

CLIMATE CHANGE AND CULTURAL HERITAGE

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Climate Change and Cultural Heritage: Local Evidence, Global Responses

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RECOGNIZING THE URGENT THREATS TO BOTH NATURAL AND CULTURAL RESOURCES posed by global climate change, the World Monuments Fund (WMF) organized a panel discussion at the 2007 George Wright Society Conference that gathered professionals in the fields of historic preservation, nature conservation, and green building and asked them to examine how these disciplines could collaborate to develop strategies both for adapting to those impacts and mitigating those threats by sustaining built and natural environments.¹

WMF is a non-profit organization based in New York City that works to protect and preserve cultural heritage sites around the world—sites of all types and from all periods. Setting an agenda for protecting cultural heritage at that scale is a challenge, and in 1996, WMF launched a program that would allow it to gain the information it needed to see that larger picture—the World Monuments Watch List of 100 Most Endangered Sites.² The Watch List has since become the main tool WMF uses to learn about the dangers posed to cultural heritage sites around the world. To create the list, every two years WMF solicits nominations from governments, non-governmental organizations (NGOs), universities, grassroots organizations, and profes-

sionals in the field. From these nominations, a panel of international experts—convened by, but independent of, WMF—selects a group of 100 sites that present a snapshot of the state of global cultural heritage at a given time. Through the Watch List, WMF calls attention to and attracts support for not only 100 individual places, but also key issues in the field. In the past, major themes of the list have included issues such as conservation challenges in the developing world, threats to cultural heritage in areas of armed conflict, and the challenges of preserving Modern architecture. In addressing these challenges, WMF has been able to draw on established methods of the field of historic preservation. While each project and program presents

unique challenges, for the most part they can be addressed using familiar tools.

In 2008, however, the Watch List presented WMF with a challenge that promises to change the way preservationists will have to think about what we do: global climate change. Although the specific threats posed by climate change are familiar (water, bugs, soil erosion, etc.), and while politics and economics have always affected cultural heritage conservation, climate change will expand and exacerbate those known challenges. More important, however, is that climate change is not just a historic preservation problem; it is perhaps the most far-reaching and wide-ranging problem of our time and will affect every sector of human life for years to come. It is for this reason that historic preservationists cannot afford to work in a vacuum, and to focus only on our specific concerns. At the same time, there are ways that the field of historic preservation can make a positive difference in the world's response to climate change, but in order to be effective, we must rethink our methods—both in how we work and how we explain our work to the public.

Environmental threats—both natural and human-made—have long threatened cultural sites. Monuments that have stood on the Earth for centuries—enduring symbols such as the Great Wall of China or the aqueducts of the Roman empire—have always suffered from exposure to wind and rain, and plain old age, and in the last century especially, new factors such as pollution and other human-made environmental factors have taken their toll. Addressing these problems has been difficult, but it has also given preservationists experience—the experience needed to address the larger-scale versions of these threats that come with climate change. Historic buildings also

provide substantial, and thus far largely unexamined, information about how and why the built environment survives or doesn't over the long term. Therefore, in addition to developing new strategies for adapting and responding to climate change threats, the field of historic preservation must also focus attention on helping to convince the public to act to stop global warming by raising awareness of the threats posed to treasured monuments and historic places.

The 2008 World Monuments Watch List demonstrates that climate change impacts are already being felt today at cultural heritage sites around the world. These sites are only the canaries in the coal mine, however, and many more sites and cities around the world are vulnerable. Predictably, rising sea levels pose a substantial problem. A large portion of the world's population lives now and has always lived along the coasts and in cities built along major rivers, and so with them are many of the world's cultural sites and historic cities. In addition to rising sea levels, changing weather patterns will also cause substantial damage to historic buildings. Designed to withstand one set of environmental conditions, many historic structures will have to be adapted to survive as those conditions change. For instance, places that were once dry will be wet, and vice versa; rising temperatures will pose threats to wooden buildings in northern regions as termites and other pests are able survive at higher latitudes. As we consider global predictions about climate change impacts, it is clear that sites on every continent are in danger—from ancient sites in Peru threatened by melting glaciers to whole swaths of the Pacific Rim that will be under water, and everything in between.

Evidence

In examining cultural heritage sites on the 2008 Watch List that are threatened by the impacts of climate change, the most desperate case seems to be Herschel Island, in the Canadian Yukon. Located on the Beaufort Sea near the border between Alaska and Canada, Herschel Island is in the fastest-warming part of the world (Figure 1, no. 1).³ It is home to a historic whaling town founded in the 19th century and an ancient Inuit site that was settled some 1,000 years ago (Figure 2).⁴ The warming of the ocean and the melting of sea ice in this region have caused increasingly severe storms and sea-level rise, and, with them, coastal erosion. Rising waters are overtaking land once occupied by the historic wooden buildings of the whaling village. Melting permafrost is causing ground slumping, which is destroying archeological remains and burials that are being revealed by melting and retreating soil.

Herschel Island is currently included on Canada's World Heritage Tentative List, which is the precursor to nomination to the UNESCO World Heritage List, but the ongoing losses at the site could prevent that

nomination from going forward.⁵ The Yukon government and the Yukon Historical and Museums Association (YHMA) have been working to protect the cultural heritage of Herschel Island, taking measures such as moving historic buildings back from the coastline and carrying out salvage excavations. The nomination to the 2008 Watch List, however, stated that previously established strategies would have to be adapted given the urgency and irreversible nature of the threats posed to the site by climate change. The caretakers of Herschel Island are now focused almost entirely on salvage measures and documentation of the site so that some record of its history will be preserved for the future. They are undertaking scientific documentation of the buildings and sites and a documentary film project is being developed to record the culture and traditions of the place.⁶

There are many more sites farther south that are not so far along as Herschel Island, but which face similar challenges or will soon. The problems of warming seas and the resulting more-violent storms are expected to threaten many coastal towns and sites in northern Europe, for instance.

Figure 1. Map showing locations of cultural heritage sites impacted by climate change. Numbers are referenced in the text. Source: World Monuments Fund.





Figure 2. View of the historic settlement of Herschel Island, Canada. Photo courtesy of World Monuments Fund.

In Norway, a picturesque fishing village at Sandviken Bay (a 2006 Watch Site), near Bergen, is located in an area that is predicted to experience increasingly violent seas and winds (Figure 1, no. 2).⁷ Melting permafrost is a growing problem in northern latitudes, and many large cities and towns are vulnerable as the ground beneath them shifts and melts.⁸ Even in more temperate climes, some of Europe's oldest and most revered sites are threatened by rising seas and coastal erosion. On the Outer Hebrides of Scotland, for instance, the archeological remains of Norse settlements from the Middle Ages are quickly disappearing as a result of eroding coastlines. In Baleshare, the problem is so acute that archeologists

have appealed to the local community to help them record them before they are gone.⁹

At the other end of the Earth, in Antarctica, the bases built by the early explorers of the continent remain exactly as they were left at the beginning of the last century, complete with jars of mustard on pantry shelves and socks hanging on laundry lines (Figure 3). These explorers' huts are time capsules of another age, filled with undiluted information about the lives of the men who built them and the adventures they had. In the winter of 2007, the hut of Captain Robert Falcon Scott was bombarded with more than 100 tons of snow over the course of a few months, far more than

Figure 3. Interior view of Ernest Shackleton's hut, Antarctica. Photo courtesy of World Monuments Fund.

had previously been recorded, thought by some to be caused by warming temperatures. Interestingly, our knowledge of historic levels of precipitation is based in part on the records that the original explorers kept. They were interested in climate science and recorded some of the first scientific data on climate fluctuations in Antarctica—information that is used to track climate change today.

The inclusion of the explorers' huts on the 2008 Watch List was met with skepticism from some members of the public, and WMF was contacted by one scientist who pointed out that the increased snowfall might have been caused by factors other than global warming.¹⁰ On the other hand, we also heard objections based on the idea that Antarctica was not melting “that fast,” i.e., that it would be at least 50 years until substantial portions of the land ice on the continent would melt. As the caretakers of sites that are hundreds, if not thousands of years old, preservationists must view a threat of loss in fifty years as imminent. Indeed, the fact that we can point to changes that are rooted in the time scale of human history may be our most effective strategy in supporting public action to halt climate change.

Not all climate change threats are about ice and snow and water lines. In Africa, huge areas of the continent, and particularly the wide strip of land known as the Sahel, are experiencing drought and desertification, and when it does rain, it often rains more intensely.¹¹ Increasingly dramatic



shifts between wet and dry and hot and cold across the Sahel and in other parts of Africa are also wreaking havoc on agriculture and people, as well as cultural heritage.

The Chinguetti Mosque, in Mauritania, was founded in the 9th century and was once a stop on the caravan trade route through Africa (Figure 1, no. 3; Figure 4). It was also an important center of Islam, and today a major collection of medieval Islamic manuscripts is housed there. A World Heritage site that was first included on the Watch List in 2006, the Chinguetti Mosque is now threatened by desertification, which brings with it not just encroaching sands that cover and erode building material, but also the danger of flash flooding.¹² When heavy rain falls in these areas, the dry earth and sand cannot absorb water quickly



Figure 4. Chinguetti Mosque, Mauritania. Photo courtesy of World Monuments Fund.

enough and it rushes through the site and into buildings, causing dangerous conditions as well as damage.¹³

Also in West Africa, another World Heritage site, known as the megalithic circles of Senegal and Gambia, is also threatened by drought and dramatic wet-dry cycles. The vast area covered by these remarkable assemblages has suffered drought

and increasingly dramatic temperature fluctuations in recent years (Figure 1, no. 4; Figure 5). The sharp changes in temperature and humidity have caused many of the stones to crack, but more damaging for this unique landscape is soil erosion. Drought has caused a substantial loss of vegetation and, with it, soil erosion, which is exacerbated when it does rain. The significance



Figure 5. Megalithic circles in Senegal. Photo courtesy of World Monuments Fund.

and grandeur of the megalithic circles, like those of Stonehenge and other Neolithic sites around the world, depends in large part on their arrangement within the landscape. As the soil beneath them weakens and moves, however, stones topple over—leaving piles of rocks, in essence—and destroying much of the meaning and visual impact of the monuments.

In the Himalayan region of northern India, traditional temples and towns appear as simple mud and wood structures set in a spectacular landscape (Figure 1, no. 5; Figure 6). Inside, these apparently humble buildings have beautiful and complex interiors, decorated with elaborate paintings and brightly colored sculpture (Figure 7). A traditionally arid climate, this region used to experience rain largely as light sprinkles, but in recent years the area has experienced

short, but heavy, downpours that the traditional mud structures are simply not equipped to withstand.¹⁴ In the longer term, these temples and towns are also threatened by melting glaciers of the Himalayas, which will themselves cause flooding through runoff and glacial lakes bursting their banks. The experience of getting to these buildings, along with their setting in the natural landscape, are closely tied to their significance and purpose. As we think about how to preserve the cultural heritage of this region, it is important to consider this context. If we wait too long to act, we may be forced to take emergency measures that will have a dramatic effect on this context—such as the construction of incongruous shelters or the extraction of precious interior paintings and sculpture for their protection or dispersal to museums. These



Figure 6 (above). General view of the town of Leh, India. Figure 7 (right). Interior decoration at the Sumda Chunn temple in Ladakh, India. Photos courtesy of World Monuments Fund.

sorts of salvage responses will dramatically alter these sites, and the meaning for the people who built and use them, and to those who journey to see them, would be lost.

In another part of Indian subcontinent, the low-lying nation of Bangladesh has always struggled with flooding. The historic city of Sonargaon, which contains thousands of extraordinary and elaborate buildings constructed by aristocrats and kings in the Middle Ages (Figure 1, no. 6; Figure 8), has been deteriorating for years because of neglect and lack of resources, but this deterioration is also exacerbated by flooding caused by the loss of natural barriers—such as mangrove forests—and by ris-



ing seas. Bangladesh is also one of the most vulnerable countries in the world when it comes to climate change, both as a result of



Figure 8. A flooded historic building in Sonargaon, Bangladesh. Photo courtesy of World Monuments Fund.

its geography and its economic status. Even conservative estimates of future sea level rise would result in flooding that would displace tens of millions of people in Bangladesh.¹⁵ Flooding on this scale, combined with the poverty and lack of infrastructure in this densely populated country, will cause a humanitarian crisis of enormous proportions, and by that point, the protection of cultural heritage sites may no longer be feasible.

As we consider these issues, we need only look to Louisiana for an example of such a scenario. New Orleans, which is home to one of the largest collections of historic buildings in the country, presents a case study (Figure 1, no. 7). New Orleans is not only a cautionary tale of natural disasters waiting to happen—and possibly more frequently and with greater severity as the

Earth warms—it is also an example of how cultural heritage can and will be lost in those disasters if we don't prepare for them, and, how deeply that loss will be felt. Thousands of the distinctive houses of New Orleans were damaged by Hurricane Katrina, but many more have been destroyed since the storm through short-sighted demolition in the effort to clean up. Now, a substantial part of the fabric of the city—its character and history and one of the reasons people want to go there—has been lost. Now that the disaster has passed, the people who lived in New Orleans before the storm want to return to their brightly colored shotgun houses and Creole cottages. In addition, the distinctive built environment is a key attraction for visitors, whose funds fuel an important economic engine of the city.

The historic buildings of New Orleans are not simply charming for tourists and residents, however; they are also practical architectural responses to the climate—built up on piers in case of floods (of normal levels), constructed out of cypress wood that comes from the nearby swamps and is more resistant to damage caused by humidity, and made with high ceilings and windows that provide cross breezes in hot weather. Tearing down and replacing these houses with buildings that could be constructed anywhere not only destroys the character of the city and its history, but is also bad environmental strategy.

Responses

A key challenge of addressing the threats posed by climate change is how to convince people to act collectively towards a common goal and to do so without the promise of immediate or visible results. Indeed, if effective, much of the action required to halt global warming will have little or no discernible effect for most people, as the goal of these actions is in large part to prevent change. Convincing people to radically change their behavior in order to maintain the status quo is an exceedingly difficult task.

Climate change is a global threat, but preservation, like politics, is local. Most of the work of historic preservation is done on the state, city, or even neighborhood level, and it has long been difficult to coordinate efforts on a wider scale—to agree on priorities, and to make collective decisions about what to spend our money and time on, and on what to save and what to sacrifice. In order to effectively prepare for and adapt to the impacts of climate change and to use historic preservation as a means for mitigation of its effects, however, preservation-

ists—and natural conservationists—must think differently and work together in new ways.

This presents a number of challenges, but it is clear from some examples of how we are working today that new approaches are necessary. One such example is the conservation project now under way at Fort Jefferson in the Dry Tortugas (Figure 1, no. 8). Constructed on a spit of land off the southern tip of Florida and part of Dry Tortugas National Park, Fort Jefferson is the object of a multi-year, multi-million-dollar conservation effort led by the National Park Service.¹⁶ Fort Jefferson is endangered by exposure to salt air, rusting internal metal structures, and the eroding ground on which it was built. This building is one of many coastal historic sites in the U.S. that are threatened by rising sea levels and other threats posed by climate change, and although many sites may be protected from those threats through thoughtful conservation and maintenance, it is important that we consider the question of how to allocate resources for these efforts. Predictions about climate change impacts would seem to indicate that Fort Jefferson is likely both to experience significant further damage as a result of increasingly severe hurricanes and storms, and, by the end of the century, to be frequently flooded if not largely under water.¹⁷ With sites like this in mind, the question of allocating resources must be expanded to consider new factors. For instance, New Orleans is a city of hundreds of thousands of people that is also in danger and already suffering, and many more historic places where people live and visit around the country and the world, and which could arguably be considered more important to human history, are also vulnerable. In addition to historical significance,

the cultural heritage community's response to climate change must take into account how historic sites contribute to or are part of the human habitat, and how protecting them may support efforts to adapt to and mitigate climate change threats overall. This includes incorporating historic sites into sustainable development and economic planning. This is particularly important as we consider the potential impacts on major cities such as London and New York. In London, the Thames Barrier already works to keep that river from overflowing its banks and flooding the city—and there are concerns about how long it will continue to be able to do so.¹⁸ In New York, much of the city was built on reclaimed land, and densely populated areas—not to mention international airports that move millions of people and tons of goods each day—already are at or close to sea level. These and other cities all contain historic sites that are threatened by climate change, and which will only become more vulnerable as humanitarian and economic concerns grow more urgent.

It is time for the cultural heritage community—together with governments, NGOs, and other stakeholders—to make some hard decisions. One way to do this would be to undertake a sort of “triage” for cultural heritage, in which three main categories of sites are identified:

- Sites that are doomed.
- Sites that are so important that we are willing to save them at almost any cost.
- Sites that could be saved if we plan ahead and consider climate change in conservation efforts.

For those sites that are doomed, we must accept these losses rather than invest time and money in them. Like the caretakers of Herschel Island are already doing, we

need to stop trying to shore up doomed places and start documenting them now, or else we will lose them from history forever.

For those sites that must be saved at all costs, we have to start thinking about this now, and try to build some kind of consensus about what places humanity simply cannot live without—and for which we are willing to take heroic measures to protect. These sorts of heroic measures have been taken before, but they are expensive and can be controversial. A few decades ago, with the construction of the Aswan Dam in southern Egypt, many ancient monuments were going to be flooded and the world decided that it was worth it to literally move mountains to save the great temple of Abu Simbel, built by the pharaoh Ramses in the second millennium BC. The temple at Abu Simbel was originally sited on a spot along the Nile meant to impress Nubians sailing up to Egypt. To protect it from flooding that would come with the construction of the Aswan Dam, the temple was moved to another site. The imposing royal message to the Nubians was sacrificed, but Ramses and his temple were saved.

In Venice, a city that has been struggling with water since the day it was built, huge engineering projects to protect the city are underway—giant floodgates and breakwaters are being built to protect it. How long this will hold off the waters is anyone's guess.¹⁹ The time is now to begin to identify these save-at-all-costs sites around the world and determine which are the most vulnerable to climate change impacts.

The third category—those sites that can be protected through strategic planning and interventions—is the largest and the most complex. It includes the many sites around the world that require conservation and protection for many of the usual rea-

sons—neglect, lack of resources, exposure, old age—but which will suffer more dramatically as a result of climate change. These include such places as Kilwa Kisiwani in Tanzania, where WMF is developing its first project that specifically seeks to address climate change impacts on a cultural site by demonstrating new ways to approach cultural resources within their natural environments (Figure 1, no. 9). Kilwa is a World Heritage site on the east coast of Tanzania that was occupied from the Middle Ages through the Colonial era. Preserved there are the ruins of early palaces, forts, houses, and a mosque, all set within a picturesque seaside landscape (Figure 9).

The buildings at Kilwa are deteriorating as a result of coastal erosion and exposure to salt air and wind. These problems will be exacerbated by global warming and rising sea levels, but right now they are also

caused by the loss of the natural protective barrier along the coast—mangrove forests. WMF is working with the Tanzanians to preserve the Gereza Fort at Kilwa and to restore mangrove barriers at the same time. While this probably won't save the site for centuries, WMF chose this project to serve as an example of the new way that we have to think about cultural heritage preservation—shoring up the sites of Kilwa without addressing the land beneath them is pointless. If we can demonstrate successful alternatives, however, perhaps we will be able to encourage our colleagues, governments, and supporters to think this way about other places and work with us to make smart decisions in the future.

This is just one example of the types of integrated, multidisciplinary approaches that historic preservationists need to consider and develop. If we want to preserve

Figure 9. The Gereza Fort at Kilwa Kisiwani, Tanzania. Photo courtesy of World Monuments Fund.



our cultural heritage in its natural habitat, which happens to also be our own, we must approach the work of cultural heritage preservation from new angles. We have to ask ourselves: Do we want to experience the wonders of the world in the future as their creators did—in the deserts, jungles, plains, and cities in which they were built—or do we want to consign them to museums and display cases, or risk losing them completely? The answer for those of us charged with preserving cultural and natural heritage is clear, but we have a long way to go to explain these threats and their consequences to the wider public.

An important part of our efforts to change the way the cultural heritage field as well as public policy address the threats posed by climate change will be specialists' ability to demonstrate that preserving existing historic buildings is an inherently "green" activity. There is much to learn from those human-made structures that have survived for generations, including how to design for repair and maintenance instead of replacement, how to build structures that are well-suited to their natural environment, and how traditional methods and locally available resources can support sustainable construction along with economic and community development.

Effective public education and change depends on collaboration. The cultural heritage preservation and environmental conservation movements share a common mission to protect and sustain existing resources; however, there has been limited collaboration between the two disciplines. The threats posed by global climate change present us with the need and opportunity to

develop an integrated approach to preserving and sustaining the built and natural environments by pooling our resources, consolidating our efforts, and sharing our skills and experience to further our shared goals. Such an effort would bring together the fields of nature conservation, cultural heritage preservation, and sustainable development to develop strategies that will increase public interest and awareness of efforts to address climate change threats; gather and disseminate information about climate change threats to cultural and natural resources among public and professionals; and undertake projects that demonstrate core principles and strategies.

Additionally, on the issue of mitigation of climate change threats, while it is important for cultural and natural heritage professionals to set an example by reducing our own carbon footprints, there is much more that we have to contribute. The work of heritage conservation itself can also contribute substantially to mitigation efforts. The environmental benefits of preserving historic buildings are many, including the simple fact of reusing and repairing instead of replacing existing structures, as well as the advantages of using traditional, locally sourced materials that are well suited to local environments and therefore require fewer resources to heat and cool and maintain. It is also essential that we more systematically integrate natural and cultural heritage conservation, that is, undertake projects that focus on the conservation of cultural sites along with the natural environment that surrounds them. In short, we have much to learn, but also much to teach, and the time to act is now.

Endnotes

1. The panelists were Rebecca Beavers, coastal geologist, Geologic Resources Division, Natural Resource Program Center, National Park Service; Dinu Bumbaru, policy director for Heritage Montreal and secretary general of ICOMOS International; and Charles Allen III, assistant director for external relations of the Center for Bioenvironmental Research (CBR), Tulane and Xavier Universities, and president of the Holy Cross Neighborhood Association of New Orleans, Louisiana. The session was organized and chaired by the author.
2. Information about WMF, the Watch program, and individual sites on the list are available at www.wmf.org.
3. IPCC 2007a, 30, 32, Figure 1.2; IPCC 2007e, 620.
4. See Yukon Environment, *Herschel Island–Qikiqtaruk Territorial Park Management Plan*, 14, 17–18, for a discussion of climate change and other stressors on the site.
5. The Tentative List entry for the site can be found at <http://whc.unesco.org/en/tentativelists/1939/>. See also Colette et al. 2007, 58–59.
6. The film is being developed by Fresh from the Yukon, Inc., Productions.
7. For a discussion of climate change impacts and adaptation strategies in Norway, see Sygna et al. 2004. A news story in Oslo last year about a collapse of an unoccupied apartment building cited increasingly severe weather caused by global warming as a factor in its deterioration (Berglund 2007).
8. Anisimov and Reneva 2006, 172 and passim; IPCC 2007d, 486.
9. For information about the shoreline archeology project in Baleshare and other parts of the islands, see www.shorewatch.co.uk/index.htm.
10. WMF is grateful to A.J. Monaghan for the information he provided. For some of his work on the subject, see Monaghan, Bromwich, and Schneider 2008, and Monaghan, Bromwich, Chapman, and Comiso 2008. Analysis of climate change impacts and development of predictions remains a subject of some debate among climate scientists. For an overview of some of the questions that continue to be debated, see IPCC 2007c, 663 and passim.
11. On desertification, erosion, and other soil degradation in West Africa, see Elasha 2006, 7, Figure 2, 19, and 16–17, 19–20 for discussion of changes in rainfall patterns. See also IPCC 2007f, 436, for a brief overview.
12. Cassar et al. 2007, 24, Box 8.
13. A historic example of the dangers of flash flooding to desert sites is the ancient Nabataean city of Petra, where the Siq—a deep and narrow valley that leads into the city—was outfitted with elaborate water management systems by its ancient residents. In 1963, several tourists were killed as a result of flash flooding in the Siq and Jordanian authorities have since taken steps to prevent flooding.
14. For information about rainfall patterns and variability in this region, see IPCC 2007d, 471–473.
15. IPCC 2007d, 484–485.
16. Information about the restoration project can be downloaded from the NPS website: www.nps.gov/drto/upload/Restoration%20site%20bulletin4.pdf.

17. IPCC 2007e, 630 and passim.
18. Connor 2008. For a general discussion of threats to London cultural heritage, see Colette et al. 2007, 66–69. See also www.environment-agency.gov.uk for information about increased use of the Thames Barrier in recent years and plans for the future.
19. For recent discussions of the barriers project (popularly known as the “Moses” project) to protect Venice, see Merali 2002; Cocks 2005–2006, 23–27; and Jamiolkowski and Ulam 2005–2006, 28–29. For a case study on Venice by the UNESCO World Heritage Centre, see Colette et al. 2007, 70–71.

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