Chapter 7

Cultural Heritage and Natural Disasters: Incentives for Risk Management and Mitigation

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Cultural heritage, encompassing the archaeological and historical built environment and movable heritage, is at risk from natural disasters, especially in low-income countries Fires, earthquakes, flooding, tsunami, land and mud slides, winds, and tropical storms are among the major causes of loss and damage. These disasters result in the loss of irreplaceable artistic and cultural assets and are costly. The harm to cultural heritage further increases in the absence of adequate risk estimation, evaluation, and minimization measures. Just as the loss of family photographs and treasured art objects is one of the most painful personal blows resulting from a natural disaster, so is the loss of significant cultural heritage landmarks a sore impoverishment for communities.

Major disasters—that is, high consequence/low probability events—occur with relentless disregard to cultural assets. Less serious events that might occur either over longer periods (sea level rise or climate change) and with greater frequency (periodic flooding, siltation, or desertification), than high probability/lower consequence situations, can also be highly damaging,

The last decades have witnessed a series of costly disasters that have struck cultural centers: the 1997 earthquake in Assisi, which destroyed priceless Giotto frescoes; the 1996 earthquakes in Yunnan Province in China, which reduced to rubble parts of the World Heritage city of Lijang, the fire in Madagascar, which destroyed the national archive; the 1997 floods in eastern Germany; and the 1998 Central American hurricanes.

The historic record relates many tales of natural disasters: floods, earthquakes, fires, and storms. Perhaps the most famous natural disaster of all time was the eruption of Mount Vesuvius and the destruction of Pompeii, Herculaneum, and other nearby towns. The mythical story of Atlantis symbolizes the loss of a whole civilization due to a powerful and mysterious natural occurrence.

Although there is a long tradition of devastating natural disasters that have destroyed irreplaceable cultural resources, awareness of the need to reduce risk is low, and memory is short of costs incurred because of lack of preparedness. In the developing world evidence points to a pattern of higher vulnerability to these natural disasters, a weak record of implementation of protective measures to control or limit damage, exacerbated negative impacts, and lengthy recovery time.

Why? Effective risk management of cultural assets is rare because of inadequate knowledge of the assets, failure to calculate the true cost of loss and damage, and the difficulty of putting a value on the nonmarket nature of many cultural heritage values. Arguments deployed in Venice by elected officials are typical: ". . . there is no point in spending $3 billion on a project now when the next really bad flood could be 167 years away." Moreover, like other types of environmental risk

management, the risks are highly location dependent, which seems to reduce the likelihood of concerted national or international efforts

The following comments will consider the types and degree of risk to cultural heritage; systems and tools for reducing and mitigating risk, principles of risk preparedness for cultural heritage; existing programs to avert risk; incentives to manage risks; and proposals for improving risk management for cultural heritage.

Venice: An Example

In the past in Venice devastating floods, like that of 1966, occurred once every 800 years. Scientific evidence now suggests that their frequency is likely to quadruple to once every 200 years. This increase is due to the influence of sea level rise, subsidence, and changing weather patterns After the 1966 flood a huge effort was undertaken, despite political squabbling and the familiar shortcomings of the Italian bureaucracy, to repair sea walls, churches, and palazzi, and the artistic heritage left to decay by years of negligence A consortium proposed a system of large mobile gates, Operation Moses, to defend Venice from high waters by shutting off the lagoon from the sea. One argument says that the floodgates would " provide Venice with the ultimate long-term insurance policy complementing other more conventional measures "

Yet decisionmakers remain uncertain about what steps to take. The current mayor of Venice has insisted that the issue of high water be kept in perspective: "The problem of acqua alta does not resolve the city's other problems," namely his administration's efforts to revive and modernize his decaying city while preserving its artistic legacy. As one journalist wrote, "While scientists continue to argue, a tide of other troubles risks swamping Venice, tourism for one. More than 10 million tourists visit Venice every year, including 7 million day trippers As their numbers rise relentlessly, the Venetians are continuing to desert their city" In the context of urban environmental problems, deciding on a plan to protect cultural heritage from natural disasters seems elusive

Types of Natural Hazards

The main types of natural hazard that affect cultural assets are fire, flooding, earthquakes and related disasters, tsunami, land and mud slides and avalanches, winds and tropical storms, and sea level rise. Examples of types of damage to historic buildings and their contents, historic districts, and archaeological sites and cultural landscapes follow.

Fire

Fire causes severe damage directly and indirectly to property and cultural heritage. The main types of damage that result from fire are

- Damage to buildings and their contents: full or partial destruction of objects and building elements by burning
- Damage from heat smoke and combustion byproducts to structures, interior finishes, and objects
- Water damage resulting from the effects of fire fighting
- Damage to historic districts: damage to structures and objects as above, destruction of municipal infrastructure systems
- Damage to archaeological sites and cultural landscapes· damage to structures and objects located within sites and landscapes as above, destruction of natural habitat, increased risk of secondary damage from floods and mud slides.

Flooding

Severe direct and indirect damage to property and cultural heritage can be caused by flooding. Floods are varied in form slow rising rivers, rapidly rising rivers, as in the 1997 floods in East Germany; and breakdown of river system controls or dams.

Damage may range from soiling basements and lower floors and their contents, and long-term increase in residual moisture to destruction of structures and buildings from the tremendous force of flood waters Forms of damage to buildings and their contents include

- Collapse or movement of a building due to force of water flow

- Soil erosion near buildings or foundation settlement
- Detachment of connected elements such as stairs
- Inundation of building services sited in basement areas
- Contamination of water with sewerage systems
- Damage to objects from water and humidity.

Damage to historic districts includes:

- Damage to constituent structures and objects
- Full or partial destruction of municipal services
- Loss or damage to municipal infrastructure

Damage to cultural landscapes and archaeological sites consists of loss or destruction of landscape elements and defining features, alteration of landscape functioning, and deposition of debris.

Earthquakes and Related Disasters

Earthquakes can cause damage both directly and indirectly to property and cultural heritage, resulting in various types of damage.

Damage to buildings and their contents consists of structural collapse and damage related to lateral forces transmitted to buildings. Historic districts, in addition to damage to component structures and objects, may also suffer damage to their infrastructure and transport systems. Archaeological sites and cultural landscapes may suffer the types of damage noted for individual monuments and buildings as well as damage to landscape features, increased risk of secondary damage from fire and flooding, and loss of habitat.

Tsunami

Tsunamis (tidal waves) are of high importance in coastal regions, particularly in the Pacific basin. Damages are similar to high force flooding.

Land and Mud Slides and Flows, and Avalanches

In mountainous or hilly regions, land and mud slides and avalanches are hazards of importance. They are often related to other hazards: mud slides occur during flooding, particularly in eroded areas. This winter's avalanches in the French, Swiss, and Italian Alps are a warning of the potential to destroy property and life.

Winds and Tropical Storms

Storms associated with high winds and precipitation are hazards typical of coastal areas in tropical and subtropical climates. These storms are devastating and indiscriminate in their paths. The recent storms in Honduras exemplify the impacts of these disasters on human settlements and their cultural assets.

Sea Level Rise and Coastal Change

Many coastal zones are located in geologically dynamic areas where sea levels and coastal profiles are changing, Historically, change in sea level has been an important cause of damage to cultural sites. Witness the underwater ruins off the Turkish coast. Today measuring sea level change has become more reliable, but short of elaborate systems of dikes or other sea barriers, little can be done to prevent the incursion of water onto land. Similarly, changes in river courses over time have had an impact on cultural sites. Sites that once were at river's edge now may be some kilometers from the river bed; or sites that were once some distance from rivers now may be inundated.

Elements of Disaster Planning and Mitigation

Although the specifics are different, disaster planning and mitigation will need to take into account many of the same sorts of factors. Three basic questions are critical:

- What can go wrong?
- What are the range and magnitude of the adverse impacts?
- How likely are the adverse impacts?

In summary form, information needed for the major types of natural disasters are as follows.

For flooding.

Historical record of past floods
Probability of flooding occurring

Probability of height and volume of flood waters
Sensitivity of cultural heritage to flooding

For tsunamis:
Probability of tsunamis occurring in the region
Probability of tsunamis height and run-up (zoning maps show areas that would be submerged at various run–up heights)
Sensitivity of cultural heritage to tsunami waves

For land and mud slides and avalanches:
Historical record of past landslides and avalanches
Assessment of slope stability
Extraneous factors (water saturation, construction works)
Mapping of cultural heritage sites

For tropical storms:
Probability assessment for the intensity and frequency of storms (velocity, duration, direction)
Topographic features that may protect or expose heritage features
Possible effects of other structural, vegetative, or landscape features
Adequacy of roofs and supporting structures to withstand wind forces

Analysis of Risk from Natural Disasters: Risk Profile

Risk analysis concerns three components: hazard, control mechanism, and receptor. The magnitude of hazard is related to the nature and quantity of materials and/or process that constitute the risk source, that is, water flows, wind strength, earthquake strength. Controls might be physical (dikes, dams, seismic reinforcement) or management based (procedures and training). Receptor (or target) can be a historic town, museum, archaeological site. Because much has been written on this subject, the present paper will not examine analysis at length.

The combination of the three factors will determine how significant a risk exists by considering what is the probability of the adverse event and what would be the consequences. Risks are site dependent.

Important contributory factors that affect outcomes for cultural heritage are: the type and volume of objects on site (ceramics, glass, paper); location of above ground or underground storage tanks and other infrastructure; leak detection mechanisms; maintenance arrangements, staff training and awareness; and presence of residents.

Evaluating Risk for Cultural Heritage

Two factors are at work in evaluating risk of damage to cultural heritage: the probability that events will cause or lead to degradation, and the severity of the degradation. Among the standard approaches for evaluation is a ranking matrix for severity and probability

Typically, severity will be evaluated on a scale of 1 to 5 in which 1 represents fatality, property damage, or business interruption over $50 million, 2 = severe injury involving hospitalization and evacuation of the public, property, or business interruption greater than $1m and less than $50 m.; 3 = property damage greater than $50,000 but less than $1 m; 4 = minor injury, contamination restricted to site, damage greater than $1,000 but less than $50,000; and 5 = minor injury, fire that is controlled by hand held fire extinguishers.

Probability is also judged on a scale of 1 to 5 in which 1 represents once per year – high ; 2 = once per 10 years – moderate; 3 = once per 100 years – medium, 4 = once per 1,000 years – low; and 5 = once per 1,000,000 years – very low.

Risk Mapping

Risk mapping, which provides a geographical component to risk evaluation, adds another set of information to enable better prediction. Such mapping is being tried in Italy, partially as a response to several decades of severe earthquakes. The U S. National Park Service has also instituted a system of risk mapping for cultural and natural resources under its control.

Principles of Risk Preparedness and Mitigation for Cultural Heritage

Cultural heritage management has benefited from advances in environmental planning and a change in orientation from the focus on individual monuments to heritage in its wider physical and social context. These lessons in turn help define a series of principles for heritage risk management in which advance planning stands as a determinant of effective protection. The nine principles can be defined as follows:

1. Disaster planning for a cultural heritage site should be conceived for the whole site including its buildings, structures and contents, and landscapes
2. This planning should integrate relevant heritage considerations within a site's overall disaster preparedness and mitigation strategy.
3. Preparedness requirements should be met in heritage sites by means that will have least negative impact on heritage values.
4. Documentation of heritage sites, their significant attributes and any history of disaster response is the basis for appropriate disaster planning.
5. Maintenance programs for historic sites should take into account a cultural heritage at risk perspective.
6. Property occupants and users should be directly involved in the development of emergency response plans
7. During emergencies, securing heritage features should be a high priority
8. Following a disaster, every effort should be made to ensure the retention and repair of structures or features that have suffered damage or loss.
9. Conservation principles should be integrated where appropriate in all phases of disaster planning and mitigation

Risk Management for Cultural Heritage

Risk management is the process of implementing decisions about accepting or controlling risk, based usually on cost-benefit analysis. Risks may be controlled through the application of technology, procedures, or alternative practices. In the field of cultural heritage, the formative experience of World War II showed the need for emergency planning for museums and other places of high cultural value.

To identify and minimize potential damage and liabilities, significant gains in reducing risk can be achieved by using the following systems, preferably in a coordinated manner: national inventories of historic sites; Object ID; and an emergency works and advice service. At a site-specific level, individual disaster plans can be detailed. Although standards for inventory and Object ID will be set at the national level, much of this preparatory work can be delegated to the local level.

National Inventories

National inventories of historic places are the keystone of heritage management for the simple reason that knowing what one's resources are is a prerequisite for effective safeguarding. It is a hallmark of the developing world that inventories are incomplete, dusty, hard to access, and unrelated to overall spatial planning.

Two recent advances enhance the effectiveness of national inventories. The first is the definition of "core data standards" for archaeological and historic sites under the auspices of the Council of Europe. The core data approach encourages a more efficient and uniform system of recording information. The second advance is the advent of inexpensive computer technology and diffusion of Geographic Information Systems (GIS). GIS has opened the possibility of large and speedy gains in national inventories. The GIS data base combines spatial attributes and thematic map layers with information such as administrative boundaries, cadastre information, historic maps, site inventories. Maps can be layered with additional features and information sets as needed. After years of stagnation fine work has been carried out with the help of international aid in Jordan, Tunisia, and the West Bank–Gaza, the latter by a nongovernmental organization (NGO), Riwaq.

Such inventories have proven highly useful for disaster mitigation. A GIS database can provide precise locational information depicting historic features and

extent of damage (for example, from floods). In a recent flood episode in the Chesapeake and Ohio Canal National Park in the United States, the standard operational procedure to assemble a disaster response team composed of park officials and an interagency task force was modified by adding mapping professionals. Among the data collected were peak flood data, which helps to analyze patterns of flood impacts over time; flood damage monitoring; and direct aid to the most vulnerable areas. A Geographic Information System (GIS) can aid disaster response to identify resources, create accurate maps showing both natural and cultural resources, and establish databases to enhance maintenance of facilities.

Object ID

Object ID is an international documentation standard for the information needed to identify art and antiques—the movable heritage. It responds to the failure of the current practice of recording objects to enable owners, dealers, customs officials, and police to identify objects confidently and quickly and was initially prompted by the dramatic costs of loss of art works through illicit trade and theft. Its applicability for disaster mitigation is also high. Today illicit trade in antiquities, theft of art works, and loss of art through disasters particularly impoverishes the developing world Spearheaded by the Getty Information Institute, Object ID is the result of intensive consultations with key groups involved in the art trade: museums and cultural institutions. art galleries and auctioneers. appraisers. customs officials. police. insurance companies and international agencies. The contents of the standard were identified by a combination of background research, interviews, and surveys of major institutions

Object ID is based on the concept of core data standards, that is, the minimum basic information required for identification. The inclusion of the category "distinguishing features" is an important factor in the usefulness of the tool for the purposes of recognition. Object ID was designed to meet the needs of the recorder as well as the retriever: information is easy to input, and it is easy for a lost object to be found It complements existing object inventories of museums and other collections. Launched in 1997, it is still to gain general currency.

Emergency Works and Advice Services

Some countries have put into effect emergency works and advice services for disasters. In the United Kingdom, English Heritage recently set up an Emergency Works and Advice Scheme. It is designed to help owners deal with sudden catastrophes and unforeseeable circumstances and to prevent dramatic deterioration in a building or monument: "to buy time" for it until a permanent solution can be put into place. It includes advice and a site visit, and covers work that is necessary immediately to protect the overall stability or integrity of an historic building or to preserve specific features The proposed work must be the minimum necessary, using the most cost-effective means to achieve the objective. Regional teams are responsible for the delivery of this system.

Individual Disaster Plans

At the individual site level, disaster plans are essential. Most major museums and some historic cities have such plans in place. The plan may include appointment of a disaster team including volunteers; evacuation of material; removal of debris and cleaning; evaluation of structural damage; securing of funding to return site to pre-disaster condition; and training of staff to deal with dangers and other aspects of disaster response. Risk reduction through adherence to building codes, fire proofing, fire alarms, resistant glass, and seismic strengthening are key elements in any preventive effort.

Initiatives to Reduce Risk from Disasters

A number of initiatives have tried to improve current practice. Among the most relevant are the following:

Operation Blue Shield

Borrowing the emblem of the 1954 Hague Convention, the Blue Shield initiative to improve risk pre-

paredness for cultural heritage was begun by the International Council on Monuments and Sites (ICOMOS) in 1992. In 1996 an international committee of the Blue Shield was created for coordinating emergency response efforts on behalf of ICOMOS, ICOM, ICA, and IFLA. The committee identified five key areas: funding, emergency response, training and guidelines, documentation, and awareness. But the very areas that they defined have proven to be stumbling blocks for Blue Shield' lack of adequate funding, ineffective coordination with international and national agencies responsible for disasters, and inability to respond in a timely manner to disasters. Blue Shield has yet to deliver tangible results.

The Getty Conservation Institute Disaster Preparedness, Mitigation and Response Activities

In 1990 the Getty Conservation Institute (GCI) began a collaborative project in Skopje (in the former Yugoslavia) to develop a methodology for seismic strengthening of Byzantine churches and other historic structures In the same year in California GCI initiated a study with similar aim for adobe structures. Also in this year it organized an international conference in St. Petersburg, Conservation and Disaster Recovery: International Cooperation at the Library of the USSR Academy of Sciences," which reviewed the post-1988 fire. The CGI has had no recent activities.

Appropriations for Disaster Relief

In the U.S. natural disasters in the 1990s prompted the Congress to approve supplemental appropriations for disaster relief In 1994 the Northridge Earthquake caused significant damage in the Los Angeles area. Congress responded by earmarking $10 million for historic preservation activities from a total appropriation of $550 million from the President's Discretionary Fund for Unanticipated Needs. In the previous year flood relief funds also allocated monies for preservation actions (some $5 million out of $6 billion). In the later case flood relief was used to fund nonconstruction activities such as on-site inspection by teams of preservation professionals to inspect buildings and provide technical advice. Printing and dissemination of a technical booklet, "Treatment of Flood Damaged Older and Historic Properties," was also funded

Regional Workshops

A regional workshop on Integrating Cultural Heritage into National Disaster Planning, Mitigation, and Relief was held in Macedonia in 1997. Sponsored by the University of York, the Getty Grant Program, the Ministry of Culture of the Republic of Macedonia, and U.S. and Macedonia ICOMOS, this meeting had as its aim the development of national disaster plans. A case study on the World Heritage Site at Orhid was prepared, focusing on risks from fire and earthquake. A network of experts was initiated, but there has been virtually no follow-up on the conference.

English Heritage Emergency Works and Advice Scheme

As noted above, this scheme is designed to help owners deal with sudden catastrophes and unforeseeable circumstances and to prevent deterioration in a building or monument until a permanent solution can be put into place. It is built upon the regional conservation capacity of English Heritage.

Incentives for Mitigation and More Effective Risk Management

Incentives are bound to two factors: knowledge and delivery systems Knowledge in this sense takes the form of both know-how or technical knowledge, for example, on what works needs to be undertaken, and information problems. Technical knowledge of best practice for earthquakes or water damage is unevenly accessible so that inappropriate techniques may be used that may cause additional damage. As in the case of other forms of knowledge, knowledge is less widely available in poorer countries and among the poor. Other incentives can be activated through the legal system and devolution of some responsibilities to the private and voluntary sector.

Knowledge of the value of cultural heritage and the cost of its loss is weak, particularly in poor countries. In some cases the financial implications from adverse events to the heritage may be difficult to assess Nevertheless, the huge costs of repair or replacement have not been used effectively by those responsible for cultural heritage to persuade decisionmakers of the cost effectiveness of preventive planning and systems. Recent work on the economics of heritage conservation will be useful for understanding the total economic value of heritage.

An interesting effort to improve information problems is the Treasury of St. Francis of Assisi exhibition on view at the Metropolitan Museum of Art. As the *Financial Times* review notes, "If any good could be said to have come from the calamitous earthquakes that ravaged the Upper Church of the Basilica of St. Francis in Assisi in 1997, it is through the pleasure afforded by the 70 spectacular and revered icons, relics and religious works of art... that have been dispatched on an international tour in its wake." The exhibit, funded by a private Sienese bank, has raised awareness of the gravity of the Umbrian disaster.

Delivery of mitigation systems is also a problem. Comprehensive national inventories of historic sites, recording systems for movable cultural property, such as Object ID, and emergency regional expert teams are three simple ways to reduce damage, yet are not widespread.

There are however, a number of incentives that can be employed to improve the management of risk. These include legal requirements and activating the private and voluntary sector.

Legal Requirements

Legal compliance can be a powerful tool in improving disaster management for heritage. This may include compliance to specific building codes, earthquake resistant measures, and use of fire retardants. The consequences of breaching legislation can be extremely serious, and in addition to any fines for breach of legislation, repair or replacement costs (if applicable) or clean-up works can also be levied.

Indemnities are also a tool. In the case of art objects that are lent to foreign institutions, a system of indemnities is in place that operates at a national level. This represents a sort of insurance against loss due to natural disasters and acts of god.

Private Sector Role in Reducing Losses

In many countries private sector insurance and reinsurance plays an important role in sharing risks and reducing economic losses caused by disasters. They help cushion the blow for historic properties. Citizen groups can organize into neighborhood groups to respond to natural disasters, perhaps focused around historic religious structures.

The Poor, Cultural Heritage, and Protection

The poor are particularly vulnerable to loss of their cultural assets when natural disasters strike. In historic cities where cultural sites are dense, whether in Quito or Tblisi, low income households are often proportionally over-represented and thus are more likely to suffer when disaster hits They are also less likely to be able to mobilize the resources needed to repair damaged cultural sites.

Natural disasters often aggravate already vulnerable situations Chronic lack of maintenance of cultural heritage and inadequate infrastructure services deepen damage from disasters In the historic center of Tblisi, Georgia, buildings already weakened by water damage from leaking pipes and inadequate maintenance were dealt a death blow by earthquakes that brought down historic buildings on their inhabitants' heads. Thus, a large number of relatively minor events such as groundwater contamination, lack of down pipes, and poor overall maintenance, when coupled with earthquake damage, have destroyed many historic buildings.

Recommendations for Adoption of Natural Disaster Risk Management

Cultural heritage is highly vulnerable in natural disasters, and current mechanisms to manage risks do

not meet the growing, and overlooked, needs of mitigation and management. A careful program of support will result in significant cost savings to national and local governments, the insurance industry, individuals, and international relief agencies Priority actions to be implemented include:

- Integrate measures for cultural heritage protection in global disaster management efforts.
- Support the creation of comprehensive national inventories of historic places.
- Institute the use of Object ID.
- Identify higher risk sites for priority action
- In vulnerable areas draw up emergency preparedness plans, especially for museums.
- Allocate resources for planning and implementation of management systems.

Although disasters are disastrous, perversely they are often a catalyst and an opportunity for improvement. Cities such as Dubrovnik have seized on the opportunities presented by damaging natural disasters, in their case an earthquake, to draft legislation to enable new fiscal measures and to rehabilitate historic districts.

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