

Research Project on Climate Change and Archives Phase 2 Report: Infrastructure for Mellon Foundation, Public Knowledge program

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Executive Summary

Climate change is intensifying infrastructure concerns related to the storage, preservation, and accessibility of archives. This public report is adapted from the comprehensive Phase 2 (Infrastructure) report prepared for the Public Knowledge program of The Andrew W. Mellon Foundation as part of a larger eighteen-month research project on archives and climate change. Sections of this report have been edited from the original for length and to preserve confidentiality of insights from individual subject matter experts. Additional reports from Phase 1 (People) and Phase 3 (Collections) will also be released. The three phases of research culminated in a final report that is available to the public.¹

Between October 2023 and January 2024, I conducted research related to facilities, digital infrastructure, and emergency preparedness/disaster response. I sought to understand and contextualize the current and anticipated infrastructure concerns in the American archival profession and what this means for archives' capacity for climate change adaptation.

Major questions that guided this phase of research included:

- What baseline information exists about American archives facilities?
- What digital infrastructure do archives need?
- What challenges exist for implementation of sustainable facilities standards?
- Are issues of insurance coverage beginning to impact archives?
- What barriers do archives face with emergency preparedness and disaster recovery?

As climate change increasingly impacts archives, archives infrastructure is a little understood and under documented area with major gaps between best practices and reality. Some infrastructure concerns, such as emergency preparedness, have seen major advances in the last two decades, though there is still much work to be done. The key findings of this report include:

- **There is little comprehensive and longitudinal data concerning archives infrastructure.** There are no longitudinal data collection efforts that attempt to obtain information about or from every American archival institution regarding building location, facility type and use, collection size, storage conditions, or level of emergency preparedness. As a result, it is difficult to quantify with confidence how much of the American archives infrastructure is exposed to climate change, the total volume of at-risk materials, how much archives themselves contribute to climate change emissions, and whether the situation is growing worse or better.
- **Major data sources on archives locations do not include additional information about facilities.** Existing US archives data sets do not include facility-specific information, such as whether archival records are located in a basement or attic (two spaces notoriously vulnerable to leaks or floods), building elevation, or the grading around a building.
- **There is limited information on the extent of US archival holdings.** Government archives are more likely to have larger holdings compared with other types

¹Tansey, "Research Project on Climate Change and Archives."

of archives. However, surveys of archives show many respondents do not record the total size of their physical or digital collections. If archives are unable to do the most basic work of recording the extent of their collections, they are at a disadvantage when it comes to advocating for the appropriate infrastructure to steward their collections.

- **Limited data suggests many archives continue to struggle with basic storage environments.** Several surveys have found that temperature and humidity controls are not available in all archives. These are essential components for managing archival records storage environments.
- **There are widely recognized energy efficiency guidelines for cultural collecting institutions, but many archives face challenges in adopting these standards.** Until recently, facility guidelines for collections-based cultural heritage institutions such as archives recommended maintaining a very narrow and constant temperature and humidity range. New research has shown that the range of allowable temperature and humidity is more flexible than previously thought. While this research has been integrated into some institutions' standards (such as the National Archives), many other archives struggle with implementation due to the required investment in assessment and monitoring.
- **Significant challenges remain with physical and digital collection management and storage capacity.** Many archives report they are at physical collections storage capacity, and yet also do not have all of their collections fully inventoried and accessible. Many archives are engaged in working with digital collections, and do not have a digital preservation plan.
- **Emergency preparedness is becoming more urgent.** Disasters are becoming increasingly frequent and more severe due to climate change. Fortunately, many archives have disaster plans. However, far fewer practice drills or update emergency plans on a regular basis.
- **Education, training, and response networks are vital.** Subject matter experts repeatedly emphasized the importance of training at all levels. Cultural heritage emergency preparedness networks perform essential work to build relationships between cultural heritage professionals and the emergency response community.
- **The full extent of disaster-related archival losses are unknown.** Reporting on disaster losses is key to driving both internal and external support for emergency preparedness and disaster recovery. There are some precedents for documenting these losses, but this is an area that needs far more attention.

Introduction

Climate change is intensifying infrastructure concerns related to the storage, preservation, and accessibility of archives. Climate change is associated with more frequent and severe emergencies and disasters that can disrupt the safety of archives and archivists. In addition to disasters, climate change is ushering in a period of unpredictable and weird weather that makes caring for collections more challenging than in the past. Furthermore, many of the activities used to preserve and make archives accessible—from heating and cooling systems for collection stacks to cloud storage providers for digital preservation—can also contribute to climate change through increased use of fossil fuel energy.

Every part of the country is impacted by climate change, meaning that all archives are increasingly vulnerable to infrastructure weaknesses. The Fifth National Climate Assessment (NCA), representing the recent work of fourteen federal agencies and nearly 500 authors, observes:

As the world's climate has shifted toward warmer conditions, the frequency and intensity of extreme cold events have declined over much of the US, while the frequency, intensity, and duration of extreme heat have increased. Across all regions of the US, people are experiencing warming temperatures and longer-lasting heatwaves. Over much of the country, nighttime temperatures and winter temperatures have warmed more rapidly than daytime and summer temperatures. Many other extremes, including heavy precipitation, drought, flooding, wildfire, and hurricanes, are becoming more frequent and/or severe, with a cascade of effects in every part of the country.²

This 18-month research project for the Public Knowledge program of the Andrew W. Mellon Foundation looked at three major areas of concern for climate change adaptation and archives: people, infrastructure, and collections. This second report covers infrastructure. As climate change increasingly impacts archives, archives infrastructure is a little understood and under documented area with major gaps between best practices and reality. Some infrastructure concerns, such as emergency preparedness, have seen major advances in the last two decades, though there is still much work to be done.

Between October 2023 and January 2024, I conducted research related to facilities, digital infrastructure, and emergency preparedness/disaster response. I sought to understand and contextualize the current and anticipated infrastructure concerns in the American archival profession and what this means for archives' capacity for climate change adaptation. This research explored questions related to American archives facilities, digital preservation infrastructure, sustainable facilities guidelines, insurance coverage, and archives-specific disaster recovery challenges.

² U.S. Global Change Research Program, "Chapter 1," 16.

Defining Infrastructure

Infrastructure includes the buildings and facilities, physical and digital systems, equipment and tools that archivists use to preserve archival materials *and* make them accessible to users. In Deb Chachra's book *How Infrastructure Works: Inside the Systems That Shape Our World*, she provides the following observation about infrastructure:

*What makes infrastructure, infrastructure? "All of the stuff that you don't think about" turns out to be a surprisingly good starting point. For something to be considered infrastructure, its presence and characteristics are taken as a given.*³

Preservation in the context of archives infrastructure takes place through regulation of building environmental conditions, securing collections through access systems to prevent loss, digital backup redundancy and checksum monitoring, and other storage and maintenance related activities. Access takes place through online digital collections provision, digitization of analog materials, providing finding aids to collections, providing user reference services, and through using archival materials in a reading room. Infrastructure also determines the extent to which archives may be vulnerable to, or protected from, an emergency or disaster.

Archivist Rand Jimerson uses a restaurant metaphor for archives in his book *Archives Power*.⁴ Jimerson identifies archivists as the staff of a restaurant (for example, a reference archivist as a waiter, a processing archivist as kitchen staff, and a department head as the chef), and archives users as the restaurant's customers.

To expand on Rand's metaphor, we might think of unprocessed archival collections as raw ingredients, processed archival collections as menu items, and archives infrastructure as similar to the restaurant infrastructure that food service workers use to transform ingredients into meals. Archives infrastructure can be thought of similar to the building, equipment, and various utility systems of a restaurant, such as a:

- dining room (reading room),
- kitchen (processing spaces and staff offices),
- specialized cooking equipment (file folders, pencils, polyester sleeves, nitrile gloves),
- refrigeration (archival storage stacks and servers),
- food storage containers (archival boxes and shelves, digital repositories),
- menus (public-facing finding aids), and
- ticketing systems (internal collection management tools)

³ Chachra, *How Infrastructure Works*, 10.

⁴ Jimerson, *Archives Power*.

Major Infrastructure Issues and Connection to Climate Change

There are three major findings associated with this phase's research. These findings are ordered from the area of greatest concern through areas where there is already some degree of progress that can be built upon. Although these findings are specific to infrastructure concerns, they also touch upon many personnel related issues identified in Phase 1, which will be discussed towards the end of this report.

The first finding is that there is insufficient data on the infrastructure situation and needs of archives. The second is that while there are many evolving best practices and guidelines for achieving more sustainable energy efficiency within the building, storage, and preservation practices of archives, there is a major implementation gap. The third finding is that progress on emergency preparedness over the last two decades has increased, however this progress has been highly localized. There is no major national strategy to address the emergency preparedness needs of all archives.

Data Limitations

There are significant gaps in data sources on archives infrastructure. There are no longitudinal data collection efforts that attempt to obtain information about or from every American archival institution regarding building location, facility type and use, collection volume, storage conditions, or level of emergency preparedness. As a result, it is difficult to quantify with confidence how much of the American archives infrastructure is exposed to climate change, the total volume of materials at risk, how much archives themselves contribute to climate change emissions, and whether the situation is growing worse or better.

The Heritage Health Information Survey was conducted by the Institute of Museum and Library Services (IMLS) in 2014 and published in 2019. This was a follow-up survey to the Heritage Health Index initially conducted in 2004. Both surveys sought to understand the extent of the preservation needs of objects and materials across America's collecting institutions, including archives, libraries, museums, scientific collections, and historical societies. The 2014 Heritage Health Information Survey surveyed collecting institutions about their preservation needs, environmental storage conditions, emergency preparedness, and staff responsibilities. The data is reported both in aggregate, by sector, and by institution size (small, medium, or large). This is useful in being able to compare, for example, large archives versus small archives, or libraries versus museums.

The largest recent survey of American archivists, A*CENSUS II, was a two part survey, with the first survey targeting all archival workers in 2021, and the second survey targeting archives administrators conducted in 2022. The first iteration of A*CENSUS was conducted in 2004. In the 2022 survey, administrators were asked about the volume of collections under their institution's stewardship, public access to collections, annual volume of accessioned and deaccessioned materials, and other data that gives clues to larger infrastructure concerns such

as storage issues or existing level of digital preservation infrastructure. However, respondents were not asked to report on building-specific concerns, such as whether archives are primarily located on-site or off-site, whether the building experiences periodic small scale disasters (e.g., a leaky roof), or whether the building has ever experienced major hazards (e.g., a hurricane or flood).

While both the Heritage Health Information Survey and A*CENSUS II are excellent sources of information related to the state of archives in the United States, both surveys have only been conducted twice, and it is not clear what the long-term plans are, if any, for continuing to carry out these surveys. The Society of American Archivists (SAA) has cited repeating A*CENSUS as a goal within its Work Plan on Diversity, Equity, Inclusion, and Accessibility, and has identified work on this goal as commencing between 2025 and 2026.⁵ Review of recent SAA Council materials do not indicate that preparatory work has started on the major undertaking associated with repeating A*CENSUS. SAA has also ushered in some resources relevant to encouraging greater use of quantitative data. These include the adoption of the *Guidelines for Standardized Holdings Counts and Measures for Archival Repositories and Special Collections Libraries*,⁶ the creation of the Committee on Research, Data, and Assessment,⁷ and the creation of a data repository, the SAA Dataverse.⁸

Without a clear institutional commitment to repeating and carrying out major national surveys, any survey data remains a snapshot in time and cannot be used to measure progress or deterioration across America's archives. There are additional smaller-scale surveys that have focused on specific types of cultural heritage organizations that, if repeated, could provide far more empirical and longitudinal information about the evolution of these organizations. These include examples such as Association of Tribal Archives, Libraries, and Museums' (ATALM) 2012 and 2022 studies of tribal libraries, archives, and museums,⁹ and Lyris's 2020 study of small archives.¹⁰

A major exception to the lack of longitudinal data comes from the Council of State Archivists (CoSA), which conducts a biennial survey of state and territorial archives (i.e., archives responsible for the preservation and access of state/territorial government records). Although there is not always a 100% response rate, and state archives data should not necessarily serve as a proxy for all archives, the biennial data reported from state archives demonstrate that even within this group there is widespread variation in collection size, personnel, budgets, services, and emergency preparedness.

⁵ Society of American Archivists, "Work Plan on Diversity, Equity, Inclusion, and Accessibility"; Society of American Archivists, "Strategic Plan Actions and Timelines, FY2023-FY2025."

⁶ Society of American Archivists and Association of College and Research Libraries - Rare Books and Manuscripts Section, "Guidelines for Standardized Holdings Counts and Measures for Archival Repositories and Special Collections Libraries."

⁷ Society of American Archivists, "Committee on Research, Data, and Assessment."

⁸ Society of American Archivists, "SAA Dataverse Collection Development Policy."

⁹ Jorgensen, "Sustaining Indigenous Culture: The Structure, Activities, and Needs of Tribal Archives, Libraries, and Museums"; Jorgensen and Johnston, "Chapter 1. Tribal Archives."

¹⁰ Clareson and Grinstead, "Small & Diverse Archival Organization Needs Assessment Project' Summary Report."

Experts have repeatedly cited the lack of comprehensive and consistently gathered data concerning the practices and holdings of archival institutions specifically, and cultural heritage organizations generally, as a major barrier to profession-wide planning and advocacy efforts. First, it hinders archival organizations from effective identification of the areas of largest vulnerability in order to build strategic advocacy efforts. Second, this lack of data means there are few clearly agreed upon benchmarking norms for archives to internally measure themselves against. Third, lack of data means that empirical and replicable research on archives is limited. Finally, the inconsistency of including location information within data gathering efforts means it is difficult to identify those archives that face the most existential risks due to climate change.

Locations and Facilities

Data on the locations of archives and information about facilities is critical baseline information for researchers to conduct a comprehensive assessment of climate change exposure of archives in the United States. Climate change risk mapping typically relies on geospatial data to determine how factors such as elevation, floodplain, urban building density, and other factors may result in specific climate change risk factors for a given location. Accurate data concerning archives locations and facilities is essential to painting the full picture of risk in the United States.

Up until 2017, the largest available data set on archives in the United States was OCLC's ArchiveGrid, which at the time numbered just over 1,200 repositories. The OCLC ArchiveGrid data set generally represented institutions which had the resources to put encoded (i.e., Encoded Archival Description) finding aids online. This left out a significant number of smaller archives, as well as institutions that may not be traditionally thought of as an archive, but which still have responsibility for archival records.

Two major data projects in recent years have attempted to identify, verify, and consolidate geospatial information related to archives in the United States. The first is the RepoData project. In 2017, Penn State archivist Ben Goldman and I received a grant from the Society of American Archivists Foundation to create a comprehensive data set of US archives. We hired a research assistant, Whitney Ray, and our RepoData project team set out to try to build a major directory of archives (including organizations not explicitly identified as archives, but that had major archival holdings) in the United States. Ben and I initiated this project because our prior publication on climate change risk to archives relied on the ArchiveGrid data,¹¹ and we were concerned that without a comprehensive archives location data set, the actual risk of climate change could not be fully assessed.

The RepoData project team contacted over 150 archival organizations for any lists or directories they had with archives and institutions with archival records across the United States. After cleaning up the data, we had over 25,000 data points, and over 18,000 physical locations that we were able to geolocate on a map. Documentation from the project was stored in an Open Science Framework repository, and the data set is publicly available through GitHub.

¹¹ Mazurczyk et al., "American Archives and Climate Change."

The second major archives location data project is Providing Risk of The Environment's Changing Climate Threats for Galleries, Libraries, Archives & Museums (PROTECCT-GLAM). Led by Ed Benoit of Louisiana State University and funded with an IMLS National Leadership Grant, the project is planning to "develop a national categorical climate change risk assessment scale for galleries, libraries, archives, and museums (GLAMs)."¹² Ben Goldman and I currently serve on the advisory board given our prior experience with RepoData. As part of the preparatory work for the risk assessment, Ed and his team have consolidated several major data sources for libraries, museums, and archives.¹³ RepoData is the main source for archives data.

While archives location data has steadily improved over the last several years thanks to the efforts of the RepoData and PROTECCT-GLAM projects, this data still primarily centers on the "official" street address location of an archive. With only a few exceptions of offsite storage locations that have been added to the data, neither data set includes all of the storage locations associated with an archive. Obtaining this information would be a massive undertaking requiring inquiries with many archives. Due to space limitations, many large archives use large offsite storage facilities to supplement on-site storage capacity. A 2013 study of Association of Research Libraries (ARL) libraries found that 92% of those using off-site storage for general collections also used it for archival and special collections materials.¹⁴

The major geolocation data sets do not include anything about the facilities that contain archival materials, such as whether the archival records are located in a basement or attic (two spaces notoriously vulnerable to leaks or floods), the building's elevation, or its landscaping/grading. These factors can significantly influence the vulnerability of an archive to a flood event. Therefore, the location data that is currently available can aid in assessing risk to the street address location of an archive, but many unknown and unreported aspects about archival facilities may either increase or decrease the facility's potential exposure to damage, particularly flooding disasters.

Collection Size

The most meaningful unit of measurement for archivists to report physical collection size is cubic or linear feet. Reporting counts of collections or numbers of containers are less useful since a collection can be large or small, and archives use different container sizes to store collections based on preservation and access needs. A single collection may range in size from less than a linear foot all the way up to several thousand linear feet. In 2019, the National Archives and Records Administration (NARA) reported that it accessioned (i.e., took physical and intellectual control of) over 55,000 cubic feet of material.¹⁵ While most archives do not take in nearly that amount of content per year, archives generally acquire more material than they deaccession (i.e., archival records that are removed from an archive's ongoing responsibility).

¹² Institute of Museum and Library Services, "Louisiana State University, National Leadership Grant - Libraries."

¹³ Benoit, III, Trepanier, and Vanos, "GLAM Dataset."

¹⁴ Priddle and McCann, "Off-Site Storage and Special Collections," 657.

¹⁵ National Archives and Records Administration, "National Archives by the Numbers."

This has led to most archives experiencing acute storage issues as collections expand, but facilities do not.

The A*CENSUS II Administrators Survey also asked respondents to report what unit of measurement they use for collection volume.¹⁶ The next two tables show the holdings of archives by sector. One quarter of respondents measuring by linear feet have between 500 and 1,999 linear feet of content. Government archives are more likely than other sectors to have large total holdings exceeding 20,000 linear feet.

<i>Linear feet</i>	Academic	Government	Nonprofit	Other	All Sectors
Less than 500 linear feet	8.19%	16.36%	20.37%	7.89%	12.90%
500-1,999 linear feet	16.96%	30.91%	33.33%	31.58%	25.27%
2,000-4,999 linear feet	22.22%	7.27%	18.52%	31.58%	19.89%
5,000-9,999 linear feet	20.47%	10.91%	9.26%	10.53%	14.78%
10,000-19,999 linear feet	12.87%	10.91%	11.11%	7.89%	11.56%
20,000 or more linear feet	19.30%	23.64%	7.41%	10.53%	15.59%

Just under one quarter of respondents measuring by cubic feet have less than 2,000 cubic feet of content. More than half of government archives have holdings exceeding 20,000 cubic feet.

<i>Cubic feet</i>	Academic	Government	Nonprofit	Other	All Sectors
Less than 2,000 cubic feet	18.33%	24.07%	33.33%	27.78%	24.71%
2,000-4,999 cubic feet	18.33%	5.56%	28.57%	22.22%	17.24%
5,000-19,999 cubic feet	43.33%	16.67%	19.05%	22.22%	27.01%
20,000 or more cubic feet	20.00%	53.70%	19.05%	27.78%	31.03%

More than 500 respondents (out of a total of 746) supplied an answer to their archives' volume of material. One concerning figure that jumps out from the A*CENSUS II survey is that nearly 23% of respondents reported that they do not measure their physical collections at all.¹⁷ Additional insights about archives that do not measure their physical collections is explored in the next finding related to gaps between best practices and reality.

¹⁶ Society of American Archivists and Ithaka S+R, "A*CENSUS II Archives Administrators Survey, 2022."

¹⁷ Skinner, "A*CENSUS II: Archives Administrators Survey," 25–26.

Measuring electronic records holdings is both easier and more challenging than measuring physical holdings. On the one hand, computer storage measurements are more standardized units of measurement than cubic/linear feet and can be recalculated more easily (e.g., from gigabytes to petabytes) to facilitate cross-institutional comparisons. On the other hand, since most organizations maintain multiple copies of the same data for digital preservation purposes, survey instruments need to specify whether reported volume is of *all* digital content, or one set of original content.

A*CENSUS II Archives Administrator respondents were asked to select a range of their digital collections holdings.¹⁸ The majority of organizations that measure their digital collections holdings maintain 4 terabytes (TB) or less of content. However, more than a quarter of organizations (over 28%) report that they do not measure their digital collections.

Digital collections	Academic	Government	Nonprofit	Other	All Sectors
1-499 GB	9.38%	12.78%	15.99%	11.54%	12.64%
500-999 GB	7.42%	3.01%	8.18%	7.69%	6.93%
1-4 TB	23.44%	18.80%	20.07%	19.23%	20.92%
5-9 TB	10.55%	8.27%	4.46%	7.69%	7.61%
10-19 TB	9.38%	3.76%	4.83%	5.13%	6.25%
20-99 TB	11.33%	7.52%	5.20%	6.41%	7.88%
More than 100 TB	5.08%	8.27%	3.35%	7.69%	5.30%
My department does not currently measure its digital collections	22.66%	30.83%	31.23%	30.77%	28.13%
My department does not have digital collections	0.78%	6.77%	6.69%	3.85%	4.35%

Since digital preservation practices often assume maintenance of multiple copies of data, it is unclear how many copies of data may exist from surveys that report “total volume.” These numbers also do not typically distinguish between digitized collections of physical material and born-digital electronic records. The latter may pose more ongoing preservation challenges, since there is not an analog backup.

¹⁸ Society of American Archivists and Ithaka S+R, “A*CENSUS II Archives Administrators Survey, 2022.”

While it is not limited to the United States, the National Digital Stewardship and Alliance (NDSA) Storage Infrastructure Survey conducted in 2019 asked respondents to distinguish between storage space needed for one complete copy of digital collections and *all* copies of digital collections.¹⁹ For one copy:

- 6% required less than 1 TB
- 20% required 1-10 TB
- 34% required 10-99 TB
- 25% required 100-999 TB
- 15% required more than 1 petabyte (PB)

For *all* copies:

- 4% required less than 1 TB
- 14% required 1-10 TB
- 25% required 10-99 TB
- 36% required 100-999 TB
- 20% required more than 1 PB

Due to NDSA's focus on digital preservation, this likely explains why the numbers from respondents to this survey are much higher than the A*CENSUS II numbers.

Storage Conditions

Physical and digital storage conditions greatly influence preservation and access concerns with collections. Even the most stable content in an archive will generally experience some kind of inherent degradation over time, and appropriate storage conditions are essential to prolonging the life of archival records. When collections are stored according to widely accepted guidelines and best practices, this means collections are more likely to be in a stable preservation environment that minimizes damage to materials. Maintaining collections in appropriate storage conditions such as archival-quality boxes and folders also facilitates access to collections, by making it easier for archivists to pull materials and for users to handle content.

Beyond the normal “wear and tear” to archives from normal variations in temperature and humidity as well as typical day to day handling conditions, the storage conditions of archives, whether physical or digital, is an essential line of defense during an emergency or disaster. Archival quality boxes provide a surprising amount of protection for collections exposed to a burst pipe or minor leak. Even if the boxes become soaked, the materials inside will likely experience less damage than unhoused records, and this will aid the salvage process. Archival quality boxes also create a stable microenvironment for the contents inside, mitigating against temporary fluctuations in temperature and humidity.²⁰ Storing multiple copies of digital collection files across various geographic locations (for example, with on-site servers as well as a vendor cloud storage provider) ensures that if a disaster affects the power grid in one area, another set of files can be retrieved from the unaffected location.

¹⁹ Alagna et al., “2019 Storage Infrastructure Survey,” 13–14.

²⁰ Ntanos and VanSnick, “Understanding the Environment in an Archive Store.”

Physical collections should be stored in facilities with environmental controls (e.g., temperature and humidity) and secured storage areas, inside archival-quality boxes and storage containers, without folders or boxes being crammed with material, on uniform powder-coated metal shelving. Collections should not be too close to the floor, and should not be shelved in areas known to have frequent environmental storage concerns, as is often the case with many basements or attics lacking environmental controls. Since different formats may have different storage needs (e.g., analog film may need to be kept at colder temperatures), ideally archives would have specialized storage environments dedicated to items with specific needs. One challenge for many archives is that unprocessed collections (i.e. backlogs) are often not housed in archival containers until they are processed. This means that unprocessed collections can be doubly vulnerable to damage and loss: first, because they are not housed in appropriate storage containers, and second, because without a full inventory of what is in a collection, it may not be obvious what was lost if damage occurs to a collection before it is fully processed.

Digital collections storage and preservation practices emphasize storing multiple copies of files, ideally in different locations. The concept of LOCKSS (Lots of Copies Keeps Stuff Safe) operates on the assumption that if one copy fails, others are available to take its place. This is also why there is emphasis on keeping multiple digital copies across geographic locations and digital storage systems, in case one system experiences a failure (whether due to a natural disaster, equipment failure, or unauthorized intrusion). In addition to storage practices, there are numerous additional preservation practices such as performing fixity checks (i.e. monitoring file integrity) to ensure that stored files are not degrading in their storage environment.

There are very few studies that go beyond basic and generalized questions about the storage conditions of archival collections, whether physical or digital. However, examining the limited data indicates a wide array of storage conditions across US archives. Given that larger institutions may be more likely to answer a survey in the first place, as well as having the resources and expertise to manage an appropriate storage environment for collections, it is possible that inadequate storage conditions may be underreported in the existing data.

Temperature and humidity considerations have an enormous impact on the storage conditions of collections. If there are major changes in a rapid time period, this can negatively impact collections by increasing the risk for mold damage, decay, or item damage. The IMLS Heritage Health Information Survey of US collecting institutions found that 86% of surveyed archives had temperature controls and 78% had humidity controls—numbers that are better compared with all US collecting institutions ²¹

However, more targeted surveys, especially those focused on specific states, paints a less reassuring picture concerning basic environmental storage conditions. This is likely because targeted surveys may receive more responses from smaller archives. The 2012 ATALM study

²¹ Institute of Museum and Library Services, “Protecting America’s Collections: Results from the Heritage Health Information Survey, February 2019,” 25.

found that 46% of tribal archives, libraries, and museums lack climate controls.²² The 2019 California State Library Cultural Collection Protection Survey of California collecting institutions (a survey adapted from the IMLS survey) found that 60% of California archives had temperature controls and only 40% had humidity controls.²³ State historical records advisory boards (SHRABs) have also found lower numbers compared with the IMLS survey. A 2008 Missouri SHRAB survey of 300 repositories with archival records found only 45% of respondents used temperature controls, and only 34% have humidity controls. These low numbers pose additional concerns since the same survey found that only 57% of respondents use archival boxes.²⁴ A 2023 Virginia SHRAB survey of 68 repositories asked a slightly different question, focusing not on the presence of controls, but about stability of environmental conditions and monitoring. The survey found that 55% of respondents reported monitoring of temperature and humidity, and that half reported the levels were consistent.²⁵

Gap between Best Practices and Reality

Over the last two decades, a wide variety of archives and archives-adjacent methods, best practices, guidelines, and standards have been introduced and adopted to varying degrees. These developments include archives profession guidelines revising older approaches to appraisal, accessioning, and processing. Other guidelines have emerged from adjacent fields such as museums, libraries, and preservation/conservation and have been adopted by many archives. Many of these approaches were formulated with a recognition of the real material limitations of archives in an attempt to maximize resources, increase service to users, and decrease operating costs.

Although these methodologies are not always formulated for the purpose of strengthening archives in the face of climate change, they often have secondary benefits in increasing institutional adaptation and resilience. For example, the rise of extensible processing practices is an effort to gain as much intellectual control over archives as possible given the challenges of collection backlogs. By prioritizing inventorying as much of an archives' holdings as possible, this information is of enormous value if and when a major disaster happens since it supports archivists in identifying what was damaged and lost.

There are distinctions between guidelines, best practices, and standards. These terms and others are often used interchangeably in the archives field, and subject matter experts interviewed for this project who are familiar with the differences often pointed out the importance of using the correct terminology. This Phase 2 report will generally use “guidelines” when there is a published reference document or “best practices” when referring to widely accepted (though perhaps not widely implemented) archival professional practices. The term “standard” will only be used when a published standard is referenced that has been adopted by a major professional

²² Jorgensen, “Sustaining Indigenous Culture: The Structure, Activities, and Needs of Tribal Archives, Libraries, and Museums,” 14.

²³ California State Library, “California Cultural Collection Protection Survey Report,” 26.

²⁴ Missouri Historical Records Advisory Board (MHRAB), “2008-2009 Statewide Records Assessment Survey,” 4.

²⁵ Virginia State Historical Records Advisory Board, “SHRAB Preservation Survey,” 9, 12.

association such as the Society of American Archivists, or another organization, according to its standards adoption process.

It is widely recognized throughout the US archival profession that there are major gaps between best practices and the operating conditions of most archives. Yet because the entirety of the American archives profession does not have a culture of standardized data reporting and analysis, there are limitations to estimating how many archives are operating according to widely accepted guidelines and best practices. Given that adherence to guidelines and best practices has a cascading effect of increased climate change preparation due to effective management of archival operations, understanding where archives fall short of best practices provides insight into where there may be additional vulnerabilities.

Building Energy Efficiency

Buildings and appropriate collection storage environments are one of the most important lines of defense for the preservation of archival materials. This is because at certain temperature and humidity extremes, the potential for damage to archival holdings increases. Physical archival materials are typically made up of organic materials like plant cellulose (paper) or gelatin (photographs) and these materials are inherently prone to deterioration. Heat, humidity, and light accelerate that inherent deterioration process. Collection storage environments should be maintained with temperature and humidity controls to prolong the life of materials as much as possible. In addition, temperature and humidity extremes can introduce new issues to materials, such as a potential mold outbreak, increased pests, or mechanical damage (e.g., a bound manuscript made of vellum may warp in extreme humidity conditions).

Until recently, facility guidelines for collections-based cultural heritage institutions such as archives recommended maintaining a very narrow and constant temperature and humidity range, typically at 65-70°F/50% relative humidity (RH) with minimal fluctuation.²⁶ In recent decades, preservation and conservation professionals have found through extensive research that this narrow range has more flexibility than previously thought. Collection stewards can now allow a greater temperature and humidity range without introducing significant damage to their collections, provided appropriate implementation.

In 2013, the Image Permanence Institute (IPI), a leader in storage condition research, published a *Guide to Sustainable Preservation Practices for Managing Storage Environments*. This guide explains how building mechanical systems (specifically heating and cooling systems) work, considerations for collection storage conditions, and summarizes IPI's research into new guidelines for more energy efficient storage spaces.²⁷ IPI found that sustained high temperatures and sustained periods of extreme humidity (high in summer and low in winter) have more impacts on collections than short term fluctuations.²⁸ This means that institutions can engage in activities like controlled shutdowns of mechanical systems on a scheduled basis (for example, at night) that can result in significant energy savings with little impact on collections.

²⁶ Image Permanence Institute, "Sustainable Preservation Practices," 5.

²⁷ Image Permanence Institute, 3.

²⁸ Image Permanence Institute, 14-15.

IPI emphasizes that responsible implementation of these standards requires institutions to commit to ongoing data gathering and assessment, including the use of environmental monitoring tools like data loggers placed in collection stacks. Collection stewards must know where their facilities' vulnerable areas are so they can anticipate potential environmental changes during seasonal transitions or major weather events. Collections stewards must also forge close relationships with facilities personnel so that mechanical systems can be adjusted based on previous data.

NARA recently updated their archival facilities standard (NARA 1571) to reflect this new research. Previously, the NARA facility standard called for storing paper textual records at 65°F and between 35-45% RH.²⁹ The newly revised standard has expanded the allowable range, now calling for storing paper textual records between 50°-65°F and 30-50% RH.³⁰ NARA previously conducted research on adjusting relative humidity setpoints and found that it likely extended life of the records and decreased utility costs by \$650,000.³¹

Although these standards result in energy savings, this does not necessarily mean that it requires less work. Some subject matter experts pointed out that because responsible implementation of sustainable facilities standards calls for a permanent and ongoing commitment of resources towards environmental monitoring and assessment, this can result in additional work for institutions that may otherwise be tempted to use the “old” setpoints and put mechanical systems on autopilot. Administrators must recognize this as a core activity and help staff find dedicated time to make this shift in the environmental conditions of collections facilities.

Every subject matter expert who was asked about energy efficiency standards noted that many small organizations have so much difficulty achieving even basic building space and collection security that they are rarely in a position to introduce sustainable facility practices. Small archives may not even have the ability to adjust temperature and humidity controls in the first place, especially in historic buildings or buildings that were not purpose built for storing collections. These observations are reinforced by the data mentioned previously from state surveys demonstrating that many small archives still lack temperature and especially humidity controls.

In a 2020 article titled “Partnering Preservation with Sustainability,” archivist Carli Lowe examined integrating sustainability into archives preservation with a focus on building design and learning from cultural preservation traditions.³² In some cases where a building or mechanical system cannot be replaced, archivists can still undertake strategies consistent with the spirit of the IPI standards. For example, in older buildings with passive ventilation that cannot be fully overhauled without losing its historic character, archivists can reorient the

²⁹ Conrad, “Archival Environments,” 39.

³⁰ National Archives and Records Administration, “NARA 1571, Archival Storage Standards,” 9.

³¹ National Archives and Records Administration, “National Archives Extends Life Expectancy of Its Textual Records at Its College Park Facility AND Saves Energy at the Same Time.”

³² Lowe, “Partnering Preservation with Sustainability.”

storage shelving and strategically place fans and space heaters while monitoring different parts of the building with data loggers to create a better storage environment.

Ultimately, storage environment guidelines provide instructions for individual institutions but the challenge remains of understanding how archives both contribute to climate change through their energy use and how climate change is posing an increasing threat to their holdings. The American Institute for Conservation's (AIC) *Held in Trust* report identified the data gap on energy usage practices as one of the major challenges in cultural heritage climate change adaptation:

The sector does not have enough data on how and to what extent it contributes to the climate crisis. It needs tools, practices, and policies that make it routine to monitor and measure energy usage (sources, efficiencies, and generation) and full carbon impacts (materials and energy) in exhibits, programs, and standard operations. There is also a lack of data on exposure of collections and heritage sites to climate change impacts, in particular limited recognition of the need for support for smaller institutions and for collections items (rather than historic sites).³³

Collection Management and Storage Capacity

Many archivists report that their archives have space and capacity issues, but are also unable or unwilling to report their archives' current volume of physical and electronic holdings in major surveys. Knowing the current volume of material is only the first step to managing archival content. It also must be inventoried and processed (also known as arrangement and description) in order to make it accessible to users.

Archives present an inherent access problem that must be mediated through useful arrangement and description of records. For this reason, it is a widely accepted best practice that all archives should endeavor to create and maintain at least basic information about all their holdings in order to achieve preservation and access goals. The SAA standard, *Describing Archives: A Content Standard* (DACS), concerns the description of archival materials and emphasizes the importance of basic descriptive information for every collection held by a repository.³⁴

Several surveys mentioned earlier in this report asked respondents to indicate how much of their archive's holdings are cataloged, inventoried, or publicly discoverable. If all archives adhered to the DACS principle of each collection having some kind of useful description, the answers to these questions would be 100%. The survey responses tell a very different story, which is that most archives still struggle with backlogs (i.e., unprocessed materials).

The 2023 A*CENSUS II Administrators report asked respondents what percentage of their institution's collections were discoverable online.³⁵ Academic and government archives were far

³³ Foundation for Advancement in Conservation, "Held in Trust: Transforming Cultural Heritage Conservation for a More Resilient Future," 21.

³⁴ Society of American Archivists, "Statement of Principles."

³⁵ Society of American Archivists and Ithaka S+R, "A*CENSUS II Archives Administrators Survey, 2022."

more likely to report more than 90% of their holdings were discoverable online compared with nonprofit and other archives.

<i>Percent of Discoverable Collections</i>	Academic	Government	Nonprofit	Other	All Sectors
0%	2.69%	13.33%	20.07%	30.77%	13.88%
1-9%	8.46%	22.22%	27.14%	28.21%	19.81%
10-29%	13.46%	12.59%	15.24%	12.82%	13.88%
30-49%	12.31%	10.37%	10.04%	5.13%	10.38%
50-69%	13.46%	9.63%	9.67%	10.26%	11.05%
70-89%	29.62%	11.85%	14.13%	10.26%	18.73%
90-100%	20.00%	20.00%	3.72%	2.56%	12.26%

The 2023 CoSA survey asked respondents how many records were inaccessible due to insufficient processing levels. Most respondents (83%) reported that less than a quarter of physical materials were inaccessible due to insufficient processing, however rates of availability for digital materials were much lower. Only 46% of respondents reported that less than a quarter of digital materials were inaccessible due to insufficient processing.³⁶

State historical records advisory board surveys have surfaced concerning information related to the physical and intellectual control of smaller archives. A 2008-2009 Missouri Historical Records Advisory Board survey found that 34.28% of institutions had at least three-quarters of their holdings inventoried, 31.44% had some of their holdings inventoried, and 34.37% had one-quarter or less of their materials inventoried.³⁷ When respondents were asked about challenges, more than one-third of respondents reported that a lack of finding aids and a processing backlog were major challenges; these were the second and third most reported challenges after lack of staff/funding. An additional 20.75% reported challenges with storage space.³⁸ The 2023 Virginia State Historical Records Advisory Board preservation survey found that the average percentage of processed collections was around 62%, but slightly less than half of collections were housed in archival enclosures and containers.³⁹

The 2021 California Cultural Collection Protection Survey Report found that 58% of archives are close to collecting capacity, and 24% are currently over capacity. Compared with historical societies, libraries, museums, and scientific collections, archives had the shortest remaining years of collecting space available (4.5 years) and required more than three times the average square footage needed by all collecting institutions to accommodate capacity (37,000 additional feet).⁴⁰ However, the same study found that only 17% of archives had 81% or more of their

³⁶ Council of State Archivists, “The State of State Records,” 7.

³⁷ Missouri Historical Records Advisory Board (MHRAB), “2008-2009 Statewide Records Assessment Survey,” 2.

³⁸ Missouri Historical Records Advisory Board (MHRAB), 5.

³⁹ Virginia State Historical Records Advisory Board, “SHRAB Preservation Survey,” 3, 43.

⁴⁰ California State Library, “California Cultural Collection Protection Survey Report,” 19.

collections cataloged. Almost 1/3 of archives respondents had less than 40% of their collections cataloged.⁴¹

These persistent gaps remain a major concern given that extensible and minimal archival processing methods to reduce backlogs have existed for almost two decades. Backlogs were previously discussed in the Phase 1 report, since their persistence is strongly linked to personnel capacity within archives. The issue remains relevant to infrastructure concerns, because having comprehensive collection information in the form of inventories, finding aids, and catalogs is a fundamental aspect of emergency preparedness. In fact, many disaster plans recommend maintaining at least one set of collection records in an offsite location. If an archive has many collections that have not been properly accessioned or processed, not only does this hinder researcher access, it also poses grave risks to accounting for potential loss in a major disaster.

Digital Preservation Best Practices

Digital preservation refers to a wide range of practices to ensure the usability of digital content over extended periods of time. Digital preservation activities can be performed on both born-digital content and files created through digitizing analog physical media. Even when archives do not acquire born-digital content, they may be confronted by digital preservation challenges if they have digitized collections such as photographs or audiovisual material. Archives now need to ensure that these digitized files are preserved and can be read into the future, especially if the analog materials have degraded.

NDSA maintains a user-friendly resource known as the *Levels of Digital Preservation*. These levels are widely used as a benchmarking tool by many institutions engaged in digital preservation activities.⁴² However, much like the absence of a registry documenting archives building/facilities information, there is also no registry for archives to report their institutional levels of digital preservation. While there is a gap between digital preservation best practices and institutional realities, without long term longitudinal data it is difficult to assess the expanse of this gap and whether it is improving or growing worse over time.⁴³

An environmental challenge associated with digital preservation is that more energy intensive processes (e.g., having two copies versus three copies, verification of file integrity upon ingest versus at fixed intervals, etc) are associated with higher levels of digital preservation. Since 60% of electricity in the United States is derived from fossil fuels, this means that digital preservation activities performed at the highest level are likely to have a larger carbon footprint than lower levels of digital preservation.⁴⁴ On the other hand, higher levels of digital preservation may protect content from major disasters such as a power grid failure or major disaster that affects data centers.

⁴¹ California State Library, 35.

⁴² National Digital Stewardship Alliance, “Levels of Digital Preservation.”

⁴³ Altman et al., “2020 NDSA Agenda for Digital Stewardship,” 56.

⁴⁴ U.S. Energy Information Administration, “Frequently Asked Questions (FAQs).”

One of the core foundations of digital preservation is having a digital preservation plan. The IMLS Heritage Health survey found that 65% of archives surveyed were engaged in both born-digital preservation and digitization of collections. Only 31% of small archives had some kind of digital preservation plan, but 60% of medium and large archives had a digital preservation plan.⁴⁵

The California state library found that 72% of California collecting institution respondents answered that born-digital content was not part of a condition assessment, long range preservation plan, or emergency plan.⁴⁶ A Nevada survey of collecting institutions found that more than $\frac{3}{4}$ of respondents did not have a digital collections preservation plan or policies/procedures to address digital holdings.⁴⁷ Among state archives, CoSA has found that most have some level of digital preservation policies and strategies. However, as of 2022, 15 state and territorial archives still do not have a digital preservation policy.⁴⁸

Much like the conversation around building facility standards, so many organizations already have difficulty meeting minimum standards for operations that it is difficult to expect them to do more. If very few organizations can achieve very high levels of digital preservation, *and* if doing so is more energy intensive, perhaps this presents an opportunity to completely rethink what digital preservation should look like in the first place.

Digital preservation is an active and quickly evolving area of best practices. This is particularly true for examining the environmental footprint of digital preservation and developing efforts to find energy efficiency. A 2019 article authored by American archivists Keith Pendergrass, Walker Sampson, Tim Walsh, and Laura Alagna explored the environmental implications of digital preservation, and raised several possible adaptations of widely accepted digital preservation approaches.⁴⁹ For example, one option is scheduling fixity checks during off-peak electricity usage periods.

Even when organizations are not fully engaged in digital preservation best practices, they understand its importance. The A*CENSUS II Administrators survey found that digital preservation, digital asset management systems, digitization, and electronic records were among the top four professional development interests.⁵⁰ Integrating emerging sustainable best practices into digital preservation education and training is essential to shift digital preservation towards lower energy consumption levels.

Subject matter experts have noted that this issue has increasing urgency because of the significant pressure institutions face to move their digital preservation activities to the cloud, and to adopt artificial intelligence (AI). Cloud computing and AI have significant carbon

⁴⁵ Institute of Museum and Library Services, "Protecting America's Collections: Results from the Heritage Health Information Survey, February 2019," 49.

⁴⁶ California State Library, "California Cultural Collection Protection Survey Report," 37.

⁴⁷ Kintop, "Nevada's Cultural Resources Survey and Report 2013," 9.

⁴⁸ Martzahl, "2022 Digital Preservation Capability Maturity Model," 7–8.

⁴⁹ Pendergrass et al., "Toward Environmentally Sustainable Digital Preservation."

⁵⁰ Skinner, "A*CENSUS II: Archives Administrators Survey," 169.

emissions that are often invisible because of a lack of vendor transparency. Cloud computing and AI are associated with exacerbating water crises, because data centers use significant amounts of water to cool servers.⁵¹

Urgency of Emergency Preparedness

Emergency preparedness and disaster response is increasingly urgent for archives across the country. With climate change impacting every corner of the United States, there are increasingly severe disasters. According to the NCA:

In the 1980s, the country experienced, on average, one (inflation-adjusted) billion-dollar disaster every four months. Now, there is one every three weeks, on average. Between 2018 and 2022, the US experienced 89 billion-dollar events. Extreme events cost the US close to \$150 billion each year—a conservative estimate that does not account for loss of life, healthcare-related costs, or damages to ecosystem services.⁵²

It is no longer a question of if archives will experience an emergency or disaster, but when and on what scale. While cultural heritage professions have devoted increasing resources and attention to emergency preparedness thanks to several pivotal events of the last several decades, American archives are still lagging in full preparation for a variety of emergencies.

Typical emergency preparedness practices in cultural heritage tend to focus on singular events in close proximity (e.g., a flood that affects the basement, a wildfire that burns down a building). However, climate change is increasing the incidence of compound events and cascading impacts, where multiple events or impacts occur simultaneously. An example is the 2023 Canadian wildfires which triggered air quality alerts in the Midwest and the Northeast. Archives in these areas may never have considered wildfire risks previously, but air quality alerts may impact how much outside air can be safely introduced via mechanical ventilation systems to maintain occupational safety. Chronic air quality issues may also introduce preservation risks to archival holdings.

Some surveys have asked cultural heritage organizations and archives to report on their emergency preparedness or disaster plan and organizational commitments to updating and practicing those plans. The good news is that archives tend to be better positioned than many other cultural organizations for emergency preparedness. The bad news is that significant gaps remain between having a written plan and having the institutional capacity to implement it.

The IMLS Heritage Health survey found that 42% of US collecting institutions have an emergency/disaster plan, and archives were the most likely type of institution (52%) to have a written plan. However, there are major differences within archives based on size: 86% of medium/large archives have some kind of emergency/disaster plan, but only 47% of small archives report the same. Only 24% of US collecting institutions have both a plan and trained

⁵¹ Monserrate, “The Cloud Is Material.”

⁵² U.S. Global Change Research Program, “Chapter 1,” 17.

staff, however archives were the most likely type of institution to have a written plan and trained staff. One-third of US collecting institutions keep duplicate collection records off-site. While archives were the least likely to have records stored offsite, they were also the most likely to have collection records in the first place.⁵³

The California survey of collecting institutions found similar numbers as the IMLS survey—only 42% of collecting institutions have a written emergency/disaster plan, but 51% of archives have an emergency plan. Of archives with a written plan, 36% have not updated this plan regularly.⁵⁴ ATALM’s 2021 survey found 57% of tribal archives have disaster preparedness plans.⁵⁵ CoSA has recently found that a majority of state archives have an emergency plan, but a majority of respondents “rarely” or “never” practice these plans. Natural disasters are the most frequently identified risk in continuity of operations planning (other types of risks include civil disturbance, pandemics, mass shootings, and arson), and 34% of respondents participate in a regional cultural heritage emergency preparedness organization.⁵⁶

As of today, there is no comprehensive national strategy that exists to support the emergency preparedness needs of all archives. Emergency preparedness often comes down to what local resources are available, the knowledge and commitment of leaders, and the organizational positioning of archives. For example, an archive in a large university library may have access to emergency response officials, while a small community archive might not.

There are uneven resources for archives that need external disaster response support. The Society of American Archivists maintains a National Disaster Recovery Fund for Archives (NDRFA), which makes small grants to archives facing disasters. The Society of Southwest Archivists formed the NDRFA after Hurricane Katrina, and the fund was later transferred to the SAA Foundation. Organizations can apply for grants up to \$5,000 to assist with immediate recovery supplies while the insurance process unfolds.

Other resources like the American Institute for Conservation’s National Heritage Responders may assist archives with hands-on support during major disasters. Getting the word out about organizations that can provide assistance is crucial since many smaller archives are not as well networked into large archival associations. On the other hand, these resources are limited and cannot always scale for a major disaster affecting many archives. Organizations that face major disasters often need to navigate the Federal Emergency Management Agency (FEMA) Public Assistance process.

As the insurance industry increasingly reacts to climate change by raising rates and even pulling out of markets, this will have implications for archives. The art museum sector is already grappling with this issue, as museums in vulnerable coastal areas find their insurance premiums

⁵³ Institute of Museum and Library Services, “Protecting America’s Collections: Results from the Heritage Health Information Survey, February 2019,” 28–31.

⁵⁴ California State Library, “California Cultural Collection Protection Survey Report,” 38.

⁵⁵ Jorgensen and Johnston, “Chapter 1. Tribal Archives,” 1.13.

⁵⁶ Council of State Archivists, “The State of State Records,” 16–17.

are increasing or their coverage is reduced.⁵⁷ Like art museums, the contents within archives are unique. But unlike museums, there is a limited “market” for archives, and this makes financial appraisals of archival collections difficult. Large archives in governments (which are often self-insured) or major universities are likely covered by their parental organization’s insurance policies, but small independent community archives, historical societies, and standalone nonprofit archives may face the greatest risk from the fluctuating insurance market.

Education and Training

Since emergencies of many kinds are likely to be faced by most archivists over the course of their careers, this makes education and ongoing professional development in this area critical for the ongoing stewardship of collections. Unfortunately, there appears to be major gaps in graduate-level education and ongoing professional development for emergency preparedness and disaster response.

Some subject matter experts expressed concern about the lack of training for graduate students. This educational gap is also reflected within the Society of American Archivists’ Guidelines for a Graduate Program in Archival Studies (GPAS). Despite being revised in 2023, the GPAS guidelines do not mention education or training related to emergencies and disasters. Given the climate crisis and how many archivists work in small institutions in which they may be a “lone arranger” (i.e. a solo archivist), it is a serious concern that emergency preparedness and disaster response is not a core part of graduate archival education.⁵⁸

One subject matter expert noted that disaster training should incorporate local conditions and risks. For example, many traditional disaster response training workshops that originate in the Eastern half of the United States involve wet salvage exercises to mimic responding to a flood or other water event. However, in the US West, there is an urgent need for training related to responding to soot and fire-damaged items following a wildfire. Sometimes things are salvageable in a fire and it isn’t a total loss. When staff lack training in salvage and recovery, or don’t know what is possible through conservation after a disaster, they feel hopeless and may think all of the affected materials are unsalvageable.

Phase 1 discussed some of the barriers to ongoing professional development. Being able to participate in ongoing professional development related to emergency preparedness and disaster response is essential for archivists’ capacity to address these issues, especially including updating emergency plans to keep up with new approaches to disaster response. Each new major disaster brings new lessons learned in effective disaster response. Early disaster response training for cultural heritage was influenced by events such as the 1966 Florence floods and the 1973 NARA St. Louis National Personnel Records Center fire. More recent disaster response training has incorporated lessons learned from the September 11th terrorist attacks and major hurricanes like Hurricane Katrina, Hurricane Sandy, and Hurricane Maria. Without support for ongoing professional development, archivists may lack the skills and institutional support for updating their disaster plans even as these needs are increasingly urgent.

⁵⁷ Ho, “Growing Claims from Climate Change Will Prompt Art Insurance Rate Increases, Experts Report.”

⁵⁸ Society of American Archivists, “Guidelines for a Graduate Program in Archival Studies.”

Importance of Networks

Emergency preparedness and disaster response networks are groups intended to promote planning for participants prior to an emergency/disaster, and facilitate resources and communications during and after an emergency/disaster. Ideally, these organizations also help build relationships between emergency management officials and cultural heritage professionals. These groups are a vital resource to assist smaller and more vulnerable archives. However, like all professional associations, their success depends disproportionately on a small number of enthusiastic and committed individuals.

The Heritage Emergency National Task Force (HENTF) formed in 1994 and was one of the first major national networks dedicated to coordinating communications and resources between the emergency management and cultural heritage communities.⁵⁹ Since 2000, dozens of other similar organizations have formed at the state and local levels. Most of these networks have affiliated under the larger umbrella of the Alliance for Response (AFR), which is currently managed by the American Institute for Conservation.

The Alliance for Response website currently maintains links to over 30 state and local networks.⁶⁰ However, since these organizations are largely self-directed, there is wide variation in their activity levels. Two subject matter experts interviewed for this research have experience with local Alliance for Response affiliated organizations and discussed similar challenges in ensuring their organizational continuity, including distributing workload so the chapter remains viable, maintaining strong relationships with emergency management officials, and reaching small institutions that may not be part of larger cultural heritage networks.

Assessing Disaster Losses

Even as disasters become increasingly frequent and severe, it is hard to assess the amount of damage incurred among US cultural heritage institutions. Since there is not a central reporting mechanism for American archives, there is not a way to quantify cumulative loss each year among archives. Some archives publicly share about disasters when they happen, but many do not.

Reporting on disaster losses is key to driving both internal and external support for emergency preparedness and disaster response. One of the major challenges during disasters is coordinating communications: making sure emergency professionals have accurate information, and reducing duplicative reporting burdens on cultural heritage organization staff.

Publicly available post-disaster reports are often limited to institutional case studies. For example, much of the literature around Hurricane Katrina's impacts on libraries focuses on the recovery efforts at specific libraries. This means it is difficult to understand the total impacts of a major disaster that affects a large area. However, there is at least one example of a major disaster assessment that can serve as a model for analyzing widespread damages.

⁵⁹ Cooper and Hagerman, "A Brief History of Emergency Programming at Heritage Preservation."

⁶⁰ American Institute for Conservation, "Alliance for Response Networks."

The 2002 report, *Cataclysm and Challenge: Impact of September 11, 2001, on our Nation's Cultural Heritage* serves as a model for the kind of post-disaster cross-institutional reporting that would be very useful to the archives profession in the wake of major disaster.⁶¹ The report was sponsored by the now defunct organization Heritage Preservation along with the Heritage Emergency National Task Force, and conducted the month following the September 11, 2001 terrorist attacks. Combining news reports with a survey, the report described the breadth of the damages, highlighted some of the major losses (like the Helen Keller Foundation which contained many of her papers), and provided information about how organizations responded as the terrorist attacks unfolded and in the subsequent disaster recovery process.

HENTF sent 122 surveys to GLAM organizations in New York City south of 14th street, and had a response rate of 46%. Institutions around the World Trade Center did not generally experience major damage, while those inside the World Trade Center often experienced partial or total losses. Less than half had an emergency plan, but more than two-thirds reported that following the 9/11 attacks they planned to update emergency plans. Forty percent of respondents noted that they were able to put parts of the emergency plan into action, such as evacuation, closing or sealing windows, and shutting off air intakes. This prevented additional damage to collections as the disaster unfolded.

More respondents experienced issues with emergency aftermath than with damage to collections; 80% of respondents experienced some kind of communications issues (phone, fax, email). There were delays with mail and supply delivery that impeded recovery and cleaning efforts, and many institutions experienced drops in visitor attendance. Only 60% of respondents had a current collections catalog or inventory, and more than half had no off-site records of their inventory. Only 53% understood how government recovery assistance worked prior to 9/11.

In addition to the Heritage Preservation report, the New York State Archives convened a group known as the World Trade Center Documentation Task Force. The Task Force conducted a survey of archives and found that archives in areas around the World Trade Center (as opposed to the collections inside the Twin Towers, which were largely lost) were generally undamaged, with the main issues being soot and dust.⁶²

Connection with Phase 1 Research

The first phase of this research project focused on **people**. The Phase 1 report found major workforce issues that likely impact archives' capacity for preparation and adaptation to climate change. These findings included the following:

- Most archivists do not yet make the connection between climate change and workforce issues.
- Term positions are widespread across the profession and unevenly distributed.
- Institutional turnover is difficult to measure but may be accelerating.

⁶¹ Hargraves, "Cataclysm and Challenge: Impact of September 11, 2001, on Our Nation's Cultural Heritage."

⁶² Hargraves, 10.

- Professional attrition poses risks to institutions, professional associations, and archives' capacity to prepare for and adapt to climate change.
- Archivists' responsibilities have significantly increased without a corresponding increase in resources.
- Workplace morale issues are widespread.
- Roving archivist programs help meet the needs of small archives.
- Professional interest in unions is growing and new unions have won improvements for archivists.
- Archivists view the role of professional associations as important in setting standards and want to see the Society of American Archivists and other associations play a more proactive role on behalf of workforce concerns.

These prior findings are worth revisiting in light of the Phase 2 findings. Infrastructure issues are affected by larger workforce issues. The strongest link between Phase 1 and Phase 2 is that resource and funding issues have a large impact on both personnel and infrastructure. This means there are major institutional disparities between those who can mobilize for climate change adaptation and those who are falling further behind.

Organizations that are unable to maintain professional full-time permanent staff are also the same organizations that often have severe infrastructure issues. We also know the least about these organizations due to their distance from professional networks. Additionally, people are an essential component of maintaining and monitoring infrastructure issues. Without personnel with preservation training, it is difficult to monitor the temperature and humidity of storage environments in order to safely implement sustainable facilities guidelines. Without a conservator on staff, it is difficult to repair items damaged by a burst pipe or flood. Without a digital archivist, it is difficult to make adjustments to digital collections to minimize energy usage. In chronically understaffed organizations, infrastructure issues are often neglected, even though one cannot pause the types of archives-threatening emergencies and disasters that are becoming more frequent and more severe. Furthermore, even though there are emerging grant programs related to emergency preparedness and sustainability, the staff capacity at smaller institutions to apply for these grants is often non-existent.

Unlike personnel issues, infrastructure issues in archives have more funding sources, mutual aid networks, and widely accepted best practices and guidelines. However, small institutions don't always have the capacity to take advantage of these resources, and larger institutions often do not want to take the risk of trying something new (such as implementing energy efficiency facility standards). In several interviews, subject matter experts stressed the importance of bottom up pressure to shift leadership towards embracing new best practices and emergency planning. It's clear that when it comes to infrastructure issues, people remain an important part of supporting and strengthening these vital systems.

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Appendix 2: Methodology and Data Sources

The primary methodology for this phase was extensive review and analysis of published and informal research on infrastructure. In comparison to Phase 1, the data sources for the Phase 2 research were both more interdisciplinary and involved less empirical research. Archives often face similar infrastructure issues as other cultural heritage organizations, and literature from these fields is useful for supplementing the limited literature on US archives infrastructure. Fields that overlap with archives include conservation/preservation, museums, rare book librarianship, and historic preservation. Many publications, presentations, workshops, and guidelines from these fields have been instrumental in shaping thinking about archives infrastructure issues, especially storage environments and emergency preparedness.

Despite the interdisciplinary nature of this phase's research materials, there were fewer actual studies produced by the collection of data using a standardized survey instrument, especially compared to the abundance of surveys relevant to Phase 1. This made comparisons and general findings about the state of infrastructure issues in archives very difficult, to the point where lack of data was identified among the top major findings in this research phase.

Phase 2's reviewed publications included far more guidelines, best practices, white papers, and case studies compared to the materials reviewed for Phase 1. Due to the interdisciplinary issues described above, subject matter experts who were interviewed often spoke generally of infrastructure issues facing cultural heritage organizations, as opposed to specifically speaking to the infrastructure conditions of archives.

Most of this report's cited resources were published in the last decade. However, major disasters in the early 2000s like the 9/11 terrorist attacks and the Gulf Coast's Hurricane Katrina had an enormous impact on emergency preparedness and disaster response in cultural heritage across multiple locations. For this reason, relevant reports from the early 2000s were occasionally included in the literature review.

Analysis of published material was supplemented by interviews with subject matter experts. I interviewed seven individuals who had relevant knowledge and expertise related to cultural heritage facilities, digital infrastructure, and emergency preparedness/disaster response.

In addition, I conducted data analysis from the Council of State Archivists State of State records survey and the Society of American Archivists A*CENSUS II All-Administrators survey. I held monthly meetings with Patricia Hswe, program director for Public Knowledge to discuss research progress, and contacted Julia Marden, Mohamed Haiyan Abdirahman, and Susanne Pichler for additional support as needed.

Appendix 3: List of Subject Matter Experts

- Hillary Ellis, Lead Emergency Preparedness Consultant for NEDCC Northeast Document Conservation Center’s California “Ready – Or Not” Emergency Preparedness Project, funded by the State of California through the California State Library
- Jennifer Jae Gutierrez, Image Permanence Institute at Rochester Institute of Technology
- Miriam Meislik, University of Pittsburgh
- Michele Pacifico, Archival Facilities Consultant, Pacifico Archival Consulting
- Linda Tadic, Digital Bedrock
- Jennifer Waxman, Head of Collection Management at Tulane University Special Collections, and member of the Steering Committee of the New Orleans Preservation Coalition and Alliance for Response.
- Former FEMA employee who worked in the cultural heritage protection space