Proceedings of
UNESCO Chair Programme on
Cultural Heritage and Risk Management

INTERNATIONAL TRAINING COURSE (ITC) on DISASTER RISK MANAGEMENT of CULTURAL HERITAGE, Ritsumeikan University in collaboration with ICCROM

Online - 29 July to 23 Aug 2024,
Onsite(Kyoto) - 30 Aug to 13 Sep 2024

Organized by Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University (R-DMUCH), Kyoto, Japan in collaboration with the International Centre for the Study of Preservation and Restoration of Cultural Property (ICCROM) and contributed by UNESCO, ICOM, ICOMOS/ICORP

DM UCH
Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University

ICCROM

Exploring the Recovery Process of Hirafuku, Sayo Town: Lessons from the 2009 Typhoon and Landslide

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Preface

The Institute of Disaster Mitigation for Urban Cultural Heritage at Ritsumeikan University (R-DMUCH) was established in 2013 as a permanent research institution, succeeding the activities of the Research Center for Disaster Mitigation of Urban Cultural Heritage, founded by Professor Kenzo Toki in 2003. Since 2006, the institute has launched the UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage (ITC) as one of its key educational activities. ITC has been conducted annually with the support of UNESCO, ICCROM, ICOM, ICOMOS/ICORP, and various national and international organizations.

Each year, the ITC invites national and international experts who are actively engaged in critical initiatives in disaster risk management for cultural heritage. The program includes interactive components such as lectures, site visits, workshops, and discussions. This year's course featured a diverse group of lecturers from organizations including the Agency for Cultural Affairs, the Tokyo National Research Institute for Cultural Properties, the National Institutes for Cultural Heritage, the Kyoto National Museum, the Kyoto Prefectural Board of Education, Kobe City's Bureau of Culture and Sports, the Sayo Town Board of Education, the Kyoto City Fire Department, the Ponto-cho Town Management Council, the Disaster Prevention Research Institute at Kyoto University, and Miyagi University. International contributors included UNESCO-EPRU, the Kathmandu Valley Preservation Trust (KVPT), the Egyptian Heritage Rescue Foundation, and George Town World Heritage Incorporated.

Participants in the ITC also attend lectures, site visits, and workshops. Still, they must formulate a draft disaster risk management plan for a specific cultural heritage site they are involved with. This exercise aims to help participants develop the ability to propose solutions tailored to their home countries' social, economic, and institutional contexts. By fostering such expertise and building technical support networks, the program strives to promote international efforts toward the sustainable protection of cultural heritage.

This year's course focused on the theme "Linking Tangible and Intangible Cultural Heritage for Disaster Risk Management". Following last year's format, the program was conducted in a hybrid manner, combining a six-day online segment with a two-week onsite program in Kyoto and other areas in Japan. Thirteen participants, selected through a highly competitive process, took part. Although the program faced challenges, such as the threat of a large typhoon during the onsite segment and the increasing severity of heat waves, it successfully concluded thanks to the cooperation of all involved.

Just as everything in the world comes to an end, this important mission will always end each year, but we do not doubt that it will also be a new beginning. We would like to express our heartfelt gratitude to everyone who has supported this activity. Thank you once again for your contributions.

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Preface

Cultural heritage, both tangible and intangible is exposed to increasing number of disasters caused by natural and human induced hazards such as earthquakes, floods, landslides, fires, vandalism and looting. The ongoing devastating wildfires affecting Los Angeles in the United States illustrates the scale and consequences of disasters on lives, livelihoods and properties including cultural heritage. Other examples include Tibet earthquake in January this year, Noto earthquake in 2024, wild fires on Hawaii in August 2023, and earthquakes in Turkey and Syria in 2023. Climate change is further exacerbating the frequency and impacts of disasters caused by hydrometeorological hazards such as hurricanes and heavy rainfall. Besides, the conflicts in the middle east, Ukraine and many other parts of the world have also increased risks to cultural heritage in an unprecedented manner. In the light of these challenges, the importance of building the capacity of professionals and institutions from cultural heritage, civic defense, disaster risk reduction and development sectors has been felt more than ever before.

Since 2006, the international training course, nicknamed as ITC organized by the Institute of Disaster Mitigation for Urban Cultural Heritage at Ritsumeikan University (R-DMUCH), Kyoto, Japan has been closely collaborating with the International Centre from the Study of Preservation and Restoration of Cultural Property (ICCROM) and in cooperation with organizations such as ICOMOS and ICOM for building the capacity in the area of disaster risk management of cultural heritage as part of the UNESCO Chair Programme on Cultural Heritage and Risk Management; one of the unique and pioneering programmes on this theme in the world. The target groups for this course have included government institutions, departments, universities, NGOs and independent professionals from cultural heritage, as well as relevant disaster management fields. The course has been based on lectures by eminent experts from Japan and abroad, field visits in Kyoto and other heritage sites in Japan, class and field exercises, role playing, simulations and discussions. It always attempted to strike a balance between classroom and field-based learning, and most importantly facilitating knowledge sharing and mutual learning among the participants through reflections and dialogue. In particular, Japanese rich experience in mitigation, response and recovery following various disasters such as 1995 Kobe earthquake and 2011 Great East Japan earthquake and tsunami as well as past floods and landslide disasters were used as living labs for site visits and field exercises.

The course was designed with a unique and novel idea of training both cultural heritage and disaster risk management professionals so that they can learn about each other's vocabulary, theoretical and practical tools, and more importantly create collaborations that are so critical for successful implementation of DRM for cultural heritage sites and institutions. The gap between the two fields was realized way back in 2005, during the second world conference on disaster risk reduction (WCDR) held in Kobe commemorating the 10 years of Great Hanshin Awaji earthquake. Thanks to the efforts of Prof. Kenzo Toki, the founding father of ITC, we could organize a thematic session on cultural heritage in collaboration with UNESCO, ICCROM and ICOMOS during WCDR, which is the largest congregation of disaster management experts. In spite of all our efforts, it was very difficult to motivate disaster management experts to participate in this meeting of cultural heritage experts, leading us to make efforts to bridge this gap through creation of ITC. Another unique feature of ITC was the development of an outline of DRM plans for heritage sites and institutions where the participants have been working before joining the course. This enabled the participants to not just gain the knowledge but also apply it in their case study projects, and in this process tailor the knowledge to their own context.

Throughout the period of implementation of ITC, we have been continuously updating the format, course curriculum and pedagogical tools, taking into account, the emerging research and practice, and the experience of our own alumni, who after graduating from the course have been successfully implementing DRM projects in their own countries and regions. To give unique flavor and focus to each iteration of ITC, we also developed specific themes such as climate change impacts, fire risks and intangible heritage. In 2020, when COVID 19 pandemic started, we turned the challenge of not being able to physically travel into an opportunity by organizing the webinar and an online workshop with our former ITC participants, who could share their practical experiences in this area after attending ITC. This culminated in the book on good practices for disaster risk management containing rich contributions from our former ITC participants, published by Routledge in 2023. In fact, knowledge dissemination has been an important aspect of

ITC and we have attempted this through several publications such as the training guide for conducting such courses (in 2013) and proceedings that have been published following each ITC.
As the pandemic continued, we developed online version of ITC that was implemented during 2021 and 2022, and lead us to develop host of audio visual teaching materials and live discussions through Zoom sessions. Following the pandemic, we could use this experience to develop hybrid format of ITC that combined both online and in person components in Japan. During this year's ITC, we further innovated through development of an online learning platform to facilitate the hybrid format.

Following participation in ITC, many alumi members actually managed to implement these projects when they got back to their own countries. Some participants lead the development of regional training programs in their own countries, while others have become resource persons for ITC and other training courses. Also several hold important positions within their national institutions, spearheading the cause of DRM in their countries at policy and programmatic levels, while some even set up their own institutions dedicated to DRM of cultural heritage. Over the years, it is not so uncommon to find ITC family members (as we affectionately call the resource people and participants) during international forums, and the special feeling of belonging to a professional network with shared mission is so much evident on such occasions. This in fact shows that the impact of training cannot be just summarized through the numbers of participants and their countries, but through a systematic evaluation of long term, direct as well as indirect impacts at multiple levels.

After 18 years of successful implementation, ITC has come to a close in 2024. While there is still tremendous global need of training in this area, I feel tremendous satisfaction that over these years, we have managed to create a dynamic and motivated community of practice that will continue to disseminate and further evolve the theory and practice of DRM of cultural heritage based on their experience. There are several areas of research and practice that need to be investigated further such as ecological approaches for DRM based on nature culture linkages, interface of disasters, conflicts and climate change, developing integrated risk assessment tools as well as innovative mitigation and adaptation measures that are tailored to specific hazards, typologies of heritage and geographical, environmental and socio-economic context, and building on traditional and indigenous knowledge systems. I hope that the valuable resource materials accumulated during all these years of ITC will be organized in an online digital archive that will serve as repository for capacity building on DRM for cultural heritage and furthering research and practice in this area. This in my view will be the best commemorative gift for the 20th anniversary of ITC in 2026.

At a personal level, I am so fortunate to have the privilege of being part of the birth and evolution of ITC over the years. From my first visit to Japan in 2004 to the setting up of UNESCO Chair program and initial discussions on the curriculum in an 'abandoned' primary school building in downtown Kyoto and being part of implementation of the course over these years, ITC has enriched me both at professional and human level, more than anything else in my career. It has helped me forge valuable friendships with amazing people from around the world. And of course, I would forever cherish working on this unique life project with my former and current Ritsumeikan friends, notably Mr. Kanefusa Masuda, Prof. Takeyuki Okubo, Dr. Naoko Itaya, Dr. Dowon Kim, Dr. Lata Shakya, Ms. Junko Mukai, Dr. Li Min, Dr. Aya Miyazaki, my ICCROM friends, Mr. Joseph King, Ms. Aparna Tandon and Ms. Eugene Jo, and all the amazing lecturers with whom I had a chance to collaborate, share and learn.

My preface won't be complete if I do not express my deep sense of gratitude to Prof. Kenzo Toki, the leading light of UNESCO Chair program. His vision, foresight, professional knowledge and integrity, motivation, and charismatic personality is instrumental for the success of ITC. I also take the opportunity to remember my mentor, Prof. Herb Stovel, who was one of the pioneers in this area and the main person behind my association with ITC. May this world have leaders like this to make this world a better place to live.

ITC will close but its legacy will endure for the current and future generations of professionals, who will continue to protect the present of our past for the future.

Rohit Jigyasu, Ph.D.
Programme Manager, Sustainable Urban & Built Heritage, Disaster & Climate Risk Management, and Post Crisis Recovery, ICCROM

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1 Introduction

1.1 Background and Objectives of the 18th International Training Course (2024)

Japan in 2024 began with a devastating earthquake that struck the Noto region on January 1.

This magnitude 7.6 earthquake, with its epicenter near the tip of a peninsula jutting into the Sea of Japan, exposed the vulnerabilities of remote areas to disasters. The region, characterized by an aging population, had seen limited progress in retrofitting buildings for seismic resistance, especially among elderly households. As a result, numerous homes collapsed, and many lives were lost. A massive fire that broke out shortly after the earthquake reduced a town known for its traditional crafts to ashes. Efforts to extinguish the fire were hindered by the threat of a tsunami, which further contributed to the fire's spread. Although a nuclear power plant was located in the area that recorded the highest seismic intensity, no major incidents occurred there.

The region's challenging topography significantly impacted recovery efforts. Landslides disrupted roads, obstructing the transportation of relief supplies, while uplifted coastlines rendered it impossible for fishermen to continue their livelihood. In September, the disaster-stricken area was hit by torrential rains, destroying newly restored buildings and infrastructure and compounding the hardships faced by evacuees. Adding to these challenges, the area is a heavy snowfall region. With winter approaching, concerns are growing about the impact of snow accumulation on houses left tilted by the earthquake and on temporary facilities.

The affected region, which was already experiencing population decline, has seen 7.5% of its residents leave since the earthquake and subsequent floods. This area, home to cultural heritage structures, historic townscapes, vibrant traditional crafts, and unique festivals, now faces the risk of losing these legacies due to the disasters.

Globally, the frequency and scale of disasters deemed "unprecedented" have made this term increasingly commonplace.

Earthquakes are just one part of the story. News of floods, flash floods, landslides, cyclones, forest fires, heatwaves and destructions caused by armed conflict reaches us almost weekly from different corners of the world.

Projections of future human and economic losses from disasters, made by institutions, often paint a grim picture. However, these studies also highlight the significant benefits of proactive measures. Comparing scenarios with and without disaster preparedness clearly demonstrates the effectiveness of mitigation measures and underscores the importance of disaster risk management. Cultural heritage—tangible and intangible, movable and immovable—is particularly vulnerable to disasters. In most cases, its preservation is not prioritized during emergencies. This is precisely why advance preparation is crucial.

Even when large-scale infrastructure improvements are not feasible, much can still be done. Compiling inventories of heritage assets, organizing networks of residents and experts, and establishing communication channels can help safeguard the value of cultural heritage during emergencies and recovery. These measures can reduce vulnerability in the long-term recovery process and ensure that lessons learned are applied to future preparedness.

Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University, and Its Training Course.

Since 2006, the UNESCO Chair Program on Cultural Heritage and Risk Management at the Institute of Disaster Mitigation for Urban Cultural Heritage of Ritsumeikan University (R-DMUCH) has been dedicated to providing technical support for this purpose. The *International Training Course on Disaster Risk Management of Cultural Heritage (ITC)*, now in its 18th year, serves as the program's core activity. As of today, a total of 206 professionals from 79 countries worldwide—representing government agencies, universities, NGOs, private companies, and other organizations working in the fields of cultural heritage and disaster risk management—have participated in the ITC.

The International Training Course on Disaster Risk Management of Cultural Heritage (ITC) was established in response to recommendations made during the Special Thematic Session on Risk Management for Cultural Heritage at the UN World Conference on Disaster Reduction (WCDR) held in January 2005 in Kobe, Hyogo, Japan. Among these recommendations was a call for the academic community to develop research, education, and training programs that integrate cultural heritage—both tangible and intangible—into disaster risk management strategies. This emphasis on incorporating cultural heritage into disaster mitigation efforts was later reinforced by the World Heritage Committee at its 30th session (Vilnius, Lithuania, July 2006), which highlighted the importance of education, knowledge sharing, and innovation to foster a culture of disaster prevention at World Heritage properties.

The critical role of cultural heritage in disaster risk reduction was further recognized in the "Declaration" adopted at the International Disaster Reduction Conference (IDRC) in Davos (August 2006). This declaration underscored the need to integrate concerns for both tangible and intangible heritage into disaster risk reduction strategies, strengthened by cultural attributes and traditional knowledge. More recently, the Sendai Framework for Disaster Risk Reduction, adopted at the 2015 World Conference on Disaster Risk Reduction in Sendai, Japan, has reiterated the importance of safeguarding cultural heritage from disasters. Cultural heritage is now explicitly included as one of the key sectors in the updated "Ten Essentials" for disaster resilience outlined in UNDRR's Resilient Cities Campaign.

In response to these international recommendations, the Institute of Disaster Mitigation for Urban Cultural Heritage at Ritsumeikan University (R-DMUCH) has become a leading hub for international research, training, and information exchange in the field of cultural heritage risk management and disaster mitigation. From 2011 to 2014, R-DMUCH also served as the international secretariat for the ICOMOS International Scientific Committee on Risk Preparedness (ICORP). Many of the experts contributing to the ITC program are active members of this Scientific Committee, further enriching the course with their knowledge and experience.

The ITC aims to promote international efforts for the sustainable protection of cultural heritage through capacity building and the establishment of technical support networks. Initially held as a three-week course in Kyoto and other locations, the program transitioned to an online format during the COVID-19 pandemic. Since 2023, it has evolved into a hybrid format, combining a six-day online program with a two-week in-person program in Kyoto and other locations. The ITC curriculum is characterized by the following features:

- **Interactive Content for Selected Participants**: A limited number of participants, selected through a rigorous process of document screening and interviews, receive highly interactive training. The program effectively combines lectures, site visits, workshops, and discussions, aiming not only to provide theoretical knowledge and insights into disaster risk management of cultural heritage but also to enhance practical skills.
- **Step-by-Step Learning Progression along the DRM Cycle**: The course follows the disaster risk management cycle of before, during and after disaster. Participants are trained to analyze what attributes of cultural heritage should be protected to preserve its value for future generations, identify potential disaster

risks and vulnerabilities, and recognize key stakeholders and their roles. This comprehensive approach for preparedness and mitigation, emergency response, and recovery equips participants with the ability to conduct integrated risk assessments and plan and implement measures for each stage of the cycle.

- **Development of Individual Disaster Risk Management Plans**: During the training period, participants are required to draft a disaster risk management plan for a cultural heritage site of their choice. By creating these plans, participants learn to propose realistic solutions tailored to the social, economic, and institutional contexts of their respective countries.
- **Collaboration with UNESCO and ICCROM**: The program provides advanced training content from an international perspective through collaboration with UNESCO, ICCROM, and other global organizations. It also features leading Japanese and international experts in the field of disaster risk management for cultural heritage, offering participants the latest insights and techniques.

Fig. 1 Disaster Risk Management Cycle for Cultural Heritage

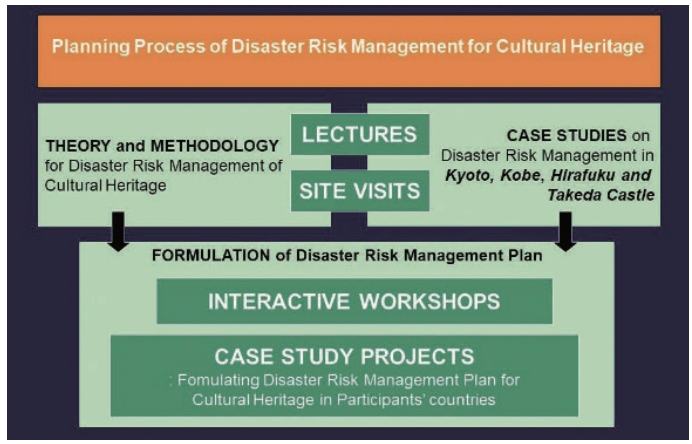

Fig. 2 The structure of ITC

This year, the theme of the ITC was "Linking Tangible and Intangible Cultural Heritage for Disaster Risk Management."

Intangible cultural heritage (ICH) may be more vulnerable than other forms of cultural heritage during disasters because of its often invisible nature. For example, if a disaster causes the displacement of a community, the rituals and traditions they once practiced might cease without notice. While efforts are directed toward reconstructing the venues, costumes, or tools required for these rituals, the knowledge of how to perform them might be lost in the meantime. Similarly, the lack of traditional skills might only become apparent when attempting to repair damaged monuments, by which time it could be too late to recover them. The same applies to the techniques for crafting the materials and tools necessary for such repairs.

On the other hand, recent years have seen growing recognition of ICH's role in contributing to disaster resilience. Across various regions, traditional knowledge embedded in how communities choose land, construct buildings, live, and organize themselves offers valuable insights into disaster risk reduction. These traditional practices deserve careful consideration and are increasingly being examined through the lens of modern science. Furthermore, evidence has shown that in the immediate aftermath of disasters and during recovery processes, ICH can play a critical role in strengthening community bonds and uplifting the spirits of individuals who have suffered significant losses.

Thus, effective disaster risk management for cultural heritage requires a dual focus: acknowledging both the vulnerabilities and the contributions of intangible cultural heritage. ICH is deeply intertwined with the geographical, climatic, and social characteristics of the regions where it thrives. The ITC, with its interdisciplinary approach, is uniquely suited to addressing this theme, fostering a deeper understanding of the dynamic interplay between tangible and intangible heritage in disaster contexts.

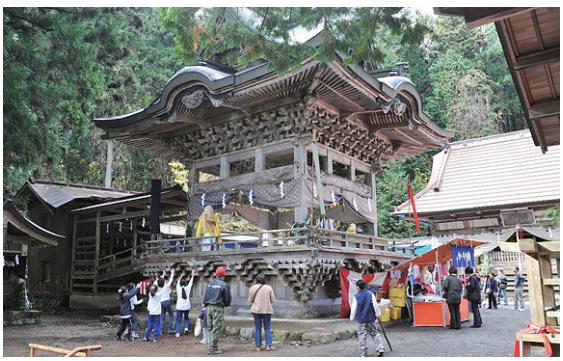

Fig. 3 A stage for dedicatory performances, Minami-Alps city, Yamanashi, Japan. The transmission of intangible cultural heritage requires the people who carry it on and also the special places and tools essential for its practice. (Photo courtesy of Hiromichi KUBOTA, Tokyo National Research Institute for Cultural Properties)

Fig. 4 The participants are learning the traditional skills and techniques which are essential for the restoration of cultural heritage buildings and represent an important intangible cultural heritage

1.2 List of participants and Resource Persons of ITC 2024

List of Participants

Bilge KÜÇÜKDOĞAN
Finance and Operations Coordinator, Stanford Archaeology Center, Stanford University, CA, USA

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Su Lin TEH
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Tonći PRODAN
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Supervisor,
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Ritsumeikan University (R-DMUCH)

1-3 Timetable of ITC 2024 (online)

	7/29 Mon	8/1 Thu	8/5 Mon	8/8 Thu	8/9 Fri	8/19 Mon	8/22 Thu	8/23 Fri
THEME	Pre-Course Orientation	Principles	Value Assessment	Risk Assessment	Feedback Session	Mitigation	Response & Recovery	Feedback Session
Venue	ONLINE							
13:00								
CET6:30					Individual Feedback Session (Available to those who wish to join)			Individual Feedback Session (Available to those who wish to join)
14:00								
15:00		Opening Remarks	Recap	Recap		Recap	Recap	
(CET 8:00)		Introduction to the course	Lecture 2 Link of Tangible & Intangible Aspects (L.SHAKYA)	Workshop 3 DRM Challenges in Historic Urban Areas and Stakeholder Mapping (D.KIM)		Lecture 5 Climate Change and Hazard Risks (Y.SATOFUKA)	Lecture 8 CH First Aid (A.TANDON)	
		Lecture 1 CHDRM Key Principles (R.JIGYASU)	Lecture 3 Value Assessment (R. JIGYASU)			Lecture 6 GIS Technology for DRM of CH (K. YANO)	Lecture 9 Response & Recovery of Gorkha EQ (R.RANJITKAR)	
16:00	Pre-Course Orientation	Discussion on Disasters of Participants	Workshop 2 Vallue Assessment (R.JIGYASU)	Lecture 4 DRR and Integrated Risk Management (R.JIGYASU)		Lecture 7 Designing Mitigation (R.JIGYASU)	Lecture 10 CH Management & DRM Planning (N.FRANCESCHINI)	
(CET 9:00)		Workshop1 Terminology of DRM (R.JIGYASU)		Workshop4 Assessing Risk Levels (R.JIGYASU)		Workshop 5 Designing Mitigation (R.JIGYASU)	Workshop 6 Heritage Management (N.FRANCESCHINI)	
17:00								
(CET 10:00)								

1.4 Timetable of ITC 2024 (onsite)

	8/30 Fri	8/31 Sat	9/1 Sun	9/2 Mon	9/3 Tue	9/4 Wed	9/5 Thu	9/6 Fri
THEME	introduction	value assessment & risk assessment	mitigation	mitigation	response (movable CH)	-	-	Conflict / Response
Venue	DMUCH	Ponto-cho	DMUCH	DMUCH & Restoration site	Kyoto National Museum	DMUCH	DMUCH	DMUCH
		Move at 8:30 to Rissei Comm. Centre			Move at 8:30 to Kyoto Museum			
9:00	Registration		Recap	Recap		Self Study	Case Study Project Work	Recap
	Opening Address		Lecture14 Environmental Water Supply System in Kiyomizudera (T.OKUBO)	Lecture 16 Traditional Approaches to Disaster Mitigation in Japanese Historic Town (T.OKUBO)	Recap @KNM			Lecture 22 Damage And Risk assessment during emergency (R.JIGYASU)
10:00	Orientation of the Course (R.JIGYASU)	Lecture 13 Ponto-cho, Community Disaster Resiliece Initiatives (A.KAMBE, D.KIM) @Rissei Comm.Centre			Lecture 20 DRM System in Kyoto National Museum (J.FURIHATA) @KNM			
	Lecture 11 Introduction of Kyoto (D. KIM)		Lecture 15 Water-Related Disaster Mitigation and Response for Kiyomizu-dera (M.FUJIMOTO)	Lecture 17 Local Design for Disaster Mitigation in Japanese House Building (O.OBA)	Site Visit 5 Kyoto National Museum and its Exhibition Rooms (J.FURIHATA) @KNM			Workshop 10 Damage and Risk assessment form (R.JIGYASU)
11:00	Lecture 12 The Need for DRM for Cultural Heritage in Historic Cities in Japan (D. KIM)	Move to Pontocho Site Visit 1 Ponto-cho Community Disaster Resiliece Initiatives (A.KAMBE, D.KIM) @ponto-cho						
	Lunch		Lunch	Lunch			Lunch	Lunch
12:00			Site Visit 2 (Video) Landslide and Prevention System in Kiyomizu-Dera Area		Move to Dmuch			
		Lunch @Izumoya	Lunch					
13:00	Participant presentation 5 x 15mins	Briefing@Izumoya	Workshop 7-2 Outcomes of Value Assessment & Risk Assessment of Ponto-cho (R.JIGYASU, D.KIM)	to Higashi Hongangji	Lunch		Mid-term presentation 5 x 15mins	Lecture 23 Disaster Mitigation and Emergency response for CH by Kyoto Fire Department (R.NAKAMURA)
14:00		Workshop 7-1 Field Exercise for Value Assessment & Risk Assessment of Ponto-cho (R.JIGYASU, D.KIM) @ponto-cho		Lecture 18 Analysis of Seismic Performance of Japanese Historical Structures (S.YOSHITOMI) @Shinran Hall	Lecture 21 Response and Emergency Drill for Movable CH (A.SALAH)			
	Participant presentation 5 x 15mins						Mid-term presentation 5 x 15mins	Lecture 24 Emergency stabilization of built heritage (R.JIGYASU)
15:00			Workshop 8 Disaster Imagination Game (DIG) in case of Ponto-cho (T.OKUBO and D.KIM)	Lecture 19 Conservation of Japanese Cultural Property Buildings and Restoration Technique (D.KIM) @Shinran Hall	Workshop 9 Emergency Drill to rescue the movable CH (A.SALAH) @Domoto house			Lecture 25 Conflicts and Intangible CH, SUDAN (T.ISHIMURA)
16:00	Participant presentation 4 x 15mins	Group work @Rissei Com.Centre		Site Visit 4 Restoration Project site The bell-house of Higashi Hongangji			Mid-term presentation 6 x 15mins	
17:00								
18:00	Welcome Dinner							
19:00								
Accommodation	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto

9/7	9/8	9/9	9/10	9/11	9/12	9/13	
Sat	Sun	Mon	Tue	Wed	Thu	Fri	
recovery	recovery	recovery	Rigional Approach	Japanese system for DRM	International Approach	-	THEME
DMUCH	Kobe	Sayo-cho	DMUCH	DMUCH	DMUCH	DMUCH	Venue
	Move at 8:00 to Kobe	Move at 8:00 to Sayo-cho					
Recap			Self Study	Recap	Case Study Project Work	Guidance	9:00
Lecture 26 Contribution of ICH for Social Cohesion and DRM Activities (H.KUBOTA)	Site Visit 6 Sawanotsuru Sake Brewary	Recap Lecture 31 Post Disaster Recovery from Typhoon and Land Slide: Hirafuku Area (T.FUJIKI)		Lecture 34 Building networks of citizens and experts for disaster mitigation of cultural heritage (R.KODANI)		Final Presentation 4 x 20mins	10:00
Lecture 27 protection of ICH for Disaster Recovery (H.KUBOTA)	Lunch	Move to Hirafuku		Lecture 35 National policy for DM of CH in Japan (H.IKAWA)		Final Presentation 3 x 20mins	11:00
Lunch			Lunch	Lunch	Lunch	Lunch	
	to DRI	Lunch @KUMOTSUKI					12:00
Lecture 28 Lessons from Post Disaster Recovery in Minami-Sanriku-cho (Y.HIRAOKA)	Site Visit 7 Exhibition of Disaster Reduction and Human Renovation Institution	Site Visit 9 Post Disaster Recovery from Typhoon and Land Slide: Hirafuku Area (T.FUJIKI)	Lecture 32 Managing disaster risks in WH city in case of Jorge town (M.ANG)	Case Study Project Work	Case Study Project Work	Final Presentation 4 x 20mins	13:00
Lecture 29 Pre-Disaster Recovery Planning for the Nankai Trough Great Earthquake in Wakayama prefecture (M.KIM)	To a JICA conference room Lecture 30 Post-Kobe earthquake Recovery (Y.MAEDA) @JICA conference room	Workshop 11 Designing Recovery (D.KIM) @Syakyo	Case Study Project Work			Final Presentation 4 x 20mins	14:00 15:00
Case Study Project Work	to Kitano Site Visit 8 Post-Kobe earthquake Recovery at Kazamidorino Yakata	To Kyoto		Lecture 33 Disaster Risk Management of Heritage Sites in Bhutan (J.MUKAI)	Lecture 36 -ONLINE- International policy for DM of CH and UNESCO'S initiatives on emergency response and recovery (S.ABRAHAM)	Wrap-up	16:00
	To Sayo Star Resort						17:00
						Closing Ceremony Farewell Party	18:00
Kyoto	Sayo	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	

2 Outline of Disaster Risk Management Plans for Case Study Projects by ITC 2024 Participants

2.1 Disaster Risk Management Draft Plan for Turkish and Islamic Arts Museum, İstanbul, Türkiye

Bilge Küçükdoğan *Finance and Operations Coordinator, Stanford Archaeology Center, Stanford University*
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1. A palace repurposed as a museum

The case study selected for this course represents a very common practice observed in Türkiye in a wide range of historical contexts and building scales: repurposing a historical edifice with a museum function. This practice enhances the visitor experience in a multitude of ways and safeguards the historical building with a meaningful and practical approach while demanding comprehensive risk assessment methodologies and mitigation strategies due to their dual role as custodians of cultural treasures and architectural heritage. This short article narrates only a small fraction of the intensive assessment, analysis, and research conducted on the Turkish and Islamic Arts Museum (Ibrahim Pasha Palace) during the International Training Course on Disaster Risk Management organized by the Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University, Japan in collaboration with ICCROM and UNESCO, ICOM, ICOMOS/ICORP.

(1) Ibrahim Pasha Palace

Constructed in the late 15th century during the reign of Sultan Beyazid II (1481-1512), the Ibrahim Pasha Palace was built atop the spectator seats of the ancient hippodrome, originally commissioned by Roman Emperor Septimius Severus (193-211CE) and expanded by Emperor Constantine the Great (306-337 CE). The palace is named after Ibrahim Pasha, the grand vizier of Sultan Suleiman the Magnificent, who lived here after his marriage to the Sultan's sister in 1524. Throughout its history, the palace has weathered numerous earthquakes and fires, each chapter marked by meticulous structural restoration efforts, commencing as early as 1521, and serves as a living testimony of various traditional design solutions to mitigate the earthquake-induced risks over the last 500 years. Unlike many imperial residences that have not survived, the Ibrahim Pasha Palace is remarkable for its endurance, having functioned continuously through centuries of political and social change as military quarters, an embassy, a revenue office, quarters for the Ottoman military band, a state archive, and even a prison[1-3].

The Turkish and Islamic Arts Museum, established in 1914 during the late Ottoman Empire as the first museum dedicated to Islamic art, was originally housed in the Süleymaniye Complex before relocating in 1983 to its current site at the historic Ibrahim Pasha Palace (Fig. 1). Its collections feature a wide range of items, including rare Quranic manuscripts, intricate Seljuk ceramics, Ottoman imperial artifacts, and some of the finest carpets from the Islamic world. Additional exhibits include sacred relics, medieval manuscripts, and a variety of stone, glass, ceramic, wooden, and ethnographic objects[4]. There is a section open to public access where it is possible to see the spectator seats of the 4th century hippodrome.

The building is one of the registered buildings of Sultanahmet Urban Archaeological component area of World Heritage Site (inscribed in 1985)[5]. The museum embodies several heritage values that include architectural, artistic, spiritual (sacred relics), historic value along with scientific, educational and social value that it inherently has as a museum. The potential loss of these values would have a profound impact, diminishing the site's capacity to illustrate the artistic achievements and cultural continuity of the Turkic Islamic world. It would also weaken the scientific and educational significance tied to the study and preservation of these rare objects, undermining the palace's role as a center for cultural heritage and public engagement.

Fig. 1 Turkish and Islamic Arts Museum (The Ibrahim Pasha Palace)
Source: Türkiye Kültür Portalı (Aerial image on the top left most[6)] and the author (the rest of the images)

2. Risk Assessment and Analysis

(1) Hazards, vulnerabilities, and impact of primary and secondary hazards

İstanbul is exposed to a variety of natural and human-induced hazards due to its geography, history, and its rapid urban growth in the last 50 years. Since the 1999 earthquakes in the Marmara Region, there has been extensive research on the natural hazards by several state and academic institutions led by the Disaster and Emergency Management Authority (AFAD) and Istanbul Metropolitan Municipality Directorate of Earthquakes and Ground Research. In the risk analysis conducted, earthquake stands out as the high probability-high impact hazard for the case building due to the city's proximity to the North Anatolian Fault Line[7-11)]. Rapid urbanization worsens this danger along with historical layers that lack seismic reinforcement on an extensive scale. In addition to natural hazards, Istanbul's role as a cultural and economic center makes it vulnerable to civil disorder and terrorist attacks. The Sultanahmet Square has experienced incidents of unrest and targeted violence in the past. Additionally, slow agents of deterioration, such as pollution, temperature fluctuations, increased humidity, storage techniques, and saltwater intrusion pose long-term risks to the case study building as well as the city's architectural heritage (Tab. 1)[12-14).]

(2) Worst Case Scenario

An earthquake with M=7.8 hit Istanbul at 14:32 and lasted 1 min 11 seconds on September 12, 2024. At 14:34, a fire started due to the electrical malfunction by the intensity of the earthquake in the attic area in the Divanhane section of the building where the wooden ceiling is supported by the wooden pillars and arches. 21 minutes after the earthquake hit an aftershock of M 6.1. The fire department in Eminönü cannot get out of the one-way street they are located due to the collapse of several buildings in the area. The fire continues until it stops after reaching the full masonry parts of the building.

2 days after the earthquake: Heavy rainfall for 6 hours leading to flash flooding on the first floor and water leakage from the cracks in the structural walls and Divanhane section's burned roof. Due to the devastating scale of the earthquake, no temporary stabilization and evacuation of the objects is possible. Water infiltrated into the building and the rainwater on the first floor was collected in the hippodrome remains. Power shortage continues for weeks, generators were not enough to destabilize the conditions of the temperature& humidity-controlled areas of the building such as storages and exhibit cases with manuscripts. The pace of deterioration of the organic objects increases.

Tab. 1 Risk analysis for Turkish and Islamic Arts Museum (Ibrahim Pasha Palace) (Source: by the author)

Primary Hazard	Secondary Hazard	Vulnerabilities		Potential Impacts
		Hazard specific vulnerabilities	General vulnerabilities	
Earthquake	Fire Looting	Proximity to active fault lines Structurally weakend due to past disastes Dense urbanization Complex structural system	**Museum features*** High # of high value movable objects Wooden display panels Display design in some rooms Located in a historical square visited by ~15 million people annually	Injury or loss of lives Damage or loss of historical layers of the complex structure Damage or loss of collections
Extreme Weather	Flast Flooding Rising water table Fire Ligthening Heatwaves Pest infestation	Historic drainage infrastructure Porous building materials Storage spaces Lead roof Organic collections	**Museum organizational capacity related issues*** Lack of DRM Insufficient number of technical personnel	Loss of herirage value Decline in tourism and economic revenue Increase in the rate of humidity and smoke related deterioration Incresed rate of pest infestation
Civil disorder/ Terrorism accidents	Looting Visitor of staff accidents Vandalism	Inherent museum tour flow risks Uncontrolled tourism Lack of cultural awareness	**Building specific issues***	Decline in economic revenue and tourism
Agents of deterioration	Air pollution Storage techniques Pests Relative humidity & temperature fluctuations	Increased population and traffic Climate change Insufficient # of conservators High # of organic objects Insufficient storage spaces	Alternative exits and access routes Hybrid construction material Historical tree in the courtyard ** The details have been excluded*	Compromised trust in the museum Increased risk of pest infestation Increased rate of deterioration Loss of valuable organic collections

Source: by the author

3. Disaster Mitigation and Preparedness Measures

Disaster mitigation and preparedness measures to reduce the vulnerabilities and inherent risks in the case of the worst-case scenario are considered under four interrelated categories as technical, management, strategic planning, and capacity building. Fig. 2 below lays out the high-level measures within each category, coordinating institution, and a very rough estimate on duration, cost to implement the measures, and the impact[12-14].

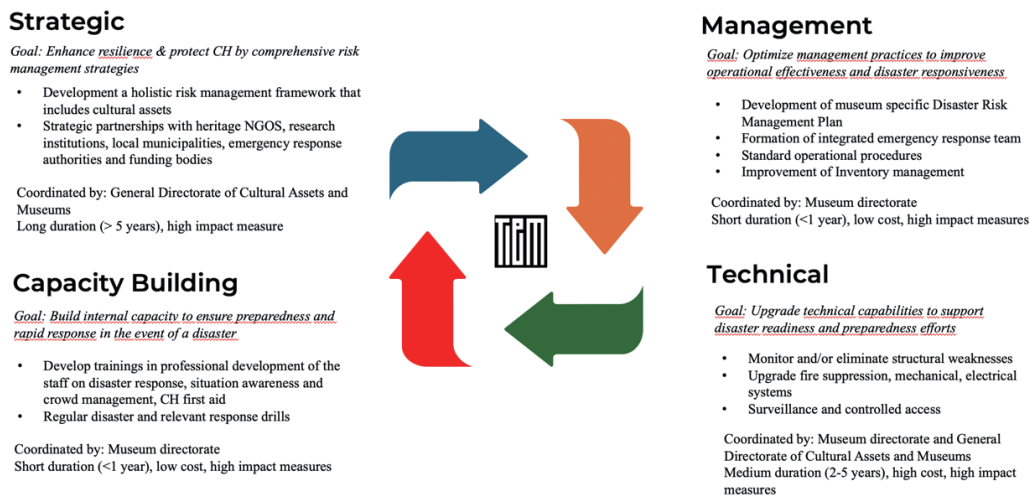

Fig. 2 Disaster mitigation and preparedness measures for Turkish and Islamic Arts Museum
Source: by the author

4. Emergency Response and Recovery Process

Given the museum's location in a densely populated area of the historical peninsula, three sub-scenarios were developed to account for the seismic behavior of nearby buildings and its influence on emergency response strategies based on the earthquake scenario. Although each scenario necessitates a different approach in various details of this response and recovery process, a general summary is provided here to highlight certain steps that are to be followed regardless of the scenario (Fig. 3).

The Emergency Response Plan for heritage sites follows a phased strategy: evacuation, assessment, and recovery. It starts with evacuating visitors and conducting a situation analysis, including a Heritage SWOT

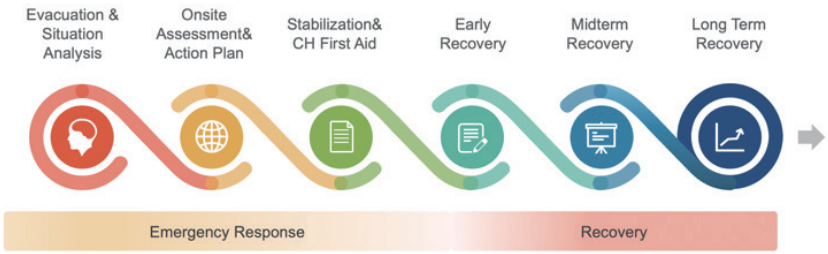

Fig. 3 Emergency response and recovery process flow
Source: by the author

assessment. Next, damage assessments are performed for the site and collections, with support from international partners. An integrated response team is established, coordinating with local emergency services (AFAD, AKUT) and setting up temporary workspaces. The stabilization phase focuses on securing structures, salvaging artifacts, and providing first aid for cultural items while monitoring for risks. The early recovery phase addresses protecting exposed areas, cleaning, and organizing damaged collections.

The recovery plan for the museum follows a structured, phased approach across early, mid-term, and long-term stages. The early recovery phase focuses on structural health assessments, designing intervention measures, and upgrading electrical, mechanical, and fire suppression systems. This stage also includes monitoring ongoing damage, prioritizing the conservation of high-risk collections, and revising damage assessments as needed. Funding requests are made to cultural and emergency organizations, while recovery strategies are adjusted based on updated information. The mid-term recovery phase, involves comprehensive restoration efforts, including seismic retrofitting and repairs. It also covers the installation of new fire suppression systems and exhibit cases, continued conservation of collections, and an updated inventory of all items. Temporary workspaces are removed, and a pop-up exhibit is introduced to re-engage the public. Finally, the long-term recovery phase, extending beyond two years, focuses on reopening the building with a renewed exhibit layout, implementing community engagement programs, and reactivating educational workshops. DRM is updated, and partnerships with local authorities and NGOs are strengthened to boost tourism and raise heritage awareness. Throughout all phases, key actors such as museum staff, emergency response teams, local government, and international heritage organizations collaborate to ensure a holistic and effective recovery process[12-14].

5. Conclusions

An architectural heritage building with a redefined function as a museum requires a comprehensive, highly tailored approach to disaster risk assessment and the development of a disaster risk management plan. All site, local, city and state-level stakeholders need to be involved in the process to ensure effectiveness and the buy-in for the DRM plan, smooth implementation, and accountability for the roles and responsibilities in every step.

As we have experienced during the course in multiple hands-on activities, drafting a disaster risk management plan is iterative by nature and each iteration necessitates more information from different employees in the museum, in the municipality or in the Ministry of Culture and Tourism, maybe a few more rounds of visit and interviews for getting more clarification, close up images or personal experiences of the museum staff or a deep dive in the architectural history of the building in the archives to shed a light on vulnerabilities and risks that have been masked by recent restorations and alterations.

Multiple events that can happen in parallel or follow each other need to be considered as probable scenarios as disaster risks do not only result from catastrophic scale events such as earthquakes. The author hopes that the extended version of this initial draft disaster risk management plan will provide a roadmap

for the museum directorate to establish one in which different stakeholders inside and outside the museum voice their input for a common goal of going through disasters especially the natural ones that are inevitable and just around the corner.

Acknowledgment

This study was conducted with the official permit granted by the General Directorate of Cultural Heritage and Museums, Ministry of Culture and Tourism of Türkiye. I am very grateful to the Turkish and Islamic Arts Museum Director Ekrem Aytar, conservator Zeynep Sürmeneli and art historian Dr. Ahmet Hamdi Bülbül, and the technicians who gave hours of their time to provide me invaluable information to start this research. I am looking forward to sharing the outcome of this study with this reputable institution.

I would like to express my sincere gratitude and thanks to Rojit Jigyasu, Takeyuki Okubo, Junko Mukai, Dowon Kim, Min Li, Abdelhamid Salah Sayed, Ming Chee Ang and all the resource persons online and and onsite, and all the D-MUCH staff who made this experience flawless. This course was truly a transformative, mind-opening and technical confidence-boosting experience not only thanks to the resource persons but also the great camaraderie, creativity, and genuine openness of the fellow ITC 2024 participants. I feel very privileged to become a part of the ITC family.

Last but not least I am very much thankful to the Stanford Archaeology Center for generously supporting me to participate in this course through the professional development funds and for encouraging me to pursue further research and analysis within the USA and abroad.

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2.2 Developing a Disaster Risk Management Plan for the Prehistoric Sites and Decorated Caves of the Vézère Valley

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1. Introduction

Nestled in the heart of Dordogne, France, The Prehistoric Sites and Decorated Caves of the Vézère Valley are a landscape of unparalleled significance in the study of human prehistory (Fig. 1). A UNESCO World Heritage site since 1979, it houses one of the most concentrated and exceptional collections of prehistoric caves and archaeological sites worldwide offering invaluable insights into the lives of the early humans who inhabited Europe during the Upper Paleolithic era. The region's rich historical narrative, inscribed in rock and earth, reflects both the ingenuity and the complexity of the societies that shaped it, marking the Vézère Valley as a keystone of European prehistoric heritage. [1)]

Fig. 1 France, Dordogne, Perigord Noir, Vezere Valley(⋯)
Source: Bertrand Rieger

(1) Component, attributes and values

The prehistoric sites of the Vézère Valley, including famous caves like Lascaux (Fig. 2 & 3), Font-de-Gaume, and Combarelles, offer a profound glimpse into early human culture, art, and society. These decorated caves showcase some of the oldest and most complex Paleolithic art, with thousands of engravings and paintings depicting animals, human figures, and symbols. Beyond art, the valley's archaeological sites, like Abri de Cro-Magnon or La Micoque, uncover a lot about prehistoric life, including tool use, social structures, and burial customs. Together, these components offer a multidimensional view of early human societies, illustrating the beginnings of an organized social life.

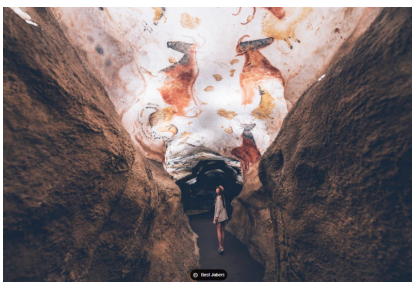

Fig. 2 Lascaux Cave
Source: Best Jobbers

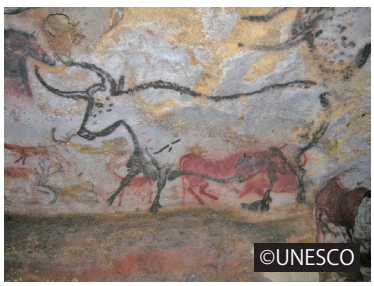

Fig. 3 Lascaux Cave
Source: UNESCO

The valley's cave art and archaeological layers offer insight into the spiritual and aesthetic lives of early humans, technological progress and ritual practices, challenging assumptions about their cognitive abilities. This site holds cultural, scientific, historical, social, educational, and economic value as it deepens our understanding of human origins and is still studied by schools and researchers, attracts global tourism, and supports local economies.

(2) Stakeholders Analysis

The management of the Vézère Valley is a shared responsibility among various institutional, scientific, and local stakeholders, each playing a pivotal role in the preservation and interpretation of this exceptional heritage. Institutional actors include the Direction régionale des Affaires culturelles Nouvelle-Aquitaine (DRAC), the Centre des Monuments Nationaux (CMN), the Conseil Général de Dordogne, the Ministère de la Culture and the Région Nouvelle-Aquitaine who all play high-influence roles in funding, regulation, and decision-making. Especially, scientific bodies like the Centre National de Préhistoire (CNP) and the Historic Monuments Research Laboratory (LRMH) play essential roles in archaeological research, site conservation,

and the development of new scientific knowledge. Educational institutions, including Université de Bordeaux, and initiatives like Pass Culture enhance public knowledge. Private owners collaborate with authorities on-site maintenance. Tourism operators, such as La Semitour, focus on public access and sustainable practices.

2. Risk Analysis

The Vézère Valley faces significant natural and human-induced hazards that threaten the preservation of its invaluable cultural heritage. This area's exposure to hazards such as floods, landslides, wildfires, and overtourism represents pressing challenges[2], considering the complex and fragile geological and environmental conditions of the region[3].

Flooding, for example, is a major disaster[4], given the Vézère River's propensity to overflow during periods of heavy rainfall[5], as occurred in 1944, 1960, and recently in November and December 2023. Landslides are another concern, given the unstable limestone and clay soils that characterise the region[6], especially near the town of Montignac-lascaux[7].

Due to the pronounced forest cover (45% of the region)[8] and the area's hilly terrain, which accelerates fire spread and complicates fire-fighting efforts, Wildfires are a rising risk just as is tourism-induced damage. The lack of coordinated response among stakeholders also further hinders effective risk management. Despite a newly established buffer zone and risk prevention plans, inconsistency in enforcing regulations across jurisdictions, coupled with limited collaboration contributes to an overall vulnerability.

The graphic above (Fig. 4) summarises the primary and secondary hazards, vulnerabilities, and the expect-

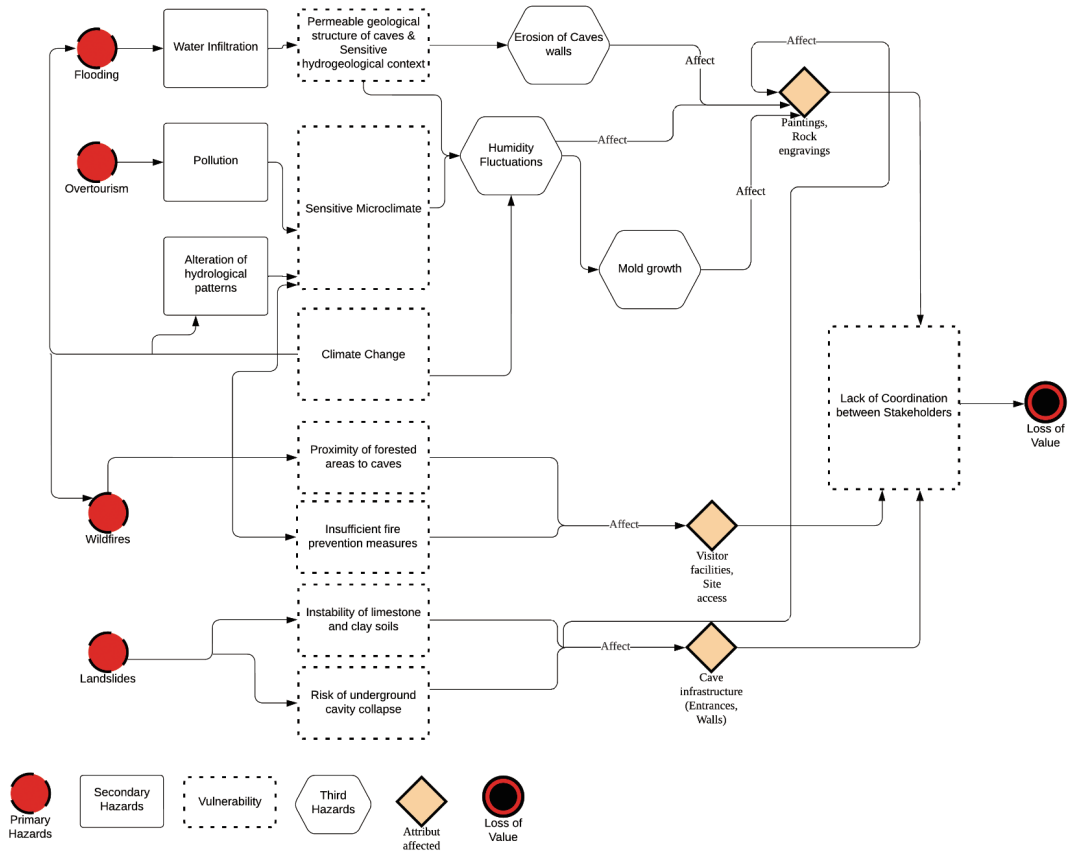

Fig. 4 Overview of the risks incurred by the site
Source : Bryan Koffi

ed loss of value by attribute. Each line details the interplay between hazards, specific vulnerabilities, affected heritage components, and the anticipated value loss underscoring the need for improved risk management to safeguard this irreplaceable cultural heritage for future generations.

3. Worst-case Scenario

On the morning of December 14, 2024, several French departments are struck by a torrential rainstorm. By 6 p.m., Météo France issues an "Orange Alert," prompting immediate protective measures to ensure public safety. Over the next days, relentless rainfall saturate the region, causing the Vézère River to rise nearly 7 meters above its banks. Montignac and Les Eyzies cities are submerge, with floodwaters reaching unprecedented levels.

The valley's hydrogeological sensitivity, characterised by permeable limestone formations and underground waterways, make its heritage sites particularly vulnerable. By December 17, three days into the disaster, the floodwaters poses direct threats to these cultural treasures.

The region's economy, heavily reliant on tourism, is hit hard. Inaccessible heritage sites force trip cancellations, depriving local businesses of vital income. Tourists faced evacuation challenges, and extended site closures signal an economic crisis for this culturally significant area.

4. Mitigation, Emergency Preparedness and Response Measures

To address the identified risks effectively, mitigation measures spanning strategic, technical, and awareness levels, should aim to strengthen coordination, preparedness, and response capabilities across the Vézère Valley.

At the technical level, a Centralised Disaster Management Task Force should coordinate stakeholders for rapid emergency response, led by DRAC Nouvelle-Aquitaine, with short-term implementation and low costs. Local Government will ensure compliance with already existing protective measures like the Flood Risk Prevention Plans, safeguarding heritage at moderate cost over a medium timeline. Regular multi-stakeholder emergency drills will enhance preparedness, while sustainable land use planning should mitigate flood risks, both requiring modest investment. A mutual aid agreement among French Departments should ensure resource sharing across departments, supported by the formation of local volunteer response teams to enhance on-ground support.

At the Strategic level, improved drainage systems and reinforced cave slides will minimise water damage, with medium costs over a medium timeline. A long-term investment in an Integrated Defense System of retractable walls will shield the valley from severe flooding, albeit at very high costs. Creation of green spaces and buffer zones offers natural flood mitigation, while stockpiling emergency supplies ensures swift action.

Lastly, awareness initiatives will include educational programs for staff and volunteers to build disaster literacy and a real-time monitoring system for community updates. Both measures are cost-effective yet significantly enhance community readiness.

To ensure visitor safety and the preservation of cultural heritage in the event of a flood, the response measures in Tab. 1 could be implemented.

Together, these measures represent a holistic approach to safeguarding the Vézère Valley's cultural treasures against future risks.

Tab. 1 Preparedness and Response Measures

Response Measures /Emergency Prepardness Measures	Details	Stakeholders Involved
A. Evacuation Plan	**1) Visitor Evacuation Plan** - Upon flood warning, evacuate visitors from caves and nearby sites, - Activate alarms and guide through evacuation routes. - Escort visitors to designated refuecareas. - Set up temporary shelters with essential supplies and medical support.	• Météo France • Site Staff • Local Emergency Services (Fire Brigades, Police) • Tourism Associations • Local Authorities
B. First aid to Cultural Heritage Procedures	**1) Situation Analysis, Damage Assessment and First Prevention Measures** - Conduct rapid situation analysis and damage assessments. - Volunteers assist in documentation and debris clearing. Experts analyze impacts and prioritize conservation efforts	• Local Authorities (Cities) • |Cultural Heritage Experts (French Ministry of Culture, ICOMOS) • Conservation Specialists • Volunteers • Local Community
	2) Emergency Stabilisation - Form emergency response team for artifact stabilization. - Implement immediate protection measures (sandbags, pumps).	• DRAC • Heritage Specialists • Conservation Experts • Local Volunteers
C. Emergency Equipment and Heritage-Sensitie Design	**1) Equipment Installation and Monitoring** - Install emergency equipment in key areas with heritage sensitivity - Maintain and monitor equipment functionality	• DRAC • Site Management (Owners, Centre des monuments nationaux] • Local Fire Brigades • Cultural Heritage Experts (ICOMOS) • Local Government (Municipal Authorities)

Source: Bryan KOFFI

5. Recovery, Rehabilitation, and Way Forward

The recovery plan for the Vézère Valley should follow a phased approach, focusing on immediate stabilisation, long-term restoration, and cultural revitalisation.

Early Recovery (0-6 months): The first phase will involve a comprehensive damage assessment, including tangible and intangible losses, with priority given to vulnerable sites. Immediate conservation actions should include the installation of protective measures, such as water diversion barriers, dehumidifiers, and temporary anti-mold treatments. Community consultations should also ensure local knowledge is integrated into recovery plans, while efforts to safeguard intangible cultural heritage will begin. Meanwhile, Business continuity will be supported through a plan to reopen undamaged areas and enhance digital tourism, maintaining international interest through virtual tours. Emergency funding will be sought through UNESCO grants and crowdfunding campaigns. Media coverage, including official visits by ministers, will highlight recovery efforts and attract national attention.

Medium-Term Recovery (6 months - 2 years): This phase will focus on detailed restoration, including structural reinforcements, climate management systems, and erosion control. Cultural activities will be reintroduced, and local art markets will be developed to support the community and tourism. Capacity-building programs will train local populations in conservation techniques and disaster preparedness. The creation of a sustainable tourism fund and international partnerships will help finance the recovery and ensure long-term viability. Temporary exhibitions and digital content will keep visitors engaged, while regular updates and media coverage will maintain global interest in the recovery process. The development of a documentary on the recovery, in collaboration with film directors and national broadcasters, will further promote the site's cultural significance.

Long-Term Recovery (2-5 years and beyond): The long-term recovery should focus on the full restoration of the caves, including advanced conservation techniques and the installation of permanent monitoring systems to prevent future damage. By 2027, the caves will be fully restored, and new technologies will ensure their preservation. Institutional disaster preparedness will be institutionalised with a permanent heritage disaster management plan, supported by regular drills and training programs. International partnerships with cultural institutions will continue to support research, preservation, and disaster risk reduction. In terms of media and communication, the premiere of a documentary on the recovery, alongside ongoing national media coverage, will keep the world engaged. The long-term recovery plan will therefore not only ensure the physical and cultural restoration of the sites but also the creation of a resilient, sustainable cultural ecosystem that benefits local communities and attracts global attention.

6. Conclusion

In conclusion, the recovery of the Prehistoric Sites and Decorated Caves of the Vézère Valley will require a comprehensive, multi-phase approach that will prioritise both tangible and intangible heritage. The risks to the sites demand immediate & coordinated action, but long-term recovery will hinge on integrating disaster risk management into broader local plans for safety, recovery, and emergency preparedness. Community involvement will be crucial, ensuring that recovery efforts are rooted in local knowledge and needs. A disaster risk plan cannot stand alone but must be part of a wider, collaborative strategy involving local authorities, cultural experts, and global partners for sustainable restoration and resilience.

Acknowledgment

I would like to express my sincere gratitude to the distinguished resource persons of the 2024 ITC. Their erudition, unyielding support, and unparalleled mentorship have profoundly shaped this endeavour. To the esteemed professors, I owe my sincerest thanks for their enlightening guidance, and to my extraordinary peers, I extend heartfelt appreciation for their invaluable insights, shared experiences, and intellectual camaraderie. This acknowledgment aspires to reflect the immense debt of gratitude I hold for all who contributed to the fruition of this work.

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2.3 Disaster Risk Management Plan for Ura Dozhi Village in Bumthang District

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1. Introduction

(1) Introduction to Ura Dozhi Village

Nestled in the picturesque Bumthang valley of central Bhutan, Ura Dozhi village is a microcosm of Bhutan's rich cultural heritage and historical significance. Geographically, the village is part of the Ura Block within Bumthang District, one of Bhutan's 20 administrative districts. Unlike the steep terrains that characterize much of the region, Ura Dozhi lies on a gentle slope, making it an ideal location for agriculture and human settlement. Historically, the village has been an important center, serving as a gateway between eastern and western Bhutan, and retains archaeological and cultural landmarks that testify to its storied past.

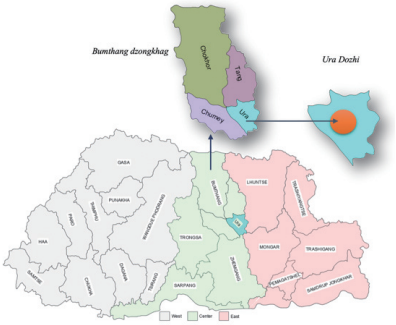

Fig. 1 Bhutan map with location of Ura Dozhi Village
Source: by the author

(2) Historical Context

The history of Ura Dozhi traces back to Bhutan's early historic period (10th–17th century CE), during the later diffusion of Buddhism in the region. This era saw the emergence of gdungs, influential secular families who ruled territories and provided protection to their subjects. Ura Dozhi was shaped under the authority of the Ura gdung, which, according to oral traditions, was the first such lineage in Bhutan. This lineage attracted nearby settlements to cluster around the gdung's fortress, forming four unified section of village around the gdung's castle—Trabi/Krispa, Tarshongpa, Toepa, and Charipa—each retaining its identity within the larger community.

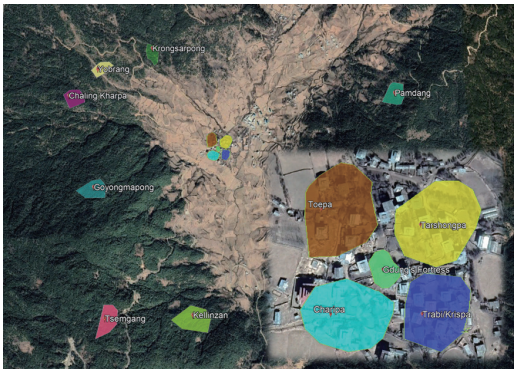

Fig. 2 Ura Dozhi village at center and old villages in the periphery
Source: by the author

(3) Cultural Heritage of Ura Dozhi village

Ura Dozhi, governed under the traditional *Gdung* system, embodies a rich cultural heritage shaped by history, religion, and enduring traditions. The *Dozhi Magmi Zhi*, a unique power-sharing governance model, highlights the community's collective ethos. Tibetan Buddhism, introduced in the 13th century, complements the village's intrinsic traditions, celebrated through festivals like Ura Yakchoe, Sang, and Goenpoi Tordok.

Architecture features traditional materials—stone, mud, and timber—with functional layouts optimizing agricultural use. Key landmarks include Ura Lhakhang, Neykhang, and the old trade route, showcasing spiritual and economic significance.

Heritage houses, such as Dangpa (first house near the Gdung fortress), Mat-Dangpa (below Dangpa), and Chukpas (affluent houses in village sections), preserve oral histories. Cultural symbols include beliefs in *Lu* spirits, sacred *choetens*, and historical water mills, reflecting harmony with nature and sustainable practices. Ura Dozhi remains a dynamic testament to Bhutanese culture and communal life.

2. Value Assessment

Value assessment is crucial in disaster risk management for heritage sites, helping prioritize the protection of key cultural, historical, architectural, social, spiritual, and economic values. By understanding a site's significance, stakeholders can align disaster strategies with heritage preservation, ensuring informed decisions that balance safety and conservation. This process strengthens commitment to safeguarding irreplaceable heritage while mitigating risks.

(1) Heritage Attributes

The heritage attributes of Ura Dozhi village are:

- Traditional Buildings: Preserved structures maintaining architectural authenticity.
- Traditional Settlement Pattern: Sustainable layout harmonized with nature and climate.
- Unique Political Heritage: The Dozhi Mangmi-Zhi System, a community-based governance model.
- Festivals: Site-specific celebrations rooted in spiritual beliefs and the environment.
- Old Route: A historic trade route linking eastern and western Bhutan.
- Heritage Houses: Distinct homes with historical significance.
- Cultural Features: Elements of Buddhist practices and local beliefs enriching its spiritual heritage.

(2) Heritage Values

The heritage values of Ura Dozhi village highlight its unique blend of architecture, culture, history, and sustainable living, reflecting its importance as a cultural and historical landmark in Bhutan.

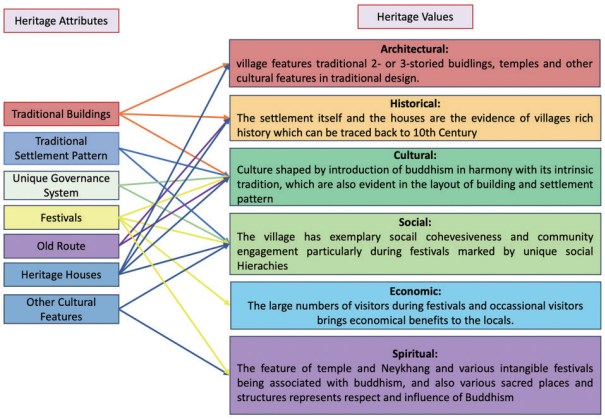

Fig. 3 Value assessment flow chart
Source: by the author

3. Damage and Risk Analysis

The damage and risk assessment for Ura Dozhi village reveals critical vulnerabilities to earthquakes and secondary hazards. Traditional, non-seismic-resistant construction and a densely packed layout increase

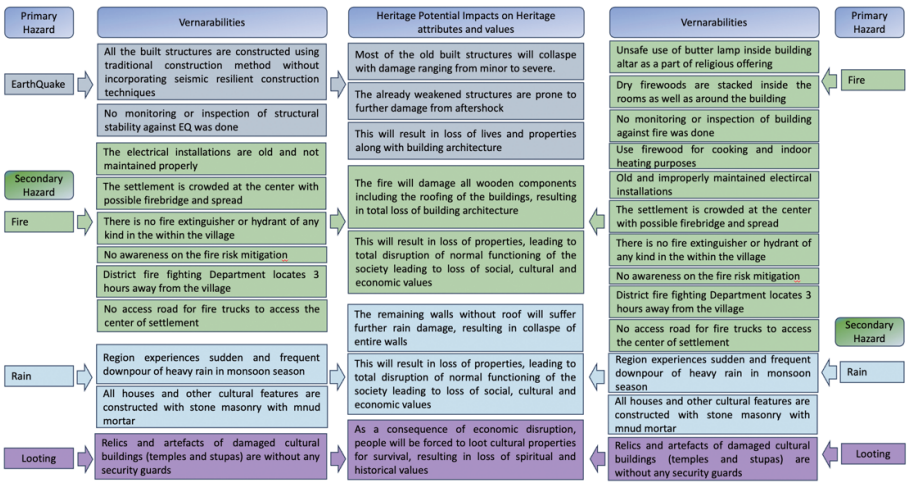

Fig. 4 Damage and Risk analysis flow chart
Source: by the author

the risk of widespread structural collapse and cascading failures. Secondary hazards, such as fires from outdated electrical systems and limited access for firefighting, pose significant threats. Post-earthquake heavy rains could further destabilize damaged structures, while the lack of disaster awareness programs amplifies the risk of chaos and looting. These factors highlight the urgent need for seismic-resilient construction, fire safety measures, improved infrastructure, and community preparedness to mitigate potential losses.

4. Worst Case Scenario

Considering the most probable hazard, vernability of the village and potential impacts from the damage and risk analysis, following worst case scenario was developed.

(1) A Day of Devastation: The Collapse of Ura Dozhi Village

On May 13, 2025, at 1:00 AM, Ura Dozhi village experienced a catastrophic 7.8-magnitude earthquake, causing extensive structural failure across the settlement. Centuries-old buildings, including significant cultural and architectural landmarks, collapsed, resulting in widespread loss of life and property. Fires broke out due to electrical malfunctions, rapidly spreading through the densely packed village, overwhelming residents and hindering suppression efforts. Key infrastructure, including the village's temple, sustained severe damage, forcing the cancellation of the Yakchoe festival—a cornerstone of the community's cultural heritage. The lack of road access impeded emergency response, leaving the central area inaccessible to firefighting teams. By dawn, much of the village had been reduced to ash and rubble, displacing the population and halting rescue operations due to the complete breakdown of power and communications systems.

Seventeen hours post-event, heavy pre-monsoon rains exacerbated the situation, triggering soil erosion and washing away remaining debris. This secondary hazard compounded structural losses and left survivors in deteriorating conditions within makeshift shelters. Looting of cultural artifacts emerged as resources became scarce, further destabilizing the community. The earthquake's cascading effects led to the collapse of local economies reliant on tourism and handicrafts. The destruction of heritage structures and interruption of cultural traditions like the Yakchoe festival resulted in significant socio-cultural degradation.

5. Mitigation and Preparedness

Mitigation and preparedness are crucial for reducing disaster impacts in Ura Dozhi village. By addressing risks, strengthening resilience, and equipping the community with knowledge and resources, these efforts protect lives, cultural heritage, and the village's socio-economic fabric. The proposed disaster mitigation measures for Ura Dozhi village aim to address seismic risks, fire hazards, and secondary vulnerabilities while strengthening community preparedness, with most interventions occurring at the village level.

(1) Seismic Risk Mitigation

- Conduct seismic vulnerability assessments of all built structures.
- Retrofit community structures, such as kitchens and zigrey buildings, and vulnerable houses by installing through-stones and repairing weak walls.
- Train local builders in seismic-resilient construction techniques and national standards.
- Raise community awareness on seismic risks and mitigation measures.

These measures reduce the risk of structural collapse during earthquakes, ensuring safer buildings and improved resilience.

(2) Fire Hazard Mitigation

- Install fire detectors in all houses, provide fire extinguishers, and establish four fire hydrants for emergen-

cy response.
- Transition households to safer cooking methods by providing LPG stoves, electric stoves, and heaters.
- Conduct regular inspections and maintenance of electrical systems to prevent fire outbreaks.
- Protect butter lamp offerings with glass covers to reduce fire risks inside sacred spaces.
- Develop fire safety awareness programs, including drills, to improve response readiness.

(3) Preparedness and Response
- Create and maintain a village evacuation plan with designated safe zones and routes.
- Train the community to provide first aid to cultural heritage during crises.
- Establish a village-level Disaster Risk Management (DRM) plan to coordinate response efforts.

These preparedness measures enhance the village's ability to respond effectively to disasters, protecting cultural heritage and ensuring community safety.

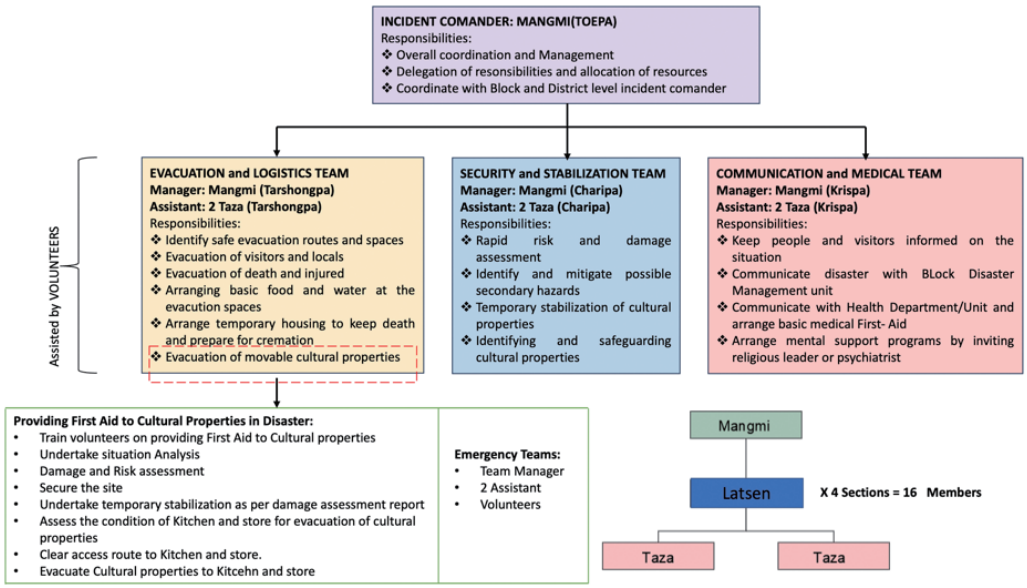

Fig. 5 Key Emergency Actors
Source: by the author

Key stakeholders include the Ministry of Infrastructure and Transport, the Department of Culture and Dzongkha Development, the District government, building owners, and local masons, ensuring technical expertise, compliance with standards, and local engagement. These integrated measures address primary hazards like earthquakes and fires while mitigating secondary risks such as structural failure, fire spread, and loss of cultural assets.

6. Recovery

The recovery plan for the village focuses on addressing immediate needs and ensuring long-term restoration while safeguarding cultural heritage and enhancing resilience. It also includes comprehensive damage assessments to identify structures requiring retrofitting, restoration, or reconstruction, with these efforts financed through the Emergency Recovery Fund. For mid- to long-term recovery, the plan will prioritize capacity building and restoration. Training programs will educate locals on cultural conservation and earthquake-resistant construction techniques to ensure long-term resilience. Funding will be sought from multiple sources, including insurance payouts, annual district and block budgets, and the Department of Culture and Disaster Division (DCDD). Property owners will also contribute to private prop-

erty restoration. Finally, the plan includes reviewing existing mitigation and preparedness measures to strengthen future disaster risk management strategies. This recovery approach ensures the safety and well-being of the community while preserving its cultural and architectural heritage for future generations.

7. Conclusion

The Disaster Risk Management Plan for Ura Dozhi village is a comprehensive strategy to safeguard its cultural, historical, and architectural heritage while ensuring community safety and resilience. It addresses vulnerabilities, such as structural weaknesses and fire risks, with targeted mitigation measures and a focus on integrating modern disaster management with traditional values. The recovery plan balances immediate needs, such as housing and protecting cultural artifacts, with long-term resilience, including training programs on conservation and seismic-resilient construction. A multi-stakeholder approach ensures collaboration across local communities, government, and funding sources. Ultimately, the plan aims to turn disaster challenges into opportunities for growth, preserving Ura Dozhi's legacy while empowering its people to manage future risks. It serves as a model for disaster risk management in culturally significant communities across Bhutan.

Acknowledgment

I am deeply grateful to my mentors Rohit Jigyasu, Takeyuki Okubo, Dowon Kim, Junko Mukai, and Min Li for their invaluable guidance in disaster risk management for cultural heritage. A special thanks to the Ritsumeikan University and ICCROM teams for their exceptional knowledge-sharing, and to Junko Mukai for her financial support, along with the ITC program for the scholarship. I also appreciate the Department of Culture and Dzongkha Development for their continuous support.
This experience was made memorable by the camaraderie of my fellow ITC 2024 participants, whose passion and collaboration inspired me daily. I am committed to applying all I have learned, ensuring its lasting impact.

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2.4 Disaster risk management in Lalibela, Ethiopia

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1. Introduction

Lalibela World Heritage Site comprises eleven churches that represent a unique artistic achievement, in their execution, size and the variety and boldness of their form. The site is divided into three groups. The north of the river Jordan: Biete Medhani Alem (House of the Saviour of the World), Biete Mariam (House of Mary), Biete Maskal (House of the Cross), Biete Denagel (House of Virgins), Biete Golgotha Mikael (House of Golgotha Mikael); The south of the river, Biete Amanuel (House of Emmanuel), Biete Qeddus Mercoreus (House of St. Mercoreos), Biete Abba Libanos (House of Abbot Libanos), Biete Gabriel Raphael (House of Gabriel Raphael), and Biete Lehem (House of Holy Bread). The eleventh church, Biete Ghiorgis (House of St. George), is isolated from the others, but connected by a system of trenches.

2. Location of the Site, Values and Attributes

Lalibela, a town in Ethiopia's Amhara Region, is known for its rock-cut monolithic churches, which date back to the 7th to 13th centuries 8. The town is a significant site for Ethiopia's antiquity, medieval, and post-medieval civilization. Christians consider Lalibela one of Ethiopia's holiest cities and a center of pilgrimage. The churches are believed to represent Jerusalem.

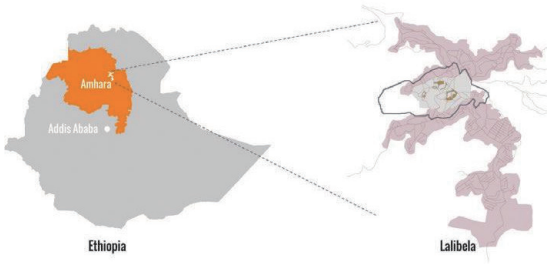

Fig. 1 Location of Lalibela Town in Ethiopia
Source: by the author

Tab. 1 Weather conditions of Lalibela Town

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)	32.73 (90.91)	33.72 (92.7)	33.72 (92.7)	33.72 (92.7)	32.73 (90.91)	30.75 (87.35)	28.76 (83.77)	27.77 (81.99)	26.78 (80.2)	26.78 (80.2)	27.77 (81.99)	28.76 (83.77)	33.72 (92.7)
Average high °C (°F)	26.51 (79.72)	27.43 (81.37)	29.02 (84.24)	29.12 (84.42)	27.21 (80.98)	25.47 (77.85)	22.58 (72.64)	22.12 (71.82)	23.85 (74.93)	24.44 (75.99)	24.8 (76.64)	25.16 (77.29)	25.64 (78.15)
Daily mean °C (°F)	21.28 (70.3)	22.49 (72.48)	24.35 (75.83)	24.92 (76.86)	23.5 (74.3)	21.72 (71.1)	19.28 (66.7)	18.76 (65.77)	19.63 (67.33)	19.8 (67.64)	19.82 (67.68)	20.15 (68.27)	21.3 (70.34)
Average low °C (°F)	13.0 (55.4)	14.26 (57.67)	16.44 (61.59)	17.37 (63.27)	17.26 (63.07)	15.35 (59.63)	14.24 (57.63)	13.5 (56.3)	12.9 (55.22)	12.74 (54.93)	12.64 (54.75)	12.64 (54.75)	14.36 (57.85)
Record low °C (°F)	7.93 (46.27)	0.0 (0)	9.92 (49.86)	12.89 (55.2)	11.9 (53.42)	12.89 (55.2)	8.93 (48.07)	6.94 (44.49)	9.92 (49.86)	8.93 (48.07)	7.93 (46.27)	7.93 (46.27)	0.0 (0)
Average precipitation mm (inches)	5.3 (0.21)	2.93 (0.12)	9.18 (0.36)	18.33 (0.72)	113.92 (4.49)	158.34 (6.23)	293.9 (11.57)	314.14 (12.37)	146.54 (5.77)	57.35 (2.26)	30.03 (1.18)	22.47 (0.88)	97.7 (3.85)
Average precipitation days (≥ 1.0 mm)	0.63	0.99	2.25	4.51	18.84	25.06	27.41	28.13	22.09	13.8	5.86	1.98	12.63
Average relative humidity (%)	37.62	30.84	31.57	33.14	52.86	67.31	80.6	84.33	78.96	70.24	59.52	47.62	56.22
Mean monthly sunshine hours	11.45	11.47	11.37	11.31	11.15	10.69	10.28	10.26	10.56	10.94	11.24	11.34	11.0

Source: https://www.weathercrave.com

3. Disaster Risk Analysis

Disaster risk analysis for Lalibela is crucial in order to protect this valuable cultural site from potential threats such as earthquakes, flooding, and landslides. The location of Lalibela, in a region known for seismic activity, makes it particularly vulnerable to the risk of earthquakes. A comprehensive risk analysis would involve identifying the specific vulnerabilities of each of the rock-hewn churches, as well as developing strategies for mitigating the potential impact of an earthquake on the site.

In addition to earthquakes, the site is also at risk from flooding and landslides, particularly during the rainy season. The porous nature of the rock on which the churches are built makes them susceptible to water damage, while the steep cliffs surrounding the site increase the risk of landslides. A thorough analysis of these risks would involve assessing the drainage systems in place at Lalibela, as well as developing plans for managing the impact of flooding and landslides on the site.

Tab. 2 assesses the effects of flooding as a major risk to the churches by comparing any secondary risks with the site's advantages and disadvantages. Finally, the table lists possible expected results.

Tab. 2 Hazard, vulnerabilities, risk and strength relationship

Primary Hazard	Secondary Hazard	Vulnerability	Strengths	Risk
Heavy Rain accompanied by Strong Wind	Flood and Debris	Churches, Visitors and heritages	Community around the heritage is already aware of the significance	Structural damage of the building, Loss or damage of movable cultural heritage, Loss of lives

Because of the dangers involved in this worst-case scenario, I have also calculated the short-, mid-, and long-term damages.

Short-term damages

- Physical damage to building, landscape and materials
- Security system and the maintenance system collapse
- Loss of artifacts

Mid-term damages

- Loss of information
- Damage to Church staff, Tourists and staff.
- Negative publicity

Long-term damages

- loss of social cohesion
- Financial crisis
- loss of knowledge

The church has decided to give this issue top priority due to the alleged high stakes. As a result, they have prepared response actions and implemented a disaster risk management plan for flood hazards. This includes training church employees to be catastrophe risk managers, developing their capacity, and finding quick fixes to minimize harm. The top priorities are putting a thorough preparedness plan into action, minimizing damage, emphasizing the need for better infrastructure, increasing awareness, and responding quickly to flood threats.

4. Risk Scenario

Based on the risk analysis, the disaster risk scenario is considered as follows. On August 10, 2024, a disastrous incident occurred at the Lalibela World Heritage Site. Heavy rain and strong winds hit the site.

Flooding in drainage channels, especially in the area of Bete Mehhanialem church, caused debris and flooding. The smooth steps and lack of handrails aggravated the situation. The narrow channels also increased the power of water, causing it to collide with tourists and tour guides. The water reservoir overflowed at Bete Gebriel-Rafael, flooding pedestrian paths and flooding the south group of churches. A metal canopy collapsed in Bete Abalibanos Church, causing extensive damage to the valuable heritage of the site.

5. Risk Mitigation and Preparedness Strategies

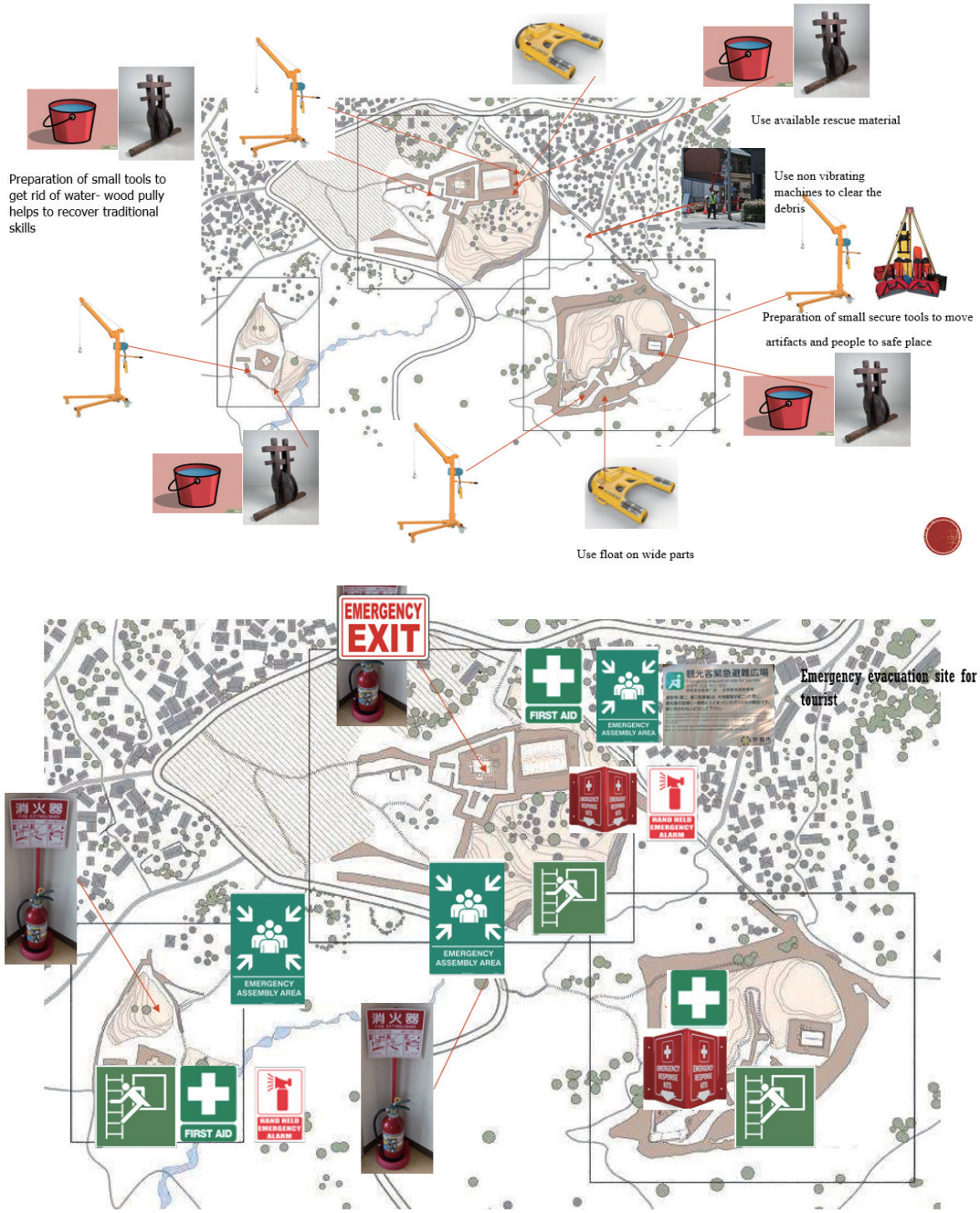

Fig. 3 Mitigation strategy and Emergency Response tools for site scale intervention
Source: by the author

6. Emergency Response and Recovery Measures

The site's cultural significance necessitates a comprehensive strategy for preservation. A planning meeting with community members and stakeholders is suggested to foster collaboration. Funding from embassies, NGOs, and other organizations is needed for infrastructure improvements and disaster preparedness training. Community awareness programs and flood warning systems are also emphasized to strengthen resilience during emergencies.

7. Conclusion

The participation of the community is an important element in mitigating and responding to disasters. It is important to involve the community in pre-preparedness training so that when a disaster strikes, all are able to respond effectively. Training the public enhances awareness, builds capacity and promotes resilience.

One example of community engagement is the provision of a pause period where community members regroup before action or interventions take place. This helps in ensuring the community refrains from hasty action and instead is given time to comprehend the issue at hand. It is also vital to hold planning meetings with the community members as well as other stakeholders, to solicit their comments, determine their requirements, and outline the comprehensive response strategy.

At the same time, in addition to working with local communities, networking with higher institutions of learning as well as technical colleges may prove resourceful during disaster response. For instance, help from institutions located within an hour's distance, such as Weldaya University, will be critical in advancing students to fill in recovery documentation, emergency system design, and community interaction.

It is of paramount importance to assign appropriate resources, time, and manpower when preparing for any disaster. Proper mobilization documentation ensures that the resources are used economically and efficiently. Involving the public and educational establishments such as universities and technical schools in the sustainability and response plans can facilitate a better vision towards disaster management.

Finally, community involvement in mobilization training, which is often impaired due to slowness on the part of disaster management actors, cannot be overemphasized. Stakeholders, resources, and time can be efficiently pooled and shared within and outside regional borders in order to prepare the population for any disaster.

Acknowledgments

I want to start by thanking the World Monuments Fund for providing me with the training, the Head of Lalibela Church Administration for allowing me to work on this incredible site, the Lalibela town authorities and local community for their involvement in the process, and the faculty from Ritsumeikan University, ICCROM, and UNESCO for joining us. I would especially like to thank Rohit Jigyasu, Dowon Kim, Junko, Min Li, and the numerous lecturers who shared their time and expertise with us. I also want to express my gratitude to my other attendees, who enhanced the training's content.

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Note: This brief list of sources does not contain the interviews and discussions with conservation experts, priests, church leaders, municipal officials, and local residents.

2.5 Disaster risk management on Mont Saint-Michel, France

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1. Introduction

Mont Saint-Michel (Fig. 1 and Fig. 2) is an island made up of a village topped by an abbey church. It is located in a bay, in which the tidal range is one of the largest in the world. The abbey church has been inscribed as a historic monument since 1862. It is a place of pilgrimage very popular for Catholic people. UNESCO inscribes the overall site "Mont Saint-Michel and its bay" in the list of World Heritage Sites: first time in 1979 and a second time in 1998 as a component of the serial property "Paths of Compostela in France"[1]. The bay is also inscribed on the "site protection" list and as a "Natura 2000" site[2].
It is therefore a preserved natural and historic site, whose influence is worldwide and attendance is both tourist and spiritual. Mont Saint-Michel is known for culinary expertise (the famous biscuit factories) and textiles (the Saint-James clothing brand in particular). All this contributes to its economic influence[3]. The amount of visitors is approximately 3 million per year[4], which makes Mont Saint-Michel one of the most visited sites in France. There are 18 inhabitants in the village, especially religious fraternity members.

Fig. 1 General map of Mont Saint-Michel
Source: Centre des monuments nationaux

Fig. 2 Cross section North-South
Source: Centre des monuments nationaux

2. The Values and Attributes

The whole site (Mont Saint-Michel and its bay) contains multiple attributes containing specific values[5]. The abbey area is composed mainly of the abbey church, the cloister, and the building called "La Merveille". All of this creates a very specific skyline turning the architectural identity of the site into a brand. The economic activities on and around the Mont Saint-Michel are very important. Some visitors also come for the religious importance of the place. All the values embedded in the site can be listed as below in Tab. 1:

Tab. 1 Values and attributes

Values	Attributes where the value is embedded	What gives it this value
Historical	The church The abbey area The arts and collections of the abbey The shops and restaurants The other buildings listed as Historical Monuments	*From the first church in 11th century to the reconstruction of the spire in the 19th century, there are more than one thousand years of constructions on the rock*
Architectural	The church The abbey area The shops and restaurants The other buildings listed as Historical Monuments	*All the parts of the Abbey are testimonies of different eras in architecture : romanesque for the nave, gothic for the choir, neo-gothic for the spire etc. And the specific location makes the whole architectural configuration unique*
Artistic	The arts and collections of the abbey	*Old artworks and objects are displayed in the Abbey, especially in the nave : old Christ on the cross (15th c.), sculpture of the Virgin with child (13th c.), sculpture of Archangel Saint-Michael (15th c.)*
Spiritual / Religious	The church The abbey area The arts and collections of the abbey The other buildings listed as Historical Monuments	*A lot of Christian pilgrims come to Mont Saint-Michel. And some religious fraternities live there*
Social	The church The abbey area The shops and restaurants	*More than 40 employees work in the Abbey, and a lot of people work for the restaurants and shops*
Environmental	The bay and its protected species	*The bay is a site listed as Natura 2000 site because of its protected species of birds*
Archeological	The church The abbey area The other buildings listed as Historical Monuments	*The archeological surveys are very important to know more about the constructions, the life on site in History, etc.*
Symbolic	The church The abbey area The other buildings listed as Historical Monuments	*The skyline of the site is known all over the world, it is one of the most famous monuments of France*

Source: by the author

3. Risk Assessment

(i) Hazards:

The natural events to which Mont Saint-Michel is exposed are mainly related to its proximity to the sea. Storms are very frequent in the bay, and with increasing strength and frequency because of climate change. The last major storm occurred in November 2023, with winds recorded over 170 km/h. The fall of trees located on the northern slope of Mont Saint-Michel is a possible secondary hazard. Thunderstorms are also very frequent on the site, and since it is the highest point of the whole bay area, lightning often strikes the top of the bell tower (and the statue of the archangel) of the church. These storms and thunderstorms are usually accompanied by heavy rains. The winds that sweep across the bay and thus Mont Saint-Michel are also considered hazards, as they are heavily loaded with sand, making them highly abrasive to the ancient masonry. Seismic activity also has to be mentioned. However, earthquakes are not powerful in this region.

Mont Saint-Michel is also exposed to human-induced hazards: a fire could occur, caused by a fault or short circuit in the electrical installations. Arson and terrorism are almost impossible inside the abbey area, knowing that all visitors are screened before entering the site, but could be very easy in the village since there is no control over people there. Overtourism has to be considered a slow and progressive hazard, causing erosion with the steps on the pavement and the sweat on the stones.

(ii) Vulnerabilities:

There are multiple vulnerabilities. Physical ones like erosion, which weakens the buildings as well as the rocks they are built on. The location, topography and density of the site can make it difficult to access: very high tides that make the mount become an isolated island, the narrow pathways in the village, etc. Some are physical, attitudinal and economic vulnerabilities, like the lack of maintenance, the fact that electrical installation and equipment are located in the wooden structures of the buildings, and the need for resto-

ration work on stones or on concrete and metal beams. The fire-fighting installations could be insufficient in the event of a major fire, particularly in terms of water pressure and quantity, despite the pumps and reservoirs. Finally, there are organizational vulnerabilities: the number of trained and authorized people to activate the sprinkler systems is insufficient, and the protocol for activation is relatively complex.

4. Worst Case Scenario

As previously mentioned, some electrical devices are located in the attics, creating a risk of fire. We have envisioned a fire starting in the attic of the choir at noon on the day of a large pilgrimage mass, with over a thousand visitors in the church. The fire would then spread quickly to the bell tower because of strong wind, and the time it would take for the firefighters to access the fire would be too long to prevent a partial collapse of the upper parts of the abbey. In the long term, the tons of water spread to extinguish the fire would cause damage to the masonry. All the following studies will be based on this scenario.

5. Mitigation Measures

To mitigate the risk of fire, the main measures could be a combination of more maintenance and improvement of electrical networks, and improvement of the procedures regarding the fire-fighting devices. We chose to sort them into three categories: general measures (blue), common to the entire site; measures specific to the abbey (green), which is owned by the Centre des Monuments Nationaux; and measures specific to the village (pink), with its multiple owners and management by the mayor and police officers. For each measure, it is important to define the risk involved and the expected outcome, the attributes that will be protected, and the stakeholders involved, distinguishing those who will pay from those with decision-making power. Finally, the implementation duration, estimated cost, and priority level of each measure must be specified. All this information has been compiled in the table in Tab. 2.

6. First aid, Early Recovery, and Reconstruction Plan

On a site like Mont Saint-Michel, with difficult intervention conditions, many stakeholders, and often a lot of visitors, it is crucial that all responders are perfectly coordinated not only in preparation but also when a disaster occurs, and finally during the reconstruction phase. Based on the scenario described earlier, it is possible to develop an emergency response plan, initial repairs, and long-term reconstruction strategy:

Few hours after the disaster: a drone inspection has to be done everywhere inside the church to identify any risk of collapsing, any dangerous crack, and to localize safe spaces and routes to enter the church. The Chief Architect will have to draw every information on maps of the church. This step can take a few days.

Once the first damage assessment is done: all the monitoring devices will be installed to prevent any suspicious movement of the structure. This step has to be managed by qualified steeplejacks.

After the monitoring device is set up, and for 1 month, the Chief Architect and engineers will design all the stabilization measures like shoring and propping. Carpenters will build and install them. At the end of the stabilization process, it will be possible for specialists to enter the church and estimate the overall costs for restoration works. This information has to be communicated by the Chief Architect and the Centre des Monuments Nationaux representatives in order to ask the funding from the Ministry of Culture, private donations, etc. An approximate date for reopening will also be defined. Once the church is safe, qualified workers in association with the ERT (Emergency Response Team) can start cleaning, evacuating and sorting the fragments.

Next, the Chief Architect will design all the restoration works, in order to contract with companies. Restoration works have to be perfectly defined to avoid any further vulnerability. Other stakeholders have to be involved (firefighters, religious fraternities), especially for the definition of the improvement of fire-fighting devices. This step will take at least 2 months. Restoration works will last approximately 2 years.

Tab. 2 Mitigation measures

Mitigation measure	To what result ?	Attributes saved/ preserved	Stakeholders involved	Duration of the implementation	Approx. cost	Priority degree
Conduct more drills with all the stakeholders	Less difficulty for firefighters to intervene	Abbey Church Abbey area Arts and collection Shops/ Restaurants Other historical monuments	(D) Centre des monuments nationaux staff members (D) Public institution *Mont-Saint-Michel* (D) Firefighters (D) Major (D) Shops/restaurant owners (D) Fraternities	Every 6 months Long term	0 €	HIGH
More cleaning campaigns of the dust in the attics	Rapid spread of fire would be reduced	Abbey Church Abbey area Arts and collection Shops (abbey)	(D) (€) Centre des monuments nationaux	Every 6 months Long term	5 to 10 k€ per year	HIGH
More maintenance on the electric networks in the Abbey	Fire (electrical induced) would be reduced	Abbey Church Abbey area Arts and collection Shops (abbey)	(€) Centre des monuments nationaux	Every week Long term	5 to 10 k€ per year	HIGH
Change the procedure for the launching of the sprinklers' pumps	Less time for the sprinkler to spread water	Abbey Church Abbey area Arts and collection Shops (abbey)	(D) Centre des monuments nationaux (D) Firefighters	10 minutes (it is only a decision to take) Long term	0 €	HIGH
Avoid any electrical device in any wooden space =	Fire (electrical induced) in the attics would be eliminated	Abbey Church Abbey area Arts and collection Shops / Restaurants (abbey)	(D) (€) Centre des monuments nationaux	1 year	80 k€	VERY HIGH
Improve or change specific pumps for the highest sprinkler network for more pressure	More efficiency of the sprinkler device	Abbey Church Abbey area Arts and collection Shops (abbey)	(D) (€) Centre des monuments nationaux	6 months	< 50 k€	MODERATE
Study the feasibility of increasing the capacity of water, maybe with another cistern	Ensure a sufficient amount of water	Abbey Church Abbey area Arts and collection Shops and restaurants (abbey)	(D) (€) Centre des monuments nationaux (D) Municipality	1 year	80 k€ (works included)	MODERATE
Restore the bell tower's beam and floors	Risk of collapsing will be reduced	Abbey Church Abbey area Arts and collection Shops (abbey)	(D) (€) Centre des monuments nationaux (D) (€) Ministry of culture	3 years	10 M€	VERY HIGH
More maintenance on the electric networks in the village	Fire (electrical induced) would be reduced	Shops / Restaurants (village) Other historical monuments	(D) (€) Shops/restaurant owners (D) (€) Mayor (D) (€) Every other landlord	Every month Long term	< 2 k€ per year per building	HIGH
Train some employees and restaurant/shop owners in the village in the evacuation of people to be more efficient	Less difficulty for firefighters to intervene	Abbey Church Abbey area Arts and collection Shops / Restaurants (village) Other historical monuments	(D) Shops/Restaurant owners (D) Employees Firefighters Mayor	6 months	0 €	MODERATE

Source: by the author

7. Preparedness

The scenario imagined earlier, like all other potential disaster scenarios, requires to define some preparedness measures. The post-disaster reconstruction is also the time for preventing future disasters and improving processes both internally and between institutions. The preventive measures can be organiza-

tional, documentary, material, or operational, as follows:

- Define emergency procedures for any case of disaster, with the identification of one leader for each case and strategic positions for all the staff members in order to be efficient during evacuation.
- Define an emergency response team, composed of two project managers from Centre des Monuments Nationaux, the Chief Architect, some qualified companies for installing monitoring devices and stabilization structures, the research laboratory for historical monuments, and some objects and artworks specialists.
- Make a stockpiling onsite and offsite of tarpaulins, security gears, flashlights, water bottles, boxes, paper, and pencils fort the sorting of fragments, etc.
- Create documentation files in digital and paper versions with all the maps of the abbey and the village, all the technical maps like electric network, water pipes, etc., pictures and technical information of all the objects.
- Conduct drills with all the stakeholders every six months, and train as many people as possible in the use of fire extinguishers.

8. Conclusion

Mont Saint-Michel is a unique site, geographically and topographically specific, and its disaster risk management plan is, of course, very complex. In this article, the DRM plan has been developed around an electrical-induced fire scenario but will need to be expanded to address all the other risks to which the site is exposed. This plan will also need to adapt to climate change and the hazards that will arise as a result. It should be consulted, updated, discussed, and shared among all stakeholders, and it must take into account any changes to the site's configuration, various works, and so on. This is the key to preserve this significant world heritage site.

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2.6 Disaster Risk Management Plan for the Museum of Fine Arts Budapest

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1. Introduction

(1) The Museum of Fine Arts Budapest: heritage status, values and attributes

Fig. 1 Museum of Fine Arts, Budapest
Source: www.szepmuveszeti.hu

The Museum of Fine Arts, inaugurated in 1906, prides itself on one of the richest collections in Europe. The Museum and its affiliated institutions display the treasures of international and Hungarian art spanning from ancient times to the beginning of the 21st century, while its large-scale temporary exhibitions attract hundreds of thousands of visitors.

The Museum is situated on a World Heritage Site – meeting selection criteria ii. and iv. – comprising the Banks of the Danube, the Buda Castle Quarter and Andrássy Avenue. On the Ground Floor, the Museum has spacious halls with high ceilings that display great art historical and architectural styles. The most renowned part of the collection is the Old Master's Gallery which is situated on the First Floor of the building. While the Museum holds various values due to its role in society, it is the artistic value that particular artworks and collections represent this paper focuses on.

2. Inventory of Potential Hazards and Worst-case Scenario

(1) Inventory of hazards related to the Museum of Fine Arts Budapest

On the basis of the Sendai Framework's definition of disaster[1)], the National Disaster Risk Assessment Report (2023)[2)], the relevant maps[3)], as well as the hazard history of the Museum, we can highlight three major hazards that need constant monitoring, assessing and understanding:

Tab. 1 Inventory of hazards

	Small-scale	Large-scale	Frequent	Infrequent	Sudden	Slow-onset	Natural	Man-made
Cyber risk		×	×		×			×
Heavy rain	×		×		×	×	×	
Fire		×		×	×		×	×

Source: by the author

As for cyber security, the two core developments that currently increase the risks for museums and their collections are the increasing merger or intertwining between IT and OT (operational technology) and the wave of digitization that further exposed museums to potential cyber attacks.
Comparing the figures of the monthly precipitation in 2023 and the average values for 1991–2020[4)] we can conclude that in late spring and in the winter months the hazard of heavy rain must be constantly taken into account in the future.

(2) Worst-case scenario

In the Museum's Basement in one of the carpenter workshops an electric shortcut produces fire. The fire

burns the space in five minutes and spreads forward, towards the mechanical room that blows up. The explosion sets fire to the offices above on the Ground floor as well as the Romanesque Hall. The Museum's Romanesque Hall is let for filmmaking. As a decoration, flammable materials are brought into the building by the filmmakers and the fire expands to the Old Master's Gallery on the First Floor.
During the fire-fighting, there is severe water damage in the artworks. Due to the panic and uncontrolled situation, the opportunity is given for theft. The incident begins on 20 August at 4 pm and it lasts for 3 hours. There are plenty of visitors in the building, as the entrance is free due to the National Holiday.
Taking into consideration the existing and unavoidable vulnerabilities of the institution (e.g. the high number of visitors, the numerous offices, and the electric devices in the mechanical room), the fire hazard can result in the loss of lives, loss or damage of movable cultural heritage, structural damage of the building, endangerment of the legal and financial integrity of the museum and last but not least loss of trust of the public, the lenders, the insurers and all stakeholders.

Action No 1: Creation of a hazard map. Based on the inventory of potential hazards the museum shall create its own general and event-specific hazard-map, containing hazard-exposure and vulnerability information for all five floors of the Museum split into various exhibition halls.

3. Mitigation and Emergency Preparedness[5)]

(1) Legislative background

The legal background needs to be fully explored since we have to ensure the compliance of the Museum's DRM plan with the existing safety-enhancing provisions of international law as well as national sectoral laws and regulations. The International Federation of Red Cross and Red Crescent Societies' (IFRC) disaster law database[6)] is an excellent example of a legal database that contains DRM indicators beyond the actual wording of the legal regulations.

Action No 2: Setting up a Key Legal Repository including the international and national legal framework as well as soft law.

(2) Stakeholders

In order to clearly determine the place the museum occupies within, the governance framework and the map of the museum's potential allies in the field of the fight risk management shall be outlined. The below figure shows how the Museum fits within the wider context of stakeholders that act in a mutually supportive and complementary way.

Action No 3: Setting up or reinforcing an emergency network.

(3) Local and national disaster risk management plans

The Museum will need to adopt and implement a local risk reduction strategy with targets, indicators and timeframes aiming at preventing the creation of risk, the reduction of existing risk and the strengthening of economic, social and environmental resilience. Naturally, the Museum's local plan shall be coherent with the National Disaster Risk Assessment.

Action No 4: Creation of a local DRM plan

The last Report on Hungary's National Disaster Risk Assessment (2023) identified twelve areas of risk and five societal values. However, the report makes no mention of culture among the societal values to be protected, neither does the 30 risk scenarios that are based on them.

Action No 5: National Directorate General for Disaster Management completes its risk assessment report by adding ‚Culture' among the societal values that are to be protected.

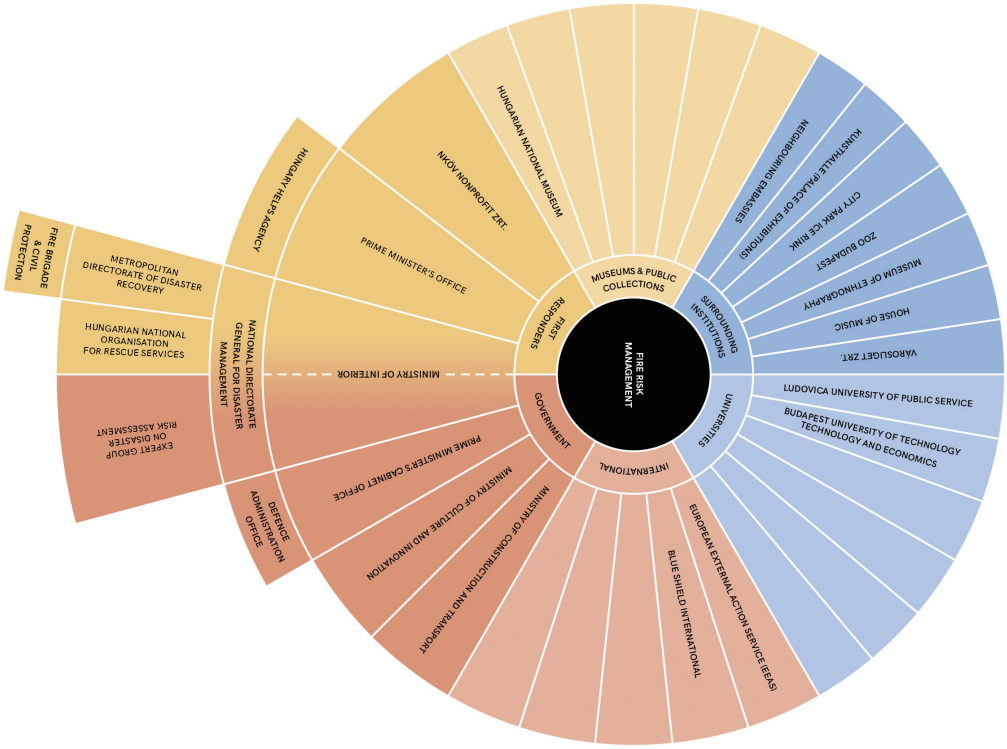

Fig. 2 Stakeholders in the field of fire risk management
Source: by the author

(4) Technical equipment for fire

The Museum has a complex fire detection and fire alarm system in place containing about 700 optical light beams. This is complemented by a large number of manually operated call points, linear smoke detectors and a large number of heat cables. The five-story Museum has three pressurized stairwells, incorporating a stairwell pressurization system ensuring that fire evacuation routes are free of smoke and heat. The museum has both dry chemical powder and carbon dioxide extinguishing systems.

Action No 6: An overall revision needs to be done for existing fire alarm and fire extinguishing systems in coherence with the fire hazard map and the evacuation plan.

(5) Training

The appropriate training of the personnel is all the more important, as the probability of a fire is much higher in the office areas where the ceilings are low and there is a lot of flammable material around with potential sources of an electrical fire. The visitors who know the building less are considered to be more vulnerable than the staff, however, visitors normally circulate in parts of the building where the fire risk is lower. Priority shall always be given to extinguishing the fire at an early stage. If one or two members of staff on each floor of the museum were appointed and appropriately trained to make the right decisions and reduce or eliminate risk, there would be a much better chance to keep the situation under control in the case of an actual fire.

Action No 7: Appoint and train volunteer fire managers on every floor of the building.

(6) Evacuation

Setting up an Emergency Response Team with various Heads of Department contributing different knowl-

edge and skills is necessary for the General Director's informed decision-making. This emergency response team would consist of the persons holding the following positions: General Director/Deputy Director, Head of Security (head of evacuation until the arrival of the fire brigade), Head of Secretariat, Head of Legal, Head of Maintenance (assist with the evacuation of visitors and staff), Head of Art handler team (occasionally) (assist with the evacuation of the artwork), Head of IT (occasionally).
After evacuating the staff and visitors the evacuation of the artworks can take place. Giving an opportunity on a regular basis to the local fire brigade to develop knowledge and experience through trainings in the Museum is paramount.

Action No 8: An Evacuation Plan for the artworks shall be elaborated including:
- A short (top 10) and a long (by collection departments) list of artworks with technical specificities (e.g. location and security hanging system) and how to share this information with the fire brigade.
- In-house (far from the evacuation route) and outdoor shelters (National Museum Conservation and Storage Centre).
- Technical necessities: bubble wrap and extra trucks.
- Responsibilities to handle art: in-house art-handling team, with the involvement of the security department (appointed group ensures that no looting occurs) and the maintenance department.
- Designation of a primary emergency exit through which the works are evacuated.

(7) Recovery

After the emergency, one of the main objectives is to maintain the financial integrity of the museum and ensure the continuity of services. Therefore, integrating disaster risk management into business models and practices is paramount. The below charts represent the immediate, short-term and long-term actions of the museum in the recovery phase.

4. Conclusion

This paper demonstrated the points of intervention to improve the current risk management strategies of the Museum before, during and after the hazards. In addition to this, the Museum, once championing the development, strengthening and implementation of relevant and coherent policies, plans, practices and mechanisms in the field of disaster risk management, will also contribute to highlight the role that cultural heritage plays in a safer and more sustainable future.

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Tab. 2 Recovery

FIRST AID	TASK LEAD	SHORT TERM (1 week - 2 years)	TASK LEAD	LONG TERM (2-8 years)	TASK LEAD
PREPARE A TEAM Supplies Assessment Documentation Salvage Packing/Transportation Communications	*Emergency Response Team*	**EXPERTISE** Determining which in-house department is involved in recovery and what third party experts need to be involved.	*Emergency Response Team*	×	×
DAMAGE ASSESSMENT Building and objects: evaluate everything, from most damaged pieces to minor damages. Type of damage and extent of damage is documented in a form.	*Engineer in Chief* *Head of concerned Collection Dept.* *&* *Head of Restoration*	**BUILDING** • Situation analysis • Evaluate conservation and architectural needs • Design • Building repairs/ construction begins	*Engineer in Chief*	**BUILDING** Restoring the building by eliminating the identified vulnerabilities. e.g: relocation of mechanical room, relocation of water pipes	*Engineer in Chief** *General Director*
RISK ASSESSMENT Identify immediate risks to collections and building. Relocate rescue staff and artworks in the safe part of the building.	*Engineer in Chief* *&* *Head of Restoration*	**ARTWORKS** Priority of restoration is established. • Stabilisation in-situ • Restoration at the National Museum Restoration and Storage Centre + Follow the location and object information: Install QR codes on frame **COST ANALYSIS, FUNDS** • Government ++++ • World Bank ++ • Fundraising/donations + • UNESCO Heritage Emergency Funds +	*Head of Restoration*	**ARTWORKS** Revise the collections and implement active collection management. Consider deaccessioning. Re-think permanent exhibitions. **APPLY FOR EXTERNAL FINANCIAL RESOURCES**	*Deputy Director** *Heads of collections*
DEBRIS CLEARANCE	*Head of Maintenance* *&* *conservators, curators*	×	×	×	×
COMMUNICATION Immediate crisis communication with: • Staff, media • Ministry of Culture	*General director with Chief of Press*	**COMMUNICATION** Regular newsletters to staff	*Head of Secretariat*	×	×
×	×	**FINANCIAL AND LEGAL STABILISATION** • Loss of income from entrance fees • Costs of repair • Staff and utility operators have to paid • Review ongoing contracts with shop, restaurant, utility operators, lenders and borrowers	*Finance Director** *Head of Legal Dept.*	**PUT NEW BUSINESS PLAN INTO PLACE** New sources of income are needed. • Conclude new agreements, revise ongoing ones • Recover outstanding invoices	*General Director** *Deputy Director* *Finance Director* *Head of Legal*
×	×	**STAFF** • On-site: Employees and volunteers whose physical presence is needed • HO: weekly reports	*Deputy Director** *Head of Human Resources*	• Rationalise human resources • New institutional organisation is established	*Deputy Director** *Finance Director* *Head of Secretariat*
×	×	**MUSEUM ACTIVITIES** ~~Acquisition~~ Research +++ Exhibitions + • Granting access to own highlights of the Buda Castle • Lending out +++ → source of income → objects are in a safe place		Additional, income-generating activities are to be considered: • Restoration for third-parties as a profit-making activity • Deaccessioning (?)	

Source: by the author

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2.7 Disaster Risk Management for complex World Heritage sites – The case of Rjukan-Notodden Industrial Heritage

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1. Introduction

(1) The Site

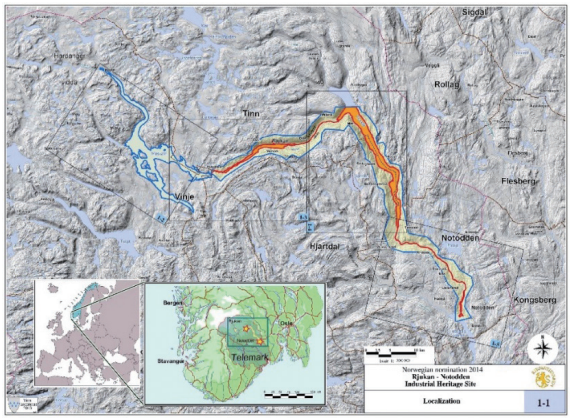

Fig. 1 Map of the inscribed World Heritage property of Rjukan-Notodden Industrial Heritage site.
Source: Nomination file, Ministry of Climate and Environment and Telemark County Council, 2014

Rjukan-Notodden Industrial Heritage represents a valuable chapter in global industrial history. The site was inscribed on UNESCO's World Heritage List in 2015 under criteria II and IV as an extraordinary testimony to Norway's industrial development in the early 20th century and its significance for humanity.

With its dramatic landscape and abundant waterfalls, Telemark was uniquely suited for hydroelectric power and energy-intensive industry. The production of artificial fertilizer using nitrogen from the air revolutionized agriculture and marked a shift from coal to hydroelectric power, driving the second industrial revolution in Northern Europe.

(2) The four components

Hydropower is the foundation of the Rjukan-Notodden Industrial Heritage, showcased by a landscape of mountains, waterfalls, and valleys that support hydropower plants, transmission lines, tunnels, factories, and towns. Lake Mosvatn's regulation, via the Møsvass Dam, ensured water flow but heavily impacted the Møstrønd community, altering the landscape and daily life.

Fig. 2 The four components of Rjukan-Notodden Industrial Heritage Site. Top left: Vemork Hydropower station. Top right: Hydro Industrial Park Notodden. Bottom left: Company Town Rjukan. All three photos: Per Berntsen. Bottom right: Railway ferry Storegut with locomotive. Photo: NIA

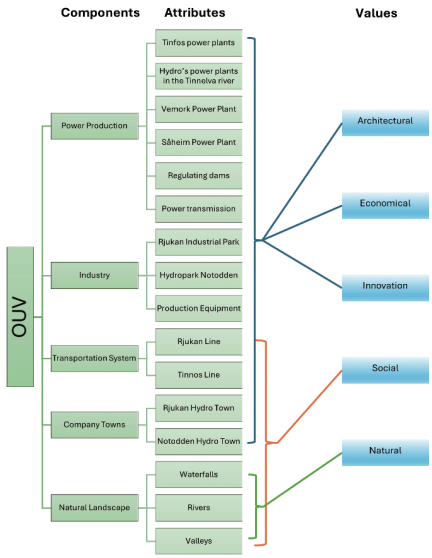

Fig. 3 Diagram showing the relations between values and attributes of the site. (2024)
Source: by the author

The industrial parks feature rich architecture blending Functionalism with Art Nouveau, Neo-Baroque, and Neoclassicism. Its monumental forms balance industrial function with rare aesthetic care.

An innovative transport system—Rjukan Railway, Tinnos Railway, and railway ferries—efficiently connected the industrial areas, setting a standard for electrified railways in Europe.

The company towns in Rjukan and Notodden exemplify early sustainable societal development with worker housing, schools, and welfare facilities, reflecting the principles of the emerging welfare state.

In total more than 600 buildings and industrial structures, two railways, two railway ferries and 16 pieces of rolling stock make this site an outstanding example of a new global industry in the early 20th century.

2. Risk Analysis

(1) The environmental context

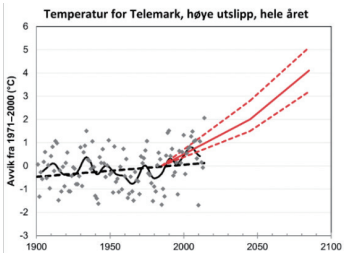

Fig. 4 Temperature trends for the period 1900-2100.
Source: Norwegian Climate Service Center, 2023.

By mid-century, Telemark's average annual temperature is projected to rise by 2°C under high emissions scenarios, with the greatest increases in autumn and winter, and fewer extremely cold winter days. Annual precipitation is expected to increase by 5%, with seasonal increases of 15% in spring, 10% in winter, 5% in autumn, and little change in summer.

Vestfjorddalen, one of Norway's steepest inhabited valleys, is highly prone to rock and landslides. In Rjukan, many century-old buildings lie within avalanche risk zones and do not meet modern safety standards. Landslides pose the greatest danger. The avalanche risk is limited to the southern side of the valley. The rockfall risk extends in some places far enough to impact constructed areas.

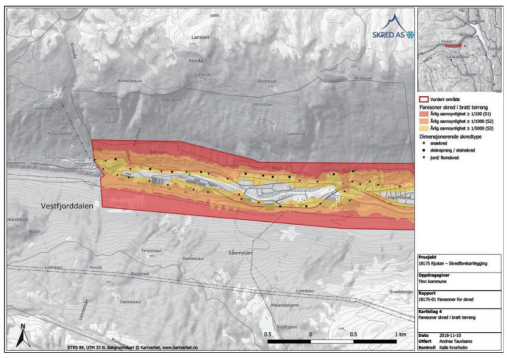

Fig. 5 Hazard zones for landslides in the western subarea of Rjukan, with symbols for the defining landslide type.
Source: Report by Skred AS to Tinn municipality, 2018.

Hydropower regulation has reduced flood magnitudes in the Måna River at Rjukan by diverting water through reservoirs and power plants into Lake Tinn. However, dam failure or power plant stoppages during extreme rainfall could trigger rare, catastrophic 500- or 1000-year floods.

Urban fires have long been a concern in Norway due to the flammability of wood, leading to entire cities disappearing. Since the 2015 World Heritage inscription, 12 fires have occurred in the core zone, with 42% causing total or significant loss of attributes.

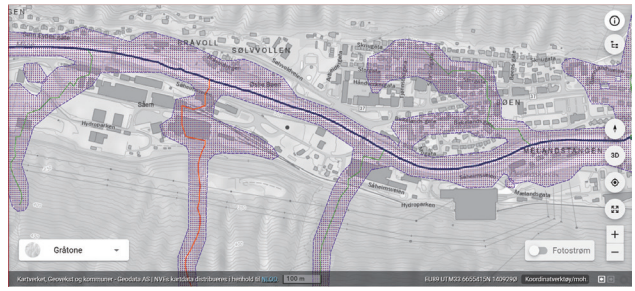

Fig. 6 Detail of NVE's flood hazard map showcasing Rjukan area.
Source: Norwegian Water Resources and Energy Directorate.

(2) Vulnerabilities, hazards and their possible impacts

Rjukan's steep terrain makes it highly prone to landslides, avalanches, and rockslides, endangering attributes like Fjellveien, Krosso, and the industrial park. Flood risks are also significant, particularly in areas near water such as Flekkebyen and Nybyen, with increased snowmelt and precipitation amplifying hazards. Flooding and landslides can cause destruction or damage to attributes, threatening the Outstanding Universal Value (OUV) and World Heritage status of the site.

Workers' houses are particularly vulnerable to fire due to minimal protection, risking the social and historical values of the Norsk Hydro system. Additionally, while war-related threats are unlikely, damage to the Møsvatn dam could trigger catastrophic flooding, compromising heritage attributes like Vemork Power Station and disrupting Norway's power production and economy.

3. Mitigation and Preparedness

(1) A disaster scenario for Rjukan-Notodden Industrial Heritage Site

On August 27th, following an unusually hot summer, relentless rainfall begins in Rjukan, persisting for four days and combining with snowmelt to overwhelm the Måna River. By early August 28th, the dam releases excessive water to mitigate risk, breaching the historic Vemork intake system and flooding the town, including key elements of the company town along the riverbanks. Delayed communication hampers evacuation and emergency responses, but efforts eventually shift to health, infrastructure, and relocating residents.

Simultaneously, soil saturation triggers a rockslide at Rjukan Railway Station, damaging the building and burying parts of the railway line. Sensitive objects from the railway exhibition, including mannequins, tickets, and artifacts, are submerged and not recovered until two days later due to delayed structural assessments. The combined impacts cause severe damage to Rjukan's cultural heritage and infrastructure.

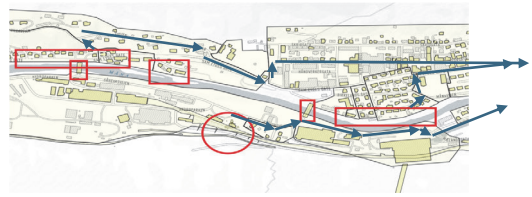

Fig. 7 Affected areas (red) in the flood and landslide scenario and evacuation routes (blue). Basemap by Tinn municipality, overdrawing by the author.

(2) The principles of Disaster Risk Management in Norway

Norway's Disaster Risk Management is guided by four principles: responsibility, ensuring daily managers also handle crises; proximity, addressing crises at the lowest possible level; equality, maintaining consistency in operations and crisis management; and cooperation, fostering collaboration among stakeholders. However, cultural heritage management remains a weak point, as municipalities often fail to practice first-line response effectively, leading to delayed damage reports and increased risk of irreversible heritage loss.

Fig. 8 The Norwegian Directorate for Civil Protection (DSB) overview highlights the inclusion of cultural values in municipalities' Comprehensive Risk and Vulnerability Analysis (ROS). Illustration: Guide to Comprehensive Risk and Vulnerability Analysis in Municipalities, DSB 2022, p. 9. Highlighting by the author.

(3) Mitigation measures

Mitigation measures, both structural and non-structural, aim to reduce or eliminate long-term risks and impacts by minimizing potential damage and enhancing resilience before a disaster. These actions, when integrated into comprehensive risk management plans, reduce vulnerabilities and promote safer, more resilient communities. For the scenario above, potential structural mitigation measures for identified vulnerabilities are listed:

Mitigation measure	Scale of intervention	Which risk or vulnerability will be mitigated?	Who is involved?	Duration of implementation	Estimated cost
Ensure fiscalization at water concession levels	Site level (but from national)	The overfyll of the water levels at the dam	KLD to point, NVE to implemet	Continuous	low
Evacuation plan for the historical objects exhibited at the station (done in collaboration with the fire department and with definition of the safe storage location)	Museum level	The risk os damage or loss of the railway collection	Owner (museum) for initiative, Municipality, with its civil protection services, for anchoring and coordination	Periodic, following each exhibition change	Low
DRM plan -stakeholder mapping -funding structure -coordination structure -priorities of intervention and evacuation routes -awarness and education plan	Site level	It would stablish coordination structure as well as priorities of intervention. It would also improve knowledge on the values and attributes, the anchoring of the OUV and ownership feelings.	Site management, Municipalities,Companies, museum, RA, UNESCO/ICOMOS	Periodic, 4 years following the political calendar	Medium/Low

Fig. 9 potential structural mitigation measures for identified vulnerabilities
Source: by the author

And at the non-structural, governance level:

Mitigation measure	Scale of intervention	Which risk or vulnerability will be mitigated?	Who is involved?	Duration of implementation	Estimated cost
Resistance tests at the Vemork inntake	Company	The breakage of the intake pipes in case of abnormal amouts of water	DSB to request, Hydro Energi AS to implement	Periodic (periodicity defined by the expert authority DSB)	Medium
Reinforcement of the pilars of the bridges (class I)	Municipal	The structural damage by water impact would be reduced	Municipality by its technical dep, CH auth. for authorizations and RA for funding	Punctual	Medium/High
Avalanche and rockslide barriers at the mountain walls above the station	Localized/ Municipal	The exposure of the station buildings and the railway line would be reduced	Municipality for implementation, owner for coordination at the bottom level, RA for funding	Punctual	High

Fig. 10 potential non-structural mitigation measures for identified vulnerabilities
Source: by the author

(4) Immediate response and early recovery

Cultural heritage first aid involves immediate actions to stabilize endangered heritage during or after emergencies, including damage assessments and stabilization measures. In flooding and landslide scenarios, accessing affected areas and assessing damage are key steps for stabilizing structures and evacuating movable objects.

Response phase	Early response	Access clearance	On-site damage and risk assessment	Security and stabilization	Evacuation from the Station
Analysis of the emergency situation, on-site damage and risk assessment, and security and stabilization. Documentation, risk management, and communication and coordination with other first-responders are continuous processes throughout all the phases.	Situation analysis - understanding of the wider context of the emergency. Development of a context-specific plan for on-site actions.	Get authorization to go to the site with the assessment teams.	Identification and recording of damage caused and risks posed to the affected buildings and collection objects. Collect knowledge to determine priorities for on-site actions. Estimate the cost.	Contain damage and reduce risks. Building and structures stabilization (secure Vemork pipeline with braces and scafolding support to the station building). In almost overlapping actions the stabilization of the railway collection at the station building is done. Monitoring of the structures is decided.	RVR has in their CH rescue van the equipment to stabilize and evacuate the collection objects to the designated room at the school.
Site management,CH authorities, museum (staff with Restverdiredning (service provider), supported by fire protection.	Site management coordinates; Unformal interdisciplinary team composed of: CH regional authority, civil protection, local fire dep., CH municipality,USN, WH site management	Site management with municipality, expert is civil protection and fire dep.	Site management coordinate; Interdisciplinary team executes.	Hydro (owner) provides contacts to the engineer company best know with the pipeline. Civil protection support.	Museum staff supported by RVR responders.

Fig. 11 possible steps of immediate response for the presented scenario
Source: by the author

Cultural heritage first aid is followed by conservation efforts to restore function and access. The early recovery phase involves creating an action plan for restoration, including condition assessments, conservation treatments, risk mitigation, and sustainable reuse to repair damage and ensure future sustainability. The early recovery phase also involves gathering resources from governments, grant organizations, and cultural institutions. Post-first-aid condition assessments define recovery needs, and engaging stakeholders ensures measures align with local requirements. This phase concludes with the final design of the long-term recovery plan.

Last phase of Response	Early Recovery	Preparation	Action plan with participation	Damage assessment forms	Access clearance	Documentation and budget calculation
Post-event evacuation of the railway station (documentation, packing and transportation)	1-Creation of the formal interdisciplinary assessment team 2-review and update the situation analysis 3-Action plan for restoration, recovery and rehabilitation 4-Budget	1-Basic training and brief 2-post-first-aid condition analysis and risk assessment 3-Gathering all the available information about the impacted area (maps, inventories, history of similar disasters, stakeholders including funding actors, etc..)	Jointly create the Plan for full recovery and rehabilitation and gantt chart (timeline) with the actions, check point meetings, milestones, funding and participation. In the first meeting focusing on the early recovery phase (to get operations going) and gradually, in the next meetings, detailing and adjusting the next phases of recovery.	Adapt the damage assessment forms to the specific situation. One form for damage assessment of buildings and industrial infrastructures; one form (Primus form) for damage assessment of movable heritage	Get authorization again, if needed) to go to the pipeline and to the station building with the assessment teams. (the	Execution of detailed condition assessment for recovery and rehabilitation: -damage caused and income losses -identified deterioration processes -security and stabilization actions -vulnerabilities and risks Budget calculation and ecure funding.
Museum (staff with Restverdiredning (service provider), supported by fire protection.	Site management takes the initiative; Interdisciplinary team composed of: CH regional authority, civil protection, local fire dep., CH municipality,USN, WH site management	Site management coordinates; Interdisciplinary team executes	Site management coordinates; Interdisciplinary team executes	Interdisciplinary team	Site management with municipality	Interdisciplinary team; Site management for funding coordination. RA, County.

Fig. 12 possible steps of early recovery for the presented scenario
Source: by the author

4. Conclusion

The complexity of the 93km, transmunicipal World Heritage site is reflected in its disaster risk management structure. While national policy recognizes cultural values as integral to local preparedness and risk management, routines need strengthening and coordination among first responders improved. Effective communication between owners, users, responders, and experts is critical. In 2025, Rjukan-Notodden Industrial Heritage will develop its first Disaster Risk Management Plan, addressing the need for safeguarding its Outstanding Universal Value amidst climate change and geopolitical uncertainty.

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2.8 Disaster risk management initiative for Sucidava Fortress A new approach for the Frontiers of the Roman Empire – Dacia

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1. Introduction

Sucidava is the most significant Late Roman fortress from the Lower Danube's northern *ripa* - river frontier. Its history illustrates the stages of fortification of the Danubian line by the Romans. The 3rd-6th century CE fort was built in the south-eastern corner of the previous civil settlement, on a plateau with excellent visibility to the Danube River and meadow, and surrounded from East, North and West by a deep natural ditch (Fig. 1). It is situated on the northern bank of the Danube, linking during the Constantinian dynasty the legionary fortress from *Oescus* (present Bulgaria) through a bridge to the city of *Romula* and then to the northern part of the former Dacia province (Fig. 2). The fort is found in a unique natural context, the areas from its immediate vicinity from the Danube River being protected, two as 'Natura 2000' sites and one national natural area.

Sucidava Fortress is part both of the Frontiers of the Roman Empire – Dacia[1)] and the Danube Limes Eastern Sector[2)]. The Frontier of the Roman Empire – Dacia [*FRE Dacia*] was inscribed on the World Heritage List in 2024 and represents a national serial nomination that focuses on the only Roman former province whose territory was integrally north of the Danube River. At the same time, the Danube Limes Eastern Sector [*DLES*] is included on the UNESCO Tentative List as a transnational serial property of four countries (Croatia, Serbia, Bulgaria and Romania). Being part of the two UNESCO *dossier* certifies the important role of Sucidava for the period of maximum expansion of the Roman Empire (nearly 170 years, from the 2nd to 4th century CE) established under the Emperor Trajan and for the period of the Roman crisis and withdrawal of troops, started under Emperor Aurelian (beginning with the middle of the 3rd century CE).

Nowadays, Sucidava Fortress is situated in the Celei neighbourhood of the Corabia town, an area with rural fabric and agricultural terrains, built over the former civil settlement. The picturesque archaeologic site and the view to the natural areas of the Danube River are the only tourist attractions from this neighbourhood, complementary to the historic centre, the quay and the former industrial port of Corabia.

The archaeologic site has witnessed numerous disasters in the past and in the present is exposed to different natural phenomena generated by the effects of climate changes, being essential to take action in preserving the Sucidava cultural legacy for future generations.

Fig. 1 Sucidava Fortress, oblique drone photograph, north-west view
Source: Dan Costea ©MNIR, 2017

Fig. 2 Relation between Sucidava and other two Roman fortified settlements: Oescus (Buglaria) and Romula (Romania)
Source: by the author

2. Site Analysis: Values and Attributes

Sucidava embeds through its attributes multiple and diverse values, in line with the Outstanding Universal Value of the *FRE Dacia*. The aim of the Roman frontier was to protect Dacia from 'barbarian' populations, to ensure the supervision and control of movements, and to secure two of the Roman Empire's most important resources, gold and salt. The constant pressure on the border is well-reflected at Sucidava by its dynamic evolution.

The UNESCO nominated attributes from Sucidava are the Roman road, the visible bridge pillar (the pile of the northern portal) and the fortress, while the civil settlement, its defending perimeter system and the present underwater and underground bridge pillars were included in the buffer zone. The ancient road was part of the Roman infrastructure, linking the former city of *Romula* with *Sucidava* – on the Olt river valley (Romania) and *Sucidava* with *Oescus* – on the Isker river valley (Bulgaria). The bridge over the Danube River connected two of the most important Roman roads, was built during the 4th century CE and was inspired by the Trajan's bridge between Drobeta and Transdrobeta (*Pontes*) from the early 2nd century CE. It was one of the longest in ancient times (2437 m) documented so far (27 pillars in the riverbed, 7 pillars in the north bank wetland and the northern portal).

Sucidava Fortress represents an ensemble of archaeologic remains, being composed of Roman elements – the hypocaust, the fountain and the complex perimeter defending system (with towers, walls and the western gate) –, earlier dated elements – the Eneolithic dwelling and the Neolithic household centre – and later dated element – the Paleo Byzantine basilica. A site museum was recently built, which host the small permanent exhibition, the artefacts storage and the rooms for the archaeologic research. The analysis of Sucidava focuses on all the nominated attributes and the ones included in the buffer zone. Specific for the fortress attribute, it was detailed both as an ensemble (as a whole) and all its individual archaeological components. The diverse and multiple embedded values were identified as follows: strategic (military and economic site in order to pass the Danube river), cultural (longevity of the fort and of the Roman habitation), historic (*praefectura* of the Legion Macedonica the 5th), landscape (the adaptation to topography), architectural (internal organisation of functions and unique buildings – the Neolithic household centre and the Roman fountain), archaeologic (6 living phases: Eneolithic and Neolithic period and 4 Roman phases, with associated artefacts), spiritual (necropolis of the Gets and Romans), natural (Natura 2000 sites), social (a gathering point for the community, a reason for community's customs and subject/place for organized educational and recreational activities), economic (guided tours and events) and educational (workshops for children, research rooms for students and archaeology campaigns).

In line with the training methodology, the attributes/components were listed by the importance of values in order to obtain a list of priorities for interventions from conservation, restoration and protection point of view. The focus will be on the components situated close to the corniche hill and in the river bed – the fountain, the perimeter defending system, the dwelling, the household centre and the bridge pillars.

3. Risk Analysis

The preliminary analysis of the sources of risk or potential threats took into consideration natural phenomena and anthropic factors.

The first identified source of risk refers to the location of the site, close to the Danube riverbed, and historic floods leading to the loss of ancient building parts. The hydrologic context[3)] is characterised by a shrinking segment of the meadow (from 9 km at Potelu to 1 km at Corabia), with five major hydrographic basins and three islands – *Ostrov* (Fig. 3). The geographic terrace from Celei/Corabia area is the lowest and widest from the left side of Danube, while the systematization solution to high water debit generated in the front of the Celei built area a buffer zone for flooding. Previous river floods directly affect the bridge pillars and, in combination with other factors, could lead to the landslide of the hill slope, archaeologic remains being found on its corniche. However, because of the recent embankment and drainage works, the phenomenon of flood is less severe.

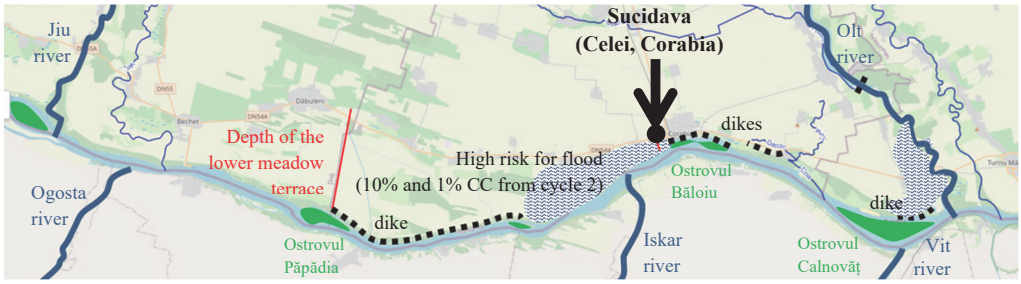

Fig. 3 Hydrologic map of the Danube river, the segment between Jiu and Olt rivers
Source: https://inundatii.ro/portal-harti/ with the author's notes

The drought represents a risk resulted from a combination of factors. Windblown and rain spits are hazards with increased recurrence in the last ten years. The archaeologic components are also affected by slow hazards, such as uncontrolled growth of vegetation, dismantling parts of walls due to differential settlement of the terrain and improper past interventions and exposure to environmental factors (un/frozen effect, sensitivity of stones).

In order to carry out a risk analysis for the site, it is necessary to take into account, besides the plausible hazards, the vulnerabilities of the ruins, being identified the potential negative impact of the hazard on each archaeologic component and the potential loss of values. As a final point, given the specific risks, it is possible to anticipate the impacts of probable disasters that can affect each component, the archaeologic site and its surroundings.

4. Risk Scenario

The identified risks with high potential were storm and fire, while the ones with high probability were storm and flood. A worst case scenario was designed, the primary hazard being flood and the follow-up subsequent secondary hazard, storm. The unfolded events over time are the landslides, due to flood and lack of measures for the stability of the slope hill, and fire, due to inappropriate electrical installation. The potential impact reflects on the visitor's life and artefacts from the museum (fire), the attributes on the corniche hill (landslides) and the remains of the tower of the perimeter defending system (falling trees).

5. Intervention Strategies / Measures

The disaster risks management plan [*DRM Plan*] states in depth understanding of local phenomena that can generate possible disasters because of multi-hazards occurrence. The main objectives are to lower disaster impacts to cultural heritage, enhance disaster mitigation capabilities and build resilience. This document will be updated with new measures replacing the implemented ones, in order to have a proper civil and heritage protection at Sucidava fortress.

5.1 Preparedness – Worst Case Scenario and Improvement of the Evacuation Plan

After the risks assessment on the components of Sucidava fortress and the ones from the immediate vicinity, a worst case scenario was created to illustrate a situation that may occur and the needed measures to be taken in order to improve the current state of infrastructure. Two evacuation routes were designed, one for civilians from the entire site and one for the artefacts from the site museum. By evaluating the existing situation in terms of equipment, signage and free routes for evacuation, a series of measures were proposed for a better preparedness – an efficient and timely emergency response – in case of multiple hazards.

5.2 First Aid for Cultural Heritage

First aid to cultural heritage encompasses the immediate and interdependent actions to be taken after (or simultaneously, by case) the response for civil protection, in order to stabilise and reduce risks to endan-

gered heritage. The first aid actions also aim to make the first steps to early recovery. For this reason, through the *DRM Plan* a response unit is designed, involving the relevant stakeholders. This unit should act in both situations for the first aid for the archaeologic components and for the artefacts hosted by the site museum. Also, in line with the site conditions and national legal framework, the response unit should be designed during the pre-disaster phase with procedures to follow and to develop training/drills.

5.3 Early Recovery

In order to ensure a timely and coordinated response in terms of DRM, it is crucial to plan interventions, especially the first ones, taking into account the general context and the resources and means available in the affected area. The order and the priorities to evacuate or protect *in situ* the existing artefacts and archaeologic components should be established at the latest during the assessment of the post-disaster situation. In this regard, it is preferable to have planned the actions to be taken by relevant actors for the early recovery after the worst-case scenario, focusing on different time frames for immovable and movable heritage and also at the general level and just to adapt them in line with the factors, partially objective, partially dictated by the contingent emergency[4)].

5.4 Mitigation and Contingency Plan

Mitigation methods for flood, storms and secondary hazards were identified for five categories: technical, monitoring, awareness, policies and regulations.

The proposed technical measures are in line with the general ones proposed in the Management plan for all the sites part of the FRE Dacia, but focus on conservation, enhancement and heritage impact assessment. For Sucidava, structural and non-structural measures were addressed to different archaeologic components and to a group of components that need the same approach, as mentioned in Tab. 1 as below:

Tab. 1 Post-recovery and mitigation measures

Mitigation and Preparedness Measure (S – structural, NS – non-structural)	**Scale of Intervention**	**Hazard to eliminate (E) Risk to reduce (R)**
NS_ Remove the concrete slabs & include the pillar into an **natural embankment**	Attribute level _ bridge pillar	R_ Degradation due to high level of the phreatic water layer and possible flood
S_ Ensuring a protection structure for the **pillars in the Danube river**	Attribute level _ bridge pillar Buffer zone / neighborhood National level	R_ Dismantle of the underwater pillars due to water speed
S_ Ensuring a protection structure for the **pillars from the meadow**. The intervention will take in consideration both heritage and natural values (with minimum alteration of the context in which the monument is found)	Attribute level _ bridge pillar Buffer zone / neighborhood	R_ Degradation of the underground pillars due to water fluctuation
NS_ New electrical installation & fire protection measures	Attribute level _ fountain	E_ Fire
S_ Consolidation and restoration project for the **overflow canal** and access corridor	Attribute level _ fountain Buffer zone	R_ Water infiltration. Possible dismantles of walls.
S_ Restauration and conservation of the **archaeologic components**	Attribute level _ fountain + Eneolithic dwelling + household + western gate & eastern tower	E_ Landslide
S_ Replace the temporary protection **structure** with a **low-loadings** one	Attribute level _ fountain + Eneolithic dwelling + household + western gate & eastern tower	R_ Landslide
S_ Conservation of emplectons and restoration of the **evacuation routes from the former towers**	Attribute level _ walls of the defending perimeter system	E_ Dismantle parts of walls
NS_ Hydro-insulation of the foundation and floor slab	Attribute level _ site museum	E_ Improper microclimate
NS_ Replace the artifacts display	Attribute level _ site museum	E_ Risk of falling

Source: by the author

The measures proposed for monitoring address to the Roman fountain and to the components from its vicinity. Sensors for monitoring the humidity and temperature are needed to eliminate improper microclimate present for the ruins founded at the hill's corniche. A water level measurement system is proposed for the fountain, the bridge pillars and bogs from the meadow (at the base of the hill).
All the components of the site are the subject of raising awareness regarding the risk of fire, even if it starts spontaneously because of dried grass or human vandalism for archaeologic ruins or because of electrical issues at the site museum. To reduce this type of risk drills will be practiced.
In terms of regulations, as mentioned also in the management plan for *FRE Dacia*, it is highly important to update the General Urban Plan of Corabia with dedicated provisions for the Celei neighbourhood and specific regulations regarding the protection of the fortress, in connection with the regulation for natural protected areas and risks mitigation and preparedness. A specificity of this site is that one archaeologic component is laid on the territory of two countries – the bridge pillars are found both in Romania and Bulgaria. To reduce the dismantling of the underwater pillars due to hydrologic factors, a partnership between the national authorities of the two countries is needed. Certain proposed measures are interdepended in terms of time and order to be developed.

6. Conclusions

Sucidava is the most significant Late Roman fortress from the Lower Danube's northern *ripa* - river frontier, highly relevant for the period of maximum expansion of the Roman Empire in its northern *limes* and for the period of Roman crisis and withdrawal of troops. It is of great importance to develop an integrated approach for disaster risk management of the site, in line with heritage preservation actions, multi-risk mitigation strategies and sustainable economic development.
After updating the UNESCO Operational Guidelines and the Romanian National Strategy for Disaster Risk Reduction 2024-2035[5)], there is a need to establish a plan and process for managing and/or reducing risks associated with disasters to the sites nominated in the World Heritage List. The *DRM Plan* for Sucidava Fortress will be the first document of this type elaborated in Romania, which may become a reference for the other 276 nominated archaeologic sites part of the *FRE Dacia*.

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2.9 Disaster Risk Management Plan for Haus Bürgel part of the Lower German Limes

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1. Introduction

Haus Bürgel is part of the World Heritage nominated serial transnational archaeological property "Frontiers of the Roman Empire – The Lower German Limes". Nominated in July 2021, the Lower German Limes extends for around 400 km and comprises 106 component parts under the criteria (ii), (iii) and (iv).
The site was originally a late roman auxiliary fort of 64 x 64 meters built in the 4th century during the Constantinian period. The walls of the original roman building are largely built over by a medieval castle and after a 19th century country estate. In the 14th century Haus Bürgel was relocated from the left to the right bank of the rhine river because of massive flooding events.
Parts of the roman walls, up to 4 meters, and foundations are still preserved today and can still be seen incorporated in the later constructions. Today the site lays in the middle of an agricultural landscape and a natural protected area, called the *Urdenbacher Kämpe*. This area is also a floodplain and includes wetlands created naturally from the flooding process. The site is owned by the NRW (Nordrhein-Westfalen) Foundation and is hosting four different functions: a Roman Museum, exposing mainly the archaeological findings of the area; the offices of a Biological Station which studies the natural protected area; and a horse stud farm family and their living space.
The site is also a focal point for community and visitor engagement with a variety of educational, cultural, natural and agricultural-related activities. Following the world heritage nomination, the site has started a transformation process, aiming to improve the visitors' experience and increase the quality and size of the museum's exhibition, as more visitors and activities are expected in the future.

Fig. 1 Intro to the site. Left: Aerial view from the north side on an activity day. Right: one section of the remains of the roman walls from the 4th century, on the southern side of the site, incorporated in later constructed structures.
Source and copyright left image: © Werner Stapelfeldt/ Stadt Monheim am Rhein
Source right image: by the author, on the 26.08.2024

2. Risk Analysis

As above mentioned, Haus Bürgel incorporates on one side different functions and on the other, important archaeological, historical and architectural values. All these elements were considered for the risk analysis and for the planning of mitigation measures.
A first discussion and a guided tour around the site with the site manager were indispensable for a de-

tailed insight at the different attributes and the vulnerabilities of the site. The prioritization criteria for the objects exposed at the museum were set by rarity and historical/archaeological importance. The material composition of the object of the collection was also taken in consideration for the first risks analysis. While regarding the remaining parts of the roman walls, one section, on the south part, was identified as having particular importance for the site, because of its integrity, educational values and at the same time for being more vulnerable. Different sources of information were considered for the conduction of the hazard analysis: the combination of hazard maps on a country level, detailed maps on the site level and direct experiences from the family living and working in the site.

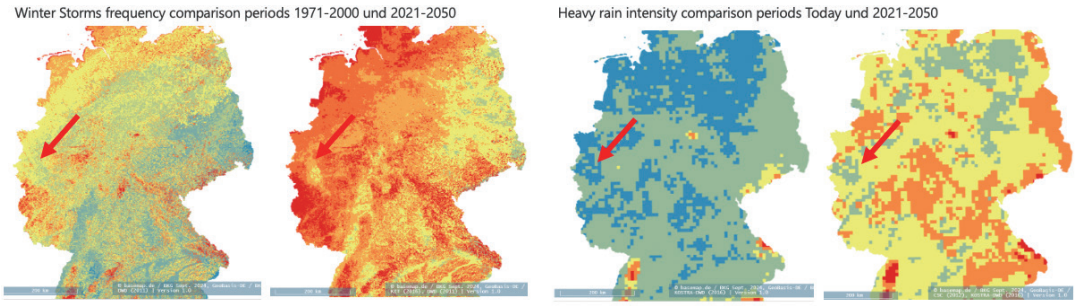

Fig. 2 Natural hazards' maps included in the analysis showing a risk comparison and projection for the next 30 to 50 years, taking in consideration climate change. From the database have been selected only the hazards which are influencing factors for the risk analysis in the case study Haus Bürgel.
Source: Bundesinstitut für Bau-, Stadt- und Raumforschung - https://gisimmorisknaturgefahren.de/immorisk.html

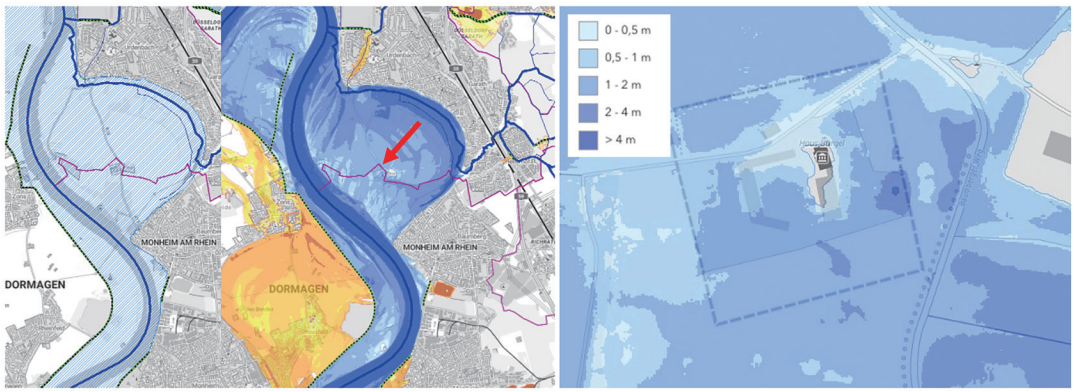

Fig. 3 Flooding. Left the floodplain area and the flooding risk map for the study area, shown only for high probability (10 to 50 years). On the right a detailed look at the site showing which parts of the site are frequently flooded by the water rise.
Source: Ministerium für Umwelt, Naturschutz und Verkehr des Landes Nordrhein-Westfalen https://www.hochwasserkarten.nrw.de/

From the risk analysis comes out that fire and flooding should have priority when thinking the scenarios and planning the mitigation measures. But while for flooding, as also for other natural hazards, there are official data to calculate probability and severity, it is for fire difficult to predict the happening. At this point was very helpful the methodology provided during the training, instructing that, when statistical data is not possible to generate, then the consideration of secondary hazards, vulnerabilities and the possible degree of loss of the attributes can be a determining factor for the prioritization process. Additionally, I also find the emotive and subjective evaluation of the situation from the site users to be very important for the evaluation. Even though flooding is a permanent hazard, the users fear fire much more. This is also due to a big fire happening at the site in the year 2000.

Tab. 1 Risk analysis for Haus Bürgel

Hazards by probability	Secondary Hazard	Vulnerabilities	Risks	Degree of loss	Affected Values	Affected Attributes
		only in relation to primary Hazards				
Storm	Fire	• Location: open field; climate change - increasing frequency and power of storms. • Functional complexity: more functions using the site.	• Loss/Damage of historical structures • Block of access for evacuation or emergency services • Affecting functionality	Low/ Middle	Architectural Social/ Economical	The Museum Collection Activities
Flooding	Fire	• Location: distance from the river; floodplain area, distance from rescue services; climate change - high frequency of heavy rains. • No protection against flooding. • Functional complexity: more functions using the site	• Loss/Damage of historical structures • Block of access for evacuation or emergency services • Affecting periodically functionality	Middle	Architectural Archaeological Social/ Economical	Roman walls The Museum Collection Activities
Heat waves	Fire	• Location: surrounded by open fields; climate change - prolonged dry periods;	• Affecting functionality	Low	Social/ Economical	Activities
Fire	Looting	• Location: isolated; distance from rescue services; climate change - prolonged dry periods; high number of lightning strikes. • Construction art and materials on site: wood for roof and floors; straw at the stable, etc. • Functional complexity: more functions using the site. • Reconstruction works – Construction site • Increasing Tourism	• Heavy loss/damage of historical structures • Loss/ damage of museum collection • Affecting heavily functionality: Site closure for a long period of time	High	Architectural Archaeological Social/ Economical	Roman walls The Museum Collection Activities

Source: by the author

3. A Worst-case Scenario

(1) Intro

As mentioned in the risk analysis, fire was the selected main hazard for this first scenario. Very helpful for the close-to-reality description of the scenario was the testimony of Mr. Reuter, from the horse breeder family, who experienced directly the fire happening in august of the year 2000. The scenario is thought as a combination of the real event of the past and the new situation at Haus Bürgel, meaning with a new and modern museum in place, bigger exhibition space, and more activities happening on site.

(2) The scenario in key steps

Scenario development	Primary Consequences	Vulnerabilities in relation to the scenario
The area where the site stands has been prone to a light flooding.	Blocked streets.	The location of the site: Floodplain.
A lightning strike hits the roof at the south-east side above the museum during the night.	First fire on the roof.	High probability of lightning strikes; Material of the roof.
Fire brigade the site in 20 minutes, later than normal due to blocked roads.	Fire spreads on the roof.	Distance of the site from emergency services.
Firefighters need more water and try to attach to the hydrants on site but one is not working and the other one has not enough pressure. they need another solution.	Fire spreads further and roof starts to collapse on the museum exhibition rooms.	No solution for fighting the first fire phase; no maintenance and sufficiency of firefighting systems.
Fire brigade needs to tear down a wall to bring the burning parts of the roof outside and extinguish them, but they cannot because the walls are protected by the monument protection law.	Fire spreads even further and more parts collapse inside the building damaging the structure and the collection.	Missing coordination between fire brigade and monument protection office. Fire brigade is not informed about the site and the collection.
Firefighters let the fire burn inside the building in a controlled way for 3 days.	Even more parts collapse damaging the roman walls.	The fire brigade has no solution to save the museum objects and roman walls.
The fire is extinguished. The stabilisation, rescue, documentation and rehabilitation process begin…	The museum and the site activities are closed for at least 2 years.	There is no rehabilitation plan in place.

4. Proposed Mitigation Measures

Collecting information from different sources, a thorough risk analysis and a detailed worst-case scenario are the sound foundation for prioritizing the measures. In addition, an analysis of the actors in two moments: first, a general one, to understand the most important stakeholders of the site; second, the actors with possible direct responsibilities in a disaster scenario. Below, the most important mitigation measures considered to be necessary for setting up the frame for the DRM plan and for mitigating the most urgent issues of the site.

(1) Prevention measures

Measure	Actors and roles
Develop the DRM-Plan and integrate it with the existing Management Plan of the LGLs, the working procedures of the museum and the disaster protection policy of the city of Monheim am Rhein.	NRW Foundation: owner, leader, coordinator
	City of Monheim am Rhein: collaborator
	LVR (Landschaftsverband Rheinland): site manager of the Lower German Limes, advisor.
Establishing an Emergency Response Team between firefighting department and Haus Bürgel. Implementing drills and exercises as per developed scenarios.	Museum: coordinator
	City of Monheim am Rhein/ Firefighting department: collaborator
	Reuter Family: on-site support
	Biological Station: on-site support
Planning evacuation infrastructure for the museum collection and protection measures for the site, the roman remaining walls and the collection.	NRW Foundation: funder, coordinator,
	City of Monheim am Rhein: collaborator
	LVR: advisor

(2) Emergency Response Measures

Measure	Actors and their roles
Define a safe archive space and procedures for rescuing, collecting, documenting and assessing the museum objects in an emergency.	Museum: coordinator
	LVR: advisor
	Volunteers
Prepare informative plans for the roman walls and the collection with safety cards for the firefighting dep.	Museum: coordinator
	LVR: advisor
	City/Firefighting department: collaborator
Plan and install easy hydrants to be used by the family/ site users for the first fire phase; Improve existing hydrants system; plan and install fire protection measures for the stable.	Museum: coordinator
	City/Firefighting department: collaborator
	Reuter Family: on-site support Biological Station: on-site support

(3) Recovery plan

The recovery plan actions are categorised in five working expertise areas. Below it is a condensed list of the most important actions for each area, as consequence to the described worst-case scenario. Responsible main actors remain the same as above.

Immovable heritage/ Building/ Infrastructure	Movable heritage/ collection	Policy Administrative
Implement stabilisation measures; Build temporary shelters.	Plan and implement collection evacuation and temporary archiving; Document collection damage and plan restoration;	Adapt and improve the damage assessment forms for movable and immovable attributes.
Plan and implement restoration measures for the structure; Plan and implement new museum exhibition.	Plan and implement shock and fire-resistant showcases and division elements for and at the collection.	Create and adopt collection inventory with objects categorisation: based on material, size, possibility of evacuation, handling possibility, etc.
Explore the possibility to build small dikes around the site or mobile walls against flooding.		Revise, update and improve the documents and procedures related to emergency situations.
Community Engagement - Education/Interpretation		**Finance**
Create and implement educational activities and tools about disaster management for cultural heritage, example: Emergency response days for CH.		Establish an emergency fund for the museum.
Create and train a group of volunteers who can support the site in emergency situations.		Create a crowdfunding platform from Haus Bürgel network of partners.

5. Conclusions

Working with a small part of a big transnational archaeological property, brings challenges in the desk research and analysis of documents and given information. The effectiveness of the management structure will probably be noted even later during the further development of the DRM Plan. However, in its smaller management, Haus Bürgel has the needed actors, for the development and implementation of the DRM Plan, already in place and collaborating with each other.

As the best practices suggest, the development of at least three scenarios is necessary for a good understanding of the situation and vulnerabilities. This will help with the prioritization and at the same time reducing the costs in planning and implementation of the measures.

The particular situation of the site in relation to flooding, being the only building in a floodplain without protection, needs to be resolved. At least 2 scenarios featuring flooding, with different water levels and speed, and storms should be taken in consideration.

Acknowledgments

The organisers, lecturers, guides, supporting staff and co-participants of the ITC 2024. NRW Foundation for the willingness to support the development of a DRM-Plan. The managing directors of the site, Ms. Anna-Lena Weber and Mr. Thomas Härtel. The family Mr. and Ms. Reuter. The planning team, Welke und Partner Architects and DTP Landscape Architects. Colleagues at BRB Lindlar. Family, Maike Petri and Catharina Lames for the support, advises and expertise.

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2.10 Disaster Management Plan for Penang Malay Gallery (Floral Tea Mansion), Penang, Malaysia

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1. Introduction

(1) Penang Malay Gallery

Located on the northeast of Penang Island, the Penang Malay Gallery (PMG) was established to highlight the history of the Malay community's arrival and development in Penang. The gallery showcases various aspects of Malay life and activities, including the Founding and Development of Penang, Trade and Commerce, The Pilgrimage to Mecca, Politics and Administration, Malay Leaders, Performing Arts, Education and Publishing, Marriage Traditions, Traditional Attire, as well as Dining and Kitchen Spaces, featured in 11 exhibition rooms within the building.

Fig. 1 The Penang Malay Gallery, key, location and site plan
Source: by the National Heritage Department Malaysia

a) The building

Built in 1893, Floral Tea Mansion showcases Sino-Malay architecture with Chinese and European influences, featuring a V-tile roof, marble floors, and Islamic motifs like the crescent and star. The driveway serves as a venue for cultural events. Entrusted to Amanah Raya Berhad in 2008, the mansion underwent conservation, but in 2019, nearby hotel construction caused structural cracks that remain unaddressed as of October 2024.

b) The objects & cultural activities

The internal spaces of PMG have been minimally retrofitted to accommodate the exhibition of cultural objects. The majority of the significant objects on display have been generously donated by the local community, while additional items have been purchased or acquired to complement the exhibition content. Most of these objects are featured in permanent exhibitions, while some items remain in storage, as the gallery lacks a comprehensive inventory system for its collection.

c) The stakeholders

The gallery is managed by the National Heritage Department (North Zone), whose office is located off-site. At the gallery itself, there are two permanent staff members, consisting of a curator and a museum assistant, supported by three personnel responsible for security and maintenance.

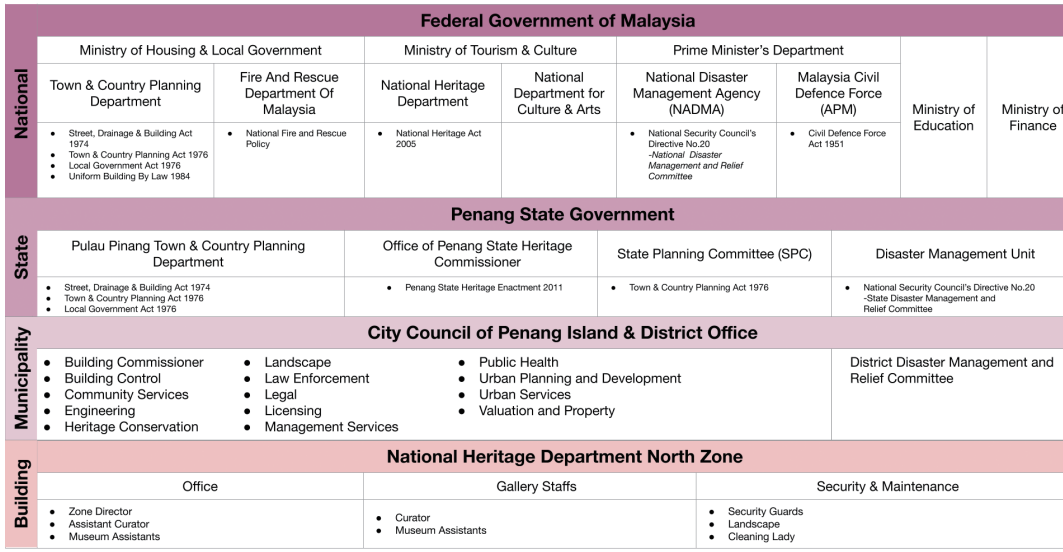

Fig. 2 Mapping of Stakeholders of Cultural Heritage and Disaster Management in Malaysia
Source: by the author

(2) Values & Attributes

Values	Attributes
Architectural Value	• style: Anglo-Malay Straits Eclectic based on Malay Traditional House • morphology: Main House Block, Connecting Block, Kitchen Block dan Garage Block, circular driveway • intricate decoratives: ceiling rose, floral motives, crescent & stars, • structure and finish: load-bearing wall built with clay bricks & lime mortar, finished with lime wash, v-shaped Indian-style tiled roof, timber flooring and staircases
Social Value	• serves as a living cultural space where traditional Malay performances such as Boria and Ghazal Parti continue to be celebrated. • remnants of the life of Jawi Pekan family: old kitchen, spice-grinding stone • houses cultural objects that portrays culture of Malay community in Penang • exhibitions (permanent/temporary)
Educational Value	• workshops, seminar, talks • information panels • training, capacity building
Artistic Value	• sculptures, paintings that portrays Malay communities in Penang • hosts cultural events and performances; Boria, Ghazal Parti
Scientific Value	• good practise of heritage building conservation as example • exhibitions • researches and documentation

Fig. 3 Heritage values and its attributes of PMG
Source: by the author

Fig. 4 Attributes of PMG
Source: by the National Heritage Department Malaysia, the author

2. Risk Analysis

(1) Hazards and Vulnerabilities

Malaysia faces increasing climate-related hazards, particularly flooding, worsened by rising rainfall intensity. Located 355 metres from the sea, the Penang Malay Gallery is highly vulnerable to floods caused by high tides and heavy rain, leading to both immediate and long-term damage. Its partial timber structure and lack of modern fire safety measures heighten fire risks, while pest infestations and invasive vegetation contribute to structural weakening. Urban development, traffic congestion, and insufficiently trained staff further expose the gallery and its valuable contents to additional risks.

	No	Heritage Values	Attributes		Hazards	Vulnerabilities	Potential Impact & its Severity	
Site & Building	1.	Architectural Value	• **style**: Anglo-Malay Straits Eclectic based on Malay Traditional House • **morphology**: Main House Block, Connecting Block, Kitchen Block dan Garage Block, circular driveway • **intricate decoratives**: ceiling rose, floral motives, crescent & stars, • **structure and finish**: load-bearing wall built with clay bricks & lime mortar, finished with lime wash, v-shaped Indian-style tiled roof, timber flooring and staircases	Catastrophic	**Primary:** Heavy, Long Rain **Secondary:** Flood, Fire	Proximity to sea Weak drainage system Weak structure (gradual damage by rising damp & salt attack) Rapid urban development Lack of maintenance Traffic congestion Insufficient trained staff Local culture & traditions Lack of fire safety measures	Damage of structure integrity & aesthetic appeal	High
							Deterioration of woodwork, and erosion of plasterwork	High
							Collapse of the building	High
	2.	Social Value	• serves as a living cultural space where traditional Malay performances such as Boria and Ghazal Parti continue to be celebrated. • remnants of the life of Jawi Pekan family: old kitchen, spice-grinding stone • houses cultural objects that portrays culture of Malay community in Penang • exhibitions (permanent/temporary) • Events and activities				Loss of cultural space	High
							Loss of cultural artifacts	High
				Slow Deterioration Agent	**Primary:** Invasive vegetation Pest infestation	Weak structure (gradual damage by rising damp & salt attack) Rapid urban development Uncontrolled Tourism Lack of maintenance Insufficient trained staff Local culture & traditions	Deterioration of cultural artifacts, furniture	High
							Loss of trust and reputation	High
	3.	Educational Value	• workshops, seminar, talks • information panels • training, capacity building				Loss of knowledge sharing platform	High
							Loss of public interest in Penang Malay culture	High
							Shortage of trainers	Medium
	4.	Artistic Value	• sculptures, paintings that portrays Malay communities in Penang • hosts cultural events and performances; Boria, Ghazal Parti • Collections				Loss of trust and reputation	High
							Damage of collections	High
							Loss of platform for cultural events and performances	High
	5.	Scientific Value	• good practise of heritage building conservation as example • exhibitions • researches and documentation				Loss of knowledge	High

Fig. 5 Risk Assessment on Heritage Values of Site & Building
Source: by the author

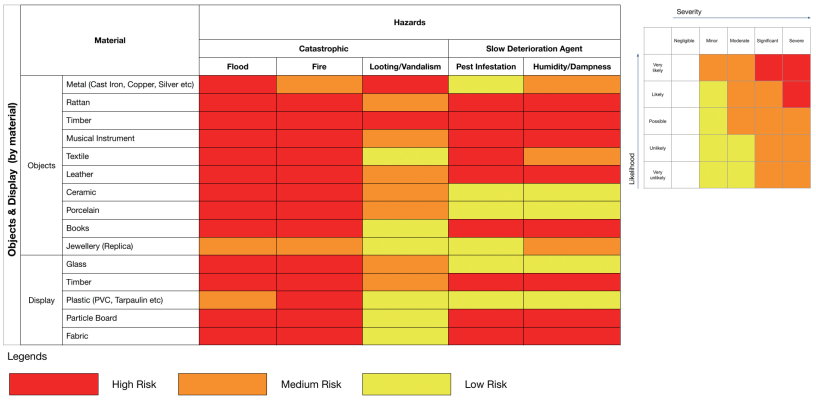

Fig. 6 Risk Assessment on Objects & Display categorised by materials
Source: by the author

(2) Worst Case Scenario: Flood & Fire

A prolonged period of heavy rain during high tide leads to severe flooding around the gallery, with water rising into the building. Due to a lack of trained staff and proper emergency protocols, no evacuation of artefacts is initiated, exposing collections on the ground floor to water damage. Moisture affects the furniture and exhibits, and debris from the flood contaminates the interior. As the water rises, it reaches an active electrical outlet, causing a short circuit that ignites a fire. Without smoke detectors or fire alarms, the fire spreads unnoticed, and the lone security guard, untrained and without functioning equipment, is unable to control it. The fire continues to grow, fueled by the timber structure, while flooding worsens, leading to further short circuits and structural collapse. The delay in emergency response due to blocked roads and high water levels exacerbates the damage. By the time firefighters and gallery staff arrive, much of the collection is either destroyed by fire or damaged by floodwaters. Looting also occurs during the chaos, leading to further loss of valuable artefacts. The gallery suffers extensive damage, requiring major restoration. As a result, the gallery is forced to close indefinitely, and the loss of trust from donors compromises future contributions.

3. Mitigation & Preparedness Measures

(1) Policy & Planning

A comprehensive Disaster Risk Management (DRM) Plan should be established at the national, state, and municipal levels. The gallery also requires a dedicated Heritage Management Plan to ensure periodic maintenance of its structure and assets. Fire safety measures in heritage buildings must be incorporated

into building codes and enforced, with further emphasis on awareness and education programs to engage the public and stakeholders in disaster preparedness. Additionally, the establishment of a voluntary fire brigade within the community could provide an immediate response to emergencies.

(2) Technical Measures

Several fire safety measures should be implemented, including the installation of fire extinguishers, smoke detectors, and a fire hose reel. A fire escape plan and designated assembly points should be established and posted throughout the gallery. Addressing the gallery's vulnerability to flooding, drainage system upgrades are critical, along with water pumps at high-risk points. Additionally, fire retardant, insect repellent, and rust prevention treatments should be applied to vulnerable materials. There must also be safe evacuation spaces for high-value objects in the event of a disaster.

(3) Maintenance, Monitoring & Security

Regular fire safety inspections, such as checking fire extinguishers and smoke detectors, are essential. Periodic humidity and salt treatments on structural elements will help prevent deterioration, which can weaken the building over time. Addressing structural cracks promptly will also mitigate risks of further damage.

(4) Training & Awareness

Capacity-building programs should be implemented for gallery staff and security personnel, focusing on fire safety and evacuation procedures for both people and objects. Moreover, engaging the local community and practitioners in discussions on DRM for cultural heritage will help raise awareness and educate the public on safety protocols.

4. Emergency Preparedness & Response

(1) Evacuation

The Penang Malay Gallery urgently needs an evacuation plan, including assembly points for visitors and temporary spaces for high-value artifacts on upper floors. Flood-prone ground floor collections require pre-determined procedures, and staff training is crucial to protect irreplaceable donations during emergencies.

(2) Emergency Response Team

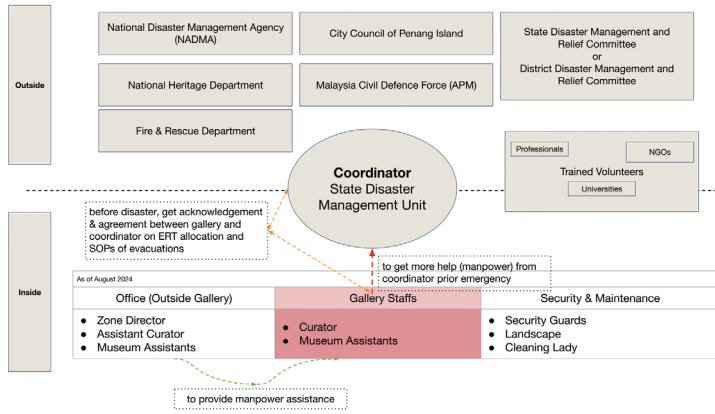

Fig. 7 Mapping of Emergency Response Team in the case of Penang Malay Gallery
Source: by the author

(3) First Aid to Cultural Heritage

In the event of a disaster, the Emergency Response Team (ERT), coordinated by the State Disaster Management Unit, would initiate first aid measures specific to the PMG. Their response would start with a

situation analysis to assess immediate risks, followed by an on-site damage and risk assessment to identify critical threats to the gallery's structure and collections. This assessment allows the team to prioritise which artefacts and areas need immediate attention. Meanwhile, a temporary roof is to be installed to protect the building from further deterioration.

Once risks are identified, the ERT would focus on security and stabilisation, ensuring the protection of both the building and its collections. By designating secure spaces and monitoring any vulnerable areas, the ERT would work to prevent further damage. This targeted approach helps preserve the gallery's assets and heritage materials, allowing for a smoother recovery process post-disaster.

5. Recovery

Short-term recovery efforts will focus on stabilising the gallery and preparing for comprehensive restoration. Following initial emergency responses, a detailed post-event damage and risk assessment will be conducted to determine the full extent of repairs and establish restoration priorities. In collaboration with conservation experts, temporary storage and treatment will be arranged for affected collections, ensuring that necessary stabilisation measures are applied. Funding for these early recovery stages will be sought from relevant agencies and stakeholders, covering costs related to structural stabilisation, conservation resources, and emergency storage solutions.

Long-term recovery will focus on fully restoring the gallery and enhancing its resilience. Conservation treatments will address vulnerabilities, including rising damp, pests, and fire risks. Upgrades to the drainage system will mitigate future flooding. Restoration will align with conservation standards, while pop-up exhibitions, fundraising, and cultural events will support community engagement. The DRM plan will be updated following a review of initial recovery efforts to improve disaster response and preparedness.

6. Conclusion

The Penang Malay Gallery faces significant risks from flooding, fire, and various vulnerabilities, necessitating a tailored DRM plan. This proceeding outlines key measures, including mitigation, preparedness, and recovery strategies such as evacuation planning and the formation of an Emergency Response Team (ERT). However, further detailed risk analysis for artefacts, as emphasised during this course, is necessary to refine the plan. Moving forward, prioritising site-specific risks and strengthening stakeholder collaboration will ensure more effective disaster preparedness and response.

Acknowledgment

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2.11 Diocletian's Palace and Beyond: Challenges in Safeguarding a Living UNESCO Heritage Site

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1. Introduction

The Historical Complex of the City of Split, centered around the Diocletian's Palace, is a UNESCO World Heritage site that represents over 1,700 years of rich cultural heritage and urban continuity. Built at the turn of the 4th century AD as a retirement residence for the Roman Emperor Diocletian, the palace is a fusion of ancient Roman, medieval, and Renaissance architectural styles, reflecting the city's layered history. Today, Split's historic complex is not only a testament to Roman architectural ingenuity but also a living part of Croatian heritage, thriving with vibrant local traditions, preserved monuments, and a resilient community that honors its ancient roots while embracing modernity. Other than natural hazards that pose a risk to cultural heritage, the development of Split, directed towards mass tourism, along with the general tourism growth in Croatia, has started to negatively impact the cultural heritage and the UNESCO site itself.

Fig. 1 The old city center of the City of Split (Source: Google Earth, with the author's processing)

2. Historical Complex of Split with the Palace of Diocletian's Heritage Attributes and Values

This heritage site faces complex challenges that threaten its integrity and sustainability. As a preliminary step in the risk assessment procedure, the fundamental values of this protected cultural zone were established. Consequently, this chapter provides initial structured overview of the key attributes of Diocletian's Palace and the surrounding complex (Zone A), their impacts, vulnerabilities, and potential loss of values.

The primary goal of this table is to highlight not only the strengths of each attribute but also the risks they face. This approach serves as the foundation for developing a robust disaster risk management plan, balancing preservation with sustainable tourism, community needs, and ongoing conservation challenges.

At the heart of this site lies its Roman Imperial Origins, which foster a deep sense of cultural pride, drawing visitors eager to connect with the legacy of the Roman Empire. However, these ancient materials are vulnerable to erosion and damage from high foot traffic, and the scarcity of authentic restoration materials heightens the risk of losing its original Roman character, which could impact both cultural identity and visitor engagement.

The complex is also notable for its Architectural fusion, a unique blend of Roman, medieval, Renaissance, and modern styles that enriches Split's historical narrative and attracts a diverse audience. This architectural variety, while visually and culturally valuable, presents preservation challenges. Structural imbalances,

Tab. 1 Preliminary summary of heritage attributes, vulnerabilities, and loss of values

Attributes	Vunerabilities	Loss of Values
Roman Imperial Origins	• Erosion of ancient materials	o Historical o Cultural
Architectural Fusion (The unique blend of Roman, medieval, and Renaissance)	• Structural imbalance between styles • Challenges in maintaining authenticity	o Architectural o Historical
Cultural Layering (The transformation from a Roman palace to a medieval and modern urban center)	• Overcrowding impacting site integrity • Risk of modern alterations overshadowing historical aspects • Displacement of local residents	o Historical o Community value
Preservation of Antiquities (Iconic structures like the Peristyle, the imperial square, and original Roman columns)	• Exposure to environmental changes • Wear and tear from visitor interactions • Insufficient funding for conservation	o Educational o Historical
Substructure Preservation	• Vulnerability to flooding • Potential collapse from structural strain • Accessibility issues for maintenance	o Archaeological o Structural
Museums (and artifacts)	• Risk of theft or vandalism • Damage from improper handling • Temperature and humidity fluctuations	o Cultural o Educational

Source: by the author

maintaining authenticity across styles, and balancing modern amenities with heritage preservation are constant obstacles, potentially threatening both architectural and historical value if not addressed sensitively. Cultural Layering is another defining feature, reflecting centuries of continuous human presence and adaptation within the palace walls. This historical depth enhances visitor interest and community pride, positioning the site as a model of "living heritage." Yet, overcrowding, modern alterations, and the risk of resident displacement highlight the tension between tourism and preservation.

Lastly, the preservation of antiquities adds significant educational (and economic) value to the site. The palace functions as an open-air museum, bringing Roman history and Croatian heritage to life. However, these artifacts face environmental exposure, physical wear from interactions, and limited funding, all of which threaten their educational and historical integrity. Without dedicated resources for conservation, this site risks losing its role as an historical resource.

3. Disaster Risk Analysis / Key Hazards and Vulnerabilities

The Historical Complex of the City of Split, including Diocletian's Palace, faces significant risks due to its unique location, construction, and high levels of public engagement. This site is vulnerable because it is

Tab. 2 Partial overview of natural and man-made hazards identified

Natural Hazards	Man-Made Hazards
Earthquakes – Due to Split's location in a seismically active region, the site is vulnerable to structural damage from earthquakes.	Terrorism - Explosions, fires, or other attacks could directly damage historic buildings, monuments, and artifacts.
Flooding – Proximity to the coast increases the risk of flooding, which can damage foundations, artifacts, and other structures.	Mass Tourism – High foot traffic causes wear and tear on historical surfaces, leading to gradual degradation and increased maintenance needs.
Extreme weather (e.g., storms, heavy rainfall) – Severe weather can lead to physical damage, especially to exposed parts of the complex.	Urban Development – Surrounding construction and infrastructure projects can disrupt the integrity of the site and may alter the historic landscape.
Temperature fluctuations – Shifts in temperature, particularly in summer and winter, can cause expansion and contraction of materials, weakening the structure over time.	Vandalism – Graffiti, defacement, or intentional damage to artifacts and walls are risks posed by unmanaged public access.

Source: by the author

situated in a seismically active area, near the coast, and is constantly exposed to both natural forces like weathering and human impacts from mass tourism and urban development.
A secondary hazard refers to the subsequent dangers that arise as a consequence of a primary disaster, such as earthquakes, floods, or some man-made hazards. These hazards can exacerbate the initial impact of the disaster and pose additional risks to human life, property, and the environment. Tab. 2 provides a partial overview of primary and secondary hazards identified as the most likely risks to the cultural heritage in Split's Old Town (Zone A).

Tab. 3 Partial overview of primary and secondary hazards identified as the most likely risks to the cultural heritage in Split's Old Town

Primary Hazard	Secondary Hazards
Earthquakes	• Fire
Flooding	• Waterborne Diseases • Fire (from electrical issues)
Extreme Weather / Temperature Fluctiations	• Flooding
Vandalism	• Thefts/Increased Crime Rates • Collapse of parts of the facade or other structures
Terrorism (*While terrorism may not be a likely event in this region, it remains a contemporary security concern and an unpredictable factor that cannot be overlooked.)	• Fire • Exsposions • Radiation (radioactive materials)

Source: by the author

The city faces significant risks from natural and human-induced hazards, primarily earthquakes and fires. As outlined earlier, Tab. 3 provides a detailed account of the vulnerabilities and the consequent depreciation of the attributes that define this protected cultural heritage site.

Tab. 4 Detailed overview of most likely primary, and secondary hazards, vulnerabilities, atributes, and loss of values

PRIMARY HAZARDS	EARTHQUAKE				
SECONDARY HAZARDS	FIRE				
VUNERABILITIES	1. AGE OF BUILDINGS 2. CONSTRUCITON MATERIALS 3. LACK OF SEISMIC RETROFITTING 4. INSUFFICIENT STRENGHTENING OF ART 5. LACK OF DRM PLANS 6. UNTREINED PERSONELL 7. LACK OF EQUIPMENT				
ATTRIBUTES	1. REMAINS OF ROMAN PALACE 2. MEDIEVAL STRUCTURES 3. URBAN PATTERN OF CITY 4. MUSEUMS (4 MUSEUMS, 7 LOCATIONS)				
LOSS OF VALUES (for each attribute from 1-4)	1. Historical - HIGH Architectural - HIGH Scientific –HIGH Cultural/social – HIGH Religious -MEDIUM Associational - HIGH Artistic – HIGH	2. Historical - HIGH Architectural – HIGH Religious – MEDIUM	3.Historical - HIGH Architectural - HIGH Religious - MEDIUM Artistic - HIGH	4. A) Museum of the City of Split Historical - HIGH Architectural - MEDIUM Scientific - LOW Cultural/Social - HIGH Religious - LOW Associational - HIGH Artistic - MEDIUM	4. B) Museum of Sacred Art Historical - HIGH Architectural - MEDIUM Scientific - LOW Cultural/Social - HIGH Religious - HIGH Associational - HIGH Artistic - HIGH

Source: by the author

Earthquakes, as the main threat, can cause severe structural damage, while fires, often triggered by earthquakes, add to the destruction and danger. These hazards are exacerbated by a range of vulnerabilities, including the age and construction materials of many buildings, which make them susceptible to collapse. The lack of seismic retrofitting further increases the risks, as does the insufficient strengthening of cultural artifacts and heritage sites, leaving them vulnerable to irreparable damage during disasters. Compounding these issues is the absence of comprehensive disaster risk management (DRM) plans, a shortage of trained personnel, and inadequate equipment, which together hinder effective emergency response and recovery.

The city's vulnerabilities extend to its rich cultural heritage. Many structures, such as the remains of the Roman palace and medieval buildings, including churches, are historically significant but structurally fragile. The city's unique urban pattern, which includes fortresses, palaces, and bustling markets like the green market and fish market, is also at risk. Museums, housing invaluable mosaics, sculptures, and paintings, are particularly vulnerable due to insufficient protective measures. The potential loss from these hazards is immense, spanning multiple values.

4. Disaster Scenario – Earthquake

The magnitude 8 earthquake on August 15th 2024 has highlighted the dire need for comprehensive disaster risk management (DRM) strategies in Split's Old City Core, a hub of cultural heritage and historical significance. The quake left hundreds of people dead or injured, as the narrow streets and aged infrastructure hindered evacuation efforts. Essential services like medical aid and firefighting were delayed due to collapsed bridges and blocked roads, exacerbating the crisis. Furthermore, the lack of disaster preparedness in cultural institutions, including the iconic Diocletian's Palace, resulted in significant risks to both human lives and invaluable artifacts.

- **Risk Assessment and Preparedness Plan for "Zone A"**

  Hazards and risks:

  1. Evacuation challenges: Many cultural heritage buildings lack up-to-date evacuation plans. Current plans must be reassessed and aligned with on-the-ground realities, such as obstacles and artifact relocation needs. Museum directors and site managers are tasked with submitting updated evacuation reports within one month.
  2. Artifact Evacuation Plans: Museums in Zone A currently do not have prioritized evacuation plans for artifacts. Directors, in coordination with the Split Fire Brigade and chief curators, must create these plans within two months. These will ensure a clear hierarchy of artifact evacuation based on their value and fragility, while maintaining confidentiality agreements.
  3. Evacuation centers: Zone A is divided into five subzones, each with designated evacuation centers both inside and outside the zone. Maps showing the locations of these centers must be prominently displayed.
  4. Temporary collection points: Artifacts and fragments will initially be moved to secure sections of Diocletian's cellars (west wing). If needed, these items will be transported to the warehouses of the Archaeological Museum in Solin after triage and first aid.

- **Prevention and Mitigation Measures**

  1. Seismic retrofitting: Identified vulnerable walls and constructions in Diocletian's cellars and other heritage sites should be retrofitted to withstand earthquakes.
  2. Reinforcement of structures: Additional reinforcements for doors, windows, and artifact displays must be implemented to protect against structural damage during quakes.
  3. Security and fire alarms: Upgraded systems should be installed in all museums and cultural sites.
  4. Emergency equipment: Install first aid kits and emergency contact tables in key locations.

- **Adaptation and Preparedness Measures**
  1. Regular drills and training: Monthly evacuation exercises for people and artifacts will be conducted in collaboration with the Split Fire Department. Reports on these exercises must be evaluated and submitted within three days to the "Zone A" Coordinator.
  2. Personnel training: Cultural heritage staff, security guards, and volunteers must be trained in evacuation procedures, fire-fighting techniques, and artifact protection.
  3. Communication upgrades: Site managers and representatives of museums must be equipped with radio devices for improved coordination during emergencies.
  4. Signage and route checks: Evacuation exits and routes must be regularly inspected, updated, and clearly marked.

- **Strategic Partnerships and DRM Planning**
  - Collaborate with official DRM agencies to integrate efforts across all cultural heritage sites.
  - Share the list of the most valuable artifacts, along with their positioning plans, with the Split Fire Brigade under confidentiality agreements.
  - Conduct ongoing risk assessments and update strategies to address emerging vulnerabilities.

Conclusion

In conclusion, by adopting and implementing these proactive measures, Split can significantly enhance its resilience against future disasters. These steps will not only safeguard the well-being and safety of its citizens but also ensure the preservation of its invaluable cultural and historical heritage for future generations. The development and execution of a robust Disaster Risk Management (DRM) plan is crucial, as it provides a strategic framework to mitigate risks, respond effectively, and recover swiftly from potential crises. Prioritizing such initiatives underscores the city's commitment to protecting its rich legacy while fostering a secure and sustainable future.

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2.12 Disaster Risk Management Plan for The Centro Patrimonial Recoleta Dominica, Santiago, Chile

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1. Heritage Status, Values and Attributes

The Museum of Decorative Arts and the Dominican Historical Museum and Heritage Library are part of this public office, the three of them are located in a colonial building named Centro Patrimonial Recoleta Dominica, located in an old and traditional neighborhood called Recoleta (with a population of 190,000 habitants) in Santiago. This building has an enormous patrimonial value and was therefore declared a national monument in 1974, since it is an example of the first constructions made in the country. The Centro dates from colonial times and was built with construction techniques of pre-Hispanic origin that date back 5,000 years. The main feature of the building was the organization of all the rooms around three courtyards that served various functions. The first patio includes two museums, a library and a salon, the second one has mainly offices, storage areas and other facilities. The third patio houses the National Conservation Center with several labs and offices. The collections of the two museums are of very varied materials: metal, glass, textile, stone and ivory, among others. The total number of objects in these collections amounts to 5,300 objects, of which 7% are on display, and 93% in storage areas located in the same building. In the case of the library, it functions as a museum hall that exhibits around 30,000 volumes *in situ*, and the other 70,000 are kept in storage in the same building.

Tab. 1 Summarizes the relation between stakeholders, attributes and values

Units	Stakeholders	Attributes	Values
• The building • Art collection • Library collection	• Chilean State • National Council of Monuments • National Service of Cultural Heritage • Municipality Council • Communities	- The colonial construction (adobe and straw) allows us to learn about building techniques used between XVI and XX in Chile. - Collection of religious objects and books of worship of the Dominican order from XVI century. The library has been located in the same place for more than 250 years. - The Decorative Arts Objects Collection, unique in our country, exhibits different manufacturing materials and artistic styles from Europe, Asia and America.	- Historical, cultural, colonial architectural. - Native vegetation more than 200 years old, with much wildlife that inhabits the patios. - The library is unique in South America, with a similar one in Peru. (More in Spain).
The National Conservation and Restoration Center	• Chilean State • National Council of Monuments • National Service of Cultural Heritage • Municipality Council • Communities • Scientific, communities and researchers • Heritage professionals	- Provide technical assistance in preventive conservation, analysis and territorial management of cultural heritage. - Conduct research, studies and analyses aimed at technical and methodological innovation in the area of competence and the generation of knowledge about heritage assets and their environment.	- Produce knowledge related to the conservation and restoration of cultural heritage. - Contributes to the professional training of future workers in the field of cultural heritage through internships and apprenticeships offered to students. - Offers an editorial platform to analyze, describe and discuss scientific analysis procedures performed on works of art when they are restored.

Source: by the author

Fig. 1 First patio view and facade
Source: by the author

2. Disaster Risk Analysis and Scenario

Chile is one of the Earth's most exposed countries to natural disasters, such as earthquakes, tsunamis and floods. Between the XX and XXI centuries, 22 earthquakes, with a magnitude greater than 8 degrees on the Richter scale have occurred in Chile, many of them accompanied by tsunamis. This meant that almost 31% of the cultural heritage was seriously affected. Last year in August 2023, floods caused by rain affected the Linares Crafts Museum, a total of 350 objects were seriously affected, and the museum was closed for seven months. Fires are currently another important threat resulting from climate change and human action. This summer, January and February 2024, a large fire, product of high temperatures and human action, affected the city of Valparaíso, destroying houses in the hills as well as 90% of the municipal botanical garden, an outdoor space with native flora. Public policies in this regard in Chile began in 1925 with the creation of the National Monuments Law, which granted protection to material heritage, and therefore strict regulations were applied that allowed its conservation and restoration. In 1982, the National Center for Conservation and Restoration was created, which was dedicated to the restoration of movable property, and the National Disaster Prevention and Response Service (SENAPRED), composed of a national committee was originally created by law in 1974.

3. Disaster Scenario

An earthquake occurred at 03:34:08 am on Monday, September 16, 2024, and reached a magnitude of 8.8 Mw. The quake had a maximum duration of 4 minutes in areas close to the epicenter, and more than two minutes in Santiago. At the time of the earthquake there was only one guard at the museum. After the earthquake, the power was cut almost immediately. Because the building is made of adobe, there was a large amount of dust in suspension, preventing the guard from immediately checking the situation. It has a roof without separation, it is an enormous space with no firewall. One patio has several labs, the second has many deposits with the collections, such as museum objects and library books. And the third has the exhibition areas. Outside the building there are several hazards: old constructions, a gas station, partial facade of an abandoned old building, a very narrow entrance to get to the actual building. The neighborhood has many old buildings with a large number of people living in them and with many illegal electrical connections. Some of the primary and secondary hazards and vulnerabilities of the site are:

Tab. 2 Primary and Secondary Hazards: vulnerabilities and potential impact

Hazards	Vulnerabilities	Potential Impact
Primary Hazards: • Earthquakes • Urban sites • Heavy rain • Flooding	• Climate change • Old infrastructure • Location near hills and river • Narrow entrances prevent emergency aid to arrive fast. • No DRM Plan or Risk assessment for cultural heritage. Native trees in the garden many native fauna (birds). • The list of library collection records is only available on paper, in the same building. • This is the only laboratory at national level where the restoration of art works, both public and private, is performed. • These labs have professionals that are continuously conducting research and publishing.	• High lost of the historical and architectural value of a colonial building. • Lost of native vegetation older than more 200 years. • The loss of the library collection, more than 100.000 books, would be irreparable because of its historical and aesthetic value not only at the national level also to a Hispanic level. • The loss of highly cost equiments donated by Japan and materials and tools would be irreparable in a considerable amount of years.
Secondary Hazards: • Collapse of electrical circuit • Suspended dust • Water cut-off • Humidity • Deposits of collections collapsed. • Flammable liquids and chemicals used to restore works of art Suspended dust • Broken and disordered objects in the showcases in the exhibition rooms areas • Aisles with books fallen from the shelves	• A collection of decorative arts unique in the country. • The exhibition hall of the library is located in the original place that is more than 150 years old. • The list of library collection records is only available on paper, in the same building. • This is the only laboratory at national level, where the restoration of works of art, both public and private, is performed. • These labs have professionals that are doing research and publishing all the time.	• The lost of important artworks from many different museums across the country. • For a long period of time would be imposible to research and do conservation and restoration of works of arts that belong to the government.

Source: by the author

4. Mitigation Measures

Develop a Disaster Prevention Systems Unit at a city level (Santiago) for Cultural Heritage involves and efficient coordination between: the municipalities of Santiago, Recoleta and Providencia, firefighters and staff from public and private museums. Its main goal would be the coordination of prevention and mitigation efforts in a scenario of a disaster within the city of Santiago. The second goal would be increased awareness and education of the general public about the Disaster Prevention System.

Tab. 3 The mitigation measures focus on five areas

Strategic	Physical planning level	Technical level	Management, maintenance and monitoring	Awareness, outreach and education
• Create a national unit in charge of the DRM for Cultural Heritage • Set a protocols agreement with fire brigade in order to protect this heritage on site. • Collaborating with cultural heritage organizations (ICCROM, ICOMOS)	• Practice and simulation drills. • The storage (30%) • area located on the second floor they should be move to the first floor.	• Review the collection policy guidelines to include a DRM point of view. • Complete the digital documentation of the library collection's highlights items.	Set a DRM plan for Cultural Heritage with an ISO certification in order to implement it.	• Personnel training (international and National) • Awareness and social media campaigns both within and outside of the museum.

Source: by the author

5. Proposals for Emergency Preparedness and Response (Mitigation Plan)

The evacuation plan is structured as follows: the safety chief acts as leader and calls the head of each brigade: fire, evacuation and first aid, all communicating by radio. Criteria and the sequence of actions are quickly established to inform each brigade leader of the incident and initiate the process of informing visi-

tors and employees about the emergency. Then, in parallel, each leader communicates with the respective fire department and first aid unit at the city level and check that a safe exit route is available. Criteria are established for access to the areas, after coordinating with the fire department, and the carabineros are requested to guard the area where the collections are to be removed to. Visitor evacuation begins. Finally, the rescue of removable assets (indoor and outdoor) is coordinated with museum director, fire-fighting units and civil protection. Inform the criteria to organize the objects at the temporary place, packing and transferring objects to the secure area in coordination with civil protection brigade. Get the first aid measures with the objects materials to initiate the work at the site or at the alternative safe space located in buildings close to the site. Manage the non-movable heritage *in situ* with special materials. Evaluate and move the objects to the remote safe storage at other institutions. Assess with the team the movable heritage and further measures.

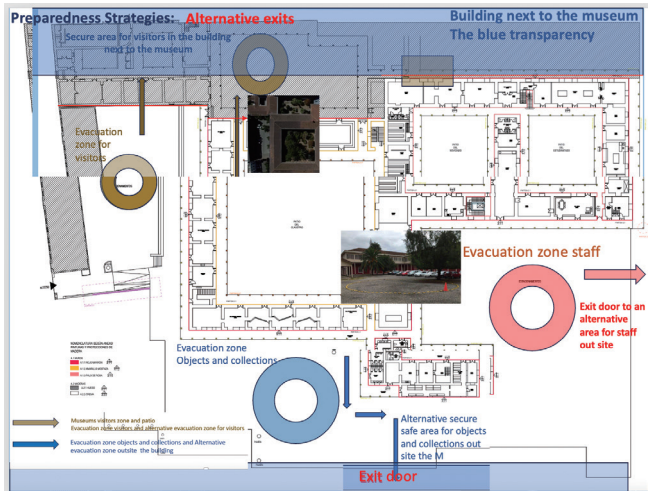

Fig. 2 Preparedness Strategies indoor and outdoor the site
Source: by the author

6. Recovery Planning

This Plan considers short, medium and long-term measures, at national and local level. At the national level it is mandatory to update the DRM people oriented to include cultural heritage working with the DIPRES (Budget Directorate), the Ministry of Public Works, the Ministry of National Assets and the National Monuments Council. Improving the composition of the National Disaster Prevention Service (law 21.364), by including a member of the Ministry of Culture and Heritage. Generate a project whose aim will be awareness, outreach and education on DRMs for cultural heritage.

At the local level: Create a building restoration team which must include architects (National Service of Cultural Heritage), conservators, museologists and an expert from SENAPRED (National Service of Disaster Preventions). Elaborate with the National Conservation Center, a plan to relocate objects in other institutions according to the categorization of level of damage in the event it is needed. Design three small exhibitions with objects from the museum's collection and library to be exhibited at other venues (public museums) to maintain the bond with the public and create awareness about DRMs for cultural heritage (this is a temporary measure because due to the level of damage the museum will be closed at least two years during the renovation of the building). Develop a National Training Course for cultural workers focused on mitigation and preparedness strategies for Cultural Heritage Recovery (practical implementation).

Conclusion

Tackling problems related to cultural heritage management is not primarily related to economic sources.

It is clear that proper coordination, precise sequencing of events and appropriate actions are much more important. Preventing events, always looking for alternative exits and safe spaces, involving the local community and training personnel are concrete and small actions that could evolve to modify a national law to be effective in the protection, conservation and management of cultural heritage for future generations. Therefore, as heritage professionals we must generate awareness at a national level to develop a national policy that includes cultural heritage preparedness and mitigation measures for risk assessment for cultural heritage and to assess the DRM for cultural heritage with other governmental entities in order to create a policy with national impact. Then, finally updating the DRM for cultural heritage at the National Service of Cultural Heritage will allow us to include public accountability among our duties in order to educate and share the results with public and private stakeholders.

Tab. 4 National and local mitigation measures

	Short term measures (1 year)	Medium term measures (1 to 2 years)	Long term measures (2 to 5 years)
National Level	• Create a committee of experts on cultural heritage to implement the first measures for the rescue and management of heritage in the face of possible disasters.	• Create a central unit that coordinates and incorporates all the other units in different ministries, articulating a single purpose and clear objectives in the medium and long term. • Update the current DRM at the national level because it is solely oriented toward people and does not include cultural heritage measures.	• Amend Article 6 of Law 21.364, which created the National Disaster Prevention Service, by including a member of the Ministry of Culture and Heritage. • Create a national unit in charge of the DRM to Cultural Heritage.
Local Level	• Set a protocols agreement with fire brigade in order to protect this heritage on site. • Include a DRM in the collection policy plan. • damage detection (categorization) with the National Conservation Center. • Relocate objects in other institutions according to the categorization of level of damage in the event it is needed. • Train security guards, museum staff, cleaning staff, volunteers.	• Set a DRM for Cultural heritage with an ISO certification. • Design and implement an annual calendar of drills in collaboration with firebrigade and other civil protections units.	• Complete the digital documentation of the library collection's highlights items. • Eliminate the building's old façade.

Source: by the author

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2.13 Disaster Risk Management for Siak Cultural Heritage Area, Indonesia

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1. Introduction

The cultural heritage area gives significant character to a city, particularly in maintaining the local cultural identity that still preserves historical values and remains of the past[1)], such as Siak Sri Indrapura City. Commonly better known as Siak City, it is the centre of the last Malay sultanate in the archipelago context and its connection with the history of the Malay peninsula and the Strait of Malacca. Siak City is also known as the centre of government of the last heirs of the Islamic Malay sultanate that controlled the inland trade route from Sumatra to the port between the nations of Malacca in the 18th and 20th centuries.

Siak City was founded in 1723, and the Siak Sultanate was established. With this age span, it can still find a clear urban pattern with zoning arrangements from the beginning time until today. There is a separation between the ruler's area, the community, and the immigrant areas. Freedom and tolerance in cultural life are still maintained today. This makes Siak City interesting as a city where traditional culture and religious rituals are inherited and practiced.

As a national cultural heritage city, this article presents how the Disaster Risk Management (DRM) approach can be implemented to maintain the city of Siak's identity and as a step of anticipation and preparation for the city and local communities in facing potential disasters[2)]. In this context, DRM can also be used as an alternative solution to problems related to treating heritage remains in the city[3)].

2. The Field Project Location and Risk Analysis

In recent years, Siak City has begun to develop and expand. However, the old area of Siak City remains the core and has a different cultural character from the surrounding development areas. With this consideration, the research area in DRM will be limited only to cultural heritage areas with clear administrative and legal status.

The study area is not a World Heritage Site but has been a national heritage area since 2018. According to the local regulation Siak Regent's Decree No. 240/HK/KPTS/2018 and Indonesia's regulation by SK Kemdikbud No. 164/M/2018[4)], this study area covers 142 ha. It is undergoing the Indonesia Urban Heritage Program, also known as *Kota Pusaka*[5)] (see Fig. 1).

The city generally experiences a summer season of approximately eight months in one year. This summer condition is often accompanied by an increase in scorching hot temperatures, which results in one of the causes of forest fires and building fires in the city of Siak. Both forms of summer consequences lead to air pollution with combustion residue particles that raise the city's temperature and worsen public health. In addition to the above, at least four months of rainy season occur yearly. The combination of high rainfall, loss of tropical forests as a buffer for surface water content, and land conditions due to fires have become factors[6)] that cause the potential for flash floods to hit the city of Siak every year.

Excessive heat conditions and high rainfall levels, as well as the loss of the surrounding forest's preventive power, have made Siak City increasingly vulnerable to various potential disasters that will be faced repeatedly, such as air pollution with hazardous particles, forest fires, and urban buildings. All of these can be seen as possible causes of the initial hazard that occurred in Siak City (https://riau.bps.go.id). The potential causes of this hazard can be described in the summary below (see Tab. 1).

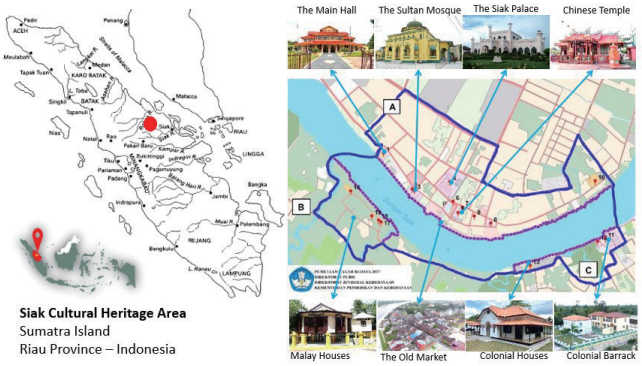

Fig. 1 Delineation of Siak Cultural Heritage Area
Source: by the author

Tab. 1 The Potential of Impact, Attributes, and Loss Values in Siak

Hazards		Vulnerabilities	Potential Impact	Attributes	Loss of Values
Primary	Secondary				
Fire	Explosions	Wooden buildings	Damage to building material	Remaining traditional style	Architectural, Aesthetical, Cultural
		Significant buildings	Lossing heritage buildings	Heritage Buildings	Scientific, Architectural, Economical
	Lootings	Urban form and space	Adapting traditions	Cultural and religious events	Aesthetical, Spiritual, Ecological, Economical, Religious, Cultural
Heavy rainfall	Flooding	Urban inundation	Accessibilities blockage	Road and bridge damage	Scientific, Ecological, Economical,
		Watershed erosion	Widening river	Losing river promenade	Spiritual, Biological, Ecological, Religious, Cultural

Source: by the author

3. The Scenario

The worst scenario simulates how disaster risk management could be presented in Siak City. As a form of anticipation and studying plans and actions in the context of DRM, a worst-case scenario was prepared that would hit the city of Siak. The scenario starts in August 2025 at the peak of the dry season. Initiated at 04:00 AM, a fire broke out in a group of old historical wooden buildings. The fire started in the morning due to a short electrical circuit. Continuing at 04:10 AM, with the wind blowing northwest at 30 km/h, the fire reached the chemical warehouse, causing a large explosion that could spread to the museum quickly —power outages during the fire limited communication and the early warning system, limiting residents' rescue options. Section (X) of the road is closed for annual maintenance and city fire hydrants are only located on the main road. At 07:10 AM, the firefighters controlled the situation three hours later. However, 72 wooden shophouses in the old market burnt (see Fig. 2).

4. Risk Mitigation and Preparedness Strategies

In responding to potential hazards in the city of Siak, such as fire, explosions, looting, heavy rainfall and flooding, it is essential to pay attention to various forms of mitigation and appropriate preventive efforts. Mitigation efforts and anticipatory preparation will involve multiple levels and scopes[7]. This can start from the level of policymakers and the planning sector, continuing to the scope of technical operations to raise awareness of the need for risk mitigation and preparedness measures as early and as responsive as possible[8-9].
The scale of interventions prepared also starts from a broader and higher level, the scope of the central government, city government, and the scale of implementing institutions to the level of the local community environment[10-11]. Furthermore, in addition to involving stakeholders at various levels and scopes, risk mitigation and preparedness strategies also consider how long it will take to implement from policy to operations in the field. It is no less important to pay attention to and provide good planning for the estimated costs required[12-13] (see Tab. 2).

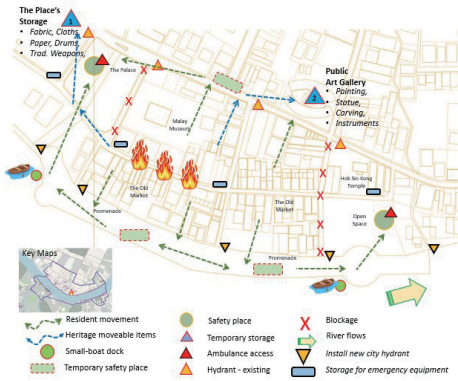

Fig. 2 The Worst-Case Disaster Scenario for the Old Historical Wooden Buildings
Source: by the author

Tab. 2 The Risk Mitigation and Preparedness Strategies

Hazards	Mitigation and Preparedness Measure	Scale of Intervention	Preventing Hazard	Stakeholder involved	Duration of implementation	Estimated Cost
Fire, Explosions, Looting, Heavy Rainfall, Flooding	**Policy** - Handling of harmful & hazardous materials	Institution	Wildfire, Fire, Explosion, Accessibilities Obstacles.	Municipality, City council, Local Leaders	< 1 Year	High
	Remapping and Upgrading for emergency facilities	Institution, Municipality		Municipality, City council	1 - 3 Years	
	Alternatives routes during construction / maintenance	Institution		City council, Local Leaders	1 - 3 Years	
	Planning - Review on zoning dan buildings function	Institution, Municipality	Fire, Explosion, Road Blockage, Collateral damage, Late respons.	Municipality, Site managers	1 - 3 Years	High
	Revise on city emergency facilities	Institution, Municipality		Municipality, Site managers, Safety inspectors, Community.	< 1 Year	Medium
	Revise on buildings permits and safety requirement	Institution		Municipality, Site managers, Building owners, Safety inspectors	< 1 Year	
	Technical / Operational - Improve on early warning system	Municipality, Institution, Neighborhood	Fire, Smoke, Lack of skills, Power outages, Late respons	Municipality, Site managers, Building owners, Safety inspectors, Community	< 1 Year	Medium
	Retrofit of buildings utilities system and building materials	Institution, Neighborhood		Site managers, Building owners, Community, Employee	1 - 3 Years	
	Alternatives for non-electric powered communication / local wisdom devices	Neighborhood, Community		Site managers, Building owners, Community, Employee	Periodic	Low
	Awareness - Awareness raising and community capacity building	Municipality, Institution, Neighborhood	Late respons, Lack of skills, Social cohesion	Building owners, Community, Employee, Visitors	Periodic	Low

Source: by the author

5. Emergency Preparedness and Response Measures

In preparing disaster risk and management plans, especially evacuation plans, attention must be paid to the spatial context and the existing character of Siak city zoning. Consideration must be given to the different levels between the overall city context and the context of the incident at a particular location[14].

Emergency preparedness and response measures for the overall city context are essential to see the role of the river that divides and simultaneously connects the two parts of the city, north and south of the river. The northern part of the city has a higher density level than the southern part of Siak city. This is also directly proportional to the availability of various facilities in dealing with emergencies and conditions, such as the availability of firefighters, hospitals, and police. In addition to reasonably good land access, the river body can be optimized and utilized to support when an emergency occurs, such as evacuation and watering from the river to the mainland of Siak City.

Meanwhile, the southern part of Siak City has a lower density level and lacks adequate urban facilities and infrastructure. Furthermore, it is quite clear that improving both access and facilities for preparedness to face emergencies in the southern part of Siak City requires more serious attention (see Fig. 3).

For the context of an incident at a particular site, emergency preparedness and response measures at least pay more attention to five critical keys, namely (1) awareness/education, (2) management/maintenance, (3) technical, (4) physical, (5) strategic level. In more detail, these five essential keys need to be adapted to

three stages in dealing with disasters, namely being applied at the pre-disaster stage, the during-disaster stage, and the post-disaster stage. Thus, emergency preparedness and response measures can be arranged and prepared more completely[15].

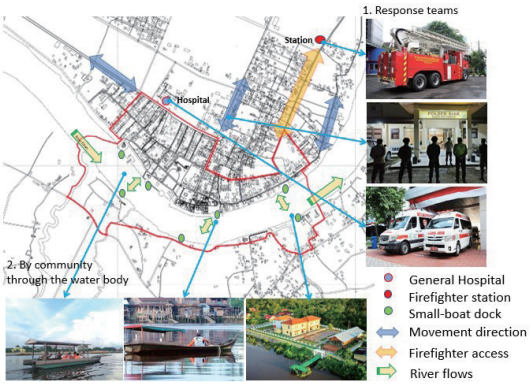

Fig. 3 The Spatial context and the character of Siak City
Source: by the author

6. Planning Measures for Recovery

There are at least two schemes in planning measures regarding a recovery plan. In the early-term recovery plan, several activities are planned, such as providing an early warning based on local wisdom[16-17], documenting the architectural style of buildings, and updating the fire prevention equipment[18]. Moreover, it is vital to prepare activities related to periodic community training and the first response volunteer training for local people[19-20], and it is essential to implement the DRM plan.

For the long-term recovery plan, not only should the building utilities system be retrofitted, but it is also possible to reconstruct the lost building as part of upgrading the building's emergency system. Another plan is to gather a fire brigade by and for the community[21-22]. The municipality is urged to construct an alternative access road and review the DRM Plan periodically.

7. Conclusions

Siak City has not become a world heritage city until now. However, the potential and spirit of maintaining local cultural identity through maintaining historical values and remaining of the past require proper guidance and planning. With the potential for hazards that are quite often present, the Disaster Risk Management approach provides an alternative solution for Siak City not only to maintain its identity and values but also a set of anticipation and preparation planning for the city and local communities in facing upcoming potential disasters.

Acknowledgment

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2.14 The 1730 Jesuit House of the Parí-an District of Cebu City

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1. Introduction

(1) Background

The 1730 Jesuit House is an *arquitectura mestiza* (architecture of native Filipino, European and Asian design) house structure that is located in the Parí-an District (now Barangay Parí-an) of Cebu City, Cebu Province, Republic of the Philippines. The old Pari-an District was once a Chinese enclave in Cebu established by Spanish colonizers and was linked to a Catholic parish established during the early 17th century. Once a separate town (*pueblo*) in the Spanish settlement of Cebu, the Parí-an served as the commercial center of the settlement. Though it is still unknown when exactly the house was built, but as per relatively recent archaeological excavations revealed shards of centuries-old trade ware, human remains and coins from the Ming Dynasty underneath the house posts. Most probably, this house with its upturned roof corners and decorative finishes was built by a Chinese merchant family. In the 18th century, the house was supposedly bought and occupied by the Society of Jesus, a Roman Catholic religious order who were involved in missionary work in the Philippines. It was a *residencia*, an administrative house for the Jesuits who were working the Visayan region. The Jesuits lost the house when they were expelled from the Philippines in 1768, and their properties were appropriated by the secular Roman Catholic Church administration.

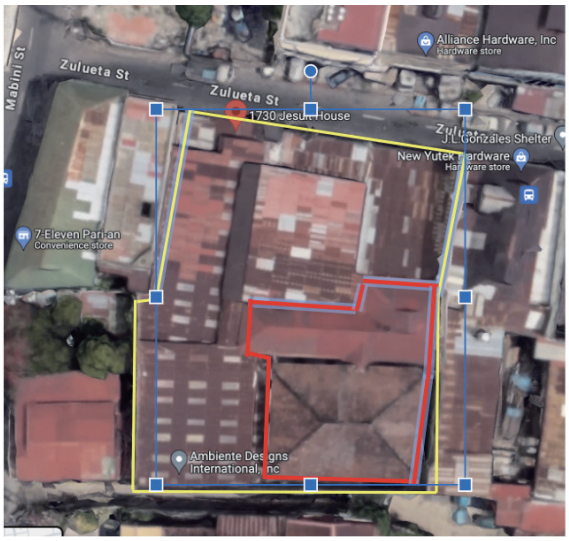

Fig. 1. 1730 Jesuit House with core (red) and yellow (buffer zone)
Source: Google Maps

Not much is known about the house from the time of the Jesuits, until the Alvarezes, a Spanish family, bought the house in the mid-19th century. From that period, more information can be culled - the house served as the headquarters for the United States Armed Forces of the Far East and it once was a private gastronomic club. In the 1960s, the house was bought by the father of Jaime Sy, present owner. A warehouse structure of concrete and galvanized iron sheets was then constructed around the 1730 Jesuit House. The warehouse and house served as storage for their business Ho Tong Hardware. During the ownership of the Alvarezes or the Sys, no major attempts were made to rehabilitate the house. So it re-

mained relatively untouched for many decades.

2. Values and Risks

(1) Values Assessment

The fact that the house is a two-story *arquitectura mestiza* masonry structure is a rarity in a country plagued by frequent earthquakes. In fact, in the City of Cebu where the 1730 Jesuit House is located, about two earthquakes are experienced every other day. In the capital of Manila, early in the colonization by the Spanish, by the end of 17th century, the Spanish Colonial Administration discontinued edifices that were constructed entirely in masonry. Instead, the government limited masonry construction to the ground floor with the upper floors of wood. Perhaps the Jesuit House is much older as it conforms to the former construction method of the early colony or perhaps simply that these building requirements were not adhered to.

Other values that the house contains are the evidence of technology and design from China. The roof has upturned corners and is constructed of *tisas*, terracotta roof tiles, and the roof joinery resembles dougong roofs. In this type of system, each element of the dougong system is fastened without the use of static fasteners but relies on friction and gravity to absorb seismic or typhoon-generated energies.

The *reliebes* throughout the house also bring great, exceptional symoblic and artistic significance. The Jesuits came to the Philippines partly because they were missionaries with their sights set on China, so to establish their *residencia* in the Parí-an was fitting. This physical evidence has great importance for the house's most important period of significance. Among the *reliebes*, there are three on the former gate entrance of Jesus Christ, Mary and the insignia of the Society of Jesuit; it is only the *reliebe* of 1730 that is inside the house. These symbols speak of the conversion of the native Filipinos into the only Christianized nation in Asia and the missionary intentions of the Jesuits.

(2) Risk Assessment and Analysis

The Republic of the Philippines is subject to many hazards since it sits on the western Ring of Fire and experiences seasonal typhoons. The combination of these hazards oftentimes leads to compounded disasters increasing the difficulty in recovery. Main hazards for the 1730 Jesuit House are earthquakes, floods, typhoons, fire, and volcanic activity.

When the house's vulnerabilities are exposed to hazards, significant features and attributes of the heritage asset may include loss of objects, building materials, and their associated values. These vulnerabilities can be attributed to human or natural factors. For the 1730 Jesuit House, its location in a former swamp, poor infrastructural development, and lack of awareness of cultural heritage are among the vulnerabilities that it experiences.

The most frequent hazard is flooding. The southern boundary of the house and the ground floor museum is where flooding is regularly experienced. Any seasonal heavy rains and typhoons can possibly cause flooding. Flooding acts on the lack of adequate drainage system, non-absorbent roads and parking lots, and garbage-filled rivers and estuaries.

In 2022, category five Typhoon Odette made landfall across the Eastern and Central Visayas; a combination of high winds and a deteriorating roof caused the roof tiles to dislodge and fall, creating a large hole and destroying historic materials. To date, because of the lack of emergency funds for private heritage properties in the Philippines, the roof is only protected by tarpaulin and an improvised fastening system.

Another primary hazard but less common one is impact caused by heavy machinery and storage of heavy stocks and supplies within the warehouse and adjacent to the 1730 Jesuit House. Plans were to move storage to the neighboring building, but because of the pandemic, business was lost and therefore employees were laid off. This prevented the relocation of these potential hazards to mitigate any possible negative impacts.

3. Disaster Mitigation

(1) Mitigation Proposals and Planning

Knowing the risks present at the 1730 Jesuit House gives ideas on how to mitigate them as it is important to be proactive before a natural or human-induced event takes place. The programming for mitigation strategies spans about ten years broken up into periods of six to two years, two years to six years, and six to ten years. It is important for the owner to phase in these plans, as up-front, the expenses would be insurmountable. Arguably, one of the biggest challenges for the 1730 Jesuit House is financial sustainability. This in turn translates to a limited capability in terms of adopting museum-scale hazard control mitigation systems. As indicated previously, the surrounding warehouse serves both as a means of sustainability for the owners (to some extent, the museum itself) and as a secondary hazard. This creates a unique conundrum wherein removing the hazard would also lead to sustainability problems for the museum. To address this puzzle in balancing the necessity for mitigating the risks and to ensure that the museum keeps its lights on, there is a three-pronged approach in planning for short-term and long-term measures.

As shown in Fig. 2, art of integrating into the community is also bringing general awareness of the heritage site; this ensures that people know about the significant structure and, with more people cognizant, there will be more immediate responses if a hazardous situation presents itself. Also, another tactic is to offer the community some knowledge and insight about their local heritage with historians, academics, practitioners, culture bearers, stakeholders, and heritage conservationists so they can have a more theoretical and practical understanding of how mitigation works to prevent catastrophic events. Community leaders and local politicians also play an important role in mobilizing the locality in the museum's nearby areas. Local government agencies also possess the mandate of implementing wide-scale DRRM plans in the area.

Mainstreaming of DRMCH initiatives is considered a longer process as integration into the local DRRM units in Cebu City may take some time to develop a partnership and for the local DRRM units to understand concepts of DRM for Cultural Heritage. As DRMCH has its own priorities, it may take some close coordination, resource allocation, and knowledge cascaded on both sides of the partnership to arrive at policies that recognize the importance of heritage and how heritage can build resilience for communities even at times of disaster.

One interesting approach in the mitigation process is the concept of heritage therapy which is practiced and owned by the community. The approach also helps build community cohesion. These expressions of intangible heritage are sources of identity and belonging, hastening organization within the community to address loss and disruption. And in the neighborhood of Barangay Parian community members still possess a strong sense of tradition through their cultural activities and rituals which date back centuries.

Another idea is to develop a more sophisticated heritage community wherein local community members can work together with the 1730 Jesuit House and neighboring heritage institutions. Together with nearby neighboring museums (Casa Gorordo Museum and Yap-Sandiego Ancestral House), the museum joins in the spearheading of the creation of a Cebu Heritage District which was initiated by the Cebu City government in 2023. A local ordinance also ensured the implementation of the project that serves as a guide in the development of the area to promote tourism activities and boost the local economy.

With these strategies for the community, then vulnerabilities are lessened: increased awareness of the benefits of culture and heritage to the urban public, increased participation in culture and museum affairs, alleviation of some economic disadvantages, and increased interest in culture and heritage as a development driver at the governance and community level. Conceivably, the museum's biggest asset in mitigating risks in its tangible heritage is its partnership with key shareholders of local heritage. This is evidenced with the owner's membership in the Cebu City's Heritage Council and close ties with neighboring museums also ensure a shared coordination in risk mitigation.

DISASTER RECOVERY AND MITIGATION PLAN (10 YEARS)			
Time	**Community**	**Site**	**Collections**
6 – 10 Years	- IEC Campaigns: Establish a "Stewards of Heritage" program: community members work together with Jesuit House and the other heritage sites Vulnerabilities addressed: - Awareness of benefits of culture & heritage to the urban public; - Community participation in culture & heritage and museum affairs Alleviation of socioeconomic disadvantages; - Interest in culture & heritage as a development driver at the governance level & community level	**Earthquake/Fire Mitigation** Removal and relocation of combustible construction materials such as wood and paper to another warehouse/open area. **Flood Mitigation** Repair and expansion of drainage system in museum and local community area. **Warehouse** Remove all metal and wooden construction material stocks from the warehouse **Drills and Simulations** Conduct joint community-scale emergency drills together with LGUs and partner museums Museum staff conduct trainings with other local heritage workers	**Collections Security** Displays are stable and safe from falling by using countermeasures sucn as retrofitting Digital catalogue of museum collections together with its present conditions and other variables **First Aid for Heritage** Conduct regular drills on collections evacuation, assessment, and monitoring **Conservation** Establish an area within museum site for a conservation laboratory Revisit site floor/area plan to determine a space for the conservation lab to be constructed
3-5 Years	Seminar and lectures on heritage preservation with historians, academics, practitioners, heritage workers, and heritage conservationists, for the local community. **Partnerships and Relationships** Cooperation with municipal DRRM unit **Heritage Therapy** ICH activities to develop a sense of community and to boost morale within the Parian area in times of disaster	**Earthquake/Fire Mitigation** New fire mitigation systems such as exterior misting Emergency evacuation signals **Flood Mitigation** Cleaning of site and community drainage systems together with local officials and community members. **Warehouse** Task force dedicated to clean the local community's waterways **Drills and Simulations** Conduct regular quarterly fire, flooding, earthquake, and collections security drills with warehouse and café personnel. Undergo DRMCH trainings for museum staff and warehouse personnel	**Collections Security** Policy to restrict access to inventories or areas of storage for collections Security monitoring equipment Information security and data privacy measures for digital catalogues and other archival documents. **First Aid for Heritage** Staff to join trainings and acquire learnings and methodologies in collections evacuation, assessment, and monitoring **Conservation** Collections/Artifacts Conservation specialist with the appropriate level of competencies
6 Mos. to 3 Years	- Communication plan for information dissemination about the site and build a strong social media presence - Cooperation with Fire Department - DRMCH partnerships with other Heritage sites - Inventory and documentation of ICH of Jesuit House and Parian	Repair/Replace broken plumbing and electrical systems **Earthquake/Fire Mitigation** Briefings on museum safety and security for museum guests Monitoring and enhancement of existing fire mitigation systems **Flood Mitigation/Warehouse** Museum and warehouse drainage systems clearance *Vulnerabilities Addressed* > Lack of expertise > Lack of disaster preparedness > Weak safety and emergency protocols > Low availability of public/community emergency mechanisms & services > Culture of complacency > Location near sea > Lack of security protocols > Lack of monitoring equipment **Drills and Simulations** Regular quarterly fire and earthquake drills. DRMCH Training modules in consultation with experts and DRMCH professionals.	**Collections Security** Basic CCTV camera and monitoring equipment Collection conditions checklist **First Aid for Heritage** Comprehensive inventory of museum collections and assessment of the conditions of the collections **Conservation** Comprehensive inventory of museum collections with the conditions of the collections **Collections Security/First Aid for Heritage** *Vulnerabilities addressed*: > Lack of expertise > Lack of disaster preparedness > Weak safety and emergency protocols > Low availability of public/community emergency mechanisms & services > Culture of complacency > Location near sea > Lack of security protocols > Lack of monitoring equipment
	HAZARDS ADDRESSED Agents of Deterioration (slow) Typhoon Earthquake Volcanic eruptions	**HAZARDS ADDRESSED** Agents of Deterioration (slow) Typhoon Earthquake Volcanic eruptions Compromised materials Theft and Vandalism	**HAZARDS ADDRESSED** Agents of Deterioration (slow) Typhoon Earthquake Volcanic eruptions Compromised materials Theft and Vandalism

Fig. 2. Ten-Year Disaster Mitigation Plan
Source: by the authors

(2) Emergency Preparedness Planning

The goal of planning is to identify key personnel, resources, and create policies: these are to organize the community actors, set physical and non-physical means to lessen inherent vulnerabilities, and encourage a change in the way of thinking about a post-disaster future that is both resilient and sustainable.

At the pre-disaster phase, when trying to minimize risks and lower vulnerabilities, development of emergency response plans that consider not only physical loss to a heritage asset but also for the safety of its occupants. There are some preventive warning systems for fire at the Jesuit House that are part of the fire suppression system that was recently installed in the interior of the house. During this pre-disaster there is also the opportunity to capacity build through training and drills and increasing community awareness of this hazard. Of course, management of resources is key to responding effectively; and, for the Jesuit house, there are adequate supplies for shoring, scaffolding, and other materials needed after a disaster.

Second to this is a response to disasters whose priority again is human safety followed by plans for steps for post-disaster first aid which requires securing inventories, bringing all documentation, turning off utilities and securing the location to prevent injury or thefts. Right now, there are some inventories, but all are not completed at the Jesuit House. Routes and evacuation sites were identified for this stage for both humans and collections/building materials.

The last stage in this emergency plan is forward-looking and starts with assessing the damage, if any, that was incurred, and consulting professionals and trained individuals to investigate damage to the building.

This point is also when first aid for heritage collection occurs. The salvage and recovery can be guided by the inventory from the museum and can be reconciled with the recovered items. Lastly, this is also a critical moment when intangible cultural heritage takes place; if the community lost their shelter, possessions and any means of survival, heritage and especially local cultural practices may help therapeutically and galvanize the community together.

4. Conclusion

The process of identifying the risks and as well as analyzing the vulnerabilities they create have been deemed essential in mitigating the impact of disasters in cultural heritage. Exercises such as planning, simulations, and case studies enable practitioners in the field to develop the necessary expertise in DRMCH. However, enabling the local community would prove to be a strategic approach when it comes to protecting the cultural heritage value of a site like the 1730 Jesuit House. A holistic approach in activating the community to protect local culture and heritage would not only mean equipping them with the right tools and skills, but to also fundamentally increase their appreciation in protecting these tangible and intangible heritage assets.

However community engagements remain to be an outlier solution to a common problem of the lack of cultural appreciation. For the museum itself, it must be dynamic in its risk mitigation measures as it would involve resources which it could not yet attain. Although simple measures like upgrading its existing mitigation controls would be a practical start towards the right direction, another practical approach would be to continue its planning and assessment of the physical conditions of the house museum through thorough reviews on its Conservation Management Plan which has as a component of cyclical maintenance, documentation, analysis of significant features of the heritage assets, and conditions assessment.

Nevertheless, the road to the implementation of a coherent disaster risk mitigation plan for the 1730 Jesuit House is an arduous yet fruitful path. Its history and cultural significance in terms of Cebu's 18th century architectural legacy makes the site a beacon for experts to further study different approaches in protecting its structural integrity. The museum, undisputedly among the country's oldest houses, could be considered a prime example in determining the right balance between protecting its cultural legacy and sustaining it. With this in mind, it is essential for DRMCH plans to be adaptable and flexible to address problems, not only limited to the site itself, but to the wider local community as a whole.

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2.15 Disaster Risk Management Plan for The Crusader Citadel in Tartus Syria

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Fig. 1 Crusader Citadel main façade
Source: Taken by the author

1. Introduction

(1) Historical overview

The history of Tartus dates back to Phoenician times when it served as a suburb to the nearby thriving island of Arwad. Over the centuries, it came under the rule of various civilizations, including the Hellenistic, Roman, Persian, and Arab empires. During the Middle Ages, the city rose to prominence under Crusader rule. The studied site, originally an older fort, was rebuilt and expanded by the Knights Templar in the 1150s to serve as their headquarters in the County of Tripoli, where Tartus was located. This continued until the Crusaders were expelled from the Levant in 1291.CE[1)]. Over time, under Mamluk rule (1291–1516 CE) and later Ottoman control (1516–1918 CE), the site transitioned from a defensive stronghold to a residential area. The citadel became the historic center, with new structures, mainly houses, built atop and within Crusader buildings. Existing Crusader structures were repurposed to serve new functions. This project focuses on the historic center within the original citadel's boundaries and the medieval city's cathedral, which now functions as a museum.

(2) Site Management

Since the retreat of the crusaders until the beginning of 20th century, the development of the site took an organic pattern. It is during the French mandate (1920–1946) that a comprehensive plan for the management of the site was made[2)] and ever since it has been treated as a site with cultural significance. The citadel was registered among the archaeological buildings and sites in Syria in 1959, and according to a later decision in 1999, any restoration work, demolition or building addition was prohibited, without prior permission from the archaeological authorities, an act that took place the same year the citadel was put on the UNESCO tentative list. A decision was issued in 1988 to form the Committee for the Protection of the Old City, and it was later amended in 1999 and 2004. After 2011, although not affected directly by the war, the property has deteriorated rapidly due to misuse, and incompetent restoration.

Fig. 2 Plan of the original Crusader Citadel
Source: Adrian J.Boas Crusader Archaeology[3].

Fig. 3 The site in the present
Source: Google Earth

(3) Attributes and Values

The site is a remarkable example of Crusader defensive architecture, showcasing the Knights Templar' innovative military techniques[4]. The cathedral, among the best-preserved Crusader religious structures, reflects the dual military and religious nature of the Crusaders. Built in Romanesque and early Gothic styles, it features defensive elements, such as arrowslits, within a sacred building. Over the centuries, the site has exemplified adaptive reuse, demonstrating the ingenuity of the local community. Generations repurposed materials and structures, creating a layered palimpsest. Notable examples include late Ottoman three-arched Beiruti houses built atop Crusader walls (Fig. 4) and a hammam constructed next to the Crusader keep (Fig. 5).

Fig. 4 Ottoman house on crusader wall

Fig. 5 hammam next to the keep
Source: taken by the author

Fig. 6 The cathedral, currently a museum

2. Disaster Risk Assessment

To our knowledge, there is no Disaster Risk Management plan for the Citadel. In fact, the citadel has been increasingly neglected in the last decade due to weakened national institutions, economic crisis and decline in tourism. These factors increase the chances of natural hazards to become disasters.

(1) Primary Hazards

Built cultural heritage in the city is threatened by a verity of natural hazards. The most important of which is earthquakes. Cities on the coast of the Levant have been hit by devastating earthquakes since antiquity[5]. Secondly, the armed conflict in Syria has had immense impact on cultural heritage, whether directly, like heritage destruction, or indirectly, like the increase in looting and illicit traffic. In addition, climate change is also causing increasingly serious threats such as the rising of sea levels[6] and wild fires that have been occurring in a regular pace, which threatens natural heritage and intangible heritage, specifically the

ones relying on timber such as ship making.

(2) Secondary Hazards

Secondary hazards that might occur after earthquakes include a tsunami, and possibly looting in case the museum is damaged. Additionally, one of the main impacts of the armed conflict is the significant increase in illegal construction of houses, vandalism and poor maintenance.

(3) Vulnerabilities and risks

The main factors that cause the site to be fragile to the natural hazards can be divided into two groups. The first is institutional which can be applied on many heritage sites in general which include ad hoc management policies, economic and political instability, conflict of interest among stakeholders, poor vertical and horizontal coordination. The second group is more structural and related to the site per se, such as deteriorated materials, illegal construction and misuse, overcrowdedness and limited accessibility to the site by vehicles.

If a natural hazard hits under these circumstances, the impact would be overwhelming. The primary concern is the potential loss of lives among both residents and visitors. Clearly, there's a significant risk to the archaeological, artistic, and historic value of the buildings and to the objects in the museum. Yet, the community is at major risk; many residents are in the old city with a precarious legal standing, and any disruption could irreversibly upset the delicate balance, paving the way for gentrification to reshape the social landscape.

3. Disaster Mitigation: Before, During and After

(1) Worst Case Disaster Scenario

On January 31st around 1 am, a magnitude 6.8 Mw earthquake hit the eastern coast of the Mediterranean. It lasted for 15 seconds. Concrete houses and extensions collapsed immediately and some stones from the vaults fell. The lintel of the Cathedral door collapsed and many stones from the tympanum, voussoir and jambs fell as well. The Inhabitants in the citadel gathered in the central court unable to escape and ambulances and paramedics were unable to enter the site. Debris from the collapsed concrete structures have landed on the dome of the hammam, threatening its stability. The damage in the museum's main gate has made it possible for a person to enter, making the collection vulnerable to looting.

(2) Before disaster: Mitigation and Preparedness

In order to reduce the impacts of the proposed scenario while considering the current conditions of the site and its vulnerabilities, various measures could be taken as shown in the table (1).

(3) During disaster

Based on the characteristics of the site and the associated risk, it would be important to the follow these measures in order to reduce potential losses:

a) Provide assistance to rescue teams during the search for survivors and assign specific tasks to trained people from the Directorate of Antiquity and Museums (DAM).
b) Evacuate the displaced to immediate shelters as a first step before placing them in temporary shelters.
c) Coordinate with the concerned services (civil defense, security forces…etc.)
d) Prepare a preliminary damage assessment to the main site components.
e) Publicize the most urgent needs to maximize benefit from immediate humanitarian response.
f) Place barriers to block unauthorized access to the museum to prevent looting and vandalism.
g) Apply temporary protective measures and stabilize.
h) Collect any pieces of significance such as architectural details and store properly.

Tab. 1 Mitigation and Preparedness

Mitigation type	Measure	Scale	What is mitigated?	Actors	Duration	Cost
Technical	Stuctural mapping of the site's components	The site	• Loss of lives • Reducing harm of people and paramedics	Municipality, DAM, key figures from the population	Medium	Medium
	Stabilization and retrofitting along safety tracks and within houses					High
	Identify possible evacuation spaces and create clear evacuation tracks			Municipality, DAM Investors CH organizations, Legislators Local communities	Medium	Medium
Maintenance and monitoring	Reduce deterioration agents (vegetation, unsustainable materials…)		- Loss to the site's authenticity - Loss of historical knowledge	Municipality, DAM CH organizations Local communities	Medium (frequent)	High
	Set up a monitoring system	The Cathedral	- Looting - Loss of historical knowledge	DAM, CH organizations, Local community,	Short	High
Policy	Awareness and education: • Diversification of the function • Workshops and onsite lectures	City, province	- Looting - Loss of the archaeological site - Loss of intangible heritage - Loss to the site's authenticity - Loss of historical knowledge	NGOs and heritage organizations Schools and universities	Medium	Medium
	Training for: • Inhabitants • Employees of various backgrounds			Municipality, DAM, NGOs and heritage organizations		
	Prepare DRM for all CH sites					
Urban Planning	Incorporate heritage sites into urban and regional management	City, province	- Social inequality - Illegal construction - Overcrowdedness - Misuse	Ministry of Public Works and Housing, Muncipality, Urban planning commitees, tourism services	Long	High

Source: by the author

(4) After disaster: Recovery

The recovery of the site might be a long and thorny process coupled with many challenges. As mentioned previously, some residents might face legal challenges to return to their homes and the event might be taken as an opportunity by entrepreneurs to take control. This might contribute to further urban violence and inequality which is already contributing to the deterioration of the site. For this reason, it will be important to promote the history and memory of the local community and their integration with the site and to take advantage of solidarity among the inhabitants.

In addition, recovery would take place on several stages which differ in timeframe and methods of execution. Recovery measures can be divided in two groups as follows:

Short term recovery measures which include:

a) Documentation and assessment:

- Evaluate the extent of damage to the site's main components and identify the structures whose destruction affected the most people.
- Conduct a thorough safety assessment to identify hazardous conditions

b) Train knowledgeable volunteers (Students from the faculties of architecture, archaeology and tourism).
c) Stabilize damaged or unstable structures with the appropriate methods such as shoring to prevent further damage or collapse.
d) Restrict access to unsafe areas to ensure safety.

Long term recovery measures which include:

a) Incorporate Disaster Risk Management into the management of the site and urban planning of the city.
b) Ensure legal protection is in place to prevent development at the expense of heritage.
c) Involve local communities in the rebuilding process to build capacities and offer job opportunities.
d) Implement educational programs to engage the public in the site's history, significance, and ongoing restoration efforts.
e) Encourage the involvement of heritage organizations in Syria and the region
f) Continuously monitor the site's condition during and after restoration.
g) Encourage research about the site's history and valorisation.

4. Conclusion

The Crusader Citadel in Tartus is a symbol of centuries of cultural, architectural, and social history, highlighting the creativity and resilience of its people. The site shows how different civilizations, from the Crusaders to the Ottomans, shaped Tartus and its heritage. Today, the Citadel faces serious issues, including neglect, misuse, environmental threats, and weak management. These problems are made worse by the lack of a clear plan to protect the site, leaving it exposed to risks like earthquakes, climate changes, looting, and unregulated construction. Protecting the Citadel requires a well-rounded plan that includes proper city planning, strong legal protections, and actions to prepare for disasters. With the right efforts, the Citadel can remain a valuable part of Tartus's history and culture for years to come. Given the current situation in Syria, it is both realistic and crucial to involve the local community in any preservation efforts, making them an integral part of the planning process. The people who live in and around the site often face challenges to their presence, and their efforts to maintain the Citadel and its rich history are frequently overlooked. This involvement is not only necessary for the site's preservation but also for acknowledging the local community's role in safeguarding their shared heritage.

Acknowledgment

I would like to express my sincere gratitude to the organizers of the ITC program, as well as to all the esteemed lecturers involved. I also thank my fellow participants who made this experience more enjoyable. I extend my thanks to my colleagues at the Directorate of Antiquity and Museums and the Directorate of the Old City for their valuable support. Lastly, I want to acknowledge and appreciate the warm reception and help of the residents of the old city of Tartus.

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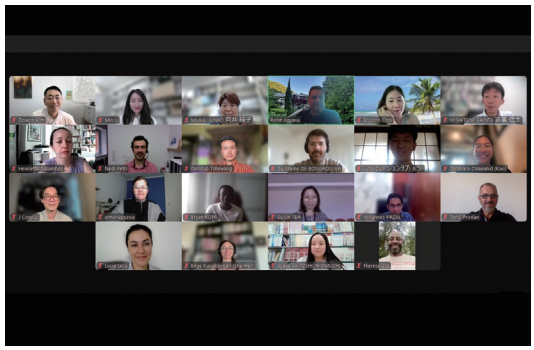
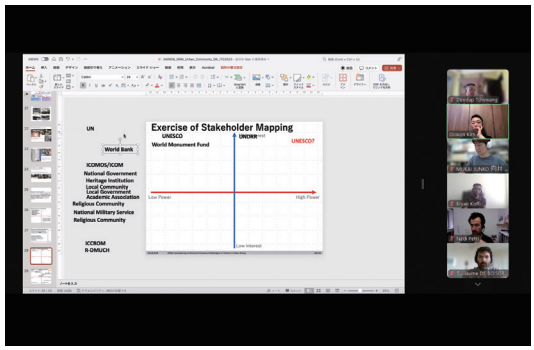
3 Appendix

Photos of ITC 2024



Group photo at the online session

Group photo with the Chancellor of Ritsumeikan



Workshop at online

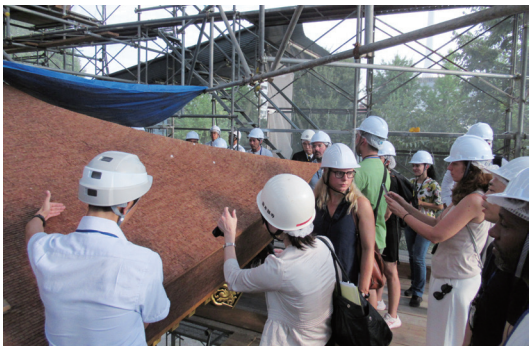
Lecture at Rit-sei community center

Site visit in Ponto-cho area

Workshop about the risk assessment

Lively discussion by participants

Lecture by Prof. Yoshitomi at Shinran-hall



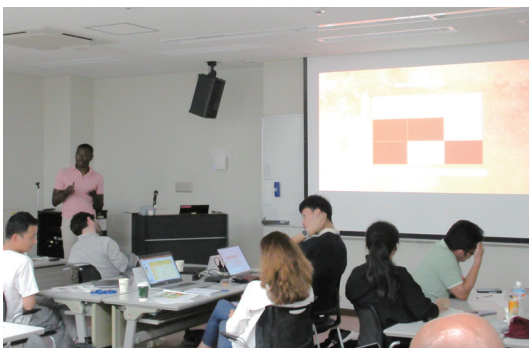
Site Visit at Restoration site of Bell Tower in Higashi-Hongan-ji

Site Visit at Kyoto National Museum

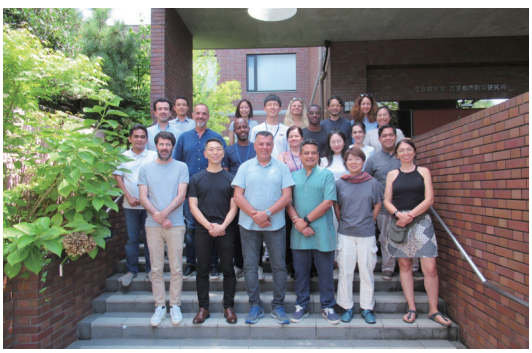
Group photo at Meiji-Koto-Kan in Kyoto National Museum

Workshop about Rescue of Movable Cultural Heritage

Group photo at Old Domoto-house



Mid-term Presentation



Group photo in front of R-DMUCH

Site Visit at Sawanotsuru Sake brewery

Seismic isolated structure under Sawa-no-tsuru Sake brewery

Site Visit at Disaster Reduction and Human Renovation Institution

Site Visit at Moegi-no-yakata

Site Visit in Hirafuku area, Sayo-cho

Workshop of recovery planning

Lecture by Dr. Ang

Case study working

Final presentation

Previous International Training Courses (2006-2023)

ITC 2006

In 2006, which was the first year for this course, eight participants from four countries were invited; namely India and Pakistan, which were struck by a great earthquake in 2005 in Kashmir; Indonesia, which suffered the Indian Ocean Tsunami triggered by the Sumatra Earthquake in 2004 and the Earthquake on the Javanese Island in 2004; and Korea, which had suffered a big forest fire.

ITC 2007

In 2007, R-DMUCH exchanged MOU with ICCROM and established a criterion for choosing participants with the support of ICCROM. As a result, eight trainees from Bangladesh, China, Peru and Philippines were invited for the training course.

Based on the experience of 2006 training course, it was decided to make a closer relation between the lectures, site visits, and workshops. Therefore in 2007, several related sets of lectures were held in the mornings and workshops in the afternoons. Based on these, discussions were facilitated by the instructors so that the trainees were able to reflect more effectively on the challenges for cultural heritage disaster management within their own context.

ITC 2008

The 2008 training course actively built upon the rich experience gathered during the courses held in the previous two years. This year had participants from five countries from Asia and Europe, namely Nepal, Bhutan, Iran, Serbia and Chinese Taipei. Effort was made to make this year's course, more field-based by drawing upon the unique opportunity offered by the location of important World Heritage Sites in Kyoto such as Kiyomizu-dera and Ninna-ji temples. Most of the workshops were, therefore, based on field work undertaken by the participants in these sites. This year's course also put greater emphasis on exposing the participants to the **methodology for undertaking disaster risk assessment for cultural heritage sites.**

ITC 2009

The 2009 training course further evolved on the basis of rich feedback provided by the participants of the training courses from previous years. In response to the need for making the course more relevant to specific requirements and constraints of the developing countries, it was decided to organize the course partly in Japan and partly in Nepal.

Moreover, for the first time, the training course had a specific theme, namely **"Earthquake risk management of Historic Urban Areas".** For this purpose, Kyoto and Kathmandu, two historic cities with rich cultural heritage but extremely vulnerable to earthquakes, were chosen as the case study sites for undertaking field exercises during the training course.

The first week of the course was organized in Japan and it focused on familiarizing the participants with the basic methodology for risk assessment and management for cultural heritage properties. The participants were shown various disaster prevention facilities developed for numerous cultural heritage sites in Kyoto. Second week in Kathmandu focused on the earthquake vulnerability and capacity of the World Heritage Monument Zone of Patan and its surrounding historic urban area, both at building and area levels. The UNESCO Chair programme was built upon the four years of very rich experience gained through very active participation of lecturers from Japan and abroad, as well as the international participants from various countries from Asia, Europe and the Caribbean and was further enriched by the contents of the training course in subsequent years.

ITC 2010

Fifth UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage 2010 was held from 13 to 26 September 2010 in Kyoto, Kobe and Sasayama, Japan. In the light of destructive Haiti earthquake on January 2010, this fifth International Training Course especially focused on **emergency response and long term recovery of wooden and masonry composite Cultural Heritage from disasters**. It was attended by 11 participants from 5 countries; Bhutan, Palau, Peru, Serbia and Turkey.

On the final day of the course, the international symposium titled "How to protect Cultural Heritage from Disaster; Risk Preparedness and Post Disaster Recovery" was organized by Ritsumeikan University and the ICOMOS International Committee on Risk Preparedness (ICORP). In the symposium, the current challenges for protection of cultural heritages taking into account the context of post disaster recovery was discussed in great depth with international experts from UNESCO, ICOMOS, ICORP and a representative of Kyoto-Gokoku-ji Temple; World Cultural Heritage site in Kyoto.

ITC 2011

Sixth UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage was held from 10 to 24 September 2011 in Kyoto, Kobe and Tohoku area of East Japan. In the light of increasing vulnerability of rapidly urbanizing settlements, the course focused on **"Integrated Approach for Disaster Risk Mitigation of Historic Cities".** The course was attended by 11 participants from 8 countries; Columbia, Jamaica, Kenya, Uganda, China, Mexico, India and Bangladesh.

ITC 2012

Seventh International Training Course on Disaster Risk Management of Cultural Heritage held during September 2012 in Kyoto, Kobe and Tohoku area of East Japan focused on sustainable recovery of cultural heritage. Accordingly the theme of the course was **"From Recovery to Risk Reduction for Sustainability of Historic Areas"**.

ITC 2013

The theme of the 8th UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage was **"Reducing Disaster Risks to Historic Urban Areas and Their Territorial Settings through Mitigation"**. The course focused on policies and planning measures for mitigating risks to cultural heritage from multiple hazards such as earthquakes, floods, landslides and fires, especially in rapidly urbanizing context of developing countries. Special techniques for mitigating risks from earthquakes and fires were also highlighted besides policies, planning and design interventions for long term restoration and rehabilitation of cultural heritage following disaster through a special workshop in the area affected by the Great East Japan Disaster in 2011.

ITC 2014

One of the main reasons for extensive damage to cultural heritage is due to fires resulting from natural (bush/forest fires) or human induced causes (arson, chemical or bomb explosion, poor electric wiring or during renovation works). Also fires can result from earthquakes as was the case during 1995 Great Hanshin Awaji earthquake in Japan. Considering these issues, the 9th UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage focused on **"Protecting living cultural heritage from disaster risks due to fire"**. Policies and planning measures for reducing fire risks to cultural heritage especially in rapidly urbanizing context of developing countries, special techniques for fire prevention and mitigation, emergency response as well as interventions for long term restoration and rehabilitation of cultural heritage following disaster were discussed during 2014 course.

ITC 2015

Earthquakes and floods cause immense damage to cultural heritage. Recently devastating earthquakes in Nepal in 2015, 2013 earthquake in Philippines, North Italy earthquake of 2012 caused vast damage to cultural heritage. Moreover 2014 floods in Balkan region, 2011 floods in Thailand and 2010 floods in Pakistan also caused damage to historic towns and archaeological sites such as Ayutthaya. While vulnerability of cultural heritage to earthquake and floods is increasing more than ever before, there are many examples of traditional knowledge systems developed by communities for mitigating against earthquakes and floods. Considering these issues and challenges the 10th International Training Course focused on **the protection of cultural heritage from earthquakes and floods, and other associated hazards**.

ITC 2016

Climate change is increasing the frequency of disasters caused by hydro-meteorological events such as heavy rainfall, flash floods, cyclones, typhoons and storm surges. As a result, many heritage sites located in global hot spots such as coastal areas especially below sea level are exposed to risks of inundation greater than ever before. Also, there might be low frequency high intensity incidents of flooding that may trigger landslides along mountain slopes. Moreover, climate change resulting in higher temperatures increased incidents of wild fires putting cultural heritage located in forested areas to greater risk than ever before. The 11th International Training Course specially focused on the **protecting cultural heritage from risks of natural disasters including those induced by climate change**.

ITC 2017-2018-2019

The courses focused on **the integrated approach for movable and immovable heritage for disaster risk management of heritage sites as well as museums and its collections before, during and after a disaster situation**.

ITC 2020 Alternative Programme

ITC training course was not conducted due to COVID-19 pandemic. However, as an alternative programme, we conducted webinar series "**Capacity Building for Disaster Risk Management of Cultural Heritage: Challenges and Opportunities in Post-COVID Times**" (on 27 June and 4 July 2020) and a workshop "**Good Practices for Disaster Risk Management of Cultural Heritage**" (on 8 to 10 October 2020).

The webinar series aimed to discuss the future directions of cultural heritage management through presentations by resource persons of ITC. Webinar was structured with two parts. The first webinar focused on the stages before the disaster that is "**Disaster mitigation and Preparedness**" and the second webinar focused on the stages after the disaster that is "**Disaster response and recovery**".

The workshop aimed to showcase various projects on disaster risk management of cultural heritage undertaken by the former participants of ITC since 2006. It also aimed to review the activities of ITC since 2006 and works towards building a stronger network among the ITC resource persons and the former ITC participants.

ITC 2021

The subtheme of the course was **"Disaster Risk Management of Cultural Heritage: Learning from the Japanese Experiences"**. The course was focused on Japanese experiences in each of the phases of DRM cycle: Risk assessment, Mitigation and preparation, Emergency response, Recovery, and Policies and frameworks. Due to COVID-19 pandemic, the course was conducted online. And to provide a more effective online course, three sessions were prepared for each phase, of which were as follows: preparatory session (lecture videos, site visit videos), interactive live session (workshops, group work, group discussions) and post-interactive session (case study project preparation).

ITC 2022

The subtheme of the course was **"Traditional knowledge for disaster risk management of cultural heritage"**. The course was focused on role of traditional knowledge in disaster risk management including Japanese experiences in each of the phases of DRM cycle: Risk assessment, Mitigation and preparation, Emergency response, Recovery, and Policies and frameworks. Due to COVID-19 pandemic, the course was conducted online. And to provide a more effective online course, the three sessions: preparatory session (lecture videos, site visit videos), interactive live session (workshops, group work, group discussions) and post-interactive session (case study project preparation) are prepared for each phase.

ITC 2023

Under the theme **"Safeguarding and Utilization of Intangible Cultural Heritage for Disaster Risk Management of Cultural Heritage,"** the programme focused on the vital role of Intangible Cultural Heritage (ICH) in disaster risk management, emphasizing its importance in protecting and sustaining cultural heritage. It showcased Japan's "Traditional skills, techniques, and knowledge for the conservation and transmission of wooden architecture," inscribed on UNESCO's Representative List in 2020, as a prime example of ICH supporting both tangible heritage and disaster resilience. The programme also examined Japan's disaster response measures and shared global practices adapted to diverse local contexts. Held for the first time in a hybrid format, it combined online sessions and on-site training, fostering broader participation and deeper engagement.

Participants List of the Previous Training Courses

Following is a list of annual participants and observers for the Training Course from each year. It is in the order of Name (Country), Work Position and Affiliation, and the Cultural Heritage Site where each participant generated his/her DRM Plan.

No	Name (Country)	Work Position and Affiliation	DRM Plans of Cultural Heritage Formulated by the Participants
ITC 2006, the 1st year			
1	Poonacha KODIRA (INDIA)	Director (Conservation), Ministry of Tourism and Culture Archaeological Survey of India	Qutb Minar and its Monuments, Delhi, WHS
2	Anup KARANTH (INDIA)	Project Coordinator, Urban Earthquake Vulnerability Reduction Project, United Nations Development Programme (UNDP) India	
3	Sektiadi (INDONESIA)	Lecturer, Dept. of Archaeology, Faculty of Culture Sciences, Gadjah Mada University	Prambanan Temple Compounds, WHS and its Surrounding Environment
4	Manggar AYUATI (INDONESIA)	Supervisor of Rescue on Preservation Division, Dept. of Cultural and Tourism, Center for Preservation of Cultural Heritage of Yogyakarta Province	
5	Fauzia QURESHI (PAKISTAN)	Head of the Department of Architecture, National College of Arts, Lahore	Rohtas Fort, WHS
6	Hussain KHADIM (PAKISTAN)	Coordinator, Disaster Management Desk RDPI, Rural Development Policy Institute	
7	Seok JEONG (SOUTH KOREA)	Government employee of Modern Construction Field, Tangible Cultural Heritage Bureau, Cultural Heritage Administration, Republic of Korea	Historic Villages of Korea: Hahoe, WHS in Andong City
8	Woongju SHIN (SOUTH KOREA)	Concurrent Professor, Dept. Interior Architecture, Chosun College of Science and Technology	

ITC 2007, the 2nd year			
1	A.K.M. Monowar Hossain AKHAND (BANGLADESH)	Deputy Secretary, Ministry of Home Affairs, GOVT. of Bangladesh	Lal Bagh Fort, Dhaka, Bangladesh
2	Md. Rafiqul ALAM (BANGLADESH)	Executive Director, DWIP UNNAYAN SONGTHA (DUS)	
3	Shijun HE (P.R. CHINA)	Officer of Protection & Construction Office Protection and Management Bureau of World Cultural Heritage Site - the Old Town of Lijiang	Old Town of Lijiang, WHS
4	Cuiyu HE (P.R. CHINA)	Staff of Engineering & Project Dept. Protection and Management Bureau of World Cultural Heritage Site - the Old Town of Lijiang	
5	Maria Del Carmen CORRALES PEREZ (PERU)	Instituto Nacional De Cultura Architect of the conservation and Restoration Sub Direction	Historic Centre of Lima, WHS
6	Partricia Isabel GIBU YAGUE (PERU)	Chief of Laboratory of Structures, Japan-Peru Center for Earthquake Engineering Research and Disaster Mitigation	
7	Glen CONCEPCION (PHILIPPINES)	City Disaster Action Officer and City Environment & Natural Resources Officer, City Government of Vigan	Historic Town of Vigan, WHS
8	Eric QUADRA (PHILIPPINES)	Architect, LGU-Vigan City	

ITC 2008, the 3rd year			
1	Choening DORJI (BHUTAN)	Architect, Division for Conservation of Heritage Sites, Department of Culture, Ministry of Home & Cultural Affairs Royal Government of Bhutan	Tashichho Dzong
2	Karma TENZIN (BHUTAN)	Civil Engineer, Tashichhodzong Maintenance Division, Dzongkhag Administration	
3	Mahmoud NEJATI (IRAN)	Deputy of Research & Technical Consultant, Recovery Project of Bam's Cultural Heritage	Bam and its Cultural Landscape, WHS
4	Fatemeh MEHDIZADEH SARADJ (IRAN)	Assistant Professor, Department of Conservation, Iran University of Science and Technology	

5	Kai Ube Prasad WEISE (NEPAL)	Architect, Planners' Alliance for the Himalayan & Allied Regions	Patan Durbar Square Monument Zone in Kathmandu Valley, WHS
6	Suman Narsingh RAJBHANDARI (NEPAL)	Assistant Professor, Nepal Engineering College	
7	Ivana FILIPOVIC (SERBIA)	Architect Conservationist, Cultural Heritage Preservation Institute of Belgrade	Lower Town in Belgrade Fortress

Observers

	Name	Work Position and Affiliation
1	Shang Chia CHIOU (TAIWAN)	Professor, Department of Architecture and Interior Design, National Yunlin University of Science & Technology
2	Shen Wen CHIEN (TAIWAN)	Associate Professor, Department of Fire Science, Central Police University

ITC 2009, the 4th year			
1	Rong YU (P.R. CHINA)	Lecturer, Wenhua College, Huazhong University of Science and Technology	Dujiangyan, WHS
2	Yuan DING (P.R. CHINA)	Researcher, Tongji University, National Historic Cities Research Center	
3	Ramesh THAPALIYA (NEPAL)	Architect, World Heritage Conservation Section/Ministry of Culture and State Restructuring, Department of Archaeology	Patan Durbar Square Monument Zone in Kathmandu Valley, WHS
4	Suresh Suras SHRESTHA (NEPAL)	Archaeological Officer, Ministry of Culture and state Restructuring, Department of Archaeology	
5	Pauline BROWN (JAMAICA)	Senior Director, Office of Disaster Preparedness and Emergency Management	Port Royal City
6	Audene BROOKS (JAMAICA)	Senior Archaeologist, Jamaica National Heritage Trust	
7	Sergius CIOCANU (MOLDOVA)	Head Scientific Researcher, Institute of Cultural Heritage of the Academy of Science of Moldova	National Museum of Fine Arts (Buildings and Collection)
8	Valeria SURUCEANU (MOLDOVA)	Curator, National art Museum of Moldova	

Observers from Nepal in the Kathmandu Part of the ITC 2009

	Name	Work Position and Affiliation
1	Keshab P. SHRESTHA	Chief, National History Museum
2	Punya Sagar MARAHATTA	Lecturer, IoE, Tribhuvan University
3	Ajay LAL CHANDRA	Assistant Professor, Department of Architecture and Urban Planning, IoE
4	Gyanin RAI	Chief (Administration, Information & Public Relation Section), Lumbini Development Trust
5	Inu PRADHAN SALIKE	Lecturer, Khwopa Engineering College
6	Saubhagya PRADHNANGA	Head of Culture and Archaeology Unit, Lalitpur Sub Metropolitan City Office
7	Chandra Shova SHAKYA	Head of Heritage Section, Lalitpur Sub Metropolitan City Office
8	Prabin SHRESTHA	Head of Urban Development Division, Lalitpur Sub Metropolitan City Office
9	Ashok SHRESTHA	Head of Administration Division, Lalitpur Sub Metropolitan City Office
10	Sainik Raj SINGH	Head of Earthquake Safety Section, Lalitpur Sub Metropolitan City Office

ITC 2010, the 5th year			
1	Dechen TSHERING (BHUTAN)	Structural Engineer, Division for Conservation of Heritage Sites, Department of Culture, Ministry of Home & Cultural Affairs, Royal Government of Bhutan	Wangduephodrang Dzong
2	Junko MUKAI (BHUTAN)	Deputy Chief Conservation Architect, Division for Conservation of Heritage Sites, Department of Culture, Ministry of Home and Cultural Affairs, Royal Government of Bhutan	
3	Alexander G. DWIGHT (PALAU)	Director, Historical Preservation Officer, Bureau of Arts & Culture, Ministry of Community & Cultural Affairs	Bai: Traditional Meeting Houses
4	Sunny NGIRMANG (PALAU)	Palau National Registrar, Bureau of Arts & Culture, Palau Historic Preservation Office	

5	Teresa VILCAPOMA HUAPAYA (PERU)	Professor, Sagrado Corazon University	City of Cuzco, WHS
6	Olga Keiko MENDOZA SHIMADA (PERU)	JSPS Research Fellow, Graduate School of Science & Engineering, Ritsumeikan University	
7	Marilene TERRONES DIAZ (PERU)	Professor, Sagrado Corazon University	
8	Milica GROZDANIC (SERBIA)	Director, Cultural Heritage Preservation Institute of Belgrade	Kosancicev Venac, Belgrade
9	Svetlana Dimitrijevic MARKOVIC (SERBIA)	Architect - Conservator - Senior Associate, Cultural Heritage Preservation Institute of Belgrade	
10	Zeynep GUL UNAL (TURKEY)	Assistant Professor, Dr. Yildiz Technical University, Faculty of Architecture, Restoration Department	Eskigediz Heritage Site
11	Meltem VATAN KAPTAN (TURKEY)	Research Assistant, PhD Student, Yildiz Technical University, Faculty of Architecture, Structural Systems Division	

ITC 2011, the 6th year			
1	Celina RINCON (COLOMBIA)	Assessor for the Heritage Director Office, Ministry of Culture	History Center of Santa Cruz de Mompox, WHS
2	Cheryl NICHOLS (JAMAICA)	Training Manager, Office of Disaster Preparedness and Emergency Management	The Holy Trinity Cathedral
3	Jose Ramon PEREZ OCEJO (MEXICO)	Part-time Teacher, Universidad de las Américas (Puebla, MEXICO)	Colonial City Centre of Puebla, WHS
4	Julius MWAHUNGA (KENYA)	Senior Cultural Officer, Ministry of State for National Heritage and Culture, Department of Culture	Lamu Old Town, WHS
5	Remigius KIGONGO (UGANDA)	Conservator Sites and Monuments/ Site Manager, Department of Museums and Monuments	Kasubi Tombs, WHS
6	Janhwij SHARMA (INDIA)	Director (Conservation and World Heritage), Archaeological Survey of India, Ministry of Culture	Taj Mahal, WHS

7	Md. Aamir Hussain SHIKDER (BANGLADESH)	Urban Local Body Coordinator, Bangladesh Municipal Development Fund (BMDF)	Historic Mosque City of Bagerhat, WHS
8	Qing WEI (P.R. CHINA)	Deputy Director, Cultural Heritage Conservation Center, THAD	Kulangsu
9	Yu WANG (P.R. CHINA)	PhD Candidate, Urban Design and Planning Department, Norwegian University of Science and Technology (NTNU)	Taoping Qiang Village

ITC 2012, the 7th year			
1	Suzie YEE SHOW (FIJI)	Secretary General, ICOMOS PASIFIKA	Levuka Town, WHS
2	Vikas LAKHANI (INDIA)	Sector Manager, Gujarat State Disaster Management Authority	Champaner - Pavagadh Archaeological Park, Panchamahal District, Gujarat, WHS
3	Sang sun JO (SOUTH KOREA)	Research Associate and Curator, Heritage Repair Division, Cultural Heritage Administration of KOREA	Jongmyo Shrine, WHS
4	Rosli BIN HAJI NOR (MALAYSIA)	Head of Melaka World Heritage Office, Melaka World Heritage Office	Historic City of Melaka, WHS
5	Ni LEI WIN (MYANMAR)	Communications Officer at World Concern Myanmar, Relief, Recovery and Development Project in Myanmar	Bagan located in Manadalay Division, Myanmar
6	Helen McCRACKEN (NEW ZEALAND)	Policy Adviser - Heritage, Ministry for Culture and Heritage	Cuba Street Historic Area, Wellington
7	Usman SHAMIM (PAKISTAN)	Programme Officer, Kuchlak Welfare Society (KWS)	Mehrgarh, lies on the "Kachi plain" of now Balochistan, Pakistan
8	Poorna YAHAMPATH (SRI LANKA)	Consultant - External Resource Person, Disaster Risk Management & Climate Change for GIZ	Sacred City of Kandy, Sri Lanka, WHS
9	Sibel YILDIRIM ESEN (TURKEY)	Conservation Architect, Ministry of Culture and Tourism	Agora Archeological Site in the Historic City of Izmir

Observers

	Name	Work Position and Affiliation
1	Dong Seok KANG (SOUTH KOREA)	A Section Chief of GIS, Cultural Heritage Administration
2	Thi My Thi TONG (VIET NAM)	PhD Student, International Environmental and Disaster Management Laboratory, Graduate School of Global Environmental Studies, Kyoto University

ITC 2013, the 8th year			
1	Saleh Mohammad SAMIT (AFGHANISTAN)	National Manager, Community Development Programme, Aga Khan Foundation-Afghanistan	Cultural Landscape and Archaeological Remains of the Bamiyan Valley, WHS
2	Dian LAKSHMI PRATIWI (INDONESIA)	Head of Archaeological Section, Division of History, Archaeological and Museum, Cultural Service Office, Government of Yogyakarta Special Territory	Kotagede Heritage Area, Yogyakarta Historic City
3	Kambod AMINI HOSSEINI (IRAN)	Director, Risk Management Research Center (Associate Professor), Risk Management Research Center, International Institute of Earthquake Engineering and Seismology	Golestan Palace, Tehran Bazaar and their surrounding old urban fabrics, Tehran
4	Barbara CARANZA (ITALY)	MEC srl, Italian Army "LIGURIA" ARMY MILITARY COMMAND	Monumental Cemetery of Staglieno, Genoa
5	Paola MUSSINI (ITALY)	Researcher, SiTI-Instituto Superiore sui Sistemi Territoriali per l'Innovazione	Portovenere, Cinque Terre, and the Islands (Palmaria,Tino and Tinetto), WHS
6	Zaha AHMED (MALDIVES)	Assistant Architect, Heritage Department, Male' Republic of Maldives	Laamu atoll Isdhoo Old Friday mosque in Maldives
7	Arjun KOIRALA (NEPAL)	Advisor, Urban Planning and Infrastructure Development, GFA Consulting Group (Nepal Office), on behalf of GIZ/ Nepal Municipal Support Team, Ministry of Urban Development, Department of Urban Development and Building Construction	The city core area of Tansen Municipality
8	Kenechukwu Chudi ONUKWUBE (NIGERIA)	Director of Programs, Development Education and Advocacy, Resources Initiative for Africa (DEAR Africa)	Sukur Cultural Landscape, WHS
9	Muhammad Juma MUHAMMAD (TANZANIA)	Director, Urban and Rural Planning, Department of Urban and Rural Planning	Stone Town of Zanzibar, WHS

10	Hatthaya SIRIPHATTHANAKUN (THAILAND)	Landscape Architect Ministry of Culture, Fine Arts Department, Office of Architecture	Historic City of Ayutthaya, WHS

ITC 2014, the 9th year			
1	Elena MAMANI (ALBANIA)	Project Manager, Deputy Head of Office, Cultural Heritage without Borders(CHwB)	Gjirokastra, WHS
2	Catherine FORBES (AUSTRALIA)	Built Heritage Advisor, GML Heritage; Australia Institute of Architects, Australia ICOMOS	The Rocks Historic Urban Precinct
3	Sasa TKALEC (CROATIA)	Head of Office of Director, Croatian Conservation Institute	Castle Batthany in Ludbreg
4	Juan Diego BADILLO REYES (ECUADOR)	Architect Conservator freelance, Volunteer South America Coordinator	San Antonio del Cerro Rico de Zaruma
5	Abdelhamid SAYED (EGYPT)	Chairman, Conservator in the Ministry of Antiquities, Egyptian Heritage Rescue Foundation (EHRF); Training & Capacity Building Unit Manager, Egyptian Earth Construction Association (EECA)	Bab El-Wazir, El-Darb Al-Ahmar District, Historic Cairo, WHS
6	Anaseini KALOUGATA (FIJI)	Senior Project Officer Levuka, Department of National Heritage, Culture and Arts	Historical Port Town of Levuka, WHS
7	Cinthia CABALLERO (HONDURAS)	Urban control and planification unit, Alcaldia Municipal Del Distrito Central (Gerencia Del Centro Historico)	Central District Historic Area
8	Jyoti PANDEY SHARMA (INDIA)	Professor, Department of Architecture, Deenbandhu Chhotu Ram University of Science & Technology	Fatehpur Sikri, Agra District, Uttar Pradesh, WHS
9	Saut SAGALA (INDONESIA)	Senior Fellow, Resilience Development Initiative	Gedung Sate Building, Governor office of West Java Province
10	Alaa HAMDON (IRAQ)	University Lecturer, Researcher and Earthquake Expert, Remote Sensing Center, Mosul University	Al-Hadba Minaret and Nirgal Gate / Mosul City
11	Richard NESTER (NEW ZEALAND)	Technical Advisor – Historic, Department of Conservation	Government Buildings Historic Reserve
12	Zafar SHAH (PAKISTAN)	Regional Emergency Officer (South Punjab), Punjab Emergency Service (rescue1122), Emergency Services Academy	Lahore Fort, WHS

13	Hussain SALEH (SYRIA)	Head of the scientific research commissions department, Higher Commission for Scientific Research	Crac des Chevaliers (in Arabic: Castle Alhsn), WHS
14	Kaichard RUTTANAWONGCHAI (THAILAND)	Captain assistant, Klongtoey fire station, second operation, fire department, Bangkok metropolitan	Vimanmek Palace, WHS

ITC 2015, the 10th year			
1	Marcela HURTADO SALDIAS (CHILE)	Assistant professor, Departamento de Arquitectura, Universidad Técnica Federico Santa María	Historic Centre of Valparaíso
2	Benjamin Kofi AFAGBEGEE (GHANA)	Assistant Conservator of Monuments, Ghana Museums and Monuments Board	Asante Traditional Buildings
3	Stephan DONA (HAITI)	Disaster Risk Reduction Advisor, Plan Consult	Citadelle, Sans Souci, Ramiers
4	Mohamad Faruk MUSTHAFA (INDIA)	Chief Executive Officer, RAPID RESPONSE	Mahabalipuram
5	Mohammad RAVANKHAH (IRAN)	Teaching/research assistant in Department of Environmental Planning, Ph.D. Candidate in International Graduate School: Heritage Studies, Brandenburg University of Technology Cottbus	Bam and its Cultural landscape
6	Aurelio DUGONI (ITALY)	Regional Director of ANPAS Sicily Committee, National Association for Public Assistance (ANPAS)	Archaeological Area of Agrigento
7	Hisila MANANDHAR (NEPAL)	Urban planner, Kathmandu Valley Development Authority	Patan Durbar Square
8	Sonam LAMA (NEPAL)	Assistant professor, Nepal Enginnering College	Boudhanath Stupa and surrounding area
9	Ilse Anne Elisabeth DE VENT (NETHERLANDS)	Senior inspector, Geo-Engineering, the Dutch State Supervision of Mines	Hogeland, Groningen, the Netherlands
10	Bashar Ibrahim HUSSEINI (PALESTINE)	Senior Project Architect & Fast Track Coordinator, Welfare Association – Old City of Jerusalem Revitalization Program "OCJRP"	Old City of Jerusalem
11	Gerald Vallo PARAGAS (PHILIPPINES)	Urban and Environmental Planner (Licensed), City Government of Tacloban	The Sto. Niño Shrine and Heritage Museum, and the People's Center and Library
12	Marko ALEKSIĆ (SERBIA)	Associate, Central Institute for Conservation in Belgrade	Serbian Orthodox Monastery Žiča

13	Pamela Jane MAC QUILKAN (SOUTH AFRICA)	Programme Officer, The African World Heritage Fund (AWHF)	Robben Island
14	Witiya PITTUNGNAPOO (THAILAND)	Lecturer, Faculty of Architecture, Naresuan University	Ban Pak Klong Village, Bangrakham, Phitsanulok Province, Thailand
15	Ngoc Phu PHAM (VIETNAM)	Vice Director, Hoi An center for Cultural Heritage Management and Conservation	Hoi An Ancient Town, Vietnam

Observer

	Name	Work Position and Affiliation
1	Satoko TOYODA (JAPAN)	Student, Stuttgart State Academy of Art and Design, Germany

ITC 2016, the 11th year			
1	Maria Cristina Vereza LODI (BRAZIL)	Architect Preservationist, Rio de Janeiro Municipal Government / Rio World Heritage Institute	Carioca Landscapes Between the Mountain and the Sea
2	Fatma Saidi TWAHIR (KENYA)	Architect, Sites and Monuments; & Mombasa Old Town Conservation Office, National Museums of Kenya	Mombasa Old Town Conservation Area
3	Muhammad Fathi Hasan AL-ABSI (JORDAN)	Associate conservator Architect, Engineering and conservation department/ Department of Antiquities (DOA)	Petra or Karak castle
4	Dulce Maria GRIMALDI SIERRA (MEXICO)	Senior conservator for conservation and research of decorative elements at archaeological sites, Coordinación Nacional de Conservación del Patrimonio Cultural (CNCPC), Instituto Nacional de Antropología e Historia (INAH)	Zona Arqueológica de El Tajín, Veracruz (Tajín Archaeological Site)
5	Barbara MINGUEZ GARCIA (SPAIN)	Consultant, The World Bank	Antigua Guatemala
6	Vanessa Anne TANNER (NEW ZEALAND)	Senior Heritage Advisor, Wellington City Council	Newtown Shopping Centre Heritage Area
7	Nermina KATKIĆ (BOSNIA AND HERZEGOVINA)	Associate for archaeology, Commission to Preserve National Monuments of Bosnia and Herzegovina	Old Bridge Area of the Old City of Mostar

8	Mihaela HĂRMĂNESCU (ROMANIA)	Lecturer, PhD Architect, 'Ion Mincu' University of Architecture and Urbanism, Faculty of Urbanism	(Part of) Delta Dunarii, Romania – Tulcea city and surroundings proximity
9	Alberto Enrique PASCUAL (PANAMA)	Director, Fundation CoMunidad	Fortifications on the Caribbean Side of Panama: Portobelo – San Lorenzo
10	Sherwynne Bagaoisan AGUB (PHILIPPINES)	Legislative Staff Officer IV, Senate Economic Planning and Policy Office, Senate of the Philippines	Historic Town of Vigan
11	Mohamed ROUAI (MOROCCO)	Professor – researcher, Earth Sciences Department, Faculty of Sciences, University Moulay Ismail, Meknes, Morocco	Volubilis Archaeological Site (Morocco)
12	Navneet YADAV (INDIA)	Associate Director, Disaster Risk Management	Shimla City, Himachal Pradesh
13	Claudia Cecilia GONZÁLEZ MUZZIO (CHILE)	Partner at Ambito Consultores, Ambito Consultores Ltda.	Qhapaq Ñan, Andean Road System
14	Amna SHUJA (PAKISTAN)	Assistant Director -Recovery & Rehabilitation, National Disaster Management Authority	Mohenjo-Daro archeological sites
15	Maria Elena ALMESTAR URTEAGA (PERU)	Senior Auditor – Specialist in Culture Management and Cultural Heritage, Contraloria General de la Republica	Chan – Chan Archaeological Zone (La Libertad, northern coast of Peru)

Observer

	Name	Work Position and Affiliation
1	Sakiko OSHIBA (JAPAN)	Undergraduate Student, Toyo Institute of Art and Design

ITC 2017, the 12th year			
1	Dorji WANGCHUK (BHUTAN)	Conservator, National Museum of Bhutan	National Museum of Bhutan (Ta Dzong)
2	Abner Omaging LAWANGEN (PHILIPPINES)	Local Disaster Risk Reduction and Management Officer, Local Government of Tublay, Benguet, Philippines	Banaue Rice Terraces
3	Hamit BİRTANE (TURKEY)	Technical Expert, Directorate of Gallipoli Historical Site	Gallipoli Historical Site
4	Innocent Hudson MANKHWALA (MALAWI)	Archivist (Conservation Section), Department of Culture, National Archives of Malawi	Museum of Malawi
5	Ming Chee ANG (MALAYSIA)	General Manager, George Town World Heritage Incorporated	George Town UNESCO World Heritage Site
6	Victor MARCHEZINI (BRAZIL)	Researcher, National Centre for Monitoring and Early Warning of Natural Disasters (CEMADEN)	São Luiz do Paraitinga town, state of Sao Paulo, Brazil
7	Virasith Sith PHOMSOUVANH (LAO PDR)	Acting Deputy Director of Remote Sensing Center, Ministry of Natural Resource and Environment (MONRE)	The Town of Luang Pra Bang
8	Sayma IQBAL (INDIA)	Lead Conservation Consultant, INTACH, Kashmir Chapter	Shri Pratap Singh Museum
9	Bertrand Pascal LAVEDRINE (FRANCE)	Director of the Centre de recherche sur la Conservation, National Museum of Natural History	National Museum of Natural History
10	Domenico GRECO (ITALY)	Civil Engineer - Young Researcher at University of Salerno, ICOMOS/ICORP Italy	Cilento National Park and Vallo di Diano with The Archeological Sites of Paestum and Velia
11	Khin Aye YEE (MYANMAR)	Operation Officer, Social, Urban, Rural and Resilience Global Practice, World Bank Group, World Bank, Myanmar	Yangon or Bagan (tbd)

Observers

	Name	Work Position and Affiliation
1	Chan Min PARK (SOUTH KOREA)	Curator, National Research Institute of Cultural Heritage
2	Sophie ABRAHAM (SWITZERLAND)	Junior Professional Officer, Disaster Risk Reduction, Emergency Preparedness & Response Unit, Culture Sector, UNESCO

ITC 2018, the 13th year			
1	Marcia Furriel Ramos GALVEZ (BRAZIL)	Architect, Architectural preservation group - associated to the Memory and Information Center, FUNDACAO CASA DE RUI BARBOSA - MINISTERIO DA CULTURA (House of Rui Barbosa Foundation - Ministry of Culture)	Museu Casa de Rui Barbosa (Rui Barbosa's Historic House Museum)
2	Jamyang Singye NAMGYEL (BHUTAN)	Architect, Division for Conservation of Heritage Sites, Department of Culture, Ministry of Home and Cultural Affairs, Royal Government of Bhutan	Trashigang Dzong
3	Kundishora Tungamirai CHIPUNZA (ZIMBABWE)	Chief Curator, National Musuems and Monuments of Zimbabwe	Great Zimbabwe World Heritage Site
4	Abel Assefa GIRMAY (ETHIOPIA)	Heritage Conservator, Authority for Research and Conservation of Cultural Heritage	Taitu Hotel
5	David Antonio TORRES CASTRO (MEXICO)	Full Time Conservator, National Bureau for Cultural Heritage Conservation part of National Institute of Anthropology and History (Coordinacion Nacional de Conservacion del Patrimonio Cultural, Instituto Nacional de Antropologia e Historia)	Ex Dominican Convent of Santo Domingo de Guzmán, Tehuantepec, Mexico
6	Sumeru TRIPATHEE (NEPAL)	Country-Humanitarian Preparedness & Response Coordinator, Oxfam GB (Oxfam in Nepal)	Pashupatinath Temple Area, Kathmandu, Nepal
7	Irakli KOBULIA (GEORGIA)	Independent Consultant	Upper Svaneti
8	Vikas Namdeo KURNE (INDIA)	Disaster Management Coordinator, Indian Red Cross Society	Chhatrapati Shivaji Maharaj Vastu Sangrahalaya
9	Idrees JEHAN (PAKISTAN)	Disaster Risk Reduction Officer (DRRO), FATA Disaster Management Authority (FDMA)	Peshawar Museum
10	Farhad BANIZAMAN LARI (IRAN)	Project manager, Tarh e-No Andishan Consulting Engineers Co.(Thinking New Approach(TNA))/ Lecturer at University of Applied Science and Technology (Red Crescent Organization/Tehran Disaster Mitigation and Management Organization(TDMO)	Bazar Qaisary, located in the city of Lar(my home town), south of Fars State, southern Iran

11	Grace DE SMET (BELGIUM)	Autonomous researcher on endangered Cultural Heritage; student Master after Master in Urban Studies at Vrije Universiteit Brussel (Belgium); Intern at UNESCO Culture Emergency Preparedness and Response Unit	The city-center of Brugge
12	Catalin Andrei NEAGOE (ROMANIA)	Architect at the National Institute of Heritage, Romania, Visiting Lecturer at "Ion Mincu" University of Architecture and Urbanism, Bucharest, Romania	Historic Centre of Sighişoara
13	Rosa Grazia DE PAOLI (ITALY)	OFFICIAL, Calabrian regional Council	Historical Center of Reggio Calabria
14	Enrica DI MICELI (ITALY)	Post-doctoral researcher, Sapienza University	The Archeological Area in the ancient city-center of Rome, Palatinum Hill, with a special focus on the "Gallery of the Collapsed Vaults"
15	Francesca GIULIANI (ITALY)	Ph.D student, Civil Engineering at the Department of Engineering of Energy, Systems, Territory and Construction, School of Engineering, University of Pisa (Senior Member of the Italian Youth Association for UNESCO)	Historic Centre of San Gimignano (Italy)

Observers

	Name	Work Position and Affiliation
1	Aditia Rahma Putra (INDONESIA)	Spatial Planning Division, Municipal Government Of Semarang
2	Kasaqa Temoinunia Tora (FIJI)	Project Manager, The National Trust of Fiji
3	Sehyun KIM (SOUTH KOREA)	Research Assosiate, National Research Institute of Cultural Heritage

ITC 2019, the 14th year			
1	Virginia Fernanda GONZÁLEZ (ARGENTINA)	Museum Director, Museum Director Cultural Secretary of National Government	Historical Museo of Sarmiento
2	Angela Maria MICELI (ITALY)	Individual Professional, AIAPP Professional Association of Landscape Architects	Lungotevere Tor di Quinto (Quinto's Tower/Tiber_Riverfront Park)
3	Monia DEL PINTO (ITALY)	PhD researcher, Loughborough University	MuNDA -Museo Nazionale D'Abruzzo (National Museum of Abruzzo)

4	Mahrous Eid Moustafa ELSANADIDY (EGYPT)	Chief Curator, National Museum of Egyptian Civilization, Nubia Fund, Ministry of Antiquities	National Museum of Egyptian Civilization, Nubia Fund, Ministry of Antiquities
5	Enrique RODRIGUEZ LEON (COSTA RICA)	Preparedness and Response chief / Risk and Emergency Management Unit, GAD - decentralized autonomous municipal government of Canton Duran (city of Duran)	Museum and archeological site of The Lovers of Sumpa and Museum and archeological site of the Venus of Valdivia
6	Clinton Dean JACKSON (SOUTH AFRICA)	Manager: National Inventory, South African Heritage Resources Agency	Dal Josafat Cultural Landscape
7	Roy GIAMPORCARO (ITALY)	Junior Professional Officer, Cultural Heritage, Culture Sector, UNESCO Amman Office	The Historic Centre of Naples, ITALY
8	Alessia STROZZI (ITALY)	Officer, Ministry of Cultural Heritage, Marche Region's branch	The Lazzaretto of Ancona, (Mole Vanvitelliana)
9	Samson Lukabya NABBIMBA (UGANDA)	Clan Leader-Red Ant (Kinyomo), Kabaka's Trail Coordinator, Kabaka Foundation	Wamala Tombs
10	Ameneh KARIMIAN (IRAN)	DRR Advisor & Project Coordinator at Iranian Relief Association (IRA) NGO Researcher & Scientific Coordinator at Tamadon Karizi Consulting Eng. (TKCE)	Qasem-Abad Qanat and Akbar-Abad Qanat (twin qanats) part of the Persian Qanats (WH serial property)
11	Shah Zahidur Rahman Zahidur ZAHID (BANGLADESH)	Shelter Specialist, Early Recovery Facility, Resilience & Inclusive, Grouth Cluster, UNDP Bangladesh	Somapura Mahavihara in Paharpur, Badalgachhi Upazila, Naogaon District, Bangladesh
12	Lilit GEVORGYAN (ARMENIA)	Researcher, Institute of Geological Sciences of National Academy of Sciences of Armenia	Geology Museum after H. Karapetyan of Institute of Geological Sciences of National Academy of Sciences

ITC 2020 Alternative Programmes

Due to COVID-19, ITC training course was not conducted in the year 2020. Alternative to our regular programmes, webinars and workshops by selected former participants were conducted.

"Capacity Building for Disaster Risk Management of Cultural Heritage: Challenges and Opportunities in Post-COVID Times"

Webinar 1 "Rethinking disaster mitigation and preparedness", 27 June 2020

Name	Work Position and Affiliation	Topic
Ksenia CHMUTINA	Senior Lecturer in Sustainable and Resilient Urbanism, Loughborough University	Considering multiple risks and inequalities in COVID-19 times and beyond
Lee BOSHER	Professor of Disaster Risk Management, Loughborough University	Considering multiple risks and inequalities in COVID-19 times and beyond
Takeyuki OKUBO	Professor, College of Science and Engineering, Ritsumeikan University	Community based DRM workshops with digital network for post-COVID times
Yoshifumi SATOFUKA	Professor, College of Science and Engineering, Ritsumeikan University	Consideration of Climate Change for DRM
Joseph KING	Director of Partnership and Communication, Partnership and Communication Unit, ICCROM	How should international organizations working in the field of cultural heritage sector rethink on their activities in the light of COVID-19?

Webinar 2 "Rethinking disaster response and recovery", 4 July 2020

Name	Work Position and Affiliation	Topic
Aparna TANDON	Senior Programme Leader, First Aid and Resilience for Cultural Heritage | Sustaining Digital Heritage, Programme Unit, ICCROM	What can we learn from COVID-19 response cultural heritage?
Wesley CHEEK	JSPS Fellow, Visiting Researcher, Ritsumeikan University	How can we address sustainable and resilient recovery by mainstreaming cultural heritage
Elke SELTER	Doctoral Researcher, SOAS, University of London	Reflecting on PDNA methodology based on COVID-19 experience
Ming Chee ANG	General Manager, George Town World Heritage Incorporated	The Disaster Risk Management Implementation during COVID-19 in George Town, Malaysia

"Good Practices for Disaster Risk Management of Cultural Heritage" Workshop

From 8 to 10 October 2020, the following participants joined the online workshop.

	Name	Country (ITC participated year)	Topic
1	Elena MAMANI (The Best Practice winner)	Albania/Greek (ITC 2014)	"Utilisation of traditional water cisterns as water source in case of fire in Gijokastra, Albania"
2	Dulce María GRIMALDI (The Best Practice winner)	Mexico (ITC 2016)	"Mapping risks for cultural heritage in Mexico"
3	Ming Chee ANG (Exemplary Practice Award winner)	Malaysia (ITC 2017)	"George Town world heritage city, Malaysia"
4	Abdelhamid Salah Abdelhamid SAYED	Egypt (ITC 2014)	"Fire risk mitigation strategies for urban heritage site in Cairo, Egypt"
5	Junko MUKAI and Dechen TSHERING	Japan/Bhutan (ITC 2010)	"Disaster risk management plan for Punakha Dzong, Bhutan"
6	Marcela HURTADO	Chile (ITC 2015)	"Disaster risk management plan for Humberstone and Santa Laura altpeter works, Pozo Almonte, Chile"
7	Vanessa Anne TANNER	New Zealand (ITC 2016)	"Heritage New Zealand Pouhere Taonga (HNZPT) draft guidance for preparing heritage risk management plans"

ITC 2021, the 15th year			
1	Alexandre A. COSTA (PORTUGAL)	Founder and partner and head of research and development/Invited professor; NCREP-Consultancy on Rehabilitation of Built Heritage, Ltd./ Polytechnic Institute of Porto, School of Engineering	National Palace of Sintra, Portugal, belonging to Sintra World Heritage Cultural Landscape, and National Monument.
2	Ana GóMEZ URIBE (COLOMBIA)	Advisor on conservation and collections management, Strengthening Museums Program /Colombia National Museum / Ministry of Culture	Rafael Núñez House Museum
3	Artnet HASKUKA (KOSOVO)	Chairperson, Council of Cultural Heritage – Prizren Historic Center	Prizren Historic Center/ Kosovo
4	Aya MIYAZAKI (JAPAN)	Doctorate Student University of Tokyo (Until 3 May 2021, UNESCO Office in Lima)	Historic Center of Lima, Peru
5	Flavio HAENER (SWITZERLAND)	Cultural Property Protection Responsible, Canton Basel-Stadt, Government	Cultural Property of Basel-Stadt

ITC 2021, the 15th year			
6	Jennifer LANG (USA)	Adjunct Associate Professor, Director of MSc (Conservation), The University of Hong Kong	Fung Ping Shan Building, University Museum and Art Gallery, The University of Hong Kong
7	Katrīna KUKAINE (LATVIA)	Director, Development Department The National Library of Latvia	The National Library of Latvia
8	Luana ALESSANDRINI (ITALY)	Head for the UNESCO World Heritage, Urban Decorum, Urban Hygiene and Communitarian Policies Sector, Municipality of Urbino	Municipality of Urbino
9	Mikael GARTNER (USA)	Infrastructure Design Reviewer, United Nations Office for Project Services	Nan Madol: Ceremonial Centre of Eastern Micronesia
10	Raphael IGOMBO (KENYA)	Head of education and Public programs Department, National Museums of Kenya	Fort Jesus Museum
11	Richard BAULA (PHILIPPINES)	Conservator, National Historical Commission of the Philippines	Taal Heritage Town, Taal, Batangas, Philippines
12	Veronica PIACENTINI (ITALY)	Officer, Italian Civil Protection Department	Villa Torlonia in Rome (Italy)
13	Vinka MARINKOVIć (CROATIA)	Conservator restorer, Croatian Conservation Institute	Diocletian's Palace, Split, Croatia

Observers

	Name	Work Position and Affiliation
1	Mohamed SOLIMAN (EGYPT)	JSPS International Researcher DMUCH-Ritsumeikan University
2	Suzana KASOVSKA GEORGIEVA (NORTH MACEDONIA)	Deputy director and trainer, Institute for Research in Environment, Civil Engineering and Energy

ITC 2022, the 16th year			
1	Amalija PAVLIĆ (CROATIA)	Senior Advisor, Institute for the Restoration of Dubrovnik	Old City of Dubrovnik (WHS)
2	Amanda Emma OHS (NEW ZEALAND)	Senior Heritage Advisor, Christchurch City Council	Canterbury Provincial Council Buildings and Grounds
3	Birsen INCEL (TURKEY)	Technical Expert (MSc Architect-Restoration Specialist), Directorate of Gallipoli Historic Site	Kilitbahir Castle Museum

4	Chao-Shiang LI (Taiwan ROC)	Associate Researcher & Adjunct Assistant Professor, Cultural Properties Research Center / Development of Interior Design, China University of Technology	Tamsui Old Street in New Taipei City
5	Chris Soliz (USA)	Adjunct Instructor, Emergency & Disaster Management, Western Carolina University	Kauffman Center for Performing Arts
6	Evan OXLAND (CANADA)	Built Heritage Advisor, Parks Canada Agency, Indigenous Affairs and Cultural Heritage Directorate, Built Heritage Unit – National Office	Canadian Rocky Mountains Parks (WHS)
7	Federico ZAINA (ITALY)	Research Fellow, Department of Architecture, Built Environment, Construction Engineering, Politecnico di Milano Adjunct Professor, Department of History and Culture, University of Bologna	Craco Town
8	Jean Francois LAFLEUR (Republic of Mauritius)	Site Manager, Le Morne Heritage Trust Fund	Le Morne Cultural Landscape
9	Martin Nicolás FERNÁNDEZ-ORDÓÑEZ (GUATEMALA)	Curator of Casa Popenoe, Francisco Marroquin University	Casa Popenoe / Francisco Marroquin University (WHS)
10	Masoud NAKHAEI (IRAN)	Earthen Structures Conservation & Climate Change Risk Management Consultant, Pasargadae and Persepolis World Heritage Sites	Persepolis (WHS)
11	Michel Louis DE L'HERBE (CHILE)	Consultant in Emergency Management and Public Safety, Michel De L'Herbe Emergency Management Consulting MGMT	Natural History Museum of Valparaíso
12	Natalie Ann DE LA TORRE SALAS (PUERTO RICO)	Public Archaeology Outreach Coordinator, Southwest Region, Florida Public Archaeology Network, Florida Atlantic University	Pineland Archaeological Site
13	Raghda Nasr EL. NEZORY (EGYPT)	Inspector, The Ministry of Tourism and Antiquities	City of the Dead (WHS)
14	Rana Nadim DUBEISSY (LEBANON)	Project Coordinator, BILADI NGO	Beiteddine Palace

15	Suraj GAUTAM (NEPAL)	Executive Director, Institute of Himalayan Risk Reduction	Changu Narayan Temple (WHS)

Observers

	Name	Work Position and Affiliation
1	Arkebe Negash KIBATU (ETHIOPIA)	Heritage Conservator, Authority for research and conservation of cultural heritage
2	Hernandez Oroza ALBERTO (CUBA)	Head of Department, Department of Diagnosis and Surveying, Historic Center of Havana
3	Mara POPESCU (ROMANIA)	Lecturer, George Emil Palade University of Medicine, Pharmacy, Science and Technology of Târgu Mureș
4	Ana Teresa Teves REIS (PORTUGAL)	Researcher (Cultural Heritage), University of Évora, City UniMacau Chair on sustainable Heritage; HERCULES Laboratory
5	David Robert MASON (UK (AUSTRALIAN-BRITISH))	Senior Heritage Specialist, Public Works Advisory
6	Priyanka Dhiraj PANJWANI (INDIA)	1. Conservation Architect (Freelance) 2. Co-ordinator, National Scientific Committee on Risk Preparedness, ICOMOS India

ITC 2023, the 17th year			
1	Emily Dy RAMOS (USA)	Emergency Preparedness Specialist/ Recovery Program Manager, New York City Emergency Management	The Tenement Museum
2	Florencio MOREÑO II (PHILIPPINES)	Museum Curator and Officer, Culture and Heritage Unit, Casa Gorordo Museum - Ramon Aboitiz Foundation Inc.	Casa Gorordo Museum
3	Hassan ALNEMARI (SAUDI ARABIA)	Urban Heritage Manager, Heritage Commission	Historical Jeddah (WHS)
4	Jessica LEWINSKY (ISRAEL)	Responsible of Preventive Conservation, Israel Museum, Jerusalem	Israel Museum, Jersualem
5	Jisoo KIM (REPUBLIC of KOREA)	Researcher, Safety and Disaster Prevention Division, National Research Institute of Cultural Heritage (NRICH)	Gyeongbokgung Palace
6	John E. DUMSICK (USA)	Senior Engineer/Historic Preservation Specialist, US Department of State, Bureau of Overseas Buildings Operations, Office of Cultural Heritage	Tangier American Legation Museum & Tangier American Legation Institute For Moroccan Studies (TALIM), Tangier, Morocco

ITC 2023, the 17th year			
7	Kenneth Javier TUA (PHILIPPINES)	Trustee, Executive Board, and Country Project Director, ICOMOS Philippines	Historic City of Vigan (WHS)
8	Lujza VARGA (HUNGARY)	Head of Department, Hungarian National Museum (NHM)	Hungarian National Museum (with member institutions located in Hungary, Turkey, Poland and the Czech Republic)
9	Moses MKUMPHA (MALAWI)	Chief Monuments Officer, Department of Museums and Monuments of Malawi	Chongoni Rock Art (WHS)
10	Muhammad Rizwan RIAZ (PAKISTAN)	Associate Professor, University of Engineering & Technology, Lahore	Fort and Shalamar Gardens in Lahore (WHS)
11	Razan AL-FAQEER (SAUDI ARABIA)	Conservation Architect Senior Officer, Diriyah Gate Development Authority	At-Turaif District in Diriyah (WHS)
12	Rut BALLESTEROS CARRIÓN (SPAIN)	Cultural Heritage Conservation Manager, The Royal Commission for AlUla	AlUla Old Town (included in the Tentative List for the Syrian Hajj Road)

Observers

	Name	Work Position and Affiliation
1	Nadhem AL-ABSI (YEMEN)	Consultant - Civil Engineer UNESCO Project Coordinator for Disaster Risk Reduction in Yemen
2	Zahida QUADRI (PAKISTAN)	Assistant Director - Disaster Cell Director, Directorate General Antiquities & Archaeology, Culture, Tourism, Antiquities & Archives Department, Government of Sindh, Pakistan

Intern Students

	Name	Work Position and Affiliation
1	Chaewon KIM	Graduate Student, Graduate School of International Relations, Global Studies Major, Ritsumeikan University
2	Konami KAWAGUCHI	4th-year Student, Graduate School of Policy Science, Ritsumeikan University
3	Xiaolei SHA	Graduate Student, Advanced Architectural, Environmental and Civil Engineering Major, Graduate School of Science and Engineering, Ritsumeikan University
4	Yiqi ZHANG	4th-year Student, College of International Relations, Ritsumeikan University Enrolled in the Graduate School of Interdisciplinary Information Studies, The University of Tokyo

Workshop on Designing Post-Disaster Recovery for Hirafuku, Sayo Town

United Nations
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