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Archival adaptation to climate change

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Discussion of the likely impacts of climate change on archives is significantly deficient in the archival profession. Archives hold rare and unique materials that are irreplaceable and institutional adaptation to climate change is critical to the survival of these resources. The earliest effects of climate change are likely to be increased weather events that threaten the physical safety of holdings. Hurricanes, floods, and fires pose particular risks to archives due to potential damage to buildings as well as from limitations of local infrastructure to rapidly respond to disasters. Disaster preparedness for archives needs to include planning responses to a wide variety of situations that threaten holdings. As societies begin to adapt to climate change, archivists should consider how values of sustainability and resiliency might inform archival practice.

KEYWORDS: archives, archivists, preservation, cultural heritage, climate change, sea-level rise, climate adaptation, resilience

Introduction

According to the National Climate Assessment, the United States will in future years likely experience an increasing number of climate-change related trends that will influence residential patterns, agriculture, natural resources, and future investments in infrastructure. Many of these changes will be due to increasingly severe weather and rising sea levels that will pose significant dangers to most of the population in the country (USGCCR, 2014).

Climate change is one of the greatest contemporary threats to archival repositories and the records in their custody. Increasingly severe disasters like hurricanes, floods, and wildfires pose immediate dangers. At best, archives affected by such events may be able to evacuate certain holdings, to move collections to safer parts of buildings, or to salvage materials using disaster-response teams. At worst, a disaster may result in total loss, with collections of records or even a repository's entire holdings damaged or lost beyond recovery. Longer-term trends such as human migration and rising sea level may necessitate decisions concerning the geographic relocation of archival records.

Despite these mounting threats, the American archival profession has to date not demonstrated significant interest in addressing the likely impacts of climate change on archival repositories, the livelihoods of archivists working in vulnerable locations, and the public's ability to access vital records threatened by severe weather. To the extent that risks to archival holdings have been considered, it has primarily been through the lens of disaster planning and

management, which emphasizes emergency response, but does not address long-term adaptation for repositories in geographically vulnerable areas (Gordon-Clark & Shurville, 2010). However, a significant body of literature has examined the effects of climate change on long-term viability of other areas of cultural heritage, such as monuments and architecture (Holtz et al. 2014; UCS, 2014; O'Brien et al. 2015). This work has significant value for archivists who are only beginning to consider similar questions.

As archivists adapt to meet the challenges of climate change, they can draw inspiration from previous shifts in theory and practice. Revising traditional archival methods to meet contemporary challenges is familiar to most practitioners. Archivists have responded to the processing demands associated with increasingly large collections of modern paper and electronic records by embracing new processing and cataloging practices that recognize limited institutional resources. These techniques have been developed in recent decades to help archivists make more records available to users. This may be construed as a sustainability response, albeit from a labor and resource-allocation perspective, rather than an environmental one. Embedding responses to climate change in long-term planning for stewardship of records is a path toward developing a professional culture of sustainability and resiliency. Current archival practice emphasizes access for researchers in the foreseeable future, but overlooks major shocks outside the control of archivists.

Archivists will have to meet the challenges of climate change on two fronts: interim protections and

long-term planning. Interim protections, such as institutional disaster-response plans and choices about processing materials, are easier to implement since this work can be done at the local level and is based on existing guidance. Future planning for these issues is more fraught, as long-term archival adaptation to climate change calls for more research and coordinated efforts between archives and parent organizations, as well as among archivists across the profession. Decisions on interim protections and long-term planning must also be worked through within the local contexts of individual repositories (e.g., archives that are part of a larger organization, such as a university, government agency, or corporation), within larger emergency response and adaptation frameworks at state and federal levels, as well as across the archival profession. Values of sustainability and resiliency must inform archival adaptation to climate change.

This article primarily focuses on the challenges that American archives are likely to encounter when seeking to adapt to climate change and does not significantly address similar threats to archives in an international context. However, American archivists must consider that climate change crosses national boundaries and colleagues in other countries face similar issues that may require a multinational response.

Cultural Heritage and Climate Change

Archives are often grouped with other cultural heritage organizations such as libraries and museums (sometimes referred to as LAMs) and are similar to these institutions in that they preserve cultural heritage. Moreover, archives maintain the “materials created or received by a person, family, or organization, public or private, in the conduct of their affairs and preserved because of the enduring value contained in the information they contain or as evidence of the functions and responsibilities of their creator” (SAA, n.d.a). The LAM community has developed over the years a significant body of disaster planning, preparation, and management guidance. The following discussion is not a comprehensive review of this material but rather provides a brief appraisal of recent literature and resources pertinent to archives and climate change.

There is little professional discussion or guidance that specifically considers the major threats posed by climate change to the continuity of records and repositories. A rare exception is the work of Australian archivist Matthew Gordon-Clark, who has researched rising sea-level threats to the national archives of Pacific island nations (Gordon-Clark & Shurville, 2010; Gordon-Clark, 2012). This work

examines particular national archives that face the greatest danger, as well as the political and access problems associated with the possible transfer of records to other national jurisdictions. He concludes that archivists in developed nations have an ethical duty to assist with the threats and that more research must be done to formulate potential long-term solutions.

American archivist Casey Davis (2015) presented a four-item activist agenda for archivists interested in climate change during a 2015 regional archives conference. Davis has gone on to found ProjectARCC (Archivists Responding to Climate Change), an advocacy group of mostly American archivists examining the intersections of climate change and archives. ProjectARCC’s (n.d.) four committees reflect the four-item agenda called for in Davis’ original presentation. The four committees are dedicated to examining the threats of climate change to archives, to considering the carbon footprint of archival repositories, to promoting climate-change related collections, and to working with climate-activist groups to preserve organizational records. In addition to ProjectARCC, another professional organization has recently signaled interest in how climate change may adversely affect archives. The Disaster Planning and Recovery Subcommittee of the Regional Archival Associations Consortium announced that their 2015–16 focus will be on climate change (Labinsky, 2015).

Although they exist primarily as institutional planning documents, two federal entities with significant archival holdings, the National Archives and Records Administration (NARA) and the Smithsonian Institution, have developed climate change-adaptation plans required by recent executive orders (NARA, 2013; 2014; Smithsonian Climate Change Adaptation Working Group, 2013; Smithsonian Institution, 2015). Between 2009 and 2015, the Obama administration (2009; 2013; 2015) issued three executive orders concerning federal agency adaptation to climate change, requiring development of plans that incorporate sustainability and resiliency.

In its 2014 plan, NARA acknowledged the risks posed by climate change to its facilities, but stated it did not yet have enough local data to implement specific regional facility-adaptation plans (NARA, 2014). In contrast, due to a 2005 comprehensive risk assessment of multiple threats to its operations, the Smithsonian has more data concerning climate-related threats and vulnerabilities to its facilities, but to date has not released extensive local facility-adaptation plans (Smithsonian Climate Change Adaptation Working Group, 2013; Smithsonian Institution, 2015).

While not explicitly addressing climate change, preservation and conservation professionals have

developed many tools to promote disaster mitigation and effective emergency management for archives. These tools have significant value for archivists working in areas increasingly vulnerable to severe weather events precipitated by a changing climate. The Coordinated Statewide Emergency Preparedness (COSTEP) framework may be the most comprehensive. Developed by the Northeast Document Conservation Center in cooperation with several other library and archives organizations, COSTEP is a guidance document that institutions can adopt and use to encourage coordination of archival disaster responses with existing state and local emergency-management infrastructure (NEDCC, 2009). For example, Massachusetts began implementation of COSTEP in 2007 and over the course of several years has successfully integrated dozens of cultural heritage organizations within the larger infrastructure of Massachusetts state emergency-response measures (Massachusetts Board of Library Commissioners, n.d.).

In addition to the archives profession, resources from allied fields may be valuable to archivists. Preservationists have long been the primary advocates for disaster preparation and management within the broader cultural heritage sector. The American Institute for Conservation of Historic & Artistic Works (AIC) maintains a special team known as the National Heritage Responders for conservators responding to disasters. The team formed in response to the aftereffects of Hurricanes Katrina and Rita, which dramatically affected the holdings of many libraries, archives, museums, and historic buildings (AIC, 2015).

Heritage Preservation, an organization in the process of dissolving and transferring many of its programs to AIC, previously hosted the Heritage Emergency National Task Force. Between 2005 and 2011, the group gathered information on massive weather disasters affecting cultural heritage institutions, primarily in the United States. Previously, several regional emergency-response networks existed as a result of workshops offered through Heritage Preservation's Alliance for Response program in the early 2000s; however, many now appear to be defunct (Alliance for Response, n.d.; Heritage Preservation, 2015).

Heritage Preservation also conducted the Heritage Health Index survey in 2004, the first comprehensive survey to examine the preservation conditions of collections held by American libraries, archives, museums, and other cultural heritage institutions. Over 3,000 institutions responded, with over a quarter of them reporting a lack of environmental controls for humidity and temperature and more than half indicating water/moisture damage to holdings

(Heritage Preservation & IMLS, 2004). Since then, efforts to coordinate centralization of cultural heritage disaster response have been proposed without apparent implementation (Silverman, 2006). There has been much discussion but little action. It is unclear why this is the case; however, any centralization of cultural heritage disaster response is challenging due to the proliferation of professional organizations that do not always work together and the nature of librarians, archivists, and museum curators who have different disciplinary training and professional networks. In the last four years, an increasing number of cultural heritage and preservation events have focused on climate change and this may finally provide the impetus to centralize cultural heritage disaster response (NARA, 2011; Metropolitan New York Library Council, 2014; Newport Restoration Foundation, n.d.).

Other cultural heritage sectors that focus on the built and natural environment have made far more progress on climate-change adaptation, particularly its effects on buildings and monuments, archaeological sites, and historical landscapes (Holtz et al. 2014; O'Brien et al. 2015). This is understandable, as the holdings of libraries, archives, and museums are less geographically bound and can be migrated to safer locations. While individual monuments can sometimes be relocated to a safer location, most buildings, sites, and landscapes are indelibly tied to their physical location (Cazenave, 2014; Neuhauser, 2015). Historic preservation professionals are reckoning with the fact that difficult decisions may be needed that involve extensive heritage-protection plans or letting a site be destroyed (Craig, 2015; Veerkamp, 2015). In cases where a heritage site is left unmanaged against the forces of climate change, the archival record of that place through extensive documentation may be all that survives (Melnick, 2015).

Even if the planet manages to stay below the widely-recommended 2°C target in global temperature warming, sea-level rise is expected to affect over 100 World Heritage sites designated by the United Nations Education, Scientific, and Cultural Organization (UNESCO); a temperature increase of more than 4°C would affect over 140 sites (Marzeion & Levermann, 2014). In a 2005 survey conducted by UNESCO's World Heritage Centre, 72% of respondents reported that "climate change had an impact on their natural and cultural heritage" and that 125 World Heritage sites were specifically affected (Jigyasu et al. 2013). Many of these sites contain irreplaceable archival records.

Cultural heritage professionals challenged by climate change may find guidance from organizations dedicated to emergency response in regions affected by armed conflict. For example, Blue Shield Interna-

tional works to protect cultural property as defined in the 1954 Hague Convention and coordinates with emergency-response organizations and other cultural heritage organizations to safeguard cultural heritage sites and objects. Blue Shield (2014) is monitoring the current civil war in Syria to identify particular at-risk heritage sites. Climate change's effects can have grave implications for security risks, as the 2006 Syrian drought is widely recognized to have contributed to the region's destabilization (Gleick, 2014; Kelley et al. 2015). In many areas of the world, cultural heritage may be threatened not only by disastrous weather, but by armed conflict that scarce resources or weather damage could trigger.

Embedding Sustainability and Resiliency in Archival Practice

It is important to consider the challenge of archival adaptation to climate change through the lens of sustainability and resiliency. Sustainability is commonly defined as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Resiliency considers the ability of systems, organizations, and individuals to survive and recover from major disruptive events (Zolli, 2012). Mounting comprehensive archival adaptation to climate change requires efforts that incorporate both sustainability and resiliency.

Sustainability is not just about building design or waste streams—it is also about the acquisition, appraisal, processing, and outreach choices archivists make on a daily basis as part of professional practice. Sustainability and resiliency in an archival context form a complementary relationship. Sustainable choices enable archives to be resilient in the face of climate-change threats. Sustainable archival practice means making present-day archival choices that enable future archivists to carry out their jobs and ensure survival of cultural heritage.

Of the thin amount of literature that addresses (either directly or indirectly) climate-change impacts on archives, much of it focuses only on the sustainability question (Abbey, 2012; Wolfe, 2012). In contrast, disaster-preparedness literature clearly promotes resilience, but it tends to treat disasters as "acts of God" as opposed to advocating creation of a long-term resiliency framework for a changing climate.

Like cultural heritage organizations around the world, most archives in the United States are underfunded and understaffed. As archives adapt to climate change, they must consider how choices around resources and high-priority activities support sustainability and resiliency of the parent institution. Archi-

vists that concentrate their adaptation efforts on, for instance, acquiring sustainability certification for new or renovated facilities will find that these projects do not prepare them to recover from the shocks of a massive disaster. Archivists must find a way to integrate sustainability and resilience planning both to reduce institutional contributions to climate change and to protect their repositories from climate-change threats.

The next two sections consider the types of sustainable and resilient choices archivists can make in a changing climate.

Revisiting Traditional Archival Practice

Issues of sustainability in the literature pertaining to archives and libraries often reference the notion of "scalability," the ability to perform at maximum capacity over the long term, with respect to economic or social sustainability, rather than environmental sustainability (Rieger, 2011; Vinopal & McCormick, 2013). It is common for archives to engage in a new activity (e.g., rapid digitization of analog content for online access) but then to find that the activity does not scale, due to understaffing and underinvestment by the parent organization, and therefore is not "sustainable." Within the archives profession, much of the work on sustainability has examined processing, digitization, and digital preservation practices intended to lead to economic sustainability, given the precarious budget and staffing of most archives.

Much of the sustainability activity in the LAM sector focuses on building, energy, and material-purchase contributions to carbon emissions (Henk, 2014). However, few archivists have examined how archival practice itself can be adapted in response to climate change. An exception is Mark Wolfe's (2012) argument that reliance on building controls does not address the environmental impact of archives as well as rethinking archival practice through a framework of sustainability does.

In the face of rising risks from climate change, archives in the United States face threats comparable to other American communities: increasingly severe disasters that jeopardize the built environment, such as floods and hurricanes, as well as rising sea levels that endanger many of the country's coastal population centers. Most archives are part of a larger parent institution, such as a university, corporation, local or state government, or museum. Therefore, any plans for adaptation or preparation must occur within the context of larger organizational structures. Many of these entities do not have adaptation plans in place, severely compromising their resilience capacity. Fewer American cities are engaging in adaptation planning activities (58%) compared with all interna-

tional cities (75%). The United States also has the highest proportion of cities of all countries focusing exclusively on emissions-mitigation efforts without including resiliency or adaptation initiatives (Aylett, 2014). Less than half of all American states have climate change-adaptation plans and there is little information on the overall adaptation efforts of the private sector (Bierbaum et al. 2012).

Consistent with disaster-preparedness recommendations, archivists should ensure that they have a disaster plan in place that includes “policies, procedures, and information that direct the appropriate actions to recover from and mitigate the impact of an unexpected interruption of operations, whether natural or man-made” (SAA, n.d.b). However, it is critical that they shift their treatment of disaster preparation from a stand-alone activity to a set of procedures that is woven into the rest of archival practice to increase professional resilience. Treating disaster preparation as separate from the rest of the archival enterprise often means it is relegated to the bottom of a to-do list, or the sole responsibility of one person, instead of the shared obligation of an archives staff. Disaster plans are susceptible to a lack of testing, such as practice drills, to assess effectiveness before a true disaster hits (Muir & Shenton, 2002). Centering a mindset of preparedness in all facets of archival practice can ensure a new form of social, economic, and environmental sustainability within archival work.

To envision how archivists could shift to sustainable and resilient practices that incorporate disaster awareness, it is worth revisiting several core archival practices:

Appraisal and Acquisition: The process refers to how archivists evaluate the informational and research value of a body of records and the ways in which an archival repository takes physical and/or intellectual custody of the records through their transfer from a donor or originating office (i.e., accession). In the post-custodial model, archivists may work with individuals or organizations that will continue to manage their own records (i.e., no process of acquisition). This article primarily considers the traditional custodial work of archives.

Arrangement and Description: This refers to the process by which archivists physically arrange and generate descriptive information documenting the content of records and preserve the intellectual relationships among records in a given collection.

Preservation: A multifaceted approach to ensuring the continued integrity of archival records. Preservation encompasses practices such as monitoring envi-

ronmental conditions of storage areas (e.g., temperature and humidity levels), as well as conservation calling for physical interventions with respect to records at risk of damage or loss (e.g., removing mold from water-damaged documents).

Reference and Access: This core practice refers to the processes by which archivists connect users to archival resources. Unlike libraries with browsing stacks, archives store records in closed areas for security purposes (archives are by definition irreplaceable). By making catalog records available online and answering questions, archivists help users identify the records they need to use. Digitization of analog records and the rise of electronic records bring significant access challenges. Digitization is a time and resource-heavy activity, so not all materials can be easily digitized. Electronic records often exist in formats that are no longer readable by current computing systems. Depending on the records, archivists may make these freely available online or may restrict access to them based upon certain donor or intellectual property conditions.

Outreach and Advocacy: Archivists are often called upon to advocate for their archives within their parent organization, but also for the larger archival profession. Archivists also value identifying and cultivating new audiences through outreach efforts, realizing that a strong base of users is one of the best ways to encourage continued investment and support by parent organizations.

In typical archival practice, disaster preparation is most strongly associated with preservation. However, positioning disaster preparation along one single aspect of professional functions leaves it vulnerable to marginalization. Disaster preparation may be reconceived in a new framework, by considering how seemingly unrelated archival functions support preparedness.

Sustainable Choices that Support Resiliency

Responsible archivists will not support transfer of records to archival custody unless they reasonably expect that the materials can be adequately cared for, processed, and made accessible to users (barring donor or institutional restrictions on access). Most archives have some form of collection policy regarding the records that they will accession into their custody. However, the reality is that many archives sometimes take collections at odds with their own collection policy, even if they lack sufficient storage space or staff to process the records. This may be due to parent-institution politics, or because many archivists

cannot say “no” to new accessions (whether because of legally mandated records transfers or the goodness of their hearts). Over the last several decades, as the cost to produce analog and electronic information has declined, there has been an explosion of records, leading to unsustainable archival acquisition practices in which archivists acquire more records than they can reasonably process and make available for public use (Wolfe, 2012). A combination of reluctance to apply stringent appraisal practices, overreliance on traditional processing methods, and understaffing has resulted in most archival repositories attempting to manage extensive backlogs of unprocessed materials. These collections often lack physical and intellectual control, meaning they may be housed in unsuitable containers (e.g., acidic boxes, rusting filing cabinets), and have little to no documentation (e.g., a finding aid or inventory) identifying the contents. Unprocessed collections are a particular liability when disasters strike since they are more likely to contain unidentified fragile materials and lack documentation establishing intellectual control.

A critical part of disaster response is having a clear idea of what was damaged in order to triage materials and prioritize recovery efforts. When unprocessed collections become impaired, an already difficult process of recovery becomes harder to manage. As archivists appraise collections, they should take care to realistically consider how long the materials might be part of a backlog. Unprocessed collections often occupy an “out of sight, out of mind” space. Lack of documentation about the volume and locations of backlog collections is common in archival repositories. This has grave ramifications if a disaster hits these materials before they have been fully processed and documented. Insurance companies and disaster agencies (e.g., Federal Emergency Management Agency, state and local departments of emergency management) may require documentation, such as inventories, finding aids, and catalog and accession records to process claims for recovery work.

The mainstreaming of More Product, Less Process (MPLP) processing (an approach to minimal processing popularized in the early 2000s) arose specifically as a response to growing backlogs (Greene & Meissner, 2005). The MPLP procedures have been celebrated for their emphasis on increasing access. Some argue that MPLP has helped readjust the unreasonable labor expectations of overstretched archivists, while others believe that the emphasis on expediency undercuts their intellectual work (Meissner & Greene, 2010). Other archivists note that adopting MPLP implies a higher degree of reliance on extensive climate-control systems to passively perform preservation functions that were previously actively

done under traditional and more extensive processing methods. For example, archivists may forego stabilizing fragile forms of paper during processing, under the assumption that a resource-intensive building climate-control system will regulate temperature and humidity enough to make up for the lack of item-level handling while processing. This could have countervailing effects on repositories seeking to reduce their carbon emissions (Wolfe, 2012; Jones, 2014). From a disaster perspective, any level of processing that establishes a degree of physical and intellectual control over an unprocessed collection as soon as possible is worthwhile.

As of 2004, 70% of American archives did not have an emergency plan with trained staff prepared to execute it (Heritage Preservation & IMLS, 2004). State archives have made a particular effort to increase disaster preparation since Hurricane Katrina; between 2006 and 2014, the number with an emergency plan in place increased from 14 to 43 (CoSA, 2015). Even fewer repositories have identified the records that are most vital or should have highest priority in the event of a disaster. A 2007 survey of state archives and records programs showed that not all programs had identified vital records in their emergency plans (CoSA, 2007). Archivists frequently note that archives are, by definition, difficult to insure since they are irreplaceable. However, if archivists have warning about a looming disaster, they may have a short time in which to evacuate or move records. Archives with an institutional collecting mandate (e.g., government archives, corporate archives, university archives) may place the highest value on records such as articles of incorporation, deeds, and building plans. Like a family’s birth records and marriage certificates, these vital records of a parent organization are critical to ensuring operational continuity in the event of a disaster. Loss of these records can severely stymie recovery efforts. Records with historical value but not critical to continuity of operations may have less priority in an emergency.

Archives that do not contain parent-organization vital records still need to identify high-priority collections as well as internal documentation supporting collections. Characteristics of high-priority records include 1) the archival repository’s own internal accession, donor, catalog, and inventory records; 2) collections with extremely high research value; and 3) collections with a large quantity of fragile materials that, if damaged, may be totally lost (e.g., film and audiovisual collections). At first glance, these criteria may seem to encompass virtually all of an archive’s holdings—after all, if a collection has made it into an archive, it should have high research value. However, even among extremely valuable

collections, there may be portions not worth prioritizing, such as newspaper clippings and printed ephemera. Decisions about what to save first should be made well in advance.

Following a disaster, the public may need information about access to affected records. Archivists should find ways to share information about how collections were affected, when restoration efforts will make collections usable again, the scope of loss, and how patrons can help with recovery efforts. Depending on the scale and expected time and expense of recovery from the disaster, this information may be shared via an archives' blog and website and on social media. If damage is localized to a small number of collections, but the recovery period is expected to be long, the catalog and inventory records for those collections should be updated to reflect access restrictions.

Disaster planning also aligns closely with archivists' orientation toward advocacy and outreach. By demonstrating how the preservation of records is critical during a disaster, archivists not only highlight the importance of archives but reach new audiences such as disaster-management professionals (Carmicheal & Federal Emergency Management Agency (FEMA), 2015).

Disasters

Dozens of American archives in the last several years have suffered from disasters resulting from flooding and hurricanes. In 2004, the University of Hawai'i at Manoa experienced a flash flood that dramatically affected the Hamilton Library, with damage to over 200,000 rare maps and photographs, several thousand of which were valuable materials related to the history of Hawai'i and the Pacific region. A class of library-school students meeting at the time even had to quickly escape the flood (Stone, 2004; Davis, 2006). The entire campus sustained US\$80 million in damage and the library "account[ed] for almost half of the damage costs" (University of Hawai'i, 2014). The recovery company used by the university, Belfor, was also called upon by Tulane University in the aftermath of Hurricane Katrina (Diamond, 2006).

During Hurricane Katrina, archivists around the Gulf Coast raced to save their collections from the ravages of mold and complete disintegration wrought by floodwaters and wind. Within New Orleans, the levee failure created a "toxic stew" in which library and archive holdings sat for several days due to a mandatory evacuation and the immediate focus on ensuring human health and safety. Tulane University's libraries suffered arguably the greatest damage ever in an American academic library (Corrigan,

2008). As a member of the Association of Research Libraries (ARL), an elite group of North American research libraries, Tulane's libraries had more resources than others to deal with the aftermath of the hurricane and floods; nevertheless, they experienced massive losses of materials and subsequent recovery efforts spanned several years. The main research library's audiovisual and microform collections were almost entirely lost while the printed music scores sustained extensive damage, although most were eventually salvaged. Flood waters inundated the Special Collections building, damaging an entire floor of archival collections, including historical ephemera and political papers (Corrigan, 2008). Much of the Special Collections material was in due course recovered; however, some vulnerable items such as film reels were completely lost during the recovery process. Tulane's libraries ultimately sustained approximately US\$30 million in losses and the administration cut a dozen staff positions as part of the overall university reorganization (Diamond, 2006).

Hurricane Katrina and its aftermath affected virtually every academic library and archive in the New Orleans metropolitan area, as well as most school and public libraries. Over 100 public libraries were adversely affected in Louisiana and more than 30 in Mississippi (Nevins & Nyberg, 2006). Even when the flood waters did not inundate a particular location, the insufficient operational infrastructure failed to prevent heavy mold outbreaks (Skinner, 2006). Elsewhere in the Gulf Coast region, Hurricane Katrina and its repercussions affected dozens of academic libraries, archives, and museums (Nevins & Nyberg, 2006; Wall, 2006). Even when collections survived relatively unscathed, large numbers of library staff suffered great losses to their homes, health, and sometimes family and friends' lives. In addition, vital records maintained outside the purview of archival repositories were often damaged. Residents who evacuated without their own vital documents, such as a birth certificate, marriage license, or other records, faced large obstacles in replacing these materials (Swartz, 2005).

A common reflection through much of the post-Katrina recovery literature is how even the most thorough plans may be no match for a large-scale disaster (Diamond, 2006; Skinner, 2006; Wall, 2006; Corrigan, 2008). Employees with institutional email addresses became unreachable as institutional servers went down; those with Gmail, Hotmail, or Yahoo addresses were easier to reach. However, emergency contact lists at the time did not always include non-institutional addresses. Administrators at Tulane University established an online listserv through Yahoo to communicate with employees (Diamond,

2006). Government officials closed access to the region for weeks following the levee failures and only emergency responders and other designated personnel were able to enter, which meant few professional librarians and archivists could assess the situation on-site. Disaster-recovery specialists often value different knowledge than do archivists and these differences may have effects for response efforts, for instance in taking necessary immediate steps to halt the growth of mold in water-damaged collections (Passley, 2013).

In addition to Katrina, other recent hurricanes have had disastrous consequences for American archives. The archives of the Slate Valley Museum (located on the New York-Vermont border) suffered damage from two feet of water that flooded document-storage boxes during Hurricane Irene in 2011 (NYCH, 2015). When Hurricane Sandy hit New York City and its surrounding area in 2012, several smaller archives suffered damage to their collections, including the non-profits Eyebeam Art and Technology Center, Printed Matter Inc., and the National Guard Militia Museum of New Jersey (Webre, 2013; NJDMVA, 2015; Printed Matter, Inc., n.d.).

Comprehensive numbers on how many American archives have been affected by disasters in recent years do not exist because no periodic census is taken to assess this kind of annual damage. Given the irreplaceable nature of these records, collecting these data would be difficult and an alternative measure would be needed to assess damage, such as volume of records lost or dollar value of insurance payments. Inadequate information limits wider understanding of how climate change may continue to affect American archival repositories. Archivists lack data to adequately inform the stakeholders of their parent organization, as well as emergency-management officials, on the dramatic losses that can occur in the wake of a disaster.

Long-Term Adaptation

Looking past intermediate steps of improving disaster preparedness, some archival repositories in increasingly geographically vulnerable regions like coastal areas may need to reckon with the possibility of relocation—whether of the entire archival repository building and its collections or of specific groups of records—or even dissolution. Few archives will make these decisions solely on their own, as most are part of a larger parent organization, such as a university, government, or corporation. It is likely that decisions about continued human occupation of threatened areas will ultimately be decided by state and federal policy, as well as the risks the insurance in-

dustry is willing to bear. Historic preservationists have noted that changes to the federal flood-insurance program may affect the insurability of historic properties and sites (Eggleston & Wellock, 2015). Archives located in these affected sites, or in other endangered areas, may find insurance coverage increasingly hard to attain, which may be the ultimate lever that forces a shift to long-term adaptation and/or relocation.

It is important for archivists to plan for these circumstances now so that they can start to embed climate-change adaptation into their advocacy and outreach activities. This adaptation can build upon earlier efforts to incorporate sustainability into archival practice as a way to enhance resiliency. If planning is delayed until urgent conditions have become fully manifest, government plans are unlikely to prioritize archives in more expansive community or organizational climate-adaptation initiatives.

Sea-Level Rise

Sea-level rise, which will significantly affect many major American coastal cities, presents the most obvious long-term danger to archives, threatening the physical viability of continuing to house records in vulnerable locations. Depending on projected emissions pathways, between one and seven major population centers in the United States (i.e., population > 350,000) will have significant areas below future high-tide lines (Strauss, 2013). Archivists alone will not make decisions about where to relocate records housed in areas vulnerable to inundation. Corporate directors, university presidents, governing boards, and government officials of organizations that house archives will participate in tough decisions about what justifies relocation. Most disaster-management officials are unlikely to prioritize cultural heritage adaptation, so cultural heritage professionals must become their own best advocates. Archivists may be pressured to make difficult choices about prioritization for saving records, or finding them new homes, or may be asked to identify reformatting solutions (e.g., mass digitization or microfilming) to reduce physical storage needs (Line, 2006).

Residential relocation in response to climate change has already begun in parts of the United States. Several native tribal communities in Alaska and Louisiana are in the process of relocating to safer areas due to increased sea-level rise, thawing permafrost, and/or loss of natural barriers to mitigate flooding. Many of these tribes lack adequate access to governmental assistance for relocation and there is no designated federal agency to help native (as well as non-native) communities proactively migrate to safer

areas before coastal erosion and rising sea levels threaten to overwhelm current residential locations (Maldonado et al. 2013). Hurricanes and coastal erosion have particularly affected Louisiana tribal lands, an issue compounded for tribes without federal recognition (Ferguson-Bohnee, 2015).

Some historical monuments, such as the Cape Hatteras lighthouse in North Carolina, have been relocated due to eroding shorelines and rising tide lines (Holtz et al. 2014). Because many natural and cultural coastal landscapes are expected to be lost or radically altered over the coming decades, some adaptation, such as engineering sea walls, levees, dikes, and building elevation will be needed to help protect existing communities. Other areas may be completely lost. American history has numerous examples in which coastal and floodplain communities have chosen or been forced to migrate due to high costs of attempting to control inevitable disaster (Isacoff, 2014). In 2010, the last house on Holland Island in Maryland's Chesapeake Bay finally collapsed (Fahrenthold, 2010). The island had experienced almost total desertion in the preceding decades due to residential concern about the island's stability (Gibbons & Nicholls, 2006). Other areas of the United States are confronting similar issues; the Inupiat village of Kivalina in Alaska may be completely lost to erosion and rising sea levels by 2021, but there is no clear source of funding available for relocation efforts (Maldonado et al. 2013, DeMarban, 2015).

Fortunately, unlike an entire settlement with unique topography and historic buildings, archival records are much easier to physically relocate, given enough time and planning. Physical relocation of these materials raises significant concerns, including whether the archive's parent institution will continue to operate or be ultimately dissolved, and whether its assets (including the archival records) are transferred to another institution. Regardless of outcomes, archivists working in areas subject to sea-level rise must find ways to embed themselves in the long-term planning for their parent institution's future. Without early involvement in institutional adaptation efforts, archivists' interests are unlikely to be prioritized.

Future Research

The overall topic of climate change is largely absent from the American archival profession. Even when the issue is addressed, the discussion typically concerns reduction of carbon emissions. Few resources, whether publications, training, workshops, or conference programs, exist regarding the adaptation of archival repositories to climate change. This emphasis is understandable regarding what archives can do to reduce or mitigate carbon emissions, such

as choosing environmental controls and decisions about materials, transportation, and storage matters. Archivists have significant influence over these activities, while appropriate adaptation measures, such as deciding where to move a university archives on a campus threatened by rising sea levels or coastal erosion, may often be outside of their direct control. In addition, sustainability questions may be psychologically easier to tackle than those associated with resiliency. Planning for adaptation to a changing climate inevitably raises disturbing questions about risks to human safety, collections, livelihood, and operational continuity.

American archivists should consider the following topics to develop a robust professional response to climate change:

- Conduct a comprehensive census of financial and collection losses sustained by American archives due to disasters associated with global climate change. Currently, there is no accreditation body for American archives, so this effort would either have to be a research project (likely sponsored by a large organization such as the Society of American Archivists) or a reporting infrastructure would need to be established.
- Examine archives that are developing or implementing climate-adaptation plans. More research is needed to determine whether any archives are formulating these plans or whether staff assume that the parent organization will take the lead on adaptation issues.
- Investigate FEMA and insurance-company payouts to American archives for material losses. Collection of this information could help archivists inform stakeholders on the potential risks of inadequate facilities or staffing to care for records.
- Prepare a comprehensive survey of American archival repositories located in geographically vulnerable areas threatened by sea-level rise. Particular attention should be paid to territories and associated states, many of which are far more vulnerable to rising sea levels due to their isolated oceanic geography than mainland archives. This information could be used to inform new priorities for archival grant programs such as the Institute for Museum and Library Services or the National Historical Publications and Records Commission. These organizations may consider creating new grants to help archivists with collection adaptation and relocation efforts.
- Assess the current state of regional and national coordination of cultural heritage emergency-response organizations. Currently, many of these efforts are scattered and cultural heritage staff

may be unaware of resources available during a crisis.

Conclusion

The American archival profession is not alone in its delayed response to climate-change adaptation. Across the country such oversights are common at both the state and federal level. At present, FEMA is currently encouraging states to include climate-change considerations in their hazard-mitigation grants, which are available to areas following a presidential major-disaster declaration (FEMA, 2015). This development may hasten state response to climate-change adaptation, because only seventeen states have so far adopted climate-adaptation plans (Elliott, 2015).

It appears that most federal agencies are currently in the exploratory stages of determining the impacts of climate change on their activities and agency-adaptation plans. Of federal agencies examined in 2015, the Department of Defense was recognized for releasing the strongest assessment of how climate change would affect its mission (Leggett, 2015). Otherwise, the United States Government Accountability Office's (GAO) recent review of coordinated federal response to climate change, which it identifies as a high risk to the solvency of the federal government, found significant problems. The GAO (2015) report noted, "There are no programs to monitor and independently validate the effectiveness and sustainability of federal efforts to reduce the fiscal exposure posed by climate change. Thus, there is no way to demonstrate progress in implementing corrective measures." For this reason, archivists should not expect government agencies in the United States to develop a robust adaptation agenda before taking action to manage the effects of climate change.

Archives contain a wide range of records necessary to support society. Institutional archives such as those situated in government, universities, and corporations steward significant groups of records essential to uninterrupted operation of civic affairs. Vital records include those needed for individuals to demonstrate their identity, for universities and businesses to prove their legal and tax status, for students to document their education, and for local jurisdictions to establish property boundaries. Collecting repositories also provide a critical service to society by preserving the papers and records that reflect community history and cultural heritage.

The increasingly severe weather and sea-level rise associated with anthropogenic climate change raises significant challenges to the archival profession. Archival repositories in geographically vulnera-

ble areas will have to adapt through a combination of intermediate and long-term practices that draw on values of sustainability and resiliency. These steps are necessary to ensure that the critical services archives provide to society are not threatened by the shocks of climate change. Archivists who contribute research in these areas will find that colleagues in the allied fields of librarianship, museums, and historic preservation have developed significant work that can be adapted to archival theory and practice. Developing this awareness within the archival profession is critical to guiding archivists through the challenges of global climate change.

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