

Seeing the Forest for the Trees: A Spatial Database to Enhance Potential of Legacy Collections at the Washington State University Museum of Anthropology

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Abstract *In this article we describe recent work designed to build a synthetic research program through the creation of a geospatial database of archaeological collections curated at the Washington State University Museum of Anthropology. Over the past several years, faculty, staff, and students have been engaged with significant rehabilitation work on legacy collections. However, until recently, the Museum lacked a central database of site information, which hindered our capability to develop a regional understanding of holdings and therefore a synthetic program. As described here, our efforts resulted in the compilation of data encompassing materials from 1,635 archaeological sites, 1,073 of which contain artifact collections that are currently housed at the Museum. Our phased approach will allow for the building of this foundational spatial geodatabase, which we see as a dynamic and evolving resource that will grow and change in the future. Understanding the spatio-temporal distribution of these significant archaeological resources will enhance research, educational, and stewardship capabilities for decades to come, and will ultimately boost public understanding and appreciation for the discipline and the need for public support of museum and curation facilities in the state of Washington and beyond.*

Introduction

The authors of a recent *American Antiquity* article aptly entitled “The Future of American Archaeology: Engage the Voting Public or Kiss Your Research Goodbye!,” observed that “publicly funded and mandated archaeology in the United States has been attacked multiple times during the past several years” and that we must communicate our results with the public or risk losing support (Klein et al. 2018:1). Indeed,

The public benefits of archaeology depend in a very basic way on the success of archaeology as a research field. If archaeological research does not continue to produce improved understandings of the human past, or if archaeological research loses its scientific and scholarly credibility, the public’s attention to and interest in things archaeological will diminish. At worst, it can erode into an antiquarian interest in artifacts merely because they are old or into seeking occasional titillation from archaeological fantasies of the usual “lost tribes and sunken continents” sort (Wauchope 1962; also see Williams 1991). [Lipe 2002:20]

There is no question that the benefits of archaeology are not always clear to the public, at least partially because “the work is highly technical, and research results are generally published in books and articles written primarily for other archaeologists” (Lipe 2002:20). While challenging, archaeologists have an obligation to improve the public’s understanding of archaeology, to engage with Tribal communities and local stakeholders, and to make research results more accessible—not only to preserve the field but also because it is an ethical responsibility of the discipline (Merriman and Swain 1999; McManamon 2000; Lipe 2002; Little 2002; King 2009).

While public perceptions of archaeology often revolve around field discoveries, these issues are also important for museums and curation facilities. These institutions are often underfunded and understaffed, and the public often does not know about or understand the immense research potential that lies within a museum. As observed by Merriman and Swain (1999), failing to make use of the vast potential of archives and collections ignores the research goals of archaeology and undermines claims commonly made as to the intrinsic value of maintaining such collections, often at significant cost to the public. In the United States this situation is made more challenging by the fact that museums face a “curation crisis,” a situation that refers to the fact that there are far more archaeological collections that have been (and are currently being) generated (through contract and scholarly work) than there are resources to manage them (Childs 1995). Historically, it was common for most project resources to be spent on field excavation and analysis, while curation was an afterthought, with little to no funding set aside for the maintenance and continued use of legacy collections. It is thus quite common for modern academic museums to depend heavily upon agency agreements and institutional support to keep their doors open, and thus it is critical that museums maintain public support for critical federal and state funding. While staff are often too busy with grant writing and maintenance activities to move beyond baseline work, a variety of means have been suggested to alleviate this situation, and here we focus on the notion of synthesis as a guiding framework for growth at Washington State.

Synthetic research is considered one of the greatest challenges and opportunities in archaeology today and can be a benefit to public understanding and appreciation for the discipline while promoting and informing our understanding of the human past (Altschul et al. 2017). Museums and curation facilities have holdings that encompass numerous sites (sometimes spanning multiple regions) and are positioned (with the right funding and personnel) to promote synthetic activities and create and house substantial research databases. In this article, we describe efforts along these lines at the Washington State University (WSU) Museum of Anthropology (MoA), a primary repository for Pacific Northwest archaeological collections, predominantly from the Columbia Plateau, although with collections spanning to Utah. Specifically, we focus on one aspect of ongoing work: to enhance the Museum’s stewardship of archaeological collections through the development of a geospatial database of the Museum’s legacy collection holdings, which was mostly excavated by Washington State University faculty and students in the 1960s and 1970s (Figure 1). Understanding the spatial distribution of these significant archaeological collections will help us to improve our stewardship of these collections, research accessibility, learning opportunities, and collaboration with indigenous communities.



Figure 1. WSU field excavations at Wexpúsname (45GA61). (WSU Museum of Anthropology, Image 45GA61.12530 7-396)

Background

WSU MoA is an official repository for archaeological collections and associated archival materials that meets the curation standards published in title 36 CFR pt. 79 (see <https://www.nps.gov/archeology/tools/36cfr79.htm>) in compliance with federal and state mandates. Pacific Northwest collections are primarily from sites in the Columbia Plateau in eastern Washington State and include extensive holdings from prominent sites, such as Marmes Rockshelter (45FR50; Hicks 2004), Lind Coulee (45GR97; Irwin and Moody 1978), and Wexpúsname (45GA61; Leonhardy et al. 1971; Nakonechny 1998), as well as lesser-known sites that await full study and reporting. The MoA also houses collections from outside of Washington State, including a very large collection from Utah associated with the Cedar Mesa Archaeological Project (Lipe et al. 2018). In addition to the archaeological collections, the MoA houses ethnographic collections of objects, dating to the period following contact between Euroamericans and Native communities from the Inland Northwest and elsewhere.

The MoA engages in a broad mission of promoting understanding of human cultures through research, education, and stewardship of substantial archaeological and ethnographic materials from the northwest. Staff are engaged in activities related to this mission, including collection maintenance and rehabilitation, teaching and outreach, and making the collections available for research and other creative activities. For example, the MoA provides internship opportunities for WSU undergraduate students, maintains a learning collection of unprovenienced materials for classroom use, and frequently hosts school groups from elementary to high school with staff providing talks and demonstrations that draw on material curated at the Museum. Whenever possible, the staff collaborates with local Native communities in research planning and public outreach activities. Full engagement in these endeavors is a

challenge and the two permanent Museum staff members—including the full-time Director and Assistant Professor (Shannon Tushingham) and one half-time Repository Manager (Diane Curewitz)—depend upon assistance from graduate students, interns, and staff, who are funded through “soft money” agreements and grants.

In addition to its laboratories and other curation facilities, the MoA also manages the Northwest Reading Room, which houses a large collection of books, articles, journals, reports, other media, grey literature, and unpublished materials related to the anthropology of the Pacific Northwest. Notably, many of these documents were authored by WSU students and faculty and represent decades of research and cultural resource management activities, including the *WSU Laboratory of Anthropology, Reports of Investigation* series; the *Washington Archaeological Research Center* reports; *WSU Laboratory of Archaeology and History, Project Reports*; the *Center for Northwest Anthropology, Project* reports; and the *Contributions to Cultural Resource Management* series.

Over the past several years, the MoA has invested a significant amount of energy into these resources to reinvigorate and expand the MoA to be a modern research center, including updating museum collections management practices and facilities with the goal of improving research, education, and collections stewardship activities related to our mission. However, several challenges first needed to be addressed. A primary need was to complete rehabilitation of numerous legacy collections (e.g., stabilization and repackaging objects into plastic bags to meet archival standards, scanning archival materials, and the creation of digital collections databases). This goal has largely been met: as of this writing most of the Museum collections have been rehabilitated thanks to funding provided over the past four years primarily from the Walla Walla District of the U.S. Army Corps of Engineers (WWACE) and the Washington State Department of Transportation (WSDOT).

Numerous recent research projects have made use of these collections. For example, a survey of the Museum holdings generated materials for studies on smoking pipes in the Pacific Northwest. Analyzed for ancient residues, these objects provided exciting insights into the antiquity of tobacco cultivation and use in the Columbia Plateau region (Damitio 2018; Tushingham et al. 2018). These studies not only speak to the history of sacred tobacco use but also informs programs designed to combat persistent tobacco use rates among modern Tribal communities (Snyder 2016; Tushingham et al. 2018). Other recent regional-scale work includes an analysis of Late Prehistoric lithics and pre-contact social interactions in the southern Columbia Plateau (Harris 2018), and an investigation of the historical distribution of salmonid populations based on innovations in ancient DNA analysis of salmon bone from pre-contact archaeological sites (Johnson and Kemp 2017; Johnson, Kemp, and Thorgaard 2018). The Museum also enables researchers to revisit legacy collections using modern analytical techniques and theoretical perspectives, e.g., Wexpúsnime (Nakonechny 1998), Rock Creek Shelter (Frierson 2018), and the Turkey Pen site of Cedar Mesa (Matson 2014, 2018; Lipe et al. 2018). R. G. Matson and colleagues excavated a midden at the Turkey Pen site, Cedar Mesa, Utah in 1972 (Matson 2014, 2018), which has prompted many important research contributions over the past 40 years (Lipe et al. 2018). For example, flotation analyses of midden samples and macrofloral and pollen analyses of human coprolites from the midden established that late Basketmaker II groups had a primary dependence on maize farming (Aasen

1984; Lepofsky 1986; Matson 1991). The earliest examples of the distinctive Southwestern variety of domestic turkey were found at the site (Nott 2010; Speller et al. 2010; Kemp and Lipe 2014; Lipe et al. 2016). Isotopic analysis of individual human hairs document variation in maize intake by individuals during the year (Cooper et al. 2016). Swarts and colleagues (2017) identified evidence of selection for early adaptations to temperate zone growing conditions by genomic analysis of Basketmaker II maize. The earliest example of a tattooing implement from western North America was discovered at the site (Gillreath-Brown et al. 2018). Battillo (2018) found that maize fungus was a potentially important contributor to Basketmaker II diet and nutrition. In addition to these recent examples, there have been numerous earlier works, including peer-reviewed scholarly papers, Ph.D. dissertations, and Master's theses, as well as countless paper and poster presentations, that have been based on collections currently or formerly housed at the WSU MoA. For example, see the WSU Department of Anthropology's list of dissertations and theses here: <https://anthro.wsu.edu/publications-and-research-resources/theses-and-dissertations/>.

Undergraduates students have also always been involved with museum collections, and they currently work with varied archaeological and ethnographic materials through internships and special topics courses (Figure 2). A recent example includes *Fish, Water, and People in the Northwest: Implementing Collaborative Community-Based Research at the Museum of Anthropology*, an innovative collaborative research project involving joint mentorship by a WSU faculty mentor (Tushingham) and a Tribal mentor (Josiah Pinkham, Nez Perce Tribe) with undergraduates from various disciplines who developed a series of creative displays at the MoA communicating themes outlined through community-based interviews, which were designed to increase awareness of cultural history, local Native American communities, and environmental issues (Tushingham and Pinkham 2015).



Figure 2. Museum staff and undergraduate interns working on collections rehabilitation and education project at the WSU MoA, Spring, 2014.

Geospatial Database Development

With the work of rehabilitating the physical collections and their associated standalone databases largely complete, we tackled another major challenge: the MoA, until recently, lacked a central database with site summary information. This information was somewhat atomized in various inventories and not centralized, which hindered our capability to develop a regional, synthetic program. We present the results of this effort to summarize and pull critical information together in a spatial geodatabase, including baseline data from every site from which the MoA has material.

Presently, we have focused on plotting the location of WSU collections sites in the Pacific Northwest as Phase 1 in our project to understand any overarching spatial patterns of our holdings particularly as they relate to the geography of the Columbia Plateau (Table 1). In addition to site locations and other basic data, our intent is to continue to develop the database to include other important variables (e.g., site age, site type, and the presence or absence of key artifact and feature classes like salmon bone, groundstone, obsidian, houses, and storage features). Compilation of such data is an essential step in addressing critical research questions and synthetic needs faced by regional scholars. Indeed, the Columbia Plateau—where the majority of MoA materials originate—is a particularly rich area archaeologically with great potential for understanding significant issues of global importance (hunter-gatherer subsistence intensification, the evolution of sedentism and storage, indigenous management of plants and fish, among many other topics), but much of this potential remains largely unrealized (Prentiss et al. 2005:48; Ames 2009; Collins and Tushingham 2014).

Table 1. Current and Future Development of WSU MoA Geospatial Database

Phase 1*	Phase 2	Phase 3
Site number(s)	Archaeology survey phase	Storage features
Site name(s)	Radiocarbon data	Faunal data
Coordinates	General artifact categories	Artifact types
Agency	Refined site coordinates	Artifact material
Artifacts (yes/no)	House pits	Additional feature types
Records (yes/no)	---	---
*Phase 1 of the project has been completed at the time of publication for the Pacific Northwest sites		

Methods

Over recent decades, archaeological research has increasingly integrated geographic information systems (GIS) in a variety of ways (Lock 2000; Conolly and Lake 2006; Bevan and Lake 2013). The applicability of GIS ranges from site-level plotting to the analysis of the distribution of sites throughout a region. Given that the use of GIS has become the norm in archaeological research, the lack of basic geographic information on sites in the MoA collections has been a major lacuna.

We created a database for the MoA sites, which was derived from a thorough review of existing inventories of the Museum's artifact and document storage facilities. The sites were double-checked to ensure that site data was not duplicated and that each site was linked to basic data including associated agency and project (where applicable). The most significant single source of data was provided by the WWACE, the agency whose collections make up the largest proportion of Plateau sites held by the Museum. The WWACE maintains a geodatabase of their own that includes site data and site spatial information in the form of polygons representing site footprints. The WWACE data accounts for approximately twenty-three percent of the sites in the MoA collections. We gathered the remaining spatial data using site forms and survey reports accessed through the MoA's archives and the Washington Information System for Architectural and Archaeological Records Data (WISAARD) maintained by the Washington State Department of Archaeology and Historic Preservation (DAHP) (<https://dahp.wa.gov/historic-preservation/find-a-historic-place>).

The data from non-WWACE sources were mostly in the form of point locations in Universal Transverse Mercator or latitude–longitude coordinates and Public Land Survey System (PLSS) descriptions. Sites with locational data solely in the form of PLSS descriptions were converted to a single point (in decimal degrees) using the “TRS-data” online tool that outputs the centroid of a given description down to the section, i.e., a square mile (Environmental Statistics Group 2003). The point data derived from site forms and other reports are more general than the WWACE polygonal data. Rather than undertake the laborious process of defining site footprints for several hundred sites not included in the WWACE database, the WWACE data were converted to points using the “Feature to Point” tool included in Esri ArcGIS 10.5.

These simple data are now maintained in a Microsoft Access database, which is used to update the Esri shapefile through the use of a model—a sequence of processing tools saved in a workflow that can be activated as a single process. In this case, the model is simple and consists of a sequence of two tools, where the first interprets the data in the x- and y-coordinate fields as latitudes and longitudes and the second outputs the resulting layer of points as an Esri feature class within a geodatabase maintaining the rest of the information from the working Access database (Figure 3).

Microsoft Access provides a relatively user-friendly platform for the maintenance of a dynamic database such as the one discussed here, while an Esri geodatabase is suited for the mapping and analysis of spatial data. The workflow described above allows us to use the latter functionality without sacrificing the former.

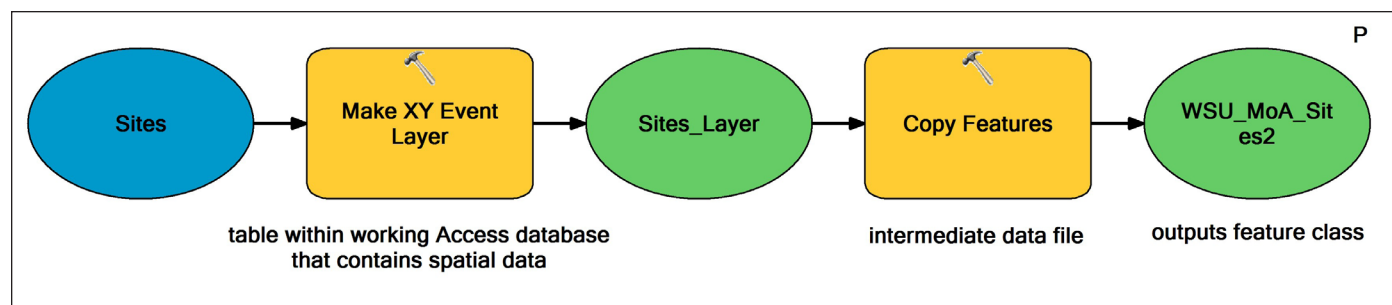


Figure 3. Esri ArcGIS model used to extract site data from Microsoft Access and output it as a feature class.

Results

The WSU MoA holds materials from 1,635 archaeological sites. One thousand seventy-three of the sites yielded artifact collections, which are currently curated at the MoA. Reflecting on the history of archaeology at WSU as a center for scholarship on the Columbia Plateau, most of the sites in the WSU MoA collections are located along the rivers of the Columbia system, in particular the Lower Snake and Lower Columbia Rivers. This is illustrated in Figure 4, which shows a distribution of sites throughout the state of Washington. Hundreds of sites are represented on this map, which mostly excludes sites in Oregon and entirely excludes sites in Utah associated with the Cedar Mesa Project. Additionally, we have not fully counted or produced coordinates for all of the BLM and Cedar Mesa sites but intend to do so in the future. Table 2 shows a minimum number of sites for Cedar Mesa and the BLM; however, the number of sites is likely to be over a thousand. The density of sites is so high in some locations that many of the points are overlapping (Figure 4). For example, the visual overlapping of sites occurs along the Lower Snake, around the confluence of the Snake and the Columbia, and along the Upper Columbia in northeast Washington. While presented at a coarse scale here, these point data are, in certain areas, abundant enough to enable spatial analysis at multiple scales: local, sub-regional, and regional, such as a recent study on the change in the distribution of sites during the Archaic in Middle Tennessee (Gillreath-Brown and Deter-Wolf 2019).

Figure 5 summarizes these data (using Leaflet), displaying the centroids of several spatial groupings of sites along with the number of sites in each group. Leaflet, a mobile-friendly interactive mapping software, would allow for the Museum to expose the distribution of sites to researchers or public without showing the exact site locations, allowing for protection of the sites. The five groupings in southeast Washington include 483 sites, approximately 30% of the MoA sites. WSU archaeologists were intensively focused on excavating sites surrounding dam constructions along the Columbia River system during the middle of the twentieth century (e.g., major development and water reclamation projects include Ice Harbor, Lake Roosevelt, Little Goose, Lower Monumental, McNary, O'Sullivan, and numerous surveys summarized at the MoA's website [<http://www.archaeology.wsu.edu>]).

Building the database also allowed us to better quantify our agency holdings and connections. Most of the collections managed by the MoA are owned by federal

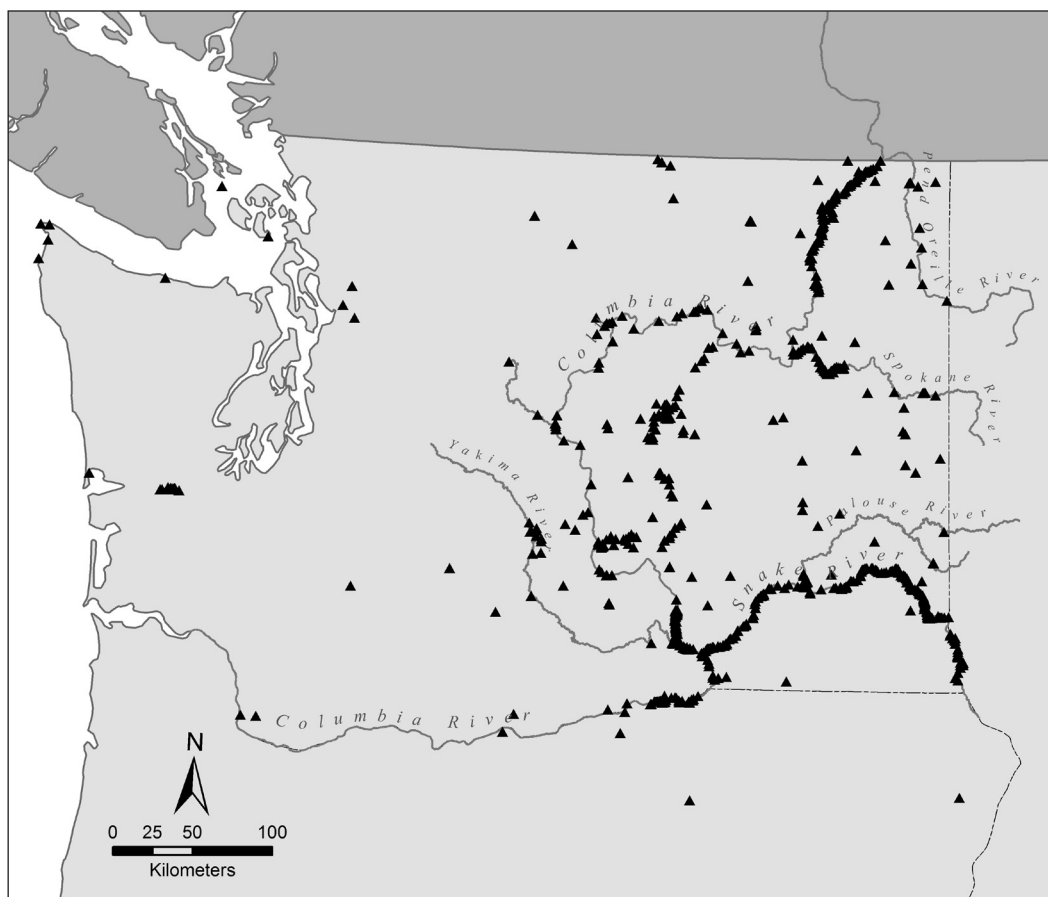


Figure 4. This map shows the distribution of archaeological sites with records or artifact collections in and around the state of Washington. Stream data from the U.S. Geological Survey National Hydrography Dataset.

Table 2. Five Largest Owners with Artifacts and Materials in the WSU MoA

Agency	Number of Sites
Bureau of Land Management, Utah	807*
Army Corps of Engineers, Walla Walla District	374
Bureau of Reclamation, Pacific Northwest Region	124
WSU Department of Anthropology	91
Bureau of Land Management, Oregon-Washington	88
*This is a minimum number of sites for BLM land in Utah, which is a product of several projects including the Cedar Mesa Project. We will be working towards finishing Phase 1 on the Utah sites in the future.	

and state agencies (Table 2) with the Utah Bureau of Land Management owning the largest single portion of the holdings. However, other holdings are significant and the MoA manages collections on behalf of the WWACE (the largest owner of Northwest Plateau sites), the Bureau of Reclamation, the U.S. Forest Service, the Washington State Department of Transportation, and others. This is in addition to materials from nearly a hundred sites that were generated as part of WSU-sponsored projects or that are “orphaned” from their owners in one way or another.

Conclusions and Future Directions

We have developed and presented in this article a framework that brings together geographic locations with other fundamental data on all of the sites curated at the MoA, although with the main focus being on the Pacific Northwest sites. This framework, along with future additions in Phase 2 and 3 (Table 1), will facilitate research, give us a better understanding of MoA holdings on a regional scale, and enhance the long-term stewardship of these collections. For example, a researcher will be able to better target site materials for their research question or search for similar sites for an inter-site analysis. We can now better share the sites and materials with local Native communities, allowing to better target materials or

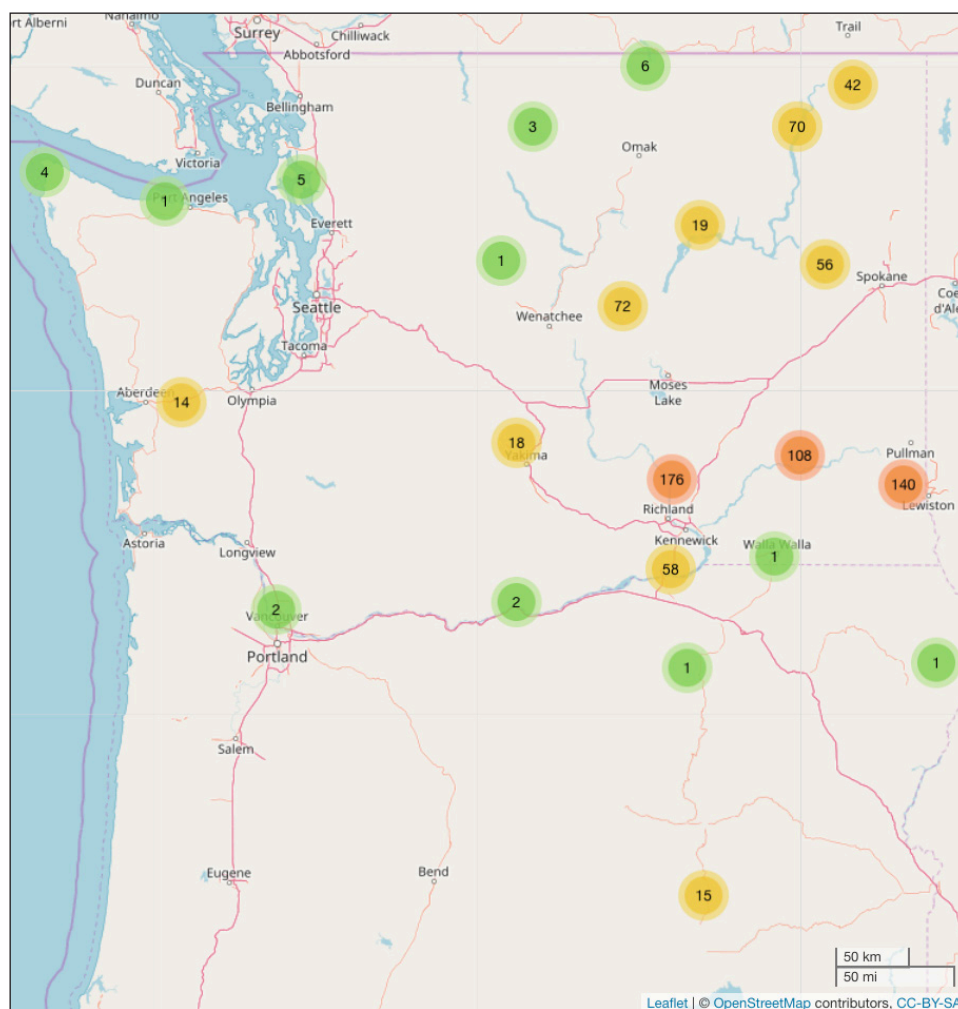


Figure 5. This map shows the centroids of several spatial groupings of sites with records or collections at the WSU MoA. The number in the center of each dot represents the number of sites within that group. Map produced under Attribution-ShareAlike 2.0 Generic (CC BY-SA 2.0). (<https://creativecommons.org/licenses/by-sa/2.0/>), which was altered by putting the site groupings. © OpenStreetMap contributors.

sites that they may be interested in. The geospatial database greatly enhances the ability to study inter- and intra-site spatial patterns at a range of scales. Figures 4 and 5 illustrate the breadth and depth of the WSU MoA's stewardship of the cultural heritage of the Columbia Plateau. The GIS database presented here is a starting point and its construction will continue with the assistance of students and MoA staff, which will provide a critical basis for future research. The overall intent is that this project will grow over time and be a long-term resource for future scholars.

Future additions to the WSU MoA sites database will include further details regarding each site, such as adding a temporal dimension and the size and scope of the associated collections (Table 1). The collections curated at the MoA represent thousands of years of history in the Pacific Northwest, both before and following the arrival of Euroamericans. Distilling previous research on these sites to broad periods and more precise radiocarbon dates where they exist would be another invaluable element in aid of a regionally-based research program. More qualitative information like site type and size are likely future additions to the database discussed in this article.

This database and its future expansions can then be paired with other kinds of geospatial datasets that might include a socio-political history of the Northwest (including boundaries of tribal ancestral land and contemporary reservations), locations of stone raw material quarries, major waterways, watersheds, human management and plant cultivation areas, and paleo-environmental histories relevant to indigenous resources. Much of these data are available from government or other sources, therefore a major goal of this work is to enable researchers at the MoA and elsewhere to integrate museum site data with other kinds of data relevant to a given study or research program. We hope to use this resource by relating MoA holdings to collections housed elsewhere and environmental and landscape-scale data.

As we develop and encourage use and research of MoA collections, it is critical that a formal research protocol is in place that is developed with local Tribal communities and collections owners. The MoA is committed to ethical use of collections, transparency of all activities, and collaboration with Tribal communities. We require all researchers, including WSU faculty and students, to complete research requests in coordination with Museum staff, collections-owning agencies, and Tribal communities as appropriate. We are actively pursuing innovative means of improved stewardship of cultural materials, embedding best practices in our work flow, and encouraging research collaborations with indigenous communities from project inception. Indeed, some of the best and most interesting research develops through such partnerships, and we encourage researchers to consider early on how their work may be communicated with the public and how it may benefit and/or involve Tribes.

The WSU MoA is one of many curation facilities and research institutes throughout the world that oversee numerous archaeological collections with limited support. Often—and certainly in our case—archaeological collections include the materials and written results of many disparate projects that have unique histories and idiosyncrasies, with varied project investigators, inventory structures, project goals, theoretical and methodological approaches, and contexts (field schools, salvage/cultural resource management-driven projects, thesis and Ph.D. projects, inadvertent discoveries, etc.). It is possible, however, to “see the forest for the trees,” by focusing our lens on the macro spatial and temporal patterning of many seemingly disparate data that derive from a constellation of projects, implement-

ed over many decades. In our view, developing a spatial database is an essential step toward synthesis, collaboration, and the development of broader, long-term impacts to enhance both the MoA's stewardship of its collections and the potential for the wealth of materials and records at the MoA to be used in research projects. As these efforts move forward, an integrative research program on the archaeology of the Columbia Plateau region will be developed around this framework at the WSU MoA. Indeed, we see this foundational spatial geodatabase as a dynamic and evolving resource that will grow and change in the future—and our intent is that it will provide an essential tool that will facilitate greater research, stewardship, and learning opportunities on the archaeology of the Northwest for decades to come.

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REFERENCES CITED

- Aasen, Diane K.
1984 *Pollen, Macrofossil and Charcoal Analysis of Basketmaker Coprolites from Turkey Pen Ruin, Cedar Mesa, Utah*. Unpublished Master's thesis, Department of Anthropology, Washington State University, Pullman.
- Altschul, Jeffrey H., Keith W. Kintigh, Terry H. Klein, William H. Doelle, Kelley A. Hays-Gilpin, Sarah A. Herr, Timothy A. Kohler, Barbara J. Mills, Lindsay M. Montgomery, Margaret C. Nelson, Scott G. Ortman, John N. Parker, Matthew A. Peeples, and Jeremy A. Sabloff
2017 Fostering Synthesis in Archaeology to Advance Science and Benefit Society. *Proceedings of the National Academy of Sciences*, 114(42):10999–11002.
- Ames, Kenneth
2009 *Coprolites, Shell Middens and Villages: An Idiosyncratic Look at the Current State of Northwest Archaeology*. Keynote address given at the 62nd Northwest Anthropological Conference, Newport, Oregon.

Battillo, Jenna

- 2018 The Role of Corn Fungus in Basketmaker II Diet: A Paleonutrition Perspective on Early Corn Farming Adaptations. *Journal of Archaeological Science: Reports*, 21:64–70.

Bevan, Andrew, and Mark Lake

- 2013 Introduction. In *Computational Approaches to Archaeological Spaces*, edited by A. Bevan and M. Lake, pp. 17–26. Walnut Creek, CA: Left Coast Press.

Childs, S. Terry

- 1995 The Curation Crisis. *Federal Archaeology*, 7(4):11–15.

Collins, Mary, and Shannon Tushingham

- 2014 Exploring the Future of Archaeology on the Plateau: The 2014 Washington State University Museum of Anthropology Plateau Conference. *SAA Archaeological Record*, 14(5):26–31.

Conolly, James, and Mark Lake

- 2006 *Geographical Information Systems in Archaeology*. Cambridge, U.K.: Cambridge University Press.

Cooper, Catherine, Karen Lupo, R. G. Matson, William Lipe, Colin I. Smith, and Michael P. Richards

- 2016 Short-Term Variability of Human Diet at Basketmaker II Turkey Pen Ruins, Utah: Insights from Bulk and Single Amino Acid Isotope Analysis of Hair. *Journal of Archaeological Science: Reports*, 5:10–18.

Damitio, William J.

- 2018 *Pipes and Smoking in the Precontact Pacific Northwest Societies*. Master's thesis. Department of Anthropology, Washington State University, Pullman.

Environmental Statistics Group of the University of Montana

- 2003 TRS-data. Web program, <http://www.esg.montana.edu/gl/trs-data.html>, accessed June 25, 2018.

Frierson, Andrew G.

- 2018 *Occupational History and Land Use at Rock Creek Shelter (35LK22), Southeastern Oregon*. Master's thesis. Department of Anthropology, Washington State University, Pullman.

Gillreath-Brown, Andrew, Aaron Deter-Wolf, Karen R. Adams, Valerie Lynch-Holm, Samantha Fulgham, Shannon Tushingham, William D. Lipe, and R. G. Matson

- 2018 *Redefining the Age of Tattooing in Western North America: A 2,000-year-old Artifact from Utah*. Manuscript submitted. Available from andrew.d.brown@wsu.edu.

Gillreath-Brown, Andrew, and Aaron Deter-Wolf

- 2019 Modeling Archaic Settlement Patterns and Ecology in the Middle Cumberland River Valley of Tennessee. In *The Cumberland River Archaic of Middle Tennessee*, edited by Tanya M. Peres and Aaron Deter-Wolf. Gainesville: University of Florida Press. In press.

Harris, Kathryn A.

- 2018 *Lithics and the Late Prehistoric: Interaction on the Columbia Plateau*. Ph.D. dissertation. Department of Anthropology, Washington State University, Pullman.

Hicks, Brent A., editor

- 2004 *Marmes Rockshelter: A Final Report on 11,000 Years of Cultural Use*. Washington State University Press, Pullman.

Irwin, Ann M., and Ula Moody

- 1978 *The Lind Coulee Site (45GR97)*. Project Report, No. 56. Pullman: Washington Archaeological Research Center, Washington State University.

Johnson, B. M., and Kemp, B. M.

- 2017 Rescue PCR: Reagent-rich PCR Recipe Improves Amplification of Degraded DNA Extracts. *Journal of Archaeological Science: Reports*, 11:683–694.

Johnson, B. M., Kemp, B. M., and Thorgaard, G. H.

- 2018 Increased Mitochondrial DNA Diversity in Ancient Columbia River Basin Chinook Salmon *Oncorhynchus tshawytscha*. *PLoS One*, 13(1):e0190059.

Kemp, Brian M., and William D. Lipe

- 2014 Ancient Turkeys. In *Tortuous and Fantastic: Cultural and Natural Wonders of Greater Cedar Mesa*. *Archaeology Southwest Magazine*, 28 (3–4), edited by William D. Lipe, p. 30.

King, Julia A.

- 2009 The Challenges of Dissemination: Accessing Archaeological Data and Interpretations. In *Archaeology and Cultural Resource Management: Visions for the Future*, edited by Lynne Sebastian and William D. Lipe, pp. 141–167. Santa Fe, NM: SAR Press.

Klein, T. H., Goldstein, L., Gangloff, D., Lees, W. B., Ryzewski, K., Styles, B. W., and Wright, A. P.

- 2018 The Future of American Archaeology: Engage the Voting Public or Kiss Your Research Goodbye! *Advances in Archaeological Practice*, 6(1):1–18.

Leonhardy, Frank, Gerald Schroedl, Judith Bense, and Seth Beckerman

- 1971 *Wexpúsnime (45GA61): Preliminary Report*. Report of Investigations, No. 49. Laboratory of Anthropology, Washington State University, Pullman.

Lepofsky, Dana

- 1986 *Preliminary Analysis of Flotation Samples from the Turkey Pen Ruin, Cedar Mesa, Utah*. Unpublished report on file at the Laboratory of Archaeology, University of British Columbia, Vancouver, Canada.

Lipe, W. D.

- 2002 Public Benefits of Archaeological Research. In *Public Benefits of Archaeology*, edited by B. J. Little, pp. 2–28. Gainesville: University of Florida Press.

Lipe, William D., R. Kyle Bocinsky, Brian S. Chisholm, Robin Lyle, David M. Dove, R. G. Matson, Elizabeth Jarvis, Kathleen Judd, and Brian M. Kemp

- 2016 Cultural and Genetic Contexts for Early Turkey Domestication in the Northern Southwest. *American Antiquity*, 81(1):97–113.

Lipe, William D., Andrew Gillreath-Brown, Nichole Fournier, and Shannon Tushingham

- 2018 *Supporting Scientific Studies of Archaeological Collections from Cedar Mesa Canyons. Bureau of Land Management Grant 1511 (UT-952)*, Washington State University, Pullman, WA. Available from lipe@wsu.edu.

Little, B. J., editor

- 2002 *Public Benefits of Archaeology*. Gainesville: University of Florida Press.

Lock, G., editor

- 2000 *Beyond the Map: Archaeology and Spatial Technologies*. Amsterdam, NL: IOS Press.

Matson, R. G.

- 1991 *The Origins of Southwestern Agriculture*. Tucson: University of Arizona Press.

- 2014 Cedar Mesa Basketmaker II: The Story Continues. In *Tortuous and Fantastic: Cultural and Natural Wonders of Greater Cedar Mesa*. *Archaeology Southwest Magazine*, 28 (3–4), edited by William D. Lipe, pp. 24–30.

- 2018 *Turkey Pen Excavation (revised)*. Unpublished report posted at the Washington State University Library Research Exchange. Available at <<http://hdl.handle.net/2376/5302>> (accessed 09-28-2018).

McManamon, F. P.

- 2000 Archaeological Messages and Messengers. *Public Archaeology*, 1(1):5–20.

Merriman, N., and H. Swain

- 1999 Archaeological Archives: Serving the Public Interest? *European Journal of Archaeology*, 2(2):249–267.

Nakonechny, Lyle Daniel

- 1998 *Archaeological Analysis of Area A, Wexpusnime Site (45GA61)*. Unpublished Master's thesis, Department of Anthropology, Washington State University, Pullman.

Nott, BreAnne

- 2010 *Documenting Domestication: Molecular and Palynological Analysis of Ancient Turkey Coprolites from the American Southwest*. Unpublished Master's thesis, School of Biological Sciences, Washington State University, Pullman.

Prentiss, William C., James C. Chatters, Michael Lenert, David S. Clarke, and Robert C. O'Boyle

- 2005 The Archaeology of the Plateau of Northwestern North America during the Late Prehistoric Period (3500–200 B.P.): Evolution of Hunting and Gathering Societies. *Journal of World Prehistory*, 19(1):47–118.

Snyder, Charles Melvin, Jr.

- 2016 *Culture, Health, and Hope: Exploring Historical Trauma, Syndemics, and the Application of Anthropology to Reducing Disparities in Native American Health*. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman.

Speller, Camilla F., Brian M. Kemp, Scott D. Wyatt, Cara Monroe, William D. Lipe, Ursula M. Arndt, and Dongya Y. Yang

- 2010 Ancient Mitochondrial DNA Analysis Reveals Complexity of Indigenous North American Turkey Domestication. *Proceedings of the National Academy of Sciences*, 107(7):2807–2812.

Swarts, Kelly, Rafal M. Gutaker, Bruce Benz, Michael Blake, Robert Bukowski, James Holland, Melissa Kruse-Peoples, Nicholas Lepak, Lynda Prim, M. Cinta Romay, Jeffrey Ross-Ibarra, Jose De Jesus Sanchez-Gonzalez, Chris Schmidt, Verena J. Schuenemann, Johannes Krause, R. G. Matson, Detlef Weigel, Edward S. Buckler, Hernán A. Burbano

- 2017 Genomic Estimation of Complex Traits Reveals Ancient Maize Adaptation to Temperate North America. *Science*, 357:512–515.

Tushingham, Shannon, and Josiah Pinkham

- 2015 *Fish, Water, and People in the Northwest: Implementing Collaborative Community-Based Research at the Museum of Anthropology*. Washington State University Undergraduate Innovators Initiative Grant. Final Report.

Tushingham, Shannon, Charles M. Snyder, Korey J. Brownstein, William J. Damitio, and David R. Gang

- 2018 Biomolecular Archaeology Reveals Ancient Origins of Indigenous Tobacco Smoking in North American Plateau. *Proceedings of the National Academy of Sciences*, in press.

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