A Checklist for Sustainable Management of Archaeological Collections

S. Terry Childs and Danielle M. Benden

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. A collection may be both artifacts and associated records (e.g., field notes, photographs, and data) or just associated records when no artifacts are recovered. In either case, their care and long-term management require resources of time, money, and labor, which have not been broadly forthcoming since the significant influx of collections began in the United States with the enactment of state and federal historic preservation laws in the 1960s and 1970s. Inadequate, unsecure storage space, shortage of professional curatorial staff, poor accessibility to collections for research and other uses, and orphaned collections[1] are some of the many problems identified as part of the curation crisis besieging the United States (e.g., Bustard 2000; Childs 1995, 2006, 2010, 2011; Childs, ed. 2004; Ford 1977; GAO 1987; Lindsay et al. 1979, 1980; Marquardt 1977; Marquardt et al. 1982; Milanich 2005; Sullivan and Childs 2003; Thompson 2000) and many other countries (e.g., Kersel 2015;

ABSTRACT

The discipline of archaeology has been tolerating, at best, a "curation crisis" for decades that is unsustainable. The many issues related to long-term collections care continue to worsen. To counter this trend, we advocate that planning for collections be integrated into project administration from inception such that the management of archaeological collections begins before fieldwork and continues well after recovered collections reach the repository. To conceptualize this process, we identify the Collection Management Cycle as a framework for the many stakeholders involved in archaeological projects. We also provide a checklist that identifies the responsibilities stakeholders have to the collections they generate, fund, care for, manage, and/or study. Concerted use of the checklist and other proposed solutions will lead to a new era of a more sustainable archaeological practice.

Durante décadas, la disciplina de la arqueología ha tolerado, en el mejor de los casos, una "crisis de curación" que es insostenible. Los muchos problemas relacionados con el cuidado a largo plazo de las colecciones continúan empeorando. Para contrarrestar esta tendencia, proponemos que la planificación de las colecciones sea integrada en la administración del proyecto desde el comienzo, de tal forma que el manejo de las colecciones arqueológicas comience antes del trabajo de campo y continúe después de que las colecciones recuperadas lleguen al depósito. Para conceptualizar este proceso, identificamos el ciclo de administración de la colección como un marco para los muchos depositarios involucrados en los proyectos arqueológicos. Además, proveemos una lista de verificación que identifica las responsabilidades de los depositarios respecto a las colecciones que generan, financian, cuidan, gestionan y estudian. El uso conjunto de la lista de verificación y otras soluciones propuestas conducirá a una nueva era de prácticas arqueológicas más sostenibles.

Kibunjia 1996; Perrin 2009; Smith and Murray 2012). The current trajectory is unsustainable over the long term without reliable resources, including commitment by the many stakeholders involved. Millions of artifacts and associated records are currently cared for across the United States, while many more are recovered as sites are destroyed each year primarily due to development activities associated with population increase, road expansion, and energy discovery and operations.

This article focuses on new archaeological collections and how to more fully integrate them into the overall management of either a CRM or academic project, from beginning to end, to establish a sustainable practice that ensures that the research and educational values of collections are maintained over time. This process involves many critical stakeholders, including academic and CRM archaeologists; students; federal, tribal, state, and local government agencies; descendant communities; private landowners; repository personnel; professional organizations and granting institutions; the media; and the general public. The vast complexities associated with tackling the curation of existing or legacy collections are a topic for a separate article.

A framework by which to understand the interrelationships between archaeological project management and the recovered collections has been offered (Childs 2011) and is elaborated upon in this article. It involves a series of management stages that occur before fieldwork begins (e.g., planning, budgeting, permitting, funding), during and through the fieldwork and laboratory phase (e.g., excavation, processing, analyzing, report writing), and well after fieldwork ends. The latter includes preparing collections for deposit into the repository (e.g., conserving, packing), physical acceptance into a facility (e.g., accessioning, cataloging, storing), access and use of the collections, maintenance (e.g., inventorying, inspecting, conserving), enhancements (e.g., rehousing collections, migrating electronic data), and disposition.

In this article, we propose a Collection Management Cycle (Cycle) for an archaeological project and align it with a checklist of key collections-related tasks with an emphasis on things to consider for new archaeological projects. Our goal is to assist the many stakeholders in CRM firms, academia, government agencies, tribal programs, and repositories, among other groups, in avoiding the pitfalls that have led to and continue the curation crisis. Most people involved in and supporting archaeology have specific roles in only a portion of the entire Cycle (Childs 2011). Accordingly, we identify the stakeholders, explain their responsibilities within each collection management stage, and point out their interrelationships so that the system functions sustainably.

The archaeological profession can make significant strides toward sustainability by considering the Cycle and using the checklist. Further, archaeologists can use these tools to identify the part they play within the Cycle, recognize the collections-related tasks that are undertaken by others throughout the entire process, and know with whom to communicate. We conclude this article with some recommended actions for sustainability; that is, investment in the present by the many involved stakeholders to ensure access to collections for future research and other public benefits (Bradley 2007).

THE COLLECTIONS MANAGEMENT CYCLE OF AN ARCHAEOLOGICAL PROJECT

The nine management stages illustrated in Figure 1 provide a framework by which to manage archaeological collections sustainably, both in terms of cost and time. Most of the stages are unidirectional, flowing from one to the next in a logical order. Many of the associated tasks occur in different locations (e.g., offices, the field, laboratories, and repositories) and are accomplished by various stakeholders. The stages are interdependent and impact one another, making it increasingly important for all involved to be aware of what occurs in areas in which they do not normally work. For example, the access/use stage involves decision-making by curatorial staff about the future availability of collections based on feedback from the curation acceptance, maintenance, enhancements, and deaccessioning stages. Collections that are intensively used should be well maintained and may need future enhancements to extend their usability, whereas those that have never been researched or used for public education may not be prioritized for significant investment and enhancement (MacFarland and Vokes 2016). Additionally, we place an arrow between deaccessioning and the first stage of a new project to signify our hope that the lessons learned by navigating through the Cycle for one project informs the various stakeholders as a new project is undertaken.

The Cycle is operationalized by using the checklist (Table 1), particularly as new projects are planned and implemented. We also offer it as a useful teaching tool to inform stakeholders about their responsibilities to the artifacts and/or associated records that are generated from all archaeological projects.

Stage 1: Project Scope and Programming/Plan/Budget/Agreements/Funding

This first management stage is a complex of activities that may begin some years before a project even starts. We realize that not all listed tasks are relevant to both CRM and academic projects. The order in which these occur may also vary based on several factors. For these reasons, we consider them all together and advise use as appropriate to the project at hand.

The connection between project scoping, programming, funding, and awarding contracts for CRM projects and archaeological collections is critical to a sustainable process. This begins when a project proponent, such as a government agency or energy company, undertakes or anticipates undertaking management of an archaeological investigation that will yield artifacts and/or associated records. The cultural resource managers and contracting officers who are involved in developing and issuing the Request for Proposal (RFP) should
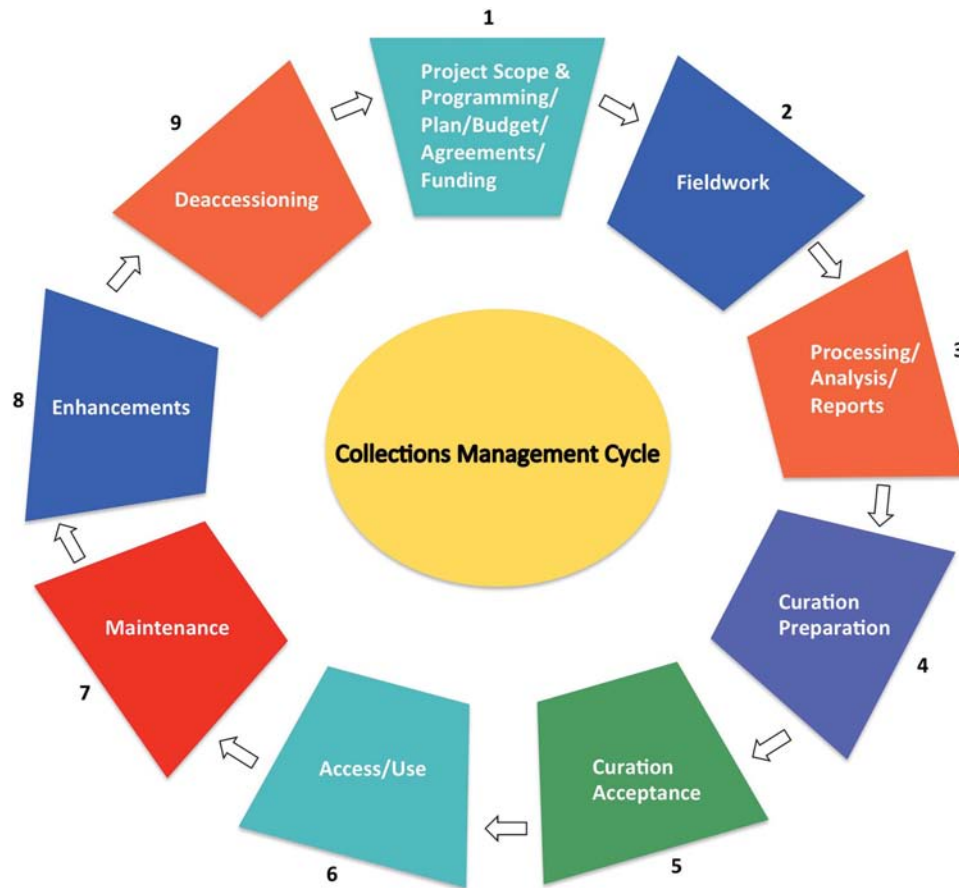
FIGURE 1. Collections management cycle of an archaeological project.

- Be aware of the relevant federal, state, or local laws that govern the ownership and long-term care of the resulting collection.
- Identify the repository where the collection will be housed. 36 CFR Part 79, *Curation of Federally-Owned and Administered Archaeological Collections,* provides federal standards for selecting a repository that are useful for both federal and non-federal projects. An important factor in this determination is a repository's mission and scope, including its willingness and ability to be custodian of the collection recovered during the project.
- Include the associated costs of collections management in the initial government estimate for the project, including the curation fees to be collected by the designated repository. This estimate should include a realistic contingency to cover the difference between the anticipated collection size and the actual size once the archaeological work is completed. Another consideration in the estimate is object conservation costs that might be needed, especially for work in frozen or waterlogged contexts where such treatments are likely to be needed.
- Consider the appropriate type of contract to award that recognizes a collection will be created. These are, minimally, fixed price (lump sum), cost-reimbursable, or time and materials with either not to exceed cost limits or cost plus (see Majewski [2010] for details about these contract types). A time and materials contract with cost plus is generally best for testing and data recovery projects that may result in many more artifacts

than anticipated in the contractor's bid, so that the costs for curation are adequately covered. A contract for a no-collection survey (Butler 1979) that results only in associated records will need to cover the costs of curating those records, whether hard copy, digital, or both.

Anyone planning to conduct an archaeological investigation, including project proponents, CRM companies bidding on a RFP, academics, and students, should have a clear collecting strategy in their scope of work that assists with project planning and budgeting. An effective collecting strategy takes into account the project type (e.g., survey, testing, large-scale excavation), time period(s) to which the recovered cultural material dates, an approximation of the quantity of artifacts that may be unearthed, the types and quantities of the samples that will be collected, and a sampling strategy (if any) applied to specific artifact classes (Childs and Corcoran 2000; Sonderman 2004; Sullivan and Childs 2003). All of these factors inform budget formulation and the need to include collections moving from fieldwork to the repository acceptance stages of the Cycle, as discussed below. Formulas for calculating curation costs have been developed that can assist during scoping, programming, planning, and budgeting by project proponents, contracting officers, CRM firms, agency archaeologists, researchers, and students (Drew 2010; Lyons and Vokes 2010; Majewski 2010; Sonderman 2004).

TABLE 1. Checklist for Managing Archaeological Collections (To access this as a one-page printable document, please visit https://doi.org/10.1017/aap.2016.4).

Stage/Checklist Item	Done?	Stakeholders Involved
STAGE 1: PROJECT SCOPE AND PROGRAMMING/PLAN/BUDGET/AGREEMENTS/FUNDING:		
Have a strong understanding of relevant federal/state/local laws that govern ownership and long-term care of resulting collections.		1, 2, 3, 6, 7
Identified the repository where the collection will be housed and communicated with repository personnel.		1, 2, 3, 6, 7
Programmed the associated costs for collections into the project budget, including curation fees and conservation costs.		3, 6
Considered the appropriate type of contract to award, which recognizes a collection will be created (e.g., fixed price, cost-reimbursable, time and materials with "not to exceed" or "cost plus" options).		3, 6
Developed a scope of work that includes tasks related to recovered artifacts and associated records as specified in the Request for Proposal.		1, 2
Have a collections strategy that considers culling and sampling, in-field analysis, and/or object reburial, as applicable.		1, 2
Have a curation budget, including line items for supplies, repository fees (objects and records), conservation, and other related costs. *Make sure to include a contingency provision if significantly more artifacts are recovered than outlined in the collection strategy.*		1, 2
Obtained all permits necessary to begin an archaeological project.		1, 2
Clarified collection ownership and responsibilities of all stakeholders. If you are working on private land, has the land owner signed a Deed of Gift?		1, 2
Secured a curation agreement that clearly states the obligations of all parties, and obtained the repository's acceptance standards.		1, 2, 3, 6, 7
Identified/Secured/Provided funding for analysis, report writing, curation supplies, repository fees, and long-term curation (including future enhancements).		1, 2, 3, 6, 9
STAGE 2: FIELDWORK:		
Carried out your collecting strategy and considered it to account for significantly more recovered artifacts.		1, 2
Developed protocol for tracking artifacts from the field to the lab.		1, 2
STAGE 3: PROCESSING/ANALYSIS/REPORTING:		
Conducted thorough analysis and prepared a report.		1, 2
Identified in the report and SHPO site files where collections are curated and what objects were sampled/culled/removed for destructive analysis.		1, 2, 3
Taken steps to make the report, or parts thereof, accessible to interested parties.		ALL
STAGE 4: CURATION PREPARATION:		
Analyzed, cataloged, packed, labeled, and prepared collections according to repository standards.		1, 2
Prepared digital associated records with required metadata for upload onto server space, and labeled all digital photos and files.		1, 2
Identified objects in need of conservation and followed through on a plan for treatment.		1, 2
Delivered the collection to the designated repository.		1, 2, 3, 5, 6
STAGE 5: CURATION ACCEPTANCE:		
Agreed to accept a collection for curation, ensuring that it will be accessioned, cataloged, properly stored, and accessible for future use.		7
Invoiced for the curation fees, as applicable.		7
Ensured that the accessioning and cataloging information is accurate and complete, including the owning party who is accountable for the collection.		7
Obtained a repository agreement for long-term care of collections.		3, 7

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TABLE 1. Continued.

Stage/Checklist Item	Done?	Stakeholders Involved
STAGE 6: ACCESS/USE:		
Taken steps to ensure the collection will remain accessible for future use, including providing information on the Internet about where it is curated.		ALL
STAGE 7: MAINTENANCE:		
Made arrangements for and carried out regularly scheduled inventories and inspections and a plan for long-term curation and conservation treatments.		3, 7
Migrated digital data to updated formats.		1, 2, 3, 7
STAGE 8: ENHANCEMENTS:		
Evaluated collections to determine if they need enhancements such as rehousing, conservation, or digitization.		1, 2, 3, 7
STAGE 9: DEACCESSIONING:		
Identified collections or portions of collections that are candidates for deaccessioning.		1, 3, 4, 7
Followed through on protocols required in appropriate laws and regulations.		1, 3, 4, 7

Key: Major Stakeholders (corresponding numbers are listed in the far right-hand column).

1. Academic and CRM archaeologists

2. Students

3. Federal/Tribal/State/Local government agencies

4. Tribes and descendant communities

5. Private landowners

6. Developers

7. Repository personnel

8. Professional organizations

9. Granting institutions

10. The media

11. The general public

Knowing the designated repository's fee structure (i.e., one-time, "in perpetuity" fee per cubic foot box for objects, per linear foot for paper records, and per file or gigabyte for digital records) and their requirements for deposition is crucial at this stage. Some repositories charge a fee to register the deposited collection (Childs et al. 2010), which is designed to help support repository staff in anticipation of the later stages of the Cycle (Lyons and Vokes 2010:227).

Given all this information, agencies and other project proponents should not automatically accept the lowest bid for CRM projects that inadequately budgets for curation costs. A "low bid always wins" approach undermines the goal of working toward a sustainable process, is contrary to the intent of law, and is detrimental to collections preservation and accessibility for future research.

For academic-based research projects, securing funding for collections can be a difficult task because some granting organizations do not fund curation costs related to fieldwork. The National Science Foundation (NSF) will provide curation funds as part of a larger project budget. Including the costs of both collection preparation and long-term care in the project budget is vital to the future preservation and accessibility of the collection and is tied to the ethics of professional archaeologists.

Also during Stage 1 (usually after the project or grant award), archaeologists should secure the permits and agreements necessary to accomplish the scope of work and ensure proper curation of the resulting collection during the subsequent management stages outlined in Figure 1. An archaeological fieldwork permit is usually required for projects on U.S. government lands and in most foreign countries. Such permits often identify the organization(s) or institution(s) responsible for the long-term management of the recovered collection; fiscal oversight associated with long-term curation; the appropriate repository to curate the collection; and the permittee's responsibilities for collections-related costs. No new projects should be approved by the permitter, usually the land-managing agency or landowner, unless adequate provisions for long-term collections care and management are specified.

For projects allowed on U.S. private lands, the principal investigator should encourage the landowner to donate the resulting collection to a public repository so that it will be available for future uses (Sonderman 2004). Some state museums will accept private yet systematically recovered collections for free, but require a deed of gift from the landowner to document transfer of ownership. In all cases, permits and ownership documentation should be in place prior to beginning a field project.

Although the project proponent may identify the repository where the collection will be deposited, the contractor or researcher needs to secure a curation agreement, a formal document that clearly states the responsibilities of the depositor and the repository as the custodian of the collection. The depositor's responsibilities are generally twofold: (1) follow the collection preparation requirements, which may vary significantly between repositories, before delivering the collection, and (2) pay the fees for long-term curation and other costs.

The collection owner, often an agency, and project archaeologist should also identify who will follow through on all aspects of the project, including contacting repository personnel early in the project planning to obtain the repository's standards (e.g., guidelines on labeling, packaging, and cataloging). Doing so will prevent additional fees and breaches of the curation agreement and maximize future accessibility.

Stage 2: Fieldwork

Collections are generated when archaeologists remove physical objects from the ground and create associated records to document a project. As outlined in the checklist, it is important during this stage that archaeologists carry out the already devised and approved collecting strategy, consistently employ the method discussed in the project proposal to track the recovery and preparation of the objects from the field to the laboratory so that objects are not lost, and identify objects that may require conservation in the field. All paper and digital records should be continuously accounted for during fieldwork.

Since curation funding (Stage 1) is often hard to estimate and/or secure, some government agencies have adopted a no-collection policy in the field (Butler 1979). This process involves recording the artifacts found during fieldwork, then leaving them in place at the site. Others discard certain material classes in the field, rebury them at the site, or keep a sample of diagnostic or redundant artifacts after in-field analysis. No-collection and in-field analysis for survey projects are relatively common practices, especially in the western United States, because of mounting curation costs and insufficient repository space (e.g., Childs et al. 2010; Heilen and Altschul 2013; Lyons et al. 2006; Sagebiel et al. 2010). Furthermore, some tribes have voiced their preference to leave the artifacts at the site due to cultural concerns related to removing them and practical concerns regarding the costs of curation (Lightfoot 2008).

No-collection strategies and in-field analysis are contentious practices that can impact the ethic to preserve collections for the future (Beck and Jones 1994; Childs et al. 2010; Griset and Kodack 1999; Heilen and Altschul 2013; Heilen 2013). Technicians conducting fieldwork may not have the expertise to perform in-field analysis. That inexperience may increase the costs of the fieldwork stage, which defeats the intended cost-saving purpose of such a policy (Majewski 2010). Further, it is difficult for anyone, trained or untrained, to thoughtfully analyze and document artifacts in the field without having the entire recovered collection for careful study in the laboratory.

Stage 3: Processing/Analysis/Reports

As new collections enter this stage, they are appropriately washed and studied by the project archaeologists. Principal investigators are responsible for the written project report at the end of the analysis. Some sampling, as discussed in the collection strategy, may take place during this stage. Sampling should be done by archaeologists with expertise in the artifact class in question. The project report and state site files should identify the collection owner and the repository where the collection is curated and include general information about what, if anything, was sampled or removed for destructive analysis.

Stage 4: Curation Preparation

Archaeologists are responsible for properly packing, labeling, and cataloging artifacts and associated records according to the standards of the designated repository and then delivering the collection. Conservation work that might have been included in the project budget often occurs at this time. Proper curation preparation should reduce the need for Enhancements at a later date, thereby decreasing the future funding needs of the collection.

Repositories generally utilize a cataloging system to more easily track and retrieve collections and may require that certain data be entered electronically prior to depositing the collection. Cataloging system formats vary quite significantly, so it is important to check the individual requirements of each repository. The repository's catalog system is not usually an in-depth analytical tool and, therefore, does not replace the thorough analysis forms that archaeologists have completed in Stage 3 of the Cycle.

Stage 4 also includes digital records management, which is part of the associated records of a collection. This involves following repository policies for acceptable metadata and file types that are then uploaded onto server space for long-term preservation (Drew 2010; McManamon and Kintigh 2010; Niven 2011). Digital records and data can be curated at a different repository than the one selected for the objects, so a clear relationship between the objects and digital records should be well documented in order to facilitate future research. Preferably, the digital records should be publicly accessible via the Internet so researchers do not have to visit two different repositories. If this is the case, sensitive data, such as site location, should be redacted prior to public dissemination.

Stage 5: Curation Acceptance

It is important to work closely with repository staff in this stage since institutions differ in the number and types of positions responsible for overseeing collections management and curation. For example, a small repository may have only one staff member charged with overseeing all these activities while a large repository may employ several people with more specific roles (e.g., director, curator, conservator, registrar, collections manager).

In most cases, registrars and/or collections managers are charged with checking that all necessary catalog information is present, the collection was packed to repository standards in Stage 4, and that the collection owner is designated in the accession or other record. Repository staff will also assess any curation fees incurred up to and during this stage as specified in the curation agreement.

The repository agreement—a formal document entered into between the collection owner and the repository—should be reviewed to clarify responsibilities of both parties. The collection owner, often a government agency, and repository staff should have addressed any open issues, such as whether the collection owner or custodian (repository) is responsible for accessioning the collection. Accessioning is generally done by the owner to document the legal rights to the collection. Usually, the curator will make decisions about collections use, including destructive analysis. The repository agreement usually specifies protocol for authorization from the collection owner during this decision-making process. Additionally, intellectual property rights and copyright associated with high-resolution photography and 3D scanning are new issues that need to be addressed. These technologies are increasingly used to enhance object documentation and research (Ahmed et al. 2014; Kuzminsky and Gardener 2012). Decisions about their use should be agreed to and documented in this stage.

Stage 6: Access/Use

Access and use for public benefit is the primary reason why collections are made and preserved long term. Curators decide on access to collections for use in scholarship, exhibits, public programming, and consultation with descendant communities, when applicable.

All future uses are predicated on collections remaining accessible to many stakeholders: academics and CRM archaeologists, students, tribal members and other descendant communities, museum exhibit staff, interpreters in state and national parks, and the media who publicize archaeology. While some of these stakeholders have responsibilities that fall within other stages of the Cycle, all major stakeholders are linked to collections access and use. For example, government and CRM archaeologists need to know where relevant collections are located to enable analysis while planning a new project and preparing an appropriate collecting strategy. Government archaeologists should use collections from their land to facilitate resource management decision-making about future archaeological investigations. And repository personnel are involved because they provide collections access to these many stakeholders, a difficult task at many understaffed institutions.

While collections reuse is on the rise for research (e.g., Collins et al. 2010; Daniels 2014; Green et al. 2014; Newbury 2014; Sinopoli 2013) and heritage uses by tribal communities (Colwell-Chanthaphonh and Ferguson 2008; McCarthy 2016; Neller 2004; Shackel 2011), it can be difficult for stakeholders to track down where collections are housed if the repository is not identified in the project report and site files. Some collections may not be readily accessible when requested for use due to incomplete Curation Preparation in Stage 4. However, many repositories are posting their collections catalog online to improve knowledge about and access to collections (King 2009). These catalogs generally include object photographs and omission of confidential or sensitive site information.

Archaeologists who create and study collections and the collection owners should work with the repository curator or other designated employee to promote collections access and use. While often undervalued, collection use for coursework that is focused on reanalysis, training in curatorial responsibilities, and artifact conservation are worthwhile endeavors. Further, faculty should encourage students to pursue thesis and dissertation topics with an emphasis on existing collections. Project archaeologists, collection owners, and repository personnel should do their part in persuading the media to reveal the stories told by the artifacts and records and highlight the issues associated with insufficient collections care (e.g., Bawaya 2007; Curtis 2008; Edgar 2008; Malakoff 2011; Reichhardt 2007).

FIGURE 2. An example of a recent collections enhancement project. All artifacts were removed from acidic storage containers and repackaged into polyethylene plastic bags and placed into coropolast boxes with clearly labeled box inventories and labels created using an electronic database (top). Associated records were rehoused into appropriate storage containers and a finding aid was created (bottom).

Both archaeologists and granting institutions, such as NSF, National Endowment for the Humanities (NEH), and Wenner-Gren Foundation, should support research on existing collections to validate their research potential and justify the need for their long-term curation. Repository personnel should document each instance of use to further justify that support.

Stage 7: Maintenance

Repository personnel conduct physical inventories to inspect collections at regularly scheduled intervals. During these inspections, any conservation needs should be assessed, and ensuing treatments conducted as necessary. Migration of digital records and data is another important maintenance task. For collections owned by agencies or other organizations, this stage is carried out most effectively when the collection owner and repository staff work together to ensure completion.

Stage 8: Enhancements

New collections may eventually need to undergo remedial efforts to extend their longevity or "life." A curator usually authorizes these kinds of decisions, in consultation with the collection owner as appropriate, as s/he considers the collection's research potential and educational value. One type of enhancement is rehousing whereby repository personnel remove objects from acidic field bags and repackage them into archival-quality bags

and boxes for long-term preservation and accessibility (MacFarland and Vokes 2016; Marino 2004; Figure 2). Another enhancement may be to float large volumes of soil samples to reduce the collection size and make the resulting artifacts and ecofacts readily available for research. New procedures were recently developed to reduce the hazards associated with this type of enhancement (Majewski et al. 2015).

Other enhancements include entering handwritten card catalog data into a searchable collection management system to ensure easy retrieval of object information and 3D scanning that is proving successful for research, exhibition, and collection management (Ahmed et al. 2014; Bruno et al. 2010; Kuzminsky and Gardiner 2012). Consolidating collections is the process of uniting collections from different repositories into one facility. It is another enhancement that occurs for various reasons including, but not limited to, facilitating research so that an archaeologist does not have to travel to multiple repositories to analyze one site collection, at the request of tribes who wish to reunite collections during the NAGPRA process, or due to a change in mission or collecting scope. Consolidation also occurs when collections are moved from a substandard facility into one that has appropriate environmental and security controls, an action that also streamlines collections care under one set of curatorial standards and procedures.

Enhancements are infrequent due to limited funding that is difficult to predict during project budgeting (in Stage 1). The

curator, or other designated repository personnel, determines when a collection needs enhancement and should work closely with the collection owner (i.e., government agency) and granting organizations to fund the necessary activities. Enhancements should not be as necessary in the future if new collections undergo the tasks presented in the checklist.

Stage 9: Deaccessioning

Effective collections management involves preserving collections over the long term following Stages 1–8 above so that deaccessioning is not needed for new collections. This is especially true if a repository follows a clearly written mission statement and scope of collections under which a curator carefully considers new acquisitions.

We include deaccessioning as a stage in the Cycle because there may be a legitimate reason that a collection or objects within a collection should be deaccessioned in the future. Such reasons may be extreme physical degradation; loss of object provenience information that makes it useless for future research, outreach, or exhibition; or highly redundant objects with no research value (Childs 1999; Kersel 2015; Merriman 2008; Morris and Moser 2011; Sonderman 1996). Deaccessioning may be warranted in these cases, but involves the collection owner, repository staff, and archaeologists working together in the public (including tribal) interest to verify collection ownership; evaluate the appropriateness of the artifacts identified for deaccession; and select an appropriate method(s) of disposal, such as transfer, repatriation, donation, or destruction, usually through an established priority order. The collection owner, working with repository personnel, then executes the method of deaccessioning the objects, which removes all related ownership responsibilities for long-term care. Careful documentation of the disposition process is an essential component of this stage.

While disposition of human remains and other cultural materials occurs under the Native American Graves Protection and Repatriation Act (NAGPRA), as appropriate, deaccessioning is generally not an accepted management tool for archaeological collections because many believe that it violates the stewardship ethic of archaeology and may undermine future research opportunities (Childs 1999; Kersel 2015; Sonderman 1996). New sections of 36 CFR 79, *Curation of Federally-Owned and Administered Archaeological Collections,* were proposed in 2014 to regulate the disposition and deaccession of specific federal material remains. Once public comments are considered and the final regulations published, deaccessioning may become another tool in the management of federal collections.

In the end, archaeologists should reflect on how well their previous projects followed the Cycle and determine any necessary improvements before undertaking new ones. Careful consideration should be given to engaging the various stakeholders that participate in different, but often overlapping stages of collections management in the archaeological process. If widely adopted by all stakeholders involved, the checklist will aid in developing a more sustainable archaeological practice for newly generated collections and, perhaps, help some existing collections continue productively on the Cycle.

RECOMMENDED ACTIONS

In addition to the understanding and implementing the Cycle, accompanying checklist, and improved practices by stakeholders, we propose additional short-term and long-term actions to further the efforts toward more sustainable collections management.

Professional Standards on Collection Recovery in the Field

Decisions involving no-collection projects, sampling, in-field analysis, and object reburial have a serious impact on the availability of robust, systematic field collections for future research, education, interpretation, and uses by descendant communities. The legal and ethical ramifications of no-collection policies and related strategies have been questioned for some time (Beck and Jones 1994; Butler 1979; Griset and Kodack 1999; Heilen and Altschul 2013), while others (King 2008) call for a critical analysis of collecting practices. Currently, there are no professional standards to assist archaeologists in making appropriate decisions regarding these strategies.

A recent study by Heilen and Altschul (2013) examined the accuracy of in-field analysis of two surface-collected sites in New Mexico and Arizona. The results were alarming. In-field analysis had very low accuracy from a statistical perspective and was deemed "inadequate for site interpretation" (Heilen and Altchul 2013:130). Beck and Jones conducted a similar experiment in Nevada and concluded that "on-site analyses do not come without a cost to the archaeological record" and that "some degree of disturbance will occur even when measures are taken to prevent it" (Beck and Jones 1994:314). The study illustrated that "the claim cannot be made that a no-collection strategy preserves the integrity of the record" (Beck and Jones 1994:314). Results are often not replicable, which undermines the scientific process of archaeology, even when exercising detailed procedures for in-field analysis. Government agencies and project archaeologists employing these strategies during fieldwork should exercise caution. If used, the artifact analysis should be well documented in the project report and curated with the associated project records.

Therefore, we advocate for a concerted effort by archaeologists in all sectors, tribal and other descendant communities, and professional societies and associations working together to develop standards and guidelines regarding the ethics and practice of no-collection, in-field analysis, and collection reburial.

Training

Problems associated with the curation crisis often relate to the general lack of formal collections management and curation training for professional archaeologists. Relatively few graduate programs offer specific courses on curation methods and best practices to address the crisis, but this is changing. Some courses are designed to teach students about curation methods and offer training in the practical application thereof (Jenks 2014). Many existing curatorial courses use object-based teaching methods (Chatterjee et al. 2016), whereby archaeological collections are

FIGURE 3. Undergraduate students at the University of Wisconsin are trained in a hands-on archaeological curation methods course. They learn the theoretical principles and practical applications involved in caring for and managing archaeological collections.

used to illustrate theoretical concepts relating to the care and management of material culture (Figure 3). Others use objects in undergraduate courses to explore past cultures (Jamieson 2015). We propose that the Cycle and accompanying checklist can be used to frame a stand-alone academic course. They can also be used in training for government cultural resource managers and contracting officers so that the responsibilities and short- and long-term costs of archaeological collections management are better understood and become part of agency financial planning.

Retirements in CRM and Academia

An often overlooked aspect of long-term curation is the retirement of CRM company principal investigators and faculty in academia. What happens to all the objects, records, and data an archaeologist generates in his or her career? Quite frequently, collections and records are abandoned with no funding to care for them. Or, the individual may take their records with them upon retirement to store in their attic or garage or transfer them

to another employee or former graduate student. This can be mitigated in the short term if CRM firms and anthropology departments develop written curation procedures for retiring professionals to follow prior to departure (Knoll et al. 2016; Sullivan and Childs 2003:99). The Council for the Preservation of Anthropological Records developed a series of useful bulletins that provide guidance for ensuring that associated documentation is safeguarded and accessible long-term (http://copar.org/bulletins.htm). Adopting these recommendations will help to ensure that important data, including the physical artifacts, are preserved for future uses.

CRM Company Closures and Mergers

A reality of the CRM industry is that companies may close or be bought out or merge with other companies. Archaeological collections may become abandoned or discarded in this process, particularly those that did not pass through the fieldwork to curation acceptance stages. This problem can be eased in the short term if CRM companies follow the Cycle proposed in this article for each project in the company portfolio and track where it is located in the Cycle. Planning to complete Stages 1–5 can then be integrated with the planning for an impending merger or closure. Also, care should be taken in Stage 1 of the Cycle to ensure that each project has a collection strategy and was appropriately budgeted and funded to accomplish Stages 2–5.

Structural Funding for Collections

Managing collections long term is detailed, costly work and funding is limited for the complete Cycle. Essential to a sustainable process is that the project proponents and archaeologists responsible for a new project recognize their legal and ethical responsibilities for a recovered collection and appropriately budget for it. All stakeholders should collaborate over the long term on ways to stretch existing resources and to establish other funding streams, such as

- When possible, repositories should deposit collected curation fees into an interest-bearing trust or endowment and use the interest accrued to benefit the collections (Childs et al. 2010). Repositories should consider assessing fees for access and use of collections, when appropriate. Notably, it is less expensive to analyze an existing collection than to excavate a new site for a dissertation project. Repository personnel might also consider fundraising campaigns for significant existing project collections as an effective way to cover costs.
- Federal agencies operating in compliance with the National Historic Preservation Act should consider alternative mitigation for some projects that involves completing some of the missed collection management stages for existing collections rather than excavating new sites. Collections consolidation into regional repositories can increase efficiency of collection management practices, reduce costs, and facilitate research access.
- Archaeologists should collaborate within their professional societies to launch a consolidated lobbying effort geared toward major granting institutions, like NSF, NEH, and Wenner-Gren Foundation, for more support to care for and enhance collections.
- Professional societies and associations should proactively educate state and federal legislators, as well as university administrators, about the benefits of archaeological collections to science and society to garner new support for collections preservation.

Professional Association of Archaeological Repositories

We argue in this article for communication among the various stakeholders to improve archaeological collections management throughout the Cycle. A missing component of this interaction is a professional group that gives voice to and unites the archaeological repositories across the United States (Childs 2006, 2011). If such a group is established in the medium-long term, some key issues that could be addressed are

- Consistent standards for the Curation Preparation stage of the Cycle. The CRM and agency communities are plagued by the need to more easily predict and budget for long-term curation at repositories. Currently, the requirements for how to catalog, label, and package objects and archives vary widely. While it may be difficult to establish national standards, progress could be made if the American Cultural Resources Association, the trade association for the CRM industry, had a counterpart to work with toward a common goal.
- Consideration of the time frame for managing archaeological collections "long-term" or "in perpetuity." Archaeological collections are growing in numbers at a rapid pace, and little is being done to control growth in ways that do not undermine our discipline's scientific principles and methods (Sullivan 1993). How long is "long-term?" Is this time frame a reasonable standard by which to preserve *all* archaeological collections when many are orphaned or deteriorate without Enhancement and the process is underfunded? What methods could be implemented to control the growth of collections that enhance research value, such as a complete inventory of collections curated by state, to yield better decision-making about new fieldwork (Sullivan 1993) or significance criteria to evaluate the long-term research value of collections (Jamieson 2015; Racine et al. 2009; Schacht 2011)? Archaeological repository personnel should work with the professional archaeological community, including government cultural resource managers, to begin to address these questions. Input from tribes, descendant communities, and the general public will be essential to positive outcomes.
- Repository accreditation. The American Alliance of Museums (AAM) has a highly regarded and rigorous process for accrediting museums in the United States, whereby museums receive professional validation of excellence. A similar program for archaeological repositories would raise their "professional credibility and visibility" (Childs 2006:208), while focusing on different accreditation criteria. In addition to the AAM model (AAM 2013, 2014), the Texas State repository accreditation program (Johnson 2003; Texas Historical Commission 2007) is a useful example to consider.

SUMMARY AND CONCLUSIONS

There is no shortage of challenges when considering a sustainable approach to archaeology and the management of new collections. The Cycle and accompanying checklist provide a

practical framework by which to ensure that collections are addressed throughout the entire process of an archaeological project. Working collaboratively, the many stakeholders can improve how collections are planned for, generated, analyzed, cataloged, and preserved. Furthermore, they can save money by identifying efficiencies within this process, especially if they effectively perform the tasks in the checklist and communicate with others who work in different parts of the Cycle. A cultural shift in the discipline is upon us. Gone are the days when collections can be recovered without forethought and the budget to manage them long term. A more sustainable archaeology is possible, but a multifaceted approach involving the many stakeholders through the Cycle is necessary to make that happen.

Data Availability Statement

Original data were not used in preparation for this article.

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NOTE

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