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Climate change and cultural heritage: conservation and heritage tourism in the Anthropocene

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This paper reviews some of the actual and potential effects of climate change on cultural heritage and its management with special reference to heritage tourism. This analysis will help to identify knowledge gaps and issues in relation to different types of heritage, management strategies and policy-making, as well as enabling an understanding of the potential significance of climate change impacts in a regional, national and international setting. The analysis is also relevant to understanding the broader pressures of environmental and global change on the management of heritage tourism sites, and cultural heritage in particular, in the Anthropocene.

Keywords: climate change; cultural heritage; conservation; adaptation; heritage tourism; cultural landscape

The physical impacts and science of climate change present a number of significant challenges for tourism with respect to its effects on destinations, infrastructure, resources, competitiveness, tourist flows and behaviours, as well as adaptation and mitigation (Scott, Gössling, & Hall, 2012; Scott, Hall, & Gössling, 2015). However, while there is substantial understanding of the current and potential effects of climate change on the tourism system, specific knowledge of how it will affect heritage tourism is little understood, especially beyond the extent to which environmental change may be used as part of destination branding (Morris, 2014). Not least of the potential direct physical effects of climate change on cultural heritage are sea-level rise (SLR), increases in the intensity of extreme weather events and changes in humidity (Cassar, 2005; Intergovernmental Panel on Climate Change (IPCC) (2014a, 2014b). However, as Hall and Ram (2015) have indicated, the focus of the various IPCC reports on climate change are much more geared towards natural heritage as opposed to cultural heritage sites, although the threat is very clearly recognised (Cassar, 2005; Hall, 2008; Howard, 2013; Moore, 2010; Pearson & Williams, 1996; Rowland, 1999; Terrill, 2008). Similarly, concerns over World Heritage also often tend to

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emphasise the effects on natural values (Wang, Zang, & Du, 2015; Zeppel, 2012). Although there is now greater recognition of the potential impacts of climate change on cultural heritage including the built environment and cultural landscapes (Harvey & Perry, 2015; Perry, 2015; Phillips, 2015), as well as the role of culture in climate change adaptation, resilience and vulnerability (Adger, Barnett, Brown, Marshall, & O'Brien, 2013). Nevertheless, although concern is growing McIntyre-Tamwoy (2008) describes as “a disturbing lack of engagement with the issues by all levels of government, academia and practitioners” (p. 8). A situation that is concerning given that “so much of our heritage exists among people and communities, and is bound up with social interactions, cultural identity and cohesion; it is clear that climate-change impacts are not only physical phenomena” (Cassar, 2009, p. 6).

The identification of knowledge gaps and issues in relation to different types of cultural heritage is crucial to the development of appropriate strategies to adapt to climate change, including with respect to heritage tourism (Cassar, 2009; Hall, 2007, 2008, 2010; Scott et al., 2012). Therefore, this paper provides a review of some of the key themes and issues with respect to the impacts of climate change on cultural heritage, especially in light of the relatively low level of awareness of some of these issues outside of immediate threat of SLR or World Heritage (Scott et al., 2012). Some of the issues raised here are reflective of larger issues of global change that affect heritage of which climate change is only one dimension. Indeed, heritage conservation and heritage tourism arguably now need to be positioned within the context of the Anthropocene with respect to the impact of global change and societal consumption on heritage, the things we otherwise wish to keep (Hall & Saarinen, 2010; Maus, 2014; Solli et al., 2011). Furthermore, the issue of cultural heritage is addressed also by the framework of Ecosystem Services (ES), under the conceptualisation of cultural services, which focuses on the physical, emotional and mental benefits, both tangible and intangible, human being gains from ES (e.g. Daniel et al., 2012; Milcu, Hanspach, Abson, & Fischer, 2013; Millennium Ecosystem Assessment, 2005) and landscape (Bieling, 2014; Tengberg et al., 2012).

Such reviews are significant given the need for heritage to “adapt to changes, physical and intellectual, within its environment” (Cassar, 2009, p. 10). Organisations who are responsible for the development of regional and site cultural heritage conservation strategies need to be aware of the issues involved, as “poorly informed decisions about adaptation can lead to badly specified measures that not only diminish the significance of historic assets but also reduce their flexibility to respond to future climate change” (Northern Ireland Environment Agency, 2010, p. 10). This presents a major challenge for heritage preservation and tourism; as Cassar (2009) notes “instead of driving technological change, we will have to adapt to uncontrolled change” (p. 10).

The first part of the review examines four specific areas of potential and observed threats from climate change on cultural heritage: cultural landscapes, the built environment, buried archaeology, and parks and gardens. This is then followed by a discussion of the strategies for adapting cultural heritage to climate change as well as effective policy-making. Key themes are also identified.

Evidence of threats and observed changes to cultural heritage

Cultural landscapes

Cultural landscapes are not only limited to actual tangible heritage such as specific agricultural forms or built environments, but also include more intangible aspects such as the rituals which occur within a landscape, and the symbolism that also serves to embody

generations of history experienced by those who engage with the landscape (Aplin, 2007; McIntyre-Tamwoy, 2008). Cultural landscapes are perceived as the interface between nature and culture, including both tangible and intangible heritage (Tengberg et al., 2012). In the context of World Heritage, UNESCO define cultural landscapes as cultural properties that “are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal” (UNESCO, 2005).

Three main types of categories of cultural landscape are identified by UNESCO (2005): designed and crated landscapes (parks and gardens, historic and/or religious monuments), organically evolved landscape and the associative cultural landscape which has religious, artistic or cultural associations. The various associations that cultural landscapes carry are important when valued in terms of attachment to place (Tengberg et al., 2012). Economically, landscape is particularly significant if activities such as tourism are considered (Hall & Lew, 2009; Ramkissoon & Uysal, 2011; Rowland & Ulm, 2012). Change or loss of cultural landscape values may also affect the attractiveness of destinations to particular market segments (Hall, James, & Baird, 2011; Howard, 2013; Rotherham, 2010).

Raymond and Brown (2011) revealed that perceptions of climate change risk were partly driven by the values that people assign to or hold for a particular landscape, and suggested that adaptation strategies should therefore be placed-based (see also Hess, Malilay, & Parkinson, 2008). Nevertheless, the common issues facing locations suggest that there is significant policy learning to be gained from exchanging experiences and practices (Gordon, 2012). For example, there is great risk to cultural heritage from SLR around Pacific Island coastal areas since coastal sedimentation has buried many heritage sites (Nunn, 2012; Techera, 2011). Wilbanks, Ensinger, and Rajan (2007) have conducted similar research in the Indian city of Cochin, and found that SLR not only damages cultural heritage sites, but also places pressure on fisheries. One solution put forward to counter these impacts was creating a “model of climate change response combined with contemporary sustainable development” (Wilbanks et al., 2007, p. 32) which could then be used to promote Cochin as a model means of mitigating and adapting heritage to climate change in the broader context of sustainable development (see also Barthel-Bouchier, 2012).

The integration of sustainability with the protection of cultural landscapes is also a focus of the landscape ecological approach of Pearson and Gorman (2010) in the Northern Territory of Australia. This approach identifies the values and needs of differing groups of stakeholders and encourages sustainable planning through an adaptive process that is both holistic and continuous. Loulanski (2006) similarly argues that a functional holistic approach should be taken which meets the changes in cultural heritage preservation where purposeful preservation, sustainable use and development are all part of a dynamic perspective which imagines a landscape of functional heritage as opposed to “frozen” heritage. Head (2010) also supports this functional approach, and suggests that “adaptation is as important as mitigation” (Head, 2010, p. 234) with respect to cultural ecology. Indeed, reinvention is integral to the marketing and promotion of cultural heritage products (Lowenthal, 1985).

Built environments

The built environment plays host to many of the different issues that emerge from climate change (Brimblecombe, 2014). Research into climate change impacts on the built environment is strongly focused on the effects of environmental pollution and changed climatic

conditions on heritage buildings (Brimblecombe, 2014; Brimblecombe & Grossi, 2010; Lankester & Brimblecombe, 2012; Smith, Gomez-Heras, & McCabe, 2008; Wilby, 2007) and historic monument decay (Grossi et al., 2011; Brimblecombe, Grossi, & Harris, 2011; Sabbioni, Brimblecombe et al., 2006; Sabbioni, Cassar et al., 2006; Smith et al., 2008; Viles, 2002). Bonazza, Messina, Sabbioni, Grossi, and Brimblecombe (2009) note the scientific awareness of the variety of scenarios which could eventuate due to climate change but also point out that “many open questions exist concerning the future trends of individual damage processes” (p. 2039). Addressing uncertainty is clearly important in order to develop effective conservation strategies. For example, Pendlebury, Townshend, and Gilroy (2004) argue that the cultural value attached to the built environment should not only be viewed from an economic perspective, but also as a force for social inclusion through regeneration programmes which promote preservation of heritage sites.

In responding to potential uncertainty, the Northern Ireland Environment Agency (2010) suggests that two approaches should be utilised for the adaptation of heritage buildings: the “no regret” (meaning basic maintenance) option or a “low regret” option, one where the short-term economic and environmental benefits outweigh the cost involved. Nevertheless, Butt, Giddings, Jones, Umeadi, and Cooper (2011) argued that “failure to take action now would not only jeopardise environmental also economic sustainability” (p. 212).

McIntyre-Tamwoy (2008) argues “little consideration has been given to ascertaining the loss of tangible heritage places, sites and [how the loss of] structures will affect communities and the intangible aspects of culture” (p. 8). The maintenance of cultural assets also has a close relationship with place resilience (McPhearson, Andersson, Elmqvist, & Frantzeskaki, 2015). This applies not only with respect to economic loss but also the psychological distress of a changed sense of place. Spenneman (1999) highlights how in the wake of a natural disaster response efforts can actually place cultural heritage resources at risk, partly through ignorance caused by a lack of awareness of their significance, but also through a lack of training of those responsible for the managing the environment where a natural disaster has occurred. Importantly, Rojas (2007) highlights the need to move beyond an emergency intervention model to develop a long-term vision for protection from climate change that provides greater resilience for the overall built environment.

Buried archaeology

Global-change archaeology recognises that past human decision-making processes in terms of both culture and attitude and “variable time and space scales, the concept of landscapes as the cumulative history of human-environmental interactions, agency, and meaning”, play “equally significant roles” in archaeology (Hardesty, 2007, p. 1) (see also Mitchell, 2008). Howard, Challis, Holden, Kinsey, and Passmore (2008) studied the impact of climate change on river catchments in Britain, and noted that while there appears to be emphasis placed on research on the built environment in cultural heritage research there is also much to be gained by policy-makers from empirical evidence collected from archaeological sites. Indeed, Cassar and Pender (2005) argues that preservation schemes designed to alleviate flood risk can actually potentially cause more damage to buried archaeology than flooding.

Parks and gardens

Bisgrove and Hadley (2002) suggest that the same factors that affect the built environment and archaeology are also present in examining climate change effects on historic parks and

gardens in the UK. Their research noted the need to establish a distinction between sudden, extreme events and long-term trends in order to develop strategies applicable to the wide variety of effects of climate change. Cassar and Pender (2005) note that climate change has already created a difficult scenario for replanting in landscapes where historic sites have suffered prior storm damage. Temperature changes, coupled with excessive rainfall and wind, have hampered efforts to restore damaged English parks and gardens, while high tides and flooding have also placed formerly safe historic parks and gardens sites at risk from erosion. Similarly, in Canada Lemieux and Scott (2005) suggested that conservation planning frameworks for parks and gardens were actually based on a sense of climatic and geographic stability which is untenable when placed in the context of climate change. Subsequent research by Lemieux and Scott (2011) suggested that these factors were exacerbated by the limited organisational and financial capacity of heritage agencies to respond to such pressures.

Strategies for adapting cultural heritage to climate change

A variety of strategies have been studied in response to the challenges presented by climate change to cultural heritage preservation. These strategies can be grouped into three areas: planning time-scales, monitoring, management, maintenance, loss and obsolescence (Cassar, 2005).

Planning time-scales

Difficulties have been noted in implementing planning time-scales for climate change impacts on cultural heritage due to the long-term nature of the planning cycles involved (Cassar & Pender, 2005; McIntyre-Tamwoy, 2008) as well the spatial scale involved (Pearson, 2007; Pearson & Gorman, 2010; Taylor, Flatman, Marshall, & Rydin, 2011). Planning issues are also exacerbated by difficulties in achieving stakeholder consensus, especially when cultural heritage is in private ownership and there are significant gaps in assessments of heritage values (Zan, Bonini-Baraldi, & Gordon, 2007).

Realistic time frames for planning are critical for heritage conservation strategies to be successful (Hunter, Burkitt, & Trangmar, 2010). "Adaptation operates at different spatial and societal scales and that success or its sustainability needs to be evaluated against different criteria at these different levels" (Adger, Arnell, & Tompkins, 2005, p. 85). This line of argument is also supported by Wilson and Piper (2010) who examined large-scale infrastructure projects and found that these only focused on the before and after stages of heritage preservation; the actual processes involved of going from the former stage to the latter were found to have been ignored altogether, which in turn served to compromise the successful outcome of preservation activities. Wilson and Piper (2010) suggest that "economically driven decision-making can have dire consequences for ecosystems and the heritage environment" (p. 6) for planning time-scales, and argued that further research on the time frames used in heritage preservation projects was vital in monitoring climate change impacts.

Monitoring, management and maintenance

Long-term conservation concerns such as maintenance and monitoring are important in terms of protecting cultural heritage (Cassar & Pender, 2005; Trow, 2008). Adger et al. (2005) note that "adaptation that requires large-scale investment is likely to be episodic

and staggered” (p. 85). Improvements to existing cultural heritage affected by climate change induced impacts might not be possible because of cost. This raises the spectre of what Cassar and Pender (2005) describe as, “difficult choices on what to sacrifice and a preference for funding to be directed towards maintenance instead of new building work” (p. 615).

Nasser (2003) notes that in order to remain competitive in attracting tourism many heritage sites are undergoing “redefinition and reinterpretation” (p. 467). The ongoing maintenance of parks and gardens also requires a long-term perspective. Bisgrove and Hadley (2002) suggest that adapting such areas to cope with climate change will incur additional expense, but if a long-term perspective were to be adopted on both a national and international level then this could help to slow the effects of climate change on garden heritage.

The monitoring of cultural heritage sites has revealed that those which most at risk are in coastal areas which are experiencing the impacts of SLR as well rising acidification and temperatures (Foale, 2008; Pearson, 2007). Ideally, cultural heritage protection can occur as part of broader resource management strategies (Foale, 2008). Nevertheless, there is a real need for the input of indigenous and other cultural stakeholder advice to be incorporated into conservation decision-making so that they are appropriate to both the community and the adaptation context, especially given the value of indigenous practices for adaptation to environmental change (Adger et al., 2013; Jacob, McDaniels & Hinch, 2010; King, Penny, & Severne, 2010; Wolf, Allice, & Bell, 2013).

Loss and obsolescence

The emphasis on socio-economic models in climate change research has arguably led to a lack of focus on the human elements of climate change in terms of loss and obsolescence, and this has consequently been identified as an under researched area in the context of cultural heritage (Henry & Jeffery, 2008). Not only is there the actual physical loss of buildings, monuments and artefacts, but there is also what Henry and Jeffrey (2008) refer to as “cultural loss” (p. 12), that takes into account how heritage values are assigned in terms of both tangible and intangible cultural heritage. They also argue that to close this knowledge gap there needs to be more research conducted at a local level to study how social and cultural resources are deployed.

In terms of the built environment, more thought needs to be given to environmental obsolescence and the adaptation of historic buildings to survive climate change before heritage buildings are demolished without “sound environmental reasons” (Cassar & Pinder, 2005, p. 615). Butt et al. (2011) argue that to close what they term the “obsolescence gap” (p. 9) ongoing maintenance and refurbishment of buildings will be required. Although Mitchell (2008) suggests that such work will be overlooked due to its cost and frequency.

The acceptance of the loss of some components of heritage in order to save coastal archaeological sites has been met by the attitude that what was worth saving was down to “value, significance, and money” (Cassar & Pinder, 2005, p. 615). This raises the question though of how different groups of stakeholders are expected to agree on what is significant and what is not, even when listed under national legislation. Butt et al. (2011) point out that sustainability and obsolescence are inversely related concepts which require engagement from multiple levels of stakeholders in order to ensure that appropriate resources are available to encourage cost-effective preservation. A significant knowledge gap is the potential causes and effects of climate change induced obsolescence in the built environment (Butt et al., 2011), especially with respect to improving the operational performance of buildings and refurbishment projects.

Policy actions

In order to seek solutions to the problems presented by climate change for cultural heritage, effective policies must be formulated and implemented. Barriers to sound policy-making have been recognised by Cassar and Pinder (2005) to occur primarily in the areas of cooperation, funding, research and education.

Cooperation

Political inertia and a lack of flexibility are often responsible for stalling investment in environmental and heritage protection. In Malta a lack of stakeholder cooperation emerged in the wake of a “shift in emphasis away from being a mass-market destination towards becoming one of cultural heritage [which] follows one of mass-market tourism on the island” (Foxell & de Trafford, 2010, p. 156). Risk management strategies need to be flexible and allow stakeholder participation over “long time horizons” (Jones, 2010, p. 19) in order to monitor climate change impacts which were found to vary significantly from region to region. Similarly, in research on heritage conservation efforts in New York and London, Hunt and Watkiss (2011) noted that both cities had benefited from having stakeholders engaged early on in the risk assessment process.

Scott and Becken (2010) note that although increasing attention is being given to climate change issues within the tourism industry, the actual willingness to enact change is another issue altogether; a situation not helped by tourism’s supply chains often being fragmented. Collaboration has also been highlighted by Leask and Rihova (2009) in their research into heritage tourism in the Shetland Islands as being vital to conservation and development programmes whilst remaining sympathetic to protecting the integrity of heritage sites. Many different stakeholders oversee tourism on the islands, and although conflict existed to some degree, adopting what was deemed as best practice in terms of heritage tourism policy was found to have worked in the face of significant change (Leask & Rihova, 2009).

Security of funding

Maintenance of cultural heritage in light of climate change is a primary concern amongst stakeholders at a variety of levels, and may be addressed by incentives directed at providing a “more equitable balance” (Cassar & Pinder, 2005, p. 615) in terms of funding repair and maintenance. The lack of specific budgets designed to improve research into mitigating the impacts of climate change on cultural heritage in Australia has resulted in a financial imbalance in funds available to different levels of government (McIntyre-Tamwoy, 2008). If those charged with being responsible for monitoring the effects of climate change on heritage sites are denied the necessary budgets to even begin to deal with the challenges presented by climate change then organisations may need to adopt different strategies to try and ensure the allocation of sufficient working budgets in the future. Although the loss of climate change funding as the result of governmental change is a significant issue with respect to the development of longer-term conservation strategies (Hedger, Connell, & Bramwell, 2006).

Research

Research is integral to climate change response. Nevertheless, McIntyre-Tamwoy (2008) notes how little government research has actually focused on heritage site sensitivity to

climate change. The Australian Greenhouse Office (2006) defined such sensitivity as “the degree to which an area of interest or activity will be affected, either adversely or beneficially, by a particular change in climate or climate-related variable” (p. 57). Claesson (2011) also highlights the importance of research in a developing country context. Linking sustainability issues with the assessment of the impacts of climate change on cultural heritage in Cochin, where temperature increases have led to waste disposal problems and affected local fisheries, provides a useful template for future climate change research. Assessments made in Cochin, even with limited data for long-term projections, allowed for recommendations to be made towards the development of a localised response in partnership with local experts (Claesson, 2011). The research provided empirical evidence of the “undesirable impacts on cultural heritage preservation – from accelerated deterioration of historic structures; to accelerated loss of historic landscapes [resulting in] reduced touristic interest” (Claesson, 2011, p. 32).

The need for a streamlined framework to deal with cultural heritage assets and the interaction of external factors which impact heritage management has seen the promotion of the soft system approach to cultural heritage (Hutchings & Cassar, 2006). Building on the importance of sustainability indicators for measuring change in material cultural heritage (Cassar & Pinder, 2005), this approach has proved valuable to researchers as it allows heritage management to be examined as a single entity integrating social, economic and environmental factors in order measure how successful conservation activities have been (Hutchings & Cassar, 2006). Better data on the effects of climate change on cultural heritage in turn allows researchers to help guide the policy actions and strategies of decision makers.

Another stream of research has focused on vulnerability of specific cultural landscapes to climate change impacts (Brace & Geoghegan, 2011; Geoghegan & Leyson, 2012; Nettle, Desilvey, Anderson, Wetherelt, & Caseldine, 2014), including with respect to tourism (Hall, Scott, & Gössling, 2011; Kaján & Saarinen, 2013; Tervo-Kankare, Hall, & Saarinen, 2013). For example, the Inuvialuit Settlement Region of the western Canadian Arctic was the focus of a study by Pearce et al. (2011) who discovered that climate change had “constrained travel routes to hunting areas, and the ability to practice traditional activities” (p. 1). This study suggested that vulnerability research targeted towards the local community that provided a long-term approach towards strategic planning could serve to identify the factors that have caused increased vulnerability to climate change and allow for adaptations to be developed over time rather than take an ad hoc approach (Pearce et al., 2011). The importance of socio-cultural dimensions is also stressed by O’Brien, Eriksen, Sygna, and Naess (2006) who argued, “greater attention needs to be placed on the social context of climate change impacts and on the processes shaping vulnerability and adaptation” (p. 50). Such concerns are increasing since adaptation of cultural heritage to climate change often involves indigenous and traditional communities, which demonstrate vulnerabilities and maladaptive capacities to deal with changes (IPCC, 2014a). Although there has been a significant response to these issues (e.g. Adger et al., 2013), the challenge remains to look at the social dimensions of climate change beyond economic concerns.

Education

Public interest groups and opinion leaders are critical for education by providing expertise and consultation towards the successful implementation of projects designed to safeguard the environment (Foxell & de Trafford, 2010; Hunter et al., 2010). Cassar (2009) suggests the use of reflective practice in the education of heritage practitioners, allowing knowledge

and skills to be developed that identify where maintenance or monitoring is required and to enable change to be initiated if needed. This approach marks a move away from past risk aversion, “because heritage conservation needs entrepreneurs who are able to take risks and who can respond to the changing requirements of the sector” (Cassar, 2009, p. 10).

The importance of ensuring that communication regarding climate change impacts on cultural heritage is grounded in “sound decision-making [that] should be based on good data for modelling, expert opinion from a wide range of disciplines, and careful integration of this data and opinion into planning processes and plan implementation” (Hunter et al., 2010, p. 132) cannot be stressed enough. Information on climate change needs to be clearly communicated and based on empirical evidence so that stakeholders can see value in the adaptation process and feel that they are part of the decision-making system. However, Mitchell (2008) warns ominously that “demands for continued economic growth and a still widespread lack of appreciation of what climate change will entail probably render this ambition wholly unrealistic” (p. 1093).

Key themes

Analysis of the literature on the effects of climate change on cultural heritage reveals several reoccurring themes. These themes are discussed further below.

The importance of an integrated response to climate change impacts

As climate change is an issue which affects cultural heritage sites in a myriad of different ways, it is important to remember that there is no one-size-fits-all solution. Nevertheless, integrated approaches are vital for the mitigation of and/or adaptation to, climate change (Murphy, Thackray, & Wilson, 2009). The agencies responsible for heritage have to adapt to “uncontrolled change” (Cassar, 2009, p. 10); this is not a situation where practitioners have the luxury of being in control, and often unprecedented actions are required to meet new and unusual circumstances. The use of an integrated approach not only involves stakeholders at a variety of levels, but also could serve to address what Bonazza et al. (2009) terms the uncertainty which exists in terms of the strategic directions required to deal with individual damage processes, particularly within the built environment.

The protection of cultural heritage requires a unified approach

The response to climate change is the responsibility of the cultural heritage community as a whole, including the tourism industry that greatly benefits from the role of heritage as destination attractions. A long-term vision is required for the development of appropriate strategies (Bisgrove & Hadley, 2002; Erlandson, 2012), including with respect to planning for disaster management and preservation strategies (Siegel et al., 2013; Spenneman, 1999), heritage tourism (Convery, Corsane, & Davis, 2014), and ES (McPhearson et al., 2015; Tengberg et al., 2012).

Cultural heritage carries human values

Cultural heritage is both tangible and intangible, and values are assigned within society on social, cultural and economic dimensions (Hutchings & Cassar, 2006). Given that the phenomenon of climate change is experienced within a variety of cultural contexts, the elements that are intertwined with heritage preservation are complex and may be easily

misunderstood by those outside of a particular culture. Therefore, mitigation and adaptation should be undertaken with a high level of consultation with those groups who may inhabit or work within heritage sites (Foale, 2008; Trow, 2008). Failure to do so not only means that the opportunity to learn about past adaptation to climate change from indigenous groups may go unrealised (King et al., 2010; McIntyre-Tamwoy, 2008), but also that the documentation of the social and cultural fabric of heritage sites could be lost altogether.

Risk mitigation and adaptation research is currently underfunded

Research based on empirical evidence and quality data is needed in order to develop integrated heritage management frameworks and requires better levels of funding. However, in relative terms cultural heritage below the status of World Heritage Sites, appears to attract little financial attention especially when in competition for funds for other sectoral adaptation measures. Nevertheless, increased funding would increase the body of research not only for mitigation and adaptation, but could also take into account the various impacts of climate change on tourism activities that are closely linked to cultural heritage (Scott et al., 2012). However, the tourism industry itself needs to take a significant lead in reducing its own emissions and protecting heritage rather than causing further damage which could lead to loss or obsolescence (Scott et al., 2015).

Conclusion

Climate change poses a major threat to cultural heritage and heritage tourism. Failure to respond with adequate strategies to deal with climate change means that more and more irreplaceable cultural heritage will be lost. This will be compounded by the disappearance of material heritage and the intangible dimensions with which it is interwoven (Rowland & Ulm, 2012). From an economic perspective, providing financial resources towards research and education could benefit a range of heritage sites. Nevertheless, the challenge of climate change is such that there needs to be a move towards what Loulanski (2006) terms as a functional approach to cultural heritage, rather than thinking of heritage as being frozen in time. However, such is the threat to cultural heritage that increased questions may be asked not only about the type of research that is conducted on cultural heritage and heritage tourism in the Anthropocene but also how research is conveyed. As Cassar (2009) argues with respect to climate change:

Because gathering scientific evidence takes time, using scientific evidence alone to influence policy on the protection of cultural heritage from climate change is not enough. It makes sense to advocate for the protection of the physical, social and cultural environment as an integrated whole, not only because the weight of qualitative and quantitative evidence is greater, but also because the effects are inseparable. (p. 6)

Such an approach also highlights that concern for cultural heritage and heritage tourism cannot be divorced from larger concerns such as the benefits human beings gain from ecosystems, nature and landscapes (Millennium Ecosystem Assessment, 2005) and the need for sustainable development (Barthel-Bouchier, 2012). Indeed, efforts to reconcile the well-being of humans and nature within the rubric of sustainability would appear to not only be an appropriate general response to climate change, but also offer one of the best means to conserve cultural heritage in the Anthropocene.

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