

## Climate change and cultural resources: Navigating a precarious future

*Margaret D. Breuker and Naomi Kroll Hassebroek*

**Climate change is not on our doorstep; it is in our house.** Parks around the world contain abundant examples of how climate change is affecting the resources within. Here in the United States, climate change is giving a new urgency to the National Park Service (NPS) mandate to preserve places that tell the story of our country's vast geography and complex history "for the benefit of future generations." Wildfires encroaching on Bent's Old Fort National Historic Site (pictured on the cover of this issue of *Parks Stewardship Forum*), flooding in Yellowstone National Park—these recent events shock and surprise us as if, somehow, units of the national park system should be immune to the realities of our times.

As specialists at the Historic Architecture, Conservation and Engineering Center (HACE) for Region 1 at NPS, focusing on preserving historic structures, monuments, and museum collections in national parks stretching from Maine to Virginia, our work on cultural resources increasingly addresses the consequences of a changing climate. Naomi has been responding to extreme weather events for two decades. In 2003 she was part of an emergency response team performing triage conservation on thousands of archaeological artifacts at Historic Jamestown that had been saturated by Hurricane Isabel's storm surge. At the time, Isabel was perceived to be a singular historic event. By 2012, surveying damage to structures in New York Harbor in the aftermath of Superstorm Sandy, she understood that we were in fact witnessing a new environmental reality. Damage assessment of and repair from smaller events—water infiltration in houses whose historic gutters are now undersized, flooding in buildings on sites with inadequate storm drainage systems—have since become a regular part of the workload.

Margaret became involved with climate change while working on facilities projects involving HVAC (heating, ventilation, and air conditioning) systems in NPS historic buildings, visitor centers, and museums. Margaret's knowledge of how materials react to environmental changes would aid projects by finding the "canaries in the coal mine" or damage to objects from poor interior climates in conjunction with the mechanical system assessment. As it became evident that climate extremes were becoming much more frequent, it also became increasingly difficult to protect the collections from the effects of exterior temperature and humidity using modern systems. HACE has since pursued an alternative: the design of specific interior microclimates that are not only better for the buildings and cultural objects contained within, but also more sustainable.

When we were first approached by Rolf Diamant with the idea of a *Parks Stewardship Forum* issue that explored climate change and cultural resources, we welcomed the opportunity to step outside our frequent practical engagement with the topic, examining themes from a broader level and inviting our colleagues from NPS and beyond to share their work to the same end.

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A visitor takes in the moonrise outside historic Fort Jefferson in Dry Tortugas National Park. This is one of the largest 19th-century American masonry fortifications. Sea level rise poses a significant threat to the fort. However, all seven islands of Dry Tortugas are under constant threat of inundation. Several of the islands disappear seasonally due to rising seas, including Middle Key. Bird Key has disappeared altogether. NATIONAL PARK SERVICE

Madeline Cooper’s piece “Mapping and the future of caring for the past: Using GIS as a tool to understand the risk of emergencies to cultural heritage collections” examines the history of emergency preparedness and disaster response in conservation and describes a GIS-based strategy she and others have piloted for identifying real-time and projected weather-based threats to cultural heritage institutions. Such tools are accessible to institutions of all sizes and budgets and can be instrumental to understanding risk and preparing for an event and its aftermath. Preparation is always a significant factor in the effectiveness of any emergency response effort, and in the success of disaster mitigation.

The development of an NPS service-wide strategy for climate change response is discussed in Jeneva P. Wright and Morris (Marty) Hylton’s “Plan the work, work the plan: An introduction to the National Park Service Climate, Science, and Disaster Response Program.” They describe guidelines and protocols for assessing current and future vulnerability of resources within parks, prioritizing interventions based on resource importance, and mitigating climate change’s effects on structures. Wright and Hilton are tasked with the NPS mission, cognizant of politicization and other challenges, and rooted in a series of previous NPS climate response frameworks. The program embraces partnerships and stakeholder engagements, Tribal and descendant groups, local governments and cultural resource agencies. Purposely located and co-managed alongside the Natural Resources Stewardship

and Science Directorate, NPS recognizes the strong relationship between cultural and natural resources, and the benefit of an integrated approach. The authors also touch on the question of relinquishment: when should, or must, the ephemerality of resources be acknowledged?

The question of loss is particularly relevant to resources threatened by sea level rise—coastal structures and archaeological sites, whose contents are diminished daily by shoreline erosion. In “Strategies for meaningful engagement: A commentary on collaboration in archaeological climate adaptation planning,” Courtney Hotchkiss, Erin Seekamp, and Alicia McGill explore the necessity and methodologies of collaboration with Tribal Nations whose pre-contact material history is largely contained within disappearing coastal sites. They note a different cultural perspective of loss by some Tribal partners, one that perhaps has relevance to resources beyond these cultures.

Climate change also threatens historic house museums and their collections, resources that are particularly susceptible to rising environmental temperatures. Due to a lack of insulation in their historic construction, house museums are prone to significant solar heat gain, creating uncomfortable conditions for staff and visitors alike. However, climate control systems in buildings can create a vicious circle—contributing to greenhouse gas emission footprints, or urban thermal “hot spots,” as well as increased energy consumption. The idea of using microclimate techniques to solve specific indoor climate problems, or to protect specific materials or collections, is a solution widely used in Europe, and discussed in Bart Ankersmit and Marc Stappers’ paper, “A brief overview of climatization strategies of historic houses in the Netherlands.” Microclimates reduce the need to enforce a climate on the *entire* building when the problem that needs to be solved may be just in one location (say, the top floor), or for a particular purpose (climate control for a veneered piece of furniture). Ankersmit and Stappers discuss the effectiveness and sustainability of climate zones in a unique 1770 summer house outside of Utrecht, as well as numerous other unique examples of site-specific microenvironments. Adaptations, such as personal climate control systems, must be made for staff and visitor comfort.

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Climate change creates conditions conducive to larger, more frequent fires, particularly in the American West. On April 19, 2020, the Tunnel Fire entered Sunset Crater Volcano National Monument and burned over the park in its entirety. NATIONAL PARK SERVICE





A wayside exhibit at Hagerman Fossil Beds National Monument puts climate change into geological-time perspective—and offers some suggestions for actions people can take today. The National Park Service has begun to speak frankly about the threats climate change poses to national parks and park values, but many difficult conversations lie ahead. NATIONAL PARK SERVICE

In many instances, these techniques are a reaction *to* changes in climate—keepers of museums and historic buildings are simply reacting to increased temperature and humidity changes in their structures. In July 2012, the Department for Communities and Local Government in the United Kingdom published a report, *Investigation into Overheating in Homes*, to better understand the impact of heating in the context of current and predicted climate change conditions in the UK.<sup>1</sup> This significant assemblage of research provided insight into the numerous factors that contribute to heat gain in dwellings in the UK. Not surprisingly, the authors found that solar gain was the most significant cause of overheating.<sup>2</sup> Among their suggested solutions are more passive cooling strategies, such as opening windows; the use of shutters, sunshades and interior curtains; tree planting; and humidistatic control (the acceptance of cooler exterior air when interior air is warmer).<sup>3</sup> This more thoughtful, evidence-based approach to extreme temperatures and humidity is discussed by David Bittermann in “Why do we keep doing this? An argument for informed environmental assessments.” Bittermann and his staff were often called upon to investigate mold outbreaks in historically furnished museum buildings. The first solution often proposed is better climate control: dehumidification, or an entirely new HVAC system. Sometimes, however, the answer is much simpler: housekeeping. Experiments show that microbes in dust are mainly bacteria that can grow with a population equal to or higher than those in outdoor soil samples.<sup>4</sup> Prevention includes combining a strong monitoring program of historic surfaces where mold develops (underneath dining and kitchen tables, wall fabrics, chair backs, etc.), climate monitoring, and a greater frequency of *cleaning* these surfaces.

This confluence of the natural world and cultural material is undeniable. In “Climate change and Martin Van Buren National Historic Site: Building a holistic plan,” the park’s superintendent, Megan O’Malley, discusses how natural and cultural disciplines can come together to better interpret the impacts of climate change on US national historic sites. This collaboration is not only relevant, but essential if we are going to take a holistic approach to climate change and preservation efforts. O’Malley stresses the importance of monitoring weather patterns that give both natural and cultural professionals the critical information they need to make decisions about future actions. The measurement of yearly rainfall is an example of data crucial to natural resource stewardship. This helps to better understand climate change cycles of flooding or drought. Periods of drought are not only devastating to agriculture but can mean a higher concentration of pollution levels that are not routinely washed off from building and monument surfaces, leaving nutrients and favorable conditions for biological organisms to thrive.<sup>5</sup> This, in turn, can cause significant biological staining and physical damage.<sup>6</sup> Extreme weather puts more stress on both natural landscapes and cultural resources, which are inextricably intertwined. The cultural and natural worlds often overlap in indistinguishable lines, as in NPS sites themselves. Carolyn Monastra’s photographs of climate effects in parks and other publicly stewarded lands (“The Witness Tree project: A portfolio”) give a stunning, sobering visual account of the threats that affect both natural and cultural resources, showing the resiliency (at present, at least) of the natural landscapes and the species that comprise them.

*People have made great strides across the globe to protect cultural resources through community engagement; evidence-based data analysis; local, state/provincial, and national funding; and legislation.*

What else can be done to help navigate the future of our culture resources? Taking action. In Stephanie Shapiro and Sarah Sutton’s “Cultural heritage resources in climate action” we come to understand that through organized coalitions, people have made great strides across the globe to protect cultural resources through community engagement; evidence-based data analysis; local, state/provincial, and national funding; and legislation. Public knowledge is key: making sure that we don’t lose sight of the fact that the future relevance of our cultural resources depends upon their continued recognition. Public discourse and exposure to the issues relating to cultural resources and climate change is vital if we are to navigate this precarious and unknown future. With the articles that follow, we hope you will be inspired to share the research, policies, and unique solutions presented here to advocate for the preservation of our collective cultural past.

#### ENDNOTES

1. Andrew Cripps, Paul Wilkinson, Michael Davies and Malcolm Orme, *Investigation into Overheating in Homes: Literature Review*, AECOM 1-122. London: Department for Communities and Local Government, July 2012.
2. Ibid., p. 11.
3. Ibid., p. 9.
4. Ibid., p. 23.
5. Javier Reyes et al., “Influence of Air Pollution on Degradation of Historic Buildings at the Urban Tropical Atmosphere of San Francisco de Campeche City, Mexico,” in *Monitoring, Control and Effects of Air Pollution*, Andrzej G. Chmielewski, ed. (London: IntechOpen 2011), pp. 13:201–226.
6. J.J. Ortega-Calvo, X. Arino, M. Hernandez-Marine, and C. Saiz-Jimenez, “Factors Affecting the Weathering and Colonization of Monuments by Phototropic Microorganisms,” *The Science of the Total Environment* 167, pp. 329–341 (1995).



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#### On the cover of this issue

Climate change creates conditions conducive to larger, more frequent fires, particularly in the American West. As a result, historic structures and artifacts are at greater risk of fire damage. The Bent's Fort Fire started on the morning of April 12, 2022. Approximately 85% of the national historic site's 800 acres burned. Thanks to the efforts of fire crews, the reconstructed adobe fort was undamaged. | [NATIONAL PARK SERVICE](#)