# Preemptive Strategies and Collaboration for Emergency Planning: Lessons Learned at Vizcaya in Miami

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Fig. 1. The Barge, Vizcaya Museum and Gardens, Miami, Florida, built 1914–1922, during Hurricane Irma, looking east, September 12, 2017. All images courtesy of Vizcaya Museum and Gardens.

Through the lens of Hurricane Irma's impact at Vizcaya Museum and Gardens, this paper explores preparedness and partnerships for building resilience at heritage sites.

A changing climate is categorically reaffirming what preservation professionals have long known to be true: Cultural patrimony is anything but static. Sites, structures, and objects are in a perpetual state of transformation, constantly responding to fluctuations in environment, use, and degree of care. Almost irrespective of context, heritage professionals are fundamentally charged with thoughtfully and strategically managing change. This is increasingly true, as heritage sites grow progressively more vulnerable to disruptive events, be they climatic, economic, or social.[1]

Few places in the United States exhibit change more theatrically than South Florida, where the natural and built environments appear to be in a proverbial tit for tat. Practicing preservation in an unsympathetic marine environment is a relentless battle against salt and moisture, vegetation and pests. Conservation-management planning at Vizcaya Museum and Gardens in Miami, Florida, is equally about emergency planning as it is about maintenance (Fig. 1).

Miami's summers are hot and long, while its winters are growing warmer and wetter. Nuisance flooding is commonplace in multiple neighborhoods.[2] Pests are abundant and menacing. The environment is palpably changing. Artist and writer David Campany has written of Vizcaya, "The sea is coming. Perhaps not today, but it is coming."[3]

The 2017 Atlantic hurricane season was one of the most active, deadly, and destructive in history.[4] By means of lessons learned from Hurricane Irma's impact on Vizcaya, this paper explores the intersection of preparedness and mitigation, pragmatic strategies for bolstering site-specific readiness, and the merits of partnership between heritage practitioners, institutions, and their communities toward building resilience.

## The 2017 Atlantic Hurricane Season

The 2017 Atlantic hurricane season remains the costliest on record.[5] The six major hurricanes, including multiple Category 5 storms that made landfall, caused nearly $300 billion in damage.[6] FEMA considers Hurricanes Harvey (August 2017), Irma, and Maria (both September 2017) a "historic disaster" collectively—events so catastrophic they incited changes in legislation and agency operations. The storms' names were retired to recognize the number of lives lost and destruction left in their wake.

Hurricanes are categorized by a measure of wind speed from 1 through 5 on the Saffir-Simpson hurricane wind scale. According to the National Oceanic and Atmospheric Administration (NOAA), numerous other factors contribute to a storm's potential impact, including its size, air temperature and density, atmospheric pressure and stability, rainfall, ocean surface temperature, and wind shear, as well as shoreline topography and hydrographic conditions, land use and development, and storm direction when it makes landfall.[7] In the U.S., flooding from storm surge is more deadly and more damaging than the combined impact of all other hurricane-related threats, including wind.[8]

Hurricane Irma was slated to strike Miami directly as a Category 5. Irma slowed to a Category 3 when it made continental landfall and, mercifully for Miami, veered west, brushing the city with her "dirty side."[9] The outer bands of the storm brought wind gusts of approximately 100 miles per hour, according to the National Weather Service, causing considerable damage to portions of the city. Because the storm was so large, rain, wind, and aggressive wave action were prolonged, lasting over 12 hours. Storm duration affected the degree of damage to the landscape and infrastructure, with a surge that measured nearly 4 feet, flooding the neighborhoods of Brickell and Coconut Grove.[10]

## Resource Strains

In any disaster, public safety is paramount. In advance of Irma, Florida's then governor Rick Scott issued evacuation orders for 18 counties, resulting in what was one of the largest population dislocations and sheltering missions in U.S. history.[11] Southbound lanes of Interstates 75 and 95 were reversed to expedite the evacuation of over 6.8 million residents in advance of the storm (over 30 percent of residents in the third-most populous state in the country).[12]

Florida experienced fuel and water shortages before, during, and after the storm, and 15 million residents lost power.[13] Between Hurricanes Harvey and Irma, it was nearly impossible to purchase or rent any portable generators, fans, or dehumidifiers in the eastern U.S.[14] With Hurricane Maria bearing down on Puerto Rico, labor was also in short supply.

## The Intersection of Preparedness and Mitigation

FEMA defines "mitigation" as actions taken to reduce or eliminate the long-term risk to human life and property from hazards; it defines "preparedness" as the deliberate, critical tasks necessary to build, sustain, and improve the operational capability to prevent, protect against, respond to, and recover from incidents.[15] Both terms acknowledge that emergency planning is iterative, cumulative, and ongoing, as both aim to progressively reduce risk and associated impacts. Both require the commitment and collaboration of diverse stakeholders and disciplines. While published data is focused on mitigation, both offer direct and indirect cost benefits.[16]

Mitigation efforts truly take time, much like recovery, and tend to be mired in bureaucracy and stymied by expense. Meanwhile, communities may be pummeled by cascading events in short succession, causing episodic and progressive damage that can complicate and expand existing scopes of maintenance, repair, and mitigation.[17]

Underscoring the distinction between hard infrastructural improvements and

softer preparedness initiatives is particularly important in the context of historic sites. While adaptive efforts are often costly, intensive, and potentially invasive, preparedness activities and skill building are typically more readily achievable. Communities, and site management, can consider public-assistance programs in addition to locally available resources to cover near- and longer-term readiness. Furthermore, sites and institutions should be encouraged not only to rely on community-based preparedness and assistance but also to focus on their own readiness. Cultural sites may find themselves quite isolated when a region or municipality is incapacitated, especially if its staff is personally affected. Heritage practitioners can engage regionally with one another and with emergency-management professionals to expand networks, share resources, and ultimately build resilience.[18] The preservation community should be encouraged to support sites in preparing for greater self-sufficiency.

## Vizcaya Museum and Gardens

Much of South Florida's infrastructure cannot be protected through conventional civil-engineering solutions due to its geology: Water comes from multiple directions, seeping up through the region's foundation of porous limestone.[19] Floridians see the tangible and existing consequences to climate change and its denial in real time, as much of the state is challenged with how to possibly accommodate more and more water.[20] Florida's heritage sites are often not viable candidates for typical engineered adaptive measures, such as levees, floodwalls, and many flood-proofing techniques; therefore, alternative options for protection—as well as interpretation, presentation, and use—must be developed. There are no current municipal plans for hard infrastructure improvements to help protect Vizcaya Museum and Gardens from future storms or rising seas. Site stewards are responsible for devising and investing in measures to safeguard the landmark property.

Vizcaya was constructed between 1914 and 1922 along the shores of Biscayne Bay in Miami, Florida (Fig. 2). Designed by architect Francis Burrall Hoffman Jr.,

Fig. 2. Vizcaya, view looking west at the east facade of the Main House, the Barge, the Tea House, at left, and Boat Landing, at right, from Biscayne Bay. Photograph by Bill Sumner, 2010.

artistic director Paul Chalfin, and landscape architect Diego Suarez, the estate was the winter home of James Deering, an agricultural industrialist from Chicago and vice president of his family's conglomerate, International Harvester. Vizcaya—a National Historic Landmark, an accredited museum, and a public garden—is one of the most complete remaining examples of a European-inspired estate from the nation's Gilded Age. The site includes 22 historic structures, a collection of over 2,500 objects that span 2,000 years, an archive with original documents detailing the design and construction of the estate, 10 acres of formal gardens, and a native hardwood hammock.

Fig. 3. The Barge at Vizcaya, looking south, ca. 1920. Courtesy of the Ella Holgersohn Collection.

Fig. 4. The North Walk at Vizcaya, looking east, after the Great Miami Hurricane, 1926.

Reduced from its original footprint, the site now occupies over 80 acres with more than 2,300 feet of shoreline. Several structures along Vizcaya's waterfront project into Biscayne Bay, including the iconic Barge, a limestone-clad island made to appear as a ship. The Barge, accessible only by gondola, features a sculpture program by famed nineteenth- and early twentieth-century sculptor Alexander Stirling Calder. It was conceived as a folly, as well as a breakwater, to protect the east elevation of the Main House (Fig. 3). The house is situated within 85 feet of a retaining wall at the shore, its easternmost elevated terrace a mere 50 feet from the water's edge.

Given its location, storms and sea-level rise are Vizcaya's primary threats. The site has endured nine major hurricanes and countless tropical storms in its 105-year history, sustaining major flooding from storm surge as far back as the Great Miami Hurricane of 1926 (Fig. 4). While every storm is different, scenes in their aftermath are notoriously daunting and familiar, offering the opportunity to build upon experience and better prepare for future storms.

## Damage Done

Hurricane Irma broke records for its size and intensity, and Miami barely avoided a catastrophic direct hit. Vizcaya's gardens were submerged by approximately 6 feet of storm surge, exceeding average depths measured elsewhere in the city. An unprecedented amount of water entered the site, according to horticulture personnel and longtime staff at Vizcaya. Water rushed up the North Walk alongside the Main House, filling and overflowing the drained 80,000-gallon swimming pool and flooding the grotto. Bayfront structures, including the Tea House and Barge, sustained significant

losses of stone cladding and decorative elements, and the Boat Landing was substantially destroyed (Figs. 1 and 5). Floodwaters deposited muck, seaweed, and other debris several feet deep throughout the site (Fig. 6).

Vizcaya's Main House has a basement below the bay's water level. The north and east portions of the basement, which are especially close to the bay, are home to the museum's café and shop; the other half of the basement houses the building's infrastructure, including electrical, mechanical, and wastewater systems. After Hurricane Wilma flooded the café with nearly 6 feet of water in October 2005, Vizcaya embarked on an ambitious six-year mitigation campaign, installing an elevated standby generator, an updated pump system, more robust bulkhead protection, new storm doors, laminated glass for flood protection at ground-level fenestration, and less water-sensitive interior finishes in the most at-risk spaces. A transfer-switch failure during Irma denied power to the pumps. This, and a cascade of other deficiencies, resulted in approximately 4 feet of water in the lower floor of the Main House and water inundation in several museum spaces, saturating multiple objects in the collection. Vizcaya sustained an estimated $6 million in damage from Irma.

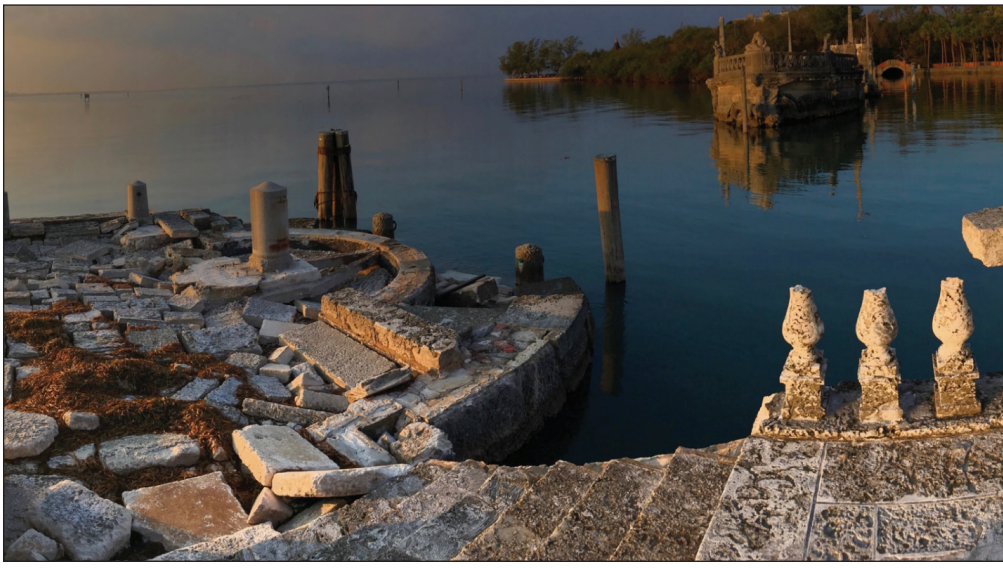
It took nearly three days to pump the water out of the basement. Temperatures after the storm were around 94°F with extremely high relative humidity. Conditions were similar inside the museum, and within 24 hours of the storm, mold began blooming on several surfaces. Vizcaya did not have reliable electricity for three weeks. Staff cobbled together a means for temporary climate control, using fans and small dehumidifiers powered by portable generators. Temperatures remained high, but relative humidity was kept below 60 percent within decorative spaces that house collections.

## Consequential Challenges

Persistent high temperatures and unrelenting humidity in the days and weeks following the storm created problematic microclimates in several remote areas of the museum. Power was restored to the site in phases. During this period, an electrical fire started in a closet. Fortunately, the fire was quickly detected and extinguished, and smoke was not distributed throughout the museum since the HVAC was inoperable, but the experience compounded existing challenges.

Fig. 5. The Boat Landing at Vizcaya, showing damage after Hurricane Irma, September 13, 2017.

Fig. 6. Vizcaya's Marine Garden after Hurricane Irma, September 20, 2017.



Perhaps most unsettling were the rodents and cockroaches, displaced by floodwaters with newfound access to interiors through doors and windows left open to improve air circulation. Pests, too, flooded museum and office spaces, eating through sealed bags of food and nibbling on several collection items in their own desperation. High water expanded mosquito breeding grounds on the heels of Miami's 2016 Zika virus scare. And then there was the pervasive and "inglorious problem of mold."[21] Never had Vizcaya felt more like an ecosystem, a potent reminder of place.

## Partnerships among Institutional Staff, Private-Sector Professionals, and Community Members

Preservation and design professionals can support emergency-management efforts at heritage sites through a variety of plans and partnerships. In an institutional context, staff is the first line of defense in an emergency, ideally supported by an established network of consultants, contractors, organizational partners, response personnel, volunteers, and community members. The following comments on preparedness, response, and short-term recovery efforts reflect various successes and learning opportunities at Vizcaya in the aftermath of Hurricane Irma.

**Build relationships.** Relatively few cultural sites have preservationists, engineers, architects, conservators, or hygienists on staff. Heritage professionals, whether employed in institutions or in private practice, can work to establish formal agreements with each other and allied practitioners as a part of readiness. Procurement for public and some private institutions is arduous, time consuming, and bureaucratic. The process becomes infinitely more so after disasters, particularly if localities are without power, even if only briefly, and time is of the essence. To facilitate swift mobilization for response activities, institutional staff and their consultants can ensure agreements are in place and revisited or renewed when emergency-planning documents are updated annually.

Similarly, heritage sites should budget for and prioritize procuring provisional equipment and support personnel. Locating such equipment in the wake of Hurricanes Harvey, Irma, and Maria was nearly impossible, and HVAC functionality was not safely restored at Vizcaya for a prolonged period.[22] Having a contract in place should increase responsiveness and timely access to critical supplies, equipment, and support. Alternatively, portable equipment in an accessible storage space is a worthy investment, akin to an insurance policy. Perhaps most consequential in preserving the museum's interior in the weeks after Irma was an ad hoc system of fans and small dehumidifiers maintained by Vizcaya staff for protecting fragile finishes and collections from mold growth and associated damage. Use of this provisional equipment was necessary long after power was restored as flood-related damage compounded existing challenges with the failing HVAC system.

Additionally, connecting with first and secondary responders enables stewards to familiarize emergency-management professionals with site, object, and cultural sensitivities and their significance before the throes of disaster. Following Irma, Vizcaya appointed a willing staff member to manage a dedicated call line for the cultural community at the Miami-Dade County Emergency Operations Center during future events. This gave the museum and similar organizations greater visibility and enhanced access to information and response personnel.

**Documentation and maintenance.** Pre- and post-event documentation, including maintenance records, evidence of "emergency protective measures," and photographs of pre-storm conditions, are required by FEMA for public-assistance grants and for insurance purposes. A well-maintained property fares better during and after a disruptive event, but maintenance recommendations often go unheeded in favor of more pressing or intriguing projects. Consultants can objectively stress and contextualize the importance of maintenance. Additionally, where appropriate and applicable, they can use historic construction methods and materials. Traditional materials are more robust in floods and often more easily salvaged.[23]

In 2016 Vizcaya partnered with the University of Florida's Envision Heritage initiative to document several of its most vulnerable spaces, including the Barge. Laser scanning and photogrammetry were used to capture dimensionality and existing conditions with high accuracy and detail. In the absence of measured drawings, elevations and plans generated from the scans were used for grant applications and contracting documents, saving time, money, and effort during mitigation planning. This documentation provides pre-hurricane data for predictive modeling, informing repairs, and reproducing lost elements for an upcoming mitigation campaign.

**Training.** Training helps establish muscle memory and empowers and enables colleagues to be more confident, proficient, and effective in a response scenario. Heritage practitioners can promote a culture of safety at their organizations and among their clientele. Cultural sites need to allocate time and resources to annual or biannual emergency preparation and response training. Events ideally involve a variety of constituents, including allied professionals, emergency-management personnel, and volunteers, and cover heritage-relevant topics as well as complementary curricula. Commissioned emergency-preparedness training at Vizcaya provided valuable opportunities not only for learning and practice among staff and several volunteers but also for team building and connection through recovery efforts. These themes are expanded upon in the following sections.

**Community engagement and support.** Sites should capitalize on volunteerism. During the honeymoon phase of a disaster, communities heal by banding together.[24] When feasible and appropriate, this can be an opportune time to canvass for support from the community, as well as from a broader network.

The catastrophic 1966 flood of the River Arno in Florence, Italy, was the pivotal

event that galvanized the global cultural community to act cohesively and decisively in response to a disaster. A great number of lives were lost; countless masterworks of art were destroyed or damaged; and a million books in the city's low-lying Biblioteca Nazionale were submerged.[25] The resulting devastation was a catalyst for change and innovation in conservation practice.[26]

While the broader cultural community recognized the universal importance of what was lost or affected, a majority of the responders were untrained volunteers, flocking to Florence from across the continent and elsewhere, appreciatively dubbed *gli anglei del fango* or "the mud angels."[27] Nonetheless, such an event underscored the critical importance of local preparedness, and heritage organizations around the world have increasingly focused on local capacity-building initiatives.[28]

In the days after Irma, community members of all ages showed up to Vizcaya in droves. They arrived unprompted, offering to help, after seeing images of the site on local news and social media outlets. Almost every individual had a story about why Vizcaya was personally significant. It was humbling and motivating. It was also another unexpected layer of recovery work that the staff was unprepared to manage. Staff orchestrated a system for organizing, equipping, and mobilizing hundreds of volunteers on the fly, primarily to help clear debris.

Vizcaya has since established a means for registering volunteers through a mobile app to capture contact information and release of liability. Cultivating and training a volunteer corps for emergency preparation, response, and recovery efforts can be initiated in advance of an event. This type of collaboration builds community capacity, helping staff and neighbors share knowledge, skills, and a sense of purpose. Such support may be useful for other projects and points in time.

These examples, while different in scope and scale, demonstrate people's connection and commitment to heritage. Cultural heritage, both tangible and intangible, is tied to history, memory, and tradition. Binding people together through a shared sense of the past, it has the ability to unite and inspire communities. In the aftermath of disasters, heritage property and practice can play vital roles in consensus building. Further, heritage professionals are uniquely equipped to implement a holistic and integrated approach, considering and balancing the interdisciplinary perspectives of various relevant stakeholders in disaster scenarios.

**Accept reality.** There are numerous practical ways that preservation professionals can help cultural sites build resilience for emergencies. But equal consideration should be given to the myriad philosophical questions surrounding significance, value, use, integrity, authenticity, perception, expectation, and, ultimately, reality. In the case of the most vulnerable tangible resources, there simply may not be reliable or achievable means for sustaining their physicality as-is, in perpetuity. Site stewards must therefore prepare to engage in what equates to palliative care. Resilience demands difficult decision-making and radical honesty to better manage change.

Heritage professionals possess the ability to evaluate resources with objectivity and empathy. These skills become particularly relevant for those serving in a consulting capacity to risk-prone or damaged cultural property. Consultants or volunteers may be coming from an unaffected region, and/or they may not share the degree of emotional attachment to place, site, building, or object as the client or the community. For these and other reasons, third-party advisors should be poised to offer informed and sensitive, yet objective, advice and impartial recommendations.

Data from the U.S. Department of Health and Human Services suggests that individuals function with 30 percent less cognitive capability in crises.[29] Emergencies can be traumatic, and response and recovery efforts are exhausting. Mental and physical well-being during response and recovery cannot be overlooked. For institutional personnel, for example, the abrupt and violent undoing of work that took years to plan, fund, and execute is demoralizing. Feelings of grief or of being overwhelmed, disillusioned, and helpless are common.[30] Consultants may be better positioned to prioritize or contribute a dispassionate viewpoint to time-sensitive decision-making immediately following an emergency. Moreover, recovery is slow. Communities continue the process long after storms pass and media coverage subsides, for months, years, and sometimes decades. Institutions are in for a long haul, and their consultants can offer invaluable support and perspective along the way.

In a discussion following Irma, a Vizcaya staff member proposed an eventual relocation of the collection to higher ground or off-site as a long-term preservation approach. While the archive has since been moved off-site, this suggestion, at the time, was widely rebuffed. NOAA's sea-level-rise viewer, using the website's sea-level sliding scale, features Vizcaya specifically, with water visibly creeping up the steps of the east terrace of the Main House.[31] NOAA's intermediate-high sea-level-rise predictions for the years 2060 and 2100 (approximately 3 and 6 feet, respectively) imply that the gardens will be inundated in 40 years, with water in the basement of the Main House.[32] Vizcaya's evolution ultimately requires visionary thinking, perhaps shepherded by those not enmeshed in routine operational activities or pressing budgetary concerns. Understandably, museum personnel are emotionally and fiscally invested in the urgency of current circumstances, involving a variety of storm-recovery and mitigation projects, as well as requisite envelope improvements.[33] How can staff think 40 to 80 years in the future when the existing roof has surpassed its service life? But, if NOAA's projections manifest, Vizcaya, and many sites like it, require a reimagined future.

## Conclusion

The continuation of record-breaking, increasingly frequent, disruptive events is practically guaranteed. With grim predictions from an expanding chorus of climate scientists and researchers about future natural disasters, impacts to cultural heritage are inevitable. Relative to rising sea levels and storms, the preservation community has long been aware of the both inherent and increasing vulnerabilities of coastal heritage sites, but exactly how to adapt and mitigate to protect these sites remains an overwhelming question. Responses should include adaptive, scaled strategies that are not just specific to regions, states, and municipalities but also pertain to neighborhoods, individual properties, and sites.

Professionals working in the heritage sector are bound by the ethics, codes, and interventions of well-accepted preservation practice, yet the prevalence of "unprecedented" events calls for out-of-the-box thinking. Never has pursuing the work of preservation with ingenuity, compassion, and creativity been more timely or important. This is especially true in emergency scenarios, for both discrete events like hurricanes and slow-onset disasters, such as climate change.

Methods for protecting heritage property from climate-related threats are as diverse and idiosyncratic as the sites and collections themselves. There is no accepted formula for addressing such threats. But preservation professionals can build more resilient responses by leaning on their collaborative capacities, interdisciplinary skill sets, and a shared commitment to care.

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## Notes

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9. Matthew Cappucci, "Dissecting the Parts of a Hurricane," *Washington Post,* Sept. 10, 2017, https://www.washingtonpost.com/news/capital-weather-gang/wp/2017/09/10/dissecting-the-parts-of-a-hurricane/. A hurricane's "dirty side" refers to the right front quadrant of the storm relative to the direction it is moving, thus compounding its strength with wind speed plus velocity.

10. Cangialosi, Latto, and Berg, 10.

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14. This statement is based on conversations with the regional directors of Belfor Property Restoration and local ServePro franchises between September and October 2017.

15. See "Chapter 2: Preparedness" and "Chapter 3: Mitigation" in *Emergency and Risk Management Case Studies Textbook* (Washington, D.C.: Dept. of Homeland Security, FEMA, 2004), https://training.fema.gov/hiedu/aemrc/books-download/emoutline/.

16. For every one dollar that FEMA spent on natural-hazard-mitigation measures between 1993 and 2003, an average of four dollars was saved in property losses; K. Porter et al., *Natural Hazard Mitigation Saves: 2019 Report* (Washington, D.C.: National Institute of Building Sciences, 2019).

17. Hurricane Irma left much of Puerto Rico without power on September 7, 2017. Less than two weeks later, Hurricane Maria made landfall in Puerto Rico as a Category 4 storm, severely compromising the island's already fragile critical infrastructure, leaving the entire island without power and largely without drinking water; Robinson Meyer, "What's Happening with the Relief Effort in Puerto Rico," *The Atlantic*, Oct. 4, 2017, https://www.theatlantic.com/science/archive/2017/10/what-happened-in-puerto-rico-a-timeline-of-hurricane-maria/541956/.

18. For example, the Foundation for Advancement in Conservation's Alliance for Response initiative.

19. Elizabeth Kolbert, "Miami Under Siege," *The New Yorker*, Dec. 14, 2015.

20. Kolbert.

21. James Hamblin, "The Looming Consequences of Breathing Mold, Flooding Means Health Issues that Unfold for Years," *The Atlantic*, Aug. 30, 2017, https://www.theatlantic.com/health/archive/2017/08/mold-city/538224/.

22. Companies like Belfor, ServePro, and Polygon offer supplies, equipment, and personnel for response and recovery for prearranged rates.

Vizcaya did not have an existing contract with a restoration contractor when Irma hit.

23. In contrast to FEMA's *Technical Bulletin 2: Flood Damage–Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program* (Washington, D.C.: Dept. of Homeland Security, FEMA, Aug. 2008), https://www.fema.gov/media-library/assets/documents/2655.

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26. Andrew Rob, presentation on the progression of emergency preparedness, response, and recovery for cultural patrimony (Alliance for Response [AFR] Collections Emergency Planning meeting, Washington, D.C., June 4, 2019).

27. Richard Jobs, "Florence's Mud Angels," *History Today* 67, no. 8 (Aug. 2017), https://www.historytoday.com/history-matters/florence%E2%80%99s-mud-angels.

28. Examples include ICCROM's Disaster-Resilient Heritage initiative, the Smithsonian Cultural Rescue Initiative's Heart Emergency and Response Training (HEART), the Smithsonian's partnership with the Iraqi Institute for the Conservation of Antiquities and Heritage in Erbil, and FAIC's National Heritage Responders and regional Alliance for Response programs, among others.

29. Rebecca Kennedy, presentation on mental health after disasters and emergency-response training (Vizcaya Museum and Gardens, Miami, Florida, Aug. 8, 2018).

30. "Phases of Disaster."

31. "Sea Level Rise Viewer," National Oceanic and Atmospheric Administration, accessed March 28, 2021, https://coast.noaa.gov/slr/#.

32. *Unified Sea Level Rise Projection Southeast Florida: 2019 Update.*

33. Telephone interview with Remko Jansonius, deputy director for collections and curatorial affairs, Vizcaya Museum and Gardens, March 29, 2021. A detailed description of various mitigation projects planned or underway is beyond the scope of this paper.

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