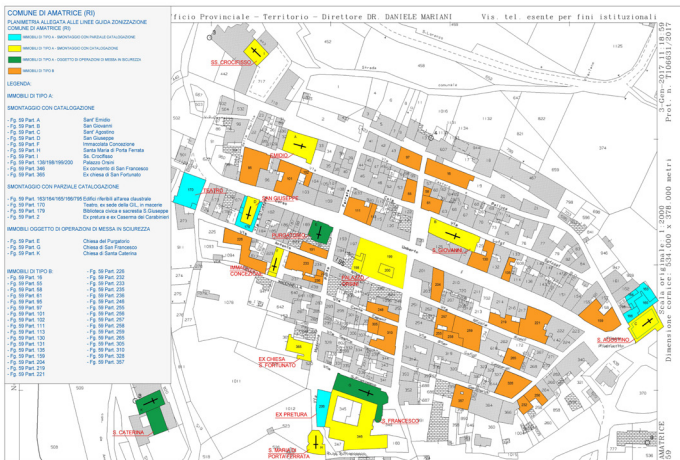
In the *Operational indications* some standardized procedures are defined. However, the complexity and uniqueness of each emergency event could make it necessary to adopt specific derogation procedures, defined through emergency regulatory provisions (such as municipal ordinances).

Generally, the local authority (municipal administrations or other public agencies) that in ordinary conditions deals with the disposal of urban waste can carry out rubble management. If the amount of rubble should exceed their organizational capacity, private companies may hire also through specific exceptions to the public contract regulations. In recent emergency events, rubble management was mainly entrusted to the Regions, through the Special Offices for Reconstruction (USR). If urgent reasons require immediate interventions, some phases or activities can be directly carried out by the operating structures of the National Civil Protection System, primarily the National Fire and Rescue Service.

Regarding cultural heritage, all activities must be implemented under close supervision by the Ministry of Culture through its peripheral offices, particularly the Regional Secretariats that coordinate the Regional Crisis Unit (UCCR-MiC).¹⁰

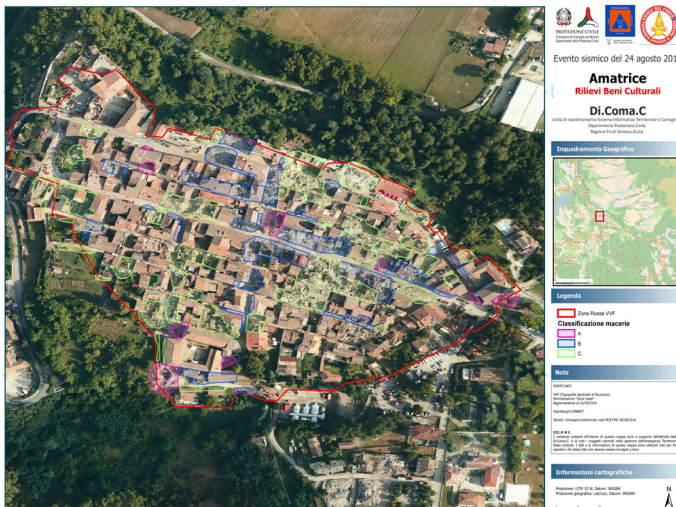
¹⁰ See note 5.

Firstly, from the operative point of view, it is necessary to identify and map the different types of rubble (A, B and C). This activity focuses on the cartography first, using aerial photography and cadastral maps, after which it is carried out on site, by circumscribing the various piles of rubble with the use of pegs or other delimitation elements. Each pile is identified by its predominant rubble type, though all types may be present in varying percentages.



5. Amatrice, historic centre after Central Italy earthquake, 24 August 2016. Identification on the cadastral map of buildings of cultural interest (type A debris) and of historical building with significant architectural elements (type B debris) © UCCR-MIC Lazio

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6. Amatrice, historic centre after Central Italy earthquake, 24 August 2016. Mapping on a high resolution aerial photograph of the piles of rubble corresponding to the buildings previously identified on the cadastral map and consequent classification in Type A (pink pattern), Type B (blue pattern) and Type C (green pattern) © DICOMAC, UCCR-MIC Lazio

If no short-term measures are available, the building debris (especially type A) needs to be protected with temporary tarpaulins. Long-term protection may involve scaffolding or protective roofing for fragile findings. Measures to divert rainwater are also necessary to prevent it from penetrating under the debris.

The debris must preferably be pre-selected on site, through a preliminary visual inspection to identify hazardous waste and elements of cultural interest. Due to emergency reasons connected with traffic circulation or people safety, as an alternative to on-site selection, a temporary storage site can be used where sorting and selection operations can be carried out without haste.

Simultaneously with the removal of the rubble, it is necessary to secure what remains of the monumental or historic buildings. In many cases, rubble piles often play a “structural” role in stabilizing ruins. Therefore, their removal must necessarily go hand in hand with the consolidation works.

In urban aggregates or entire historic centres, it is also important to preserve the memory of the pre-existing urban layout, by avoiding ground-level demolition and maintaining base wall parts as cornerstones for future reconstruction planning.

Methodology for type “A” debris

This methodology applies to rubble piles that contain mainly, but not exclusively, type A debris.

Type A debris must be kept on site, i.e. near or within the building from which it refers. If this is not practicable, it must be placed in a safe place, also considering areas that could become available once the debris belonging to other categories (type B and C) has been removed.

After the preliminary activities, the developed methodology provides an initial selection and separation on site, aimed at recovering the immediately recognizable elements of cultural interest. At the same time, it is necessary to proceed with an initial cleaning of incongruous materials (e.g. reinforced concrete blocks, brick-cement roofing, etc.) according to no cultural interest debris procedures (type C).

If the removal of the rubble requires a long period of time, adequate protective structures must be built to replace the temporary tarpaulins (for example temporary sheds with wooden or steel structures).

Any fallen building elements, fragments or artefacts must be collected, identified, classified, numbered, and if displaced, securely stored for later reinstatement and to prevent decay and/or robbery. For this purpose, archaeological stratigraphic excavation techniques can be used to divide the area in quadrants. For the correct identification of the original position of each element, this procedure also allows to reconstruct the process of the complete building collapse or of some parts of it. All elements selected concerning type A debris must be preserved even if severely damaged.



7.a



7.b



7.c



7.d

Accumoli, Santa Maria della Misericordia Church, type A debris management: initial selection to recover the immediately recognizable elements of cultural interest (wooden altars, statue of the Pietà, various devotional artefacts, etc.) - activities carried out by the firefighters for emergency reason with the coordination of technical officials of the Ministry of Culture 7.a © Corpo Nazionale dei Vigili del Fuoco 7.b © Corpo Nazionale dei Vigili del Fuoco 7.c © Alessandro Betori 7.d © Alessandro Betori



7.f



7.g



7.h

Accumoli, Santa Maria della Misericordia Church, type A debris management: recovery of the stone elements of architectural interest also through the controlled dismantling of the unstable structural parts - activities carried out by a construction company specialized in the cultural heritage element sector; numbering and cataloguing of each stone element for the correct identification of their original position © Maria Agostiano



Accumoli, Santa Maria della Misericordia Church, type A debris management: storage of recovered stone and wooden elements in a covered area near the church 7i © Maria Agostiano 7i © Alessandro Betori



Methodology for type “B” debris

This methodology applies to rubble piles that contain mainly, but not exclusively, type B debris. Therefore, on the basis of instructions given by a qualified technical expert (restorer, art historian, archaeologist, etc.) or by a technical official of the Ministry of Culture, before moving the rubble with mechanical means, each element, that can be immediately identifiable as type A debris, must be recovered.

The subsequent selection to recover further elements of particular value, as well as the greatest possible quantity of elements of historical importance, takes place under the supervision of the Ministry of Culture. This operation is ordinarily on site or nearby, logistical conditions permitting; otherwise, it can be performed in delimited and equipped areas, specifically identified by the competent municipal administration, for the storage of type B debris.

When moving and stacking materials, attention must be made to accurately pairing the pile of rubble with its quadrant or cadastral particles and then to associate the selected elements with the corresponding pile of rubble, so as to be able to trace their original location.

Conclusion

Although expressly indicated for seismic events, the illustrated methodology can be used for any other emergency.

Its strength lies in being grounded not just in theory, but in critical analysis of regulatory provisions applied during the seismic events in L'Aquila (2009), Emilia Romagna (2012), and Central Italy (2016/2017), as well as practical experience gained from these events. While the procedures have been extensively tested, they remain flexible for adaptation to specific emergency scenarios and are open to further refinement.

Another strong point of the document is the broad agreement reached among all the administrations involved, beyond the logic of sectoral regulatory provisions. Although managing culturally significant debris is a highly specialized field requiring constant Ministry of Culture supervision, the procedures can and should be shared among all the actors involved and pertain to all types of rubble, implementing the related advantages in terms of costs and benefits.

A critical point, often stressed, is the relationship with the subsequent reconstruction process. We often wonder whether such a demanding expenditure of human, instrumental and economic resources, also taking into account the long-term management of reusable rubble storage sites, is justified. The need to act urgently means that rubble management is based on the hypothetical belief of re-use as many original materials/elements as possible in the reconstruction plans, and at the same time actually reusing all the recovered elements. Only the subsequent reconstruction planning process, which often requires many years and could lead to the decision not to rebuild some structures and/or hamlets, will define the actual utility of the recovery phase of the rubble, with the risk of having wasted time and economic resources unnecessarily.

In other words, it is not the reconstruction process that determines the recovery process of cultural heritage debris, but, rather, if the correct approach, in terms of methodology, is adopted, the rubble recovery results become essential for the subsequent reconstruction phase.

Resorting to virtual reality for cultural heritage protection purposes: findings from the EU-funded PROCULTHER-NET Project

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Introduction

In 2023, the PROCULTHER-NET - “Protecting Cultural Heritage from the Consequences of Disasters-Network”¹ project developed a study with the aim of facilitating the definition of technical and conceptual elements needed for adequate integration of cultural heritage scenarios within existing or underway virtual reality (VR) tools so as to assist the efforts made by the Union Civil Protection Knowledge Network-UCPM² in this field.³



The thematic community fostered by PROCULTHER-NET offered the opportunity to capture a multi-disciplinary perspective about the possibilities enabled by the extended reality technologies to ensure a people-centred design of specific and effective technical systems in support of the shared purpose of disaster and risk management of cultural heritage.

This was possible firstly thanks to the findings of the *Ex-Ante Feasibility Study on the Establishment of a Thematic Community*⁴, another tool developed by PROCULTHER-NET

¹ PROCULTHER-NET project is an initiative co-funded by the Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO) in the context of the Union Civil Protection Mechanism (UCPM). It was implemented under the coordination of the Italian Presidency of the Council of Ministers - Civil Protection Department (Italy) in collaboration with the International Centre for the Study of Preservation and Restoration of Cultural Property- ICCROM, the Ministry of Interior-Disaster and Emergency Management Authority - AFAD (Türkiye), the German Archaeological Institute - DAI (Germany), the Ministère de l'Intérieur - Direction Générale de la Sécurité Civile et de la Gestion des Crises-DGSCGC (France), the Fondazione Hallgarten-Franchetti Centro Studi Villa Montesca-FCSVM, the Ministry of Culture and Tourism of the Region Government of Castilla y León - JCyL (Spain), the Federal Agency for Technical Relief - THW (Germany), the Suor Orsola Benincasa University- UNISOB (Italy) and the University of Porto- UPORTO (Portugal). For more details also see: <https://civil-protection-knowledge-network.europa.eu/projects/proculther-net> Accessed 7 June 2024.

² For more details see: <https://civil-protection-knowledge-network.europa.eu/> Accessed 7 June 2024.

³ For more details see: https://civil-protection-knowledge-network.europa.eu/system/files/2024-05/PROCULTHERNET_D3.3%20Feasibility%20study_.pdf Accessed 7 June 2024.

⁴ For more details see: https://www.proculther.eu/wp-content/uploads/2022/12/PROCULTHER-NET_D2.1-Ex-ante-feasibility-study-on-the-establishment-of-a-thematic-community_1710.pdf Accessed 7 June 2024.

in 2022 that provided for context, needs and capacities available at the European level in the specific field of cultural heritage protection. Secondly, the *Key Elements of a European Methodology to Address the Protection of Cultural Heritage during Emergencies*⁵, the document built on the lessons learnt and best practices capitalized by the members of the PROCULTHER⁶ consortium to provide for a set of elements for the inclusion of the protection of cultural heritage at risk in all disaster risk management processes, served as conceptual framework to guide the discussion among all project partners. In addition, an analysis of some of the existing studies and literature has helped clarify where we stand in terms of technological developments, but also how the protection of cultural heritage is addressed in the adoption of virtual tools. The Training Centre Network on 3D and VR-TRACENET project⁷ was the main source to get a clear picture of the state of the art in the use of VR tools within the European Union Civil Protection Mechanism-UCPM⁸ framework.

This article summarizes the outcome of this study, which also helped bridge the gap that currently exists in virtual capacity building processes where cultural heritage protection is not yet completely addressed.

Why should cultural heritage be included in virtual tools?

Cultural heritage protection is a key sector of disaster risk management. However, although many virtual and in-presence learning initiatives on cultural heritage protection do exist, only a few include this sector as part of the disaster risk management learning process.

Regardless of the type of presence required (physical or online), cultural heritage protection is still perceived as a non-traditional civil protection sector and many efforts are being made to strengthen the link between civil protection and cultural heritage authorities/stakeholders for the effective inclusion of cultural heritage in this field. Due to the interdisciplinary and operational gap between these two worlds, cultural heritage and disaster risk management actors involved in emergency activities tend to act separately. This separation is often caused by language barriers, differing working methods, procedures, mandates, and varying levels of awareness on the topic. In light of the devastating and increasing impact of natural and man-made hazards on vulnerable communities, this is no longer acceptable. The risk we face not only consists in the severe loss of cultural heritage itself, but also in the

⁵ For more details see: <https://www.proculther.eu/wp-content/uploads/2022/06/PROCULTHER-Methodology.pdf> Accessed 7 June 2024.

⁶ The Protecting Cultural Heritage from the Consequences of Disasters-PROCULTHER project was implemented by a consortium led by the DPC, and participated by ICCROM, AFAD, DGSCGC, FCSVM, JCyL. For more details see www.proculther.eu Accessed 7 June 2024.

⁷ For more details see: <https://civil-protection-knowledge-network.europa.eu/projects/tracenet> Accessed 7 June 2024.

⁸ For more details see: https://civil-protection-humanitarian-aid.ec.europa.eu/what/civil-protection/eu-civil-protection-mechanism_en. Last access 07/06/2024.

consequent damage to the identity, dignity, recovery and development of affected communities, and on the impact on humanity as a whole.

This is particularly significant if we consider that, among the many competence areas addressed by the UCPM, the need to protect cultural heritage at risk is increasingly rising, as the interconnection of this sector to the resilience of communities at risk has now been widely acknowledged.⁹

At the same time, as highlighted by PROCULTHER-NET, it is strongly recommended to ensure adequate training and exercise programs focused on this sector, benefiting from the knowledge-sharing potential of the UCPKN, not only in terms of curricula and scenario-based training, but also in terms of technological improvement, while ensuring consistency with the technical and operational procedures required by the UCPM. In simple terms, this can be translated into the opportunity for the UCPM and its Participating States:

- to add, under the UCPKN umbrella, training and exercises dedicated to the protection of cultural heritage,
- to promote the use of VR tools specifically dedicated to this topic,
- to include cultural heritage protection in other specific or more general training and exercise activities.

Virtual reality's potential for cultural heritage protection

Based on the definition used by TRACENET, this article refers to VR tools in terms of a “computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings”.¹⁰

VR can be used to create immersive simulations of cultural heritage sites and for a variety of purposes, this article specifically advocates for the role these tools can have in terms of capacity building both in the preparedness and response phase of disaster risk management, with a special attention to training and exercise activities.

Indeed, the study developed by PROCULTHER-NET highlights several uses of VR, including disaster planning, restoration, dissemination and education. VR can be employed to facilitate the elaboration of more intuitive safeguarding plans for cultural heritage, to create virtual replicas of cultural heritage sites, 3D models of buildings,

⁹ As specified in the “Concept on Cultural heritage in conflicts and crises”, released by the Council of the European Union “Cultural heritage is an important element in the lives and identities of communities and people, a powerful component for the building of resilience that can serve as a basis for sustainable recovery and lasting peace.” For more details see: <https://data.consilium.europa.eu/doc/document/ST-9962-2021-INIT/en/pdf> Accessed 7 June 2024.

¹⁰ For more details see: D2.2-Best practices and guidelines, UCPM-2022-KN-General - Project Number 101101703, 2023, p. 5.

monuments, and artworks, that can be accessed and enjoyed by people around the world in a safe and immersive way, even if the original site is damaged or destroyed.

Without detracting from the crucial role VR can play in these fields, it is essential that any emergency management exercise tool developed include specific provisions related to cultural heritage, bearing in mind the conducive role that VR technology can have to the overall protection and legacy of cultural heritage. Indeed, its role can be key to allow for high learning standards, offering near-real environments for training while reducing the risk of impact and damage to the object of the practice. At the same time, these virtual tools can enable three-dimensional digital model for tangible cultural heritage, which records real and accurate information on the texture, dimension or associated conservation issues, as well as their relationship with intangible cultural heritage.

Furthermore, having the possibility to simulate risks and also the behaviour and reactions of people in emergency contexts can also help to better cope with crowd management, particularly in very popular cultural heritage sites and buildings, where the interaction between rescue operations addressed to the population vis-à-vis cultural heritage is crucial in disaster risk management.¹¹ Indeed, having the possibility of simulating the real impact of hazard can help better understand the criticalities that may arise, also taking into account a multi-risk scenario, and provide solutions for monitoring and supporting the correct treatment of these assets. This could also sustain better knowledge on how to avoid or minimize the risks of cascading events that can result both from secondary natural or man-made events (e.g., trafficking or error in treatment/management).

Currently many new technologies, such as tactile gloves and exoskeletons, could enable feedback in terms of resistance to force and tactile sensation. This could provide a comprehensive and immersive experience in all the challenges that cultural heritage protection presents. However, in-depth research should be undertaken to allow for a better utilization of these tools.

Due to the current limitations, the proposal of PROCULTHER-NET focuses, in particular, on training emergency responders in:

- risk and damage assessments on cultural sites and buildings
- planning proper interventions
- planning and setting up temporary storage
- the safe and effective handling of cultural heritage in emergencies
- shoring cultural buildings.

Considering these topics, VR simulations can provide responders with realistic training scenarios that allow them to practice their skills in a safe environment. For example, VR simulations can be used to train responders in the use of equipment for

¹¹ Carrozzino M., Piacentini V., et al. 2012. See also: R. Brondi, M. Carrozzino, et al., 2016.

the stabilization of damaged structures, the removal of hazardous materials, and the rescue of people from collapsed buildings; to train responders in the proper handling of cultural heritage objects, such as artworks and manuscripts; to plan evacuations, and assess damage. For instance, firefighters could simulate the evacuation of people and the use of fire extinguishers without any risk to the operators, while, in the meantime, learning how to act to avoid any damage to cultural objects and buildings. In the same way, cultural heritage operators could test the correct evacuation and intervention methods on cultural heritage objects and surfaces in different disaster scenarios (flood, earthquake, fire...).¹²

Furthermore, the use of VR can offer the possibility to monitor and evaluate the actions to be tested during an exercise. Based on this increased capacity of monitoring operations, strategies and tactics can be analysed and reshaped to ensure a better performance in real emergencies. Therefore, the availability of virtual cultural heritage scenarios can become an opportunity for more people to practice DRM operations, putting into practice and fine-tuning standard operating procedures, interoperability schemes, as well as techniques for intervening on cultural heritage assets and buildings. This will increase, not only the teams' ability and effectiveness in responding to disasters but also the public awareness of cultural heritage.

In addition, these VR technologies could also be applied and used in emergency in case of events where the integrity of cultural heritage and operators is at risk. In particular, in situations in which people's safety is at stake, in order to limit their exposure to danger, cultural heritage experts cannot access unsafe buildings. The possibility of using such a virtual representation system would be of great help in immediately understanding the state of cultural heritage sites and assets are in, their original location, etc., so that rapid and targeted action can be taken, even if the affected building is not known.

The creation of immersive experiences can help people connect with cultural heritage in a new way. This can lead to increased public awareness and support for cultural heritage protection and, consequently, enhance the security of cultural heritage by increasing an active participation of the community in the protection of their cultural heritage.

At the same time, there is no systematic research and design specification on how to convey the intangible cultural heritage knowledge and value in experiential courses. This leads to the learners' emphasis on the experiential process and lack of knowledge of the content of intangible cultural heritage itself.¹³ Recent research

¹² An interesting application has been provided by the Italian National Fire and Rescue Service that has been exploring the adoption of specific VR training modules for rescuers based on actual CH 3D models, as a compensating measure for those difficult-to-reach CH, whereas the impact of common fire safety measures would not be acceptable.

¹³ Y. Ji, et al., 2021.

demonstrated that the use of VR to protect intangible culture has led people to ignore the factors of time and space, and accurately understand the unique charm of traditional culture.¹⁴ Therefore, VR tools can also be adapted to better define actions related to this field, by providing adequate rooms to simulate the complexities of crowds' behaviour, particularly related to intangible issues, such as religious processions and pilgrimages.

Conclusion

Although VR has great potential in safeguarding cultural heritage, the challenges remain. These include funding constraints, technological barriers and the need for international cooperation in sharing resources and expertise. Such challenges include:

- **Cost.** Compared with other traditional tools, VR technology can be very expensive, which can limit its availability to smaller organizations and institutions.
- **Accuracy.** VR simulations must be accurate and up-to-date to be effective, also taking into account aspects related to cultural sensitivity. At the same time, in a fast-paced world with increasing climate variability, it may also become stagnant if not regularly monitored and updated.
- **Maintenance:** maintenance of VR tools needs to be constant and regular. It also needs to be undertaken by specialized operators, not easily reachable and always available.
- **Skills and Training.** VR requires specialized knowledge to properly operate the hardware and software. At the same time, while VR training can be used for the improvement of many technical aspects, mentioned above, manual skills, for example, cannot be trained without deeply exploring the potential of new technological improvements.
- **Lack of real interaction among actors:** the lack of direct interaction among all involved actors can be a barrier for some organizations. Interaction and comparison among all the involved stakeholders are essential to reach shared decisions. It can be difficult to recreate this kind of interaction in VR.
- **Data interoperability:** collecting numerous CH 3D models most often means managing massive data by many different organisations responsible for CH protection. It is therefore reasonable to leave that massive data where it is stored, while implementing common interoperability services to ensure seamless exchange of data between the many entitled actors and avoid to trap it in unreachable data silos.
- **Ethical implications and data security:** the use of VR could encompass issues in terms of data privacy but also in terms of digital replication of sensitive sites, and the potential for misuse of VR simulations.

¹⁴ Y. Du, 2022.

However, as technology continues to advance, it is plausible to think that the application of VR in the protection of cultural heritage will become increasingly effective and sustainable.

VR has the potential to be a valuable tool for cultural heritage protection in emergencies. As VR technology continues to develop, it is likely that these challenges will be addressed, and that VR will become an increasingly important tool for protecting our CH in the face of emergencies and adversity.

It is therefore urgent to invest resources and efforts in the production of tools and solutions to improve interoperability among different actors ensuring a coordinated approach that also includes cultural heritage protection in different contexts facing those risks generally experienced by disaster risk management operators.

LIST OF REFERENCES

Alma Mater Studiorum Università di Bologna. 2024. RESTART-REsilienza e Sviluppo Territoriale: patrimonio A Rischio e Tutela. Accessed 22 May 2024. [<https://site.unibo.it/resilienza-patrimonio-culturale/it>]

Alma Mater Studiorum Università di Bologna. 2022. SIRIUS-Strategie per la gestione del patrimonio culturale a rischio. Accessed 22 May 2024. [<https://site.unibo.it/patrimonioculturalearischio/it>]

Alma Mater Studiorum Università di Bologna. 2022. Sotto una buona stella. SIRIUS-Strategie per la gestione del patrimonio culturale a rischio. Accessed 22 May 2024. [<https://site.unibo.it/patrimonioculturalearischio/it/sotto-una-buona-stella>]

Aveduto, G., Tanca, C., Lorenzini, C., Tecchia, F., Carrozzino, M., Bergamasco, M., Safety Training Using Virtual Reality: A Comparative Approach. In: De Paolis, L., Bourdot, P., Mongelli, A. (eds) Augmented Reality, Virtual Reality, and Computer Graphics. AVR 2017. Lecture Notes in Computer Science, vol 10324.

Breuer C., Dohrmann A., Harder S., Hoene C., Siegel A., Weber D., Vernetzte Notfallvorsorge für Kulturgüter: Eine Umfrage unter den Notfallverbänden Deutschlands. Diskussion Nr. 33, Halle (Saale): Nationale Akademie der Wissenschaften Leopoldina, 2023. Accessed 29 May 2024. [https://www.leopoldina.org/fileadmin/redaktion/Publikationen/Nationale_Empfehlungen/2023_Leopoldina_Diskussionspapier_Vernetzte_Notfallvorsorge_web.pdf]

Brondi R., Carrozzino M., Lorenzini C., Tecchia F., Using mixed reality and natural interaction in cultural heritage applications, in INFORMATICA, vol. 40, 2016. Accessed 7 July 2024. [<https://www.informatica.si/index.php/informatica/article/viewFile/1434/907>]

Brondi, R., Aveduto, G., Carrozzino, M., Tecchia, F., Alem, L., Bergamasco, M. Immersive Technologies and Natural Interaction to Improve Serious Games Engagement. In: De Gloria, A., Veltkamp, R. (eds) Games and Learning Alliance. GALA 2015. Lecture Notes in Computer Science, vol 9599. Accessed 7 July 2024. [https://www.researchgate.net/profile/Raffaello-Brondi/publication/283080400_Immersive_Technologies_and_Natural_Interaction_to_Improve_Serious_Games_Engagement/links/571b34c908ae6eb94d0d3fef/Immersive-Technologies-and-Natural-Interaction-to-Improve-Serious-Games-Engagement.pdf]

Bundesamt für Bevölkerungsschutz und Katastrophenhilfe, SilK - SicherheitsLeitfaden Kulturgut (ed.). SicherheitsLeitfaden Kulturgut, Bonn: 2021. ISBN 978-3-949117-09-1. Accessed 5 June 2024. [https://www.bbk.bund.de/SharedDocs/Downloads/DE/Mediathek/Publikationen/Kulturgutschutz/silk-sicherheitsleitfaden-kulturgut.pdf?__blob=publicationFile&v=2]

Carrozzino M., Piacentini V., Tecchia F., Bergamasco M., Interactive Visualization of Crowds For The Rescue Of Cultural Heritage In Emergency Situations, SCIRES-IT

SCientific RESearch and Information Technology. In: Ricerca Scientifica e Tecnologie dell'Informazione, Vol 2, Issue 1 (2012), 133-148 e-ISSN 2239-4303. Accessed 7 July 2024. [https://www.researchgate.net/publication/232807670_Interactive_Visualization_of_Crowds_for_the_Rescue_of_Cultural_Heritage_in_Emergency_Situations]

Claude C., Perris S., Picard G., Thibault C., AMA Art Media Agency. Newsletter issue 359, March 2024. Accessed 25 June 2024 [https://www.aurora-euproject.eu/wp-content/uploads/2024/04/ama-359-en_compressed.pdf]

Comune di Ravenna. 2023. Piano Protezione Civile Comunale. Accessed 22 May 2024. [<https://www.comune.ra.it/aree-tematiche/protezione-civile/piano-di-protezione-civile-comunale>]

Presidenza del Consiglio dei Ministri - Dipartimento della protezione civile. Decreto del Capo Dipartimento n. 4353 del 13 dicembre 2023 - Indicazioni Operative per la Gestione delle macerie a seguito di evento sismico. Accessed 7 July 2024. [<https://www.protezionecivile.gov.it/it/normativa/decreto-del-capo-dipartimento-n-4353-del-13-dicembre-2023-indicazioni-operative-la-gestione-delle-macerie-seguito-di-evento-sismico/>]

Di Cocco I., Dalla lista dei danni alla mappa del tesoro. La creazione del database e dell'archivio cartografico GIS come opportunità per conoscere, organizzare, gestire il patrimonio culturale dei territori colpiti dal sisma. In: C. Di Francesco (Ed.), A Sei Mesi Dal Sisma. Rapporto Sui Beni Culturali in Emilia-Romagna. Bologna: Minerva Soluzioni Editoriali srl, 2014.

Directive of the Minister of Cultural Heritage and Activities and Tourism, 23 April 2015, Aggiornamento della direttiva 12 dicembre 2013, relativa alle Procedure per la gestione delle attività di messa in sicurezza e salvaguardia del patrimonio culturale in caso di emergenze derivanti da calamità naturali. Accessed 7 July 2024. [<https://www.beniculturali.it/comunicato/direttiva-del-ministro-dei-beni-e-delle-attivita-culturali-e-del-turismo-concernente-le-procedure-per-la-gestione-delle-attivita-di-messa-in-sicurezza-e-salvaguardia-del-patrimonio-culturale-in-caso-di-emergenze-derivanti-da-calamita-naturali>]

Du Y., Protection of Intangible Cultural Heritage Based on VR: Taking Xiuyan Jade Carving Craft as an Example, in: Mathematical Problems in Engineering, vol. 2022, Article ID 5146193, 8 pages, 2022. Accessed 7 July 2024. [<https://onlinelibrary.wiley.com/doi/10.1155/2022/5146193>]

Fischer U., From vision to reality - the Cologne Container for the protection of cultural heritage. PROCULTHER-NET Project. Technical Bulletin, Issue n° 1, March 2023, pp.24-29.

Galtung J., Cultural Violence. In: Journal of Peace Research Vol. 27, No. 3. Aug., 1990: pp. 291-305. Accessed 7 July 2024. [<https://www.galtung-institut.de/wp-content/uploads/2015/12/Cultural-Violence-Galtung.pdf>]

Graham K., Spennemann D.H.R., State emergency service local controllers' attitudes towards disaster planning for cultural heritage resources. In: Disaster Prevention and Management. 2006, vol. 15, issue 5 :742-762.

Ji Y., Zhong S., Zhang B., Clark S. M., Constructing Embodied Interaction of Intangible Cultural Heritage Course through Immersive Virtual Reality. In: Chinese CHI '21: Proceedings of the Ninth International Symposium of Chinese CHI. October 2021. Pages 133 - 138. Accessed 7 July 2024. [<https://dl.acm.org/doi/10.1145/3490355.3490373>]

Jokilehto J., Iccrom's Involvement in Risk Preparedness. In: Journal of the American Institute for Conservation. 2013 (39): 173-179. Accessed 22 May 2024. [<https://doi.org/https://doi.org/10.1179/019713600806113275>]

Kulturrat Thüringen. 2023. Notfallvorsorge für Kultureinrichtungen. Accessed 29 May 2024. [<https://www.kulturrat-thueringen.de/de/notfallvorsorge-fuer-kultureinrichtungen.html>]

Liceo Classico Statale Dante Alighieri di Ravenna. 2023. Racconti dall'Esarcato. Un podcast su Ravenna, per Ravenna. Accessed 31 May 2024. [<https://sites.google.com/view/raccontidallesarcato/home>]

Matiz Lopes P.J., Integrated risk assessment for cultural heritage sites: a holistic support tool for decision-making. Lucca: University of Lucca, 2016. Accessed 22 May 2024. [http://e-theses.imtlucca.it/195/1/Matiz_phdthesis.pdf]

Märker A., Die Gründung des Notfallverbunds Leipziger Archive und Bibliotheken, in: Bibliotheksdienst 6. Jg., H. 7. 2012: 557-569. Accessed 29 May 2024. [<https://www.yumpu.com/de/document/read/7532937/die-grundung-des-notfallverbunds-leipziger-archive-und-bibliothken>]

Maxwell I., Drdácký M., Vintzileou E., Bonazza C., Hanus A., Safeguarding cultural heritage from natural and man-made disasters - a comparative analysis of risk management in the EU. Brussels: EU Publication Office, 2018. Accessed 7 July 2024. [<https://op.europa.eu/en/publication-detail/-/publication/8fe9ea60-4cea-11e8-be1d-01aa75ed71a1>]

Michalski S., Pedersoli L.J., The ABC Method: a risk management approach to the preservation of cultural heritage, Ottawa: Canadian Conservation Institute, 2017. Accessed 5 July 2024 [https://www.iccrom.org/sites/default/files/2017-12/risk_manual_2016-eng.pdf].

Ministero della Cultura. 2020. Circolare SG n. 22, 26 marzo 2020 - Gestione coordinata delle attività di messa in sicurezza e salvaguardia del patrimonio culturale in occasione di eventi derivanti da calamità naturali. Specificazioni. Accessed 22 May 2024. [<https://dgspatrimonioculturale.beniculturali.it/wp-con>

[tent/uploads/2020/08/Gestione-attivita%20-%20messa-in-sicurezza-e-salvaguardia-patrimonio-culturale-per-calamita%20-%20naturali-SG-Circolare-N.-22_26_03_2020.pdf](https://www.beniculturali.it/uploads/2020/08/Gestione-attivita%20-%20messa-in-sicurezza-e-salvaguardia-patrimonio-culturale-per-calamita%20-%20naturali-SG-Circolare-N.-22_26_03_2020.pdf)

Ministero della Cultura. 2016. Direttiva del 12 settembre 2016 prot.11807 recante "procedure di rimozione e recupero delle macerie di beni tutelati e di edilizia storica". Accessed 22 May 2024. [<https://www.beniculturali.it/comunicato/direttiva-del-12-settembre-2016-prot-11807-recante-procedure-di-rimozione-e-recupero-delle-macerie-di-beni-tutelati-e-di-edilizia-storica-rettifica-data-protocollo-dg-abap-servizio-iii>]

Ministero della Cultura. 2016. Direttiva DG-APAB 12 agosto 2016 - Procedure di rimozione e recupero delle macerie di beni tutelati e di edilizia storica. Accessed 22 May 2024. [https://dgspatrimonioculturale.beniculturali.it/wp-content/uploads/2020/08/Procedure-rimozione-e-recupero-macerie-beni-tutelati-e-edilizia-storica-Direttiva-DG-ABAP-12_08_2016.pdf]

Ministero della Cultura. 2016. Direttiva del 12 settembre 2016 prot.11807 recante "procedure di rimozione e recupero delle macerie di beni tutelati e di edilizia storica". Accessed 22 May 2024. [<https://www.beniculturali.it/comunicato/direttiva-del-12-settembre-2016-prot-11807-recante-procedure-di-rimozione-e-recupero-delle-macerie-di-beni-tutelati-e-di-edilizia-storica-rettifica-data-protocollo-dg-abap-servizio-iii>]

Ministero della Cultura. 2012. VincoliInRete. Accessed 21 May 2024. [<http://vincoliinrete.beniculturali.it/VincoliInRete/vir/utente/login>]

Ministero della Cultura, Istituto Centrale del Restauro. 2004. Carta del Rischio. Accessed 22 May 2024. [<http://www.cartadelrischio.beniculturali.it/login>]

Notfallverbände: Gemeinsames Portal der Notfallverbände Kulturgutschutz. 2024. Accessed 29 May 2024. [<https://notfallverbund.de>]

Pedersoli J. L. Jr., A Guide to Risk Management of Cultural Heritage. ICCROM - Canadian Conservation Institute. 2016.

Preventionweb. 2005. Kyoto declaration 2005 on Protection of cultural properties, historic areas and their settings from loss in disasters. Accessed 22 May 2024. [<https://www.preventionweb.net/publication/kyoto-declaration-2005-protection-cultural-properties-historic-areas-and-their-settings>]

Protezione Civile Regione Emilia-Romagna, Regione Emilia-Romagna, Servizio Geologico Sismico e dei Suoli. 2018. Programma nazionale di soccorso per il rischio sismico dell'Emilia-Romagna. Accessed 21 May 2024. [<https://geo.regione.emilia-romagna.it/schede/pnsrs/index.jsp?id=39014>].

PROCULTHER Project, Key Elements of a European Methodology to Address the Protection of Cultural Heritage during Emergencies, Città di Castello: Luogh-

Interiori, 2021. ISBN 978-88-6864-370-6. Accessed 7 July 2024. [<https://www.proculther.eu/wp-content/uploads/2022/06/PROCULTHER-Methodology.pdf>]

PROCULTHER-NET Project, Feasibility study for the conception of CH focused virtual reality and learning tools to be integrated into the Union Civil Protection Knowledge Network, Accessed 7 July 2024 [https://civil-protection-knowledge-network.europa.eu/system/files/2024-05/PROCULTHERNET_D3.3%20Feasibility%20study_.pdf]

PROCULTHER-NET Project, Ex-Ante Feasibility Study on the Establishment of a Thematic Community, Accessed 7 July 2024. [https://www.proculther.eu/wp-content/uploads/2022/12/PROCULTHERNET_D2.1-Ex-ante-feasibility-study-on-the-establishment-of-a-thematic-community_1710.pdf]

PROCULTHER-NET Project. Technical Bulletin, Issue n° 2, July 2023. Accessed 7 July 2024 [https://civil-protection-knowledge-network.europa.eu/system/files/2023-06/PROCULTHER_NET_TECHNICAL_BULLETTIN_N2.pdf]

Rathgen-Forschungslabor. 2023. Projektstart: Holistisches Risikomanagement am Rathgen-Forschungslabor. Accessed 3 June 2024. [<https://www.smb.museum/museen-einrichtungen/rathgen-forschungslabor/ueber-uns/nachrichten/detail/projektstart-holistisches-risikomanagement-am-rathgen-forschungslabor/>]

Regione Emilia-Romagna. 2023. La classificazione sismica dei Comuni in Emilia-Romagna. Accessed 21 May 2024. [<https://ambiente.regione.emilia-romagna.it/it/geologia/sismica/la-classificazione-sismica/la-classificazione-sismica-dei-comuni-in-emilia-romagna>]

Regione Emilia-Romagna. 2022. Moka DIRETTIVA ALLUVIONI. Accessed 21 May 2024. [<https://servizimoka.regione.emilia-romagna.it/mokaApp/apps/DA/index.html>]

Regione Emilia-Romagna. 2021. Gli indirizzi per gli studi di microzonazione sismica in Emilia-Romagna per la pianificazione territoriale e urbanistica. Accessed 21 May 2024. [<https://ambiente.regione.emilia-romagna.it/it/geologia/sismica/indirizzi-per-studi-microzonazione-sismica#autotoc-item-autotoc-13>]

Regione Emilia-Romagna. 2018. Rilievo della subsidenza nella pianura emiliano-romagnola: seconda fase. Accessed 21 May 2024. [<https://ambiente.regione.emilia-romagna.it/it/acque/approfondimenti/documenti/rilievo-della-subsidenza-nella-pianura-emiliano-romagnola/seconda-fase>].

Regione Emilia-Romagna. 2017. Portale minERva. Accessed 21 May 2024. [<https://datacatalog.regione.emilia-romagna.it/catalogCTA>]

Regione Emilia-Romagna. 2017. Rilievo della subsidenza nella pianura emiliano-romagnola: prima fase. Accessed 21 May 2024. [<https://ambiente.regione>]

emilia-romagna.it/it/acque/approfondimenti/documenti/rilievo-della-subsidenza-nella-pianura-emiliano-romagnola/monitoraggio-2011-2016-prima-fase].

Shakya L., Li M., Miyazaki A., Kim D., Jigyasu R.. International training course (ITC) on disaster risk management of cultural heritage : proceedings of UNESCO chair programme on cultural heritage and risk management. Kyoto : UNESCO, DMUCH - Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University, 2024. Accessed 27 June 2024. [https://rdmuch-itc.com/wp-content/uploads/ITC2023_proceedings.pdf].

Siegel A., Die Notfallverbände in Deutschland. In: KulturBetrieb (1). 2021: 78-79. Accessed 29 May 2024. [http://www.kulturbetrieb-magazin.de/fileadmin/user_upload/kulturbetrieb-magazin/magazin/KulturBetrieb-2021-Ausgabe-1-Mai.pdf].

SiLK - SicherheitsLeitfaden Kulturgut. 2024. Accessed 5 June 2024. [<https://silk-project.de>.]

SiLK-Tool. 2024. Accessed 29 May 2024. [www.silk-tool.de].

SiLK-Tool (English version). 2024. Accessed 5 June 2024. [<https://www.silk-tool.de/en/>]

Simon S., Der Vandalismusvorfall auf der Museumsinsel im Oktober 2020 und die Taskforce Risikomanagement "der Stiftung Preußischer Kulturbesitz". Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (ed.). KULTUR!GUT!SCHÜTZEN! : Tagung 2021. Bonn, 2023: 17-27. ISBN 978-3-949117-15-2. Accessed 29 May 2024. [https://silk-project.de/wp-content/uploads/221109_BMI_KdB_SiLK-Tagungsband_Online_v3_ba.pdf]

Spennemann D.H.R., Cultural heritage conservation during emergency management: luxury or necessity?. International Journal of Public Administration. 2007(22):745-804.

Tandon A., Guidance Note on Urban Search and Rescue at Heritage Sites, Geneva: OCHA-INSARAG. 31 March 2023.

Tandon A., Chmutina K., inSIGHT: A Participatory Game for Enhancing Disaster Risk Governance. Rome: ICCROM, 2020.

Tandon A., Post-disaster damage assessment of cultural heritage: are we prepared?. ICOM-CC 18th Triennial Conference. Copenhagen, 2017:1-7. Accessed 11 July 2024. [<https://www.icom-cc-publications-online.org/1670/Post-disaster-damage-assessment-of-cultural-heritage--Are-we-prepared>]

Tandon A., Endangered heritage: emergency evacuation of heritage collections, Paris: UNESCO, International Centre for the Study of the Preservation and Restoration of Cultural Property, 2016.

TRACENET, D2.2-Best practices and guidelines, UCPM-2022-KN-General - Project Number 101101703, 2023.

TRACENET, D2.1, Survey analysis and status-quo of ICT solutions for civil protection needs, UCPM-2022-KN-General - Project Number 101101703, 2023.

UNESCO, Convention Concerning the Protection of the World Cultural and Natural Heritage, (1972). Accessed 22 May 2024. [<https://whc.unesco.org/en/conventiontext/>]

UNESCO, WORLD BANK, CURE. Culture in City Reconstruction and Recovery. Position Paper. Paris: UNESCO 2018. ISBN 978-92-3-100288-5. Accessed 25 June 2024 [<https://unesdoc.unesco.org/ark:/48223/pf0000265981>]

Unijunior. 2024. *Unijunior. Conoscere per Crescere*. Accessed 31 May 2024. [<https://www.unijunior.it>]

United Nations Office of Disaster Risk Reduction, Why are disasters not natural? Accessed 25 June 2024 [<https://www.undrr.org/our-impact/campaigns/no-natural-disasters>]

Urban Recovery Framework. UN-HABITAT. 2022. Accessed 27 June 2024. [https://unhabitat.org/sites/default/files/2022/04/un-habitat_urf_advocacy_note_march_2022_1.pdf]

Warsaw Recommendation on Recovery and Reconstruction of Cultural Heritage. UNESCO - Ministry of Culture and National Heritage of the Republic of Poland. 2018.

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