Is cultural heritage life saving?

Case study analysis to the relation between flood risk management and cultural heritage

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Introduction

Cultural heritage[1] is increasingly prone to the impact of natural hazards such as floods, landslides, and storms. The risk of floods is considered the most common and most destructive risk for cultural heritage (Li et al., 2017). It is expected that as a result of climate change, there will be an increase in frequency and severity of natural hazards, including floods, in the near future (IPCC, 2012).

The Sendai Framework for Disaster Risk Reduction 2015-2030 is an international agreement, striving to reduce disaster risk, as well as "(…) economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries (…)" (UNISDR, 2015). Also in the EU Floods Directive (2007/60/EC) an explicit reference is made to cultural heritage (European Commission, 2007).[2]

Reducing the adverse impacts that floods can have on cultural heritage is highly important, especially within the context of climate change (Arnbjerg-Nielsen et al., 2013; Pelling, 2011). The aim of disaster risk management (DRM) is to reduce disaster risks by trying to avoid, limit, or enhance the preparedness for response capacity. Flood risk management thereby encompasses the three components of prevention, mitigation, and preparedness (UNISDR, 2009).

This paper outlines various case studies, which highlight the linkages between flood risk management and cultural heritage and how the impacts of floods have been reduced through tangible and intangible cultural heritage as well as vice versa.

Flood risk management and cultural heritage

Comprehensive flood risk management involves, among others, conducting flood risk assessments and developing flood risk plans and maps. Flood risk assessments are used for evaluating the risks of water sources, such as groundwater, surface water, rivers, streams, and inundation of coastal areas due to sea level rise. In addition, these assessments can appraise the vulnerability and potential impact on cultural heritage structures and areas.

Emerging approaches to risk and impact assessment put emphasis on the visual and geo-spatial methods. For instance, Li et al. (2017) proved usefulness of visual analytics for analysing flood risk and supporting decisions on cultural heritage. Flood maps are also useful tools to show where the areas at risk of

[1] Cultural heritage, as defined in the article 1 of the Convention concerning the Protection of the World Culture and natural Heritage, is rather broad and refers to in general 'monuments', 'groups of buildings' and 'sites' (UNESCO, 2005), thus it is tangible. The Intangible cultural heritage is defined in a separate document as "the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage" (UNESCO, 2003).

[2] "It is feasible and desirable to reduce the risk of adverse consequences, especially for human health and life, the environment, cultural heritage, economic activity and infrastructure associated with floods" (European Commission, 2007).

inundation are and in particular the cultural heritage related structures. For instance, a flood map was developed and established for the New Taipei City in Taiwan (Wang, 2014).

A mix of methods was suggested by Vojinovic et al. (2014), i.e combination of qualitative and quantitative approaches to flood risk assessment at heritage sites. Further to this, Reiman et al. (2017) applied the Intergovernmental Panel on Climate Change (IPCC) risk framework to quantify the risks on the UNESCO World Heritage Sites in the Mediterranean coastal area, in terms of hazard, vulnerability and exposure.

Yet, despite these efforts, little is evident about tackling the adverse impacts of floods on intangible heritage. Most of the impact assessment in the cultural heritage and disaster context has been linked to built infrastructure or certain natural heritage. Bond et al. (2004) argued that this may be due to the legislation, such as the EU EIA directive, which gives priority to built and tangible heritage assets.

Fatorić and Seekamp (2017) identified the barriers to preservation of cultural heritage under changing climate conditions and concluded that one of the most salient barriers is limited knowledge about the intersection of climate change and cultural heritage. They argue that traditional knowledge and skills of local communities regarding climate adaptation efforts can reinforce and strengthen heritage preservations.

Hence, there is a need to examine current approaches to flood risk management and cultural heritage and for new solutions, such as enhancing impact assessment practices. Genuinely, there are linkages both ways between cultural heritage and flood risk management. Cultural heritage (tangible and intangible) can help to reduce the impact of floods as well as the possibility to implement certain flood risk management practices, measures and interventions that can help to mitigate the impact of floods on cultural heritage (Figure 1).

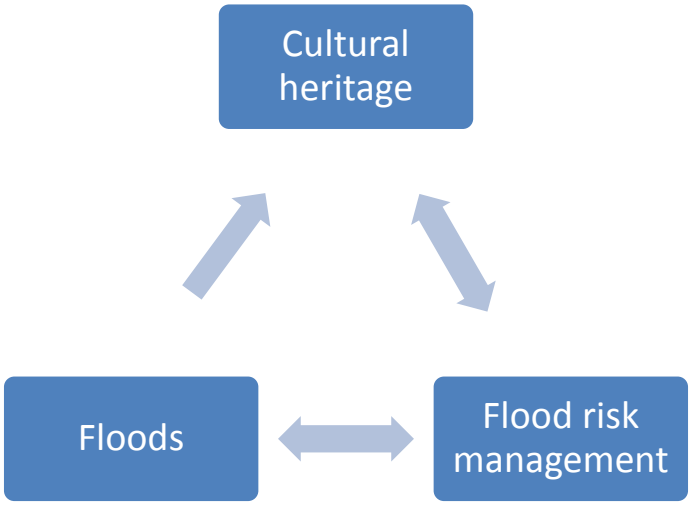

Figure 1 Linkages between flood risk management and cultural heritage (Source: own composition).

Cultural Heritage as historical example of flood risk reduction

In various countries, different cultural heritage practices contribute to prevention and mitigation of flood risk, often coupled with the traditional land use systems. For example, in the Guadalentin catchment in Murcia, Spain, vegetated earth-banked terraces are implemented already in historical times. These terraces help to reduce the formation of gullies and retain water from upslope, thereby mitigating flooding, as well as reducing the impact to infrastructure and siltation of water reservoirs. The terrace ridge act as a sink to reduce the velocity and runoff, while the vegetation on the terrace improve the soil structure and increasing the water infiltration capacity (De Vente, 2011).

Figure 2 Traditional vegetated earth-banked terraces in Murcia, Spain (Source: Joris de Vente, 2011).

The Guwahati Smart City Development project in India deals with the prevention of flood risk of the Brahmaputra river. Every year the Brahmaputra river floods extensively with major risks for the environment, local communities, and their cultural heritage. In Guwahati, temple ponds (water tanks) were essential components of the historical water management system. These surface water bodies sustain water flow dynamics between the highland and the lowland of the city's landscape, functioning as storm water reservoirs.

Historically, the temple ponds were also used for ritual bathing before entering the temple and for drinking, washing, and fishing, serving a large community living near the temples. Unfortunately, rapid urbanisation has taken its toll on the 'heritage of water'. In order to protect the city of Guwahati from flooding, it is necessary to a find solution that links the traditional knowledge systems with the design of the renovated water system and the restoration of the water heritage assets. Achieving this requires for local communities to work together on the restoration of water heritage and thus flood risk reduction (Dewani, 2016; Guwahati Smart City Limited, 2017).

Figure 3 Jorpukhuri pond near the Ugratara temple in Guwahati, India (Source: Indiawaterportal.org).

Impact of flood risk management plans on cultural heritage

As part of the Flood Protection Program, the Netherlands invests in an extended dike reinforcement program since 2015, reinforcing 1100 km of dikes. In many cases, an environmental impact assessment is required. Although the program seeks to prevent damage of floods to people, structures, areas and on cultural heritage, the dike reinforcement plan itself possibly threatens the preservation of heritage assets. Thus paradoxically, cultural heritage is not only prone to flooding, also flood risk management plans form a potential risk.

This is most evident in the Markermeerdijken project, which is centred around the 50-km dike that is listed as an archaeological and built heritage site. It is an icon in the Dutch landscape and relates to the history of the ongoing fight against water. The dike has heritage value in connection to historic town centres, historic structures, and economic activities like farming, fishing, and international trade. Moreover, parts of the dike are part of the UNESCO World Heritage Site the Defence Line of Amsterdam, a great example of a defence system based on the principle of temporary flooding (inundation). The historic construction of the dike provided information for the renovated design, but measures to the dike could as well directly affect the dike as historical structure and heritage assets associated with it (Alliantie Markermeerdijken, 2017).

Stakeholder engagement is of high importance in order for the Flood Protection Program to be successful. Communities residing directly at the dikes are not always in favour of the flood risk management plans. For example, in the town of Kessel, in the Noordelijke Maasvallei, people living at the historic dike did not support the proposed raising dike height. Paradoxically, the measures to protect the local people from flooding, were not appreciated, because it disturbed their (visual) connection with the river. The social

impact of the flood risk management plan resulted in the plan to be withdrawn (Waterschap Limburg, 2017).

Figure 4 Historical buildings on the dike, town of Uitdam at the Markermeerdijk (Source: Markermeerdijken.nl).

Cultural heritage as instrument to encourage community engagement

Engagement in heritage preservation and conservation activities can encourage community involvement, while at the same time improve flood risk management and flood remediation works. In Samarco, Brazil, the collapse of the Fundão Dam in 2015 created tidal wave of mud (mining waste), washing across the countryside of green valleys, villages and farmland. It has been Brazil's worst environmental disaster, killing nineteen people. Many local communities were affected and cultural heritage assets were damaged and archaeologists and conservators-restorers were hired to recover the affected assets. Together with local people, over 2300 sacred assets and fragments have been recovered and conserved. The program helped the people not only to recover their sacred heritage together, but also to deal with the psychological effects of the disaster (fundacaorenova.org; arqueologia.arcadislogos.com.br).

Figure 5 Church after the collapse of the Fundao dam, Brasil (Source: patrimoniocultural.blog.br).

Conclusions

Flood risk, within the context of climate change, is currently considered as one of the most important risks to cultural heritage. Cultural heritage could be directly affected by flooding, as the examples of the annual flooding of the Brahmaputra river in Guwahati and the mud stream that resulted in the collapse of the Fundão Dam in Brazil, have shown. Flood risk management and community engagement go hand in hand with the prevention of flood risk (India) and the recovery of flood damage to heritage assets (Brazil).

Flood risk management plans help to prevent or limit the impact of flooding on cultural heritage, but at the same time can form a risk to the preservation of cultural heritage itself, as the Markermeerdijken project exemplifies. Here, the dike is a monument itself, being an icon in the historical landscape. The historic construction of the dike provided information for the renovated design.

The relationship between water and heritage has determined how people have managed disaster risks caused by floods. This is achieved by technical interventions and adapting living patterns of communities (Jigyasu, 2015). Cultural heritage practices and traditional knowledge about water management systems can contribute to the prevention and mitigation of flood risks, as the examples above have outlined.

At the global and local level, still, too little attention is paid to the importance of preventing adverse flood impacts on cultural heritage. More concerted efforts are therefore needed, in order to better manage the related risks and embed mitigation mechanisms into relevant legislation, strategies and plans as well as awareness raising and building capacities of the communities at risk.

Cultural heritage offers the opportunity to prevent and mitigate flood risks and add to the quality of the environment by incorporating tangible and intangible heritage as an integral aspect in the design process. The objective is not only to protect cultural heritage for the future, but also to be able to tell the story and involve the local community in preservation and conservation efforts. Connecting with the local community and intangible heritage creates added value and helps to protect tangible heritage for future purposes.

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