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

2022, 16th year
18 August to 13 October 2022
ONLINE

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

A Embankment house built on the raised land in the old castle town of Fukuchiyama.

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Preface

The "Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University (R-DMUCH)" was established as a permanent research institution in 2013 and has handed over activities from former organization as "Research Center for Disaster Mitigation of Urban Cultural Heritage" which was started by Prof. Kenzo Toki from 2003.

The "UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage" started from 2006 as one of our important educational activities, and fortunately we can continue it up to this year supported by UNESCO, ICCROM, ICOM, ICOMOS/ICORP and various national and international organizations. We are very much fortunate to have NICH, (the Independent Administrative Institution National Institutes for Cultural Heritage in Japan) that has supported us to provide the educational resources and lessons which are the integrated protection systems of cultural heritage in Japan. I would like to thank these colleagues for supporting us and participants from all over the world. The purposes of this training course are the education of practical experts in each and both fields of cultural heritage conservation and disaster risk management, and the development of a draft plan for disaster risk management to secure the safety of people and cultural value in each cultural heritage site and historical city. I hope these plans will be actual projects in each country and contribute to cultural advancement in the world.

Due to COVID-19 pandemic, ITC 2022 was conducted online. In spite of various challenges due to the pandemic situation, it was successfully completed by huge contributions from our overseas colleagues and colleagues in Japan. I sincerely appreciate all the colleagues for their support of ITC 2022.

The theme of ITC 2022 was "Traditional knowledge for disaster risk management of cultural heritage". Through living in hazard-prone areas and experiencing frequent natural hazards, local communities and indigenous peoples have developed traditional knowledge related to disasters in their localities. The course focuses on those traditional knowledge with the basic concept and phases of DRM cycle: risk assessment, mitigation, preparedness, emergency response, recovery, and policies and frameworks including the international perspectives on policies and frameworks. The related videos of lectures and site visits, interactive live sessions with group works and workshops, and mentoring sessions aimed at developing participants' individual projects were prepared to meet the learning contents of the online course as close to face to face courses that we have organized since 2006.

The outcomes were remarkable although the training was short and virtual. Some of the participants have already begun to implement their pilot project on their sites.

Thank you all again for supporting this activity, and please keep in touch with us for joining efforts towards transferring our cultural heritage to the next generation.

Takeyuki OKUBO,
UNESCO Chair Holder Professor,
Professor, Department of Environmental and Civil Engineering,
Ritsumeikan University

Preface

Since 2006, the Institute of Disaster Mitigation for Urban Cultural Heritage at Ritsumeikan University (R-DMUCH), Kyoto, Japan in close collaboration with the International Centre from the Study of Preservation and Restoration of Cultural Property (ICCROM) has been working towards capacity building 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 programmes on this theme in the world. The target groups for this course include government institutions, departments, universities, NGOs and private consultants from cultural heritage, as well as relevant disaster management fields. The course is based on lectures by eminent experts, field visits, exercises and discussions. From the inception of the course in 2006 until 2021, nearly 180 professionals from more than more than 72 countries have been trained through this annual course that is held in Kyoto and other historic sites in Japan such as Minamisanriku Cho (East Japan), Nara, Himeji, Kobe, Sasayama and Takeda .

Since 2020, COVID-19 pandemic has caused unprecedented health crisis and global disruption, but it has also brought forward immense potential for harnessing web-based platforms for communications and training, in times when travelling and face to face activities have become extremely challenging. While in 2020, R-DMUCH and ICCROM organized webinars and online workshops with former participants and resource persons in place of annual training, since 2021 we decided to take up the challenge of organizing online training course on disaster risk management of cultural heritage. Following extensive discussions among the organizing team and the resource persons, innovating course structure that included two online interactions of two and a half hours duration each week along with host of teaching resources including lecture and field visit videos, group exercises, interactive workshops and preparation of case study projects by the participants under the mentorship of resource persons. While Zoom was used as virtual platform for the online sessions and discussions, 'Slack' proved to be immensely useful for formal and informal communication among the resource persons and participants. At the end of the course, participants made presentations of their case study projects and were given valuable feedback by the resource persons. All the teaching resources as well as participants' case studies were posted on google drive for easy access by everyone. Following this structure, the second online training course was held from 18th August to 13th October 2022

As we move towards post-COVID times, it is time for us to reflect on how we should continue capacity building on the disaster risk management of cultural heritage by tailoring the existing knowledge and skills, identifying and filling gaps in terms of knowledge areas/topics, target audience, and pedagogy based on the lessons learnt from this pandemic. We will continue to build on the rich experience that we have gathered through online training this year and do hope that even when we return to face to face training, we will be able to integrate some of these virtual learning methods in a hyrid format. The pandemic period has indeed provided us valuable time to pause, reflect and reconfigure not just the focus areas of disaster risk management that have paid little or no attention to biohazards but also explore innovative ways of teaching and learning using virtual mediums that are now at our disposal. R-DMUCH and ICCROM will continue to strengthen their collaboration to meet these emerging challenges and opportunities and reduce disaster risks and build resilience of our cultural heritage around the world.

Rohit JIGYASU
Project Manager Urban Heritage,
Climate Change and Disaster Risk Management
ICCROM
Vice President, ICOMOS International Scientific Committee on Risk Preparedness

Table of Contents

1 Introduction

1.1 Background and Objectives of The 16th International Training Course 2022

Disasters and Cultural Heritage

The recent conflict in Ukraine, the COVID-19 pandemic and disasters such as fires in the Notre-Dame de Paris in 2019 and National Museum of Brazil in 2018, earthquakes in Central Mexico in 2017, Myanmar and Italy in 2016, Nepal in April and May 2015, Haiti and Chile in 2010, earthquake and cyclones in Philippines in 2014, fires in Lijiang, China in 2013 and 2014, the devastating tsunami in North East of Japan in 2011 have caused enormous loss of life, property and cultural heritage, both in its tangible and intangible as well as movable and immovable manifestations. This disaster has once again shown that cultural heritage, including historic buildings, archaeological sites, historic cities and cultural landscapes, is highly vulnerable to disasters caused by natural as well as human induced hazards such as earthquake, the Tsunami, fire, floods, cyclones/typhoons, armed conflict, theft and terrorism. These may also cause secondary hazards such as the Tsunami, landslides and fires thereby exacerbating the damage to cultural heritage. Climate Change is further causing increase in the frequency and intensity of hydro-meteorological hazards such as floods and typhoons/cyclones.

Therefore, it is important to undertake proactive measures that can reduce risks to cultural heritage from these catastrophic events through adequate mitigation and preparedness measures. During emergency phase, the challenge is how to assess damage and stabilize built heritage properties, which are at risk of demolition as well as salvage movable heritage fragments and collections and assess their damage. The long-term challenge during recovery phase is how to repair and retrofit them and undertake reconstruction that respects tangible as well as intangible heritage values while reducing vulnerabilities.

In the light of these challenges, comprehensive disaster risk management is essential for the protection of cultural heritage from disasters. Therefore, Cultural Heritage and Risk Management project of Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University (R-DMUCH) aims to organize the International Training Programme to build the institutional capacity needed to formulate comprehensive disaster risk management plans that are based on the characteristics of cultural heritage and nature of hazards to which the region is exposed.

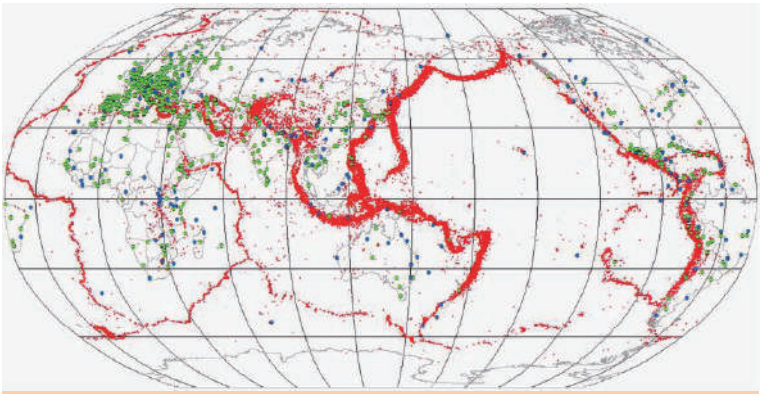


Fig.1 World Heritage Sites Located in the Earthquake Zones 2008

Tab. 1 Regional Distribution of World Heritage sites located on the Earthquake Zones

Region	0-100 km	100-200 km	Within 200km		Over 200km		Total
Cultural/Mix	100	91	191	27%	513	73%	704
Australia/New Zealand		1	1	14%	6	86%	7
Caribbean	2	3	5	45%	6	55%	11
Central America	10	10	20	59%	14	41%	34
Central Asia	2		2	22%	7	78%	9
Eastern Africa	2	1	3	14%	18	86%	21
Eastern Asia	10	11	21	42%	29	58%	50
Eastern Europe		1	1	2%	56	98%	57
European Russia			0	0%	14	100%	14
Melanesia	1	1	2	100%		0%	2
Middle Africa		1	1	100%		0%	1
Northern Africa	3	4	7	21%	27	79%	34
Northern America	1		1	7%	13	93%	14
Northern Europe	1		1	2%	49	98%	50
South America	8	16	24	57%	18	43%	42
Southeastern Asia	6	1	7	39%	11	61%	18
Sothern Africa			0	0%	7	100%	7
Southern Asia	6	8	14	29%	34	71%	48
Southern Europe	35	23	58	45%	70	55%	128
Western Africa			0	0%	16	100%	16
Western Asia	13	8	21	40%	31	60%	52
Western Europe		2	2	2%	87	98%	89
Natural	36	18	54	31%	120	69%	174
Total	136	109	245	28%	633	72%	878

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

The International Training Course on Disaster Risk Management of Cultural Heritage is a follow-up of the recommendations adopted at the Special Thematic Session on Risk Management for Cultural Heritage held at UN-WCDR (World Conference on Disaster Reduction) in January 2005 in Kobe, Hyogo, Japan. One of these recommendations advocated the need for the academic community to develop scientific research, education and training programs incorporating cultural heritage in both its tangible and intangible manifestations, into disaster risk management. The importance of strengthening knowledge, innovation and education to build a culture of disaster prevention at WH properties was reiterated also by the World Heritage Committee at its 30th session (Vilnius, Lithuania, July 2006).

Furthermore, the "Declaration", adopted at the International Disaster Reduction Conference (IDRC) of Davos (August 2006) confirmed that "concern for heritage, both tangible and intangible, should be incorporated into disaster risk reduction strategies and plans, which are strengthened through attention to cultural attributes and traditional knowledge". The Sendai Framework on Disaster Risk Reduction recently adopted at the World Conference on Disaster Risk Reduction in Sendai, Japan has further highlighted the importance of protecting cultural heritage from disasters. Cultural heritage has also been included one of the sectors in the new ten essentials that have been adopted by UNISDR's resilient city campaign.

In response to these recommendations by the international community, the Institute of Disaster Mitigation for Urban Cultural Heritage at Ritsumeikan University (R-DMUCH) has been acting as a focal point for organizing international research, training and information network in the field of cultural heritage risk management and disaster mitigation. Besides R-DMUCH also functioned as the international secretariat for ICOMOS-International Scientific Committee on Risk Preparedness (ICORP) from 2011 to 2014 and many resource persons of the course are expert members of the Scientific Committee.

180 participants in total from 72 countries have participated in our training courses till date. These participants are from East Asia (China, Indonesia, Japan, Laos, Malaysia, Myanmar, Philippines, South Korea, Thailand and Vietnam), South Asia and South East Asia (Afganistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka), Oceania (Australia, Fiji, New Zealand and Palau), North America (USA), Central and South America (Argentina, Brazil, Chile, Colombia, Ecuador, Haiti, Honduras, Jamaica, Mexico, Panama and Peru), Europe (Albania, Armenia, Belgium, Bosnia and Herzegovina, Croatia, France, Georgia, Italy, Kosovo, Latvia, Moldova, Netherlands, Portugal, Romania, Serbia, Spain, Switzerland and Turkey), Middle East (Iran, Iraq, Jordan, Palestine and Syria), Africa (Egypt, Ethiopia, Ghana, Kenya, Malawi, Morocco, Nigeria, South Africa, Tanzania, Uganda and Zimbabwe).

Objectives and Methodology of the Training Course

The main objective of the course is to provide theoretical and practical knowledge on various aspects of disaster risk management of cultural heritage. In particular, the course provides interdisciplinary training to:

- ✓ Undertake an integrated risk assessment of tangible and intangible, immovable and movable cultural heritage by analyzing their vulnerability to natural and human induced hazards that can cause disasters;
- ✓ Build integrated system for disaster risk management of cultural heritage, incorporating various measures aimed at reducing risks, responding to disasters and recovering from them.
- ✓ Formulate disaster risk management plans for cultural heritage that correspond to the local/urban, national and regional plans and policies for disaster risk management and development as well as humanitarian response and recovery mechanisms;
- ✓ To learn practical tools, methodologies and skills for disaster risk management of cultural heritage such as cost benefit analysis, value assessment, budgeting and communication methods with various stakeholders ranging from the decision makers to local communities; and
- ✓ Strengthen the international scientific support network in order to build the institutional capacity needed to formulate comprehensive disaster risk management plans that are based on the characteristics of cultural heritage and nature of hazards in the national and regional context.

The course comprises lectures, site visits, workshops, discussions, team projects and individual/group presentations. Participants are expected to actively participate throughout the course. The course aims at promoting the development of collaborations and network building among scholars and professionals in cultural heritage protection. This course is provided scientific support by UNESCO and the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM).
Based on the knowledge obtained from lectures, site visits, and exercises through interactive workshops, the training course also sets the goal of raising planning skills in disaster risk management of cultural heritage, by having each participant formulate outline of a DRM plan of a case study site or museum from the participant's home country in line with the country's respective social, economic and institutional context. In order to do so, the Institute asked the selected participants to collect relevant data/information related to the cultural heritage, hazard characteristics and local context before coming to Japan.

Fig.2 The structure of International Training Course on Disaster Risk Management of Cultural Heritage

Sub Theme of 2022 International Training Programme:
Traditional knowledge for disaster risk management of cultural heritage

Through living in hazard-prone areas and experiencing frequent natural hazards, local communities and indigenous peoples have developed traditional knowledge related to disasters in their localities. This includes knowledge of the components of disaster risk, though most often in their own language and with definitions in the context of their respective cultures as well as local ways of risk reduction, preparedness, response, and recovery. It also includes crucial aspects such as the role of local formal and informal governance structures, kinship and other social networks, and various cultural aspects.

Traditional knowledge has allowed communities to thrive and build capacity in challenging physical landscapes and multi-hazardous environments, as well as in various socio-economic, political, and cultural contexts. It is apparent that traditional knowledge is a critical component of how communities across the globe reduce and manage disaster risks in their respective localities. However, and more recently, there is an increased interest in utilising principles behind this type of knowledge in wider disaster risk reduction policies and practice, beyond communities themselves. Moreover, traditional knowledge has the huge possibility of utilizing the learnings on disaster risk reduction gained through trials and errors over time, for disaster risk management in the current context. The 2015 Sendai Framework of Disaster Risk Reduction underlines the importance of addressing the needs and the role of traditional knowledge in tackling disaster risks.

This year, ITC will focus on the role of traditional knowledge in disaster risk management. Japan is home to a variety of frequently occurring disasters, which can cause wide-ranging damage to its cultural resources. This has resulted in the development of a rich wealth of traditional knowledge that can contribute towards disaster risk management. Various organizations have taken specialized measures which are based on traditional knowledge for mitigation, preparedness, emergency response, and post-disaster recovery of cultural heritage. These measures, developed in response to local geographical, climatic, and social characteristics related to the Japanese context as well as from other parts of the world will be introduced to the participants during this interdisciplinary training.

Fig. 3 A traditional waterway for initial fire extinguishing in Gujo Hachiman, Gifu

Previous International Training Courses (2006-2021)

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).

Organizers and Participants

The training course is organized in close cooperation with ICCORM and in collaboration with the UNESCO, ICOM, ICOMOS/ ICORP, and relevant institutions of the government of Japan.

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 (MAYNMAR)	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 Lanscape 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

1.2 Timetable of International Training Course (ITC) on Disaster Risk Management

	8/18 Thu	8/22 Mon	8/25 Thu	8/26 Fri	8/29 Mon	9/1 Thu	9/2 Fri	9/5 Mon	9/8 Thu	9/9 Fri	9/12 Mon
		1st Week			2nd Week			3rd Week			
THEME		Introduction		Case Study Project Preparation	Risk Assessment		Case Study Project Preparation	Mitigation and Preparation		Case Study Project Preparation	Emergency
		Introduction and Core Principles of DRM	Participants Introduction Presentation		WS- Disaster Imagination Game	Value Assessment, Integrated Risk Management and Key Terminology		Technology for Prevention and Mitigation	WS- Traditional Knowledge for Designing Mitigation		DRM System and Education of Emergency Drills
Venue		Online	Online	Online	Online	Online	Online	Online	Online	Online	Online
15:30		Opening Remark 1 (President of ritsumeikan Univ)	Recap	Mentoring Session Individual Case Study Project Preparation Time	Recap (Group Presentation)	Recap (Group Presentation)	Mentoring Session Individual Case Study Project Preparation Time	Recap (Group Presentation)	Recap (Group Presentation)	Recap	Recap (Group Presentation)
15:35			Intro-presentations of Participants and Comments Q&A (5min*5participants and comments)							Mid- term Presentations of Participants and Comments Q&A (5min*5participants and comments)	
15:40		Opening Remark 2 (Director General of ICCROM)									
15:45											
15:50		Orientation of the Course (R.JIGYASU/ D.KIM)			Site Visit 1 (video) Introduction to the Maintenance System in Kiyomizu-Dera World Heritage Site	SM & Q/A (Lec 6) Disaster Risk Reduction and Integrated Risk Management (R.JIGYASU)		SM & Q/A (Lec 8) Seismic Performance of Japanese Historical Structures (S. YOSHITOMI)	SM & Q/A (Lec 12) Traditional Knowledge for Disaster Mitigation in Japanese Houses (O.OBA)		SM & Q/A (Lec 13) Disaster Mitigation for Cultural Heritage by Kyoto City Fire Department (K. KISHIMOTO)
15:55											
16:00											
16:05											
16:10		SM & Q/A (Lec 1) Development of Disaster Risk Management for Cultural Heritage in Historic City: Kyoto (K.TOKI)			SM & Q/A (Lec 4) Environmental Water Supply System in Kiyomizu Area (T.OKUBO)	Site Visit 2 (video) Ponto-cho Townscape Improvement Area			Site Visit 3 (video) Kozagawa-Japanese Rural Houses & Its Traditional Knowledge for DRM		Site Visit 5 (video) Fire Prevention Facilities at Higashihongan-ji
16:15								SM & Q/A (Lec 9) Landslide Assessment (M. FUJIMOTO)	Site Visit 4 (video) Fukuchiyama-Japanese Town Houses & Its Traditional Knowledge for DRM		
16:20			BREAK							BREAK	
16:25											
16:30		BREAK			BREAK	BREAK			BREAK		BREAK
16:35	Pre-Course Orientation	SM & Q/A (Lec 2) Introduction of Kyoto (D. KIM)	Intro-presentations of Participants and Comments Q&A (5min*5participants and comments)		SM & Q/A (Lec 5) Introduction of DIG (T.OKUBO)	Group-Work (Lec 7) Disaster Risk Reduction or Disaster Risk Production: Considering Urban Challenges in Historic Urban Areas (K CHMUTINA and L BOSHER)		BREAK	Workshop 3 Designing Mitigation (R. JIGYASU) (case study: Kiyomizu-dera)	Mid- term Presentations of Participants and Comments Q&A (5min*5participants and comments)	SM & Q/A (Lec 14) Cultural Heritage Disaster Risk Management System and Response in the Event of a Disaster in Japan (R. KODANI)
16:40											
16:45								SM & Q/A (Lec 10) Climate Change and Risk Prevention (Y. SATOFUKA)			
16:50											
16:55		SM & Q/A (Lec 3) Key Principles for DRM of CH (R.JIGYASU)									
17:00											
17:05											SM & Q/A (Lec 15) Emergency Response Utilizing Traditional Knowledge by Community in Nepal (L. SHAKYA)
17:10			BREAK							BREAK	
17:15											
17:20											
17:25											
17:30		Workshop 1 Terminology of DRM (R.JIGYASU) (case study: Kiyomizu-dera)	Intro-presentations of Participants and Comments Q&A (5min*5participants and comments)		Workshop 2 Disaste Imagination Game (T. OKUBO) (case study: Kiyomizu-dera)			Summery and Exercise (Lec 11) GIS for Disaster Management of Historical Cities and Cultural Heritage (K. YANO)		Mid- term Presentations of Participants and Comments Q&A (5min*5participants and comments)	Group Work/ Discussion
17:35											
17:40											
17:45											
17:50											
17:55											

9/15 Thu	9/16 Fri	9/19 Mon	9/22 Thu	9/23 Fri	9/26 Mon	9/29 Thu	9/30 Fri	10/3 Mon	10/6 Thu	10/7 Fri	10/10 Mon	10/13 Thu	
4th Week		5th Week			6th Week			7th Week			8th Week		
y Response		Recovery			Policies and Frameworks						Conclusion		
WS- Roll Play	Case Study Project Preparation	From Response to Recovery (Lessons from Great Hanshin EQ & Great East Japan EQ)	WS- Designing Recovery Process	Case Study Project Preparation	Government Policies and DRM Frameworks	Good Practices of DRM	Case Study Project Preparation	Case Study Project Preparation			Final presentations	Final presentations and Virtual Farewell Party	THEME
Online	Online	Online	Online	Online	Online	Online	Online	Online	Online	Online	Online	Online	Venue
Recap (Group Presentation)		Recap (Group Presentation)	Recap (Group Presentation)		Recap (Group Presentation)	Recap (Group Presentation)					Final presentations of participants and Comments Q&A (9min*3participants and comments)	Final presentations of participants and Comments Q&A (9min*4participants and comments)	15:30
													15:35
													15:40
													15:45
SM & Q/A (Lec 16) Conflict Analysis for Cultural Heritage (E. SELTER)		SM & Q/A (Lec 18) Post Disaster Recovery Process in Tohoku (Y. HIRAOKA)	SM & Q/A (Lec 22) DRM System in Kyoto National Museum (J. FURIHATA)		SM & Q/A (Lec 24) Governmental Policies of Disaster Risk Management for Cultural Properties (T. INAGAKI)	SM & Q/A (Lec 26) Recent Development and Emergency Response to Cultural Heritage in Crisis Situations (G.BOCCARDI)							15:50
													15:55
													16:00
													16:05
		Site Visit 6 (video) Recovery Process after Tohoku Earthquake in Minami- Sanriku											16:10
											BREAK	BREAK	16:15
SM & Q/A (Lec 17) Formulation of Scenarios (A. TANDON)		BREAK	SM & Q/A (Lec 23) Disaster Recovery through a Social Science Lens (W. CHEEK)		SM & Q/A (Lec 25) Management System and Management Planning for Heritage Sites (E. JO)	SM & Q/A (Lec 27) PDNA and Post Disaster Recovery Frameworks (E. SELTER)							16:20
													16:25
		SM & Q/A (Lec 19) Heritage Building Information Modelling (HBIM) (T. EMPLER)											16:30
BREAK			BREAK										16:35
	Mentoring Session Individual Case Study Project Preparation Time			Mentoring Session Individual Case Study Project Preparation Time			Mentoring Session Individual Case Study Project Preparation Time	Feedback Session	Feedback Session	Feedback Session	Final Presentations of Participants and Comments Q&A (9min*3participants and comments)	Final Presentations of Participants and Comments Q&A (9min*4participants and comments)	16:40
		SM & Q/A (Lec 20) Emergency Response and Recovery after 2015 Gorkha EQ (R. RANJITKAR)			BREAK	BREAK							16:45
													16:50
													16:55
		SM & Q/A (Lec 21) The Recovery Utilizing Traditional Knowledge in India (R. JIGYASU)											17:00
					Panel Discussion on "Traditional Knowledge for DRM of Cultural Heritage" Panelists: Dave Paul Zervaas (UNDRR), Elena Isayev (Univ. of Exeter) Boyoung Cha (ICHCAP) Takeyuki Okubo (Ritsumeikan Univ.) Facilitators: Rohit Jigyasu (ICCROM) Dowon Kim (Ritsumeikan Univ.)	Workshop 6 Discussion with Former Participants on "Challenges for Making DRM Plans of CH" (K. CHMUTINA) Former Participants: -Katrīna KUKAINE - Vinka MARINKOVIĆ -David Antonio TORRES CASTRO -Sayma Iqbal -Ameneh KARIMIAN					BREAK	BREAK	17:05
Workshop 4 Role Play (A. TANDON)		Group Discussion	Workshop 5 Designing Recovery Process (W. CHEEK)								Final Presentations of Participants and Comments Q&A (9min*4participants and comments)	Course Completion Certificate Giving Ceremony and Closing Remarks	17:10
													17:15
													17:20
													17:25
													17:30
													17:35
												Virtual Farewell party	17:40
													17:45
													17:50
													17:55

2 Outline of Disaster Risk Management Plans for Case Study Projects by ITC 2022 Participants

2.1 Disaster Risk Management Plan for the Building of the Institute for Restoration of Dubrovnik in World Heritage Site, Dubrovnik, Croatia

Amalija Pavlić *architect, Institute for the Restoration of Dubrovnik*
e-mail: amalija.pavlic@zod.hr

1. Introduction

Dubrovnik is located on the eastern coast of the Adriatic sea (Fig. 1). Although the earliest traces of human activity in the area of Dubrovnik are recorded in the Prehistoric Period, evidence of continued habitation dates back to the Hellenistic Age. The City grew economically during the Middle Ages because of shipping, trading, and diplomatic skills. Dubrovnik systematically developed independent administrative and judicial institutions and expanded its autonomy. The governmental and legal framework gave Dubrovnik full political independence, with all the internal governmental elements of a sovereign state, which the city retained up until Napoleon's campaign in the early 19th century. Gradually acquiring all attributes of statehood (territory stretching 50 km south and north of Dubrovnik, citizenship, money, coat of arms, seal, flag, independent administration, judiciary and legislation, its own diplomatic missions, and foreign policy), the community of Dubrovnik began to be called a republic – Respublica Ragusina. In 1808 the independent Republic of Ragusa was abolished and under French rule. After the Congress of Vienna in 1815, the area of Dubrovnik came under the rule of the Habsburg Monarchy, retaining significant geostrategic importance.

During the 20th century, Dubrovnik was part of Yugoslavia, and in 1979 the city suffered severe damage in an earthquake. In 1991, Dubrovnik became part of the independent Republic of Croatia. During the Independence War (1991–1995), it was exposed to extensive shelling that caused severe damage to the historic city core.

Today Dubrovnik is the economic, cultural, and administrative centre of Dubrovnik-Neretva County and one of the most visited tourist destinations in the Mediterranean area. The entire city of Dubrovnik is a historical monument with significant examples of fortification architecture (city walls with fortresses, towers, and bastions from the 12th-17th centuries), Gothic-Renaissance churches, monasteries, palaces, and fountains.

Fig. 1 Dubrovnik, present state
Source: Institute for the Restoration of Dubrovnik

The focus of this study is to create a framework DRM plan for the building of the Institute of the Restoration of Dubrovnik, which is situated in the historic centre of Dubrovnik, in its seismic most vulnerable area. The Institute for Restoration of Dubrovnik was founded in 1979 as an institution that organizes

the restoration of the cultural heritage of Dubrovnik and takes care of the preservation of its genuine urban, architectural and cultural values. Institute was founded after the city suffered severe damage in an earthquake of 7º MCS scale intensity when 833 objects were damaged. The damage was estimated in 1980 at over 436 million US$. The Law for restoration of the endangered historic centre of Dubrovnik was introduced in 1986 to help with restoration after the earthquake.

2. Old City of Dubrovnik – case study site

Key heritage attributes

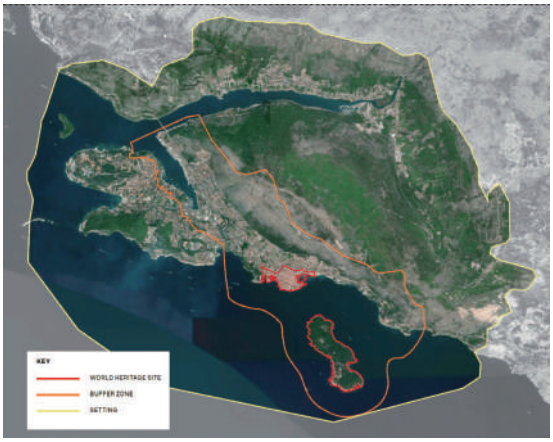
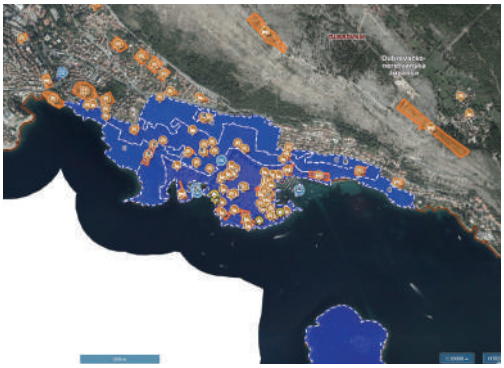


Fig. 2 Territorial coverage of the World Heritage site, buffer zone and setting
Source: UNESCO, Dubrovnik-Neretva County Spatial Plan



Ministry of Culture and Media Republic of Croatia protects:
1. entire city of Dubrovnik a cultural and historical complex
2. most important buildings as individually protected monuments
3. buffer zone and its individually protected monuments

Fig. 3 Zones of protection Ministry of Culture, Republic of Croatia
Source: https://geoportal.kulturnadobra.hr/geoportal.html#/

The historic core of Dubrovnik was inscribed on the World Heritage List in 1979 under the name Old City of Dubrovnik, under criteria (I), (III), and (IV).
Dubrovnik also meets the requirements of authenticity and integrity, including all built and spatial components inside and outside the City Walls that contribute to the Outstanding Universal Value of the Old City of Dubrovnik within its Historic Urban Landscape setting.
The very same year Dubrovnik was inscribed on the UNESCO List (1979), an earthquake of 7° (MCS) hit Dubrovnik, causing severe damage to its architectural heritage. After the Independence War (1991-92), it was inscribed on the List of World Heritage in Danger from 1991 to 1998. In 1994, at the suggestion of an advisory committee and UNESCO experts, the site was expanded, the heritage area grew to e 96.7 ha, and the buffer zone to 53.7 ha. During the second cycle of periodic reporting, in 2015, the need to expand the buffer zone was identified in order to preserve the spatial and visual integrity of the WHS, as well as to protect it from the growing pressures of modern development. The need to expand the buffer zone was confirmed by the experts of the joint UNESCO/ICOMOS Reactive Monitoring Mission in October 2015. The expanded buffer zone was adopted in 2018 and it covers an area of 1188.6 ha... (Fig. 2 and 3)

3. Hazard – Vulnerability - Risks Analysis[1)]

The internal census of the population, households, and apartments was conducted in 2016 in the area of Dubrovnik within historical walls. The total number of inhabitants of the historic core was 1557. Although the number of permanent residents is reduced in comparison to previous censuses, the number of people in city centre is largely increased with tourists. That is why the optimal number of people in the city centre has to be specified by carrying capacity, which has to be produced. For now, the optimal number is considered under 8000. (Fig. 4 and 5)
Dubrovnik area, including the World Heritage site, is classified as a high-risk earthquake area Dubrovnik is

also at risk of fire, floods, droughts, and climate changes. In recent years, a series of such unwanted events have been recorded. (Fig. 6 and 7)

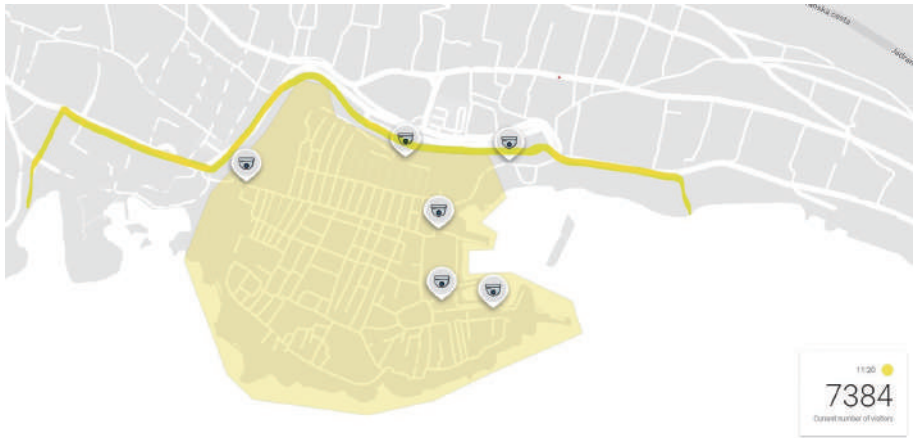


Fig. 4 Number of people inside World Heritage site (city walls)
Source: City of Dubrovnik

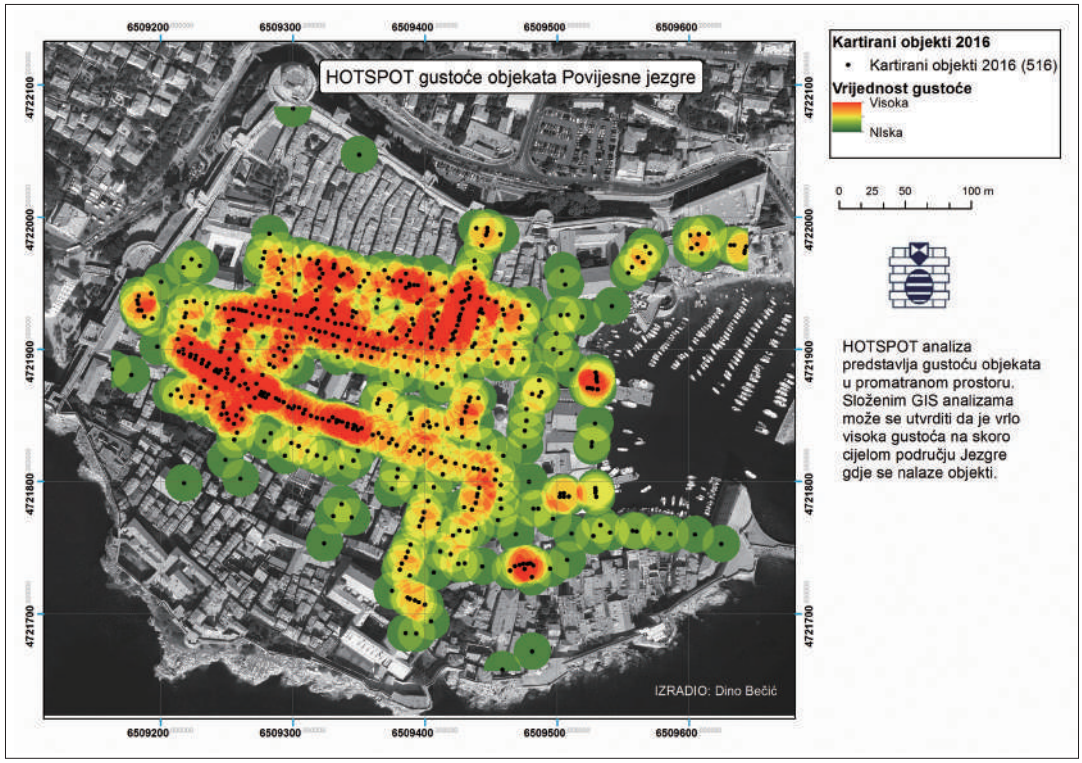


Fig. 5 HOTSPOT analysis of the density of usage of the spaces
Source: City of Dubrovnik

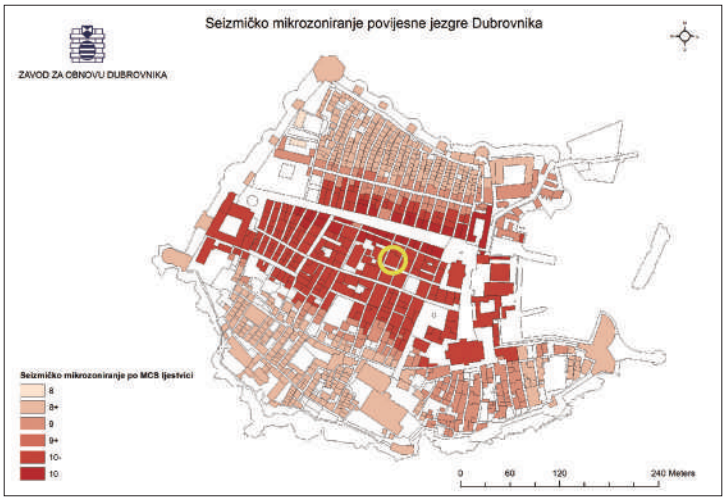


Fig. 6 Dubrovnik, seismic microzoning of the city centre, with the position of the building of the Institute for the Restoration of Dubrovnik
Source: Institute for the Restoration of Dubrovnik

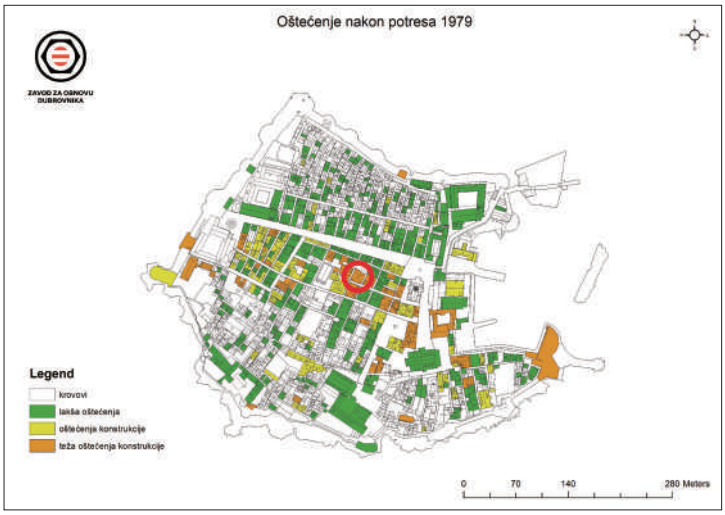


Fig. 7 Dubrovnik, damage after earthquake in1979, including the building of the Institute
Source: Institute for the Restoration of Dubrovnik

Tab. 1 Detailed correlation between hazard, vulnerability and the risks
Source: by the author

HAZARDS	VULNERABILITIES	RISKS
EARTHQUAKE – high probability **FIRE** – medium probability **HEAVY RAIN/ STORM/ WIND** – high probability **RISE OF THE SEA LEVEL** – medium probability **HEAT WAVE** – high probability	• Seismic and fire vulnerability of buildings due to materials: load bearing stone walls, non-fire resistant wooden roof construction with tile rooftops • Buildings with damaged construction • City is densely built - position of buildings near each other (blocks of buildings) • Only two main entrances/exits – potentially problematic traffic connections • Different terrain conditions in different areas of the city • State of the preservation of the buildings, not equal in whole WHS • Only few city squares have enough open space	**Social** • Human losses • Loss of place to live - residents have to move out • Loss of economical income **Heritage** • Loss of authenticity in case of losing residents • Loss of heritage value in case of damage of historical buildings/ churches/public buildings/ museums

3. Developing a Disaster Scenario

PRIMARY HAZARD: Earthquake

SECONDARY HAZARD: Fire

A strong earthquake (VII MCS scale) strikes during a summer day (hypothetically August, Saturday, 9:00 AM), while there are approximately 8000 visitors and citizens in the city centre of Dubrovnik. Tourists are sightseeing on streets, museums, and city walls. Meanwhile, citizens are in grocery shops, green market, and on the way to the beach. The earthquake damages a lot of historical buildings. Some buildings are entirely collapsed, and roof tiles and beams fell from others, causing blockage of the streets. There are fires in some buildings, especially in restaurants, where cooking oil is collected for proper disposal. There are human losses and people are injured under collapsed material from the buildings and structures. Since there are only two main entrances/exits into the city within the walls, everyone tries to escape from the city. People panically try to exit. Blockages on the streets prevent rescue and evacuation of the people. Also, prevent the arrival of the ambulance and fire department vehicles. At the same time, some people try to steal parts of museum collections, private property, etc., which are momentarily unattended.

Building of the Institute for the Restoration of Dubrovnik is situated in the most endangered city area. It is structurally strengthened and has fire detectors and various types of fire extinguishers. Employees are, at the moment of the hypothetical event, mostly on vacation, just a few of them work and are in the building. They survive the first impact and help prevent more damage.

4. Mitigation Measures

In order to avoid or mitigate the consequences of the above-described scenario, as shown in table 2, a lot of measures can be created on different levels. The creation of the disaster response policy and disaster response planning are activities on the State and City level. But every stakeholder inside the city should be involved and prepared at some level.

The cost of some measures, such as structural reinforcement of the buildings is high but necessary. At the same time, some of the preventive activities are low cost, and the results are immediate. The constant maintenance measures should include the consolidation of structures (especially located along the evacuation routes), and maintenance of roofs, chimneys, and hydrants.

Other low-cost measures are raising awareness among residents, owners of businesses, museum staff, and tourist guides, as well as maintenance and signalization for the safety of evacuation places and routes.

Tab. 2 Proposed Mitigation Measures
Source: by the author

BUILDING LEVEL (Institute for the reconstruction of Dubrovnik (IRD)					
MEASURE DESCRIPTION	**LEVEL**	**LIMITED HAZARDS**	**STAKEHOLDERS**	**DURATION**	**COST**
Rescue plan for documentation	Institution level (IRD)	Reduce impact on documentation	Institute DRM team	Medium	High
Establish a DRM team and continuous training of the employees	Institution level (IRD)	Prepare a response in case of an earthquake or other emergency	Institute DRM team	Short-medium	Low
Establish the network for emergency situations in the institutions that take care of cultural heritage	National level, City level, private, NGOs	Preparation for effective response in case of emergency	Ministry of Culture, City State archive, churches, museums, rescue services	Medium	Medium
Research of the new methods of strengthening buildings against earthquakes, as a business activity of the Institute (new materials and methods of installation)	Institution level (IRD), implementation on the block of buildings/ building level	Increase the level of earthquake resistance of historical buildings	University of civil engineering in Zagreb, Seismic institute of Croatia, IRD, Ministry of Culture, Conservatory department of Dubrovnik	medium-long	High

CITY LEVEL (IRD is included in every measure)					
MEASURE	**DESCRIPTION**	**STAKEHOLDERS**	**DURATION**	**COSTS**	**EFFECTS**
PLANNING	developing and implementing Management plan and Disaster Disk management plans	Government state/ county/ municipality	Long	Medium/ Low	Connect institutions Improve risk Preparedness
MAINTENANCE	Consolidation of structures	City/State	Long	High	Reduces the effects of the earthquake/fire
	Roof tile maintenance	Private/City	Medium	High	Reduces effects of the earthquake/ Heavy rain
	Hydrant maintenance	City	Short	Low	reduces fire effects
	Drainage maintenance	City	Medium	Medium/ High	Reduces heavy rain and flood effects
EDUCATION	Earthquake/fire scenario drills	City	Short	Low	Improve risk Preparedness
AWARENESS	Improving street signalization	City	Medium	Low	Improve risk Preparedness

5. Preparedness and Response Measure

Dubrovnik, as a site with a high concentration of cultural attributes, requires an emergency team, which includes rescue teams (firefighters, paramedics, police, and civil protection), and cultural property experts, who must take care of preliminary damage assessment and rescue heritage properties. They also have to be included reconstruction and renewal processes. In case of the occurrence of a disaster, good preparedness and organization can ease early recovery.

Tab. 3 DRM pilot project proposal
Source: by the author

DRM PILOT PROJECT PROPOSAL			STAKEHOLDERS
1.	Continuous digitalization of documentation of the Institute for Restoration of Dubrovnik	FIRST YEAR - FIRST TASK	Institute for the Restoration of Dubrovnik (IRD), State archive
2.	Adding data in GIS for the whole WHS site – in first phase only documentation in possession of the Institute for the Restoration of Dubrovnik	FIRST YEAR - SECOND TASK	Institute for the Restoration of Dubrovnik (IRD)
3.	Connecting data between institutions to get the entire data of UNESCO WHS site	CONTINUOUSLY	City of Dubrovnik, Conservatory department Ministry of Culture, Seismic institute, Social data
4.	Review of escape routes and safest escape places for citizens and tourists Defining safe corridors – according to the aseismic reconstruction of the blocks of buildings (interlinkage of data: seismic strongest buildings seismically reconstructed buildings, MCS scale risk chart)	SECOND YEAR - THIRD TASK	City of Dubrovnik, administrative departments and Institutions
5.	Implementing new scientific data on earthquake protection and the impact on historical buildings	CONTINUOUSLY	Institute for the Restoration of Dubrovnik (IRD), Conservatory department Ministry of Culture, Seismic institute, University of civil engineering Zagreb

6. Conclusion

Dubrovnik is a specific site with a lot of users, owners, and stakeholders in a small area. Lots of activities are maintained at the same time, it is a living city with residents, public and private businesses, schools, and tourist activities. The potential disaster would have a huge impact on the cultural heritage but at the same time on the quality of life of its residents. It is essentially important to work on prevention, raising consciousness, and including all stakeholders in the implementation of protective measures.

References

1) Management Plan for the UNESCO World Heritage site of the Old City of Dubrovnik 2021-2026.
2) Ivanka Jemo: Models of creating documentation in function of the restoration of Dubrovnik, EU-CHIC , Split, Croatia 2012

2.2 Disaster Risk Management for the Former Canterbury Provincial Council Buildings and Grounds

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e-mail:amanda.ohs@ccc.govt.nz

Fig. 1 Former Provincial Council Buildings, timber buildings, Durham Street North, Christchurch.
Source: by the author, 2022.

Fig. 2 Former Provincial Council Buildings, Bellamy's (left), timber buildings and courtyard.
Source: by the author, 2022.

Fig. 3 Former Provincial Council Buildings, deconstructed Stone Chamber.
Source: by the author, 2022.

1. Introduction and Site Context

The highly significant Former Provincial Council Buildings and Grounds (CPCB) (Figs. 1,2,3) has stood vacant and unrepaired in the central business district since being severely damaged as a result of the February 2011 Christchurch Earthquake sequence. The city lost large numbers of heritage buildings to demolition after the earthquakes - one third of central city heritage protected buildings were lost. The Christchurch City Council (the Council) is responsible for the CPCB, which was temporarily secured after the earthquakes. The CPCB has been cared for with a base level of maintenance and management while decisions are made on its future use and while funding for repair and reconstruction is secured.

The CPCB was constructed from 1857-1865 to house the local provincial government offices, debating chambers and refreshment rooms. At the time of the earthquake, the CPCB housed offices, a restaurant and bar, and public information on the history of the buildings.

The CPCB is a prominent landmark, located on a busy corner intersection and bounded by the Ōtakaro-Avon River (Fig. 4). Around the buildings, Ōtautahi-Christchurch's central business district continues to recover from the earthquakes. Through partnership projects, mana whenua (indigenous people with traditional authority over the land) cultural heritage values have been interwoven into adjacent recovery

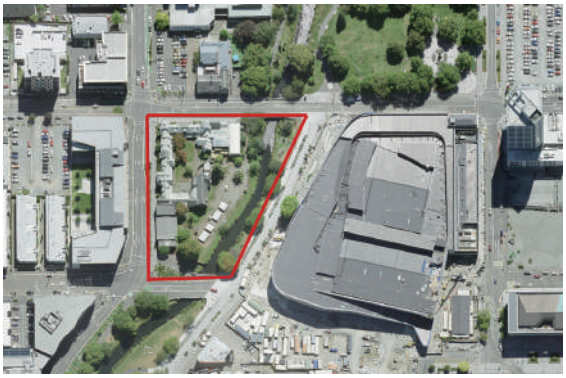

Fig. 4 Aerial Photograph identifying case study site (red outline).
Source: Canterbury Maps http://canterburymaps.govt.nz/, viewed 7 November 2022.

Fig. 5 Te Whāriki Manaaki woven mat of welcome with CPCB in background.
Source: by the author, 2022.

projects such as Te Pae, the recently completed convention centre, as well as artworks, interpretation, and public realm design in the Ōtakaro-Avon River corridor and Victoria Square (Fig.5).

2. Heritage Status, Values, and Attributes

The CPCB and grounds are of heritage significance at regional, national, and international levels[1]. The complex has heritage protection through scheduling in the Christchurch District Plan as a Highly Significant group of heritage items collectively known as a place (Fig.6). The national heritage agency Heritage New Zealand Pouhere Taonga, recognises the CPCB under the Heritage New Zealand Pouhere Taonga Act 2014 as a Category I Historic Place on the national New Zealand Heritage List/Rārangi Kōrero. Category 1 historic places are of special or outstanding historical or cultural significance or value

The CPCB is also protected under its own Act of Parliament – the 1928 Canterbury Provincial Buildings Vesting Act (amended 1988), which requires the buildings to be maintained as a memorial of the foundation of the Province of Canterbury. In addition to this regulatory and statutory recognition, community consultation undertaken as part of Council's Our Heritage, Our Taonga Heritage Strategy 2019-2029 strongly identified that the heritage buildings remaining after the earthquakes are precious survivors.

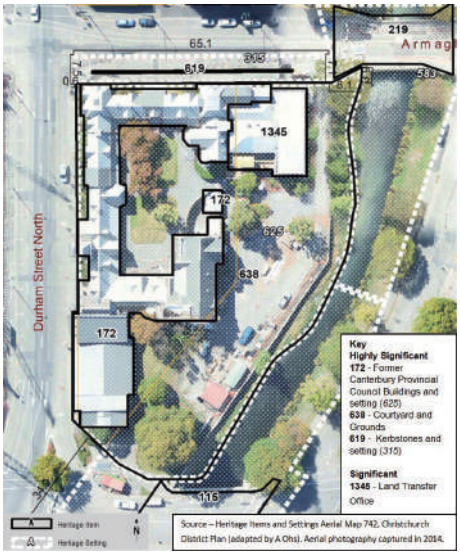

Fig. 6 Heritage Aerial Map excerpt indicating extent and levels of regulatory heritage protection.
Source: Christchurch District Plan with annotations by the author.

The CPCB is of architectural significance for its incremental development around a central courtyard in three stages (1857-59, 1859-60, and 1864-65) (Fig.7). This growth over time, first in timber and later in stone, expresses the growing size, wealth and ambition of both the province and its provincial council. Architect B.

Fig. 7 CPCB Heritage Attributes.
Source: photographs by the author; floor plan, Skews Hey Ussher Architects, 1998.

W.Mountfort adapted medieval English models to the colonial context and is often credited for creating Christchurch's defining architectural character as a Gothic Revival city. Technological and craftsmanship values are evident in the early, high quality construction materials, methods, and techniques and the high standard of detailing and workmanship. As the only purpose-built provincial council buildings that are extant and as a memorial to the Province of Canterbury, the CPCB has high historical and cultural heritage value to Ōtautahi-Christchurch and Aotearoa-New Zealand. These colonial buildings are an iconic landmark for their prominent location and relationship to the landscape. The site formed part of Puāri Pa (traditional Maori settlement), and is of significance to mana whenua as an important mahinga kai (food gatherine area), however, these important cultural values are less visible. Awaiting repair and reconstruction, the place has the potential for dialogue about Christchurch's complex story of colonisation, and the place of Gothic Revival architecture within that.

The CPCB was significantly damaged by the earthquakes, in particular, the stone sections were severely compromised. The Stone Chamber, Durham Street North and Armagh Street towers collapsed, and deconstructed to sill height. The flagstone corridor and plastered walls were damaged throughout. Despite this damage, the complex as a whole, together with the courtyard and grounds, has high integrity and authenticity. The Former Land Transfer Office has been altered over time and is a later building (1924).

3. Actors and stakeholders

There is a broad range of stakeholders with interests and responsibilities for the site (Fig. 8). Care and maintenance of the buildings is the responsibility of (the Council) under the Vesting Act (1928), therefore the Council has the highest influence and interest in the place. Alterations require the approval of the Minister of Conservation. Targeted engagement with the emergency sector, the Ōtautahi-Christchurch community, neighbouring businesses, mana whenua, and potential users of the buildings would increase their interest and influence to benefit the disaster risk management of the heritage place.

Fig. 8 CPCB stakeholder mapping.
Source: by the author, 2022.

4. Key hazards and vulnerabilities

Hazards have been identified and assessed using a risk evaluation matrix (Fig.9). The damaged and temporarily secured buildings (particularly the stone buildings) are very vulnerable to further earthquake damage. The Alpine Fault, a different major fault to the one which caused the 2011 earthquakes, has a high probability (estimated at 30%) of rupturing in the next 50 years with a magnitude 8.0 earthquake event[2]. Therefore the earthquake risk has been assessed as extreme. Terriorism has been assessed as ex-

Hazard	Likelihood	Impact	Disaster Risk
Earthquake	4	5	Extreme
Flood	4	2	Medium
Snowstorm	2	3	Medium
Storm event	2	2	Medium
Fire	4	5	Extreme
Terrorism	2	5	Extreme
Gradual Deterioration	5	3	High

Fig. 9 CPCB Risk Assessment.
Source: by the author, 2022.

treme due to the buildings' association with government, its location opposite the international convention centre, and near to public open spaces. Christchurch recently experienced unlawful occupation of public spaces by freedom protesters, and in Wellington the Parliament buildings and grounds were occupied with damage to property. Flooding from the Ōtakaro-Avon River has been assessed as a medium risk. This hazard is historically frequent and estimated to increase as much as 10 to 15% with the effects of climate change[3]. However the buildings are located on high ground, and flood waters historically only reach the steps of the stone buildings, which have a low vulnerability to flood damage[4]. The landscape and archaeological values of the grounds are however vulnerable to flood damage. The vacant buildings are at high risk of gradual deterioration through the impacts of pests, rising damp, water leaks, wet and dry rot, efflorescence, mould/lichen, borer, vandalism and minimal maintenance. The vacant status also contributes to the extreme risk of fire.

5. Disaster scenario

An existing sprinkler system throughout the building provides fire suppression and is regularly maintained. However, vulnerabilities to fire result from the timber construction, the vacant status, and the lack of a monitored fire alarm, fire doors, or disaster risk plan. In addition, there is limited monitored surveillance, an increasing occurrence of unwanted entry to the site, and a citywide average of one fire in a vacant heritage building each year since 2019. There are no security personnel on site, and security cameras only cover the east frontage of the building. Therefore a worst case scenario could involve an intruder entering from the west frontage behind tall vegetation and starting a fire at 3 am on a weekday morning in February which is the height of summer. The sprinkler system malfunctions, and the fire spreads quickly. An observer contacts the fire service, which douses the building in water to put the fire out. The fire burns large areas of timber fabric, with secondary loss of fabric due to water and smoke damage, along with mould and fungal growth. In this scenario, the building becomes a prominent eyesore in the central city, and the owner decides it is uneconomic to repair and reconstruct. This decision is not widely opposed by the community, and the buildings are demolished.

6. Mitigation measures

The immediate technical priority is installing a monitored fire alarm system. This is closely followed by measures to improve security systems. These technical measures will be a moderate to high expense. There are a number of quick and low cost management, maintenance, and monitoring measures, such as clearing the building of combustible materials (Fig. 10) and lowering vegetation (Fig.11) that will reduce the fire risk. Additional security cameras are required on Durham Street (Fig.12) Immediate education and advocacy with stakeholders is required to generate support for bringing forward the earthquake repair and to identify potential community uses. Medium and longer term work is required to plan and undertake the earthquake repair works, to provide access to the fire service, and prepare and implement a fire plan which may include measures such as fire doors.

Fig. 10 material, office, CPCB.
Source: by the author, 2022.

Fig. 11 Tall vegetation, Durham Street North.
Source: by the author, 2022.

7. Proposals for emergency preparedness and response

Figure 12 illustrates mitigation and emergency preparedness measures on site. In addition to the mitigation measures proposed, the following activities undertaken prior to the emergency event will improve emergency preparedness:

- Develop a response plan for fire
- Regular scenario practice with Fire and Emergency New Zealand (fire service)

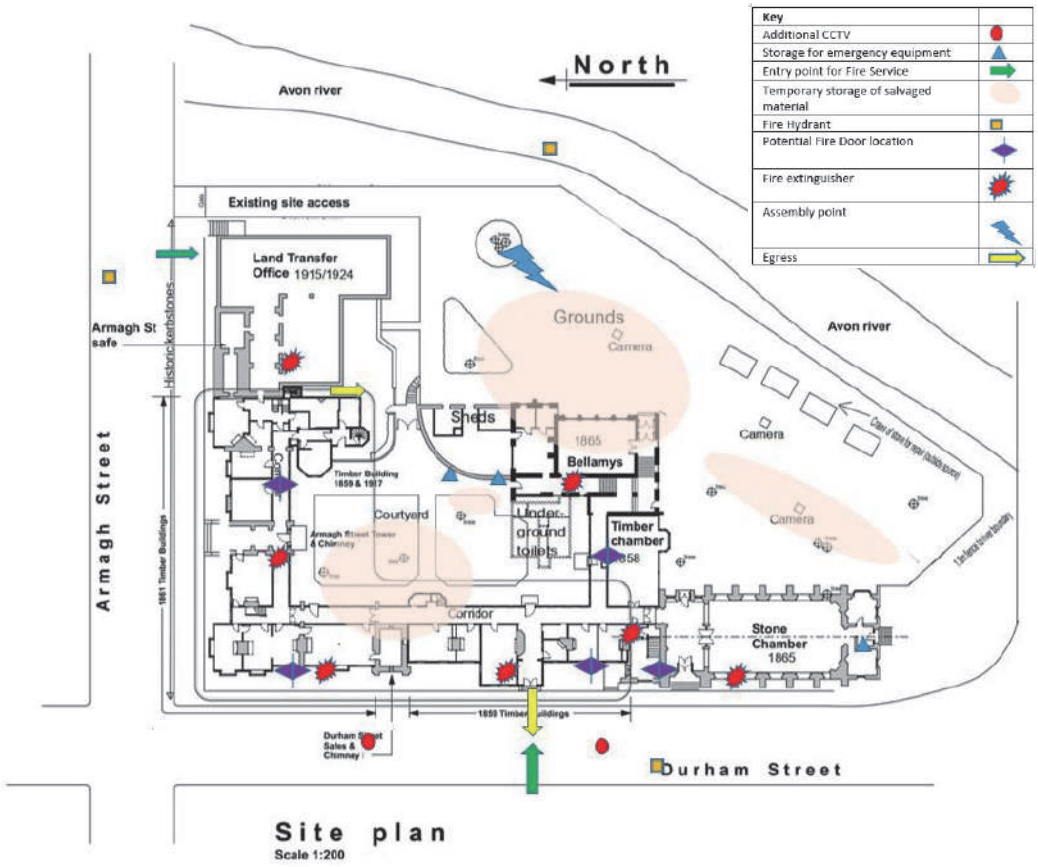

Fig. 12 Site plan showing existing and proposed mitigation and preparedness measures.
Source: Christchurch City Council with annotations by the author.

・Familiarise fire service with site/values/priority areas
・Create damage and risk assessment form templates
・Develop a methodology for fabric salvage/tagging/storage
・Collate plans and documents (update conservation plan/undertake three-dimensional digital scanning).

These will be implemented by the Council, engaging expert consultants as required, and by including the fire service in site meetings and planning.

Emergency response (Fig. 13) will involve a number of actors, including the owner, fire service, conservation architect, heritage engineer, and specialists as required (conservators, stonemasons, archaeologists, arborists, builders, mould removal specialists).

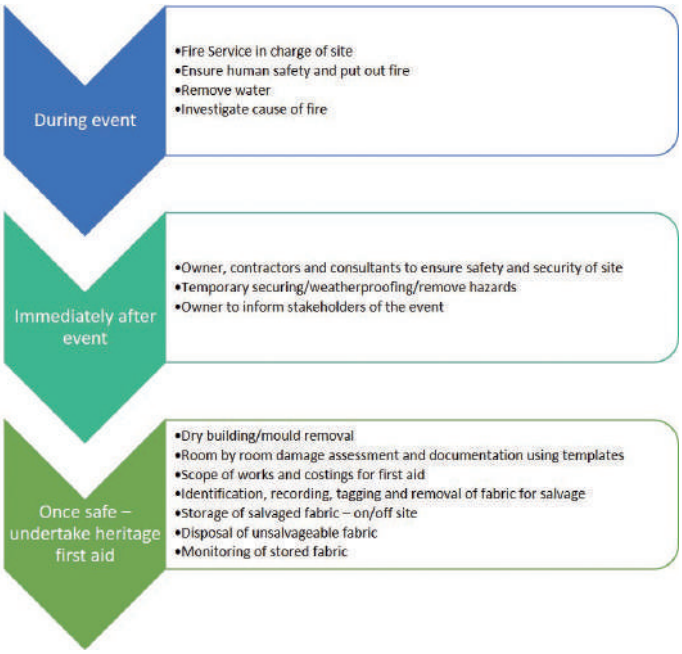

Fig. 13 CPCB Response Plan.
Source: by the author, 2022.

8. Proposals for emergency recovery

Planning for recovery from a future fire scenario is inextricably intertwined with the current need for recovery of the CPCB from the 2011 earthquake damage. Recovery will need to be a phased approach, considering the scale and complexity of works. To date the earthquake recovery has been paused due to the huge financial cost to repair the whole complex and reconstruct the Stone Chamber. The council as the owner should lead the recovery, ideally with a multidisciplinary team. The less damaged sections should be repaired first with available funding, allowing part of the complex to be returned to use in order to generate an income and enable community access.

Reconnecting the community with the site is vital to the success of the recovery and in order to bring the buildings and grounds to life once more as a living memorial to the foundation of the Province of Canterbury. This can be done through temporary activation, including artwork, events, and storytelling opportunities. It can also be done through community generated uses. There are existing models for community activation and involvement that have been successfully used elsewhere in the city for community earthquake recovery that the Council can draw on. Members of the public can also take on and lead some of this work with Council support, in line with the Council's Heritage Strategy.

Stabilization and monitoring of fabric (in situ and stored) will need to be undertaken in the early stages.

Conceptual, then detailed planning and regulatory Building Consent and Planning approvals will need to be obtained for all phases of work. As activity on site brings a new set of fire hazards, these will need to be carefully managed during construction works. While phase one of the repair and reconstruction is underway, external funding will need to be sought to fund the reconstruction and repair of the deconstructed Stone Chamber and severely damaged Bellamy's wing. Alongside the repair works, a Māori heritage values assessment should be commissioned to inform future integration and appropriate expression and recognition of those values on the site. This approach is evident in public realm works in the vicinity of the site and could be achieved through a landscape design partnership approach with mana whenua.

9. Conclusion

The former Canterbury Provincial Council Buildings and Grounds have high heritage significance for a wide range of values, some of which are hidden and have the potential to be sympathetically expressed on site. This landmark heritage place is resilient in many ways but also has vulnerabilities and faces a number of hazards now and into the future. Through the process of developing a disaster risk plan for a fire scenario, the need to address the vacant site and earthquake damage as a matter of urgency has been identified alongside fire mitigation measures. There is strength in fostering collaboration, integration, and partnership with stakeholders with the potential to positively contribute to the risk reduction, emergency preparedness, and ultimately the recovery of the buildings in any future emergency events.

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2.3 Disaster Risk Management Plan for A Century-old Temple: Tamsui Fuyou Palace, Taiwan

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1. Introduction of Tamsui Fuyou Palace

(1) Historical and Geographic Setting

Tamsui is a seaside district in New Taipei City, Taiwan, with a population of 183,278. There are 738 residents within the boundary of the village where the Palace is located[1]. The history of Tamsui Fuyou Palace's construction dates back to Qianlong's reign in the Qing Dynasty (1782), located just in front of the Tamsui old port. In the late Qing dynasty, due to that Tamsui's proximity to mainland China and it is a naturally built harbor, it quickly became a major fishing and trade port (Li, 1996). The Tamsui Fuyou Palace was constructed in response to the expanding domestic and international traveller population's demand for spiritual comfort and support in light of maritime safety. Since then, the emerging blocks have been extended from the Fuyou Palace, which is at the core area of Tamsui old town. There are six temples built later in this area (See Fig.1).

Fig. 1 Tamsui Fuyou Palace, New Taipei City
Source: by the author

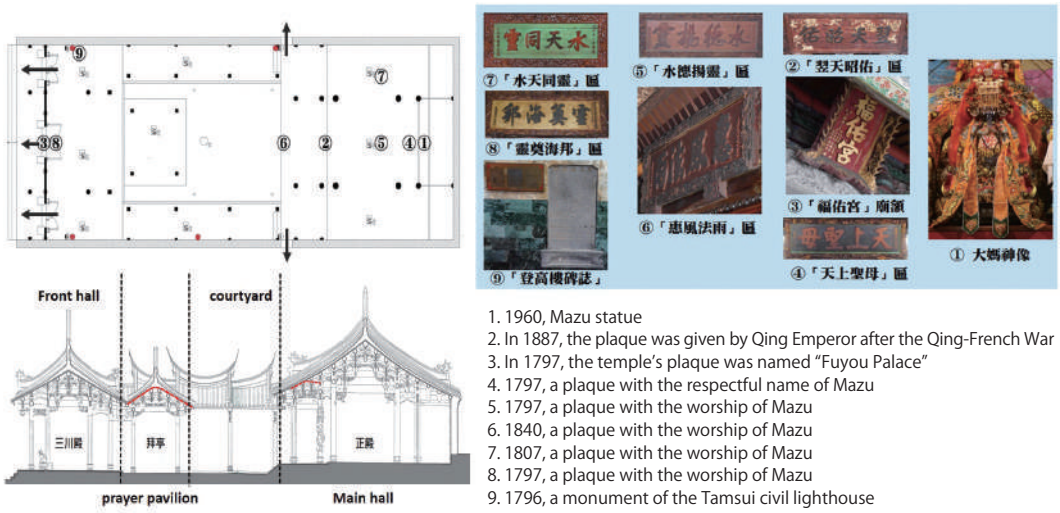
Fuyou Palace is the earliest temple worshipped Mazu in Tamsui. It was rebuilt and completed in 1796. In 1972, the local believers initiated the new constructions around the palace. In 1985, it was listed as National Monument based on its value in culture, history, and aesthetics.

(2) Heritage Value and Attributes

The main part of Fuyou Palace follows the Taoism style. The temple is divided into a front hall, a prayer pavilion, a show stage (courtyard), the main hall, two corridors, and an auditorium at the back of the temple. Goddess Mazu is placed in the center of the main hall. As a long-standing local belief center, it connected Han communities of different ethnic groups and laid the foundation for the early development of Tamsui since the 18th century; it is also the local spiritual sustenance during the Qing-French War and the Japanese period up to the present day.

The historic temple maintained mostly original wooden and stone-built construction, which dated back to the 17th AD. Inside, the 200-year-old art crafts of fragmented ceramics, murals, stone and wood carvings, and plaques are preserved (See Fig. 2). The key heritage attributes (architecture, religion, narratives, antiq-

uities, and living heritage) of Fuyou Palace can be summarized in Fig. 3., including historical, architectural, cultural, social, religious, and artistic values.



1. 1960, Mazu statue
2. In 1887, the plaque was given by Qing Emperor after the Qing-French War
3. In 1797, the temple's plaque was named "Fuyou Palace"
4. 1797, a plaque with the respectful name of Mazu
5. 1797, a plaque with the worship of Mazu
6. 1840, a plaque with the worship of Mazu
7. 1807, a plaque with the worship of Mazu
8. 1797, a plaque with the worship of Mazu
9. 1796, a monument of the Tamsui civil lighthouse

Fig. 2 The collection of Tamsui Fuyou Palace
Source: by Tamsui Fuyou Palace (2022)[3)]

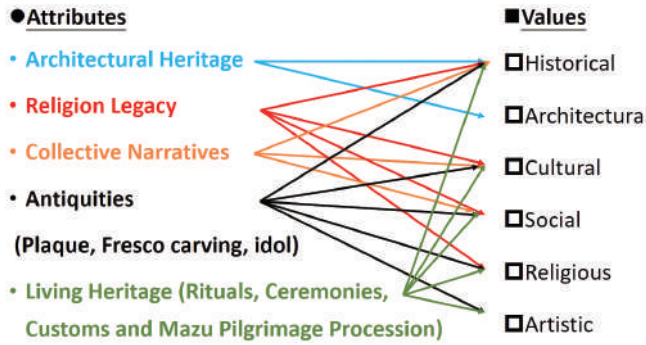


Fig. 3 The Heritage Attribute and Value of Tamsui Fuyou Palace
Source: by the author

2. Risk Analysis of Tamsui Fuyou Palace

The following demonstrates the inter-relationships between hazards and vulnerabilities, as well as the potential impacts on the heritage attributes of Tamsui Fuyou Palace.

(1) Typhoon and Flooding

Typhoon is one of the three major disasters in Taiwan (the other two are earthquake and flood), and Tamsui is no exception. Fig. 4 shows the most frequent typhoon route around Taiwan is from the northeast side towards the northwest direction. Tamsui (marked in red star) is at the junction of route 1 and route 9 facing a high potential hazard impact. According to existing records, there were three times of flooding (see Fig.5, marked in blue points) approaching Fuyou Palace, but no direct impact on the temple (marked in red square). According to the above, the medium risk is identified regarding the hazards and vulnerabilities to Fuyou Palace; there are more potential impacts towards antiquates than architecture in the perspective of heritage attributes.

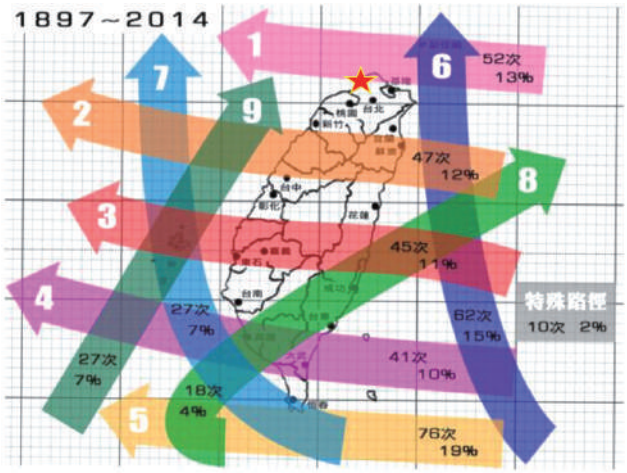


Fig. 4 The Heritage Attribute and Value of Tamsui Fuyou Palace
Source: TYPHOON ROOM[4)]

Fig. 5 Flood Disaster History in Tamsui
Source: Tamsui District Office, New Taipei City Government, 2021[5)]

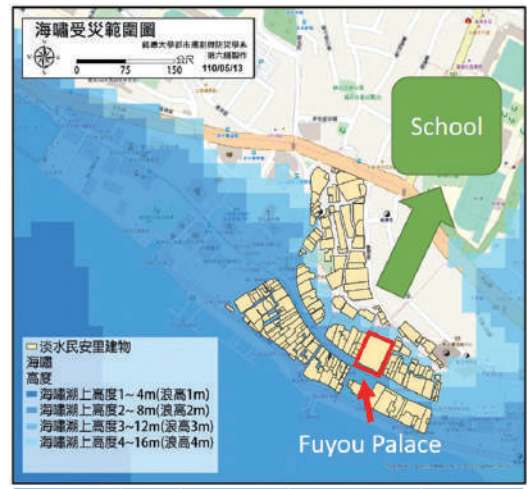
(2) Earthquakes and Tsunamis

Based on the official simulation data in 2021[5)], the earthquake-resistant classification of the Fuyou Palace neighborhood is as Fig. 6. With a 6.9 scale earthquake in Shilin (15 km away from Tsunami), the simulation demonstrates that there will be 2 buildings fully collapsed, 1 building half collapsed, 17 buildings with slight structure damaged. About 35% of the residents choose public assistance for refuge; using the total population of 738 as a basis for calculation, 258 residents need to be resettled. A comprehensive refuge space plan is needed to meet the requirement. Therefore, the medium risk is identified regarding the hazards and vulnerabilities to Fuyou Palace in Earthquakes; the potential impacts of the heritage attributes from strong to weak sequentially are architecture, antiquates, and traditional knowledge.

Regarding the tsunami, in the case of this region, it is usually generated by earthquakes below water. The latest simulation data (2021)[5)] gives the situation that an offshore earthquake of 7.3 scale (90 km away from the Tamsui) which causes the 79km per hour tsunami with a height of 8 to 10 meters hitting this area (see Fig. 7). Considering the historically low probability of occurrence, this simulation should be in the me-

Epicenter	Scale	Depth	Rupture length/width	Fault dip
Shilin, Taipei City (15 km away)	6.9	8km	56km/20km	50°

Fig. 6 Earthquake simulation of Fuyou Palace neighborhood
Source: Tamsui District Office, New Taipei City Government, 2021



Location	Scale	Cause	Tsunami speed	Height
Offshore at Jinshan (90 km away)	7.3	Storegga Slide	79km/hr	Run-Up 8-10m

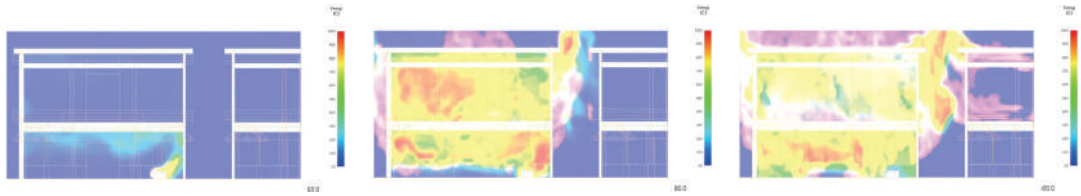
Fig. 7 Tsunami simulation of Fuyou Palace neighborhood
Source: Tamsui District Office, New Taipei City Government, 2021

dium risk of the hazards and vulnerabilities of Fuyou Palace; the potential impact towards heritage attributes in sequent are antiquates, architecture, and the belief of sea goddess.

(3) Fire Hazard

After a series of workshop, discussion, and site investigation in the Fuyou Palace, there are several fire risks as below, a) the temple's internal space uses open fire (lighting incense and staff kitchen), b) the building's cable lines are aged, c) the visitors are vast in the particular event which overloads the capacity, d) except the front door's temple court, the other three sides' external space, and the surrounding lane/alley are narrow causing the difficulty for tourists to evacuate, e) lots of fireworks during the Mazu Pilgrimage Procession. The research team conducts a fire simulation (CPRC, 2022) with the adjacent buildings separated by 3 meters in the case of Fuyou Palace (see Fig. 8). It demonstrates that within 60 seconds, the fire point started on the bottom floor and had made it to the ceiling; after the 80s, the fire spreads to the next building's first floor; 120s later, the fire spreads to the next building's ground floor.

Thus, regarding the hazards and vulnerabilities of Fuyou Palace, the high risk of fire is recognized in consensus by the site managers and the research team. And the potential impacts of the heritage attributes (in the sequence of intensity), including architecture, antiquates, traditional knowledge (documentation), and social conflict.



60 seconds 80 seconds 120 seconds

Fig. 8 Fire simulation of Fuyou Palace
Source: CPRC, 2022

3. Worst Case Disaster Scenario

(1) Fire Accident during the Pilgrimage Procession

A fire accident during the Mazu Pilgrimage Procession of Fuyou Palace is set for this scenario. The scenario is dated April 21st, 2029 Saturday. The day was 28° sunny/windy with a humidity of 80.1%[7]. The fire accident is caused in two places and both are in the route of the Mazu Pilgrimage Procession (see Fig. 9). The first fire point (fire point B) is at Fuyou Place, at 14:23, due to the crowded prayers and visitors, someone accidentally knocked over the incense burner, the sparks hit a group of paper money; meanwhile, a series of firecrackers and fireworks were set off, one of the burning pieces dropped into a shophouse then became the second fire point (fire point A).

Fig. 9 Worst Disaster Scenario of Tamsui Fuyou Palace: Fire
Source: by the author

Thereafter, because the senior temple staff were in the Procession, only one newly joined volunteer who has not yet completed the fire drill training. The crowd delayed both the staff and firefighters from getting to the fire in time. Due to windy weather (East wind) and dry daytime, the fire spreads to the neighborhood buildings. Some residents were injured, including the temple staff. 15 buildings were burned within 30 minutes. Many people were injured as a result of the pushing during the evacuation. Zhongzheng Road (the historical street) was closed for safety. The shops in the historical street were forced to close down. For the palace, the wooden structures were burned down, and the stone bases and pillars still stood but with dark scorch marks. Only the Mazu idol and a couple of plaques were rescued.

(2) Disaster Mitigation Measures Proposals for the Fire Scenario

By reviewing the above fire scenario as the worst disaster to Fuyou Palace, the following mitigation measures proposals are generated for reference. These proposals can be generally concluded in four scales of intervention, including the national level, city level, building level, and the site/attributes level (see Tab.1). At the national level, a cooperation network for emergencies in the cultural heritage institutions including the legal framework and financial support is in demand. The measure could provide an effective response based on the current heritage network in the case of emergency but also offer the existing financial support for recovery. For the city level, an extra outdoor sprinkler system at the front courtyard and a dedicated fire escape route for the fire hazard should be considered. It could create the advantage of probably eliminating fire in the minimum territory and shortest time. Regarding the building level, to reduce the impact on collections and wooden structures during a serious fire, it should make a rescue plan for collec-

tions and documentation by mapping a 2nd escape route but also adopt the appropriate fireproofing coating to the whole or part of wooden structures (given the probable impact of fireproof coating on the timber components of this historic building, it must first be examined and approved by the relevant government agency. Finally, at the site and attributes level, the suggestions are encouraging the annual events to include training courses and renewing the rescue plan through regular fire drills yearly, as well as sufficient emergency kits at the place.

Tab. 1 Proposals for the fire scenario of Fuyou Palace
Source: by the author

	Description of Mitigation Measure	Scale of Intervention	Which hazards are eliminated, reduced	Who would be involved	Duration of implementation	Estimated Cost
1	Cooperation network for emergencies in the culture heritage institutions	National	[1]Prepare an effective response in the case of emergency [2]Financial support for recovery	Culture sectors, tourism sectors, heritage institutions (museums, National archive, etc.), rescue services, NGOs, religious charities, public representatives, and temple managers.	Long	Low
2	Extra sprinkler system and dedicated fire escape for the fire hazard	City	Probably eliminated fire in the minimum territory and shortest time	The city council, civic engineers, firefighters, environment specialists, and behaviourist, temple manager, local communities.	Medium	Medium
3	[1]Rescue plan for collections and documentation (2nd escape routes) [2]Adopt the appropriate fireproofing coating to the whole or part of wooden structures	Building	Reduce impact on collections and wooden structures during a serious fire	Temple management team, relevant departments, experts, and residents/ volunteers.	Short-Medium	Low
4	[1]The annual events include training courses and renewing the rescue plan yearly [2]Regular fire drills [3]Emergency kit	Site level, attributes level	prepare an effective response in the case of emergency	Temple management team, relevant departments, experts and residents/ volunteers.	Short-Medium	Low-Medium

This case study site adopts the theoretical framework of social capital with regard to the pre-disaster recovery programing. Social interactions are a form of social capital that can offer help when it's needed (Woolcock & Sweetser, 2002; Pelling, 2003; Aldrich, 2012). As shown in Fig. 10, Tamsui Fuyou Palace is placed at the centre of a network of local social capital that also includes local businesses, organisations, professionals, and historical sites. The *Linking Social Capital* (public sectors network) initiates the pre-disaster recovery mechanism, followed by the involvement of the *Bridging Social Capital* (network B: NGO, NPO, and academics), and the *Bonding Social Capital* (network A: residents, heritage owners), which serves as the recovery hub by communicating with and responding to the stakeholder-network.

Using the aforementioned framework and the disaster scenario as a guide, the pre-disaster recovery programming must take into account the following elements: the size of the permanent residents' housing; the lack of emergency evacuation sites; the redesign of the old street; the urban renewal of buildings with the addition of green space; the connection of the updated building to the main road; and the early placement of the disaster relief road. This document proposes six pre-disaster recovery recommendations, including district configuration, rebuilding, reconstruction and conservation, optimization of evacuation routes, creation of vast open spaces, disaster preventive warehouse, and formation of local shelters (see Fig. 11).

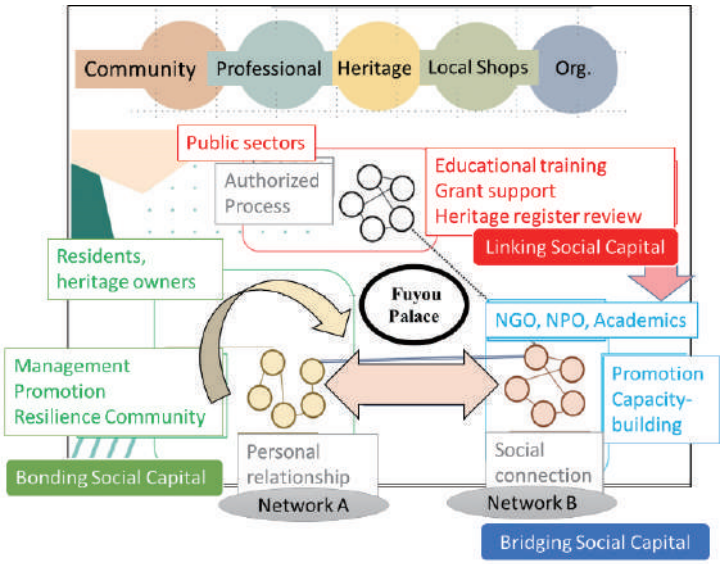


Fig. 10 The Theoretical Framework of Social Capital
Source: CPRC, 2022.

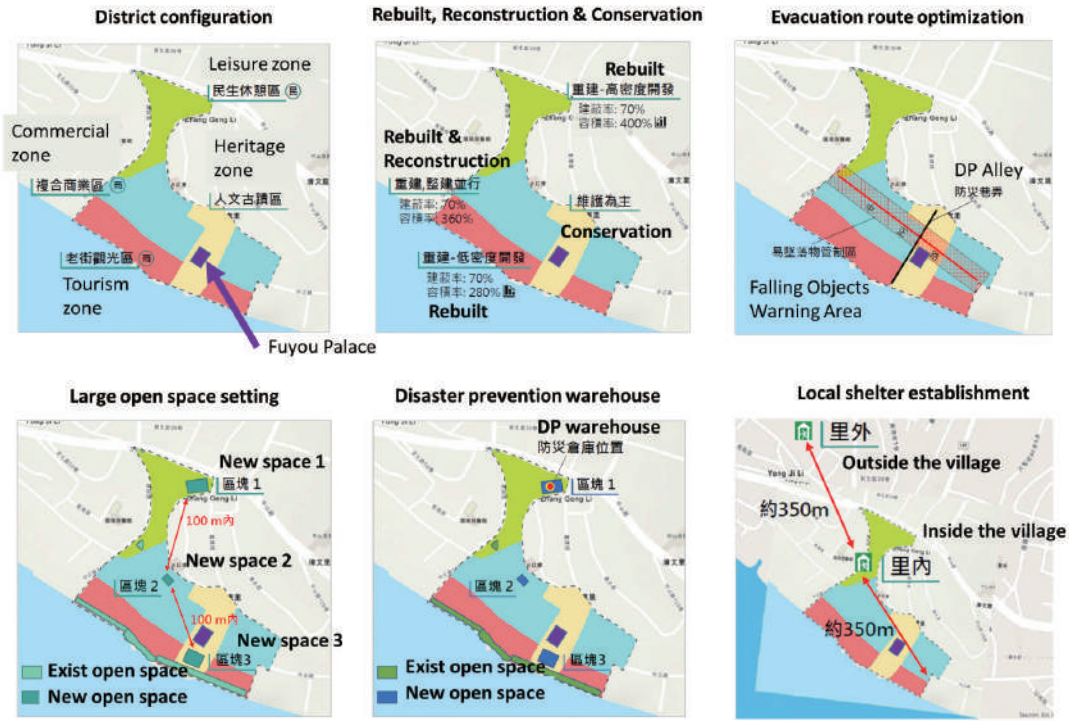


Fig. 11 Tamsui Fuyou Palace Pre-disaster Recovery Proposals
Source: CPRC, 2022.

4. Conclusion

This paper demonstrated the necessity to improve the current risk management strategies at Fuyou Palace to mitigate the effect of future hazards. The recognized short-term actions include

a) Disaster Risk Management (DRM) framework in legal and fanatical: requesting the stakeholder institutions to engage Fuyou Palace's protection network and to financially support the Site Management and

DRM plans.

b) Evacuation: planning a coherent visitor path from the backyard to the front court to create the multi-escape routes, also creating further evacuation routes (identify the five doorways to the temple court) as indicated in the disaster mitigation strategy.

c) Preparedness and reduction measures: regular fire drills and emergency kits; rescue plan for collections and documentation (the 2nd escape routes);

d) Training: keeping the awareness of staff in detailed characteristics of the site for hazard prediction; making the connection between DRR activities and the local event.

And the Medium and long-term measures include

a) Stakeholder and community: raising awareness among the population on the relevance of Fuyou Palace and stakeholders, and providing trainings for the first aids in case of hazards.

b) Protecting: adopting the approval fireproofing coating to the whole or part of wooden structures (after being examined and approved by the heritage sector), outdoor sprinkler system and dedicated fire escape.

In conclusion, this paper reveals the importance of participatory planning for pre-disaster recovery proposals. The proposal for Fuyou Palace's DRM aims to establish a 3-level detection reporting system lying daily (for the site manager), regular (for the authority), and practical drills (for community capacity-building). According to the scenario, it highlights a close follow up on disaster reporting is essential for the next stage of programming, this paper gives the following to-do-items, including disaster notification, cultural relic rescue, disaster relief treatment, personnel evacuation, evacuation, and resettlement, refuge site, material preparation, resource mobilization, and emergency response task grouping for the further reference.

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2.4 Cultural Heritage Resiliency Plan: an Interactive Protection Plan Focused on Enhancing Preparedness Capacity for the City of Music

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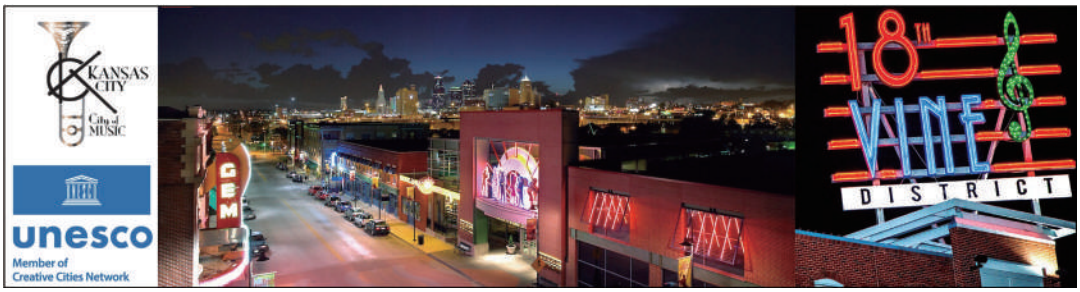

Fig. 1 18th and Vine Historic District; Kansas City, Missouri (United States).
Source: Chris Soliz, Bridgeway Consulting LLC ©

1. Introduction

(1) Presentation of the case study

In 2017, the Kansas City local government and heritage stakeholders embarked on an important journey to safeguard its tangible and intangible heritage surrounding the jazz music traditions that have influenced music worldwide. This has resulted in the city being recognized as a City of Music under the UNESCO designation (City of Music). This case study represents a further effort to provide a disaster resilience capability specifically for the 18th & Vine Historic District to utilize in the protection of the historical elements and musical traditions.

Kansas City was home for Charlie Parker, Jr. and Ben Webster, two of the most recognizable jazz musicians responsible for the foundations of American swing music and bebop. They were also crucial to the beginnings of the 18th & Vine intersection as an international destination. Currently, there are 2 performance venues, 5 museums, 1 art gallery, and non-profit organizations that are maintaining the jazz music tradi-

Fig. 2 18th & Vine Historic District Boundaries.
Source: Chris Soliz, Bridgeway Consulting LLC ©

tion in what is now the Historic District (Fig. 1 and 2). This is an important hub for the collection of tangible history and historic buildings but also provides venues for musicians to carry on the jazz traditions. In addition to providing a disaster resilience capability, this case study will explore the possibility of supporting the participating organizations and people with the means for sustainment when their primary functions are interrupted. The COVID-19 pandemic highlighted an additional need for personal and business continuity when typical business operations are prevented.
This case study will create a resilience plan that delivers equitable access to preparedness information, development of response teams, and partnership with the local emergency management agency. It will result in organizational capacity for response and recovery, alternative facility use plans as public shelters, and formal (marketable) skills for individuals to use in support of emergency situations.

(2) Historic and traditional values

The City of Music in Kansas City has determined several program goals that reveal the historic and traditional values associated with the jazz music heritage. Significantly, 60% of all art and culture organizations in the region are in Kansas City.
As a Creative City of Music (Fig. 3), Kansas City is working to[1]:

- Promote jazz heritage as a driver for sustainable development through city-adopted policies for neighborhoods, with jazz music being the principal component
- Implement cultural district planning according to the universal values carried by Local 627 African American jazz musicians' union, to honor and valorize the historic and existing culture of the 18th and Vine Historic District, and local neighborhoods
- Implement a Jazz Corridor, which identifies all aspects of Jazz for the national and international creative consumer for entertainment, education, historic preservation and businesses purposes
- Build an economic development plan in the city's urban core and cultural tourism sites which will include a strong international component and connect to countries with an interest in jazz and Black American Music; and
- Engage other Creative Cities through musical collaborations including the Voyage of the Drums Jazz Festival, aimed to foster inter-cultural understanding, tolerance and mutual respect through music.

Fig. 3 UNESCO Cities of Music.
Source: www.citiesofmusic.net

2. Risk analysis and local assessment

As active caretakers of tangible and intangible cultural heritage, participants in the Cultural Heritage Resilience Plan are committed to the preparation, response, and recovery strategies outlined in this Plan. To implement this protection framework, an extensive hazard and risk assessment has been conducted to focus solutions on risk reduction, response, and recovery plans. This is presented in an interactive format, providing continually updated and current information that enables equitable access for the entire cre-

1 Kansas City, UNESCO City of Music, https://citiesofmusic.net/city/kansas-city/

EVENT/EXPOSURE	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED?	INTERNAL RESOURCES	EXTERNAL RESOURCES	
	Probability of Occurring within next year	Possibility of injury or death	Physical losses and damages	Interruption of operations	Preplanning / Training / Exercises	Supplies / Personnel / Infrastructure	Mutual Aid / Coordination / LEPC	Relative threat. Threat Increases with Percentage
RISK ANALYSIS	0 = Unlikely < 5% 1 = Possible 6 - 40 % 2 = Likely 41- 80% 3 = Highly Likely > 81%	0 = Negligible <1% 1 = Limited 2 - 40% 2 = Critical 41 - 90% 3 = Catastrophic > 90%	0 = Negligible <1% 1 = Limited 2 - 40% 2 = Critical 41 - 90% 3 = Catastrophic > 90%	0 = Negligible <1% 1 = Limited 2 - 40% 2 = Critical 41 - 90% 3 = Catastrophic > 90%	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 - 100%

Fig. 4 Risk Data Analysis Tool.
Source: Chris Soliz, Bridgeway Consulting LLC ©

ative community. (Fig. 4)

The risk analysis is comprised of three parts to consider national, regional, and local data. First, a high-level understanding is achieved by the use of the National Risk Index. This generally describes a risk profile and provides a historical understanding of natural hazard risk. Second, the comparison is made with the regional analysis completed by the closest emergency management agency. This serves to validate and refine the national assessment with additional context and includes considerations for the local government jurisdiction. Third, an assessment customized for the historic district was conducted using an objective measurement of 85 elements for their relative risk and potential for harm.

Evaluation of the hazard and risk information is completed using a standardized scoring measure that provides a summary of hazard analysis. As shown in Fig. 5, this method considers the probability and severity of hazards and results in a score for relative risk. Probability is estimated according to the historical record of occurrence. Severity is measured with human, property, and business impact while considering existing mitigation measures and organizational capacity for resilience.

Fig. 5 Risk Analysis Results; Probability / Severity.
Source: Chris Soliz, Bridgeway Consulting LLC ©

3. Worst case scenario

A worst-case scenario has been considered only as a method to establish why an emergency plan is needed and the benefit it provides. While risk analysis for the historic district indicates winter weather and a high crime index should be prioritized, this is not a prediction of events. This scenario serves to facilitate the discussion surrounding the usefulness of using historic sites as public shelters and the value that formal training offers.

A winter storm (representing the primary hazard) has persisted in Kansas City, Missouri for several days and is expected to last another several days. Freezing temperatures have forced closures of government offices, schools, and businesses. The utility infrastructure is having difficulty remaining in service because of the cold and the difficulty for city workers to manage the outages.

Although the city does have pre-established shelters and warming centers, conditions have now caused

power outages across many areas in the city. The neighborhood nearest to the 18th & Vine Historic District has lost power, and so has the nearest designated warming shelter. However, the power has remained intact for the areas encompassing the historic district. In response to the need for a warming shelter, The Museums at 18th & Vine have decided to open its doors to the public. (Fig. 6)

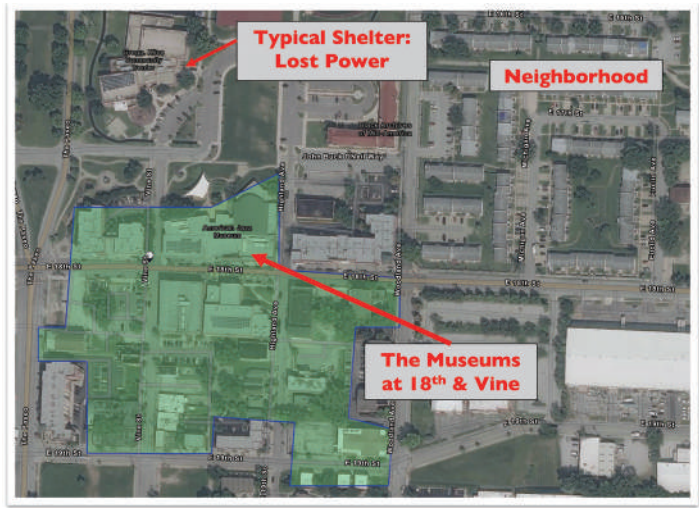

Fig. 6 18 & Vine Worst Case Scenario.
Source: Chris Soliz, Bridgeway Consulting LLC ©

The museum, however, does not have the capacity to operate a public shelter. Staff is not trained, and the facility does not have the necessary equipment or supplies on hand. Tensions begin to rise due to increasing numbers and lack of capacity. A visit from government officials does not help to reduce tensions, as satisfactory solutions are not available in response to questions from the public.

With no forthcoming information, minimal shelter capacity, and persistent power loss conditions, public anger reaches a tipping point. An active violence situation (representing the secondary hazard) arises that puts community members in danger and the heritage site at risk. Although local law enforcement arrives quickly, people have been injured, and the museum has sustained physical damage.

4. Development of the Cultural Heritage Resiliency Plan

(1) Goals and objectives

In addition to the protection of cultural heritage, it is the goal of this Resilience Plan to aid the heritage community in pursuing business and personal income reliability during times of emergency. This is a strategy currently in development by the Art of Creative Resilience, "The potential impact of redeploying creative sectors in support of community response and recovery, rather than shuttering their operations in times of emergency, is enormous."

Goals:

- Increase the creative community's capacity to plan for, respond to, and recover from emergencies.
- Develop an interactive web-based platform that heavily utilizes GIS tools to provide "always current" situational awareness for any organization.
- Enable each participating organization to form an emergency response team aligned with the local and state response framework.
- Establish a cooperative regional heritage emergency response team aligned with the local and state response framework.
- Identify alternative use opportunities for heritage sites by partnering with the local emergency management agency to establish public shelters.

- Establish a formal Shelter Management Team to support local emergency management programs and provide alternative income skill sets.

(2) Mitigation projects resulting in an inclusive and actionable response/recovery plan

Participants in this Resiliency Plan are committed to a multi-pronged approach to reducing risk. Specific projects will be undertaken to train a response force, protect assets, support community protective efforts, and prepare for recovery to the greatest extent possible.

- Complete a detailed inventory of organizational assets to establish a tool providing the ability to immediately evaluate assets using a standardized, comprehensive method.[2]
- Develop organizational policies for emergency conditions. This will provide a marketable, and verified, skill set for individuals and align the organization with the National Incident Management System (NIMS).[3]
- Register each organization with the FEMA Public Assistance Grants Portal to enable each to apply for federal assistance in relief of costs incurred while responding and recovering.[4]
- Develop emergency response teams that are dedicated to cultural heritage, may be utilized by the local emergency management agency for shelter management. Management of training and people can be accomplished using FEMA's One Responder system.[5]
- Implement a training plan that is aligned with NIMS, prioritizes safety, and develops specialized skills relevant to the organization. Additionally, this will provide formal skills credentialing.[6]
- Conduct facility assessments and coordinate with the local Emergency Management Agency to use as a public emergency shelter during times of crisis.
- Establish a qualified shelter management team for any facility determined to be appropriate for use as an emergency public shelter.
- Partner with the local emergency management agency to join the local government's Hazard Mitigation plan by developing a mitigation project specifically for designated Historic Sites.
- Coordinate with the local emergency management agency for consideration in the National Emergency Power Restoration prioritization listing for post-disaster recovery.[7]

(3) Pilot project development and implementation

The pilot project is to develop and implement an interactive, web-based resilience tool for the protection of the 18th & Vine Historic District in Kansas City, Missouri (Fig. 7). This will require the assembly of interactive Geographic Information Systems (GIS) mapping tools and useful data analysis for stakeholders within the historic district (Fig. 8). Technical analysis will be largely automated, and will provide the community profile, risk priorities, risk reduction strategy, response capability, and recovery processes. Direct heritage stakeholders will be included to determine their perceptions, priorities, and needs. Finally, all participating organizations will be trained in the use of the resiliency platform.

Primary objectives:

- Develop/Refine Interactive Plan
- Engage/Enlist Adoption of Plan by Historic District Organizations

2 First Aid to Cultural Heritage in Times of Crisis, International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM)

3 National Incident Management System, https://www.fema.gov/emergency-managers/nims

4 FEMA Public Assistance Grants Program, https://grantee.fema.gov

5 FEMA One Responder Portal, https://preptoolkit.fema.gov/web/national-resource-hub/personnel-qualifications

6 FEMA Incident Command System training, https://training.fema.gov/nims/

7 US Army Corps of Engineers' Emergency Power Facility Assessment Tool, https://www.usace.army.mil/Missions/Emergency-Operations/National-Response-Framework/

Fig. 7 Interactive Web-based Resiliency Plan.
Source: Chris Soliz, Bridgeway Consulting LLC ©

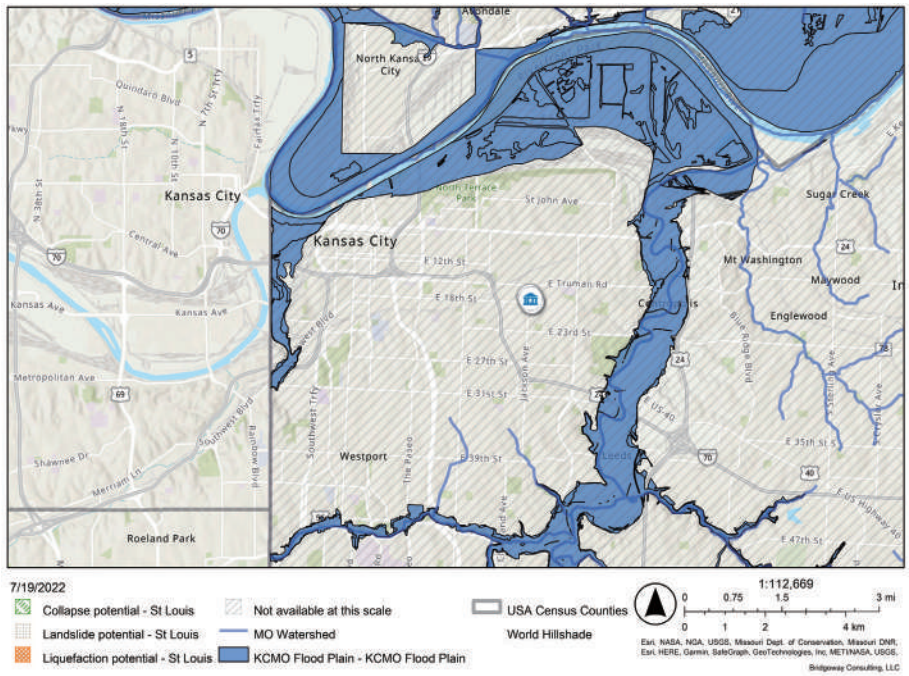

Fig. 8 Geologic Hazards Map.
Source: Chris Soliz, Bridgeway Consulting LLC ©

- Provide Emergency Response Training
- Partner with Local Emergency Management

4. Summation

The Cultural Heritage Resilience Plan represents the City of Music's proactive effort to identify their needs, risks, and existing capacity to encourage a resilient future for the 18th & Vine Historic District. Collaboration with the local emergency management agency is a significant element, which will result in effective response teams and facilities that can enhance the provision of public shelters. Importantly, creative workers and organizations will also benefit from the creation of a new ecosystem of jobs, certifications, training, and service models that leverage creative community skills to enhance the government agency's capacity for response.

This resiliency tool bridges the gap between heritage institutions and disaster management. With an understanding of the risks faced by the creative community, an effective risk reduction plan is implemented that includes training, coordination with local response partners, and distinct response plans. Strategies are also aligned with the National Response Framework and the National Incident Management System to provide a baseline that ensures common understanding and increases capacity through cooperation with local emergency responders.

Acknowledgments

Special thank you to the host and partner in this case study. This project would not be possible without the vision and accommodations from Jacob A. Wagner, Associate Professor of Urban Planning; Design Center for Neighborhoods Department of Architecture, Urban Planning, Design University of Missouri – Kansas City, umkccreativecitieskc@umkc.edu.

2.5 Built Heritage Disaster Risk Management Plan Pilot in the Canadian Rocky Mountains National Parks: Twin Falls Tea House National Historic Site Draft DRMP

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1. Introduction

This project was first envisioned as a regional analysis of the designated Built Heritage resources in the Canadian Rocky Mountain Parks in response to a variety of concerns surrounding wildfire risk in regard to backcountry or remote resources. This document does not necessarily reflect the views or policies of Parks Canada, nor has it been reviewed against such. It is a case study of how disaster risk management could potentially play out at a National Historic Site

1.1 Site Context

The subject site, as shown in Fig. 1, Twin Falls Tea House NHS, is regionally located in Yoho National Park (YNP), just north of the town of Field in British Columbia, Canada. The building was constructed of hewn logs in the Rustic Style in three phases between 1908-1928 (Fig. 2), and strategically located in a dramatic mountainous setting of the Upper Yoho Valley by the Canadian Pacific Railway (CPR) to lure tourists to the region, offer visitors respite, and serve as a convenient location to base further adventures from. Recently under a new lease holder, the operation will once again serve as a traditional tea house for day-use refreshments and overnight stays. Parks Canada remains the land owner and authority having jurisdiction for all activities and uses on the lands.

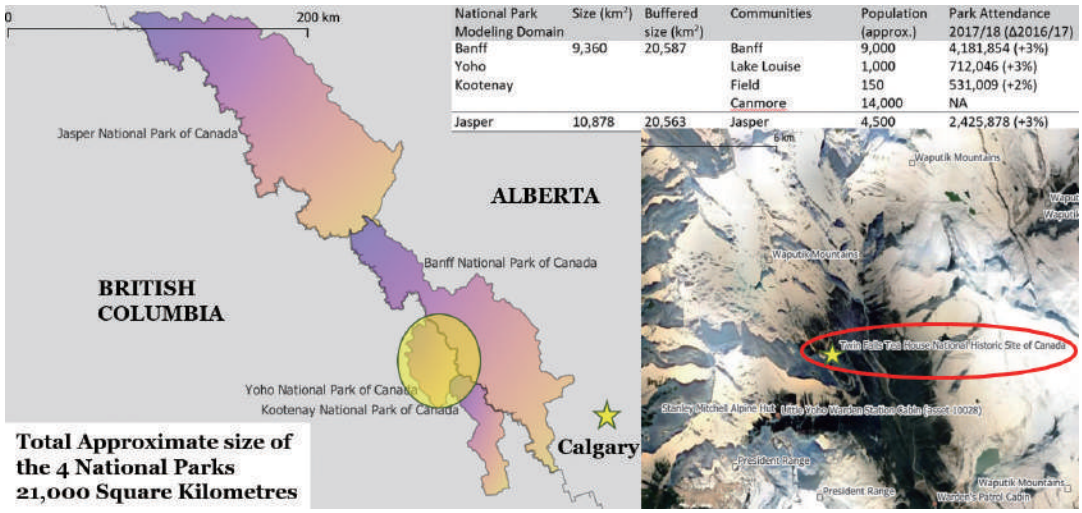

Fig. 1 Twin Falls Tea House NHS, Yoho National Park, Regional Locator Map
Source: Evan Oxland, 2022

1.2 Heritage Value

The heritage value of the site is defined by its National Historic Site (NHS) designation through the Historic Sites and Monuments Board of Canada (HSMBC) and its Federal Heritage Properties designation through the Federal Historic Building Review Office (FHBRO). It is also protected as a cultural resource under the Parks Canada Cultural Resources Management Policy. These designations are documented and supported by a variety of foundational heritage documents including a Statement of Significance, Heritage Character Statement, and administratively through the Management Statement. As per the heritage evaluation processes used at Parks Canada, these documents detail site values of *Architectural, Historical, and*

Fig. 2 Twin Falls Tea House NHS, General Building Context
Source: Bound to Explore Adventure Travel Blog, 2019 (https://boundtoexplore.com/hiking-twin-falls-yoho-national-park/)

Environmental Associations, and the *Character Defining Elements* which embody or convey them.
The site's *Architectural Value* lies in its excellent log construction in the Rustic style, including the latter double storey addition in the Swiss Chalet Style (Fig. 2). *Historical Value* includes association with Canadian Pacific Railway development of touristic facilities. *Environmental Value* includes the building's contribution to a picturesque scene, being set at the foot of the Yoho Glacier, and spectacular views from an escarpment. Significant to hiking and climbing communities, the nearby Twin Falls, fed by the terminus of the Glacier de Poilus, remains a major tourist attraction - and even became the subject of a painting by the famed John Singer Sargent in the site's earlier days.[1)] *Character defining elements* of the site primarily include the log building and its architecture. This is due to the date of designation in the 1990s when cultural landscape approaches and Indigenous values were not as recognized in the evaluation processes as they are today.

2. Hazards and Vulnerabilities

At Twin Falls, around 20 site hazards, both natural and human-induced, were identified in the process of hazard mapping by compiling previous work done in an openware qGIS environment. This included charting out numerous potential site vulnerabilities that might magnify the severity of results of a given hazard, as well as thinking about secondary hazards subsequent to a given primary hazard. Given the remote isolated location of the subject site, and the dramatic mountainous setting that it is within, the most pressing hazards are those of environmental concerns such as wildfire, flooding, debris flows, landslides, and avalanche. Hazards were analysed in terms of seasonality, exposures being radically different in summer versus winter (Fig 3). Human-induced threats, such as administrative risk, are considered to be relatively low. However, accidental fires related to either occupancy or wildfire triggered by human recreation are possible.
The physical wood material of Twin Falls was identified as one of the primary vulnerabilities, as it could provide fuel for fire or food for biological growth or decay. Climate change remains the most concerning environmental vulnerability factor. Climate predictions suggest that weather will become drier, in terms of evapotranspiration, there could actually be a net precipitation increase, but this would be driven off more quickly by higher temperatures, all meaning that the fire season is expected to increase by 31-40 days under RCP 8.5 by 2070-2100.[2-5)] Large wildfires are becoming more frequent, and generally the most concerning risk. Threats such as flooding were analysed by Public Safety Canada, and risks may include the loss or diversion of one of the unique twinned flows, and unassessed impacts on the site supporting rocky slopes above the waterfall outflow.[6)]

Fig. 3 Site Exposures to Seasonal Hazards: Summer on Left and Winter on Right
Source: Evan Oxland & Google Earth Pro, 2022

Using the ITC-DRMP Disaster Imagination Game (DIG), a worst-case scenario, was constructed to test what sort of planning, mitigation, and recovery methods could be used to help manage a particularly stressful event. This exercise is intended to help bolster the administrative systems, procedures, risk prevention, and physical resilience of a cultural heritage site in the case of a disaster generally. The worst-case scenario was defined as a number of different massive crown wildfires (natural or human-induced), a situation where fire response staff and resources have already been stretched thin or absconded by preceding threats to neighboring townsites and parks. Fires were started both by natural causes, lightning, and human induced fires surrounding recreation. With recent multi-year droughts, high temperatures and winds, the fires rapidly inflame and spread. This scenario also includes a large group of site visitors, including site operator presence-smoke becomes dense and thick and helicopter navigation to the site is not feasible. The following measures and responses address this situation.

3. Mitigations

Mitigation measures can be classified as actions intended for either risk elimination or reduction as not all hazards can be eliminated. Different types of mitigations are defined as either technical interventions on physical fabric, administrative or planning, and monitoring - which can all focus on different levels from site, landscape, region, assembly, or specific objects. The relative cost and required stakeholders for consultation of a proposed measure are also described. Two general subject mitigation measures are described below, because of their relative low cost and their magnitude of risk reduction, but many other measures, such as alarm systems and response protcols, have also been considered.

As shown in Fig 4, Fire Smart is a free and accessible public fire risk reduction program in Canada. It defines ways of assessing properties for vulnerabilities, translated numerically in the image below. Mitigation measures can then be seen as actions taken to alter the vulnerabilities and reduce risk scoring as below. Some Fire Smart activities of fuel reduction perimeters, have already been undertaken, which include reduction of vegetative fuel from a pre-established Zones 1 & 2 surrounding the structure. However, this could be further extended to Zone 3 when resources become available. In discussion with FU Fire and Vegetation staff, it also became clear that this requires cyclical maintenance, every 7-14 years depending upon growth conditions.

Additional Fire Smart activities that could be done in a sensitive way so as not to negatively affect the character defining elements of the site include the mitigation measure around the remaining Zone 1 risk of the deck, balcony, open eaves, and rafter tails with the installation of building sprinklers (Fig. 5). Further reduction could reduce the score from 62 down to 26 by strategically locating misting sprinklers to mitigate the risk of open eaves, rafter tails, balconies, and decks. Permanently mounted sprinklers could more easily open up an avenue for the building operator to collaborate with disaster risk professionals in regard to on-site building/site fire suppression systems. Permanent fire suppression supplies could be stored on site, and initiated by the site operator during an event, whereas the current fire suppression system of site-based sprinklers relies on FU Fire & Vegetation program units flying to the site utilizing pre-established GIS

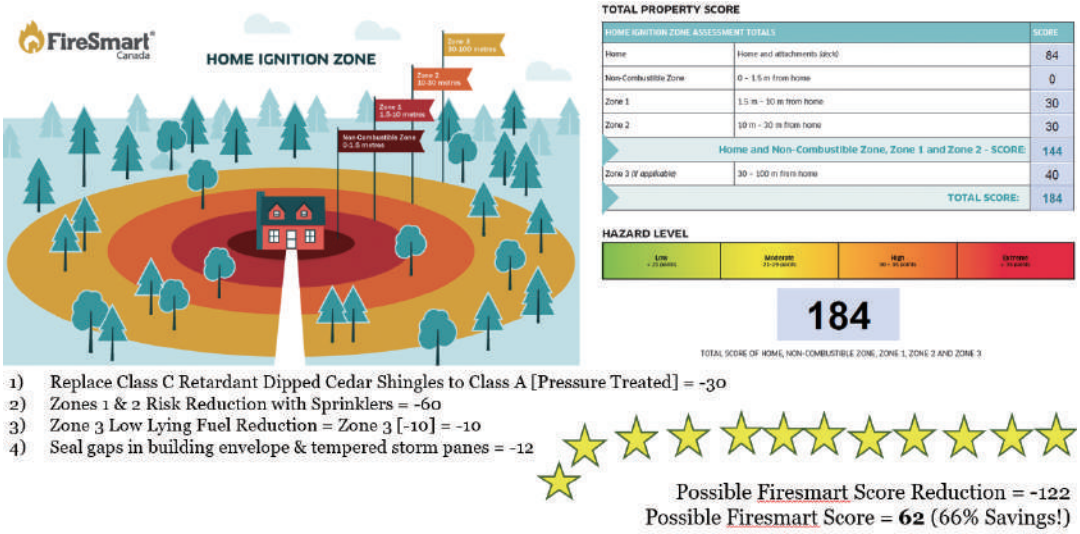

Fig. 4 Fire Smart: Ignition Zone Assessment Card, and Mitigating Score/Fire Risk Reduction
Source: Fire Smart & Evan Oxland, 2022
(https://firesmartbc.ca/wp-content/uploads/2021/04/FSC_HOA_ScoreCard-Final-TM-04-2021.pdf)

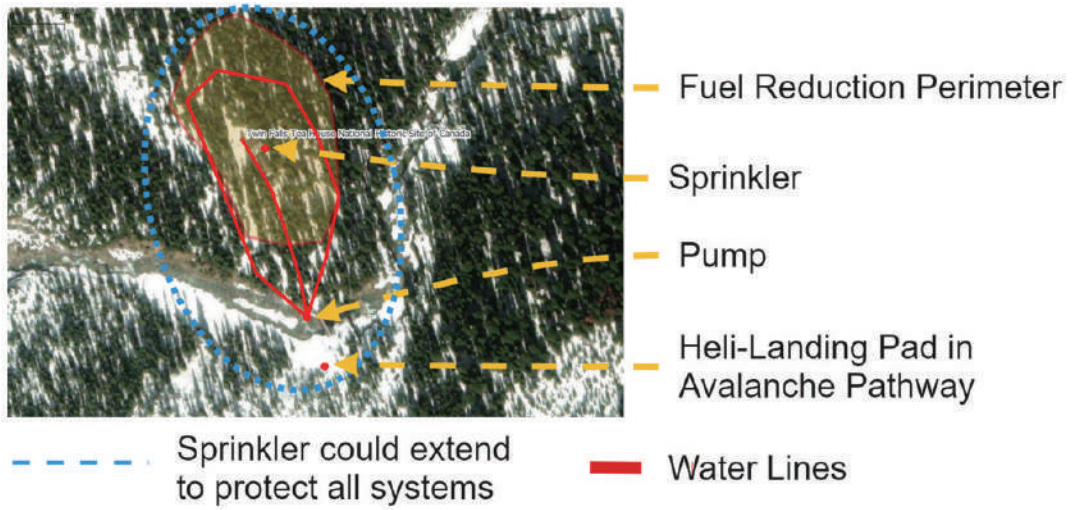

Fig. 5 Twin Falls Tea House NHS, conceptual GIS Structural Protection Plan overlaid with Author's Markups
Source: Evan Oxland, 2022

based structural protection plans (SPP). Permanent site resources could preclude a need for Fire & Veg. staff to visit this site during an event.

LLYK FU Fire & Veg has described that the deployment of SPPs are always situational dependent. Meaning, depending upon the situation that is occurring, and available resources, the SPP acts as a schematic road-map for the response team. In addition, lessons learned from other fire event responses, such as that at Fort St. James NHS, B.C., includes the danger of over utilization of water as a protection measure. Sprinklers were set on log buildings for at least 24 hours during the extreme 2020 'heat dome' event, this measure had an unforeseen secondary consequence of wood rot.[7] Therefore, it is also recommended that Fire response experts, Asset Management personnel, Cultural Resource Management advisors, and any lease holder collaborate to establish parameters for sprinkler use in an event in such a way as to reduce potential negative sprinkler side effects.

4. Emergency Preparedness

Parks Canada subscribes to the Incident Command System (ICS) for any event requiring disaster control. It is recommended that Cultural Resources Management input should be considered during an event for special considerations to mitigate potential negative impacts to heritage sites. International experience has shown that collaboration between Disaster Risk Management and Heritage professionals is both possible and leads to desirable outcomes.

Building and site egress plans were sketched out to address different scenarios of fire locations. In addition, a common problem in disaster events is that both response and recovery teams require drawing sets and survey forms for a given site. Having these at the ready allows for a faster response. Draft site survey forms and drawing sets were compiled as a package that could be used in the event of a disaster for the initial disaster survey response team (presumably Assets, Structural Engineer, Fire Engineer, and CRM/Built Heritage).

5. Disaster Recovery

Post-Disaster Recovery Planning can be summarised as in the attached schematic process diagram (Fig. 6), and follows heritage best practices and Parks Canada policy requirements. The process diagram attached narrates which actors within Parks are required to be involved, and the general process flow for conversation and decision-making. Stakeholder communication (one-way) or consultation (two-way) is determined based on the conditions of a site, the kinds of recovery options that are feasible, and the level of required involvement given the event and subject site. Stakeholder mapping has also been undertaken.

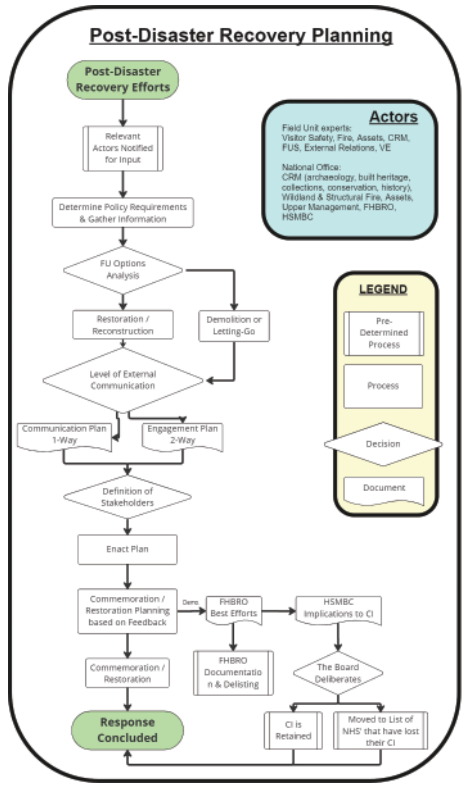

Fig. 6 Disaster Recovery Decision Making, and Consultation Process, Flow Diagram
Source: Evan Oxland, 2022

6. Conclusions

The course of study enabled the participant to familiarise themselves with best practices in the survey of disaster risk of a cultural resource. Twin Falls Tea House National Historic Site became a practical example of how to formulate a plan to mitigate disaster risks, plan for disaster response and post-disaster recovery collaboratively with property managers, disaster risk professionals, heritage professionals, and stakeholders.

Acknowledgments

Parks Canada Field Units Lake Louise Yoho Kootenay, Banff, and Jasper have all contributed greatly to the author's understanding of current systems in place for Disaster Risk Management. The program units include Resource Conservation, External Relations, Cultural Resources Management (CRM), Assets, and Townsites and Realty. Additional support has come from various program units at Parks Canada's National Office including Built Heritage, Heritage Designations Program, HSMBC, National Wildfire Management, CRM, Office of the Chief Ecosystems Scientist (OCES). Robin Bourke from Public Safety Canada provided analysis of the area surrounding Twin Falls Tea House for flood related risks and Chris Stockdale from Natural Resources Canada (NRC) kindly spent time with the author to explain recent exhaustive fire modelling done for the Canadian Rocky Mountain Parks. The author would also like to thank his ITC16' mentor Saima Iqbal, and the ICCROM, ITC/ R-DMUCH organisers, lecturers and the support of Ritsumeikan University, Japan who have provided the opportunity to explore this subject matter and learn from an international group of other practitioners.

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2.6 Disaster Risk Management Plan for the Old Town of Craco, Italy

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1. Introducing Craco

(1) Historical and geographic setting

Craco is an abandoned town located in the southern Italian region of Basilicata (Fig. 1). Its long history begins in the 6th century BC when Greeks established the first settlement (D'Angella 1986). The 400 m high cliff overlooking the Cavone river valley represented a strategic position that guaranteed the growth of the city over the centuries. The remains of the urban layout reflect different settlement phases spanning several centuries. On the top of the cliff, the Norman Tower represents the last trace of the 11th century hillfort, which expanded south-westward during the 12th century, following the contour lines (Di Marla 2020).

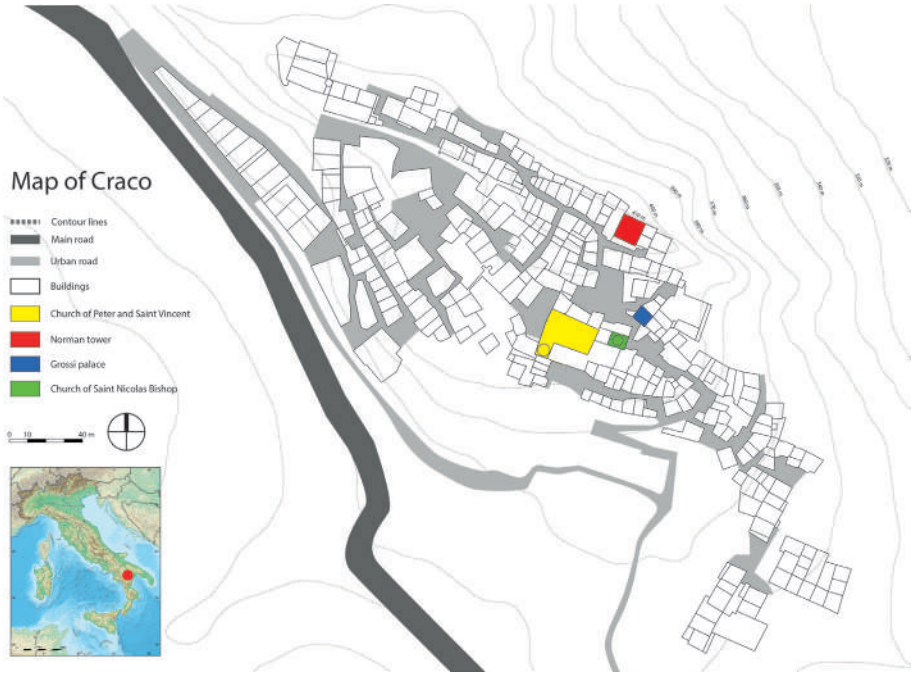

Fig.1 Plan and geographic location of Craco.
Source of the plan: redrawn by the author after de Cadhilac and Serafini 2011.
Source of the topographic map of Italy: Wikimedia commons.

Craco reached its urban and architectural splendour between the 15th and 19th centuries when the population exceeded 1,500 units and several palaces and churches were built (D'Angella 1986). This long and flourishing period came to an abrupt end between 1892 and 1922, when multiple waves of massive migrations, along with the first recorded geological hazards, led to a partial abandonment of the city. This demographic trend was halted between the two world wars, to restart in the 1950s when recurring heavy rainfalls, together with major public works, reactivated the geological faults causing numerous landslides which destroyed most of the southern part of the city. These dramatic events continued during the 1960s and 1970s, but it was only in 1979 that, after a tremendous flood hit the town followed by the famous Irpinia earthquake in 1980, the city was completely abandoned (Di Marla 2020).

(2) Craco today

Today, only a small part of the city, included in the tourist route of the Museographic and Scenographic Park of Craco opened in 2010 (Fig. 2f), can be visited (de Cadilhac and Catella 2020). This includes the main monuments city still accessible, the Church of Saint Nicolas Bishop, Norman Tower, and the Grossi Palace (Fig. 2a–d). Some glimpses on the history and abandonment of Craco can be also got by visiting the Emotional Museum of Craco located at the entrance of the city (Fig. 2e).

Fig. 2 General view of Craco (A) and the main buildings still accessible: the Normann tower (B), Grossi palace (C) and Saint Nicholas Bishop church (D).
Source: Di Marla 2020.

2. Legal framework for the protection and enhancement of Craco

(1) Local legislation

At the local level, the protection of Craco relies on law proposal No. 3925 (01-12-2010), envisaging the establishment of a commission of experts in charge of examining the proposals for recovery made by local authorities. In 2015, a Ministerial decree for the recovery of the historic centre of Craco recognized the old town, in particular, the Norman tower and Saint Nicolas church of high public interest. It also promoted the development of a management plan (MP) for their protection. However, the MP has never been produced.

(2) National legislations

Craco is also protected at the national level thanks to the Cultural and Natural Heritage Act (24-02-2004), no. 42, according to which national cultural and natural heritage, including both movable and immovable items with an artistic, historical, archaeological, or ethno-anthropological value, must be protected.

(3) International initiatives

Since 2010, Craco is also included in the World Monuments Fund "World Monuments Watch" initiative.

3. Actors analysis

The analysis of the actors includes both stakeholders and managers, while no rightsholders have been detected. Five groups of actors were identified:1) Regional and national authorities, 2) Local authorities, 3) Education and research institutions, 4) Private companies, 5) Others.

The first group includes the Regional Heritage office, National/regional funding bodies, the Ministry of Culture and the Ministry of Tourism. They play an important role in issuing new legislations and providing financial support.

The second group is composed of the Municipality, the local Police, and Firemen departments. While they can also have an important role in financing activities, they are relevant for providing permission for activities, managing the site, and developing the Disaster Risk Management program (DRM).

The third group consists of universities and research centres like ISPRA (national institute for environmental protection). They can support local authorities in drafting, monitoring, and improving the DRM as well as for conducting damage assessments.

The fourth group encompasses architecture, engineering or conservation firms and tour guides. They will conduct activities in the frame of the DRM, such as first aid and stabilization.

The last group is composed by the local community (including craftsmen) and tourists. These will support private companies at some level and will also take part in recovery and risk mitigation activities.

4. Craco's heritage values and benefits

(1) Heritage values

The different actors revolving around the old town of Craco recognized five main heritage values (Fig. 3):

Historical value: The town has been inhabited for millennia, and it represented an important urban centre, especially in the 11th century as a Norman outpost and during the 16th and 17th centuries when it reached 1,500 inhabitants.

Architectural value: There are several buildings from different periods, made of typical baroque architectural style still standing and accessible.

Spiritual and social value: The church of Saint Vincent was a major religious place hosting for 200 years a bone of the saint.

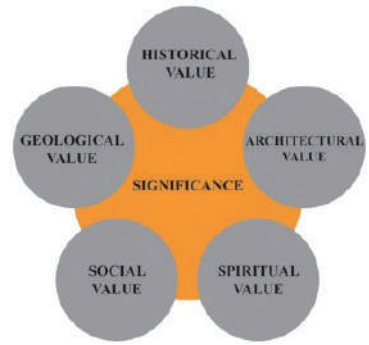

Fig. 3 Heritage values.
Source: Di Marla 2020.

Geological value: The history of Craco is intertwined with the geology of the region. The steep hill provides a natural defensive system, but is also a potential threat due to the geological fault.

(2) Benefits

Since the 1950s the evocative landscape of Craco was elected as the setting for Italian and Hollywood movies, including Mel Gibson's *Passion.* This, together with increasing touristic flow, provided high economic benefits for the Craco's community.

5. Risk analysis

(1) Historical risks and hazards

The first historical evidence of landslides that occurred at Craco dates back to 1870 and 1886 when some landslide affected the entire area (Fig. 4). In 1887, a retaining wall was built for protecting State Road no. 103. However, immediately after its completion, it underwent a deformation of 20 cm. In 1931, new land-

slides were recorded in the historic centre (Di Marla 2020). In 1952, a second retaining wall was built in the south-eastern part of the town for protecting State Road no. 103, following the reactivation of a historical fault. A deep drainage system was inserted into the wall, but without including water discharge. This will substantially influence the stability of the area in the following years. Moreover, in 1954, after a relatively quiet period, a football field was built in the area downstream of the retaining wall, thus causing a considerable overload on the slope. As a result, from 1959 onwards, numerous winter rainfalls, amplified by public works for the renovation of the sewer system and the football field, triggered multiple landslides. In 1969, new landslides were recorded, and the following year the government funded the replacement of the 1888 retaining wall with a modern one. However, shortly after, new landslides cause to collapse of the retaining wall as well as most of the buildings from the centre of the town.
While most of the area was already abandoned, the 1979 floods, together with the devastating Irpinia earthquake in 1980, forced the families still living there to evacuate the town forever.

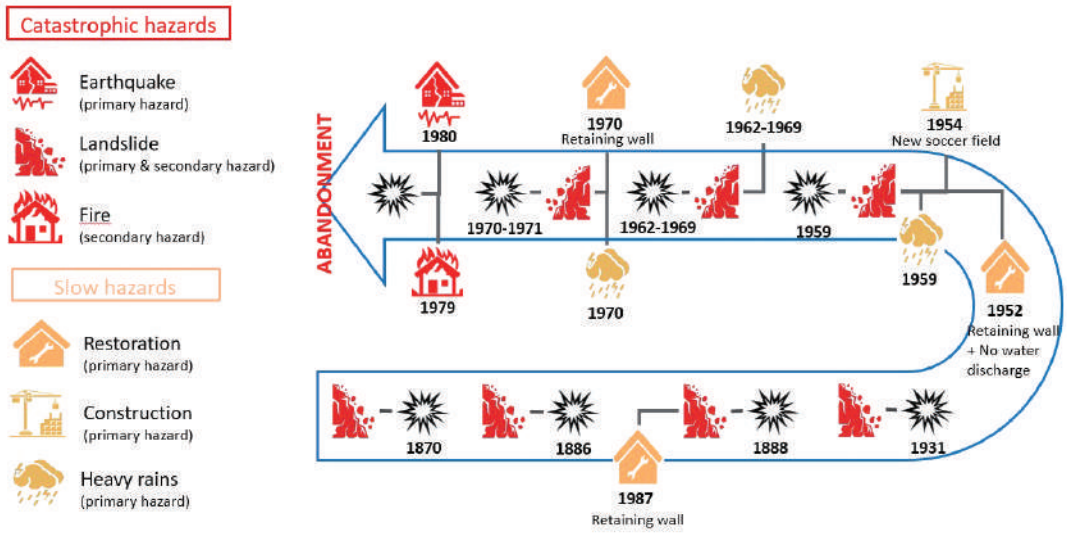

Fig. 4 Reconstruction of the history of the primary and secondary slow and catastrophic hazards at Craco.
Source: Author

(2) Current risks

The analysis recently carried out by ENEA (Corrado et al. 2018) shows how numerous sectors of the city are still at risk (Fig. 5). In particular, the maps of seismic, landslide, and fire risks highlighted at least four medium to high-risk areas. The two areas most exposed to risk are the southern and western ones, where potential earthquakes or rainfalls may trigger new landslides. Moreover, the proximity of the south-eastern part of the city to the wood makes it vulnerable to fires.

(3) Hazards, vulnerabilities, and impacts

For each of the six types of catastrophic and slow hazards threatening Craco, I identified one or more vulnerabilities and subsequential impacts. The most pressing issues regard the geological faults that are still active and may trigger landslides that can cause loss of lives and the destruction of the remaining buildings. Also, the closure or lack of tourist facilities when one or more hazards occur may lead to the same impacts as those caused by the geological faults. Figure 6 shows the complete analysis of the connection between hazards, vulnerabilities, and impacts.

6. Worst case scenario

The worst-case scenario resembles the latest events that brought the complete evacuation of Craco. It is

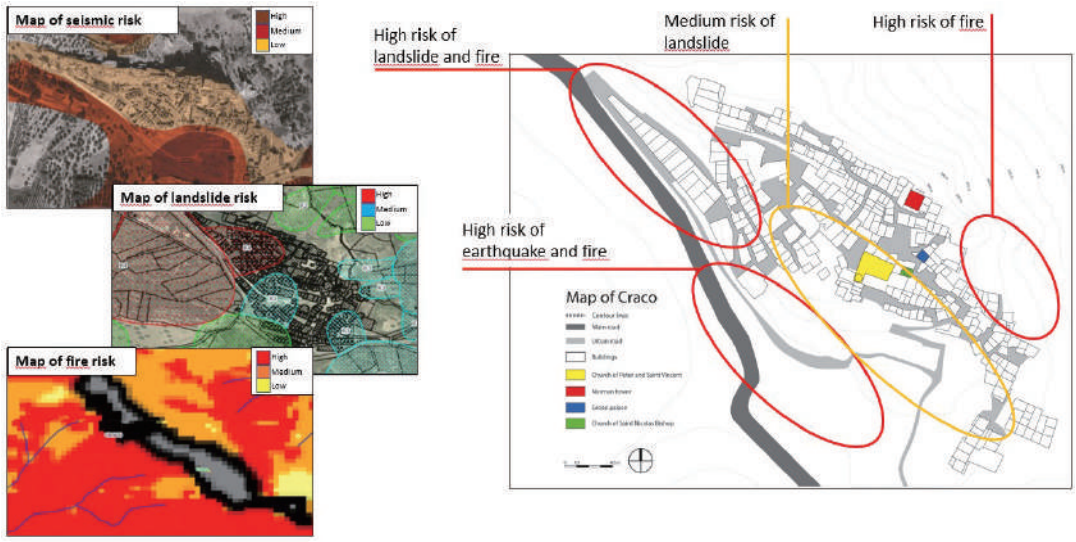

Fig. 5 Current potential hazards at Craco.
Maps source: RSDI Basilicata Region (https://rsdi.regione.basilicata.it/)

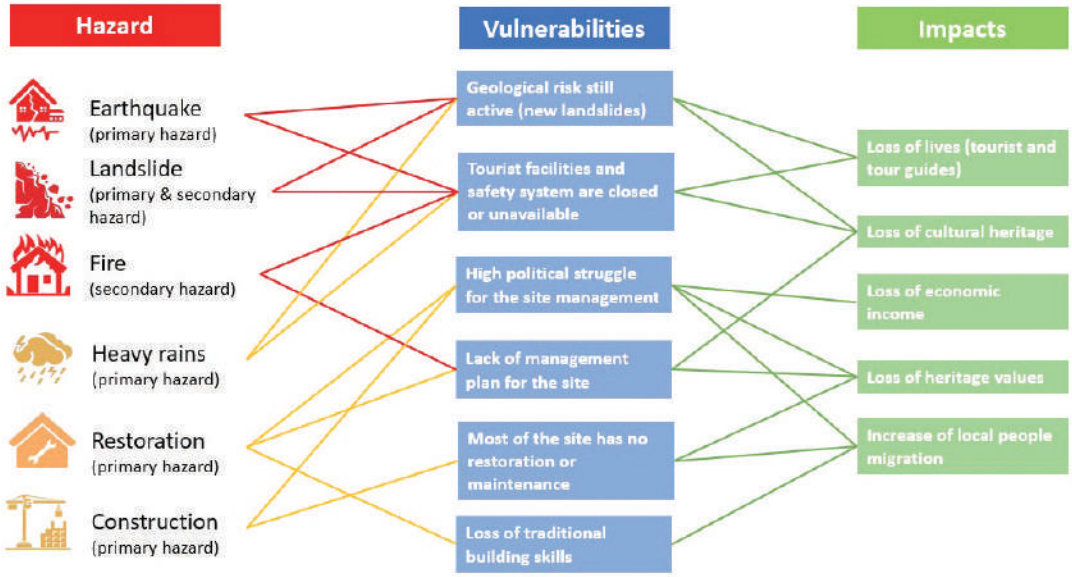

Fig. 6 Analysis of the hazards, vulnerabilities, and impacts at Craco.
Source: Author

Mid-November, and for 3–4 days heavy rain hit the entire city of Craco. After that, one day at 3.30 PM, a 6.9 M earthquake, corresponding to 1980 Southern Italy's earthquake, shakes the area northwest of Craco for about 50 seconds.

The heavy rainfall first and then the earthquake reactivates the two geological faults on which Craco is built, causing the collapse of the oldest buildings as well as the non-restored ones. It also kills/injures tourists visiting the "Craco scenographic park". The geological faults trigger multiple landslides, which are enhanced by the lack of retaining walls, causing the shifting and collapse of more buildings towards the valley, also obstructing the main road. The rubble of the collapsed buildings hits the lighting system of the park and the street. The contact with the wooden beams of the roofs causes a fire spreading throughout the city. With the only path blocked and no escape routes, tourists are trapped inside the city.

We may expect three main impacts on the site: 1. The collapse of the Norman tower and the church Saint Nicolas irreversibly affects the historical and architectural heritage values of the city. 2. The destruction of much of the city causes the immediate closure of "Craco scenographic park" representing an important economic benefit for the local community. 3. Up to 25 tourists and 1 guide were injured/dead due to the disaster.

7. Disaster risk mitigation and emergency preparedness

In this section, I provide a detailed description of both the disaster mitigation measures and the emergency preparedness strategy based on the worst-case scenario.

(1) Disaster mitigation measures

The mitigation of risks includes both multi-scalar and multi-thematic measures. Table 1 provides all the details about the type of measures, their geographic scale, the types of hazards and vulnerabilities tackled by these measures, the stakeholders involved at any level, and the duration and cost of the implementation.

Tab. 1 Selection of proposed disaster mitigation measures for Craco.
Source: Author

Mitigation measure	Geo-scale	Hazard & vulnerab. eliminated	Stakeholders	Duration	Costs
Strategic level: Implementation of a management plan and DRM	Region & City	*Hazards*: Earthquake, rainfall, fire, and landslide *Vulnerabilities*: Lack of management plan	Municipality, Regional Heritage office (RHO), Heritage specialists	Medium - Draft - Feedback - Final vers.	Low
Monitoring: Rainfall monitor system	City	*Hazards*: Rainfall and Landslide *Vulnerabilities*: Lack of monitor Syst.	Firemen, Heritage specialists, Private companies	Medium - Testing - Use	Medium
Awareness & Edu.: Training local community on risks at Craco	City	*Hazards*: Earthquake, rainfall, fire, and landslide *Vulnerabilities*: Disconnection of new generations from past	Municipality, RHO, firemen, police, ISPRA	Medium - Develop. course - Organiz.	Low/ Medium
Technical level: Apply geo-grid system on slopes	City, building	Hazards: landslide Vulnerabilities: Geological risk still active	Municipality, RHO, academics, Private companies	Medium-long	High
Technical level: Second escape route for tourists	City, building	Hazards: Earthquake and landslide Vulnerabilities: few tourist facilities and safety systems	Municipality, RHO, academics, Private companies	Medium	High

(2) Emergency preparedness strategy

The strategy is designed around the possible worst-case scenario, and it is based on the "First Aid to Cultural Heritage in Time of Crisis" (ICCROM 2018) consisting in four steps: 1) Situation analysis, 2) On-site damage and risk assessment, 3) Security and stabilization, 4) Early recovery.

1) Situation analysis: This first phase involves multiple stakeholders at the national, regional, and local levels. The aim is to isolate the area of the hazard, guarantee tourists' safety, and create a task force for conducting "damage and risk assessment (step 2).
2) On-site damage and risk assessment: A team including representatives from the local municipality, police and firemen, the museum, as well as external heritage experts provided a detailed assessment of the damage, also suggesting priority actions.
3) Security and stabilization: This is divided into two sub-steps. The first consists of the immediate stabilization of those buildings that could cause further issues, including new collapses, shifts, or chains of collapses involving other buildings. Then, the town is divided into primary and secondary interest sectors for prioritizing interventions.
   - Primary interest sector (PIS). This includes the buildings located along the touristic path that are still well preserved, thus carrying some historical and architectural value. This area is also the only one accessible by tourists with a higher economic relevance compared to the rest of the town.

- Secondary interest area (SIS). This sector includes ancient buildings of historical interest, which are not accessible. Moreover, the majority of buildings are ruined for which no restoration can be done.

4) Early recovery: After the allocation of funding, the buildings protected by the Ministerial Decree 24/02/2015 art. 136, 138, and the 2020 update and those falling within the PIS will be targeted first. The early recovery of the PIA will consist of the most comprehensive restoration and stabilization work for all the buildings and the paved way along the touristic path in order to allow its fast reopening. This recovery would also include the installation of prevention and first aid tools for monitoring rainfall, hydrant, and CCTV. Once PIS early recovery will be completed, the same actions will be conducted to the SIS.

8. Conclusion

This paper demonstrated the necessity to improve the current risk management strategies in the old town of Craco, to mitigate the effect of future hazards. The most important short-term actions include

1. Legal framework: Requesting the Ministry of Culture to include Grossi palace among the monuments under special protection status and to financially support the Site Management and DRM plans.
2. Evacuation: Expand the tourist path to create a second escape route (de Cadhilac and Serafini 2011), also creating further evacuation routes as indicated in the disaster mitigation strategy.
3. Monitoring: Installing a rainfall monitoring system and the geo-grid system to prevent new rainfall-induced landslides.

Medium and long-term initiatives may include

1. Local community: Raising awareness among the population on the relevance of Craco and organization of trainings for first aid in case of hazards.
2. Protecting: Build terracing walls with traditional materials to block future landslides.

Acknowledgment

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2.7 Disaster Risk Management Plan for Le Morne Cultural Landscape World Heritage Property in Republic of Mauritius

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1. Introduction

(1) Historical background of the Case Study

Fig. 1 Le Morne Cultural Landscape
Source: Le Morne Heritage Trust Fund

Le Morne Cultural Landscape is found is located on a peninsula that juts into the Indian Ocean in the Southwestern part of Mauritius. The Property of the Cultural Landscape includes the entire Le Morne Brabant Mountain and most of its foothills, while the Buffer Zone extends much further to include the entire peninsula and the surrounding lagoons up to the fringing reefs.

Geologically, the mountain forms part of a terminal Ankramite olivine basalt of the oldest series, dating from eight to ten million years ago. The rocks are rhomboid and are placed in an almost vertical position with lots of fissures in between. Though there are surface rocks around the edge and in some places on the plateau, there is a fairly good soil layer rich in humus in some regions. No permanent watercourse or springs have been found at the top of the mountain. It must be noted that the west side of the mountain has become drier over the last century. When approaching the mountain, the gentle foothills soon give way to steep slopes that meet towering cliffs that are often vertical or even slightly overhanging cliffs. The steep slopes are intersected by ravines and valleys, while the cliffs are marked by countless fissures and cracks, some of them almost tall as the mountain itself. The plateau is relatively flat at the highest, but much of the mountain top gently slopes towards the west. The area at the top is well protected by steep rock cliffs that deter any potential intruders from reaching the summit.[1)]

Le Morne also is home to a large number of endemic plant species that include some of the rarest in the world. It is also the habitat where the national flower of Mauritius, the Trochetia Boutoniana is found. A vegetation survey reveals the existence of some 73 species endemic to Mauritius occurring on the summit

of the mountain and shows that it is a rich native forest with several critically endangered species. Le Morne is also known for its rich fauna, that includes both native and exotic birds, butterflies, geckos, molluscs, insects, spiders, and mammals, including monkeys, bats, and shrews. Several of these plants and animal species are known to have medical and nutritional value. Le Morne is endowed with biological treasures that will need to be preserved and even enhanced. These biological attributes are relevant as they are part of the cultural landscape in which maroon slaves had tried to survive in their quest for freedom.[2)]

On 24th January 2006, Le Morne was officially declared National Heritage Site (Fig. 1) with its growing national significance for the Mauritian population valued for its shared history, especially for its strong association with runaway slaves.

In July 2008, Le Morne Cultural Landscape was inscribed on the UNESCO World Heritage List with its strong symbolism in terms of resistance to slavery and other expressions of freedom. Le Morne is particularly known for its association with runaway slaves, engaged in the globally displayed act of defiance against the system of slavery generally referred to as maroonage. While maroons were a common feature in all slave societies, Le Morne stands out as a symbol of the high price that humans will pay to retain their freedom by retreating into the dangerous Mountain that required confronting frightening heights and negotiating narrow passes. The landscape has many assets intertwined with its natural attributes: some tangible, like historical sites; others intangible, like a rich oral history and knowledge that have been transmitted from one generation to the next. The Outstanding Universal Value of the landscape highlights this symbolism of the fight of slaves for freedom which goes beyond the frontiers to countries from where the slaves came. The site is governed by Le Morne Heritage Trust Fund Act and administered by the Le Morne Heritage Trust Fund, which operates under the aegis of the Ministry of Arts and Cultural Heritage.

Le Morne Cultural Landscape was inscribed based on the following criteria:

Criterion (iii): The Mountain is an exceptional testimony to maroonage or resistance to slavery in terms of it being used as a fortress for the shelter of escaped slaves, with evidence to support that use.

Criterion (vi): The dramatic form of the mountain, the heroic nature of the resistance it sheltered, and the longevity of the oral traditions associated with the maroons, have made Le Morne a symbol of slaves' fight for freedom, their suffering, and their sacrifice, all of which have relevance beyond its geographical location, to the countries from which the slaves came – in particular the African mainland, Madagascar and India and South-east Asia.[4)]

2 Key hazards, vulnerabilities, and risks

Le Morne Cultural Landscape comprises not only the land component but also the lagoon, which has played a significant role in the history of slavery and maroonage on the landscape and makes the overall setting of the landscape. As such, below table 1 shows the main hazards associated to Le Morne Cultural Landscape ranging from meteorological, geo-hazards, human-induced, and technological that affect the entire landscape and which are both internal and external. The vulnerabilities and risks associated with each hazard are also described.[3)]

2.1 Values and attributes

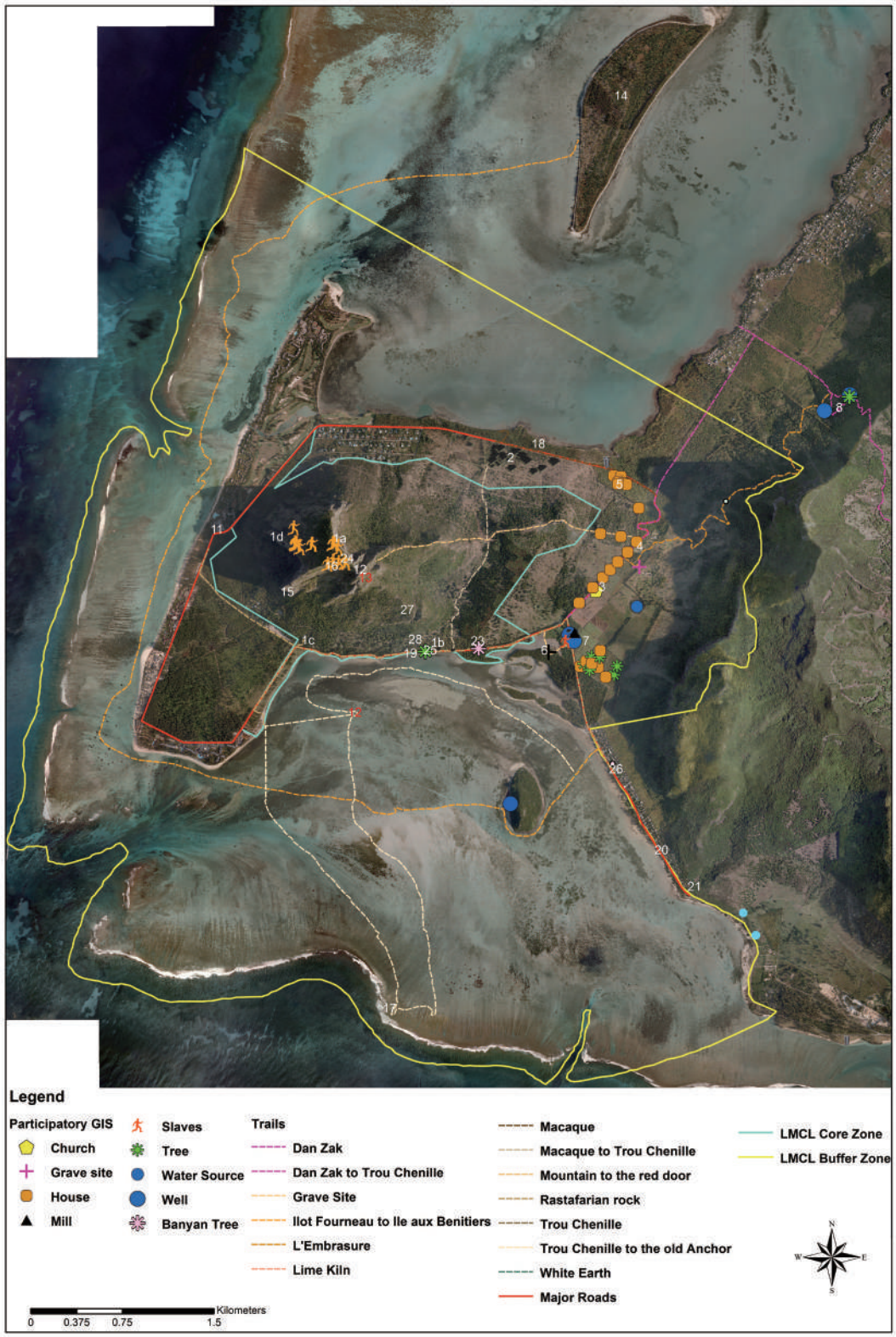
Map 1 below shows the various rich layers of attributes of Le Morne Cultural Landscape within both the property and the buffer zone. These attributes are characterized by natural and geological features such as trees, sacred rocks, ancient settlements, built structures archaeological sites, historical and spiritual areas, and ritual places which are interrelated with each other and they make the essence of the place.

Table 2 below describes the attributes labelledlabelled on Map 1 above and highlights the various values connected to them, which convey the site's Outstanding Universal Value. The analysis also reveals that the value level of most of the attributes areis "High" and requires stringent protection by national legislations due to their deep interrelationship and their location within the property, which is a highly protected area.

2.2 Impact of hazards on attributes

Tab. 1 Key hazards, risks, and vulnerabilities
Source: Author

HAZARDS	VULNERABILITIES	RISKS
Meteorological hazards		
Heavy rainfall	Climate change	Physical damage to cultural landscape Impacts on archaeological site
Water inundation/Floods	Location (Close to the ocean) Climate change	Physical damage to cultural landscape Impacts on archaeological site
Sea level rise/coastal erosion	Location (Close to the ocean) Climate change	Physical damage to cultural landscape(visitor trail, public beaches) Impacts on archaeological site Loss of livelihoods (affects fishermen) Irreversible damage to natural biodiversity/cultural landscape
Droughts (May cause fire)	Location (Dry area) Climate change	Loss of habitat (birds)
Cyclonic conditions / Strong winds	Location (Exposure to wind conditions – South East Trade Wind)	Physical damage to natural biodiversity/cultural landscape Structural damage to museum and other amenities
Geo hazards		
Landslides/boulder roll/rockfalls	Site topography (sloping and undulating nature) Lack of resilient infrastructure Lack of expertise and financial resources Climate change	Injury or loss of life (Danger to visitors climbing the mountain and those visiting the Trou Chenilles Open Air Museum at the foot of the Le Morne Brabant Mountain) Danger to residents living at the foot of the mountain Impacts on archaeological site
Human-induced hazards		
Vandalism Theft Arson Looting Environmental pollution (Dumping and waste water and run off into the lagoon)	Lack of awareness/sensitization/education Location (remoteness and secluded) Lack of surveillance Lack of enforcement Location (inaccessibility or difficulty to access some areas) Population growth Lack of general appreciation of natural and cultural heritage Lack of adequate infrastructure	Irreversible damage to amenities Physical damage to cultural heritage Eutrophication Loss of livelihood (fishermen) Loss of habitat
Fire (Wild and human induced)		Loss of visual amenity
Technological/Human-induced hazards		
Hazardous materials spills (ship grounding)	Location (close to ship passage) Poor surveillance and enforcement	Irreversible damage to marine and land resources Loss of livelihood (fishermen)
Air pollution (Transport) Increased tourism	Poor surveillance and enforcement Uncontrolled tourism Poor planning Lack of infrastructure	Health risk to visitors and staff



Map 1 Attribute map
Source: Le Morne Heritage Trust Fund

Tab. 2 Value assessment
Source: author

No	Attributes	Values	Value level
1a / 1d	**Top of Le Morne Mountain** – where maroons lived and from where they committed suicide as an act of resistance to captivity, and it contains the cave shelters where slaves sought refuge and material evidence of their occupation on the mountain like animal bones, manuports, amongst others. This is absolutely 'holy terrain' from all points of view.	Historical Educational Emotional Spiritual Cultural Remembrance Research/Archaeological Natural Economic Inspirational/artistic Symbolic	HIGH
15	**The valley of the bones** – where slaves would have landed after having jumped from the summit of the mountain.	Historical Educational Emotional Spiritual Cultural Natural Research/Archaeological Inspirational/artistic Symbolic	HIGH
2 and 28	***Ancient Trou Chenilles and Makak villages*** **– a village** where descendants of enslaved people once lived before they were forcibly removed from the land.	Historical Educational Emotional Cultural Research/Archaeological Symbolic Economic	HIGH
1c	**The Venerated Place of Resistance** – where people pay tribute to what transpired on Le Morne Mountain.	Spiritual Educational Emotional Cultural Symbolic Social Remembrance	HIGH
3 and 7	**Former L'Embrasure village, including the ruins of the catholic church, old shop, well, and maize mill** – a village was established by the people who were forcibly moved from *Trou Chenilles*.	Historical Educational Emotional Cultural Research/Archaeological Economic	MEDIUM
6	**Old Cemetery of Le Morne** – this grave site appears in maps from 1880. Many archaeological works have been carried out on this site, and the DNA test reveals that the interred were mainly of Malagasy and Mozambican origins. The site is currently being used by people to conduct certain rituals.	Research/Archaeological Historical Educational Emotional Cultural Research/Archaeological Spiritual Educational	HIGH
24	**V-Gap** – The slave crossing point to reach the plateau of the mountain.	Historical Educational Emotional Cultural Remembrance Symbolic	MEDIUM
12	**Roche Ste Marie/Ros Lakwra** – Cross on a rock in the sea opposite *Trou Chenilles.*	Historical Educational Emotional Remembrance	LOW
13	***Ilot Fourneau***, a small islet opposite Le Morne village.	Historical Research/Archaeological Economic Natural Social	MEDIUM
16	***Reef breaks*** in the sea which was used as an exit point to practice maritime maroonage by the runaway slaves.	Historical Research/Archaeological Symbolic Economic	HIGH
17	Old Limekiln of Le Morne	Architectural Historical	MEDIUM
23	Banyan tree where the *sega* dance was held at Trou Chenilles.	Historical Symbolic Remembrance Cultural Emotional Educational	HIGH

The table below shows the severity of loss and impact of the various hazards on the main attributes highlighted above. The severity of loss has been rated as High (H – Red), Medium (M – Yellow), and Low (L – Green). Certain attributes which are not directly concerned with the hazards are described as Non-Applicable (N/A – White). The various impacts have been assessed based on the exposure and proximity of certain attributes to the hazards and also based on past records and potential events.

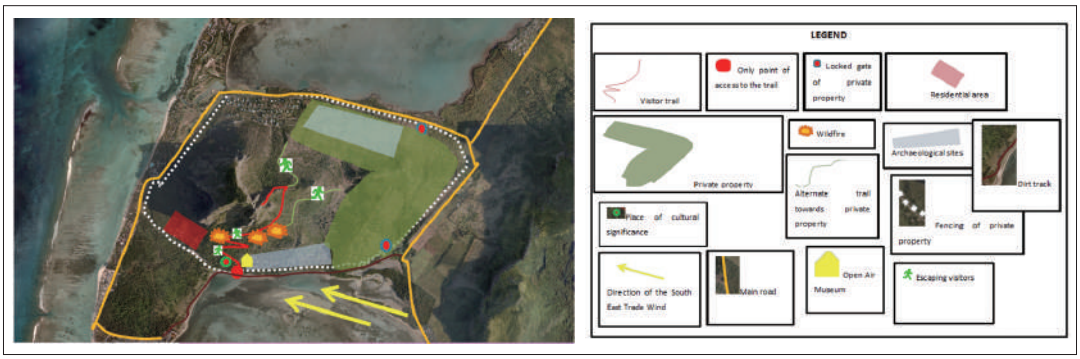
Tab. 3 Impact of hazards on attributes
Source: Author

Hazards	Likelihood	Impact on land-scape	Severity of loss of attributes											
			Attribute number											
			1a Top of the moun-tain	1d Valley of the bones	2 and 28 Ancient settlement area	1c Venerated place of resistance	3 and 7 Former L'Embrasure area	6 Old Cemetery of Le Morne	24 V-Gap	12 Roche La Croix	13 Ilot Fourneau	16 Reef breaks	17 Old limekiln	23 Old banyan (Sega) tree
Heavy rainfall	5	4	H	H	H	L	M	M	L	M	M	L	M	L
Flash flood	5	5		M	M	M	M	H	L	M	M		M	M
Sea level rise/coastal erosion	5	5	N/A	N/A	M	N/A	N/A	H	N/A	H	L	L	L	L
Droughts	4	4	M	M	L	L	L	L	L	N/A	L	N/A	L	H
Cyclone	5	5			M	M	H	H	L		M	L	M	H
Landslides/ rockfalls	3	3	M	M	M		L	L	M	N/A	L	N/A	N/A	
Vandalism	5	3	H	M	H	M	H	H	M	H	L	L	H	H
Theft	5	2	H	M	H	M	H	H	L	H	L	M	H	M
Arson	5	5	H	H	H	H	H	H	L	H	H	N/A	M	H
Hazardous materials spills (ship grounding)	2	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	M	M	H	N/A	N/A
Air pollution	2	4	L	L	M	L	M	L	L	L	L	L	L	M
Increased tourism	5	4	L	M	M	M	M	H	L	L	M	M	L	M
Development pressure	4	5	M	M	H	M	H	L	M	L	H	L	M	M

3. Worst Case Scenario and DRM measures

3.1 Description of Worst Case scenario

It was around 12.30 hrs during the summer season in January in Mauritius. The island was experiencing its highest record of temperature in its climatic history, which is 35.6℃, as a result of climate change, especially along the coastal area of Black River, which is one of the driest places on the island. This month is



Map 2 Scenario map
Source: Author

one of the peak seasons of the island in terms of tourism, and hundreds of visitors were hiking the trail of the Le Morne Brabant Mountain.

Despite several notices of smoking restrictions on site, after smoking, an irresponsible visitor discarded his cigarette, which was not completely consumed inside dry vegetation along the trail. The lighted cigarette, in addition to the dry vegetation and high temperature, provided all the conditions necessary to provoke a wildfire. As shown in map 2, the wildfire started quickly and started to spread rapidly in other areas of the mountain. Some visitors present in the vicinity got trapped because of the presence of fire on both sides of the trail, and its narrowness are preventing them from moving further. Since there is no emergency plan, some visitors tried on their own to follow an alternative existing trail around the mountain to secure themselves away from the fire. This trails lead to private properties around the mountain, which is closed by fencing. Due to the absence of a fire extinguisher system on site and the lack of water connection in this remote area, nobody could take any action on site to stop the fire. The gentle breeze of the South East Trade Wind to which the site is exposed started to worsen the situation. There was also a fear that the fire reaches the residential area on the other side of the mountain, which might be further catastrophic. Seeing the smoke from the trailhead, the security guard immediately called the nearest fire department. After 15–20 minutes, the firemen reached the site, but the sloppy nature of the mountain and the bad conditions of the trail in certain areas becomes a challenge for firemen to reach the upper part of the trail with their lorry. Hence, only equipped 4WD vehicles of the fire department have been able to access the trail. This has required at least six vehicular interventions in order to stabilize the fire and prevent its propagation after more than 2 hours. Fortunately, visitors trapped in between the fire have been able to escape within the bush, and no casualty was recorded except traumatic experiences. A large extent of the forest has been damaged by fire, and many indigenous plant species and habitats for animals have been destroyed. Some matured trees that helped to retain large boulders and rocks were burnt and weakened by fire. The root decay and loss of soil strength might at any time cause other hazards like rock fall and even landslide, especially in case of high intensity of rainfall events. Landslides with rockfalls will have a direct impact on the visitors and staff working at the mountain site and might result in injury and even loss of life. Archaeological sites such as former settlements and other tangible heritage will also be affected. With the high feeling of insecurity, the number of visitors will decrease, hence will affect the livelihood of the tourist guides, some of which are from the local community.

3.2 Mitigation measures

The mitigation measures proposed below are categorized under specific fields such as policy and planning, maintenance and infrastructure, training and awareness, and sensitization. The measures are realistic, measurable, and implementable based on the needs of Le Morne Cultural Landscape and its available resources. Considering the nature, extent, type, and topography of the landscape, the preventive measures proposed are highly recommended and visitor sensitization and education remain an ongoing activity that heritage institutions should consider. Eliminating or mitigating the factors of vulnerability, such as upgrading trail conditions, removal of bushes, installation of an electrical connection or solar-powered devices on site, and the creation of evacuation routes should also be prioritized and implemented in a phasewise manner.

3.3 Emergency preparedness, response, and recovery

The map 3 shows the time it takes to reach Le Morne and the distance on a map by emergency services such as the fire and rescue department, ambulance service, and police station. These might later be incorporated into a safety and emergency flyer.

The map 4 below provides an indication on the three evacuation trails in case the normal visitor trail is affected by fire and represents a danger for visitors to cross. It indicates three muster points, a helipad spot in case of emergency, and a parking area. Some of the communication and awareness strategies, such as

Tab. 4 Mitigation measures
Source: Author

Measure	Description	Scale	Actors	Duration	Cost	Effect
Policy and Planning 	1. Development of an emergency plan 2. Agreement with land owners through MOU	National, regional, site level	Heritage institutions Landowners Fire and rescue department Police department	Medium	High	Safe evacuation routes for visitors Prevent the loss of life and injury
Maintenance and infrastructure 	1. Removal of bushes/ shrubs that may cause propagation of fire	Site management Regional	Heritage, and government institutions Local community	Long	Medium	Stop propagation of wildfire Clearer vehicular passage and improved trail condition in case of emergency
	2. Upgrading of trail	Site management		Long	High	Prevent the loss of life and injury
	3. Creation of an evacuation route with signboards	National, site management		Short	Medium	Safe evacuation route for visitors
	4. Installation of electrical connection on site or solar-powered system	Site management, regional		Long	High	Installation of security surveillance cameras and water pumping system, fire detectors, and alarm system
	5. Purging of unstable rocks at the mountain slope	Site management, and regional		Long	High	
	6. Installation of fire extinguishers at the museum site			Short	Medium	Prevent the loss of museum's collections and thatched buildings
Training 	1. Training of tour guides and security officers	Site management Regional	Government and heritage institutions Police and fire rescue department	Long	High	Swift action in responding to emergency and improvement of risk preparedness Strengthened collaboration between actors and fire and rescue department
Awareness and sensitization 	1. Installation of more panels on site, distribution of flyers, briefing at the trailhead	National Regional and site management	Government and heritage institutions Media Landowners Local community Hotel operators	Long	High	Increased appreciation and knowledge of cultural heritage Reduce the hazards of arson, theft and vandalism

Map 3 Emergency locations and route
Source: author

fire danger rating, signage in different languages, escape signboards, and emergency numbers, will be affixed on different points for the visitors who will be assisted by security officers posted at strategic points along the trail in case of emergency.

Map 4 Evacuation map
Source: Author

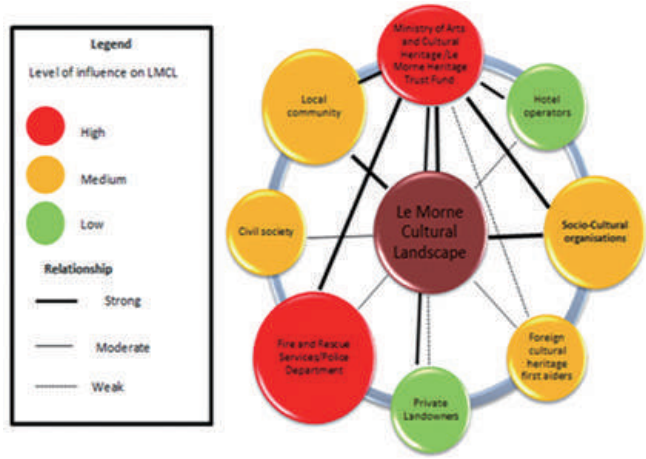


Fig. 2 Stakeholder map
Source: Author

4. Conclusion

Le Morne has become a prime tourism destination in Mauritius. Post COVID-19 statistical records demonstrate the drastic increase in the number of visitors. While tourism has high economic potential on the World Heritage Site, if not well managed and controlled, it might lead to a detrimental effect on the site. For example, as described in the worst case scenario above, arson remains a potential hazard to a landscape exposed to several vulnerable factors, despite not frequently occurring. Heritage institutions and authorities concerned shall be prepared for this hazard for swift intervention in case of emergency. Furthermore, secondary hazards resulting from a fire, such as rockfalls and landslides that are inherent to the mountain, are present and should be also addressed, as visitor safety and security shall remain a priority. The mitigation measures put in place are considered realistic and achievable in the context of Le Morne Cultural Landscape. While strengthening stakeholders' engagement is considered vital, experience also reveals that funding and awareness creation, and sensitization among the general public on the need to respect heritage places are fundamental, much needed, and yet challenging to deal with (Fig. 2). Thus, to ensure risk mitigation and prevention as well as to ensure continuity in post-disaster period, it is important to identify potential donors and highlight their role in addition to government support. Various strategies to inform and sensitize visitors shall also remain ongoing.

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I wish to thank all the resource persons of the ITC Course and my mentor for all their invaluable support and guidance throughout the program. My sincere thanks also extend to all the participants for all their advice and knowledge, and experiences shared. Last but not least, I would like to thank all the staff of Le Morne Heritage Trust Fund for their support.

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2.8 Development of a Disaster Risk Development Plan for Casa Popenoe-Francisco Marroquin University in Antigua Guatemala

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1. Introduction of Case Study

(1) Context of Casa Popenoe

Antigua Guatemala is considered by many one of the best-preserved cities of the Spanish Colonial period in Latin America. It was founded by the Spanish conquistadors in 1543 after the previous Capital was destroyed by a huge avalanche during the rainy season because it was located on a dangerous slope of the Agua Volcano. Antigua (then called *Santiago de los Caballeros de Guatemala*) was the Capital of the Captaincy General of the Kingdom of Guatemala, which extended from Chiapas, Mexico, to Costa Rica. For more than 2 centuries, Antigua consolidated as an important Spanish city, strategically located in the center of the narrow territory that united North America with South America. Throughout its 230 years as a capital, beautiful churches and monuments were built in baroque style, shaped by the constant earthquakes that hit it. This forced the development, in an effort of trial and error, of the so-called "Antigua' s Seismic Baroque", which consists of erecting very wide walls (up to 80 cm - 100 cm thick) composed of a mixture of stones, bricks, and adobe.

In 1773, a terrible earthquake left the city badly damaged. For this and other political reasons, the capital of Guatemala was moved for the fourth and last time to the valley where it is currently located. This caused it to be called Antigua Guatemala, and it was practically abandoned for more than 150 years. It was not until the first decades of the twentieth century that the city began to be restored and regained some importance.

Thanks to its many historical and aesthetic values and the natural beauty of its surroundings, the city was declared a World Heritage by UNESCO in 1979. This declaration[1)] and the existence of a strict Council for the Conservation of Antigua Guatemala[2)] have helped the city to have a better fate than many other Latin American colonial cities. But this was achieved, in large part, thanks to the foreigners who began arriving in Guatemala in the early twentieth century, impressed by the lush nature of the country, but also by the imposing ruins and the glorious past of Antigua[3)].

Fig. 1 View of the city of Antigua and volcanoes Fuego and Acatenango to the south. Photo taken from the rooftop of Casa Popenoe.
Source: by the author

Fig. 2 Developing a local Baroque style, important examples of the period still stand like Saint Pedro Church and Hospital, a block away from Casa Popenoe
Source: by the author

2. Casa Popenoe and its Values

The American botanist Wilson Popenoe (Topeka, Kansas, 1892 - Antigua Guatemala 1975) and his first wife, the English archaeologist Dorothy Hughs (Ashford, Middlesex, England 1899 - Tela, Honduras, 1932)

acquired a huge colonial house in deplorable condition in 1929–30. Established in Honduras, they undertook from a distance one of the most important architectural restorations of the 20th century in this city since it was the first house to be restored following archaeological principles. The house regained its past luster, and thanks to the careful reconstruction of its details and spaces, it became the model for all the civil restorations that followed[4].

Fig. 3 Main façade of Casa Popenoe
Source: by the author

Fig. 4 Main Courtyard
Source: by the author

Fig. 5 Main Hall. It contains some of the most important objects of the collection.
Source: by the author

After the passing of his first wife, he married in 1938 for the second time to an American art historian Helen Barsaloux (Chicago, 1904 - Antigua Guatemala, 1961), who was dedicated to collecting colonial furniture, paintings, sculptures, ceramics, silverware, and religious textiles from Honduras and Guatemala. Together they put together one of the most important collections of its kind in Central America. In addition, in 1940, they acquired several smaller properties in the back of the same block, on which they built a smaller house and a succession of gardens that served to connect it to the historic house. In 2007, Marion Popenoe and his brother Hugh (both children of Wilson and Dorothy) donated the property along with its collections and archives to Francisco Marroquin University (a private institution located in Guatemala City) in order to fulfill Wilson's dream of turning Casa Popenoe into an academic center.

Tab. 1 This table explains in more detail the several high values of Casa Popenoe as a building, its important collections, and green spaces (patios and gardens).

VALUES & ATTRIBUTES	(BUILT 1762 – 1773)
Historic (High Value)	Casa Popenoe is one of the few remaining most important aristocratic houses built in Antigua when the city was the Capital of the Central American Captaincy between 1524 – 1821.
Restoration Precedent (High Value)	Bought by American botanist Wilson Popenoe and his first wife Dorothy Hugh in 1930, **soon became the model for all later restorations in Antigua.**
Educational (High Value)	In 2007, the house was donated to Francisco Marroquin University by the Popenoe descendants (including all its important collections of antiques, art, and archives). To this day, there is no other similar case in the country.
Architectural (High Value)	It is considered the best-preserved private property of the Spanish Colonial period in Central America. Many of its features have been widely replicated in Antigua, Central America, and even the United States (Pasadena, California)
Art & Interior Design (High Value)	The property is home to one of the most important private collections of Guatemalan and Honduran furniture, paintings, sculpture, ceramics and religious textiles of the Spanish Colonial period (1524 – 1821). The collection consists of almost 3,000 objects
Landscape & Botanic (Medium Value)	Its several gardens are considered one of the most important private natural reserves in Antigua's city center (home to more than 43 species of birds).
Touristic Attraction (Medium Value)	Casa Popenoe appears in every tourist map of Antigua since the first half of the 20th Century. It is constantly visited by tourists of all kinds and from all around the world.

3. Disaster Risk Analysis

For this case study, a longer Disaster Risk Analysis was developed, which included two primary hazards (1. Volcanic eruption and 2. Earthquake) and two secondary hazards (1. Fire and 2. Flooding). Due to the limited space available for this article, I only included the material developed for primary hazards, also considered in the worst case scenario[5, 6].

Tab. 2 This table presents a summary of the two main Primary Hazards analyzed for this case study. The volcanic eruption was placed first as a result of a deeper study of the vulnerabilities of the property[7].

RISK	VULNERABILITIES	POTENTIAL IMPACT
 MAIN HAZARD 1 VOLCANIC ERUPTION • Risk of heavy *tephra fallout* (ash fall) • Last serious eruption of Pacaya: 2010 – Seriously affected Guatemala City Fuego: 2018 – Pyroclastic flow and ash fall destroyed local community south of Antigua – caused many deaths	**Site & Management:** • There are only Emergency Response Plans at country and city levels, but NO mitigation plans • The whole responsibility of national ER relies on the only institution of CONRED • Limited budget allocated for Casa Popenoe from the university • Museum is understaffed • No DRM plan for volcanic eruption • Exposed objects in corridors and Historic Kitchen to ash fall (unprotected open window to the exterior) • Evacuation of site has to be done UNTIL ash fall stops to avoid breath of polluted air • No direct communication with Official DRM Agency to receive announcements of irregular volcanic activity	• Ash fall could damage drainage system on roofs and patios (High damage) • Abrasive ash fall could damage wooden exterior features, exposed furniture and ceramic collection in the Historic Kitchen (Medium damage) • Looting could happen in case of site/city emergency evacuation (High damage)
 MAIN HAZARD 2 EARTHQUAKE Last serious earthquakes: 1917–18 (7.5 mag) Catastrophic Nationwide 1976 (7.5 mag) Catastrophic Nationwide	• Thick and heavy composite walls with no metal reinforcement structure • Heavy roof structure made of timber beams and terracotta tiles • Total dependence on city electricity (easy collapse of alarm system, camera surveillance and lighting) • Collections are not covered by insurance	• Partial collapse of roof beams, planks and walls (High damage) • Part of the collection could be damaged/destroyed (Medium damage) • Risk of looting if security system collapse (High damage)

4. Worst Case Scenario

The scenario developed for this case study considered the following hazards as primary: a VEI* 4 Volcanic eruption of Fuego Volcano, followed by a Magnitude 7 earthquake; looting was considered as a secondary hazard. This terrible situation happened during the day while an academic event attended by 60 students is taking place in the Central Courtyard.

An imaginary developing situation would start with the fact that while relatively better prepared in case of an earthquake, there is no DRM Plan in case of a volcanic eruption. Casa Popenoe Staff does not receive the official announcements of registered irregular volcanic activity on time to prepare for emergency. In the meantime, a workshop is taking place in the Central Courtyard. Attendees hear a strong explosion, and suddenly heavy ash fall starts showering the city. Chaos reigns as nobody knows what to do. Casa Popenoe Staff and visitors seek refuge in one of the rooms, waiting for the ash fall to end. Soon after the ash fall stops, an earthquake Magnitude 7 shakes the ground. Everybody runs to the exterior, finding a thick coat of ash covering the corridors. In a stampede, many people fall and get injured, and 5 people die in the process. Abrasive tephra fallout showers all exposed objects in corridors and the Historic Kitchen. The earthquake leaves deep cracks on walls, causing an exterior wall to partially collapse. Because the electric power is down, the surveillance system (cameras and alarms) stops working, and burglars get in.

A scenario like the one described above would have an impact in the psychological, physical, and material realms. Some psychological consequences could create situations like extended panic, psychological distress, chaos and lack of guidance[8)]. Most terribly, people could get seriously injured and even die. With regard to the building and the collections, some of the exposed objects could get damaged due to tephra fallout abrasion, big amounts of ash could accumulate inside of the rooms and drainage pipes system could get damaged due to sticky ash. Assuming that the building resists the earthquake, nonetheless deep cracks could reappear, and even some exterior walls could partially collapse. As a consequence, some objects inside of the rooms would get damaged/smashed in the due course of the earthquake, and finally, an irremediable loss of invaluable historic objects would happen due to looting.

*VEI = Volcanic Explosivity Index

5. Mitigation Plan & Emergency Preparedness Plan

A Mitigation Plan for Casa Popenoe was developed, taking into consideration the two primary (Volcanic eruption and earthquake) and two secondary (Fire and flooding) hazards. It considered different actions that went all the way down, starting from Site level (Institutional/Relational) to Neighborhood, City level, Building, and Collections. All of the different actions were catalogued according to the time frame (short-term, mid-term, and long-term), as well as a supposition of cost (low cost, medium cost, and high cost).

In the category of **Site**, it was proposed the first approach to DRR agencies in Antigua: Fire Fighters and CONRED, as well as presenting the DRM Plan to University authorities as soon as possible. The relationships with the **Community** were considered of the highest importance, and therefore, actions like establishing a relationship with the Conservation Council of Antigua as well as with neighborhood residents/Church leaders while sharing some information regarding the mitigation plan for Casa Popenoe that could be applied by others. At a **City** level, the DRM Plan for Casa Popenoe could be used as a case study in order to foster a DRR – CH bridge between the Conservation Council of Antigua and the main national DRR agency (CONRED).

In order to secure the **building** in the best way possible, different actions would be taken, from in-house training of staff, private security, and volunteers to specific actions depending on the hazard that is going to be prevented in the plan (Volcanic eruption, earthquake, micro floodings, and looting). Finally, for the **collections**, different mitigation measures were designed in order to protect all exposed objects and furniture, as well as those exhibited inside of the several rooms of the house. Special attention was put to complimentary measures that would protect the property and its collections from fire, the hazard for which the museum is less equipped.

The Mitigation Plan designed for this case study also included an Emergency Preparedness Plan for the museum that included different actions depending on the situation: a) Pre–Disaster, b) During Disaster, and c) Post–Disaster Recovery Actions. Considering all the four hazards mentioned above, the different actions proposed in the plan gave special relevance to people, in terms of roles and responsibilities, according to each of the possible circumstances. Because the better people are prepared, the better the actions can be carried out and applied during an emergency.

6. Conclusion

At the beginning of this course, I thought that the main risks for Casa Popenoe were the most obvious from the context: earthquakes and increasingly frequent and destructive floods. However, as the course progressed, I understood that this property is better prepared to deal with them than with other risks that were considered less possible or frequent but equally destructive. So after having carried out a thorough study of the vulnerabilities, I discovered that Casa Popenoe is in a serious danger (even of near-total destruction) if a highly explosive volcanic eruption or a major fire were to occur. Thus, when preparing a specific mitigation plan, I paid special attention to the preparation of a risk management plan that would better protect it from the latter two risks.

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2.9 Disaster Risk Management of Persepolis World Heritage Site – Multi-hazard and place approach

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1. Introduction

The Marvdasht plain, home to some of the most important archaeological sites in Iran, including Persepolis, Naqshe Rostsam, and Naqshe Rajab, is subjected to significant risks due to climate variability and extremes, such as droughts and heavy rain that negatively affect this area. Climate change, on the one hand, threatens local residents, who are predominantly farmers and, on the other hand, threatens the integrity of these archaeological sites with the risk of local autonomous adaptation. It is important to develop a disaster risk management plan since these hazards are capable of adversely affecting cultural sites and causing disasters. This project aims to develop a disaster risk management plan for the Persepolis World Heritage Site (WHS) that takes into account the values of the site and informs local residents about upcoming risks in order to encourage their cooperation.

Persepolis, located on the east part of Marvdasht plain about 60 Km northeast of Shiraz in Iran, is regarded as one of the greatest architectural, urban planning, construction technology, and art ensembles of the Achaemenid period (550–330 BC). These ruins were built on an artificial terrace about ten meters above the ground at the foot of the Rahmat Mountain dominating a vast and fertile landscape. The site was designated as a WHS by UNESCO in 1979 and has been considered the most visited WHS in Iran. A number of cultural sites, agricultural fields, a city, and permanent villages surroundsurrounds the site. Farming and small tourist businesses are the main economic activities in the area. The Sivand River, which has dried up in recent years, was the most important river in the region. This site is located in a region prone to various hazards and threats, which threatens not only its Outstanding Universal Value, but also its cultural landscape.

Fig. 1 Location of Persepolis WHS

Fig. 2 Aerial photos of the site
Source: archive of Persepolis WHS

2. Value assessment

Several monuments and stairways, Apadana palace, reception rooms, and dependencies make this site unique, according to the UNESCO World Heritage Center (2022)[1]. A great deal of information about the Achaemenids and their culture can be found in the inscriptions carved on the walls and palaces of Persepolis, where a large part of its architecture and art was destroyed by Alexander the Great during his invasion. Even after Islam arrived in Iran, this place was respected because of its importance among Iranians. As the symbol of spring and victory over darkness, Persepolis is a popular destination for Iranians during Nowruz (Persian New Year). As a result of its application to the World Heritage Committee inon 1979, the property was determined to possess Outstanding Universal Value based on three criteria (I, III, and VI).

Property boundaries contain the elements and components that contribute towards its Outstanding Universal Value, such as its culture, stories, and fabric significance (Table 1).

Tab. 1 Elements/components that contribute towards Outstanding Universal Value

Elements/components	Description
Culture	- It is known as a symbol of Iranian identity. - There are festivals associated with Nowruz (Persian new year) in Persepolis. - Traditional knowledge/skills of locals.
Stories	- Ceremonial capital of the Achaemenid Empire. - The story of East and West confrontation. - Fire hazard on an ancient city. - The story of the commemoration of ancient kings by the last king of Iran (The Celebration of the 2,500th Anniversary of the Founding of the Persian Empire) 1971.
Fabric	- Apadana staircase. - The Persepolis tombs (Artaxerxes II and Artaxerxes III). - Several building inscriptions. - Persepolis ancient sewage system. - Rahmat mountain.

3. Risk assessment

Majority of residents living near the WHS are farmers who have suffered from the drought since agriculture has been their primary source of income and livelihood. In fact, during the last decade, Iran has been hit by one of the most severe and widespread droughts in its history, affecting a significant percentage of its farming communities[2]. Drought and low precipitation have decreased the income of locals who rely primarily on agriculture for their subsistence[3]. Therefore, they rely on incomes from non-agricultural occupations, which mostly need new construction on their land. In addition, due to limited or no employment opportunities, rural communities are facing massive youth migration to surrounding urban areas, known as reactive or autonomous adaptation[4]. Additionally, because of excessive water resource exploitation and decreased precipitation, the groundwater level has fallen, resulting in the drying up of wells across the region and the need to drill deeper wells[5]. Moreover, it has also reduced soil stability, placing this seismically prone region at more risk[6]. In contrast, for properties inscribed on the World Heritage List, buffer zones play an essential role in maintaining their integrity[7], although new construction and interventions may adversely affect these buffer zones as well. Based on the analysis of the reports on the state of conservation of the WHS from 1979 to 2013, the building is one of the most common threats to cultural heritage properties[8]. Accordingly, climate change has not only posed challenges to local communities, but their autonomous adaptation to these changes has also presented threats to the WHS, both in the buffer zone and the OUV of the property, which has led to conflict between locals and heritage managers. In the Table 2, general hazards, threats, vulnerabilities, and risks are listed.

Tab. 2 List of hazards, threats, vulnerabilities and risks
Source: by the author

Hazard	Threat	Vulnerability	Risk
Earthquake (H1)	Autonomous adaptation of locals (T1)	Earthen structures (V1)	Physical/chemical damage to structures (H1+V2), (H2+V2), (T4+V3), (H3,T7+V7)
Land subsidence (H2)	New construction in the region (T2)	Ancient elements (V2)	Loss of lives (H1+V5+V8), (H3+T7+V6+V7+V8), (H2+T1+V8), (H7+T2+V5)
Fire (H3)	Vandalism (T3)	Fragile parts of the site (V3)	World heritage in danger/remove from world heritage list (H6+T1+V4+V9)
Water/Moisture (H4)	Inappropriate development (T4)	Landscape (V4)	Loss of value (H1+H2+V2), (H3+T7+V7), (T8+T6+V2)
Drought (H5)	lack of participation/ awareness (T5)	Local community (V5)	Decreasing livelihood (H5+T4+V5)
Growth of population (H6)	Theft (T6)	Museum wooden roof (V6)	Migration (H5+V5)
Flood (H7)	The site is surrounded by fields where people picnic (T7)	Green areas/South Barzan area (V7)	Loss of traditional knowledge (H5+V5), (H6+T4+V5)
	Over tourism (T8)	Tourism/visitors (V8)	Damage to the museum objects (H3+V6)
		Buffer zones (V9)	Conflict (H6+T1+T5+V9)
		The property encompasses a vast area (V10)	Loss of sense of belonging (H5+T1+T2+V5+V9)

4. Disaster Scenario

Because of the COVID-19 pandemic and travel restrictions for more than 3 years, the Iranian people do not have access to their cultural sites, such as Persepolis, which is very important for their cultural identity. On March 2023, which is the ceremony of Nowruz in Iran, after the travel restrictions were listed, people started traveling and Persepolis hosted a high number of tourists as one of the main travel destinations. Based on the data on average 50,000 tourists visited the site during Nowruz. However, because of previous hardships and travel restrictions, the number of tourists will be increased significantly and according to the warnings and the expected threats of over tourism, all cooperating organizations including Ministry of Cultural Heritage, fire departments, Red Cross centre, and NAJA (Police department) will be on alert. It should be mentioned that during the COVID-19 restrictions and due to the reduction of supervision and lack of proper monitoring, the number of unauthorized wells and constructions in the region has increased by locals to tackle the drought. Cultural heritage sector, on the other hand, tried to improve the livelihood of locals by allocating parts of the site to their handicrafts activities with the aim of reviving them.

As experts had warned, an earthquake of Magnitude 6 on 25 March at 11:35 AM will hit the Marvdasht region. The city of Marvdasht and more than 10 villages around the city will be severely damaged together with archaeological sites, including Persepolis, Naqshe Rostam, and Naqshe Rajab. The severity of the earthquake causes loss of life, especially in the low-income neighborhoods of the city together with the collapse of the infrastructure of the region, including electricity, internet, and telephone networks. During this time and hour (most visited time of the site), about 4000 tourists visit the museum and site, as well as

60 people working onsite–staff, guardians, tour guides as well as rescue teams. Because of the earthquake, four columns of Apadana palace, which were restored in the last 50 years, will collapse, resulting in a high number of casualties and damage to some of the important bas-relief of the Achaemenid period in Apadana palace. 10 minutes after the earthquake at 11:45 AM, visitors will panic and rush to the exit routes, some of them are injured in between. Rescue team and staffs of the site, who were trained in 2020, will help the wandering and injured visitors but the amount of injuries and casualties are more than their capacities. Moreover, reports will indicate that many Achaemenid architectural treasures, including reliefs, inscriptions, columns, and tombs have been destroyed, affecting the property's outstanding value. Reports also indicate the destruction of a part of the wooden roof of the museum and cause damage to museum objects (Persepolis Museum was restored to its original state in 1932 and opened as a museum in 1937). At 11:50 AM the fire starts in the crafts shops (next to the parking) for the local handicraft businesses, and the fire will move towards the parking and burns several cars.

At 12:45 PM, while most of the local rescue forces are helping the people of the city and nearby villages, the aid forces will be arriving to the region from other cities. However, the problem is that the access to the site will be closed due to the traffic created on the main access road to the site. With the cooperation of the local people, the external rescue forces will be directed from a side road to the emergency door of the site as already planned ahead.

5. Mitigation strategies

With the aim of mitigating and preparing for drought and land subsidence at the place level, as well as raising awareness of future risks and vulnerabilities among stakeholders, mitigation strategies were designed as shown in Table 3.

Tab. 3 Mitigation strategies based on available resources and priorities

Mitigation strategies	Scale of Intervention	Eliminated hazards, vulnerabilities and risks	Stakeholders	Duration	Cost
1) Strengthening partnerships with local community. (Gaining the trust of the communities around the site and creating awareness about future risks).(Periodic meetings)	Regional level	Conflict and lack of awareness.	Staffs of the site, local community, municipality, Agriculture Organization, Natural Resources and Watershed Management Organization.	Medium	Low
2) Land subsidence monitoring (Low-cost early warning system).	Regional and site levels.	Land subsidence. By monitoring the land failure future risk would be identified and eliminated.	ITC experts and site staffs.	Long	Medium
3) Designing evacuation routes and using graphic signs to illustrate evacuation routes.	Site level, museum level	Loss of lives of tourists and staffs.	Site staff/ Fire brigade/ Red cross center	Short	Low
4) Assessing the earthquake resistance of the columns and museum's structures.	Site level/ Museum level	Earthquake resistance of structures would be analyzed. Retrofitting of weak structures.	Structure engineering and experts of the site.	Long	High
5) Promoting traditional building knowledge among new generation. (Earthen architecture workshops as there are several earthen structures in the site and region).	Regional level	Forgetting earthen heritage traditional knowledge.	Staffs, locals, traditional artisan, and master builders.	Long	Medium
6) Establishment of early warning systems.	Regional level, Site and museum levels.	Avoiding and reducing the damages caused by various hazards	Site staffs, Fire department, municipality of the Marvdasht.	Short	Medium

6. Emergency preparedness, response, and recovery measures

In order to develop emergency preparedness, response, and recovery strategies, detailed assessments of the current condition have been conducted, along with gathering specific information about the hazard, its geographical location, cultural heritage types, and vulnerabilities that make the site and people more susceptible to damage (Tables 4 and 5).

Tab. 4 Emergency preparedness strategies

Designing evacuation routes for staffs and visitors.	Safe area for repository of most valuable objects.	Engagement and training of local community near the site.	Continuation of first aid training activities.
Continuation of Fire drill.	Regular maintenance-Site/building/ structures	Regular maintenance – systems: Different alarms/Extinguishers/Cameras	

Tab. 5 Emergency response and recovery

Collecting information	Hazard and its geographical location. Types of cultural heritage affected. Susceptibility to damage. The situation of infrastructures. How many staffs and people present on site.
Analyzing the information	Analyzing most valuable and damaged parts. Analyzing areas that are damaged and vulnerable to secondary hazards. Prioritizing on-site damage and risk assessment according to the extent of exposure to primary and secondary hazards. Evaluation of immediate risks to reduce further damage.
Developing Strategic plan	Constituting Quick Response Teams (already trained). preparation of resources required for doing onsite activity. Establishing a timeline and budget for on-site operations. Setting up the necessary requirements including Obtain permission, site map with the location of infrastructures, buildings, monuments and objects. Personal safety supply based on the nature of hazard. Logistics and means of communication and coordinate with other emergency actors.
Implementation of strategies	Establishing roles and responsibilities of first aiders. Immediate security actions based on the available resources. Establishing a first aid strategy for damaged parts. Monitoring and controlling the quality of the implementation of strategies.

7. Conclusion

A combination of climate change and anthropogenic factors is likely to cause more stress to WHS and their local communities. An effective approach to reducing these vulnerabilities is to design suitable activities not only at the site level but also at the place level. In this regard and as part of the disaster risk management plan for Persepolis WHS, we used the value assessment in section 2 to determine which elements/components of the property are most valuable, as well as prioritizing risk assessments according to the degree to which primary and secondary hazards are present. In addition to strengthening partnerships with the local community, monitoring of land subsidence (low-cost early warning system), designing evacuation routes and using graphic signs to illustrate evacuation routes, and promoting traditional building knowledge among the new generation, this paper proposed emergency preparedness, response, and

recovery based on the available resources and information. In conclusion, it should be noted that monitoring and controlling the quality of the implementation of strategies by responsible experts is crucial for reducing uncertainty.

Acknowledgment

I would like to acknowledge and thank ITC 2022 mentors and assistants, especially Prof. Lee Bosher, for providing such kind of opportunity as well as for their guidance and advice throughout my project process. I have extended my supreme gratitude to Dr. Hamid Fadaei, Director of Persepolis Foundation, for giving me the opportunity to do this project within the organization. In great sense of pleasure, I also would like to thank all the colleagues who cooperated with me on the project with their patience and openness.

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2.10 The Natural History Museum of Valparaiso – Disaster Risk Management Plan Report

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Fig. 1 Natural History Museum of Valparaiso, MHNV.
Source: MHNV

1. Introduction

The Natural History Museum of Valparaíso (MHNV) is a public institution dependent on the National Service of Cultural Heritage, which is related to the government of Chile through the Ministry of Culture, Arts and Heritage.

Founded in 1878, it is the second oldest museum in Chile, whose main building is the Lyon Palace, a Historical Monument. The collection repository and administrative offices are in the Porter Building, a facility connected to the Palacio Lyon building. Both buildings are located a few blocks from the Historic Center of the Maritime City of Valparaíso, an area of the city that was inscribed on the UNESCO World Heritage List in 2003. The main building, the Palacio Lyon, was built in 1881 and reached the status of a Historical Monument in 1979.

There are currently about 60,000 items belonging to collections of natural sciences, history, archaeology, and anthropology under the care of the Museum.

Earthquakes and tsunamis, wildland and structural fires, social protests, incivilities, and criminal acts are part of the permanent concerns in the protection of the Museum. An earthquake that hit Valparaiso in 1906 and the subsequent fire that destroyed the high school, irreparably affected the valuable collections that the museum had managed to accumulate.

Due to the lack of its own building, the museum periodically changed its headquarters: it started out with premises on Avenida Gran Brittany and the ex-Feria del Mar in Playa Ancha; then a small house in Viña del Mar; and finally, on November 15, 1988, thanks to a loan agreed between the Directorate of Libraries, Archives and Museums (DIBAM) and the Illustrious Municipality of Valparaíso, the museum was reopened in the Lyon Palace. It is a work of an architect and builder, Carlos Von Moltke. The building was declared a Historical Monument in 1979.[1]

1 Servicio Nacional de Patrimonio Cultural – Website https://www.patrimoniocultural.gob.cl/

2. Values /Attributes

For the purposes of this Plan, it is considered that the Values – Attributes that characterize and highlight the Natural History Museum of Valparaíso are the following and are qualified as High, Moderate, Low:

Tab. 1 Values of the proposed plan

Values	Rating
Historical	High
Architectural	High
Educational	High
Socio-cultural	Moderate
Scientific	Low

3. Risk Assessment – Multi Hazards Approach

(1) Hazards and Vulnerability

From a multi-hazards approach, and considering elements of a historical nature, as well as recent socio-cultural and political, it is possible to point out that the main hazards for the installation are:

Tab. 2 The main hazards to be considered

	Tsunamigenic Earthquake	Flood	Structural Fire	Wildland urban Interface Fire	Vandalism Crime	Landslide
High Risk						
Medium Risk						
Low Risk						

The hazards mentioned above can be dealt with separately, but the possibility of a mega earthquake and tsunami, such as the one that occurred in 1730 or 1906, presents a worst-case scenario that, in addition to the main hazard, brings other secondary hazards such as flooding and structural fire, as in the case of a tsunamigenic earthquake, taking into consideration that the museum is located within the flood zone.

The seismic gap and the high level of accumulated energy off the coast of Valparaíso, establishes that a large earthquake is expected to occur in the short or medium term, as described later in this document.

Valparaíso is located in an area where large forest fires that spread to urban areas are common. In the recent past, there has been a significant impact on the communities as a result of the spread of these wildland urban interface fires; however, due to the location of the Museum, the probability of being affected by the spread of a fire of these characteristics is considered to be low.

In the recent past, vandalism, crime, and incivilities have increased significantly in the city of Valparaíso. Although, to date the impact on the Museum has been low, it is considered that the increase in these events requires placing these hazards and the probability of their occurrence at a medium level.

Analyzing the area in which the Museum is located, it is possible to point out that landslides are a real possibility, as the recent past has shown. To date, the landslides that have occurred in nearby areas have not impacted the Museum, but this is something that needs to be monitored, as well as the mitigation works that have been carried out in nearby areas. Thus, it is considered that landslides should be rated at a medium level.

Separately, earthquakes, floods, and structural fires have a significant probability of occurrence, both as a hazard and as a risk of occurrence. Valparaiso is an old city where there are usually important structural fires, and the museum is adjacent to a relevant number of facilities and activities where a fire can originate and be affected by the spread. The fire code in Chile is weak, so the measures for detection, warning, and suppression systems are still precarious.

Floods are a hazard whose probability of occurrence has increased, especially due to climate change and extreme weather phenomena, and in this case, heavy rains in a short period of time that demand an old

rainwater evacuation system.

4. Worst Case Scenario

From the analysis carried out, it is considered that the worst possible scenario corresponds to the occurrence of a tsunamigenic earthquake of moment magnitude 8.6.

This scenario is likely and is based on available scientific information that indicates the seismic deficit that in the northern part has not yet been completed, so the occurrence of a mega earthquake such as the one proposed could occur in the near future.

The plan is based on the following specific scenario

Primary Hazard: Tsunamigenic Earthquake

Day: weekday, noon in January or February

Secondary hazard: Floods, structural fire

General description: A Moment Magnitude 8.6 earthquake is estimated for this region from the northern part of the 2010 earthquake rupture to the southern portion of the 2015 earthquake rupture (as shown in the figure on the right).

Tsunami: run up 30 meters above sea level

Visitors: 100

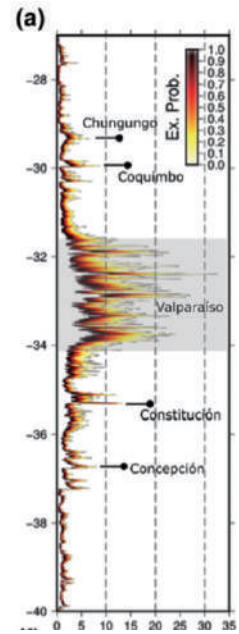

Fig. 2 Tsunami modeling

It is necessary to point out that the months of January and February in Chile are high season in terms of internal and receptive tourism.

(1) Hazards + Vulnerability

- Obvious damage to the walls of the museum building. It is unclear if there is structural damage. Fall of furniture and objects. Glass breakage. Main corridor with displaced furniture and breaking of showcases.
- Administrative building. Glass breakage. Displacement of furniture and objects. Storage rooms: movement of furniture and objects.
- Power outage. Absence of telecommunications services, which prevents the request for emergency aid.
- Apparent fire in the neighboring building. Falling debris and partial collapse blocking the North Exit.
- The staff has had to attend to their colleagues and visitors, as well as evacuate to the security zone.
- 12 minutes after the earthquake, the wave train begins to impact, destroying the main door of the museum and flooding the first floor. The storage rooms of the basement and the first floor of the Carlos Porter building are flooded. Great damage is generated by water and debris. Several aftershocks. Three of them are between 7.5–8.3 Mw.
- Emergency services are overwhelmed. There is no communication with firefighters, police, or ambulances. There is also no communication with the National Emergency Office.

(2) Effects/impacts

As a result of these events:

- Damage to the main building (Palacio Lyon) of the Museum that makes structural compromise suspected.
- Significant damage to the museum's collections is suspected.
- Carlos Porter Building: significant damage and impossibility of safe access to the warehouses. Significant damage to the collections is suspected.

– Staff members have had their livelihoods affected.
– The museum has had to close, and it is difficult to access the structure as there is a lot of debris and mud in the vicinity as a result of the tsunami.
– Due to loss of connectivity, there is no remote network access or information in the cloud.
– There is a significant alteration of the community that has had to be evacuated to safe zones that are crowded.
– Some looting is reported in the central area of Valparaiso, in commercial premises near the Museum. Personnel safety must be evaluated before moving to the Museum.

There is no possibility of accessing the buildings before an assessment of the safety of the environment and structure of the Palacio Lyon and Carlos Porter buildings. Entry into the building as a damage assessment should be part of the priority activities when implementing the recovery and continuity of operations plan.

5. Short–Term Measures (Six months)

Over the next six months, a plan will be developed that will involve the phases of mitigation, preparedness, response, and recovery, based on an appreciative approach that seeks to recognize and strengthen existing capabilities.

This plan will follow key principles of Emergency Management, such as an integrated approach (all risks/hazards, all phases, all stakeholders, and all impacts). A progressive approach, seeking to anticipate scenarios and build more resistant and resilient communities.

The actions to be developed will also seek to strengthen a risk approach (identification, risk analysis, and impact analysis) for correct prioritization. An integrated, collaborative, and coordinated approach, flexible and professional, based on science and knowledge, experience, training, ethical practice, and continuous improvement.

It will also develop a bottom–up approach, seeking the participation and involvement of the organization and its stakeholders as the key resource for the viability of the initiative.

Thus, each of the activities, when designed in detail and implemented, should follow these principles.

(1) Management

If we consider that what is relevant in a plan is the organization's capacity to implement actions, going from an academic and design action to an execution one, the participation and involvement of all levels is a key element.

It is necessary to consider that the organization has been developing an interesting work; there is motivation and concern for the occurrence of a disaster that would severely impact the lives of people, the Museum's exhibits, and the infrastructure. For this reason, the above–mentioned is even more relevant since it allows for strengthening the work developed, increasing motivation, as well as establishing the basis for continuous improvement under a high level of commitment.

Institutional Involvement and Participation

– Communicate to the Director the plan, motivate his commitment, receive suggestions, and incorporate improvements.
– Communicate to the management team the Plan as an initiative validated by the Director and part of its management. Receive suggestions, recommendations and incorporate improvements.
– Communicate to the "Evacuation Table Team" created by the Director to establish the first guidelines for the evacuation of collections. Receive suggestions, recommendations and incorporate improvements.

(2) Stakeholders Analysis

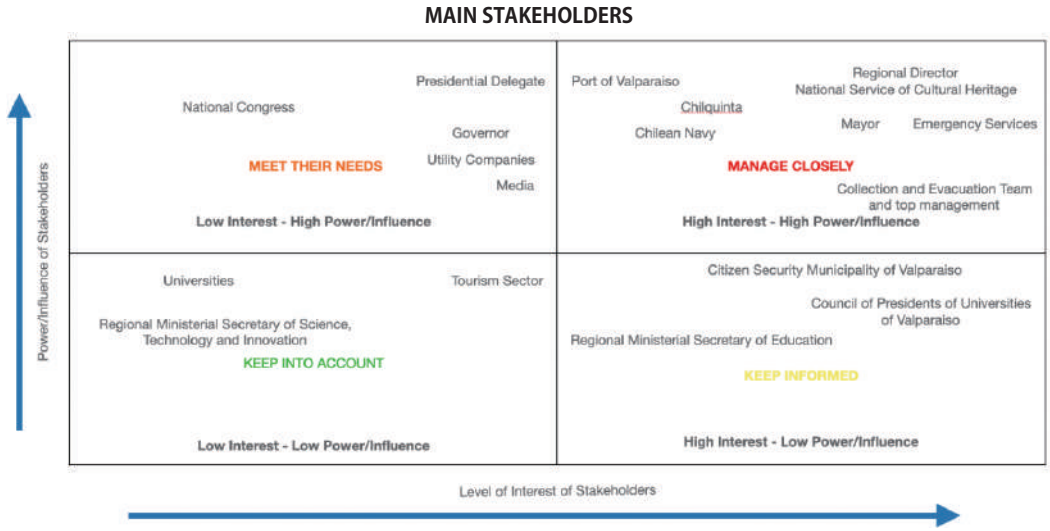

Fig. 3 The main stakeholders of this plan

(3) Mitigation

To comprehensively address the mitigation phase, a systematic approach has been contemplated to include activities that help reduce damage in the event of a destructive earthquake and tsunami.

It has been considered key to establish strategic work to strengthen engagement with various stakeholders as a way to establish joint work, alliances and raise awareness about the importance of taking mitigation measures in anticipation of a catastrophic scenario of mega earthquake and tsunami.

In this phase, specific actions are proposed that are considered urgent and key to mitigate possible damage to people (workers and visitors), property, and infrastructure.

In the next six months, the goal is to reach a specific design and proposal stage.

Strategic Level/Stakeholder Engagement:

Develop a community–stakeholders engagement strategy with a special focus on:

- Target community groups (focus group, invitations, information, participation in relevant activities)
- Municipality, Mayor, Presidential Delegation, National Congress, Regional Governor and Regional Councilor, Port of Valparaiso, Media, Utility services companies, Chilean Navy, Naval Museum, Chilquinta, Community in neighboring buildings

Physical Planning

- Seek an alliance for the evaluation of utility services (electricity, drinking water and gas network) and then establish a plan to strengthen the electricity.
- Structural evaluation of the Palacio Lyon and Carlos Porter buildings and then establish a structural reinforcement plan for buildings and facilities.
- Evaluation of design and installation of manual activation sprinklers on the roof of both buildings
- Review and proposal for repair and reinforcement of fire monitoring, detection, alert, and suppression system.

Technical Level

- Reinforcement and improvement of the seal of main access doors and access to the underground.
- Review of furniture, artifacts, and showcases in the Lyon Palace building. Anchoring and reinforcement

of fastening of furniture elements, including those found in storage warehouses.
- Availability of flood bags and Quick Dam barriers
- Incorporate fire extinguishing carts of 50 kg.
- Strengthen fire network in central parking lot

Management, Maintenance, and Monitoring Systems
- Strengthening waste management
- Strengthen electricity consumption management
- Reinforce control system and centralized monitoring of cameras.
- Reinforce the main switches, and monitoring of smoke sensors
- Establish monitoring measures of the alert system for earthquakes, tsunamis, and weather, among others.
- Review and improvement of signage
- Ensure proper opening and closing of doors in emergency exits.

(4) Preparedness

In the preparation phase, it is considered essential, within the next six months, to install some basic capabilities, starting by simplifying and massifying information to raise awareness and initiate a process of motivation and commitment to the people working in the museum, as well as installing essential capabilities and structures for incident management.
In the same way, basic elements will be defined for standard operating procedures and an emergency management and operational continuity plan, making at least a tabletop and drill.

- Dissemination and involvement of staff. Knowledge of the plan. Awareness and motivation. Strengthen a sense of pride and belonging
- Organization and training. Implementation of the CERT Community Emergency Response Team program
- Standardization of format of standard operating procedures. Application via participatory methodology and involvement. Construction of a common language and sense of team identity.
- Tabletop exercise and drill
- Development of Basic Recovery and Continuity of Operations Plan. Design of a basic guide that determines, among other things,

1. Incident Command System
2. Essential Functions, Recovery Objectives Points, Recovery Time Objectives, Essential Personnel, among other information related to a basic BCP approach.

(5) Response

During the next six months, the main elements to adequately address the response phase will be defined. The following are a series of steps that should be addressed at the proposal level and are considered to be the first systematic approach to the response, basically a step-by-step approach to the first response.

Step By Step
1. Assemble Planning Team (Administrators, Department Directors, Key Staff, etc.)
2. Incident Command System – ICS is already in place.
3. Determine whether, based on the characteristics of the earthquake, it is necessary to evacuate in the face of a possible tsunami. Turn to reliable and official sources of information.
4. Gather and count staff and visitors. If evacuation is required, appoint evacuation leaders to follow standard procedure.
5. If it is not necessary to evacuate, carry out a rapid and systematic review according to the standard procedure of action.

The priorities for the first response will be
1. Safety and attention of staff and visitors
2. Infrastructure Security
3. Security and rescue of collections
4. Business Continuity

(6) Recovery
The following steps are provided as an initial guide for managing the recovery phase. Over the next six months, we will seek to put in place the capabilities, procedures, and plan structure necessary to address each of these points.

1. Quick Check using Continuity of Operations Plan Development Check List
2. Adapt the BCP/COOP and Recovery Plan Using the Basic Guide for Operational Continuity/Business Continuity,
3. Ensure the installation of the human resources management system according to a standard operating procedure,
4. If an evacuation has been necessary and structural evaluation of the buildings is required, install a command post in alternative installation.
5. Assemble Planning Team (ICS)
6. Establish mission, team responsibilities, and time frame for development of the plan.
7. Gather existing emergency plans and documents for plan coordination.
8. A standardized checklist for the first approach will be developed.

Each of the phases and actions included in this plan considers the involvement and participatory construction of each of the initiatives, in order to generate the involvement of the members of the organization, make their implementation viable, and strengthen the sense of belonging.

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2.11 Disaster Risk Management Draft Plan for Pineland Archaeological Site Complex

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1. Introduction

Southwest Florida's Pine Island is home to the Pineland Site Complex, also known as Pineland (Figure 1) which is an outstanding site made up of seven archaeological sites and it is understood to have been one of the capitals of the Calusa. The Calusa (Figure 2) were a sophisticated social and political tribe that inhabited the Southern Peninsula of Florida as fishermen, hunters, and gatherers. This area was distinguished by two sizable shell mound complexes that were divided by a water court and an artificial central canal. Frank Hamilton Cushing, an archaeologist, visited the Pineland site in 1895, and the complex's core was spread across around 100 acres. Only 20 acres were still whole in 1989, thanks to landowners Don and Pat Randell's preservation efforts. To the south of the primary site, a succession of smaller-sized enclosures, courts, and benches were present. At Pineland, there are still a number of historic buildings that illustrate Florida's early pioneer past. The location has been designated as a County Historical Resource and is listed on the National Register of Historic Places not only because of its archaeological and historical value but also because it is also home to a diversity of ecosystems. The Florida Museum of Natural History's Randell Research Center (hereafter, RRC), which teaches about southwest Florida's archaeology, history, and ecology, currently oversees the site.

Fig. 1 Aerial view of Pineland
Source: Florida Museum

Fig. 2 The Calusa
Source: Florida Museum

2. Characteristics of the site

(1) Boundaries

RRC is a joint venture between Lee County, which purchased the property through the Conservation 20/20 program, and the University of Florida Foundation, which manages the land, including its structures and amenities (Figure 3). In 2015, the RRC, with support from the Calusa Land Trust and other donors, was able to buy five more acres that contain other two Calusa mounds - Smith Mound and Low Mound. There are still areas of Pineland that are not owned by the county, nor are they managed by RRC.

(2) Stakeholders

Stakeholder analysis (Figure 4) for Pineland divided by the stakeholders into six groups: 1) RRC, which is a program of the Florida Museum of Natural History and also managed by the University of Florida and it includes the staff, volunteers, the Advisory Board, the Randell family, and Friends of RRC; 2) Local which includes the residents of Pine Island and the Historic Preservation Commission and the Historic Preservation

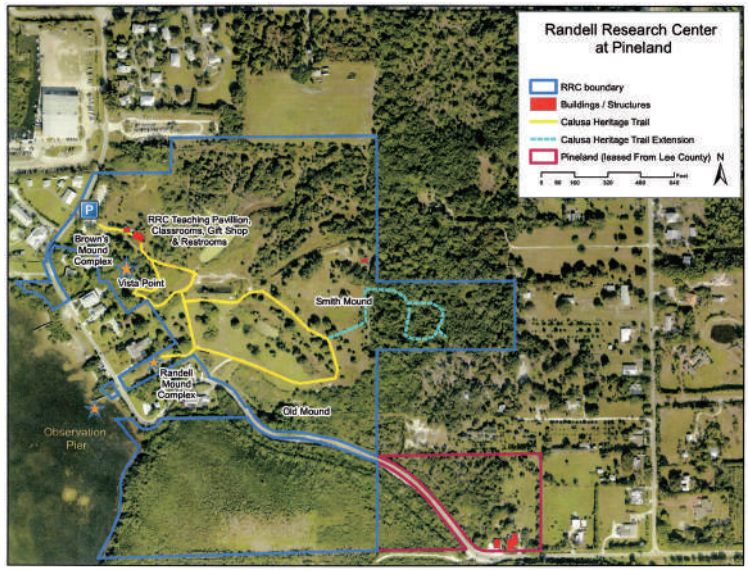

Fig. 3 Boundaries of Randell Research Center
Source: Marquardt. W. and Walker K. 2014

Fig.4 Stakeholder analysis
Source: by the author

Board of Lee County; 3) Universities that include the University of Florida, Florida Gulf Coast University and Florida Atlantic University; 4) Businesses and organizations like Tarpon Lodge Rest. and Calusa Land Trust; 5) Donors and 6) Seminole Tribe of Florida Tribal Preservation Office, Bureau of Archaeological Research, and the Florida Public Archaeology Network. This categorization of stakeholders shows this site's diverse support and unique management style.

3. Attributes and values

(1) Archaeological attributes

Pineland is a complex of seven archaeological sites; therefore, the main archaeological attributes consist of shell, sand, and burial mounds. The names of the archaeological attributes that lay within the boundaries of the site are Randell and Brown Complexes, Smith Mound or Pineland Burial Mound, Surf Clam Ridge, the Citrus Ridge, Low Mound, and Old Mound.

(2) Built attributes

The built attributes of the site include Ruby Gil House, a historic house that has functioned as the headquarters for the RRC. Also, the Calusa Heritage Trail is an interpretive walkway to the mounds, canals, and other features of the Pineland archaeological site. Other built attributes are the pavilion and the observation deck.

(3) Ecological/landscape attributes

Pineland consists of an incredible landscape that is home to a great biodiversity. Ecological attributes include the Calusa Canal, the Ibis Pond, smaller ponds, and the Eastern and Northern woods.

4. Risk Assessment

Part of the risk assessment analysis consisted in understanding the regional hazards that are experienced in the region and which of those can become site-specific hazards. Sources consulted to conduct a risk assessment (Figure 5) and analyze the impact on the attribute's values were Risk Factor (https://riskfactor.com/) and Surging Seas Risk Finder (https://riskfinder.climatecentral.org/).

(1) Regional hazards

At a regional level, Southwest Florida is mostly impacted by hurricanes. Historically, every 30–40 years, there was a major hurricane event, and most recently, every 10 years, there is a major hurricane in the region, followed by intense flooding, tornadoes, wildfire, earthquakes, and landslides.

(2) Site-specific hazards

Flooding is the hazard that runs the bigger risk of impacting the site. The town of Pine Island has an extreme risk of flooding over the next 30 years, which means flooding is likely to impact day-to-day life within the community. This is based on the level of risk the properties face rather than the proportion of properties with risk. Currently, there are no known adaptation measures for flooding in Pine Island. Pine Island has extreme risk from the heat. The "hot day" temperature for Pine Island is 105ºF. As a result of the extreme heat, Pineland also suffers a major risk of wildfire.

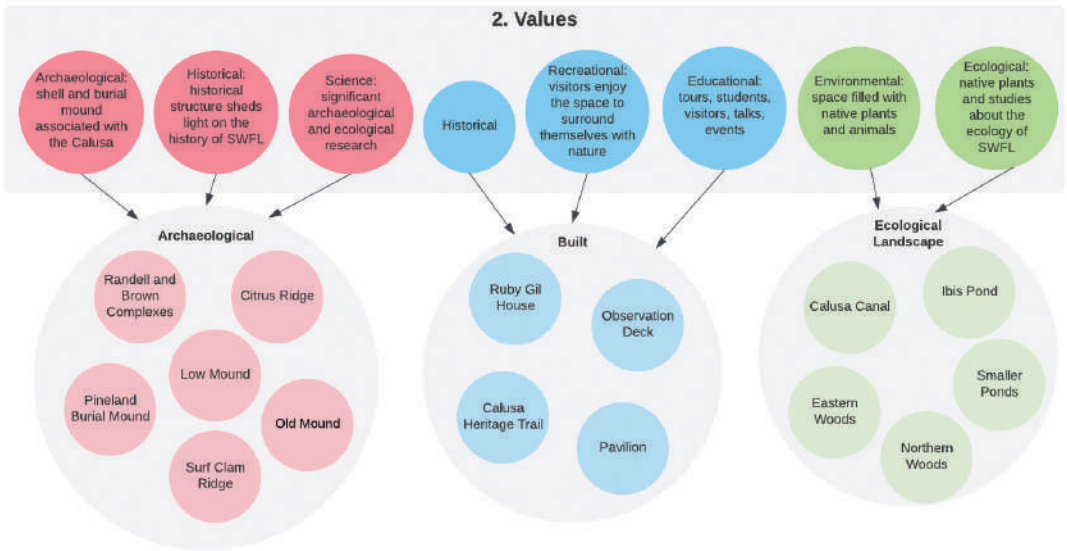

Fig.5 Attributes and values
Source: by the author

5. Disaster Scenario

It's mid-September, the peak of hurricane season, and the weather forecast had announced a hurricane cat. 5 accompanied by winds of 157 mph and a storm surge of 18 ft. Ruby Gil House has been terribly impacted by the hurricane, and the artifacts stored in it are broken and out of context. The parking lot to access the Calusa Heritage Tail has been blocked by trees and debris that fell due to the intense winds (Figure 6). Older and seasonal residents that could have immediately arrived at the site have fled the area to shelters. Some of the mounds' profiles have been impacted, and artifacts have been removed from the mound, damaged, and taken out of context. Unfortunately, subsequent rains and the great number of debris and fallen trees have damaged Smith Mound exposing human remains. It takes a long time for visitors to go to the site, consequently impacting tourism. There is a delayed post-event response since the Matlacha bridge was broken and flooded, and there is no way to get to the site – also limiting first aid to cultural heritage.

Fig.6 Access to the Calusa Heritage Tail has been blocked by trees and debris

6. Mitigation Measures

Following the analysis done through the attributes, value, and risk assessments, the following mitigation measures are suggested:

Tab. 1 Mitigation measures
Source: by the author

Mitigation measures	Description	Scale	Actors	Duration	Costs	Effect
Planning	1) Developing a management and DRM plan for the site and attributes	Site management level	RRC staff	Medium	Medium	Improve risk preparedness
	2) Do risk assessments of heritage components – keep a record	Site management level	RRC staff, volunteers, FPAN	Periodic	Low	Collect data of heritage attributes before and after hazards impact the site
	3) Buy a storage unit space for evacuating artifacts and important documents	Site management level	RRC staff	Short-term	High	Protect artifacts and documents from storm
Maintenance & Preparedness	1) Repair Ruby Gil House	Attribute level	RRC staff, volunteers, consultant	Long-term	High	Reduce the risk building and artifacts being damaged.
	2) Maintain flora	Attribute level	RRC staff, volunteers	Periodic measure	Low	Reduces chances of mounds and other areas being impacted
Training	Training of staff for caring for cultural heritage in the event of a disaster	Site level	RRC staff, volunteers, consultants	Periodic	Medium	Reduce the risk of attributes of the site being impacted hazards
Research & Awareness	Research on the protection of mounds & share the results at events at the RRC	Site level	RRC staff, universities	Long-term	High	Increase ways to protect mounds and create public awareness

7. Emergency, preparedness, response, and recovery measures

(1) Preparedness

- Once there are official warnings for a hurricane event, all staff members will keep track of the direction of the hurricane, kind of winds, and preparations to evacuate the site one to two days before the hurricane will take place.
- Part of the preparation will consist of making sure that all buildings are hurricane-proofed, and the vegetation is controlled in order to prevent any additional damage to the mounds. Evacuate artifacts to the storage unit in Fort Myers.
- Create hurricane drills among staff with the assistance of collaborators from FEMA at the end of June and review the DRM plan with the staff and volunteers.
- Create a thorough binder with all the necessary emergency response information, including a directory of emergency contacts, and have all relevant documents, including the DRM plan - in a shared online storage space that all of them can access.
- Set additional methods of communicating with staff, institutions, and volunteers in case power are out, and communication towers are out (pagers or walkie-talkies).
- Train civil protection, such as the County Sherriff's Office and the Fire Department, to deal and properly handle cultural heritage after a disaster.
- Create a headquarters for emergency response/a chat or online network to communicate and respond (ex. Florida Gulf Coast University).
- Practice and review procedures and guidelines with staff and volunteers. Maintenance protocol in action, especially controlled vegetation – look for anything that can harm the mounds.

(2) Response

- Check on staff and volunteers via phone calls and text. Coordinate meetings between the operations manager, the director, and the assistant director to discuss the emergency response plan.
- Get in contact with local neighbors and members of the Advisory Board to see if anyone has access to the site and can do a rapid evaluation of the site.
- Take into consideration different organizations that are going to be responding, like FEMA and NGOs, and also consider new stakeholders.
- In case the bridge is damaged, and access is restricted, get the proper documentation and permits ready for visiting the site. Check on the storage unit and do a rapid evaluation of artifacts and important documents.

(3) Recovery

- Contact and mobilize the network of specialists from emergency departments, the Fire Department, law enforcement, FEMA, museums, research institutes, and universities to help with the recovery.
- Damage and risk assessment of Ruby Gil House, Pavilion, Calusa Heritage Trail, and mounds.
- Provide security at the site for guarding affected objects
- Secure perimeter for public safety
- Regularly monitor areas of the site that requires maintenance.
- In case nobody can access the site due to a damaged bridge to the island, a request to Google will be sent for providing a disaster satellite map of the site.

8. Conclusion

While a draft of the DRM plan was being developed throughout the course, Hurricane Ian severely impacted SWFL, specifically the Pineland Archaeological Site Complex. This presented a unique opportunity to cross-examine what was initially proposed during the course with the lessons learned from the experience

of this recent hurricane. RRC must develop a management plan that includes a DRM plan of cultural heritage, which includes the ecology and cultural landscape of the site. In turn, this should be one of the main goals of the pilot project following the ITC. Doing this will result in a key example or case study for other sites in the region whose main attributes consist of archaeological mounds. Immovable archaeological heritage faces great challenges, but lessons learned from Pineland can shed light on different ways of assessing the impact of different hazards and managing disaster risks from storm-related events. Lastly, frequent re-assessment of involved stakeholders is crucial for mobilizing response and recovery efforts.

Acknowledgment

Thanks to Legna Salas Castillo for always remembering to give me a quick call early in the morning to make sure I woke up in time for class. Thanks to Annisa Karim, Michelle LeFebvre and Charlie Cobb for their support in taking this course. Thanks to Sara Ayers-Rigsby and the rest of my colleagues at FPAN for their support and encouragement at work. Thanks to Saima Iqbal for being a great mentor and for her incredible guidance, kindness, and patience throughout the training. It was a pleasure meeting and learning from you. Last but not least, thanks to everyone on the ITC team - professors, organizers, lecturers, guests, and classmates who made this virtual training possible and an incredibly unique experience.

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2.12 Disaster Mitigation Management Eastern Mamluk Necropolis in Cairo: Sultan Barsbãy Hospice Case study

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1. INTRODUCTION

The cultural assets of the Northern Cemetery are the main part of the living heritage of Historic Cairo, which is one of the sites inscribed on the UNESCO's World Heritage list based on the three criteria for Outstanding Universal Values (i, v, vi).[1)]

In the fourteenth and fifteenth centuries, Mamluk sultans sought to build their great tombs outside the city, south of the Citadel, which was linked to the urbanism of Cairo. It is also known as the Qabaq or the Black Square, where Mamluks used to compete in archery.[2)] Consequently, this makes the site unique that includes the most famous architecture of the Middle Ages with a military, political, and social character. Moreover, it is the only regular site visited by intellectuals[3)] (Map 1).

2. Case Study (Sultan Barsbay MADRASA)

(1) Background

Many architectural complexes were built for a number of Mamluk sultans in the northern cemetery, consisting of well-known architectural structures on both sides of the street and attributed to a number of great sultans such as Barsbay and Qaytbay. This residence has been neglected for years.

Sultan Barsbãy ruled for sixteen years throughout the period between 1422–38, at the height of the Mamluk era in Egypt. Originally, it was a hospice with a mausoleum. This complex was planned to accommodate a large number of students, occupying from both ends of the street south to the next site, covering a large area, but most of it did not last. Interestingly, its architecture was very different from the funerary structures of its contemporaries (Map 1).

Map 1 Northern Cemetery
Source by urhcproject

In addition, it was a charitable place where people drank from it that combined with its facade on the left side of the portal. On its northern and eastern sides are other mausoleums dedicated to a number of princes and relatives of him[4)] (Pic. 1).

Pic. 1 Khanqah Al sultan Barsbāy
Source by Esri

(2) Cultural Heritage Values

The site has various values that make it very important and worthwhile to preserve. It is situated in a cosmopolitan location of spiritual and religious significance. The entire building dates back to the Mamluk era. The khanqah has a unique decorative stone dome with a rich sanctuary covered with a magnificent marble floor. It consists of a masterpiece Pulpit which surrounded by a glass slide for fire protection by Egyptian Heritage Rescue Foundation (EHRF) [5] in association with the British Council. It also contains a Quran chair made of wood inlaid with ivory located in the sanctuary of the shrine (Table 1).

Tab. 1 Barsbay Values
Source by Author

Royal	Built by Mamluk Sultan
WH	Located in World Heritage Site
Spiritual	Sultan Barsbāy Mausoleum
	Amir's and Sultan's Relatives Mausoleum
Religious	Prayer Place
	Sufis students' accommodation
Architectural	Unique Original Mamluk style
	1st time, consists two Zawiyas, previous complexes
Artistic	1st time, unique decoration stone dome with a star pattern
	Sanctuary floor richly inlaid with marble polychrome
	Ancient masterpiece Pulpit from 15th C., adorned with intricate carvings surrounded with glass slide, transferred from heritage mosque that demolished in 19th by the Committee.
	Quran holder inlaid with ivory

3. Hazards and Vulnerabilities

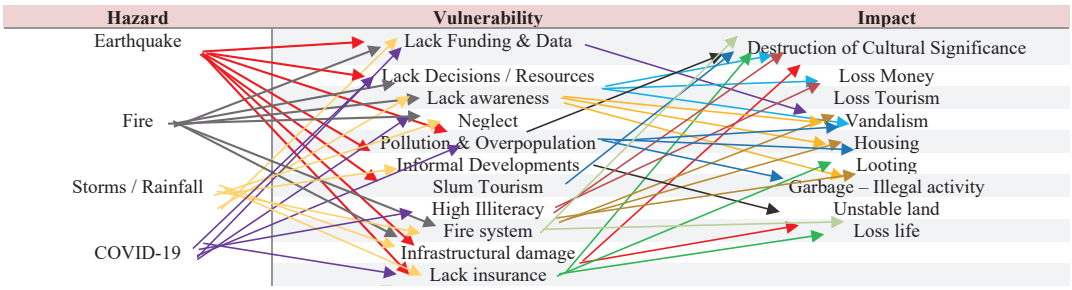
(1) The cemetery also faces such common and critical risks that occur all over the world. By analyzing the main risks on this site, one can assess the main types of natural and man-made hazards such as negligence, theft, rapid urbanization, etc. The best risk reduction plan to tackle the main risk of this site is earthquakes. Over the centuries, a number of natural hazards directly affected the infrastructures, such as seismic threat, fire, storms, etc., especially of which is worthy of mentioning was the earthquake in 1992; it had a fatal impact on life and cultural heritage. Of course, natural danger is not the only reason threatening the site but this extended vulnerability is due to human impact on the site.[6] (Pic. 2)

Natural Hazard 1900–2020	Subtype	Events Count	Total Deaths	Total Affected
Earthquake	Ground Movement	5	594	92,996
Epidemic	Bacterial Disease	1	10,276	0
	Viral Disease	2	15	143
Extreme Temperature	Cold Wave	1	3	105
	Heat Wave	3	164	66
Flood	Flash Flood	2	13	468
	Riverine Flood	6	638	167,960
Storm	Convective Storm	6	109	47,807
Mass Movement (dry)	Rockfall	1	98	697
	Subsidence	1	34	300

Pic. 2 Egypt Natural Hazards, 1900–2020
Source by World Bank

(2) Best mitigation plan will require analysis of the pre-disaster situation using data to have a resilience to reduce the after-mid-disaster impact. As for the case study, which is located in the Qaytbay area, its main hazards are earthquakes, fires, storms and post-Covid-19 effect (Table 2). Furthermore, the building is exposed to the impact of slum tourism due to having regular visitors without any arrangement or entry tickets. Similarly, the whole site is faced with the weak infrastructure of the building due to underground water; previously, damages occurred due to frequent rainfall and historic earthquakes that hit the building, and they continue to be neglected by the Ministry of Antiquities (MOTA) without any maintenance. The only information that exists is the historical and architectural data without any mitigation plan for the site or the area around the targeted buildings. The area is occupied by communities with a low literacy rate, with lack of awareness that leads to the neglect of the mosque by keepers. With no fire system, low capacity, lack of decisions that take a long time to activate will be a disaster later and lead to the loss of valuable cultural heritage. There are also many acts of looting, housing and illegal internal activities, as seen in 2016, when some criminals targeted a number of shrines. Moreover, residents across the region dump rubbish inside the shrines which affects the infrastructure and opens the way for criminals to do illegal things like drugs. Therefore, the Ministry closed off the building by placing a security cordon around it to prevent this problem, but without removing the garbage from the heritage building. As a result, the hazard is still accretion. Previous assessments conducted from 2008 to 2013[7] about damages showed that they were caused by traffic vibrations or congestion that allows vandalism to affect buildings, especially the Qaytbay area where current case study is located, with the highest percentage of pollution and overpopulation. There are many valuable pieces that are targeted by thieves such as the carved wooden minbar and the Quran stand (Map 2); moreover, there are issues of the lack of capacity and funds, neglect, pollution, sabotage, informal development, and rapid development that could potentially cause earth tremors in the area which affects directly on the heritage and its stability.

Tab. 2 Risk Analysis
Source by Author

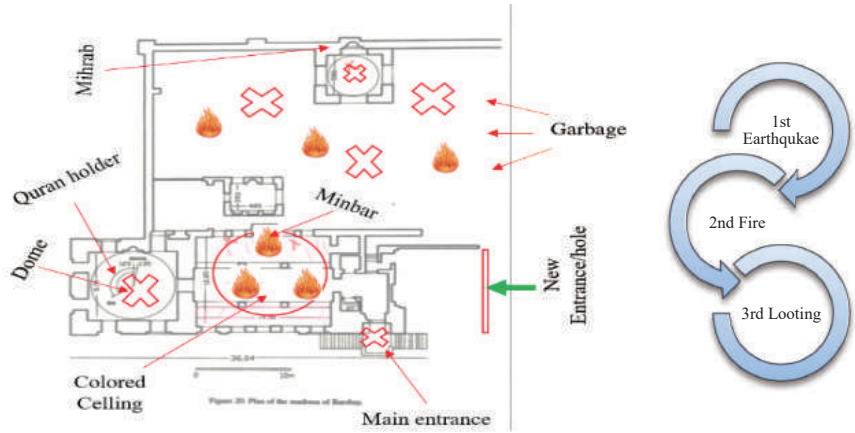


Map 2 Pollution & overpopulation Qaytbay
Source by Google Earth

4. WORST CASE SCENARIO

A strong seismic wave (Primary Hazard) of Magnitude 5.9 hit the site on 10/2023 at 12:15 pm (EET). Many parts of the buildings had serious cracks in the walls. The minaret's head fell on people, causing loss of life, blocking the main entrance, and causing a serious crack in the tomb's dome. Moreover, the gas pipe and electrical box failed to function due to the earthquakes, so the fire (Second Hazard) started to spread around a large part of the building.

Firefighters were late to reach places at risk of fire because of the long distance and peak hours in Cairo. The colored and decorated wooden ceiling caught fire and began to burn because parts of it fell inside the wooden pulpit, which was damaged by the fire and smoke. In addition, the glass slats that surrounded the pulpit had serious cracks (Pic. 3). The Civil Defense is making a side hole in the walls to enter and rescue people, while the Civil Defense and the facilitator will direct the visitors to exit the area in a safer way. The police will secure the site and the ambulance will transport the injured.

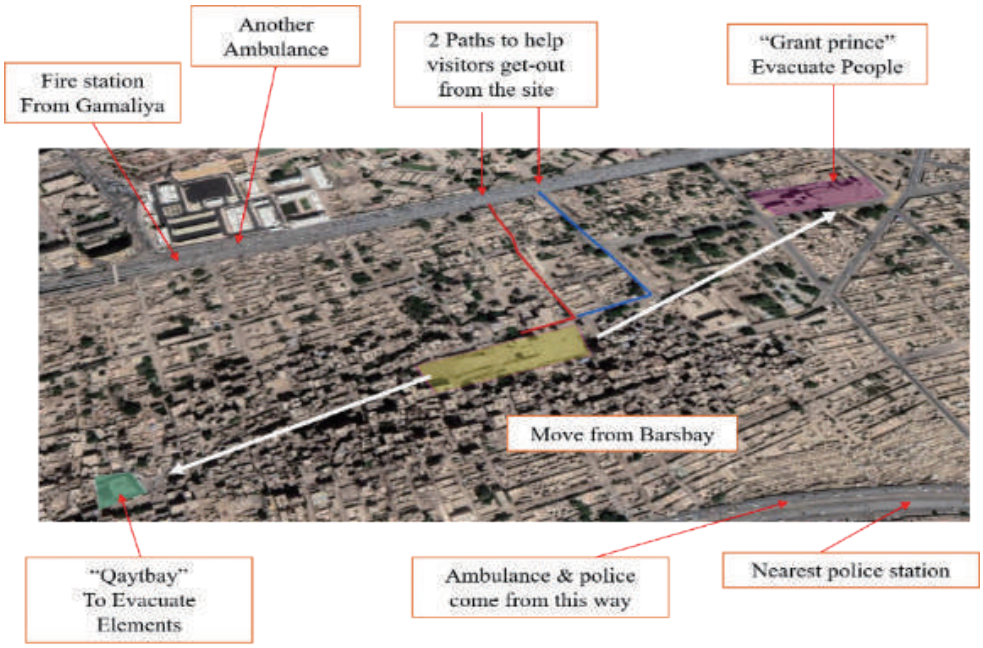


Pic. 3 Source H. Hamza, Worst Scenario, Edit by Author

5. RISK ASSESSMENT - PREPAREDNESS AND RESPONSE

The specialists and first Aider after obtaining the permits and preparing a risk assessment, acquired the data and prepared the logistical tools, etc. After securing the building, First Aid staffs marked the damaged parts and followed their list of actions with required intervention; first, demolished valuable items that had fallen will be rescued and placed in a safer location in the Qaytbay Mosque that houses an antiquities office, prior to its transportation to the Civilization Museum (Map 3). Second, Specialists begin to cement and reinforce some of the walls and document the current condition of each element. Finally, by securing

a new warehouse[8], all the pieces are transferred to Qaytbay mosque with their numbers and data of the original location. On the other hand, evacuation of people who have lost their homes is considered, as 500 persons can be evacuated to Amir Kabir Square.



Map 3 Evacuation & Intervention
Source by Author

6. ACTION PLAN AND MITIGATION PLAN

After a disaster, response and mitigation measures should be implemented to minimize and prevent future damage. The building needs a good renovation and requires a maintenance plan every 6 months. The place does not have a temporary storage to be used in times of crisis, so it requires to prepare another site to use it as a store. Security system, CCTV camera, and updated fire system with alarm, need to be implemented. A technician in reinforced glass fences should be appointed to remove it in times of crisis. In addition, updating action plan every 8 months to monitor and track seismic activity, is highly recommended. To enhance communications among all partners, creating a network for communication is required by preparing a telecom specialist list after holding several meetings (Table 3).

The best protection is to rehabilitate the building, use it to raise community awareness and hold relevant activities for children where the facilitators will follow up later; one can exchange traditional knowledge of the local community and listen to their traditional techniques. In addition, training of specialists in mitigation and intervention should be undertaken. Promote construction and garbage policies by involving the community in development plans and policies. Moreover, reducing trees, removing garbage, and developing the electricity system are essential. Professional training application for firefighters and civil defense about intervention to save cultural heritage.

Development by EHRF has been collected, documented and digitized where possible. Consider improving the risk assessment plan. The estimate for most of these procedures will be medium to very high and will take approximately 6 months to a year (Table 4).

Tab. 3 Action Plan (Duration & Estimation)
Source by Author

S	Action Plan	Institutions	Duration	Estimation
1	Restoration	Historic Cairo -MOTA	1- 2 Years	Very High
2	Consolidation	Historic Cairo	6 Months	High
3	Move valuable elements	EHRF	1 Month	High-Medium
4	Securing (CCTV)	HC- NGOs	6 Months - Year	High
5	Fire System	EHRF- NGOs - HC	6 Months - Year	Very High
6	Seismic monitor	Cairo University	Each 6 Months	Medium
7	Telecom list	Site Archeologists	2–3 Weeks	Low
8	Community Raise awareness	HC -EHRF	4–5 Months	Medium - Low
9	Rehabilitate	HC – M. of Culture	6 Months	Low
10	Improve Risk Assessment plan	EHRF -HC	4–5 Months	Low
11	toolkits	NGOs - JSPS	6 Months	Low
12	Firefighter training.	EHRF	6 Months - Year	Medium –Low
13	Data Digitizing	CULTUNA- EHRF	4–6 Months	Medium
14	Remove Garbage	District	Month	Low
15	Move the trees away	M. Afforestation	2 Months	Low
16	Reinforced glass fences technician	Foustat-Center	5 Days	Low
17	Train specialists	EHRF -MOTA	3 Months	Medium -High

Tab. 4 Stakeholders Influence & Interest
Source by Author

Stakeholder	Interest	Influence
Ministry of Culture	Very-High	High
Ministry of Antiquates	High	V. High
Ministry of Endowments	Low	Low
Historic Cairo	V. High	Very-High
Civil defiance	High	Low
Police	High	Medium
National Authority of Remote sensing	High	Low
NRIAG	High	Low
Aga Khan Foundation	High	High
Firefighting center	High	Low
Heritage specialty	V. High	V. High
National Organization for Urban Harmony	High	High
EHRF	V. High	V. High
American Research Center	High	High
USAID	High	Medium
Public Community	Medium	High
Red Crescent	High	Low

7. CONCLUSION

Cultural heritage is an important source because of the residual identity of the past and the significance it holds for the future. It could also serve as a sustainable and direct economic and social resources. In order to implement an appropriate platform, coordination among various central government sectors at both levels of planning and implementation is essential, including ministries providing services to improve resilience, hence the management of emergencies following natural hazards is very complicated. This enables reducing risks by having a thorough analysis and to create a functioning risk mitigation plan.

By learning from other experiences, it may help reduce the impact of hazards if we are not sure how to prevent it. Because disasters occur from human negligence and not as a result of natural hazards, giving opportunities to communities to participate in the various activities under multiple plans will open the way for professionals to learn and share their knowledge with those that could benefit from their experiences. Experience is a key component for optimizing different scenarios for applying the ideal mitigation plan.

ACKNOWLEDGEMENT

The knowledge exchange program of the ITC contributed to improving my vision of the methods of consulting and leadership and facing the development of heritage sites and the preservation of the conditions of the urban fabric. The Japanese expertise in traditional heritage preservation was new for me to learn, as well as knowing about new techniques to use traditional knowledge in Japanese society and sharing that with the local communities to preserve heritage was amazing. It can create multiple solutions to foreseen issues that were pursued for years without results, which could give fruitful results in the future for my site as well.

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2.13 Beiteddine Palace, Chouf - Lebanon – Conflict Based Disaster Scenario and a Proposed DRM Plan

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Fig. 1 Beiteddine Palace
Source: by the author

1. Introduction

This article presents a disaster risk management (DRM) plan for the Beiteddine Palace located in the Chouf area of Lebanon. This DRM plan was developed as part of the 16th International Training Course on Disaster Risk Management for Cultural Heritage, Ritsumeikan University, and concluded in October 2022.
Beiteddine Palace (Fig. 1) is listed as a Historic monument under the authority of the General Directorate of Antiquities at the ministry of culture in Lebanon. The complex is unique in its architecture which mixes European with Arabic styles, is lavish in details, and hosts three museums of antiquities and mosaics. Beiteddine Palace lies on the ancient Roman Road and amid a network of ancient fortifications in the area. Beiteddine Palace is also the presidential summer residence, where a part of it is renewed to host the president of the republic in summer. However, this was disrupted during the civil war that took place between 1974 till 1989. The palace witnessed many political and military events, specifically the historical rivalry between the Druz and the Christians in 1840 and the Israeli invasion in 1982. Beiteddine Palace symbolizes the political appropriation of historic monuments and changing narratives. The palace is now popular with visitors and scholars, and it holds public art festivals during the summer season.

- Brief background

Beiteddine Palace (Fig. 1) was built for thirty years, between 1788 and 1818, as the palace for the ottoman assigned ruler of mount Lebanon, Emir Bashir II. The newly appointed Emir moved the capital from Dei El Qamar, which was founded earlier by Emir Fakhredine II, to Beiteddine on the opposite hill, in fear of rebellion. The new Palace in Beiteddine was built over a hill overlooking Deir el Qamar, and above the ancient Roman road that connected the Lebanese coast with the Beqaa. The name Beiteddine translates as House of Faith because the palace was built over an old Druze hermitage (Khalwa). It is important to note that Emir Bashir II was the first Christian Maronite leader to rule mount Lebanon for half a century.
After the reign of Emir Bashir II, the ottomans used the palace for administration, and so did the French during their mandate and they declared it a historic monument. In 1943, Lebanon's first post-independence president declared the palace to be a presidential summer palace.
Beiteddine palace has renovated furniture, wooden decorated walls and ceilings, paintings, documents and books, guns and swords, textiles and cloths, in addition to a collection of Roman Glass and Byzantine mosaics. These items are exhibited in museums and the palace halls.
The Palace is situated in the Chouf mountains about 30 minutes' drive from Beirut city. The Palace sits on a hill overlooking the Roman road in the valley that connected the Lebanese coast with the inland. In the vicinity of the palace, Emir Bashir built other palaces for his sons, the closest is the Emir Yousuf palace, which

is currently used by the police as office.

During President Charles Helou's mandate, 1964–1970, Beiteddine palace underwent restoration with attention to its historical and cultural value. These efforts were hindered from 1974, the start of the civil war. In the eighties, there were some efforts to revive the palace, and again in the nineties when it was retrieved by the DGA (General Directorate of Antiquities). Yet Lebanon moving from one disaster to another, and with an unprecedented economic crisis, cultural sector is falling victim and being compromised as a priority. This is clear when we study the vulnerabilities of the Palace, where the basic infrastructure is not available.

2. Values and Heritage Value of Beiteddine Palace

Beiteddine Palace was the center of Emir Bashir's reign. It was built on a strategic hill and designed by an Italian architect. The Midan (outer most part of the Palace) plan has similarities with the blue mosque in Istanbul. The stone finishing and details are mixed between Arabic and Italian styles. It was constructed by local masons and craftsmen who used their best skills for the best outcome (Fig. 2).

The Palace still maintains its lavish wooden covered walls and ceilings, some of the furniture is remade. It houses its original collection of paintings, textiles, cloths, guns, books and utensils. A collection of Roman glass ware was added to the Ethnographic Museum, and mosaics discovered in Jiyyeh in the 1980 are housed in a museum inside the palace.

The Beiteddine Palace is a living monument of a historical episode that laid the foundation of present-day Lebanon. The Palace holds an important story, an essential part of the history of the conflict of Mount Lebanon. This value and importance of this story lead to, more than once, the political appropriation of the Beiteddine palace and efforts to shade its narrative. Today, the Palace is popular and frequently visited for its aesthetic architectural values, and for the objects it hosts. In addition, it is popular for the international art festival it hosts during the month of July.

Finally, the Beiteddine Palace, located in the village of Beiteddine, with the services and functions it presents, and its location within the village and ease of accessibility, has the capacity to reconnect with the social fabric of the area and play its role as an amalgam between different parts of the society. Heritage as education, entertainment, and responsibility is cross-conflictual and it can be the corner stone for reconciliation.

Fig. 2 Examples of the heritage attribute of Beiteddine Palace
Source: by the author

3. Risk Analysis of Beiteddine Palace

Risk analysis identifies the interrelation between primary and secondary hazards, and how they may interact with the vulnerabilities of the cultural heritage exposing it to further various hazards.[1)] The vulnerabilities may be physical, social, economic, political and attitudinal. For the case of Beiteddine Palace, the risk analysis starts with identifying the hazards and the threats, then it moves to identify the vulnerabilities of the Palace. All of these lead to the cause / effect relationship and impacts on the values of the Palace.[2)]

The hazards and threats at Beiteddine Palace are divided between slow and catastrophic. The slow threats

and hazards would be: Lack of maintenance, neglect, lack of awareness, and lack of adequate regulations to protect the palace and its heritage attributes. Lately we would add the pandemic to the slow threats especially after the Covid 19 experience which directly affected heritage sites and posed itself as a serious threat. On the other hand, the catastrophic hazards and threats at Beiteddine palace would be: Earthquake, (especially that the latest earthquake hit the area in 1954), wild fires (The palace is surrounded by a forest of old trees), then hazards related to conflict and historical rivalry such as looting, vandalism, and terrorism.

Keeping in mind that the palace is around 200 years old, and suffered vandalism and looting acts and more than one earthquake, it did receive restoration and preservation, but it still lacks basic measures to guarantee its safeguarding. Below are the Vulnerabilities that jeopardize the Beiteddine Palace in Case of slow or catastrophic hazards / threats.

- The **physical vulnerabilities** are sometimes obvious to the naked eye: water leakage inside the Ethnographic Museum and in many parts of the palace and the storages, lack of security alarms and surveillance systems, lack of electricity and internet, and the lack of firefighting system to protect the complex in case of fire.
- The **social vulnerabilities** are represented mainly in the lack of relation between the surrounding community with the palace, and this is mainly due to the political history of the palace and the political appropriation it has witnessed, which has created a conflict of the identity of the Beiteddine Palace between the Druz and the Christians of mount Lebanon, and fueled the rivalry. In addition, being the presidential summer palace in summer, Beiteddine Palace has heavy security around and inside the palace, this adds yet another layer of separation between the palace and the surrounding community. These social vulnerabilities are leading to more vulnerabilities such as lack of interest of NGOs to participate in the Palace activities or work at the palace for promoting cultural heritage, avoiding any political / religious stigma. In addition to all the above, the young generation is not interested in cultural heritage in general.
- The **economic vulnerabilities** play a major role in exposing the Palace in case of slow or catastrophic hazards /threats. Lebanon is facing an unprecedented economic contraction where the Lebanese Lira has lost around thirty times its value, and in the absence of tight security, this puts cultural objects in the danger of organized crimes of theft and looting. Also, under the economic pressure, protecting cultural heritage falls to the bottom of the priorities list. The surrounding community loses the chance of benefiting of the Palace to improve their livelihood. Add to that the lack of sustainable economic plans that gives cultural heritage its position as an economic leverage to the community. And many jobs that depend on the palace as a touristic attraction are lost, or being filled according to political preference instead of merits.
- The **institutional vulnerabilities** are increasing among the current situation where governmental institutions are lacking their main capacities. The DGA (General Directorate of Antiquities) at the ministry of Culture are the guardian of the cultural heritage and antiquities in Lebanon, and currently they have lost big number of their skilled experts who left the country in search of better working conditions abroad. The DGA is striving with minimum number of staff and almost minimum funds which is jeopardizing completion of their work. In addition to that, it is important to note that in Lebanon, due to the political regimes since the civil war, institutional positions and jobs are politicized and are not merit based. It is common to find incompetent staff with responsibility, in cultural sector and other sectors as well. This further hinders the capacity of the institutions and limits their work. Also, within the institutional vulnerability is that Universities and schools in Lebanon do not include Cultural Heritage into their curriculum, which is producing a knowledge disconnected to its geography, history and cultural identity, and this is widening the gap between communities in Lebanon in-

stead of presenting a common ground.

- The **attitudinal vulnerabilities** form a thick cushion against protecting cultural heritage. One of the main vulnerabilities in this category is the general attitude that hazards and threats are natural and unstoppable, the disbelief that people are totally helpless in front of emergency situations. Therefore, vulnerabilities are not taken seriously from the community, who believes that: "what will be, will be". Also, due to lack of awareness, visitors to the palace are satisfied with the scenery and are not interested in the stories behind the tangible heritage and its cultural value. The responsible institutions at the Palace do not put extra effort to promote the heritage attributes of the palace to the public, nor they take any effort pushing with policy makers to enact legal measures to protect cultural heritage.

4. Worst Case Scenario for Beiteddine Palace

The worst-case scenario for the Beiteddine Palace is a conflict-based scenario. It reflects the political rivalry that is still burning and leading to further conflicts and disasters. (Fig. 3)

During the month of July of 2022, during the Beiteddine art festivals, which are held in the main piazza (Midan) of the Beiteddine palace, the Lebanese Diva "Fairuz" holds a concert for the first time for 15 years. This concert is very popular among Lebanese people, and it is expected to have a wide group of politicians and diplomats in the front seats. Beiteddine Palace has a number of authorities: The DGA (the General Directorate of antiquities), The Lebanese Armed Forces LAF, The Internal Security Forces, Embassies Security Forces, and the presidential Guard.

It is important to note that the archeological storage and the museum of Ethnography, and the exhibition of the paintings and the old books are next to the main piazza, at the right of the Midan.

During the concert, a young lady approaches a diplomat in the front seat and shoots him. This creates chaos with shooting back and forth from the back seats towards the front. The museum and storages' glass are broken and looting maybe be possible at this situation. As a result to this situation, chaos overwhelms and the audience is at risk, there is a threat of loss of lives. The exhibition on Ground floor which hosts the paintings and the books is exposed, the storages on Ground Floor are exposed, the Ethnography Museum on first floor is exposed. The exchange of fire poses a risk of fire as a secondary hazard.

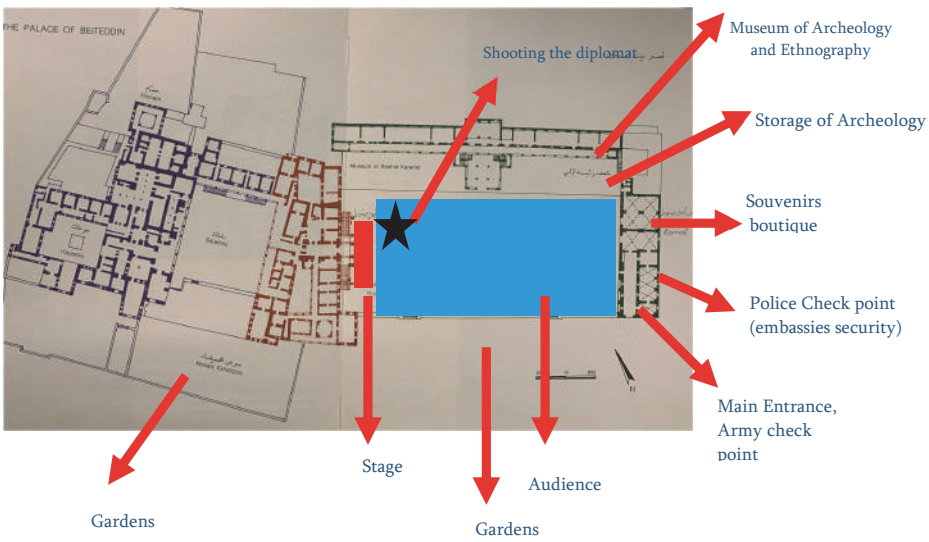

Fig. 3 The worst case scenario at Beiteddine Palace
Source: by the author

5. Stakeholders Analysis for Beiteddine Palace[3)]

The stakeholder's analysis enables awareness of the respective interests and interrelationships enabling a better understanding of the respective interests and power relations between all stakeholders and actors. (Fig. 4)

A Comprehensive mapping and stakeholder analysis for Beiteddine Palace uncovers the interrelations and players of different interests. It leads to three groups of stakeholders:

1- **The Government authority** *(ministry of culture, DGA, members of Parliament -Policy Makers, LAF, Interpol and police department, in addition to the Ministry of education, ministry of Tourism, Municipality, the civil defense and the Red Cross)*,
2- **The Civil Society and the local community** (Local Community, Religious community, Order of engineers, Private schools and Universities, Businesses and entrepreneurial sector, Local heritage and arts professionals, private Cultural institutions, and NGOs),
3- **The international Assistance for Cultural Heritage First Aid** (International Cultural Entities, International first aiders for Culture, embassies and INGOs).

The level of influence of each of these players is assessed, as well as the relations between each other.

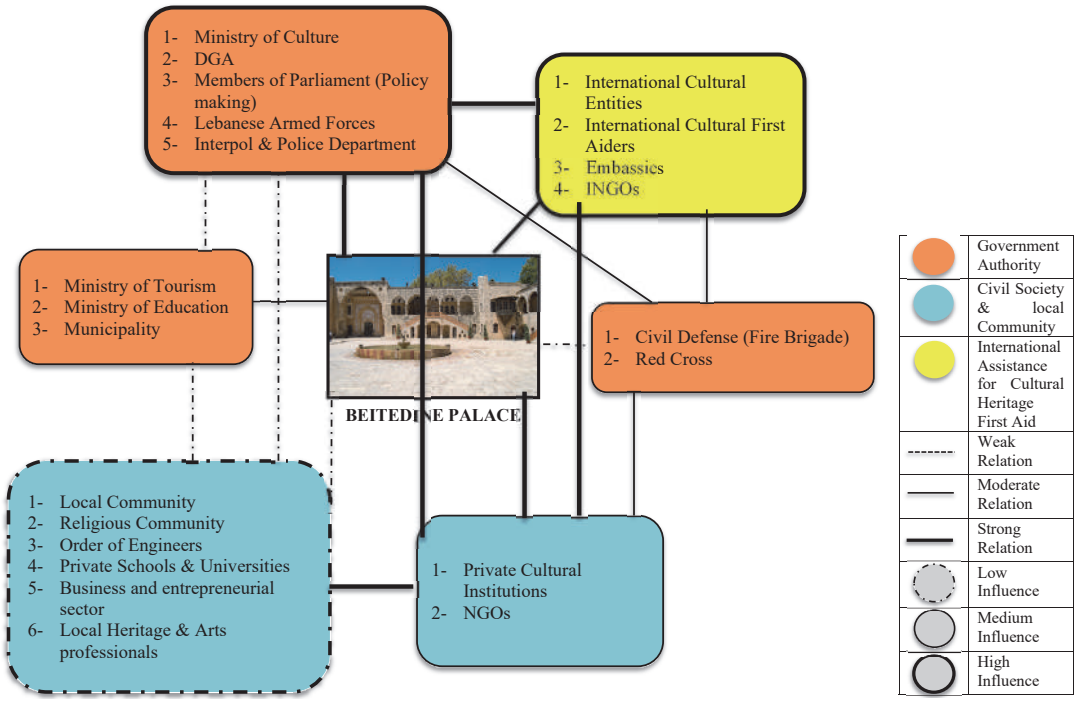

Fig. 4 Stakeholder analysis at Beiteddine Palace
Source: by the author

6. Mitigation Measures that might Reduce the Effect of the Hazard

Disaster risks can be prevented or mitigated by preventing hazards, mitigating the impact of hazards, reducing the vulnerability of the property and its environs, and training the staff in self-protection strategies. The mitigation efforts aim at reducing loss of lives and reducing the impact of disaster on cultural heri-

tage, and taking action in the time frame before the disaster reduces post-event damage to lives and property.[4)]

Mitigation measures can be introduced as interventions to reduce the negative impacts on the monument and its surrounding and save the people and their lively hoods when possible.

The Mitigation measures proposed at Beiteddine palace are divided into five categories: Strategic Measures, Management and Monitoring Measures, Technical Measures (non-structural), Awareness and Education Measures, Policies and Frameworks measures.

The mitigation measures can be on a strategic level where the state or the province are the main actors. They can also be management and monitoring measures where the municipality or the direct institution are main actors. Mitigation measures can be technical, such as fixing door locks of the museum and storages or strengthen the walls and ceilings against water leakage etc. Yet what is most important and severely needed is the awareness and education mitigation measure that can help resolve the historic rivalry and diffuse the conflict between parties and appreciate the heritage attributes for reconciliation and as economic leverage.

It is important to note that during the failure of government Lebanon is facing and the unprecedented economic crisis, the institutions are facing huge challenges by losing their skilled employees, who are leaving the country. In addition to lack of funds and deterioration of security measures.[5)]

Last but not least are the policies and framework measures that are taken on a governmental level and reflect the state policy towards protecting heritage and saving the story of the monument and the intangible heritage of the community.

- **Strategic Measures:**
  1. **Setting a comprehensive DRM plan for the palace.** This measure would be at the scale of the state, and it includes stakeholders such as the DGA (ministry of culture), the Palace management and staff, Red Cross, Civil defense, LAF (Lebanese armed forces), Municipality, Local community, police department, and other culture affiliated NGOs in the area. Setting a DRM plan for the complex should be completed within 3–6 months and has a medium estimated cost. It will mitigate effects of earthquake, Fire, Flood, Terrorism, Vandalism and Theft.
- **Management & Monitoring Measure:**

  This measure is at the scale of the Ministry of Culture and DGA, and it can include in addition to the DGA some NGOs culture affiliated and an international assistance for expertise and funding when necessary. It would take a month to two months per storage, and has a medium cost. This measure will reduce effect of theft and Vandalism, and help for first aid in times of emergency.

  These measures include the following:
  1. **Update and digitise the Inventory of the storages:** some of the archeological storages in Lebanon has no complete inventory, and the available inventories are not updated.
  2. **Prioritize Objects:** In times of emergency, it is essential to have a list of priority object for evacuation and salvage actions to be completed by the first aiders.
- **Technical Measures:**

  This measure is at the level of the ministry of culture and the DGA, and it can include other stakeholders such as specialized NGOs and international INGOs in addition to the LAF. The technical measures proposed can take from 15 days to 3 months to be completed and aim at strengthening the security and accessibility of the complex.
  1. **Strengthen all doors and windows:** check on the hinges and the locks of the doors to guarantee safety.
  2. **Stabilize all items on Display:** in the museum, some items can fall down in case of an earthquake and are in need of stabilizing.
  3. **Install Security alarms, Surveillance systems, and firefighting systems:** these measures help in reducing the impact of disasters, and can help hinder the disaster.

- **Awareness and Education Measures:**

Awareness plays a major role in mitigating impacts on cultural heritage, and it is on a wide scale in the community. It reduces the disconnection from heritage and prevents the loss of cultural heritage. The stakeholders are the DGA, ministry of tourism, ministry of education, municipality, NGOs and volunteers.

1. **Capacity Building:** training volunteers (university students and community members) on the values of cultural heritage and how to save it. Getting them involved in cultural activities that can be a leverage for the livelihoods.
2. **Promote Cultural Heritage:** using social media as a platform to promote the heritage attributes and communicate with the young community on heritage related activities…

- **Policies & Frameworks Measures:**

Policies and frameworks are taken at the state level. They are implemented by the ministry of culture and the DGA. They would target the loss of heritage, organized theft crimes of archeological objects, and demolition of built heritage. The time frame for this measure can take about 2 to 5 years and will have a high cost. The stakeholders are the parliament, the Cabinet, ministry of Culture, Cultural Heritage activists, Right holders, local community, heritage professionals and architects…

1. **Include Cultural Heritage in the schools and university curricula:** to avoid loss of heritage and create awareness at the young generation, and pave the way for a national reconciliation.
2. **Update Cultural heritage law:** the current law is 100 years old and has many gaps, it needs to be revised.
3. **Create a Built heritage Department within the Ministry of Culture:** Currently, the DGA is the responsible for archeology, monument and old cities. It is needed to create a Directorate for the old cities and the built heritage in order to set plans for mitigating disasters, and plans for preservation and adaptive reuse.

7. Emergency Preparedness Measures and Response Plan

Emergency disaster preparedness refers to measures taken to prepare for and reduce the effects of disasters. Yet these measures are related to the institutions hosting the cultural heritage, which are rather currently weak in Lebanon due to the continuous conflict and the degradation it caused during the past 45 years. The proposed emergency preparedness measures and Response plan for Beiteddine Palace includes a multidisciplinary First Aid Team for cultural Heritage that includes members from: 1-Independent Works Regiment (IWR) in the Lebanese Armed Forces (LAF), 2- civil defense (fire brigade), 3- Red Cross, 4- DGA staff, and 5- cultural institutions staff and trained volunteers. The table below shows the hierarchy by which the IWR receives order from the army commander directly and therefore saves a long line of bureaucracy, and it can be operational immediately after the disaster. And together with the multidisciplinary group they divide the tasks to evacuate the storage and museums and salvage any damaged objects. Note that the disaster management authority in Lebanon is currently disabled.

The Emergency Response Plan:

The scenario proposed in this case study is a conflict-based hazard, where a diplomat is assassinated during a cultural event in the palace. Unresolved conflicts leading to deteriorated state institutions directly jeopardizes cultural heritage, because it falls to the bottom of the priority list (Fig. 5).

It is essential at such times to create awareness among different sectors for first aid to cultural heritage, by training multidisciplinary team on evacuation and salvation of cultural property, and on recovery processes. Also, documentation is essential to keep records in case of losing the monuments or the objects. The ultimate value of the cultural heritage lies in the stories it holds and the people's relation to it, which is technically the intangible heritage, which is vital to protect and preserve. Cultural heritage should not be a victim of conflicts.

The First aid plan would follow these four steps (Short term recovery measures) (Fig. 6):

1- Evacuate the diplomats and the politicians through the secret path that already exists in the palace to the rear exit.
2- Evacuate all audience through the adjacent gardens and then to adjacent safe piazza distant from the incident location.
3- The multidisciplinary group (IWR, red cross, civil defense, archeologists, architects, etc..) divide roles and tasks.
4- evacuate and salvage objects for the storage and the museum and put objects in the nearby Curator House on the third floor, triage, wrap objects, inventory put in safe boxes and move to the national museum in Beirut under the surveillance of the IWR in the LAF.

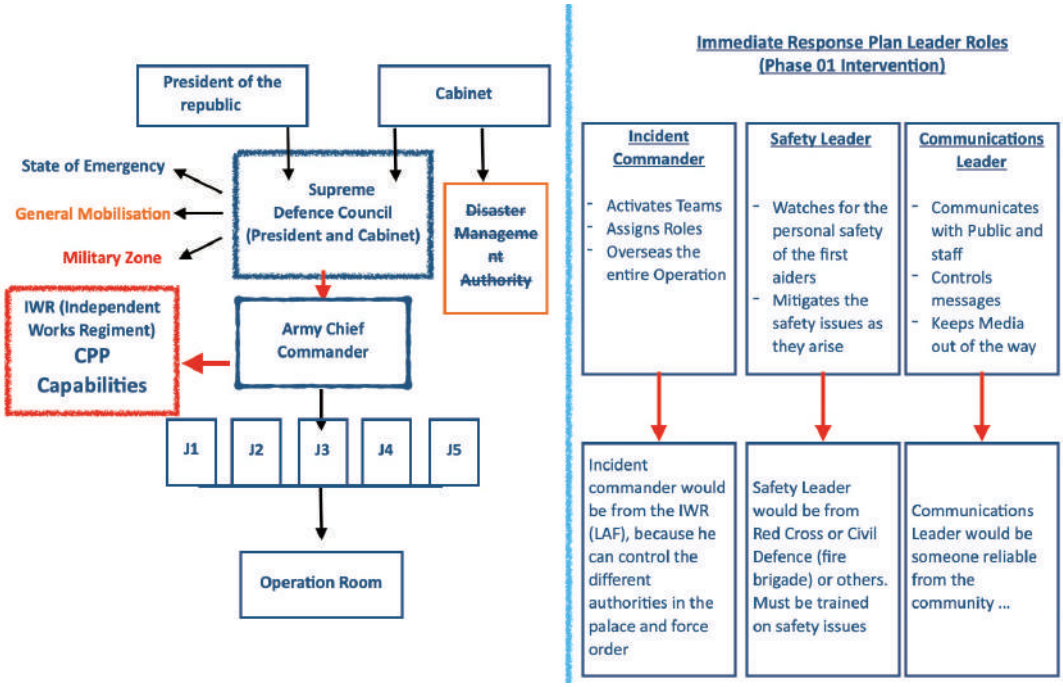

Fig. 5 Diagram of Chain command during an emergency in Lebanon, and Task division
Source: by the author

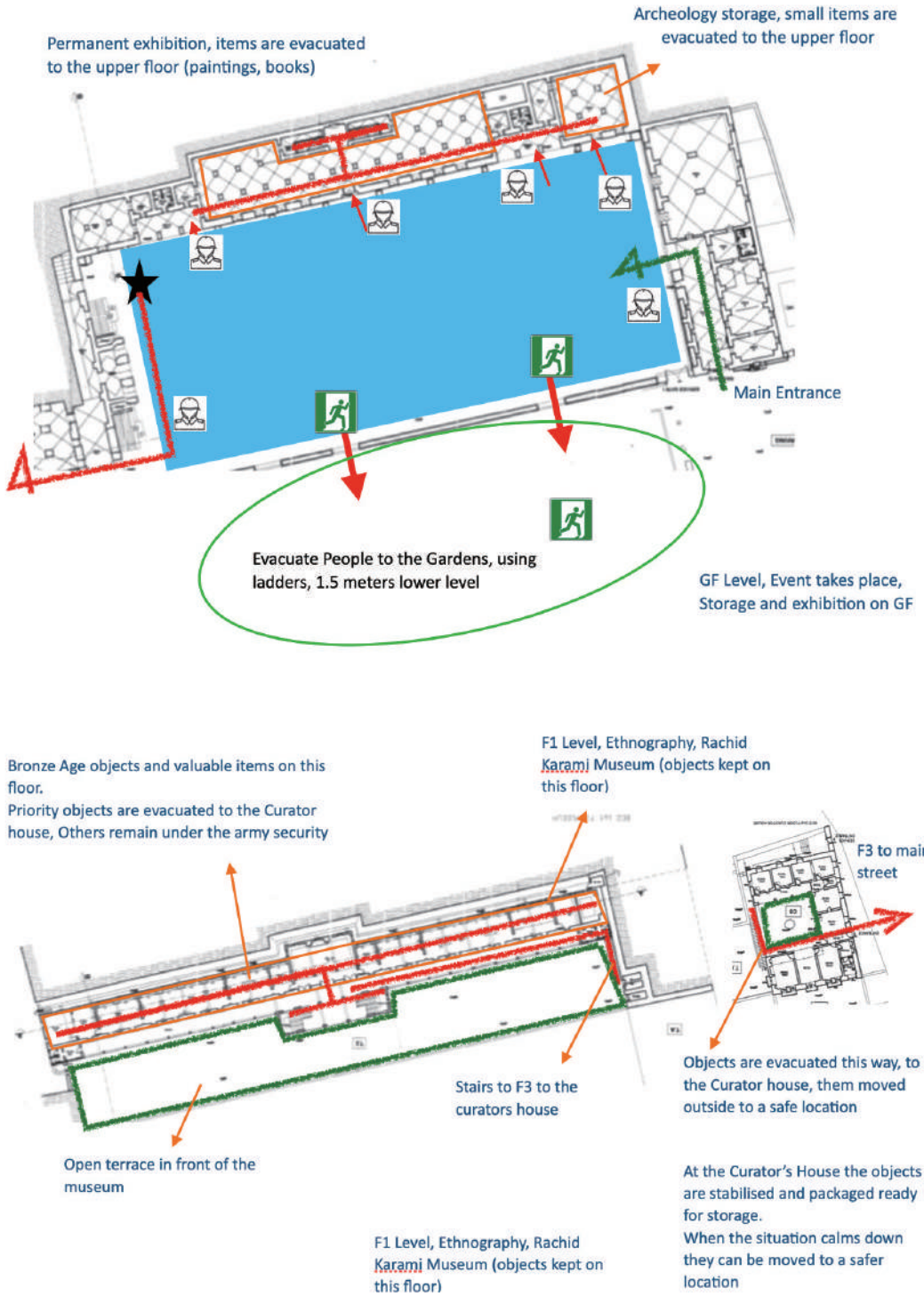

Fig. 6 Implementing the Emergency Plan at the Beiteddine Palace
Source: by the author

8. Recovery Plan for Beiteddine Palace

The recovery planning requires clear recovery framework in order to ensure that the disaster is managed effectively, to minimize the risks of further damage to the site or the monument during uncoordinated recovery actions. It is important to train the staff to implement the process of bringing back the site into normal operation.[6)]

Proposed short term measures and actions were conducted during the first aid plan.

Medium and long-term actions for planning for recovery include the following: 1) Conduct detailed damage assessments of the building and collections; 2) Monitor and review the risks; 3) Monitor and review information sources; 4) Periodically review the DRM Plan based on the effectiveness of the plan and in light of the experience of any emergencies; 5) Continuously develop and engage in staff training and capacity building for DRM and emergency situations; and 6) Continuously engage with stakeholders, community and volunteers.

9. Conclusion

Protecting and safeguarding cultural heritage is a complex process, yet formulating a DRM plan is a very good opportunity to study and assess the sites and their challenges. A DRM plan is an opportunity to identify and assess the threats / hazards associated with the disasters at a specific site. The DRM plan for Beiteddine Palace was formulated with attention to the conflict hazards as well as the climate related hazards, therefore it is hoped that it will be implemented to preserve the palace and the heritage attribute it hosts. In addition to the heritage attributes, preserving cultural heritage contributes to the sustainable economy of the Lebanese community in the future.

The implementing of a DRM plan at the Beiteddine Palace can be utilized as a model for other heritage sites and museums to follow for the development of DRM plans and the dissemination of the knowledge to preserve Cultural Heritage for the future.

Acknowledgment

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2.14 Disaster Risk Management Plan of Changu Narayan Temple

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1. Introducing Changu Narayan Temple

(1) Historical and Geographical Setting

The Changu Narayan Temple is one of the oldest temples in the history of Nepal with enormous historical, cultural, architectural, artistic and socio-religious value. It is located on a high hilltop in the Changunarayan Municipality of Bhaktapur District. It is said to have been built by King Hari Datta Verma in 325 A.D[1]. The oldest dated inscription (concerning King Mandev and his mother Queen Rajyavati) in the valley written in Sanskrit in the Gupta script is written as 383, and corresponds to 464 AD[2]. At the front of the temple, there is a beautiful statue of Garuda dating back to 5th century Lichhavi period. Similarly, the courtyard of this heritage has number of temples, sculptures and statues of gods with intricate carving in stones and woods accomplished between the 5th to 12th centuries, thereby making it the highest concentration of ancient art in Nepal. Changunarayan is a two-story pagoda-style temple dedicated to Lord Vishnu and was re-constructed in 1702 after the old one was gutted by fire. Hindus worship Lord Vishnu residing on the hill as Garuda Narayan while Buddhist identify Changu Narayan with Avalokitesvara, the Bodhisattva of Compassion.

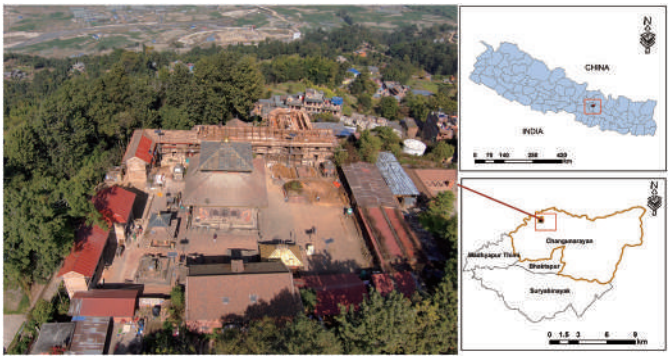

Fig. 1 Location Map of Changu Narayan Temple Complex
Source: Suraj Gautam

The temple is adorned by some of the best artistic sublimes of stone, wood, and metal-craft in the valley. The temple stands as the epitome of culture, religion, history and faith of the Kathmandu valley. The temple was listed as a UNESCO World Heritage Site in the year 1979. The Outstanding Universal Value (OUV) for the Changunarayan Temple is given by the three criterion:

Criterion (iii): The monument ensembles represent an exceptional testimony to the traditional civilization of the Kathmandu Valley. The cultural traditions of the multi ethnic people who settled in this remote Himalayan valley over the past two millennia, referred to as the Newars, is manifested in the unique urban society which boasts of one of the most highly developed craftsmanship of brick, stone, timber and bronze in the world. The coexistence and amalgamation of Hinduism and Buddhism with animist rituals and Tantrism is considered unique.

Criterion (iv): The property is comprised of exceptional architectural typologies, ensembles and urban fabric illustrating the highly developed culture of the Valley.

Criterion (vi): The property is tangibly associated with the unique coexistence and amalgamation of Hinduism and Buddhism with animist rituals and Tantrism. The symbolic and artistic values are manifested in the ornamentation of the buildings, the urban structure and often the surrounding natural environment, which are closely associated with legends, rituals and festivals.

2. Changu Narayan Values and Benefits

The Changunarayan temple complex consists of following elements as shown in Figure 2.

The pictorial representation of overall heritage elements and sculptures found in the Changu Narayan temple complex is represented by Figure 3 and Figure 4 respectively.

As per the information from the Ticket Counter, the maximum number of visits by the tourists is seen during the months of August to December, especially in the month of November, there are huge number of visitors. The major festivals during which the heritage is crowded is Char Narayan Mela, Haripurna Ekadashi, Salinadi Mela, Holi Purnima, Krishna Astami, Naag Panchami. Some of the major celebrations carried out in Changunarayan temple are summarized in Table 1:

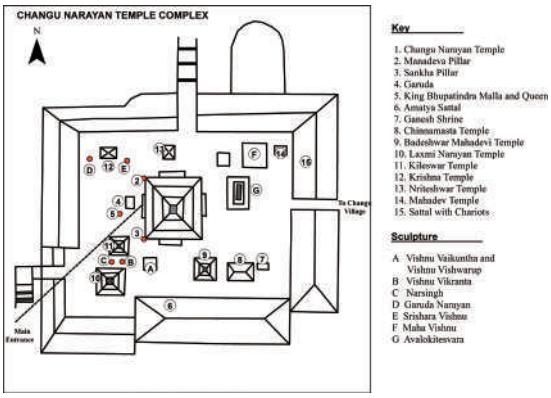

Fig. 2 Heritage Elements in Changu Narayan Temple Complex
Source: Digitized by Suraj Gautam

Fig. 3 Heritage Elements in Changu Narayan Temple Complex
Source: Photo Click by Suraj Gautam

Fig. 4 Sculptures in Changu Narayan Temple Complex
Source: Photo Click by Suraj Gautam

Tab. 1 Major Celebrations in Changu Narayan Temple
Source: Key Informant Interview with Priests of the Temple

Name	Month of Celebration
Narayan, Mahadeva and Chinnamasta Jatra	Baisakh (Apr/May)
Kalash Jatra	Shrawan (Jul/Aug)
Kusmanda Nawami	Kartik (Oct/Nov)
Haribodhani Ekadashi	Kartik (Oct/Nov)
Mahasnan	Mangshir (Nov/Dec)
Banshagopal Jatra	Falgun (Feb/Mar)

3. Stakeholder Analysis

There is a Changunarayan Development Committee and Guthi who looks after the maintenance of the heritage. The Chief Priest (Main Pujari) performs daily rituals within the temple; one in the morning as "Nitya Puja" and other in the evening as "Aarti". Besides priest, the Bhadel Community are considered to be the Caretakers of the temple. Only males from Bhadel community are allowed to enter inside the temple. They assist the Chief Priest and manage all the necessary items needed for Nitya Puja, Aarti and other rituals in the temple. The Bhadel community families interchange the place and take care of the temple according to their turns on a certain basis. Besides the Caretakers, there are two security forces assigned, one outside the heritage and one inside the temple area. Since Changunarayan falls under one of the UNESCO World Heritage Site, the Department of Archaeology (DoA) monitors and carries out surveillance over the heritage. There cannot be any activities conducted without the prior approval or permission from the DoA. The relevant officials from DoA visits the heritage area on a regular basis. The heritage area lies in the ward no 4 of Changunarayan Municipality.

4. Risk Analysis

For the identification of hazards in the Changunarayan Temple, the Local Disaster and Climate Resilience Plan (LDCRP) of the ward number 4 of Changunarayan municipality was explored. Further, the Risk Sensitive Land Use Plan (RSLUP)[3] of Changu Narayan Municipality was also studied. The LDCRP report identified the major hazards in the ward as Earthquake, Flood, Landslide, Soil Erosion, Drought, Hailstorm. There are cases of illegal sand and soil mining goes on unchecked in the western part of the Changu temple. Discussion with the priests, Changunarayan Development Committee, Guthi, representative from Bhadel Community was carried out to develop the Hazard Analysis matrix as shown in Figure 5.

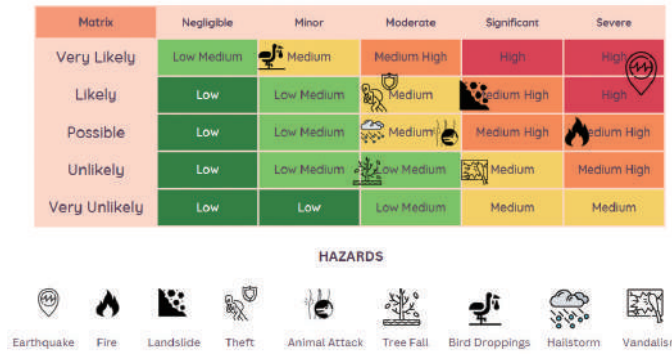

Fig. 5 Hazard Analysis Matrix
Source: Discussion with the Priest and CDC

Nepal is located at the boundary between Indian and Tibetan tectonic plates and therefore lies in a seismically active region[4]. Hence, Earthquake, is one of the constant threats to the Changunarayan temple. Over the seismic gap of 80 years, there are number of earthquake events recorded, the majority of the damages are found to be triggered by these earthquakes. Further, there has been a major case of fire of 1702, which destroyed the entire temple and it was rebuilt. Hence, the complex is also prone to the fire. The Changunarayan temple is located at the top hill and there are only staircase ways that leads to the complex. Thus, in case of any fire, fire trucks can't reach to the temple.

Besides, there are cases of Illegal mining of sand and soil from Manohara River resulting into the cases of soil erosion and landslides. With the earthquake and tremors around, such areas are prone to earthquake induced landslide. Similarly, during the chaos situation of earthquake, there are high chances of theft of statues. Further, the droppings of birds, feathers, vegetations are also some of the associated secondary hazards to the heritage site. The relation between hazards, vulnerabilities and risks can also be assessed through the arrow diagrams as shown in Figure 6 and Figure 7.

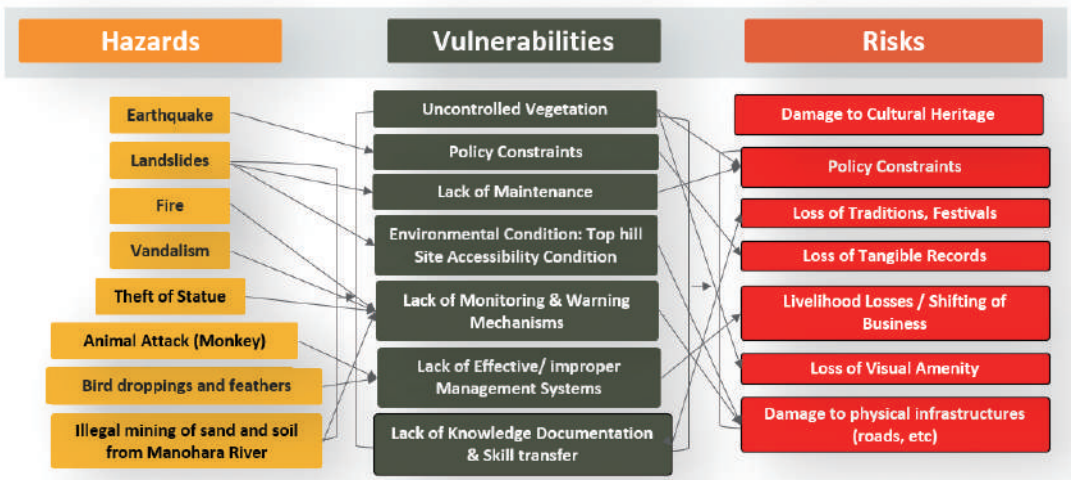

Fig. 6 Example of risk analysis for Changu Narayan temple, interconnecting hazards with vulnerabilities and risk/impacts.
Source: Suraj Gautam

Fig. 7 Dimension of Vulnerabilities
Source: Suraj Gautam

5. Worst Scenario

On the day of Saturday while people are celebrating a festival of Mahasnan, an earthquake similar to or greater than the magnitude and Intensity of Gorkha Earthquake (Saturday) shakes the Changu Narayan area in the month of November. The large number of people gathered in the temple to perform Pooja and also celebrate festival. The earthquake resulted in the cracking of the walls of the temple, breaking of struts, collapsing of the wooden roof a d damaging of the Sattals nearby. Among the three staircase-ways leading the way to the temple, one of the staircase on the North collapsed completely. The houses nearby Changunarayan temple complex also suffered complete collapse resulting in the blockage of the streets. Similarly, the main entrance gate on the East side is also completely blocked due to the debris accumulation. Due to the chaos of the earthquake and its tremor, the visitors threw away the oil lamps, candles and lightings nearby the worshipping area to escape and evacuate; which resulted in the triggering of the fire. Within 15 to 30 minutes, the oil-lamps and candles resulted into the spreading of fire in the Dhwoja and wooden components of the temples. Due to the only staircase accesses from three sides into the temple,

it was not possible to bring in firefighting trucks. The unavailability of fire extinguishers and fire hydrants made the situation much worse. The areas near the foothills were fragile due to the illegal mining of sand and soil. The earthquake triggered failures on the surrounding slopes of the temple thereby resulting in the cracks activating at the foothills. The situation became much worse and thus the priority of lives mattered the most over the heritage elements. As a result, there were no units securing the heritage elements. To make the situation much worse, few people started stealing some of the movable heritage elements as shown in Figure 8. The socio-economic aspect in the community is also affected. On an average, around 60 tourists used to visit the temple on a daily basis. Further, the locals around the heritage are also dependent on economic activities such as selling thangka, paintings, masks, dolls and pashmina clothes, handicraft. The earthquake resulted in the collapse of the local economy with the reduced or minimal number of visitors visiting the temple and severe decrease in touristic flow. In addition to it, the greatest threat to OUV and attributes of OUV in the Changu Narayan Monument Zone is the loss of traditional housing in its ancient settlement.

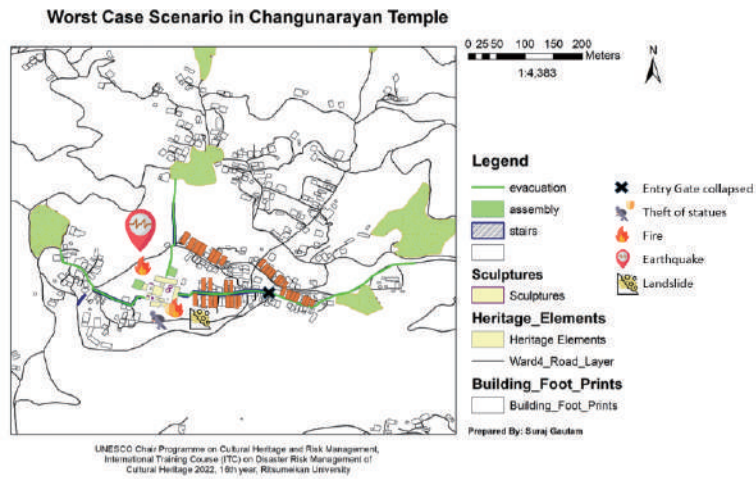

Fig. 8 Worst Case Scenario in Changunarayan
Source: Digitized by Suraj Gautam

6. Disaster risk Management Measures

i) Disaster Mitigation Measures:

Tab. 2 Disaster Mitigation Measures identified for the heritage complex
Source: Suraj Gautam

Description of various Options	Scale of Intervention	Hazards or vulnerabilities reduced	Stakeholders	Duration of implementation	Cost
Mainstreaming provisions of DRM in heritage buildings	Regional	Identified hazards, connect institutions	Policy Makers, Government, Guthi	Long	Medium
Installation of Fire Management Systems & Simulation	Site Level	site for fire extinguishers, detections, alarm	CDC, Guthi, APF, Fire Department	Short to Medium	Medium
SOP with clear roles of stakeholders on DRM of cultural heritage	National, Provincial, Site Level	Any Hazards	Guthi, DOA Stakeholders	Short to Medium	Low
Completion of Re-construction of all the elements as early as possible	Temple / Site Level	Accidents, Earthquake	DoA, CDC, Guthi, Contractors	Short	High
Slope stabilization through hybrid solutions including NbS	Temple / Site Level	Accidental Hazards, Soil Erosion, Landslides	DOA, CDC, Guthi, Contractors	Short	High

ii) Emergency preparedness & Response Strategy

Tab. 3 Disaster Mitigation Measures identified for the heritage complex
Source: Suraj Gautam

SN	Activities	Stakeholders
1	Inventory Management, Physical Assessment and Identification of the status of heritage elements and sculptures and its immediate surrounding structure	Priests, CDC, Guthi, DoA
2	Developing an Emergency Response chain of command and establish coordination mechanism with the stakeholders	Priests, CDC, DoA Guthi, LG, fire brigade, DoA
3	Assign, orient and train the APF security force for SAR and assign focal points of Guthi & CDC to take the support immediate handling of evacuation site, temporary structures like Shoring for stabilizing, CGI Sheets, tarpaulin plastics, tent and materials for the storage of heritage elements.	Priest, CDC, Guthi, DoA, Municipality
4	Prepare and develop Rapid Damage and Risk Assessment forms for the Changunarayan Heritage	CDC, Guthi, DoA, Municipality
5	List of emergency supplies, equipment, First Aid list of multidisciplinary professionals for situational awareness, condition assessment of the heritage elements.	CDC, Guthi, Municipality
6	Liaise, coordinate and plan safety assessments to identify the priorities for securing and stabilizing heritage elements like temple struts, building blocks, sculptures,	DOA, Guthi, CDC

iii) Recovery Strategy

Tab. 4 Recovery Strategies identified for the heritage complex
Source: Suraj Gautam

SN	Measures	Stakeholders
1	Site Clearance, Shoring and Support for the continuation of worshipping at the premises	Priest, CDC Bhadel Community
2	Detail Damage Assessment (DDA), Investigation of the heritage Elements and Sit-Report Report	Municipality Engineers, Fire Experts, DoA, Locals, NDRRMA
3	Storing, Cataloguing and Marking of the heritage elements / Providing stickers	Municipality Engineers, DoA, Bhadel Community
4	Look for Matching/ Recovery Funds or Grants	DoA, NDRRMA, Municipality
5	Cleaning, Community Consultation, Documenting and finalization of reconstruction plan	DoA, NDRRMA, Municipal Engineers, Skilled Manpower
6	Facilitating the provisions for the reconstruction through tendering, procurement of Nepali timber of required size	Municipality, DoA
7	Repairing of metal, stone and wood Carvings, carvings and rebuilding the structures	CDC, Bhadel Community Volunteers
8	Making the availability of skilled craftsman, technical experts from the available roster for supervision	CDC, DoA, Municipality

7. Conclusion and Outlook

This paper highlighted the necessity of DRM plan at the Changunarayan temple complex to anticipate and reduce the effect of future hazards. The complex recently suffered from the Gorkha Earthquake 2015 and has undergone reconstruction. For the sustainability and implementation of DRM plan, following components are to be considered:

i. Institutional Coordination: Among the local stakeholders like Guthi, CDC, municipality, DoA, for the implementation of DRM plan in all the cycles (preparedness to recovery).
ii. Monitoring & Installation of Fire Management System: As the complex is in the top hill and fire engine might be difficult to reach to the top due to staircase ways, proper fire monitoring system should be kept in place. Further, the rainfall monitoring, illegal mining, CCTV surveillance should be strengthened.
iii. The DRM plan needs to be implemented and updated on a regular basis for the sustainable management.
iv. Documentation of the indigenous technologies and reconstruction practices should be made.

7.1 Pilot Project, ALERT CHANGU (Adoption of Local/Indigenous practices for Emergency Preparedness, Response and Recovery through Technologies in Changu Narayan Temple Complex). Under this project,

few short-term activities are planned which includes:

Risk Mitigation / Preparedness: Digitization of the inventories through Frontier technologies like UAV in the generation of high-resolution images. Exploration of Assembly points and Open spaces for the evacuation. Preparing Map Books for the Heritage Complex.

Emergency Response: Identification of the Emergency Response Team (ERT) together with APF, preparation of the questionnaires for the Physical Assessment of each element of the heritage, conducting response drills relevant to the worst-case scenario.

Recovery: Sharing of reconstruction practices from Gorkha Earthquake, documentation of the skills on the development of Sattals and other heritage elements through videos

Acknowledgements

Firstly, I'd like to thank the organizers for providing me such a wonderful opportunity to join this International Training Course (ITC) on Disaster Risk Management of Cultural Heritage 2022 Ritsumeikan University (R-DMUCH) in collaboration with ICCROM. I'd like to express my sincere appreciation to the Changu Narayan Development Committee, especially the main priest of the temple Chakra Dharananda Raj Upadhyaya, for his kindness in sharing with me valuable information, data, and insights. I also thank my family and my organization, Institute of Himalayan Risk Reduction for allowing me time to undergo the training with ease. In addition, I would like to thank the organizers, speakers and resource persons of the ICCROM and the UNESCO Chair Programme on Cultural Heritage and Risk Management ITC R-DMUCH team, especially to Ms. Elke Selter for guiding and mentoring me with the insights of Cultural Heritage.

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3 Appendix

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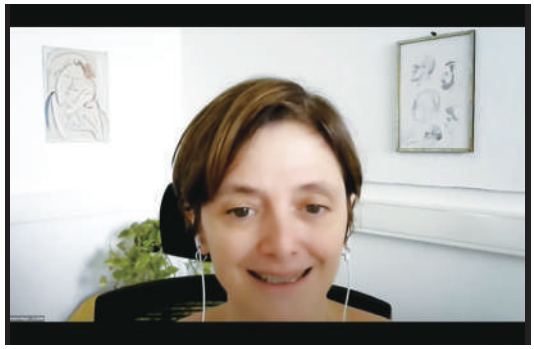
Photos of ITC 2022

Opening Remarks from Chancellor of Ritsumeikan University, Prof Yoshio Nakatani

Groupwork on Disaster Risk Reduction on Disaster Risk Production Considering Urban Challenges in Historic Urban Areas



Opening Remarks from Ms. Valerie Magar, ICCROM

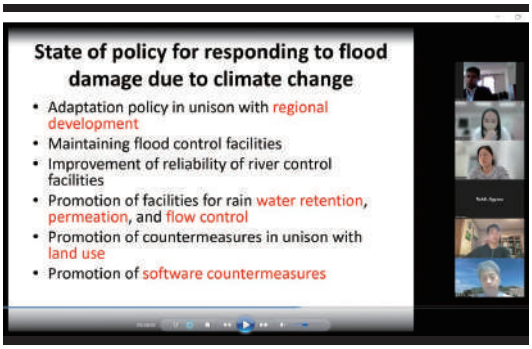
Workshop on Disaster Imagination Game (DIG)

Site Visit Video: Disaster Mitigation Preparedness (Fukuchiyama)

Lecture on Seismic Performance of Japanese Historical Structures

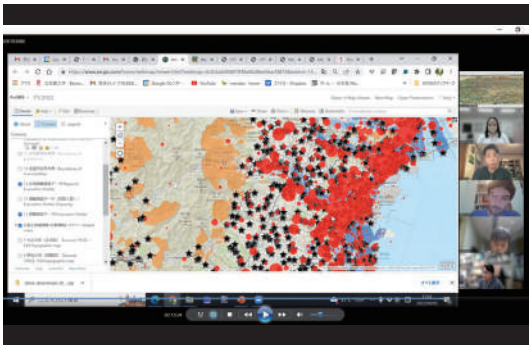
Site Visit Video: Disaster Mitigation Preparedness (Kozagawa)

Lecture on Landslide Assessment

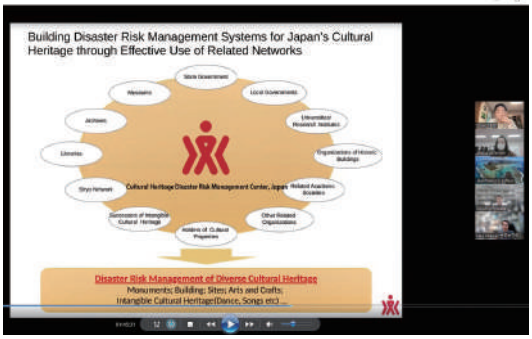


Lecture on Climate Change and Risk Prevention

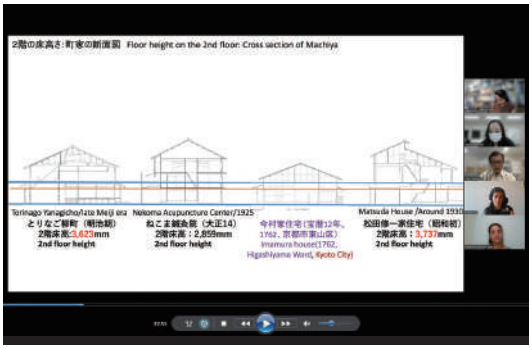
Lecture on Emergency Response Utilizing Traditional Knowledge by Community in Nepal



Lecture on GIS for Disaster Management of Historical Cities and Cultural Heritage



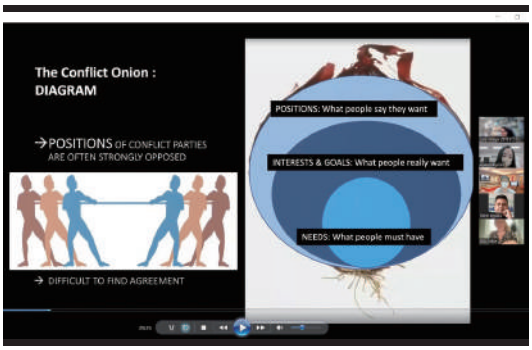
Lecture on Cultural Heritage Disaster Risk Management System and Response in the Event of a Disaster in Japan



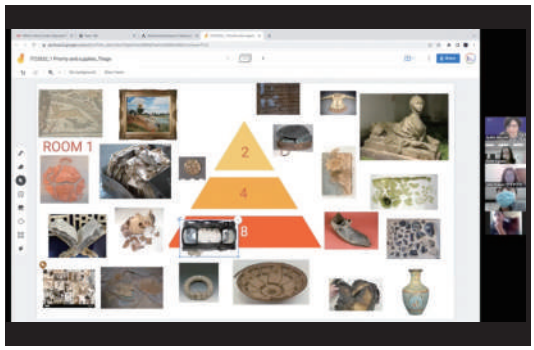
Lecture on Traditional Knowledge for Disaster Mitigation in Japanese Houses

Lecture on Formulation of Scenarios

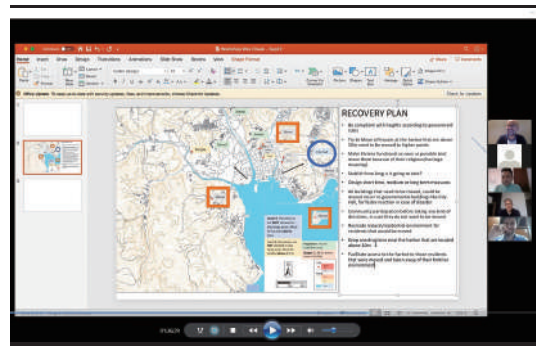
Lecture on Disaster Mitigation for Cultural Heritage by Kyoto City Fire Department



Lecture on Conflict Analysis for Cultural Heritage

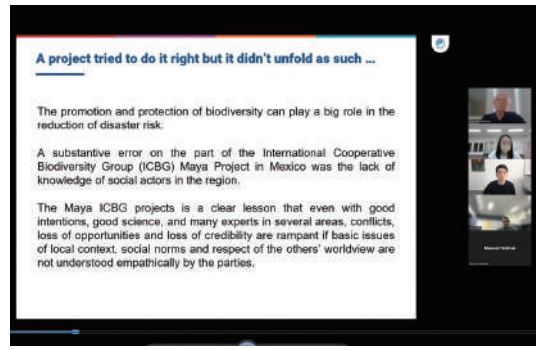


Workshop on scenario approach & Role Play

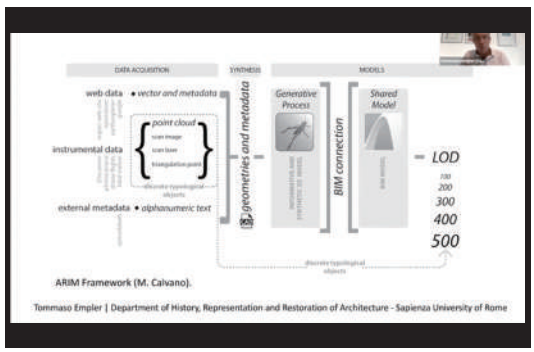


Lecture on Disaster Recovery through a Social Science Lens

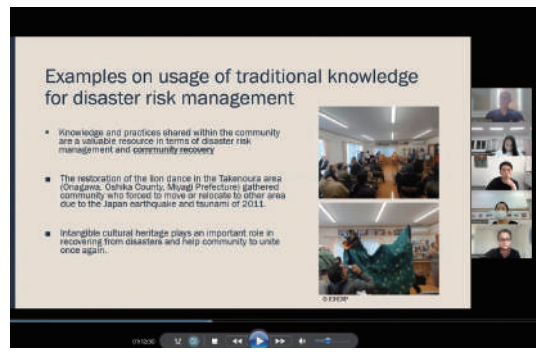
Lecture on Post Disaster Recovery Process in Tohoku



Panel Discussion on Traditional Knowledge for DRM of Cultural Heritage

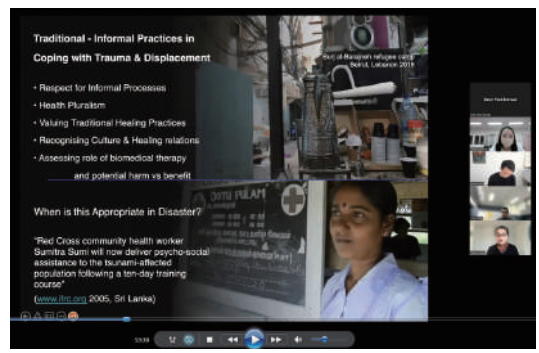


Lecture on Assessment Risk Management: BIM Procedures

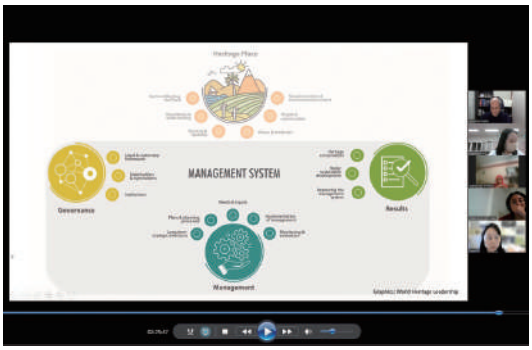


Panel Discussion on Traditional Knowledge for DRM of Cultural Heritage

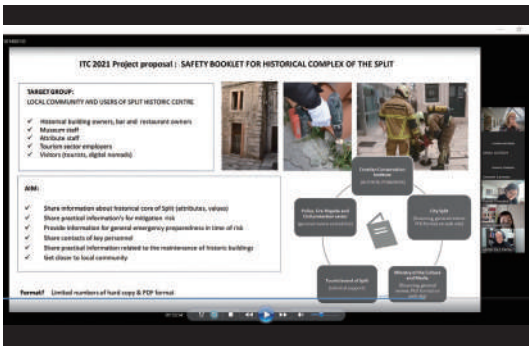
Lecture on DRM System in Kyoto National Museum



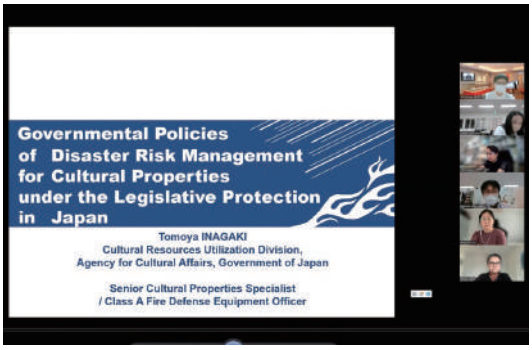
Panel Discussion on Traditional Knowledge for DRM of Cultural Heritage



Lecture on Management System and Management Planning for Heritage Sites

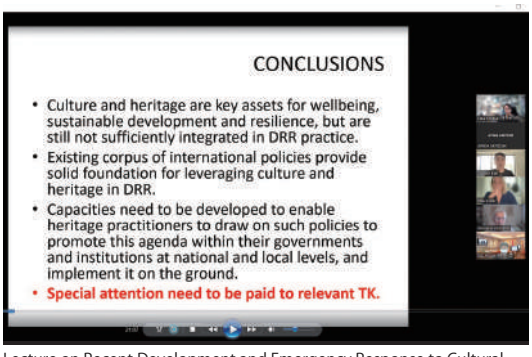


Discussion with Former Participants on Challenges for Making DRM Plans of Cultural Heritage

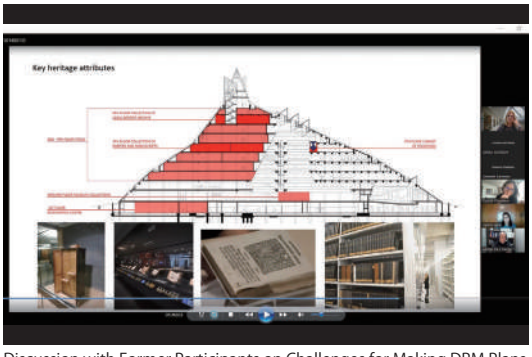


Lecture on Governmental Policies of Disaster Risk Management for Cultural Properties

Discussion with Former Participants on Challenges for Making DRM Plans of Cultural Heritage



Lecture on Recent Development and Emergency Response to Cultural Heritage in Crisis Situations



Discussion with Former Participants on Challenges for Making DRM Plans of Cultural Heritage

Discussion with Former Participants on Challenges for Making DRM Plans of Cultural Heritage

Final Day ! All the Participants and Resource Persons

Ichiburi district, Kozagawa-cho: a small village with traditional knowledge to reduce flood damage.

United Nations
Educational, Scientific and
Cultural Organization

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「文化遺産と危機管理」 京都・日本