Preserving archaeology in the digital age: Evaluating strategies for effective curation and database management.

Cenetria Leshun Crockett
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PRESERVING ARCHAEOLOGY IN THE DIGITAL AGE:
EVALUATING STRATEGIES FOR EFFECTIVE CURATION AND DATABASE MANAGEMENT

By

Cenetria Leshun Crockett
B.A., Christian Brothers University, 2019

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A Thesis Approved on

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ABSTRACT

PRESERVING ARCHAEOLOGY IN THE DIGITAL AGE:
EVALUATING STRATEGIES FOR EFFECTIVE CURATION AND DATABASE MANAGEMENT

Cenetria L. Crockett

April 24, 2024

The “curation crisis” is a dark cloud that consistently looms over the archaeological discipline, affecting the ways we plan, execute, and curate research projects. It is especially prominent within curation facilities and institutions that have the duty to preserve archaeological collections. The development of digital curation presents an avenue through which curators and collection managers can combat the crisis. Digital curation grants collection managers the ability to manage and ensure archaeological collection accessibility. Digital collection databases, particularly, have grown to become a significant component of collection management as it permits collections to be easily preserved, managed, saved, and accessible at the click of a button. However, curators and collections managers are challenged with determining the best development and management practices for digital collections, as digital curation is not directly addressed in 36CFR79, NAGPRA, or any other curation laws. This thesis evaluates the current curation and database management practices in curation institutions through survey feedback, investigates potential solutions for facility storage space maximization through
Legacy collection revitalization at University of Louisville’s Center for Archaeology and Cultural Heritage (CACHe), and discusses efforts to develop best curation and collection database practices that can be incorporated into a CACHe digital curation policy.
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CHAPTER I INTRODUCTION

Archaeological curation facilities and institutions are responsible for ensuring the proper preservation, conservation, storage, security, and accessibility of archaeological collections for perpetuity (MacFarland and Vokes 2016). However, these facilities and institutions are facing an increasing crisis in curation that has been building within archaeology for decades. In the early 1900s, the passage of various federal legislations that enabled the federal government to sponsor archaeological research projects resulted in the influx of archaeological collections in need of curatorial services. Furthermore, field archaeologists often participated in bulk collecting practices, which led to the accumulation of an outstanding number of specimens and artifacts (Benden and Taft 2019). Curation facilities and institutions faced the challenges of handling the accessioning of multiple collections at once, as these institutions often had inadequate funding, lacked professionally trained and experienced staff members, faced storage space depletion, and had environmentally insecure storage areas. In addition, the materials that were initially used to store collections (e.g., paper bags that deteriorate or acidic paper which could react with artifacts) were found to be inadequate and potentially harmful for the collected artifacts (Knoll and Huckell 2019), which impinges on the facilities’ goal of care for “perpetuity.” Recognizing the need for unified curation practices, the federal government passed the Curation of Federally Owned and Administered Archaeological Collections (36CFR79) in 1990 and the Native American
Graves Protection and Repatriation Act of 1990 (NAGPRA) legislations, which presented guidelines for the proper and ethical management and preservation of archaeological collections. Although these legislations were very impactful, the curation crisis continues to impact the archaeological discipline.

While curation facilities and institutions are dealing with the challenges of maintaining physical collections, the emergence of the digital age presented new technological methods for the curation of archaeological collections: digital curation. Through digital curation, curators and collection managers can preserve, manage, archive, and provide accessibility to archaeological digital data (e.g., field notes, provenience, provenance, photographs, etc.) (Lombardo et al. 2020). The incorporation of digital collection databases has presented an innovative route for curators and collection managers to safely preserve newly accessioned and “old” (i.e., legacy) collections in the digital realm. Digital collection databases can be structured in numerous ways, however, most of them require a private interface (for administrative use) while others opt to share selected collection information in a public interface. Regardless of whether private or public, the use of digital collections in curation institutions has enabled collections accessibility possible with just a click of a button! While more curation facilities and institutions are incorporating these systems into their curation practices, doing so has presented challenges as there is not a currently established policy or guide to aid the process of development nor management.

In this thesis, I focus on the impact that the curation crisis has on curation facilities and institutions. I also examine the presence and use of digital collections databases within curation institutions to discern current methods of development and
usage. Furthermore, I investigate the potential solutions for facility space maximization at University of Louisville’s Center for Archaeology and Cultural Heritage (CACHe) through revitalization and deaccession processes. The goals of my thesis project were three-fold:

1. Assess the current state of curation facilities and institutions focusing on their existing policies and digital collections status.

2. Assess potential for the most commonly suggested solutions for space maximization in collection storage areas, revitalization and deaccession, to improve space management at CACHe.

3. Through consultation, develop digital collection database practices that can aid the process of development and management of digital collection data at CACHe.
CHAPTER II BACKGROUND AND THEORIES

2.1 Archaeological Curation

“Curation…refers to the long-term management and preservation of archaeological materials and their associated documentation.”

-Society of Historical Archaeology

Archaeological curation plays an integral role in the archaeological discipline as it promotes the preservation of invaluable information pertaining to human history. Curators and collection managers are tasked with the day-to-day management of these archaeological collections for perpetuity and ensuring that the collections and associated documents are readily available for scholarly research and public consumption. Although the curation process holds great importance, it has not always been viewed as a priority when designing and planning projects. As a result, many curation facilities were subjected to bulk collecting practices, where collections contained high numbers of material objects. Concerns pertaining to archaeological curation arose initially in 1980 at a symposium, “The Curation of Archaeological Collection” (Bustard 2000:10). In response to the symposium, the declaration on of a “crisis” status in archaeological curation was initiated (Bustard 2000: 10). The curation crisis was found to be still prevalent twenty years later at a symposium, “The Crisis in Curation: Problems and
Solutions,” hosted by Verna L. Cowin. Many of the problems discussed during the symposium included inadequate staffing, backlogs of uncatalogued collections, substandard and overflowing storage, and lack of awareness in the archaeological community of just how bad things are (Bustard 2000:10). The curation crisis persists today as a pervasive challenge that impacts the archaeological community on a global scale (Kersel 2015; Smith et al. 2019; Domeischel and Waggle 2020).

The issues within the curation crisis were further highlighted by Bustard (2000). Based on an informal survey to curators of archaeological collections, she (2000:10) found that the top concerns for curators were associated with issues of accessibility, accountability, conservation and preservation, deaccession policies, and storage. The challenges of accessibility pertain directly to space and staffing (Bustard 2000:12). Staffing is necessary for the reception, cataloging, and inventorying of collections, and without adequate staffing the collections are not readily available for research; furthermore, when the working/storage spaces are overcrowded, the staff are presented with physical obstacles that prevent them from retrieving items from collections (Bustard 2000:12). The lack of mechanisms to hold curation facilities accountable for improving these conditions was also a perceived issue (Bustard 2000:10).

Curators have found that there is a major backlogging issue where many collections had not been catalogued causing lack of knowledge in what is being housed in the facility (Bustard 2000:10). Another issue associated with accountability that Bustard highlights is the division of collection where parts of collections are housed in separate facilities, although this typically pertains to older collections (i.e., legacy collections). This separation usually results in information loss or poor documentation which in turn
hinders collection accessibility as well (Bustard 2000:10). Many legacy collections and their associated documents are housed in overcrowded storage conditions and are stored in containers that do not meet current long-term curation standards. Further, it is expensive to manage electronic media (i.e., CD-ROM, Zip disk, computer tape, etc.) (Bustard 2000: 13). Some of these problems could be helped by deaccessioning but the topic of deaccession is a sensitive subject to address and it is difficult to form policies as most facilities answer to the federal government (Bustard 2000: 13). The next sections will highlight key standards, appropriate collection environment, and suggestions for preservation techniques to apply to collections to ensure collection integrity.

Curation Standards
In response to the initial crisis declaration, the federal and state government(s) sought to overcome the problems in curation through the implementation of guidelines and regulations. The primary set of federal regulations is detailed in the Curation of Federally Owned or Administered Archaeological Collections (36 CFR 79), implemented in 1990, which regulates the proper management and handling of federally owned collections. These rules apply to any federally owned archaeological collections. Therefore, many curatorial repositories, museums, and universities utilize these regulations for all collections. State and federal agencies like the National Park Service (2016) and state historic preservation offices (SHPOs) also implement their own more detailed guidelines to compliment 36 CFR 79 and ensure that collections are being properly cared for. What exactly are these standards and how can they ensure the long-term preservation and accessibility of archaeological collections?

Selecting a Repository
To begin with, project leaders are encouraged to select where they would store their collections after field work in the initial planning design phase of projects (SHA 1). This typically starts with the communication of project leaders with potential facilities that offer curatorial services that meet federal and state requirements (36 CFR 79: 5; KHC:42). Requirements often include:

1. Documenting, accessioning, tagging, and organizing a collection.
3. Providing climate control, fire suppression, and pest/ disaster management plans.
4. Maintaining proper archival storage and preserving the informational content of a collection with suitable materials and containers.
5. Regularly examining and maintaining a collection to ensure its preservation.
6. Facilitating accessibility for research purposes.
7. Managing, cleansing, stabilizing, and conserving a collection to ensure its long-term preservation.

Selecting a repository in advance allows for the staff at the facilities to expect and plan for the appropriate accessioning of the collections and assemblages that would be stored there. Furthermore, it is recommended that project leaders select repositories that are located in the state that the collection was obtained (Society for Historical Archaeology [SHA .5]). It is further recommended that collections from the same site/ project location or similar geographic region should be housed within the same repository so that collections remain whole (36CFR79. 9).
While much of the federal and organization regulations are heavily focused on federally owned collections, state regulations not only focus on federal collections, but also mention private collections. The Kentucky Heritage Council (2017) includes a provision on the curation of artifacts and collections from private lands. The state recognized repositories (University of Kentucky, University of Louisville, and Murray State University) must still offer the curatorial services outlined above, but in cases where private landowners seek the return of artifacts, these should be returned only directly to the owner and that documentation must be curated to ensure informational value is retained.

Collection Environment

Curators and collection managers have the responsibility of ensuring that the working and storing environments of the archaeological collections are suitable for preservation at all times (36 CFR 79. 5). The purpose of maintaining the environment is to limit/ minimize the rate of deterioration (i.e., the natural process of chemical and physical change in condition of an object) through their control of the atmospheric and physical surroundings (National Park Service [NPS] 4:1). Material objects typically react to their environment in an attempt to reach an equilibrium causing different reactions (NPS 4:1). The best way to maintain the collection environment is by monitoring and evaluating the climate (both inside the collection area and outside the building), as well as, analyzing the potential impacts of the agents of deterioration: temperature, relative humidity (RH), and light (radiation) (NPS 4:1; SHA 5). This monitoring should guide decisions on interior environmental adjustments.

Temperature
Temperature is a “measure of the motion of molecules in a material” (NPS 4:21). Temperature can impact objects (both organic and inorganic) directly in a variety of ways. When temperatures are high, the objects tend to expand, which can cause moisture evaporation in some objects resulting in deformation and cracking (NPS 4:21). Colder temperatures cause objects to contract, which can lead to brittleness that can result in cracking and flaking (NPS 4:21). The Society of Historical Archaeology (p.5) recommends that temperatures remain between 65º F and 75º F (NPS [4:22] recommends 55º F and 77º F) for storage areas that people utilize, but for areas that people seldom visit, the temperature should remain between 40º F and 60º F. In storage areas, it is recommended that temperatures should never exceed 75º F (SHA 5).

**Relative Humidity**

Relative humidity (RH) is “a ratio, usually displayed in percentage, between the mass of water vapor in a fixed volume of air (absolute humidity) could hold (without condensation) at the same time” (NPS 4:23). RH and temperature are related in that as temperature increases, the humidity levels will decrease and vice versa (NPS 4:23). The material remains are both directly and indirectly affected by humidity as all organic and most inorganic materials absorb and release water; therefore, high humidity levels (more water) can increase corrosion in metals, mold growth, and pest appearance (NPS 4:24). Low humidity levels can cause organic materials to shrink and crack (NPS 4:24). The Society of Historical Archaeology recommends for relative humidity levels to remain between 40-60% with a fluctuation rate that should not exceed 5%. However, the NPS (4:26) recommend for levels to remain between 45-55% with fluctuation that should not exceed 5%.
Light (radiation)

Lighting (radiation), both naturally and artificially occurring, is composed of wavelengths (ultraviolet radiation [UV], visible light, and infrared radiation [IR]) that can negatively affect the material objects within collections (NPS 4:3). UV radiation can cause the outer layer of organic materials to weaken, darken, yellow and/or disintegrate; while, visible lighting can cause the outer layer of organic materials, wood, photos, textiles, etc. to bleach (fade) or darken (NPS 4:3). Infrared radiation (IR) causes disintegration and discoloration in organic materials due to its ability to heat the objects. The Society for Historical Archaeology recommends that the light levels should not exceed 150 lux.

The Nation Park Service (4:3) states that a suitable climate for collection environments is one that that excludes daylight and/or filters out ultraviolet and infrared radiation and air pollutions (gases: hydrogen sulfide, nitrogen dioxide, sulfur dioxide, etc.; liquids: plasticizers from adhesives, grease; and solids: dust and salts) (NPS 4:9). Curators and collection managers are tasked with the duty to control the climate conditions of the storage area that house the collections. Through consistent monitoring and observations, curators are able to evaluate the risks to collections, adjust controls in stabilize the climate conditions, and implicate procedures to minimize damage from temperature, relative humidity, light, and air pollution (NPS 4:2). It could also aid in the development of new method of determining environmental condition, as discovered in a recent study at University of Louisville’s Center for Archaeology and Cultural Heritage where outside humidity was a better determinant for inside storage humidity than the usual high temperature equal low humidity levels (Coffield 2022).
Preservation/Conservation

Along with the maintenance of the collection environment, curation facilities are also encouraged to offer preservation and conservation services. Unfortunately, federal regulations (36CFR79) do not detail “how” facilities should preserve these collections. It is left up to the institutions that are responsible for the collections to form and implement appropriate preservation policies. These preservation policies often outline the proper cleaning, labeling, storing, and sometimes repair of artifacts.

When cleaning artifacts, curators must be gentle and exercise care to prevent destruction as many artifacts are fragile (i.e., bone) and can contain significant data (i.e., blood residue, plant material) (SHA 1). It is important that these cleaning policies outline the proper cleaning techniques that will ensure the integrity and informational values of the artifacts remain intact (SHA 1). This mindset should be applied throughout the labeling and storage process as well. When labeling artifacts, it is important for the labels to display the site and excavation unit provenience data; however, the method of labeling has been debated. Many organizations like the SHA seem to prefer direct labeling, however, include provisions for when direct labeling is not feasible. In these cases, curators should utilize other non-destructive methods (i.e., string tags with acid-free paper) (SHA 2). However, the method debate of whether curators should direct or indirectly label artifacts seems to be based on preferences. Nevertheless, the artifacts and assemblages should be stored in archival safe material and reasonably sized containers and labeled with information that includes locational data about the site, excavation units, and provenience (SHA 2). The storage containers should be transparently labeled with the site, provenience information, and box contents (SHA 3).
The SHA recommends that two copies of documentation (i.e., records, notes, reports, photographs, catalogues) should be maintained/ saved (SHA 3).

In artifact labeling, direct labeling appropriateness varies, often depending on the material composition of the artifact (e.g., wood, textile, leather, paper, and basketry). Human remains should never be directly labeled. Moreover, careful consideration of the artifact’s surface condition is crucial due to the potential for deterioration. Additionally, an artifact could be too small for direct labeling. In these situations, executing precise bagging and tagging techniques is essential to preserve pivotal information like provenience.

Deaccession
The increased awareness of the ever-present curation crisis plaguing the archaeological industry created a dialogue that resulted in potential solutions. One such solution is the deaccessioning of archaeological collections, with principal proponents like Terry Childs of the National Park Service urging the development of deaccessioning policies in management plans (Bustard 2000:13). Bustard (2000:13) argues that curation fees increase, decreased storage space, and decreased funding support presents a need for more deaccession policies. Furthermore, Bustard (2000:13) believes that more institutions/bodies should have deaccession authority for approval of the discarding of federally owned collections. According to 36CFR79 (1990: 19), a qualified federal agency officer or museum professional that meets the standards set by the Secretary of Interior has the sole authority to determine whether objects can be deaccessioned. Bustard (2000:13) wants leading archaeological organizations like the American Association for Museums (AAM), the American Anthropological Association (AAA), and the Society for American Archaeology (SAA) to have legislative authority to
deaccession archaeological collection through such mechanisms as transfer, exchange, or
donation. However, many curators and collection managers find deaccessioning to be a
sensitive topic as it promotes the discarding of primary source data (SHA 5).
Organizations like the Society for Historical Archaeology go as far as to state in their
guidelines that deaccession is “not recommended” (SHA 5); however, they recognize that
if deaccessioning is unavoidable then the material object should be completely
documented with thorough descriptions, the procedures used for selection, the sampling
techniques employed, and the final destination of the materials, which should include the
primary site documentation information (SHA 6).

Conclusion
Since formal acknowledgement of the curation crisis, various guidelines and
regulations have been issued by organizations and federal and state governments to
ensure the informational value and integrity of archaeological finds remain intact.
Twenty-three years since Verna L. Cowin’s survey and analysis of the problems, the
curation industry is still facing the same issues of storage space depletion, lack of
funding, and backlogging of uncatalogued collections. The guidelines implemented offer
a reference point for getting the collections up to standard; however, it does not help with
securing more storage space as it can be expensive and governmental funding could be
insufficient. Bustard (2000:14) suggests that more archaeologists should be involved
throughout the curation process and should receive professional training in curation
practices. This idea is still relevant today as many university archaeology programs still
do not offer courses in curation.
2.2 Digital Curation

“Digital Curation is the active involvement of information professionals in the management, including the preservation, of digital data for future use.”

-Elizabeth Yakel (2007)

The turn of the 21st century initiated the start of a digital era that introduced a new sector within the field of archaeology: digital curation. Digital curation entails the preservation of archaeological digital data in the virtual landscape. The growth of digital curation and consistent accumulation of digital data has caused curators and collection managers to seek innovative methods for the management of digital archaeological collections. Curators and collection managers are tasked with the responsibility of safeguarding and ensuring the accessibility of digital data, causing them to develop and integrate digital collection databases and repositories into their management practices. Through the utilization of digital databases, curators and collection managers are presented with an avenue in which the preservation and management of new and “old” archaeological collections can be stored and easily accessible for scholarly and public usage (Kintigh 2006: 568). In addition, the development of innovative technological methods that professional field archaeologists often utilize in the field, such as geographic informational systems (GIS) and LIDAR, often produce “born digitally” data that need to be curated (Richards 2017: 230). As archaeologists continue to accumulate data, curators are seeking to integrate collection databases and digital repositories into the archaeological discipline as a suitable method for the storage, preservation, and management of digital data.
The development and utilization of digital databases and repositories in curation has presented curators and collection managers with novel challenges. The most notable challenge would be the lack of standardized policies and guidelines. For instance, the Society for Historical Archaeology (SHA) presents recommendations for the proper cleaning and labeling of artifacts, appropriate archival materials to use for storage, the types of documentations that should be produced for each archaeological collection, and appropriate environmental conditions suitable for proper storage in curation facilities. Electronic data is mentioned briefly, but it refers to physical formats like tapes, CDs, disks, etc., emphasizing their storage alongside physical documentations. Additionally, the guide alludes to the potential development of a standardized methodology for the storage of electronic data (SHA 4). The Kentucky Historical Council presents a state guide for curation by stating curation requirements for artifacts found on federal, state, municipal, and private lands. The document also provides a list of approved curation facilities within Kentucky (Murray State University, University of Louisville, and University of Kentucky). 36CFR79, representing the “official” federal guide for curation, explicitly addresses all modes of curation, including archaeological collection management, collection accessibility, inspections and inventories of collections, and disposition (i.e., deaccession) of material remains. Each of these laws, representing “go-to” guidelines address the management of physical archaeological collections but does not directly address the correct ways to build and manage archaeological collections in the digital realm.

Curators and collection managers are tasked with developing their own standards, which can become problematic in some instances. Curators and collection managers are
also plagued with the challenge of figuring out how to best set up a digital database and the best ways of promoting its use. Below, I review the concept of digital curation and the suggested methods and standards for database construction and implementation of robust digital collection databases in archaeological curation facilities and institutions.

Defining and Theorizing Digital Curation

Digital curation emerged as a direct result of the development of the digital age, where computers and cyberspace became an essential aspect of everyday life. To keep up with technological advances, curators and collection managers were forced to seek new methods for archaeological data preservation and found the format of digital databases and repositories. Digital data preservation entails the active curation (storage) and migrating of file formats to upgraded formats to ensure their reusability in new software packages (Richards 2017: 227-228), and these practices have developed out of and alongside physical object curation efforts.

The term “curator” can be traced back as far as 1861 and was originally used to describe individuals responsible for managing museum collections (Dallas 2015: 425). However, the term has evolved significantly since the 19th century, especially with the emergence of technology and new archaeological practices. In the United Kingdom in 2004, digital curation was initiated by the development of the Digital Curation Center (DCC) and its accompanying comprehensive manual (Dallas 2015: 422). Initially, digital databases were primarily employed for archival purposes within libraries and museums. However, it has grown over the years to encompass a diversity of disciplines, including archaeology. Digital curation has become an essential component for curation facilities and repositories, as digitization has become a vital aspect of curation practices making
archaeological collections easier to manage and accessible to scholars, researchers, and the general public.

The development of collection databases has led to the establishment of new theories and methodologies in the realm of digital data practice, preservation, management, and utilization. These theories revolve around the agency of the users involved in implementing collection database and archival record keeping practices on archaeological collections. According to Costis Dallas (2015:431), the initial approach to digital data management was custodial in nature. In the custodial approach, the primary individuals implementing the record keeping practices in the digital database format were the “original” curators: museum curators and librarians. Moreover, private collectors often established their own record keeping practices on their personal collections, occasionally sharing them with researchers who were allowed access to their collections. However, this approach presented certain challenges, particularly the notion that these curators and collection recorders lacked formal training in archaeology resulting in a disconnect with what they perceived as essential data worth recording. They were untrained in identifying the types of information deemed suitable and necessary for future research purposes.

As a result, Dallas (2015:435) advocated for a new approach that prioritized the development of a cohesive set of theoretical concepts, standards, and methodologies for digital curation that could be used in graduate curriculums and transitioning into the professional domain. In addition, this new theoretical approach would acknowledge that digital curation involves multiple actors, including those involved in knowledge production, how that knowledge is portrayed to the public, and enhancement of user
experience (Dallas 2015: 435). The approach should foster collaboration between the archivist (preservers), responsible for long-term preservation and ensuring of minimal access to the digital data, the scientists (publishers) who are primarily focused on the visualization, annotation, and contextualization of the data, as well as the descendant communities that have ancestral ties to the objects being curated.

As a result of these considerations, Dallas (2017:439) presented the pragmatic approach. The pragmatic approach would place more agency in the hands of the scientists and researchers, allowing them to have a more active role in the curation process. This would ensure that the appropriate information would be preserved, and that the digital data are stored and managed accurately. There has also been a call for more training in the best curation and management of digital data at the graduate level, so students are exposed to knowledge of the best record-keeping practices before becoming full-time professionals.

Archaeology Needs a Cyberinfrastructure
The archaeology discipline requires an information infrastructure that empowers researchers to archive and facilitate archaeological data accessibility. Moreover, the academic community could derive significant benefits from the development and integration of information infrastructures (i.e., digital collection databases). These databases would grant research professionals and scholars the ability to access primary source data, foster interdisciplinary collaborations, especially during the construction process of the databases, and provide researchers with the opportunity to extract integrated data that has been analyzed for comparable observations from multiple data sets (Kintigh 2006: 568). Additionally, the digital collection database would permit researchers with the means to collaborate and share their data over the Internet, enabling
them to work together regardless of their geographical locations. The database would also present an avenue for which gray-literature (i.e., unpublished fieldwork reports) can be easily accessible and utilized (Richards 2017: 228). In addition, the database could also potentially permit secure, conditional access to NAGPRA collection information, improving the ability of tribes to initiate and consult in the repatriation process. Furthermore, there are potential educational benefits, with professors, educators, and outreach specialists gaining the ability to access published scientific data and results for use in their classes and exercises.

In order to ensure the aforementioned needs are met, Kintigh (2006:577) recommend the establishment of a “steering” group. This group would have the responsibility of formulating a strategic plan for the construction and implementation of the collection database while ensuring its ability to provide long-term preservation of archaeological data, as well as, negotiating with organizations and agencies to acquire funding resources for the database development. It is essential that the digital collections database have the following capabilities (Kintigh 2006:567):

- Encourage the creation of new approaches to collaborative and synthetic research.
- Operate at scales not currently possible to answer questions that remain unanswered due to unavailability of existing (legacy) data.
- Evaluate and incorporate archaeological data so they can be used to address important inquiries in other disciplines.
- Safeguard the ongoing research value of digital data threatened by media degradation, software obsolescence, and inadequate data documentation.
• Incorporate and facilitate collaboration with descendant communities.

The Role of Digital Repositories
Over the years, archaeologists have shown a growing interest in participating in curation processes throughout the many phases of research, though challenges remain. One challenge is that archaeologists do not have access to primary source data materials and are often reliant on publications that utilize the same sources that eventually leads to the data being interpreted as fact, rather than the primary data being questioned (Kintigh 2006: 570). However, through the use of digital repositories by curators and collections managers, this accessibility issue could be resolved. Digital repository establishment could also provide researchers from other disciplines with access to archaeological data, which they could incorporate into their own disciplinary research, stimulating more holistic knowledge growth. Another prevailing issue is that many repositories have a substantial backlog of legacy collections- collections that were excavated, later moved to repositories, and are stored and documented in a manner that does not align with current curation standards, thus making it difficult to access for research purposes (Roberts Thompson et al. 2019) - while new data are consistently being produced by new archaeological projects. There is also the issue of large quantities of digital data being left un-curated and/or lost due to hard drive failures, replaced servers or death/retirement of researchers. Consequently, many researchers have pursued the creation of a centralized data access location, leading to the establishment of digital data repositories.

The main goal of digital repositories was to become a significant asset of the scientific investigative process that would provide a space for background research, hypotheses formulations, and where new data can be easily deposited into curation facilities (McManamon et al. 2017: 3). Furthermore, digital repositories will present a
central location for the long-term preservation of primary source data that can be easily accessible for research (Kintigh 2006: 568; McManamon et al. 2017: 3). McManamon and colleagues (2017) outline three types of digital repositories that have been created for the archaeological discipline: institutional repositories, publication repositories, and “full-fledged” repositories.

Institutional repositories provide archival data that is developed and stored within research institutions like universities (McManamon et al. 2017: 4). Accessibility to these repository types is minimal with predominant use being by the faculty, staff, and scholars. Furthermore, the scope (i.e., geographical variability) of digital archaeological collections stored are minimal as well. This means that public users may have difficulty locating relevant data within institution repositories as the variability and quantity of research data is minimal and difficult to supply (McManamon et al. 2017: 4). Publication repositories like Open Context concentrate on the publication of research data and making them accessible for scientific usage (McManamon et al. 2017: 5). Open Context advocates for a publication method where researchers can submit data sets for review and modification to ensure consistency, coherency, and domain-specific quality in accordance with Open Context editors before being publicly available.

Repositories with a publication focus, such as Open Context, have the capacity to encompass a broader range of regional and international data. In contrast repositories dedicated specifically to curating archaeological materials like tDAR by Digital Antiquity play a crucial role in preserving and facilitating access to archeological and cultural documents, images, and data. Digital Antiquity’s objective is to leverage tDAR for long-term document and data preservation, enhancing usability and user experience, enhance
research capabilities, and establish a strong administrative and organizational framework for sustained growth (McManamon 2017:7). Digital Antiquity outlines their developmental approach for tDAR in the following steps (McManamon 2017:4):

1. Identifying fundamental design requirements.
2. Developing software that aligns with these design requirements.
3. Continuously refining the database to enhance user friendliness.

The only downside to repositories like tDAR is that to financially support themselves, they charge service fees to store and access documents which can be cost prohibitive, especially for the curation of legacy collections in which the original project did not budget for digital curation. These endeavors constitute integral elements of a comprehensive database structure. The following section will put forward and explore the ideal database architecture and the complexities involved in the construction of a robust database.

Digital Collection Database Architecture
When constructing a digital collections database, there are numerous attributes that require consideration, ranging from the development of infrastructures to the presentation of the database to the public. As more scientific investigations are becoming reliant on data collections, it is important to keep in mind that these projects are best developed across what Kulasekaran and colleagues (2014:53) refers to as collection architectures. Collection architectures enable the curation of data and metadata across diverse infrastructural components, allowing multiple users to seamlessly and concurrently perform analysis and publication tasks throughout the collections’ lifecycle. Moreover, it is advisable to centralize metadata at the core of the database construction, given the considerable amount of data generated not only during scientific investigations
but also at their conclusion. Having metadata at the core of the database will create a link between data and associated metadata (Kulasekaran 2014: 53). Kulasekaran and colleagues (2014) consider four aspects of the collection database which can be employed in all digital collection database development: file structure, collection architecture, workflow, and public-facing interface.

*File Structure and Collection Architectures*

When constructing the database, one of the initial requirements needed is the implementation of a robust record-keeping system. This system should feature a structured file hierarchy that would be stored within a file share, complete with descriptive labels and standardized naming conventions (key terms) for important data categories (Kulasekaran et al. 2014: 55; Richards 2017: 229). This system will enable new data and legacy collection data to be easily manageable and will enable researchers to check their files, describe and organize the files, and delete replicated files simultaneously, which could reduce time toward data entry (Kulasekaran et al. 2014:55). Afterwards, the files would be uploaded, saved, and stored within the database archive for future use.

To develop the file structure, it is useful to apply the big bucket theory in record-keeping as the main framework. When building a collection database, Kulasekaran and colleagues (2014) applied the big bucket theory with the overarching concept of provenance (site/project) representing the larger buckets. Within “site/project” file lies sub-files or groupings that are representative of the research phase of projects, such as field, study, and publication. The field and study files represent the primary data, while the publication files are the interpreted data which are often linked to online publications.
through Digital Object Identifiers (DOIs) or hyperlinks (URLs) (Kulasekaran et al. 2014: 56; Richards 2017: 230). Furthermore, each sub-file contains additional information that pertains to each domain such as “field” containing notes, “study” containing GIS documents and structures, and “publications” containing the drafts and final products.

Once the file structure has been established, it can now be applied within the framework of the collection architecture. The collections architecture can have two main domains: archival and presentation. In the archival domain, it is necessary to have an open-source software system that has the capability to store vast amounts of archaeological data and metadata. Software systems like Corral and iRODS have the ability to extract data from storage to create a consistent representation of data within a storage system (Kulasekaran et al. 2014: 57). The development of GUI-based interfaces is necessary for access to these storage systems. In the presentation domain, two main softwares are needed. The initial software will serve as the foundation for facilitating collaborative research on a project, documenting in-debt descriptions and interpretations, and establishing complex contextual connections. Kulasekaran and colleagues (2014:57) employed the Archaeological Recording Kit (ARK)- a web-based toolkit that incorporates GIS support, a versatile and customizable database and user interface, and a pre-designed data schema that can accommodate various data structures.

Furthermore, mapping and creation of metadata can be found within each constructed module in each ARK. The second software will serve as the cloud and storage area for the research projects that are still being worked on. Kulasekaran and colleagues (2014:57) utilized the software Rodeo, which provided web services, virtual machine (VM) hosting, science gateways, and storage facilities. The services that take
place within the ARK, such as GIS, databases, and web services, will be stored within the cloud of this software. During the research and publication phases, the data on the iRODS will be retrieved from the ARK. Finally, the database will need a software system for the long-term mass storage of the data and metadata produced and saved within the database. This storage system will be used to back-up input data.

 Workflow

Understanding and optimizing collection database workflows is pivotal in ensuring coherency and efficiency of data management processes. This typically involves verifying that all aspects of the software systems within the file structure and collections architecture are operating as intended. Not only should data input and archival be supported, but the database should also streamline data retrieval, analysis, and dissemination (Richards 2017: 230). The database should utilize a systemic and user-friendly approach that provides researchers with the capability to easily access, generate, update, and edit data and metadata via the private ARK interface. In essence, an effective workflow should facilitate the smooth integration of data into the architecture and support ongoing data curation tasks throughout the research process. It is recommended that the database should be structured to enable immediate data archiving upon generation, thereby preserving data integrity in the initial stages of the research project. Moreover, incorporating version control mechanisms within the database workflow can aid in the maintenance of data provenance and provide a record of changes made within the collection, which can be especially useful for collaboration projects. By focusing on the workflow of the collection database, a strong foundation for data management can be
established which can lead to more effective data-driven decision-making, research continuity, and long-term data preservation.

*Online Public-facing Interface*

Digital collection databases should have public-searchable interfaces that will permit published archaeological data accessibility to the general public. The collections architecture should already have mechanisms built in to safeguard modules that contain sensitive information. When designing the online interface of the digital collections database, it is imperative to consider every detail of metadata presentation and user experience. Kansa and Kansa (2010: 4) recommend the utilization of open standards as this will allow the archaeological data to be easily archived and preserved, as well as enable the integrated data to be used in multi-computational platforms. To ensure that the resources used for the interface work accurately, it is important to have the Web developer validate them with a validation service like World Wide Web Consortium (W3C). Furthermore, the database should utilize simple HTML or XHTML and should have easy references through the use of hyperlinks (URL). The use of hyperlinks allows the website to be easily discoverable through search engines and increases public usability.

When preparing the data for Web publication, Kansa and Kansa (2010) take various steps prior to publishing data on the Open Context publication platform. Kansa and Kansa (2010: 4) recommends cleaning the data, which includes code translation, spell checking, rows having unique identifiers, among other things, and ensuring that the projects stored have supporting metadata attached to the data sets. Lastly, one should
attempt to publish associated narrative interpretations that draws on the data. Utilizing
these steps will make for better presentation of Web-based publication practices.

Digital Collection Management and NAGPRA
The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) is a significant legislation that directly impacted the way in which Native Ancestors and funerary objects were viewed, studied, and managed by archaeologists, institutions, and museums (e.g., ownership determinations could be done for cultural objects, inventories on collections containing native items were conducted, and the return of native Ancestors and funerary objects through repatriation was facilitated). Having a deep Native community and institutional relationship can lead to better curation and collection management practices. When cataloguing and inventorying collections, researchers and curators are able to better identify Native Ancestors and tribal objects in the first instance, which can save a lot of time and money. Consultation with Native communities could also positively influence the every-day practices of the institutions, such as the rules when it comes to accessing and researching NAGPRA declared collections, how those collections should be handled and who can work with them, and the rooms in which the Native Ancestors are specifically housed (Roberts Thompson et al. 2023:10). Another conversation when working with Native objects involves the language used to discuss them. Many of the terms that archaeologists and anthropologists use in relation to Natives are still rooted in the colonial mindset and oftentimes dehumanize the Native Ancestors and the culture altogether. It is best practice to use fewer offensive terms that does not demonstrate the view of the Natives culture and Ancestors as scientific objects for study. In their work, Robert Thompson and colleagues (2023: 9) have compiled a valuable table presenting alternative terms to replace the commonly used standard terminology typically
used by researchers (see Table 1). I have incorporated some of these terms in my literature.

Table 1. Recommended Alternative Terminology (Credit: Roberts Thompson et al. 2023)

<table>
<thead>
<tr>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Remain</td>
<td>Ancestors</td>
</tr>
<tr>
<td>Fetus</td>
<td>Unborn Infant/Child</td>
</tr>
<tr>
<td>Subadult</td>
<td>Juvenile</td>
</tr>
<tr>
<td>Special Collections</td>
<td>Reverential Area</td>
</tr>
<tr>
<td>Prehistoric Ceramics</td>
<td>Indigenous Ceramics</td>
</tr>
<tr>
<td>Storage/Store</td>
<td>House/Resting (for Ancestors)</td>
</tr>
<tr>
<td>Analyze</td>
<td>Assess/Document</td>
</tr>
<tr>
<td>Discover</td>
<td>Reencounter/Rediscover</td>
</tr>
<tr>
<td>Grave Goods or Burial</td>
<td>Funerary Objects/Belongings</td>
</tr>
<tr>
<td>Furniture</td>
<td></td>
</tr>
<tr>
<td>Archaeological Site</td>
<td>Cultural Site</td>
</tr>
<tr>
<td>Prehistoric</td>
<td>Indigenous/Precontact</td>
</tr>
<tr>
<td>Historic</td>
<td>Postcontact</td>
</tr>
</tbody>
</table>

In addition to language, it is important to consider the way in which institutions, researchers, and publishers display the images of Native Ancestors and funerary objects. Native American communities have actively expressed their discontent with researchers publishing photographs of Native Ancestors and funerary objects, as it causes direct harm to the individual and community. Viewing funerary objects images holds the same weight as viewing ancestral remains for some Native Americans, causing the need for purification rites (Yerka et al. 2023). To decrease native harm, it is necessary to implement image policies for the publishing of funerary objects. The Southeastern Archaeology Conference journal (2023) has suggested the use of line drawings in place of photographs. However, some researchers oppose the policy due to the expensiveness of line drawing development, but it may just have to be a price researchers would have to
pay to mitigate the spiritual harm the actual photographs could give to the Native communities. Another aspect of the suggested image policy by SEAC is that if photographs are necessary, the publications could be published in a security guarded database where members with codes are able to access the photos. This prevents native members from unintentionally accessing the funerary images which minimizes their spiritual harm.

This image policy could be applied to institutions that have implemented collection databases in the management practices. Institutions should consult with Native community partners about the appropriate database structure, language, access levels, security, and funding for collection databases (Roberts Thompson et al. 2023: 10). Furthermore, the implementation of a NAGPRA-specific module, as suggested by Roberts Thompson and colleagues (2023: 10), presents a great opportunity for institutions to protect Native digital collections, which would include images and media of funerary and sacred objects, by implementing security barriers. Through consultation with the Native community, determination of who can access these restricted digital spaces can be established. It would also be beneficial to implement a flagging protocol for the detection of NAGPRA digital information (Roberts Thompson et al. 2023:10). When incorporating photographs in the public infrastructure, it would be best to follow the lead of SEAC and display the line drawing of the objects and place the actual images in the private and security protected sector.

The Current State of Collection Databases and Their Future
As more digital collection databases are being developed and utilized by curators and collection managers, it is important to be open about the continuous challenges
researchers and curators face with using these databases, which could lead to the creation of better database management practices. Databases can often serve as tools for managing the linkages between physical objects and the digital data about the objects (metadata) (Kansa and Kansa 2021: 83). The curation crisis has grown to encompass some of the recognized database challenges that prevail today, including the need for a standardized data integration system that would serve as a bridge to data across multiple research projects. This linkage could ultimately lead to “big data” in archaeology. Additionally, this could enhance collaborative projects that could lead to better comprehension of excavation data integrations and the data produced in the future by specialists and lab studies (Kansa and Kansa 2021: 82). Furthermore, incorporating data literacy comprehension into archeological training could enhance the ability of the researchers and scholars in their data set integration and analytical processes where they would be able to consider their biases, blind spots, and tacit assumptions (Kansa and Kansa 2021: 84). Understanding of data literacy could also help develop considerations about data relativity to broader contexts.

Museum of Anthropology at Wake Forest University
The Museum of Anthropology at Wake Forest University presents an early exemplary case study for the development and implementation of digital collection databases and online informational service within a university museum. The museum presents a three-phase project that aimed to provide cataloging information and digital images for all of the physical objects housed within the institution for public and research consumption (Whittington et al. 2011: 106). The museum used a custom-made database management program called Visual Re:Discovery, which enabled the museum to input and manipulate vast quantities of text and digital image data to make them accessible.
The first phase of the project involved the creation of the computerized database of the museum’s archaeological and ethnographical collections (Whittington 2011: 107). During this phase, the developers constructed the basic catalog format and following modules: collection management, photograph management, and lexicon which contained the most efficient and consistent field terms for easy indexing and retrieval. Moreover, the public access computer terminal which connects to the data was installed. The museum professionals were transparent about this unsuccessful aspect of the phase, which was mostly due to search results being visually and intellectually bland. The second phase aimed to improve upon the initial phase and included the integration of digital photos of the objects for faculty and public access. The final phase pushed to provide public access of cataloging information and digital images from the archival collections through the internet (Whittington 2011:108). This phase aims to enable proficient classroom teaching and student and faculty research.

The implementation of the digital database at the university museum resulted in success. Initially the museum found difficulty with getting people to use the web-database as they neglected to factor in the need for promotion. However, through the formation of various workshops that held student, teacher, and public audiences the database usage increased. Furthermore, the museum has documented that once people were aware of the database and knew how to use it, they often incorporated the database into their teachings and research (Whittington 2011:109-110). The Museum of Anthropology at Wake Forest University serves as a great example for the trials and benefits of implementing a digital database into management practice.
Collection Database Issues

As collection databases are continuously being developed and utilized in curation repositories and institutions, several prominent issues have emerged. One concern pertains to the absence of a standardized policy addressing metadata, including procedures and regulations for its production and proper use (McManamon et al. 2017; Kansa and Kansa 2020). Another noticeable shortfall lies in the insufficient emphasis on collaboration with tribal and descendant communities in digital curation (Roberts Thompson et al. 2022). Furthermore, the consideration of costs associated with short-term and long-term digital curation remains inadequately addressed (McManamon et al. 2017). Repositories and institutions face the decision of opting for open-access, similar to platforms like Open Context, or fee-based models such as tDAR. Considering costs is essential to acquiring software, associated mechanisms like maintenance and technical support, and data storage, whether it be in the cloud or in a physical drive. Additionally, there is a pressing need for the development of security guidelines for the safeguarding of digital data. This is significant in that site location and other sensitive data need to be protected to prevent offenses and looting.

Conclusion

Digital curation has become an essential part of archaeological collection management. The use of digital collection databases empowers curators and collection managers to evaluate the current state of their collections, whether they are newly accessioned, legacy status, or orphaned. While the archaeological discipline does not have a standardized policy for digital database development and management, the recommendations outlined within this paper can serve as valuable reference guides for collection architecture, structure, and web-based infrastructure publications (see Table 2).
Curators and collection managers bear the responsibility of curating, preserving, and ensuring collections accessibility, this includes digital archaeological data. Digital curation provides a means to fulfill this duty effectively. The following chapter will explore a persisting problem in archaeological curation. As we navigate the topic, it becomes apparent that the implementation of digital curation management strategies is a necessity for tackling these issues and moving towards a solution.
Table 2. Recommendations for the building and use of digital collection databases

<table>
<thead>
<tr>
<th>Names</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dallas</td>
<td>Take a Pragmatic Approach to digital collections database integration.</td>
</tr>
</tbody>
</table>
| Kansa and Kansa (2010)    | For Web-based data publication:  
  • Use Open Standards  
  • Make valid web resources.  
  • Keep it simple  
  • Recognize that machines and people are your audiences  
  • Use Hyperlinks, as they are important.  
  • Clean up the presentation and structure  
  • Provide Metadata  
  • Publish a synthesis and link it to the data |
| Kansa and Kansa (2021)    | Facilities should:  
  • Develop a Data Management Plan  
  • Enhance human workflow and communication.  
  • Implement data literacy trainings. |
| Kintigh (2006)           | Cyberinfrastructure should have:  
  • A Web-based interface  
  • Sophisticated search capabilities  
  • Data integration tools  
  • Reporting capabilities  
  • Software tools  
  • Should have centralized and distributed functions. |
| Kulasekaran et al. (2014) | Collection Architecture should:  
  • Have Metadata at its core.  
  • File structures should follow the big bucket theory.  
  • Consist of various storage software systems that are linked to the database (archival and presentation instances)  
  • Use key terms and hyperlinks. |
| McManamon et al. (2017)  | Development Efforts include:  
  • Identifying basic design requirements  
  • Developing software to meet design requirements  
  • Refining the application to improve user friendliness |
| Richards (2017)          | Databases should:  
  • Generate key terms  
  • Incorporate Gray-literature  
  • Define file formats and metadata standards.  
  • Safeguard long-term preservation  
  • Facilitate the deposit of digital data as a standard workflow process have shared and user friendly interfaces |
2.3 Curation Crisis

“All archaeological investigations, whether for cultural resources management (CRM) or academic research, result in the creation of a collection that the profession is ethically bound to preserve for future research, interpretation, and education.”

S. Terry Childs and Danielle M. Benden (2017)

Archaeological curation facilities and institutions are tasked with various “behind-the-scenes” responsibilities that include maintaining systemic inventories, accessioning new collections, cataloging, evaluating and documenting, and providing storage perpetuity for existing and new collections (MacFarland and Vokes 2016). However, these facilities are facing an on-going challenge that plagues the archaeological discipline: the curation crisis. The “curation crisis” emerged due to an increase in archaeological fieldwork (often sponsored through federal funds) where archaeologists participated in “bulk” collecting practices, leading to the shortage in adequate and secure storage space (Benden and Taft 2019). Additionally, many of the facilities employed individuals that lacked professional training and experience in curation practices and archaeological field excavation which led to the mishandling and destruction of some collections. Several publications were written in response to the initial “crisis” declaration (Childs 1999; Kersel 2015; McFarland and Vokes 2016). These publications promote awareness of the issues, while others also provided potential solutions that involved altering the methods and procedures of curatorial practices. The federal government aimed to control the crisis through the passage of various legislations like the Curation of Federally Owned and Administered Archaeological Collections (36 CFR 79)
and the Native American Graves and Repatriation Act of 1990 (NAGPRA). These mandates provided a guide for the ethical and moral management and preservation of archaeological collections. Curation facilities and institutions often utilize these mandates in the curation of new collections and existing collections when attempting to bring them up to “curating standards.”

A Deep Dive into the Crisis
The Curation Crisis became of noticeable concern in the early 1970s, when the federal government enacted a series of legislations enabling sponsorship of archaeological field research, resulting in a surge of artifacts and document collection (Kersel 2015). However, “bulk” collecting practices led to an influx of archaeological collections in curation facilities and repositories. Curator and collection managers were tasked with various responsibilities, including developing pre-fieldwork stipulations, safeguarding and digitizing collections, managing databases for research facilitation, formulating departmental policies, planning exhibitions, and understanding the interests of the public, Native American and descendant communities, researchers, and land agencies (Brenden and Taft 2019: 218). Furthermore, they have to simultaneously tackle curatorial issues such as the absence of proper inventory systems, destruction or loss of collections, lack of formal criteria for inventory evaluations, no systemic inspections of inventories, and cataloging issues that contribute to the backlog of millions of artifacts within these collections.

Another aspect of the crisis pertains to an insufficient number of stewards to accommodate the substantial influx of collections resulting in the accumulation of legacy collections- collections stored and curated in a manner that falls short of curation standards, hindering easy research access (Brenden and Taft 2019; Roberts Thompson et
Many of these stewards lacked archaeological training, contributing to subpar management of these collections. The accumulation of these legacy collections caused overcrowding in repositories and institutions, exacerbated by diminishing storage space, prompting the classification of a “crisis” in the archaeological curation.

Additionally, there was also a transformation in the planning phase of archaeological research. In the original planning stages, researchers often treated the curation and storage of their collections as an afterthought (Benden and Taft 2019; Knoll and Huckell 2019). However, there has been improvement in archaeological practices, with curation and storage now being incorporated in the initial research planning, during and after fieldwork, and throughout the “life cycle” of the collection as suggested by Benden and Taft (2019). This shift allows curation repositories and institutions to proactively plan appropriate management and storage procedures for collections before their acceptance into the repository for safe keeping. Archaeologists can also minimize the number of artifacts collected through a variety of sampling strategies (Knoll and Huckell 2019), thereby, preventing excessive collecting and subsequently increasing storage availability.

Although there have been various solutions offered and incorporated into archaeological and curation practice, the crisis is still prevailing. This is largely due to the ever-present legacy collections housed within these curation facilities and repositories. Many curation facilities plagued with legacy collections tend to have poor organization (i.e., materials are arranged by artifact type rather than provenience), no associated documentation or inventory, overpacked in boxes, and artifacts stored in “substandard” archival quality bags and boxes (Roberts Thompson et al. 2019). As a result, curators and
collections managers have sought other solutions in managing legacy collections: rehousing and deaccessioning.

A Focus on Legacy Collections

An exacerbating factor in the curation crisis are the mountains of legacy collections within archaeological repositories. These collections, obtained from excavations undertaken decades ago, suffer from inadequate storage and documentation practices, rendering them insufficient for contemporary research (MacFarland and Vokes 2016; Roberts Thompson et al. 2019; Knoll and Huckell 2019). The issues tied to legacy collections stem from extensive collecting methods and over-focus on fieldwork with minimal attention to collection care (Roberts Thompson et al. 2019: 4-5). Additionally, facilities and institutions often accepted collections in substandard conditions at no cost. Many of these legacy collections may contain NAGPRA materials, as these collections predated the law’s passage (Roberts Thompson et al. 2019). Additionally, artifacts are frequently stored in cramped boxes without proper provenience information. Curators and collection managers are faced with the challenge of managing these legacy collections and finding ways to bring them up the contemporary curation standards, simultaneously accessioning new conclusions.

Curators and collection managers address this challenge by implementing rehousing processes for their legacy collections, enabling them to generate accurate and detailed inventories of the items within the collections. Since each legacy collection presents unique challenges, the rehousing approach varies accordingly. Nevertheless, the typical process involves removing artifacts from acidic bags and boxes, organizing them, and archivally storing associated documentation through the creation of a digital inventory or database system (MacFarland and Vokes 2016:163). Furthermore, MacFarland and
Vokes (2016:163-167) outline the rehousing process in a series of steps, elaborated and reinforced by Roberts Thompson and colleagues (2019) as follows:

- **Step 1: Archive, Catalog, and Bulk Collection Inspection** - Begin by comprehensively assessing the collection’s current condition, ownership, and funding status. Organize collection boxes, bags, and associated field notes. Evaluate available funds to establish a budget for rehousing.

- **Step 2: Rehousing Preparation** - Researching site and collection details; create overview reports, identify ownership, and identifying potential NAGPRA items. Organize documented information and artifacts logically in acid-free archival folders, boxes, and bags. Digitally scan and save field notes in PDF format. Generate new acid-free “worksheet” tags with relevant provenience information.

- **Step 3: Rehousing** - Transfer artifacts to archival, acid-free plastic bags, recording information on new worksheet bag tag. Explicitly check bag contents, separating and assessing remains (e.g., bones) for human identification. Flag associated objects for possible funerary status. Refer to MacFarland and Vokes (2016: 165) for detailed procedures.

- **Step 4: Create a Digital Database** - Create a database system to accurately record collections as digital data. Consider and periodically review entries and mapping of the data, ensuring the correctness of archaeological terminology, abbreviations, excavation procedures, and site information.

- **Step 5: Database Validation** - Verify input information to preserve collection data and enable integration into contemporary archaeological research. Check for
duplicate FN numbers and errors, making necessary corrections by referring to boxes, bags, and the database.

- Step 6: Finalize Storage and Print Inventories – Print three (3) copies of the final inventory and store them in the collection box, document archive, and the master project folder. Place boxes on shelves or in secure storage area, documenting locations in the database.

- Step 7: Metadata- Store a document summarizing all rehousing efforts and the overall strategy with the project archive.

Research Potential
The practice of archaeology is inherently destructive, altering the initial environments of artifacts. This underscores the importance of documenting findings within their stratigraphic contexts for archaeological projects. Additionally, the ongoing global change in climate has had a detrimental impact on archaeological sites, as they contain records of environmental and ecological change on human timescales (St. Amand et al 2020). These sites enable paleo-environmental reconstruction and climate event identification, establishing correlations with human behaviors.

Moreover, both anthropogenic and non-anthropogenic forces, such as farming, sea-level rise, erosion, fire, and other natural disasters, threaten archaeological sites along with the primary source information they contain. Legacy collections, holding significant research potential, become increasingly relevant as new research questions are developed, particularly in realm of climate and environmental studies. Ensuring that legacy collections meet curation standards enhances their accessibility, thereby aiding in the development and implementation of such research. St. Amand and colleagues (2020: 8288) advocate for the utilization of legacy collections and their digital data in these
types of research. Many of these collections contain wood objects and tree pieces that record local precipitation patterns and can be useful in tree-ring research (e.g., dendroecology, dendroclimatology, and dendroarchaeology).

Legacy data, including digital illustrations or photographs, stored in open-access databases accessible through the Internet (with restricted site locations), enhances the research value of these legacy collections for both current and future research. Furthermore, incorporating legacy data into a digital database management system provides a methodology for researchers to report and substantiate the legitimacy of their data. This is crucial as a fundamental aspect of research is to empower future researchers to build upon existing data (St. Amand et al. 2020). This practice could also streamline the publication and citation of primary data.

In all facets of the research process, including planning and development of physical and digital collections, fostering collaboration with indigenous and descendant communities is strongly encouraged. Engaging with these communities can provide crucial insights into the site being studied, given their direct association with the archaeological materials. In the case of climate and environmental research, they often possess first-hand knowledge of climate impacts on their communities, frequently transmitted through oral traditions. Furthermore, when presenting the data to the public, it is imperative to collaborate with these communities to establish ethical parameters for accessing their cultural heritage (St. Amand et al. 2020).

Curation Funding

An integral aspect of curator and collection manager responsibilities involves ensuring that archaeological collections are maintained and managed in perpetuity-forever. While having adequate funding would ensure this objective is met, securing
sufficient funding for curation has become a great challenge for curation facilities and institutions. Many facilities lacked the necessary funding to purchase archival materials and were understaffed, leading to difficulties in curating collections. This, in turn, exacerbated the crisis in curation, resulting in the accumulation of legacy collections. Therefore, curators and collection managers often rely on curation fees to fund curation adequately.

Curation fees are typically charged to the individuals or entities that initiated an archaeological project and encompass collection preparation costs (i.e., labor/workforce and rehousing supplies) (Knoll and Huckell 2019). These fees cover payments for staff labor in inventorying and cataloging the collections, placing the objects and documents into suitable storage facilities, repackaging and conserving items, upgrading computerized records management software, acquiring supplies and materials, visiting Native American communities when necessary, and ensuring facility maintenance and security. Additionally, fees encompass various collection preparation costs such as washing, labeling, cataloging, bagging, rehousing, boxing, and more. Repositories usually calculate fees based on standardized units like per-box charges based on size, by cubic or linear foot, a notebook of hardcopy associated records, or number of oversized objects. With the increasing implementation of digital databases, repositories may introduce digital fees, potentially based on file sizes, quantities, information type, and digital storage spaces (Knoll and Huckell 2019).

Researchers are advised to plan potential curation needs for their project before initiating them. When budgeting for curation, Knoll and Huckell (2019) recommend calculating fees using the following formula: [hours to complete a task X labor rate] +
Repositories often seek proper funding from owners to aid in the rehousing process of legacy collections, emphasizing the importance of ownership establishment for collection upon accession. Further funding support can be found through federal and state grants, private foundations, and/or university support; however, these sources could be highly competitive or limited.

**Deaccession a Solution?**

As the curation crisis continues to be a thorn in the archaeology discipline, curators and collection managers have considered a more permanent solution: deaccessioning. A highly controversial practice, deaccessioning entails the “formal removal of an object or collection from the holdings of an institution or other owners, such as a repository or state agency” (Domeischel and Waggle 2020: 420). Curators and archaeologists that advocate for the practice recognize that there is a serious storage shortage and that the vast amounts of artifacts collected during fieldwork and incorporated into collections are not actually studied or used in the research as the most unique and exotic objects tend to be favored. Furthermore, some of the collections contain highly redundant materials that takes up even more space (Childs 1999: 40). Alternatively, some archaeologists and curators argue against deaccessioning practices because of the basic core principle that all recovered archaeological material objects have research value and should be preserved and stored in perpetuity for contributions in future research (Childs 1999: 39). In addition, archaeological excavation is a destructive process, so as stewards it is their ethical duty to conserve the collected materials (Childs and Brenden 2017; Smith et al. 2019). Although the debate continues today, more curators, collection managers, and archaeologists have shifted their attitudes towards
advocacy which was in part due to the official addressing of deaccessioning in 36 CFR 79 (Domeischel and Waggle 2020). However, the controversy prevails to this day.

Since its incorporation into the law, many repositories and museums have actively produced policies and methods to appropriately identify artifacts in need of deaccessioning. When considering deaccessioning, it is crucial to accurately determine that the material does not have any research value, is un-provenienced, broken, or does not fit the mission of the repository (Domeischel and Waggle 2020). However, there is no single standard available for deaccessioning determination. One possible method that is used at an Australian repository is what they refer to as a Rapid Assessment System. Based on the significance assessment used in heritage management, a rapid assessment system is a point system that aims to provide an evidence-based process for the evaluation of the research and educational values of archaeological objects, places, or collections (Smith et al. 2019). This system also provides a justification for the retention and deaccessioning of parts or all of a collection. In the rapid assessment system, four main criteria are considered: heritage (potential scientific, historic, social, and aesthetic value), documentary (accuracy and comprehensiveness of associated documentation), archaeological (quality of the overall collection, such as size and quantity) and comparative (rarity and representativeness of collections compared to others housed) (Smith et al. 2019: 20-21). As this method has been proven to be successful in Australia, adopting it in United States archaeological repositories and institutions could be just as successful. Incorporating a rapid assessment system would enable repositories and institutions with a better collection management practice and provide them with knowledge of the research and scientific values of each collection stored within their
facilities, and aid in a systematic tracking of what materials could be better used for specific research questions.

In addition to locating materials in need of deaccessioning, determining what to do with them is needed for consideration. Typically, deaccessioning entails destroying, throwing away, or transfer of the material object. However, curators and collection managers have found that incorporating deaccessioning practices can save storage space and does not necessarily involve the total destruction of the objects as they could be used towards public education programs (Domeischel and Waggle 2020). This is exemplified through the development of a teaching trunk program at the Blackwater Draw Museum. After extensive collection assessments, the museum determined that some material objects were deaccessionable based on their ownership, department and museum director input, and the criteria that these items were unprovenienced and did not contain scientific value.

The museum also diligently researched any about deaccessioning and its restrictions to ensure credibility in their decisions to deaccession. Afterwards, a proposal was officially created that incorporated the complete file information on all of the artifacts, including their accession and catalog numbers, conditions, quantity, and justification for pursuing deaccessioning (Domeischel and Waggle 2020: 424). After discussion and deaccession determination, all associated records were copied and all deaccessioning paperwork (a catalogue and deaccession records) are saved and stored. Next deaccessioning was performed with the removal of the intended artifacts from storage shelves, recategorizing them in the database, and either transferring, discarding, or applying them to a teaching program. In the case of Blackwater Draw Museum, the
deaccessioned artifacts were intended to be used in a teaching trunk program, where hands-on activities are crafted using the deaccessioned artifacts and used in K-12 classrooms, which gives the artifact an educational value.

*The Role of Tribal and Descendant Communities*

The standard view of deaccessioning presents an ethical and moral issue within archaeological practice, as it entails the breakage and destruction of artifacts (Childs 1999). However, a different perspective of this process that is essentially the same practice is the process of repatriation. Many curation facilities and federally-funded repositories in the United States have been legally required, under NAGPRA law repatriate Native American human remains, funerary object, sacred objects, and objects of cultural patrimony to their rightful tribal community owners (Childs 1999: 39).

Although repatriation demonstrates an ethical upholding for humanity and associated funerary objects, many archaeologists argue that it infringes on the potential usage in future research. A potential solution to this concern would be to actively collaborate with Native American communities throughout the process of repatriation, and even the initial research and curation phases. Native American communities have valuable knowledge about their ancestry that is often passed downwards through oral traditions and could be essential to obtaining conclusions about artifacts.

**Conclusion**

Although the curation crisis is a dominant force within the archaeological curation sector, considering the rehousing and deaccessioning of parts or all of insignificant collections can present an avenue towards a solution. Considering the curation and storage of potential collections in the initial research planning of a project can prevent the
overhaul of repetitive artifacts and aid in the funding for potential rehousing and
deaaccessioning processed of collections in the future. Furthermore, working collectively
with Native American and descendant communities in every step of the research project
could ensure the ethical preservation and management of archaeological collections.
CHAPTER III METHODS AND MATERIALS

In this study, I utilized a three-stage process to achieve the outlined goals:

1. Examine the most commonly suggested solutions for space maximization in collection storage areas, revitalization and deaccession to estimate how much space could be saved for UofL’s CACHe.

2. Determine, through consultation, the best digital collection database practices and schemes that can aid the process of development and management of digital data for UofL’s CACHe.

3. Evaluate the current state of curation facilities and institutions focusing on their existing policies and digital collections status.

In the following section, I will expand on the methods and materials used throughout this research study.

Stage 1: Legacy Collections

Recognizing that there is a curation crisis in archaeology that is consistently impacting curation facilities, I aimed to examine the two most common curation practices of space maximization in curation facilities: revitalization and deaccession. I applied these curation practices, the first physically, and the second theoretically, to two legacy collections that contain an array of material objects from pre-contact Native American origin and post-European contact contexts and are housed in UofL’s Center for
Archaeology and Cultural Heritage (CACHe): Prather Collection (12-CL-4) and Locust Grove Collection (15-JF-541).

**Prather Collection**

The Prather archaeological site (12-CL-4) is a Mississippian mound site located in the center of two distinct societies: Fort Ancient to the north and west, and other Mississippian societies to the west and south (Munson et al. 2006). The site extends over 20 acres, with the Mississippian complex constituting over 13 acres. The complex includes four mounds, a central plaza, and a residential core area. As the Prather site is significant in the mission for understanding Mississippian occupation in the Falls of the Ohio River region, numerous excavation projects have been executed at the site, most of which focused primarily on the mounds. These excavations resulted in the collection of 24,537 material artifacts (Munson et al. 2006). CACHe houses this collection, which consists of ceramics, lithics, and animal bones (Figure 1). While CACHe also houses material that fall into the historic category, I revitalized the pre-contact material from the collection only.
Locust Grove Collection

Built in 1792, Locust Grove (15-Jf-541) is a nationally recognized landmark that occupies 55 rolling acres of land and represents the deep history of Louisville, KY. American aristocrats, William and Lucy Croghan lived in the plantation home until 1878. During their tenure, they hosted several American luminaries who used the home as a
stopping location for dwelling, dialogue, campaign, and even a duel at one point (Thomas 1965). Among these luminaries were President Andrew Jackson and James Monroe, as well as Meriwether Lewis and William Clark. William Clark, brother of Lucy Clark Croghan, and Meriwether Lewis used the home as an important meeting location after their popular expedition of the Louisiana Territory.

Locust Grove was “home” to some thirty to forty enslaved workers, many of whom were purchased from local slave markets (Young 1998). The enslaved workers were also tasked with “planting and harvesting crops, digging the gardens, preserving and cooking the meals, stitching the clothes, washing the laundry, watching the children, and more” (Young 1998). Not much was documented on the daily lives of the enslaved during their time at Locust Grove; however, it is documented that the slaves were released from the slavery industry in 1849, where some remained at the home as indentured servants and the others left the property (possibly headed to the free northern states) (Young 1998). Furthermore, excavations of the site unveiled slave houses that provided a glimpse into the daily activities of the slaves (Young 1998). CACHe houses the collection, which consists of ceramic, brick, glass, nails, broken bottle, buttons, and more (Figure 2).
Figure 2. Locust Grove Collection housed in CACHe.
The Revitalization Process

The procedures of the rehousing process were based on the current CACHe policy, which share a similar process to that described by MacFarland and Vokes (2016:165) (see Chapter 2, Section 3: 36-38). The following process was used to revitalize the collections:

Step 1: I examined the contents of the bags to ensure they matched with the information written on the exterior of the bags/boxes. When a bag contained multiple material classes, I separated them into their own bags and created their own tag. Whenever I came across bags/artifacts suspected to be ancestral remains or funerary objects, I put them aside for further investigation and labeled them accordingly.

Step 2: I carefully transcribed the information written on the original “mother” bag (usually brown paper bags and old cigar boxes) to the new archival-safe zip-loc bags, before transferring the objects into the new archival-safe bags with their original tags.

Step 3: For each new bag, I recorded the following information: site number, acquisition number, site name, area, level, unit, stack (shelf) location, excavator, initial excavation date, and content. Additional information was recorded and saved to an Excel spreadsheet that served as the digital catalog for each collection.

Step 4: Once all of the contents are properly transferred, I placed the new mother bags into an acid-free box and properly labeled the box with key identification.
information, such as box number, site name, site number, acquisition number, and contents.

The contents and conditions of each material object and artifact were recorded in an Excel spreadsheet which served as the collections’ catalog. As several of the artifacts from the Locust Grove collections were out on loan, I created an additional field titled “Field Number” to the catalog in order to properly match the artifact with the appropriate catalog entry upon their return to the facility and collection.

Throughout the process, I considered the amount of space being saved based on box counts and measurements. Additionally, I recorded the time it took to complete each collection.

The Deaccessioning Process

As deaccessioning artifacts and collections continue to be a contentious solution for space maximization in repositories because in archaeology, unlike art, deaccessioned artifacts are often thrown away and therefore potentially lost for future study, many facilities prefer to avoid deaccessioning. CACHe is one of these repositories, and my goal was to develop a plausible policy for which CACHe (and possibly other facilities) could implement into their curation practice. Through the analysis of existing deaccessioning literature, I compiled a subsample of recommendations, including an emphasis for partnered collaborations with agencies and community representatives. Furthermore, I theoretically applied these recommendations to the total legacy collections housed at CACHe to estimate the amount of potential storage space that could be saved using the established policy.
Stage 2: Collaboratively Building a Collection Database

As curation facilities continue to integrate digital collection databases into their curation facilities, it is important to discern the appropriate policies and procedures for the proper management of the various digital data that are developed. Since the archaeological discipline currently does not have an official policy or guideline, I aimed to determine the best digital collection practices through a series of consultations with leading digital curation experts from curation facilities and community stakeholders. These meetings took place virtually through the Teams or Zoom application. Through these virtual meetings, topics of database hierarchy, field listings, appropriate search terms, metadata standards, and guidance on cataloguing archaeological curation were topics of discussion. Furthermore, open conversations with community stakeholders were held to ensure that people of Native American and Black heritage had the opportunity to incorporate their voices in the development of the database and protocols. The following consultants were contacted and met with: Elizabeth Quinn MacMillan and Amy Cato (Fort Lewis College’s Center of Southwest Studies), Sarah Witcher Kansa and Eric Kansa (Open Context and Digital Index of North American Archaeology), Stephen Yerka, Miranda Panther, and Beau Carroll (Eastern Band of Cherokee Indians), and Yvonne Jones (Professor at UofL’s Department of Pan-African Studies).

Through conversations with CACHe director, Dr. Thomas A. Jennings and research archaeologist, Dr. Ashley Smallwood, it was determined that the over-arching goal was to develop a digital database with both private and publicly searchable interfaces. Therefore, it was decided that the best software that would be used to construct the digital collection database at CACHe would be Collective Access. This
decision was determined based on it being the most cost efficient (free to download, however, potential fees were determined necessary for special services to set up the initial database), and the software would enable us to map the database structure from scratch. In order to do this process properly, we met with Seth Kaufman (Collective Access representative).

Stage 3: The Survey

To evaluate the current curation practices and policies for both physical and digital collections within curation facilities and institutions in the Southeast, I decided to create and distribute a survey. The survey was developed using Microsoft Forms, which was made available through my UofL’s student Microsoft account with no additional fees. I designed the survey to be brief, taking about 7 to 10 minutes to complete, as the target audience were working professionals and brief surveys were most likely to be completed. As the goal of the survey was to obtain data about current institutional policies and procedures that should be available on request, the survey does not include questions of personal opinion. Therefore, questions were formatted addressing the institution rather than the individual curator/ collection managers’ thoughts and beliefs. The questions were styled as yes/no, open-ended, and multiple-choice questions.

The survey was comprised of 34 questions that were categorized into three sections: Background, Collection Management, and Digital Curation. The sections were created to specifically target significant study themes, with each section having its goal and purpose explained to the surveyors. The Background section consisted of 3 questions that asked general questions about the identification of the institution being represented
and whether further contact with the surveyor can be made (e.g., Who are you?). The Collection Management section contained 12 questions that addressed the current curation and management practices of physical collections housed within the respective institutions (e.g., Does your facility have a deaccessioning policy?). The final section, Digital Curation, was the longest section having 19 questions that focused on digital collection management practices (e.g., Does your facility have an active digital collection?). A full listing of questions asked in each section of the survey can be found in Table 3.

I distributed the survey using two main methods: in-person and through email. I first debuted the survey in-person during the Southeastern Archaeological Conference, during my poster presentation on this current project entitled “Collaboratively Building a Collection Database.” At the end of discussions with professionals who visited my poster, I asked curators, collection managers, and tribal representatives in attendance to scan a QR code (placed directly on the poster) to take the survey. Following the conference, an email was sent to curation interest groups’ (Southeastern NAGPRA Community of Practice (SNACP) and Society for American Archaeology (SAA) Curation Interest Group) list-serves, where the survey was disseminated to group members. Lastly, I personally emailed a few curators and collection managers directly asking for their participation in the survey. I specifically targeted curation facilities in the Southeastern region of the United States.

Table 3, Survey questions listed in their 3 categories.

<table>
<thead>
<tr>
<th>Category</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>1.  Do you represent a facility situated within a university, state or federal agency, Native American tribe, or Cultural Resource Management firm?</td>
</tr>
</tbody>
</table>
2. Please list the facility/agency/Tribe that you work for or represent for the purpose of this survey.
3. May we contact you or your facility/agency/Tribe if we have follow up questions? If yes, please provide an email address.

**Collection Management**

4. How many cubic feet of collection does your facility curate?
5. What percentage of these collections are “Legacy” collections (those that do not meet current curation standards)?
6. What percentage of the collections are documentation?
7. Is it your facility’s policy to keep digital and hard copies of documentation?
8. Approximately what percentage of your total curation space is full (100% being completely full)?
9. Does your facility have a policy on recombining boxed collections to create additional space?
10. Does your facility fund or receive contracts to revitalize legacy collections? If yes, what agencies/institutions have funded revitalization?
11. Does your facility track space saved from revitalization?
12. Does your facility have a deaccessioning policy?
13. Have collection owners requested or allowed deaccessioning within the last 5 years?
14. What happens to objects after deaccessioning?
15. What happens to associated documentation?

**Digital Curation**

16. Does your facility have an active (online) digital collection database?
17. If answered “Yes” to the previous question, what software is used?
18. Does your facility have a formal digital curation policy?
19. If answered “No” to Question 18, is one currently in development?
20. If answered “Yes” to Question 18, does this policy include requirements for digital data security?
21. If answered “Yes” to Question 18, does this policy include requirements for backups?
22. If answered “Yes” to Question 18, does this policy include a requirement consult with community partners (including tribal nations) when storing or sharing digital data?
23. How much total digital content does your facility curate (e.g., total disk space)?
24. Does your facility pay for digital storage?
25. If answered “yes” to Question 24, about how much annually?
26. Does your facility charge a fee for digital curation services?
27. If answered “Yes” to Question 26, what is your digital curation fee rate?
28. Does your facility have a public facing, searchable side to your curation database?
29. If answered “Yes” to Question 28, is there a formal policy to determine what information/materials are available for the public?
30. Does your facility curate digital images of NAGPRA Ancestors or funerary objects?
31. If answered “Yes” to question 30, does your facility have or is your facility/agency developing a NAGPRA image policy?
32. If answered “Yes” to Question 32, was this policy developed in consultation with tribes?
33. How concerned are you that curation facilities will soon face a digital curation crisis and facilities will run out of or have difficulty funding digital storage space?
34. Please share challenges you have faced with curating digital materials.
CHAPTER IV RESULTS AND DISCUSSION

4.1 Legacy Collections

A total of 15 legacy collection boxes from the pre-contact context of the Prather Mounds site and the post-contact Locust Grove plantation site were rehoused into new archival boxes (see Figure 3). The contents within these collections were transferred into archivally-safe materials and were re-bagged and re-tagged with associated information. For the Locust Grove Collection, a total of 623 bags were rehoused and re-boxed. A total of 3,405 minutes was spent for the revitalization process, with an average of 5.47 minutes spent per bag. 325 bags were rehoused and re-bagged from the Prather Mounds Collection, resulting in a total of 1,620.80 minutes spent on the revitalization process, with an average of 5.02 minutes spent on each bag. In total, 948 bags were rehoused, taking approximately 5,025.80 minutes, with a combined average of 5.25 minutes spent on each bag.

Legacy collections are variable and unpredictable, comprising of multiple different objects in different conditions. Implementing the revitalization process on some of these legacy collections will increase collection space, while others may do the opposite and reduce space. The Locust Grove Collection revitalization process resulted in 6 new boxes out of 7 originals, increasing free collection space at CACHe, while the Prather Mound Collection resulted in 9 new boxes out of 8 original boxes (increasing by one box), thereby reducing (i.e., losing) space. Using the results from the pilot study, I was able to obtain estimates for all of the collections housed at CACHe. There are 108
remaining Locust Grove boxes. If CACHe continues to apply revitalization techniques to this collection, 15.5 cubic feet of collection space could be saved. Furthermore, CACHe has 428 boxes that are stored similarly to the Locust Grove Collection (i.e., cigar boxes), that could increase space by 61.1 cubic feet. Lastly, there are 105 boxes that are stored in similar fashion to the Prather Mound Collection (i.e., brown boxes and paper bags). Implementing revitalization techniques to these collections could result in 13.1 cubic feet of collection space being reduced. Ultimately, a total net space of 63.5 cubic feet could be saved at CACHe through revitalization.

Curation facilities are encouraged to fully assess their collections prior to implementing rehousing processes. I recommend that other curation facilities carefully consider and perhaps even conduct similar pilot studies with their collections. This will enable curators and collection managers to have knowledge of what is in their collections and estimate space saving (or loss) probabilities and estimate the amount of time it would take to complete revitalization per collection. This would allow facilities to build an efficient and realistic revitalization plan depending on their space needs. Furthermore, it could aid in the decision- making process for collection acquisitions and deciding whether or not the facility has enough space and funding to adequately curate and store new archaeological collections.

Another commonly suggested, albeit contentious, crisis solution is the deaccessioning of objects and collections. While much of the literature addressing deaccession policies mentions methods and the benefits of executing deaccession policies, there is not a current guide that directly discusses the amount of deaccessioning a curation facility can partake. To determine the space saving capabilities of
deaccessioning, I, theoretically, applied estimates to the total number of boxes forming collections at CACHe (N=713), not including the newly revitalized components from this study. Theoretically, if CACHe were to deaccession 5% of their collections, 35.65 cubic feet of collection space could potentially be saved. However, if they were to deaccession 10%, CACHe could potentially save 71.3 cubic feet of collection space. I do not recommend curation facilities deaccession more than 10% of their collections. However, I encourage curation facilities to carefully consider what is in their collections, along with the informational value that the objects hold prior to deaccessioning.

**Figure 3.** Boxes from the Prather Mound Collection (right) and Locust Grove Collection (left) after the rehousing process.

**4.2 Consultations**

Collaborations through consultations with digital curation experts, whose represented institutions utilize digital collection databases, resulted in the formation of
guidelines for the development and management of digital collections databases centered on archaeological collections. There were four overarching themes to consider when building a collections database: the software and server, database structure, accessibility, and associated policies and procedures. I participated in consultations with individuals representing four different entities: Seth Kaufman, developer of the curation software, Collective Access, Amy Cao and Elizabeth Quin, curators at Fort Lewis College, Stephen Yerka, Miranda Panther, and Beau Carroll, tribal historic preservation officers with the Eastern Band of Cherokee Indians (EBCI), and Yvonne Jones, a professor at University of Louisville with an expertise in local African American heritage. I summarize the results of these consultations below and note that discussions with EBCI are very preliminary at the time of this thesis and will only be minimally discussed. I have organized consultation summaries topically.

*The Software/Server*

The first step in building a digital collections database is determining which software to use. This often depends on the budget and required capabilities needed of the software to complete the tasks of digital data preservation and management. CACHe has decided to use the software, CollectiveAccess, as it is free and very flexible in that it has the ability to hold information compatible with that of archaeological collections at the box (and potentially bag) level.

When building the digital database, it is imperative to consider where it would be housed, ie, the server. For universities seeking to obtain a digital collections database, it was recommended by Cao and Quinn that the database be hosted on the university’s server. To gain an understanding of this option, the curator and collection manager should
contact the university’s IT Department. For Cao and Quinn, the advantages of the university hosting the digital database on their servers include the ability for the IT Department to have control over the accessibility of the database and user licenses. The database could be accessed only through a university computer or VPN. Although this may be a tempting advantage, curators of university collections must also be aware of the common issues associated with hosting on university servers and should consider these “disadvantages” when determining database hosting. According to Cao and Quinn, some common issues to hosting the digital database on a university server includes the following:

- IT Department could decide not to host the database on the university server at all.
- IT Department could have limited database capabilities, such as initiating back-ups and providing data security.
- IT Department would be responsible for initiating software updates. This could become problematic if the schedules do not align, leading to un-updated software.
- IT Department may opt to not provide service for the database, which makes it the curator or collections manager’s responsibility to maintain the database on the server, resulting in limited control and access to the database server.

For other facilities (and universities whose IT Departments opted to not host the database), it would be best to consider hosting the database on the server provided by the software’s creator. Choosing this route could incur additional fees; therefore, curators and collections managers should consider this when crafting their budgets. UofL’s IT Department has stated that while they can host the database on their servers, they cannot provide any support for setup or maintenance. Thus, the current direction for the new
CACHe database will be hosting it on UofL servers and with contracted assistance from Collective Access support staff. Seth Kaufman, a developer for Collective Access, explained that support, the notions of which vary, would typically be billed upfront and is based on an hourly basis. The type of support offered varies, however, Kaufman elaborated that this could include data migration, production of printable and digital reports, on-line support, and website maintenance. Furthermore, the costs for such services tended to depend on the type of project and the amount of time required to complete the project, making support costs difficult to estimate. Collective Access also provides storing services for a “relatively cheap” price. Finally, EBCI noted that there are potential security risks to hosting information about NAGPRA collections in an online database, and they recommend carefully considering the risks and benefits of including a NAGPRA module.

*Database Hierarchal Structure*

The database hierarchal structure is designed based on the various types of collections and digital content necessary for the preservation and management of archaeological collections information. Incorporated into this design are the metadata and content fields, linked to each input, which are together structured into modules (see Figure 4). CACHe’s draft database structure includes five distinct modules: Project/Group (Events), Collections/Sites, Sacred Sites, Culturally Sensitive Community Ancestors and Objects, and Education Collections. Pending further discussions with EBCI and other tribal partners, we have decided to hold off on including a NAGPRA module in the new online database. For now, NAGPRA collection data will be managed on computers that do not directly host data online.
The Project/Group (events) Module is designed to aid researchers in their projects, as it enables them to upload and document their data within the database as well as maintain a record for results. This will also facilitate tracking events such as collection or object loans. The Collections/Sites Module is where the records and metadata associated to all of the archaeological collections (e.g. digital reports, contracts, loans, etc.) contracted to CACHe would be digitally stored and managed.

Figure 4. Draft Database Structure for CACHe digital collections database.

The Sacred Sites Module enables collections information from sites that are considered “sacred”, but not necessarily NAGPRA identified, to be stored and properly managed. The collections and cultural objects residing in this collection are presumably sensitive and should be carefully monitored. Additionally, the determining of the sacredness of a site or collection should be determined in collaboration with community partners. Recognizing that other communities have sacred and spiritually charged objects that are often collected during excavations, CACHe has decided to create a Culturally
Sensitive Community Ancestors and Objects Module. The objects that make up these collections are not indigenous but can be sensitive for other communities. This module would specifically incorporate the African and African American collections housed at CACHe including elements of African burials, documentations, and spiritually charged objects, for example, information about the enslaved community (e.g., images, plantation inventory logs, etc.) could be readily accessible for the public. This is discussed further below. Lastly, the Education Collection are items that lack provenance information, or are deemed worthy of deaccessioning. These items are used as educational tools in university courses or can be incorporated into traveling teaching exhibits that could be loaned out.

All of the modules will have fields (and subfields) that aid in the digital preservation of the collections inputted. As the database has the purpose of managing accessioned collections, the metadata recorded include material types, acquisition number, location, unit, level, site name/number, FS number, feature, excavation date, excavator, weight, coordinates, notes, and other fields deemed necessary. The collections are designed to be processed and recorded at the box level, as some collections may have numerous boxes associated to them.

*Accessibility (Hierarchical Structure)*

The question of accessibility was a repeated theme throughout all consultations. Determining who would have access to sensitive data was determined based on the desire to protect collection site information, such as exact locations. To grasp a more comprehensive understanding of the database accessibility, I asked each consultant their views and thoughts on the topic. Each consultant expressed the need for certain collection information to have restricted access and capabilities. Based on these conversations, it
was determined that the database should have 4 different types of access: administrative access, student and volunteer access, archaeology researcher and professional access, and tribal and descendant access (see Figure 4).

It was determined that the administrative access would have full control of the digital collections database, as well as full access to the sensitive information stored. This access would be limited to about 2 to 3 administrators to maintain security for the information. These administrators would have the power to input new collections and site data along with their associated records (i.e., site location, owner information, curation agreement documentations, physical locations, and digital metadata: entry and access logs). Additionally, administrators would have access to Loan Agreements and Returns, uncensored digital reports, images and media, including their credit, copyrights, and use permissions. In this access, administrators would also have the power to delete information and deaccession digital data which would include the party that granted the permission, when deaccession occurred, the method used, and associated documentation. Lastly, administrators would have access to NAGPRA content including tribal/descendant contact information, documented communications, Summaries and Inventories, and Proof of Consultation records.

Considering that students and volunteers often work within curation facilities and utilize archaeological collections for research, it is important to consider student usage of the collections database. Cao and Quinn recommended that administrators should enable student and volunteer access in the digital collections database and set levels of student access. Students and volunteers would have limited access and control of the database. At Fort Lewis College, students have the ability to input object and collection information
(box and bag levels that include field specimen) such as acquisition number, location data, object type, dates. The students and volunteers are, however, restricted from accessing administrative documents like loans and contracts; however, they are able to access censored/ redacted versions of publications and site reports. Additionally, the students and volunteers are not able to access NAGPRA or culturally sensitive digital data unless they receive tribal and administrator permission. This last point is critical because, as noted in the ECBI consultations, tribes want to ensure that anyone with access to NAGPRA data or collections should be ethically prepared to handle collections and knowledge with the appropriate respect and confidentiality.

Similar to the student access, archaeology professionals and researchers would have limited control and access to the digital database, often granted on temporary basis. Researchers would have the potential ability to input their personal research data into the digital database through the creation of a new project or group. This would enable researchers to better manage and save their collected data for later use. This could also directly begin the curation process for that research. They would also have access to digital reports with the sensitive information redacted. If the researcher wants access to sensitive information, they would be required to obtain permissions from appropriate parties. The public would have limited access and zero control of the database. They would only be able to read and search for basic information pertaining to the collections and would not be able to alter or input data. If a NAGPRA module is ultimately added to the database, there would be potential for tribal archaeologists and descendants to have access to digital content upon request.
Database Management and Policies

An aspect of the consultations focused on the ways in which the digital experts managed their databases with the aim to develop policies in association with the built digital collections database. Elizabeth Quinn suggested that CACHe invests in a digital preservation assessment prior to initiating the database. Conducting a digital assessment would enable curators and collection managers the ability to know what types of digital data they have and how it could be preserved. Another outcome of the preservation and management of digital collections management conversations was the creation of the following policies: digital image and media, ethics, NAGPRA, and deaccession.

As many of the objects within archaeological collections have images and media associated with them, it is imperative to consider their roles in digital collections databases; therefore, curation facilities utilizing digital databases should have a digital image and media policy. Through conversation with EBCI, digitally curating images or other media of NAGPRA objects should be carefully considered in further consultations. Uploading NAGPRA images runs the risk of tribal members being exposed to them, which can be spiritually harmful (Yerka et al., 2023). Instead, it may be best for NAGPRA images to be repatriated along with the physical collections including legacy media such as photographs or slides, leaving the digitization decision to the tribes. Again, CACHe will continue tribal consultations on these decisions. However, images that do not fall under the NAGPRA category, can be uploaded and should be linked to appropriate metadata. Additionally, the property credits of images and media should be considered, and possibly watermarked to prevent unrequested use of the images.
Furthermore, the file formats and resolutions of the images and media should be considered, as it can affect the size of storage and preservation.

While this is the case for indigenous community objects, other communities may not agree with the restriction of their cultural items. The black community, for example, encourages the use and promotion of African and African American documents and material objects, such as funerary objects. Through consultation with Yvonne Jones, a professor in Pan-African Studies at University of Louisville, it was determined that many individuals within the black community encourage the uploading of documentation of black ancestors. Furthermore, these contents and images should be made publicly available within the digital collections database. This difference in perspectives between the black and indigenous communities could stem from their histories. Black Americans continue to face the effects of the slave industry in that much of their history had been erased and/or “white-washed”; therefore, having these archaeological objects and documentations readily available enables them to learn more about their histories.

Whereas, the indigenous community have their histories and heritage available to them through their oral histories. This goes to show that it is important to know that one policy does not always fit for each community; therefore, multiple policies should be created. Additionally, community perspectives are consistently changing, so we as a community must remain up to date on community ideas and thoughts surrounding these discussions.

In order to create an ethical and moral digital collections database, curators and collection managers should consider incorporating an ethics policy. When developing this policy, considerations for those using and viewing the database should be applied. As such, utilizing appropriate terminology is crucial. Recognizing that some legacy
terminology is necessary for the efficient maneuver and workflow of the database, it is important to determine which words could and should be replaced for more humanizing terms. A list of appropriate alternate terms that can be used within the database can be found in Table 1. Furthermore, the database should incorporate up-to-date diversity statements and an acknowledgement statement of possible legacy/offensive language usage and ask those using the database to contact the administrators if offensive or insensitive terms are located. Elizabeth Quinn suggested the incorporation of a reporting box or link to the homepage of the database.

In addition to ethical terminology, it is essential that the individuals using the digital collections database (and even the physical collections) are aware of the appropriate procedures for handling and caring for the information and artifacts. Therefore, it would be best for students and volunteers to receive ethical collections and curation training, which would occur prior to the start of their work or research. This ethical training should include best practices for working with any collections but with a specific focus on indigenous and other culturally sensitive items. To build institutional and tribal/ descendant relationships, the training could be developed in ‘true’ collaboration with multiple tribal representatives from the initial start of the training development to its completion. Beau and Miranda, EBCI representatives, suggested that designing the project as a multi-tribal collaboration would provide different perspectives on artifact handling and can build institution and tribal connections.

As new and legacy collections continue to be accessioned and catalogued into the system, there should be an explicit NAGPRA policy in place to assist with the management of the digital data. Curators and collection managers have the option of
creating a NAGPRA module in the database that would store county and state level information about NAGPRA sites. Miranda Panther suggested that these sites and collections be logged at this level will aid Tribal Preservation Offices with the determination for consultations. The NAGPRA module should be context focused restricted to administrative access only, unless students and researchers obtain authorization to access the contents. Authorization is typically given after proof of consultation, for which the researcher is responsible for obtaining and the proof could be stored in a “proof of Consultation” file. To assist in the research access process, curators and collection managers could streamline a NAGPRA form that addresses whether or not there is a NAGPRA context to the research proposals. The module should be designed to aid in the composing of NAGPRA annual reports, as tribes may request them.

When developing the module, it is important to consider what constitutes a “sacred object/site.” Based on the consultation with EBCI, all mound sites and dog burials would be considered sacred and should be consulted before researched. Curators and collection managers should consult with tribes to determine sacred objects and sites, as the term sacred is pervasive and can be different per tribe. Initially, CACHe considered implementing a NAGPRA module into the digital database, however, it was decided that we would forgo a NAGPRA module for a “Sacred Sites” module. The collections at CACHe are small in comparison to other laboratories curating NAGPRA collections. Therefore, the need for a NAGPRA module is unnecessary. CACHe would benefit more through the Sacred Sites module as it enables the importing of collection information from sites that are considered sacred, but not necessarily NAGPRA identified. This
enables the ability to monitor these collections, while keeping them restricted for security purposes. Furthermore, this module could assist THPOs in making claims for such sites.

In relation to NAGPRA, curation facilities should also have a deaccession policy. A potential policy for digital data would be to make the records unsearchable and it's tracking only available to administrators. Furthermore, the records should be retained (possibly linked to the initial input). No one should be able to access the deaccessioned information for research purposes. This policy could be applied to repatriated objects as well.

4.3 The Survey

To understand the current curation practices and policies, institutions that manage and curate archaeological collections were surveyed. A total of 40 responses were received, however, 4 of which were cut as they did not provide enough information and/or did not represent an institution. Therefore, the results represent 36 institutions from the Southeastern region of the United States. The responding institutions represent five types of archaeological institutions: cultural resource management firm (N=3), private museum (N=2), state and federal agency (N=11), tribal museum (N=1), and university (N=19). As Table 4 shows, over half of the respondents are from universities (52.8%), with federal and state agencies, which includes state museums and laboratories, representing 30.6% of respondents.

Table 4. The types of institutions and counts that participated in the survey.
A total average of 31,021.03 cubic feet of collection space was reported by institutions in the Southeastern region, with 79.71 percent of that space, on average, being at full capacity (see Table 5). To determine whether there is a relationship between the amount of collection space available and the percentage full, a correlation analysis was conducted. Results showed that there was not a correlation between the amount of collections space and percentage full, which indicates that even in areas where institutions invested in collections space, the spaces were still at full capacity (Spearman’s rho = 0.37, p = 0.105, Figure 5). This is not surprising given that on average institutions are full.

That collection spaces are at full capacity, regardless of size, indicates that curation facilities are still facing the challenges of the curation crisis, decades after its initial declaration. While legacy collections contribute to space depletion, continued collection and the generation of new archaeological collections in need of storage add to this storage stress. While catch-and-release and other sampling methods (Kersel, 2015) will help reduce incoming collection loads, large-scale mitigations will still require

<table>
<thead>
<tr>
<th>Institution Type</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRM</td>
<td>3</td>
<td>8.3</td>
</tr>
<tr>
<td>Private Museum</td>
<td>2</td>
<td>5.6</td>
</tr>
<tr>
<td>State/Federal Agency</td>
<td>11</td>
<td>30.6</td>
</tr>
<tr>
<td>Tribal Museum</td>
<td>1</td>
<td>2.8</td>
</tr>
<tr>
<td>University</td>
<td>19</td>
<td>52.8</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>100</td>
</tr>
</tbody>
</table>
curation and preservation. Therefore, we, as a community, should continue investing in
curation space while investigating and developing new methods and field techniques that
aid in the maximization of curation space. As facilities invest time and money into
locating and obtaining space (i.e., buildings, rooms, etc.) to house collections, utilizing
space saving sampling techniques could not only save space, but also time and money.
Three avenues that could reduce existing space that can potentially be addressed through
curation practices are collection recombination, legacy collection revitalization, and
deaccessioning. I address these topics in the survey below.

Table 5. Archaeological collection space and capacity in Southeastern curation facilities.
Collection recombination policies, rehousing portions of collections into boxes that are not completely full, has the potential to reduce existing curation space. Table 6 shows that there was no significant relationship between facilities at full capacity and the existence of a collection recombining policy ($t=0.443; p=0.962$). Over half of the curation facility respondents reported that they did have a recombining policy ($N=23$). It was expected that curation facilities at full capacity would have a recombining policy, however, results indicate the opposite. Curation facilities at full capacity are not likely to have a recombining policy. Curation facilities should consider the implementation of a

**Figure 5.** Correlation between collection space size and percent at which the space is in full capacity.

*Collection Management*

Collection recombination policies, rehousing portions of collections into boxes that are not completely full, has the potential to reduce existing curation space. Table 6 shows that there was no significant relationship between facilities at full capacity and the existence of a collection recombining policy ($t=0.443; p=0.962$). Over half of the curation facility respondents reported that they did have a recombining policy ($N=23$). It was expected that curation facilities at full capacity would have a recombining policy, however, results indicate the opposite. Curation facilities at full capacity are not likely to have a recombining policy. Curation facilities should consider the implementation of a
recombining policy in their collection management practice, especially those at full capacity, as it has proven to be a potentially efficient space saving technique.

Table 6. Curation facilities at full capacity and the existence of a recombining policy.

<table>
<thead>
<tr>
<th>Does your facility have a policy on recombining boxed collections to create additional space?</th>
<th>N</th>
<th>Mean %Full</th>
<th>%Full Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>12</td>
<td>81.42</td>
<td>14.286</td>
</tr>
<tr>
<td>No</td>
<td>23</td>
<td>78.83</td>
<td>17.409</td>
</tr>
</tbody>
</table>

As demonstrated in the results described in the CACHe revitalization study, bringing legacy collections up to current standards can also potentially save space. Curation facilities were asked whether they received funding towards the revitalization of their legacy collections (Table 7). Over half of the respondents (82.73%) reported that they do not receive funding for the revitalization of their legacy collections. One might expect for facilities at full capacity to be actively seeking legacy funding, however, results from t-testing indicate that there was no significant difference between curation facilities that were at full capacity and their reception of legacy collection funding (t=1.473; p=0.449).

Again, based on the CACHe pilot study and the survey results showing how full storage facilities are, as storage space continues to deplete, I recommend that curators and collection managers increase their efforts to obtain adequate funding for the revitalization of their legacy collections. Curators and collection managers can locate funding assistance through various humanities and science grants or from collection owners or
impose a subscription style curation fee, rather than the standard one-time payment, to fund long-term collection storage and maintenance.

Table 7. Curation facilities space capacity and their reception of funding toward revitalizing legacy collections.

<table>
<thead>
<tr>
<th>Legacy Funding</th>
<th>N</th>
<th>Mean % Full</th>
<th>% Full Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>12</td>
<td>74.17</td>
<td>12.41</td>
</tr>
<tr>
<td>No</td>
<td>22</td>
<td>82.73</td>
<td>17.868</td>
</tr>
</tbody>
</table>

Curation facilities were asked if they tracked the amount of space saved through revitalizing their legacy collections (see Table 8). Results showed that there was no significant difference in the percentage at which the curation facility is at full capacity and whether they track space saved through revitalization (t=0.707; p= 0.987). However, only three institutions reported that they actively track the amount of space saved through the revitalization process (73.33%).

That only three facilities track space saved could also be an indication that curation facilities are simply not initiating revitalization practices towards their legacy collections, however, the survey did not ask whether legacy collections were being revitalized. I recommend that curators and collection managers strongly consider incorporating revitalization practices into their management systems as it enables them to better understand the contents of the collections that are stored and determine ways to provide accessibility and utilize these oftentimes, “forgotten” collections. Tracking the amount of space that is saved (or not saved) through revitalization can further assist curators and collection managers with collection acquisition decisions and prevent
overcrowded storage areas. Therefore, curation facilities should seriously consider implementing revitalization and tracking the space saving abilities of this technique.

Table 8. Curation facilities percentage at full capacity and whether they track space saved through revitalization.

<table>
<thead>
<tr>
<th>Track Space Saved via Revitalization?</th>
<th>N</th>
<th>Mean % Full</th>
<th>% Full Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>3</td>
<td>73.33</td>
<td>8.819</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>80.31</td>
<td>2.904</td>
</tr>
</tbody>
</table>

Finally, deaccessioning can also save space, although it has potentially much more significant drawbacks than rehousing or revitalizing. Table 9 reports the existence of a deaccession policy in Southeastern curation facilities, to which the majority reported that they in fact did have a deaccession policy (N=22; 83.41%). Curation facilities were then asked if they had deaccessioned an object or collection in the last five years, for which the majority reported that they had not (N=19, see Table 10). However, there was no significant difference between facilities’ capacity and the presence of a deaccession policy (t= 1.809; p= 0.194), or whether facilities actively deaccessioned collections or objects within the last five years (t= 0.887; p= 0.628). Out of all the respondents, only 20 curation facilities reported the methods they used when deaccessioning collections (Table 11). The most reported methods used to deaccession collections were digitized, trashed/destroyed, or sold. Of the facilities in this survey, 80% report that at least some of the deaccessioned collections are trashed or destroyed (N=16).

Table 9. Percent full vs. Deaccession Policy
<table>
<thead>
<tr>
<th>Deaccession Policy</th>
<th>N</th>
<th>Mean % Full</th>
<th>% Full Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>22</td>
<td>83.41</td>
<td>12.606</td>
</tr>
<tr>
<td>No</td>
<td>13</td>
<td>73.46</td>
<td>20.040</td>
</tr>
</tbody>
</table>

Table 10. Percent Full vs. Deaccession in the last 5 Years

<table>
<thead>
<tr>
<th>Deaccession last 5 years</th>
<th>N</th>
<th>Mean % Full</th>
<th>% Full Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>16</td>
<td>82.38</td>
<td>16.297</td>
</tr>
<tr>
<td>No</td>
<td>19</td>
<td>77.47</td>
<td>16.283</td>
</tr>
</tbody>
</table>

Table 11. Deaccessioned by destroying objects and/or collections

<table>
<thead>
<tr>
<th>Deaccession - Destroyed</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>16</td>
<td>80</td>
</tr>
<tr>
<td>No</td>
<td>4</td>
<td>20</td>
</tr>
</tbody>
</table>

The fact that less than half of the respondents do not have a deaccession policy nor have actually deaccessioned an object, demonstrates the curation community's hesitance, to get rid of these archaeological materials. This hesitance stems from the recognition of the objects’ potential informational value. Unlike art collections that can be sold, archaeology collections are typically trashed or destroyed, which leads to their information being lost forever. Recognizing this hesitance, we should consider alternatives for the use of these collections and objects that would not lead to their total destruction. A suggested alternative could be their use as educational tools. These
collections could be placed in “education trunks,” along with instructor hand-outs that highlight the known information about the collection and object. While digitization presents an efficient avenue, it could further contribute to the potential threat of a digital curation crisis; therefore, alternatives should be considered prior to implementation.

**Digital Curation**

The survey asked a series of questions aimed at documenting current digital curation practices in facilities. Out of the 36 respondents, 20 (55.6%) do not have an active online digital curation database, while 44.4% (16) reported that they do. Those that do have a digital curation database use a variety of software packages including Emu, FileMaker, 4D, PastPerfect, Collective Access, Argus, SQL Server, Re: Discover Proficio, Interis Registries, and Arielle Collections. This diversity of packages, and the recognition that many of these are not specifically designed for archaeological collections, hints at the lack of standardization in digital curation practices.

Of respondents in this survey, 75% do not have a formal digital curation policy, while 25% reported that they do have a policy (see Table 12). Of the 27 facilities that do not have a policy, 11 (40.7%) reported that they are currently developing one. Furthermore, 16 (59.3%) do not have one nor are they developing a digital curation database. Of the total 36 facilities who responded to the survey, 20 have or are developing a digital curation database.

For institutions with digital curation policies, these policies include requirements for digital data security and data backup. 41.2% (7) of these also include a requirement to consult with community partners on digital curation management. As the area of consultation with community (including tribal) partners had a slow inheritance into
formal curation practice, this seems to be the same in the digital sector. While digital curation policies continue to lag behind physical curation policies, I recommend that we, as a community, should actively consult with communities that are connected to curated cultural materials, including digital data, to foster more ethical, equitable, and accurate preservation of sensitive data. Although there is a current increasing shift towards community-institutional interaction, more work is certainly needed in both the physical and digital arenas of curation consultation.

Table 12. Questions and responses about facility digital collections database.

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Percent</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have an active online digital collection database?</td>
<td>16</td>
<td>20</td>
<td>44.4</td>
<td>55.6</td>
</tr>
<tr>
<td>Have a formal digital curation policy?</td>
<td>9</td>
<td>27</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>Is there currently a digital curation policy in development?</td>
<td>11</td>
<td>16</td>
<td>40.7</td>
<td>59.3</td>
</tr>
<tr>
<td>Policy includes a requirement for consultation with community partners?</td>
<td>7</td>
<td>10</td>
<td>41.2</td>
<td>58.8</td>
</tr>
<tr>
<td>Provide digital storage?</td>
<td>8</td>
<td>11</td>
<td>42.1</td>
<td>57.9</td>
</tr>
<tr>
<td>Pay for digital storage?</td>
<td>13</td>
<td>23</td>
<td>36.1</td>
<td>63.9</td>
</tr>
<tr>
<td>Charge a fee for digital curation services?</td>
<td>5</td>
<td>31</td>
<td>13.9</td>
<td>86.1</td>
</tr>
<tr>
<td>Have a public facing, searchable side to your curation database?</td>
<td>9</td>
<td>27</td>
<td>25</td>
<td>75</td>
</tr>
</tbody>
</table>
To adequately assess digital storage, reported storage space was divided into two categories: small and large. The small category represents digital storage that is less than 1 terabyte, while the large category represents storage that was more than 1 terabyte. 8 (42.1%) repositories fall into the small category and 11 (57.9%) are in the large category. Of the curation facility participants, 13 (36.1%) reported that they pay for digital storage space, while 5 (13.9%) reported that they charge for digital storage services. Respondents were asked about how much they pay and charge; the few that answered stated that they pay around $300 to $2,000 annually. The two facilities that responded about service fees responded with one charging $5 per gigabyte and the other charging an $85 flat fee.

In general, the lack of information about storage and service fees suggests that curators and collection managers are not immediately aware of this aspect of digital curation. As a community, we should begin actively thinking about this aspect because as more facilities are incorporating digital collection databases into their practices (evidenced by more than half of the respondents having an existing online database), we need to know the rates and costs for digital storage. This would be similar to how the fees and rates for the curation and storage of physical collections are readily available. Given that inadequate funding and costs have helped lead to the physical curation crisis, we could potentially have a digital curation crisis on our hands, too, if we do not start financial planning now.
Of the respondents, 9 (25%) have a public searchable database. Of those that have a public face to their database, 6 (66.7%) have a formal policy to determine what is accessible online.

Table 13. Facilities level of concern about a potential digital curation crisis.

<table>
<thead>
<tr>
<th>Level of concern</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somewhat unconcerned</td>
<td>5</td>
<td>13.9</td>
</tr>
<tr>
<td>Neither concerned nor unconcerned</td>
<td>7</td>
<td>19.4</td>
</tr>
<tr>
<td>Somewhat concerned</td>
<td>14</td>
<td>38.9</td>
</tr>
<tr>
<td>Very concerned</td>
<td>10</td>
<td>27.8</td>
</tr>
</tbody>
</table>

Finally, curators and collection managers were asked about their concerns regarding a potential digital curation crisis. Table 13 shows the results from this question. 24 (66.7%) reported that they are either somewhat or very concerned. That represents 2/3rd of our curator and collection manager respondents. We have been discussing the physical curation crisis and how it took us by surprise, but the digital curation crisis does not have to. While curators and collection managers are already thinking about open access, which ensures accessibility to digital collections, and data storage, more should be done to prevent the emergence of the digital curation crisis. Here are a few recommendations for the community to consider to begin better preparing ourselves for digital curation needs:

- Consider funding digital curation specialists/stewards who work alongside physical curators and collection managers.
• Develop standards for digital curation fees and service costs, including digital storage and maintenance.

• Be selective and forward-thinking in developing policies for what should and should not be digitized and the amount of storage space the content will require.

• Remember the colonial legacy of the archaeological discipline and prevent repeating mistakes of the past that led to the physical curation crisis, such as over collecting practices. Not everything has to be digitized and uploaded into the digital sphere. This would save a lot of space, time, and resources.

• Finally, critically consult with tribal and community partners on the digitization and accessibility of sensitive collection information and imagery.
CHAPTER V CONCLUSION

The application of revitalization, recombining, and deaccessioning processes to archaeological legacy collections has been proven to increase collection spaces. Through legacy collection revitalization, it was estimated that CACHe could potentially save 63.5 cubic feet of collection space. Recombining collections has shown to efficiently increase collection space as well, although I did not directly test this method using CACHe’s recombining policy. Other curation facilities should incorporate collection space saving techniques and track the amount of space that is being saved, leading to increased storage capacity. Knowing exactly how much collection space is available could aid curators and collection managers in their decisions for future collection acquisitions. Implementing these into curation facility policies and practices offers realistic solutions to the curation crisis and should be strongly considered, as they could bring us closer to overcoming the crisis.

As curation facilities increasingly integrate digital collections databases into their curation practices, it becomes crucial to consider the various policies and guidelines necessary for building a successful collections database system. Through consultations with digital curation experts, tribal community representatives, and community
stakeholders, CACHe has identified the best digital curation practices and developed procedures for database development that other curators and collection managers can utilize. Five overarching themes should be considered when developing a collections database: software and server, database structure, accessibility, and associated policies and procedures. CACHe will develop the database using the software system, Collective Access. These consultations also led to the drafting of a digital database structure and curation policies, covering digital images and media, ethics, NAGPRA, and deaccession. When developing a collections database, it is imperative that facilities consult with tribal and other communities that may have sensitive objects within collections, as multiple policies may need to be required to address the perspectives of each community. While the results presented in the thesis are preliminary, the broader curation community should engage in open discussions and consider best practices for digital curation and management.

As the curation crisis continues to be a gray cloud over the archaeological discipline, it is up to the curators and collection managers to develop and incorporate efficient curation practices to mitigate the negative effects of the crisis. Additionally, as curation facilities integrate digital curation into their practices, it is imperative to consider future effects, such as the potential development of a digital curation crisis. Therefore, we as a community should begin having greater discussions about best digital curation practices and management now, before the crisis develops.
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CURRICULUM VITA

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Degrees Received

2024  **M.A. Anthropology**, University of Louisville

  Masters Thesis:
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2019  **B.A. History** (minor: **Anthropology**), Christian Brothers University

Research Interests
Collections management, archaeological curation practices, digital archaeology (including digital database management), NAGPRA and other descendant community cultural objects and repatriation efforts, curation crisis

Publications


Intramural Grants and Awards - received

2023 **Crockett, Cenetria L.**, Collaboratively Creating a Digital Collection Database. UofL’s Department of Anthropology ($500)

**Professional Presentations**


2024 Thomas A. Jennings, Ashley M. Smallwood, Kathryn E. Marklein, Angela D. Storey, **Cenetria L. Crockett**. Engaged Archaeology at CACHe-Fieldwork with Blind and Visually Impaired Students, Mitigating Historic Cemetery Necroviolence, and Developing a Curation Database. Presentation presented at the *Kentucky Historical Council Conference*, March 2024.


**Archaeological Field Experience**
2023 **Field Crew Member**, Dr. Johnathan Haws, Lapa de Picareiro cave site, Mira de Aire, Portugal, Archaeological Research in Portugal Program

2023 **Field Crew Member**, Dr. Ashley M. Smallwood and Dr. Thomas Jennings, Coplin Valley site, Upton, KY

**Cultural Resource Management Experience**

2023-present **Graduate Research Assistant**, Center for Archaeology and Cultural Heritage, University of Louisville

2019 **Student Intern**, C.H. Nash Museum Chucalissa, University of Memphis

**Other Relevant Experiences**

2023-present **Graduate Research Assistant**, Department of Engineering Fundamentals, University of Louisville

2019-2022 **Tour Hostess**, Archives Department, Elvis Presley’s Graceland

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**Relevant Courses Taken**

*University of Louisville*
- GEOG 558 Introduction to GIS
- ANTH 579 Ceramic Analysis
- ANTH 608 Social and Cultural Theory
- ANTH 609 Archaeology Theory and Methods
- ANTH 612 Contemporary Issues in Anthropology
- ANTH 672 Curation in Archaeology
- ANTH 562 Museums and Cultures

*Christian Brothers University*
- ANTH 160 Cultural Anthropology
- ANTH 279 Introduction to Archaeology
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**Professional Memberships**

2023-present Southeastern Archaeological Conference

2024-present Society for American Archaeology