Investigating the Role of Archaeological Information and Practice in Landscape Conservation Design and Planning in North America

Timothy M. Murtha, Nathan R. Lawres, Tara J. Mazurczyk, and Madeline Brown

ABSTRACT

The purpose of this article is to discuss the challenges and opportunities for integrating archaeological information in landscape-scale conservation design while aligning archaeological practice with design and planning focused on cultural resources. Targeting this opportunity begins with statewide archaeological databases. Here, we compare the structure and content of Pennsylvania's and Florida's statewide archaeological databases, identifying opportunities for leveraging these data in landscape conservation design and planning. The research discussed here was part of a broader project, which was working through the lens of Landscape Conservation Cooperatives in order to develop processes for integrating broadly conceived cultural resources with natural resources as part of multistate or regional landscape conservation design efforts. Landscape Conservation Cooperatives offer new ways to think about archaeological information in practice and potentially new ways for archaeology to contribute to design and planning. Statewide archaeological databases, in particular, offer transformative potential for integrating cultural resource priorities in landscape conservation design. Targeted coordination across state boundaries along with the development of accessible derivative databases are two priorities to advance their utility.

Keywords: landscape archaeology, landscape conservation design and planning, cultural resource management, preservation, GIS

El propósito de este documento es analizar los desafíos y las oportunidades para integrar la información arqueológica en el diseño de conservación a escala de paisaje, al mismo tiempo que se alinean las prácticas arqueológicas con el diseño y la planificación centrados en los recursos culturales. La orientación a esta oportunidad comienza con las bases de datos arqueológicas de todo el estado. Aquí, comparamos la estructura y el contenido de las bases de datos arqueológicos de todo el estado de Pensilvania y Florida que identifican oportunidades para aprovechar estos datos en el diseño y la planificación de la conservación del paisaje. La investigación discutida aquí fue parte de un proyecto más amplio, trabajando a través de las lentes de las Cooperativas de Conservación del Paisaje para desarrollar procesos para integrar recursos culturales concebidos de manera amplia con los recursos naturales como parte de los esfuerzos de diseño de conservación del paisaje en varios estados o regiones. Las cooperativas para la conservación del paisaje ofrecen nuevas formas de pensar acerca de la información arqueológica en la práctica y formas potencialmente nuevas para que la arqueología contribuya al diseño y la planificación. Las bases de datos arqueológicas de todo el estado en particular ofrecen un potencial transformador para integrar las prioridades de recursos culturales en el diseño de conservación del paisaje. La coordinación dirigida a través de las fronteras estatales junto con el desarrollo de bases de datos derivadas accesibles son dos prioridades para avanzar en su utilidad.

Palabras: clavearqueología del paisaje, diseño de conservación del paisaje, manejo de recursos culturales, preservación, SIG

The purpose of this articler is to discuss the challenges and opportunities for integrating archaeological information in landscape-scale conservation design research, as well as new opportunities for linking archaeological practice with comprehensive regional design and planning efforts beyond the role of scientific advisement or regulatory evaluation. The history of cultural resource management practice, combined with the intellectual history of landscape archaeology, offers transformative potential for the role of archaeologists in design and planning. To introduce these ideas, we first discuss our long-term research agenda, which was initiated after the establishment of 22 Landscape Conservation Cooperatives. For us, this experience clearly established archaeology's foundational role in contributing to these critical conservation efforts and for advancing cultural resource management and planning more broadly. Through the actual application of archaeological data in this broader context,

Advances in Archaeological Practice 7(4), 2019, pp. 382–394

DOI:10.1017/aap.2019.32

we identify methodological gaps and opportunities. Second, we critically evaluate two distinct statewide archaeological databases (Pennsylvania and Florida) to summarize some of the key hurdles and opportunities for these data to be integrated in the design process. Here, similar to recent efforts by the Society of American Archaeology Task Forces, we find that standardization will improve the effectiveness of these databases, but that this standardization process will require attention to the specific applications of these data. Our context is integrated conservation design, so we end by offering some ideas for new developments in this arena for archaeological practice.

BACKGROUND

Beginning in the early 2000s, the Department of the Interior created a cooperative conservation project with the vision of managing landscapes "capable of sustaining natural and cultural resources for current and future generations" (https://lccnetwork.org/about/about-lccs). This vision led to the creation of 22 Landscape Conservation Cooperatives (LCCs) that aim to develop best management practices, promote collaborative conservation, and identify gaps within scientific knowledge to promote innovative conservation planning and design in North America. The central goal was to advance landscape-scale conservation for both natural and cultural resources (see LCC 2018; NASEM 2016). The primary mission for each cooperative is to "develop and provide integrated science-based information about the implications of climate change and other stressors for the sustainability of natural and cultural resources" (https://lccnetwork.org/about/about-lccs). The cooperatives were each tasked with defining shared landscape conservation objectives for their region that would be derived from cultural and natural resource conservation priorities. This objective is reflected in a 2016 review of the LCCs by the National Academy of Sciences, in which they state the third science goal of all cooperatives: "Natural and cultural resources are conserved at large landscape and seascape scales, guided by the collaborative application of science, experience, and cultural or traditional ecological knowledge and the generation of new conservation knowledge" (NASEM 2016:4). The cooperatives were designed to uniquely address something no other federal program had—that is, attempting to bridge research and management for both cultural and natural resources (NASEM 2016:4).

Many of the cooperatives advanced their mission through developing spatially situated, landscape-scale conservation designs (LCDs). While there are standard methods and approaches for landscape-scale conservation designs involving natural resources (e.g., Trombulak and Baldwin 2010), no similar standards exist for integrating cultural resources into landscape designs. Moreover, in practice, cultural resources are more commonly overlaid after initial designs and analyses have been conducted in order to see where potential conflicts to the design may emerge. Building on the mandate of the cooperatives, our study argues that including cultural resources *after* initial phases of the planning process leads to an emphasis on the regulatory aspects of cultural resource management using existing databases rather than the generation of novel datasets, theoretical advancements, or new methodologies for cultural resources. This is a critical discrepancy given the fact that the cooperatives were tasked with integrating cultural resources as an integral component of conservation science—a task that is not accomplished through regulatory compliance alone.

The differences between practices for natural and cultural resource conservation planning are far-reaching. For example, in preparation for the Appalachian landscape design, natural resource stakeholders established shared habitat priorities and modeled indicator species through a series of iterative workshops. Similar efforts were not conducted for cultural resources. In addition, given the lack of available datasets for karst landscapes across the region, collaborative efforts were made to establish new datasets, while similar incomplete or missing datasets for cultural resources were not addressed. This gap was acknowledged in the 2016 report (NASEM 2016:21), which stated that although all the cooperatives had adequately focused on natural resources, their plans to address cultural resource conservation remained underdeveloped. If the cooperatives are the only federal program addressing both the natural and cultural aspects of landscape-scale conservation, the limitations of their efforts only serve to further highlight the gap between cultural and natural resource conservation science in North America as a whole. Our project is designed to fill those gaps.

Mandating the integration of cultural resources at the early stages of design and planning, the cooperatives initiated a new era in landscape design and planning. In practice, implementation of this mandate proved challenging, and subsequent efforts ended up heavily emphasizing natural resources. With the support of the National Park Service, the Appalachian Cooperative, and the Wildlife Management Institute, we designed a pilot study in January 2016 to develop processes for integrating cultural resource information in the initial stages of landscape conservation design, similar to the work accomplished for natural resources (see Baldwin et al. 2018; Leonard et al. 2017). Our pilot was initially limited to Pennsylvania in order to establish foundational data standards. We inventoried key cultural resource conservation themes, along with direct and indirect geospatial indicators of those themes (Brown and Murtha 2019; Goldberg et al. 2018; Mazurczyk et al. 2018; Murtha 2017). For example, direct indicators included statewide inventories of archaeological and historic sites, while indirect indicators linked land-use and land-cover data to document visual resources (Goldberg et al. 2018).

Broadly speaking, our long-term aims for this research are (1) to identify and describe conservation priorities related to cultural resources, (2) to evaluate data requirements and determine procedures for landscape-scale analysis, (3) to establish quantitative and qualitative measures for defining cultural resource conservation priorities, and (4) to investigate existing and potential land-use changes as well as coupled human and natural spatiotemporal dynamics for establishing cultural resource conservation principles.

For our first step, we assembled available data and developed a cultural resources conceptual framework that defines a series of procedural phases used to evaluate quantitative and qualitative aspects of cultural resources (Figures 1a and 1b). We developed this general framework following procedures similar to those used for natural resources (e.g., Trombulak and Baldwin 2010) and allied decision support systems models, such as the Intrinsic Landscape Aesthetic Resource Information System developed by Jones & Jones (Jones 2007). The Jones & Jones GIS-based decision support tool offers guidance for practitioners and landscape planners when evaluating the intrinsic value of natural resources of landscape regions for sustainable future design. Our theoretical

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

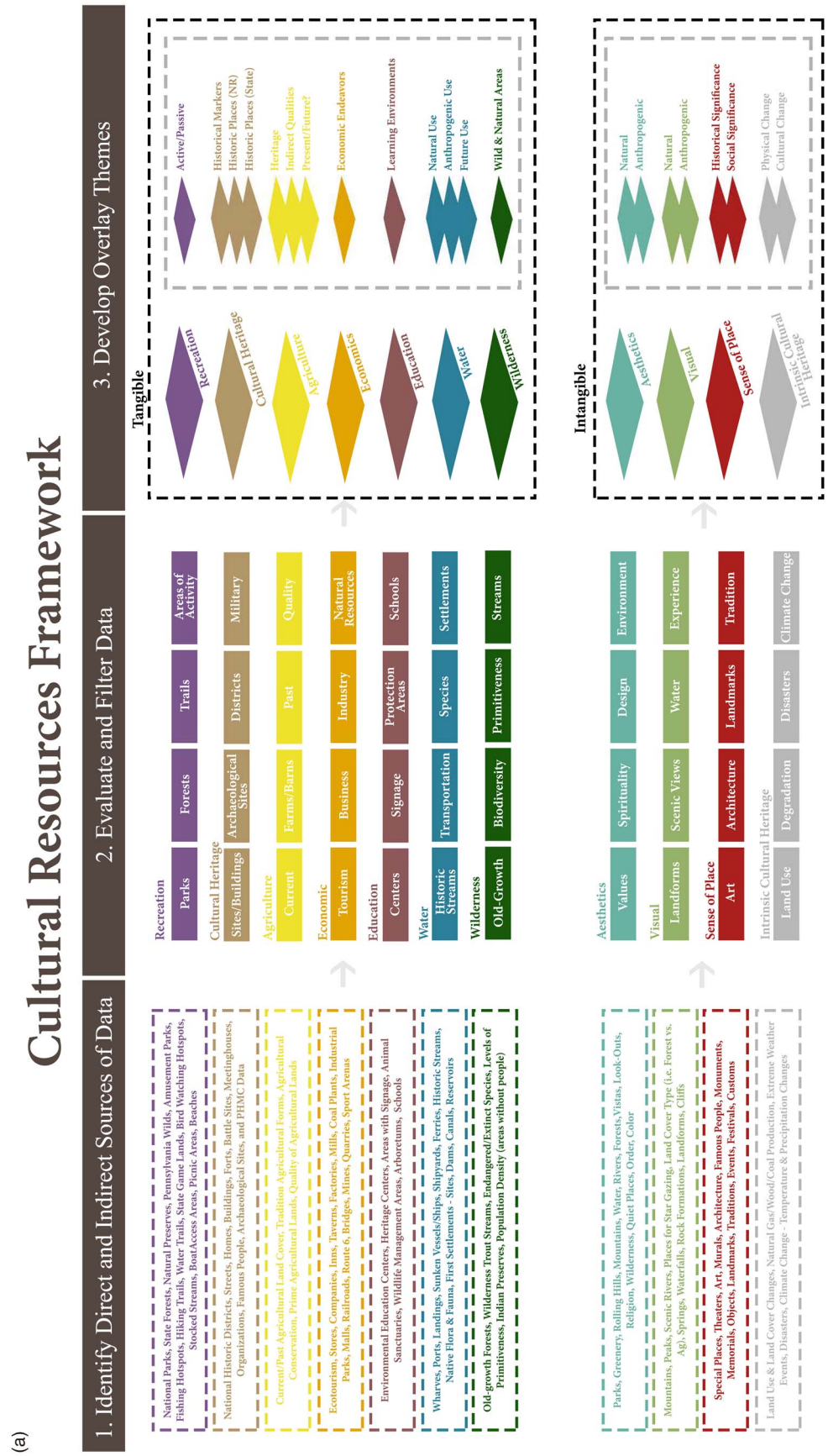

FIGURE 1. The conceptual model of cultural resource planning.

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

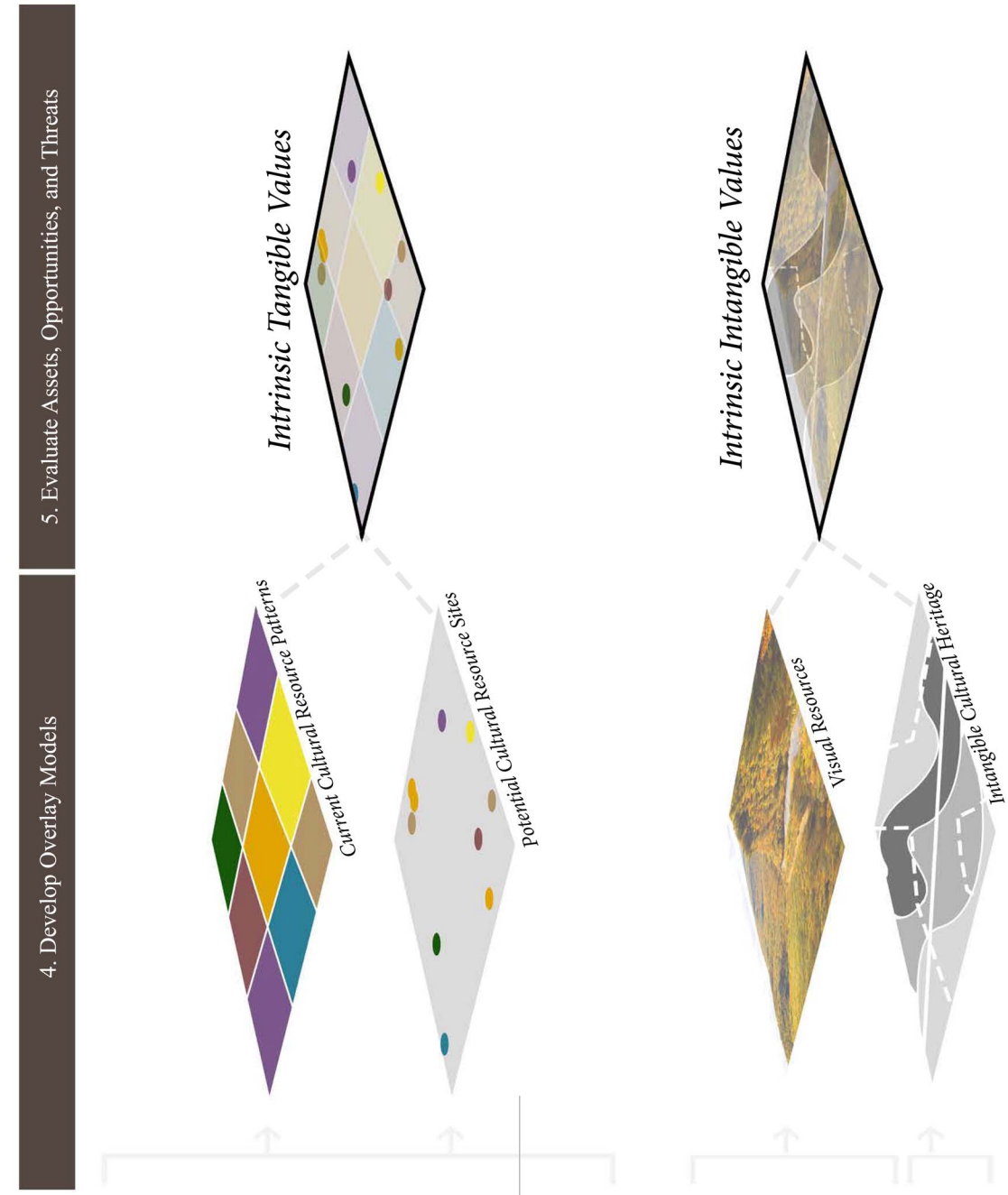

FIGURE 1. Continued.

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

framework applies several overlay analyses to explore spatial patterns of resources using both direct and indirect cultural resource data sources. The overall model is assembled around "tangible" and "intangible" resources (Figures 1a and 1b), which are broken into 11 discrete submodels. Tangible resources aim to inventory the built environment and physical landscape features (e.g., archaeological sites), while intangible resources aim to inventory aesthetic and visual qualities. The submodels are then inventoried and parameterized using available geospatial data. Archaeological data occupies a central role in our model development.

Early on in our study, we recognized the potential value of archaeological information and statewide archaeological databases as foundational resources for informing landscape conservation design. We also recognized a parallel need to compare statewide databases of these geospatial indicators because of the anticipated variability in availability and quality among states. Clearly, this data variability between states is not exclusive to archaeological information, but the specific preservation focus and secured nature of archaeological databases reinforces this important early comparative step if archaeological information is to be integrated in landscape conservation design. In reality, all of the cultural resource databases in our framework exhibited some variability across state boundaries. We concluded that archaeological data offered a unique opportunity to overcome that interstate variability because of emerging trends in practice (Alstchul 2016; Doelle et al. 2016; McManamon et al. 2016) and deep traditions in landscape archaeology (Crumley and Marquardt 1990).

To investigate the variability among state archaeological databases, we compare the databases of the Pennsylvania Cultural Resources GIS (PACRGIS) and the Florida Master Site File (FMSF). The Pennsylvania database was chosen for this study because it was already being utilized in the Appalachian cooperative work. Florida was chosen as a comparative measure because it provides a distinct context (archaeologically, historically, and in contemporary times) from the states surrounding Pennsylvania. For example, whereas Pennsylvania was a part of one of the largest multistate cooperatives, Peninsular Florida was its own cooperative. Moreover, each state has its own distinct planning and development pressures. Pennsylvania has no coastal resources, while Florida is dominated by them. Beginning this assessment with a comparison of Florida and Pennsylvania offers the opportunity to compare two states that have significantly different historical and cultural traditions but that operate within the same national cultural resource management framework. By highlighting these differences, pathways for coordinating across states, regardless of the similarities of their archaeological resources, can be established.

PENNSYLVANIA AND FLORIDA DATABASE COMPARISON

In this article, we focus on the challenges and opportunities encountered while specifically working with archaeological data from two statewide GIS databases. We describe and compare archaeological information from Florida and Pennsylvania in order to consider how each could be leveraged in landscape planning practices. Some of the challenges and opportunities are unique to each state, while others are shared across state boundaries. Perhaps most importantly, it is clear that databases of archaeological resources can offer important information for use in landscape-scale conservation design and planning, especially early on, when conservation priorities are being established.

In comparing the Pennsylvania and Florida databases, we identified several key themes: (1) issues surrounding the efficacy of interagency data sharing and the long-term durability of the data being shared; (2) the importance of developing web-based GIS programs of some scale that can be accessed, used, and understood by design and planning professionals; (3) the imperative for the development of publicly accessible archaeological information at scales that do not undermine site preservation; and (4) the imperative of regional coordination of data. While the statewide databases are similar in that they are complex efforts to archive archaeological information, they are fundamentally different in structure and accessibility. Both databases effectively archive archaeological site information for purposes of management and conservation. Both can be used for the development of statewide predictive and significance modeling. And both can be used more effectively in emerging archaeological practice, which contributes to landscape-scale conservation design.

Pennsylvania Cultural Resources GIS (PACRGIS)

PACRGIS is organized as a relational database that records multiple types of GIS data. This includes individual shapefiles for field surveys, archaeological sites, historical structures, historical bridges, historical cemeteries, National Register sites, and resource groups. There are 139,539 features of a variety of types in the overall PACRGIS. There are 116,275 historical features, whereas there are 23,164 features associated with archaeology (Figure 2). Over 50% of the historic features are referenced as buildings, while over 30% are not identified by a category. Interestingly, over 40% (47,825) of the historic features are located within 10 km of urban areas, and 26% (30,903) are located within 100 m of a stream. There is a clear spatial bias for historic features, with the majority near or within urban areas. This is a key factor when considering the application of these data for design and planning. Simply, if landscape-scale conservation priorities are derived solely from the distribution of documented resources, entire cultural landscapes could be undervalued and not fully represented in conservation plans.

As mentioned above, there is spatial location data for 23,164 archaeological features (Figure 2). The 23,164 sites provided by the Pennsylvania Historic Museum Commission have basic categorical division such as listed National Register sites, demolished/100% destroyed, SHPO (State Historic Preservation Office)-eligible and -ineligible sites, KEEPER-eligible and -ineligible sites, insufficient-information provided-sites, and non-categorized sites. In total, 42 tables with over 125 attributes can be linked through the use of the relational database in Pennsylvania. The majority of the categories are focused on key characteristics for managing sites. Detailed cultural information is accessible, but largely through grey literature—that is, linked reports or site files when they have been scanned or digitally acquired.

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

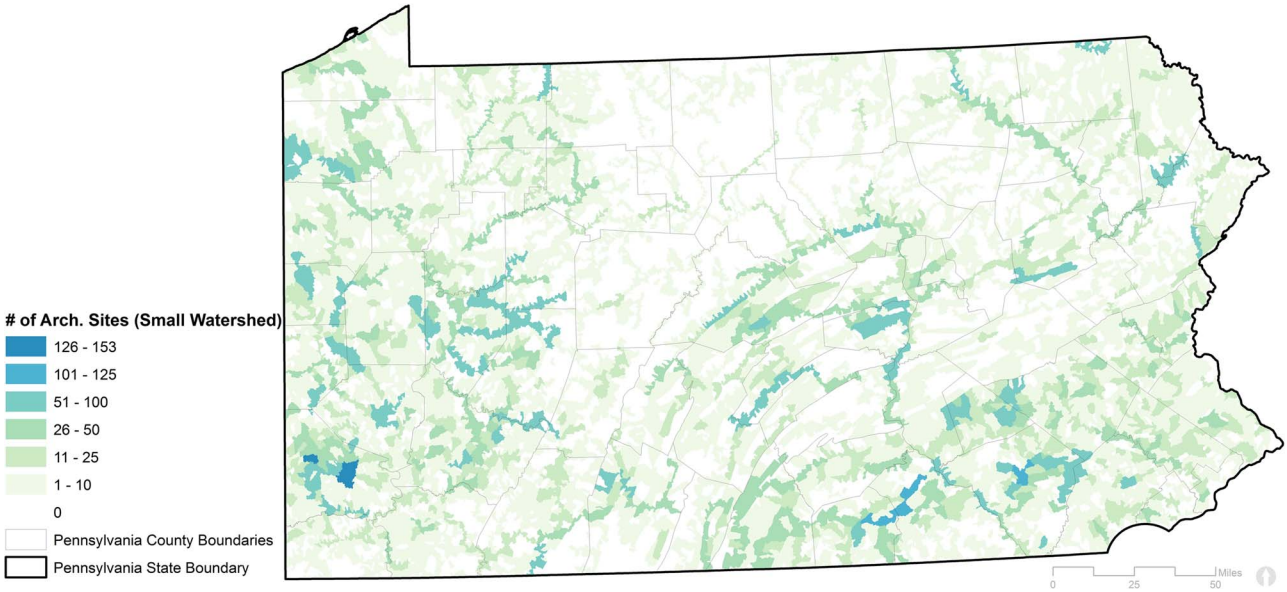

FIGURE 2. The 23,164 archaeological features in the PACRGIS summarized by small watershed.

The Florida Master Site File GIS Database (FMSF)

FMSF records multiple types of GIS data, and is structured as multiple shapefiles. This includes individual shapefiles for field surveys, archaeological sites, historical structures, historical bridges, historical cemeteries, National Register sites, and resource groups (Figures 3 and 4). The archaeological sites' shapefile includes spatial location data, along with site boundaries, for 35,257 archaeological sites throughout the state of Florida, each represented by an individual polygon. FMSF records multiple attributes for each site with a clear emphasis on codifying and characterizing cultural and chronological information. The attribute fields include "SITEID," "SITENAME," "SITETYPE," "CULTURE," "SURVEVAL," "SURVEYNUM," "D_NRLISTED," "SHPOEVAL," "PLOTTYPE," and "HUMANREMNS."

Whereas the SITEID and SITENAME fields record the essential and traditional site number and name, the SITETYPE field records important information about site function and environmental location. This field is split into six separate attribute fields, SITETYPE1–SITETYPE6, which is an important structural component of the database. The purpose of dividing this attribute into six separate fields is to account for multiple site components as well as the multiple functions of a site, or multiple functional areas a site might exhibit. There is a total of 101 different descriptors applied to the SITETYPE fields.

Much like the SITETYPE attributes, the CULTURE field is split into multiple attribute fields (CULTURE1–CULTURE8). The CULTURE fields record information regarding temporal associations and cultural affiliations. There is a total of 114 distinct descriptors applied to the CULTURE fields in the Florida database, and they cover both prehistoric and historic affiliations. The purpose of splitting the CULTURE field into eight distinct fields is to account for multicomponent sites. This is a common characteristic of sites throughout Florida. There are 14,537 sites (41.23% of all sites) in the database with at least two occupational components recorded. Furthermore, there are 6,512 (18.46%) with three components, 3,290 (9.33%) with four components, 1,897 (5.38%) with five components, 1,156 (3.27%) with six components, 739 (2.09%) with seven components, and 492 (1.39%) with eight components. Because of the number of multicomponent sites throughout the state, the splitting of the CULTURE field in such a way is a necessary structural aspect of the Florida database.

The majority of the affiliations are designations based on the archaeological culture regions outlined by Milanich (1994). Each of these archaeological cultures has a distinct chronology, and the majority of these are post–500 BC affiliations (Milanich 1994; Milanich and Fairbanks 1980; Wallis and Randall 2014). The exceptions to this are the Mount Taylor culture that begins during the Middle Archaic, and the emergent regional cultures of the Late Archaic period, including the Orange, Norwood, and Elliott's Point Complex cultures (Endonino 2008, 2010; Milanich 1994; Randall et al. 2014; Sassaman 2010). Furthermore, within a single culture region, the designations are split among the specific cultural chronologies for that region (e.g., Belle Glade I, Belle Glade II, Belle Glade III, and Belle Glade IV). In addition to this cultural information within the statewide database, there are bibliographic references to site surveys and field reports, if available.

Relating to assessment, there are three attribute fields devoted to National Register of Historic Places (NRHP) eligibility determinations: "D_NRLISTED," "SHPOEVAL," and "SURVEVAL." The SURVEVAL field documents the surveyor's assessment of a site, whereas the SHPOEVAL field records the evaluation of the SHPO regarding NRHP eligibility. The attributes listed in these fields often do not correspond to one another due to differences in opinion between a field surveyor and the SHPO. The D_NRLISTED field is only used for sites that are already listed on the NRHP, and

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

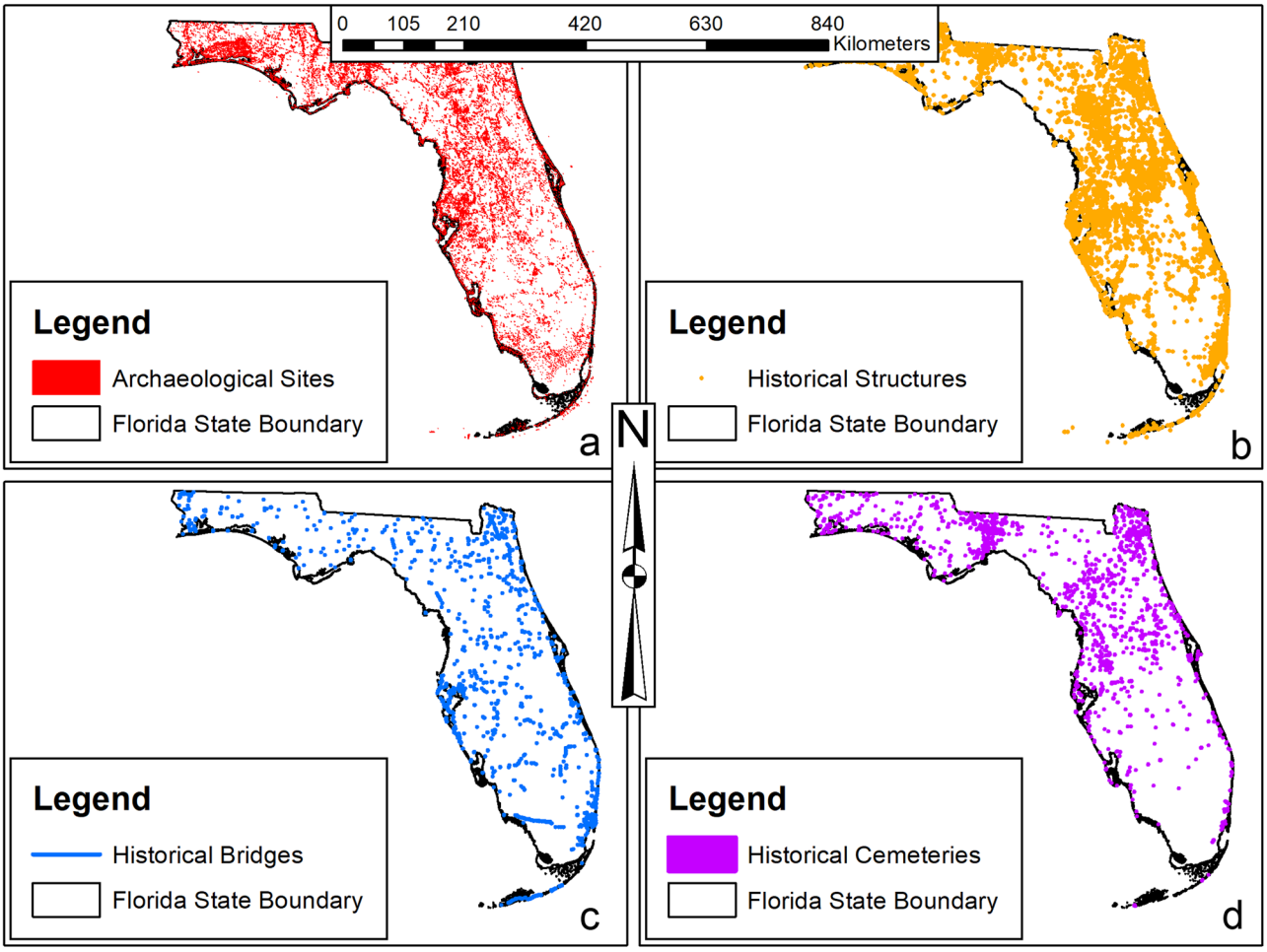

FIGURE 3. The different features within the FMSF: (a) 35,357 archaeological features of the archaeological resources shapefile, (b) 169,441 features of the historical structures shapefile, (c) 1,333 features of the historical bridges shapefile, and (d) 1,313 features of the historical cemeteries shapefile.

it records the date the site was listed. Additionally, the PLOTTYPE field records whether the polygon was mapped as a "GV" (geographic visualization) or through "NORM" (normal) methods (e.g., created through GPS coordinates of positive shovel test locations). The "HUMANREMNS" field records whether or not human remains were encountered at a site.

Comparing the GIS Databases

In trying to integrate these data into landscape conservation designs, several key comparisons are critical. First, the structures of the databases are completely different. Pennsylvania's data is structured as a multitable relational database, where attributes are grouped into several related tables. Because it is a relational database, the complex arrangement of joins and relates necessitates GIS expertise in addition to knowledge and experience with the archaeological resources. The database structure is accessible through a web-based GIS (PHMC 2018), which is useful for users who do not have experience in GIS, but this limits interoperability and any analytical processes. Florida's database, in contrast, is set up as a series of individual shapefiles, with multiple columns in a single attribute table. This structure allows for use with only basic GIS experience, and it is easily portable to the end user's personal device. Currently, there is no web-based portal to query or use these data, so end users must have software installed to analyze these data.

Second, for planning and design, site assessment of both eligibility and evaluation of preservation state is critical, especially when considering standardization. There are substantial differences in this content of the databases. First, over 70% of the sites contained in the Pennsylvania database are listed as having "Insufficient Information" for National Register of Historic Preservation eligibility, whereas only 8% are identified as having "Insufficient Information" in the Florida database (see Table 1). The differences here suggest not simply a difference in the completedness of the assessment of resources but a fundamentally different conceptualization of the determination of eligibility. For instance, if the classification of "Not Evaluated by SHPO" is included for the Florida data, 64% of features are either not evaluated or have insufficient information, which is similar to the 70% frequency for the Pennsylvania. While this variability is

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

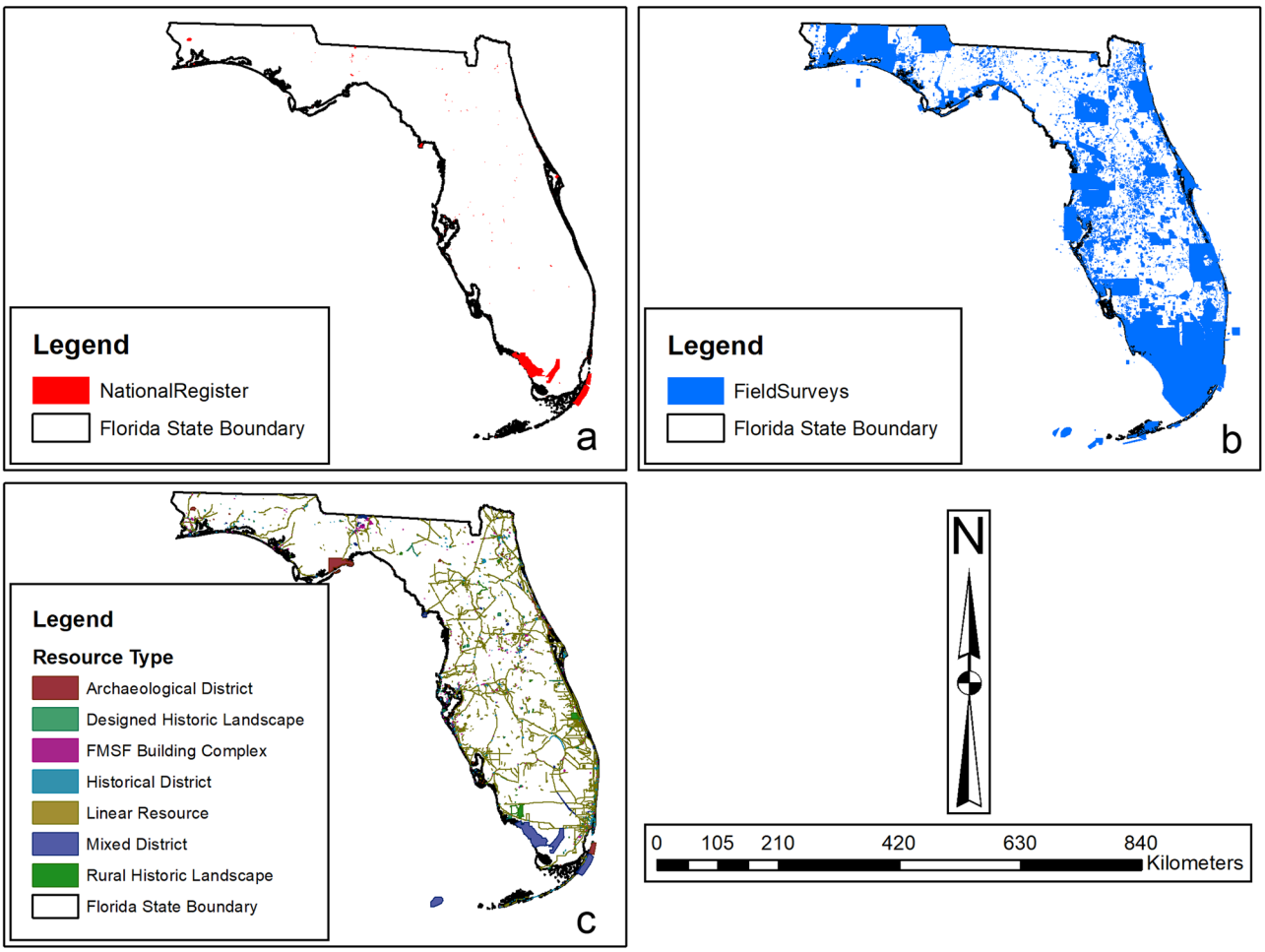

FIGURE 4. Further illustration of attributes of features in the FMSF: (a) 1,770 National Register–listed sites in the National Register shapefile, (b) 18,648 features in the field survey shapefile, and (c) 2,650 features in the resource groups shapefile.

intimately known and discussed in state offices, planning professionals and private firms rely on expert assessment data in order to develop conservation designs. For example, if a designer wants to develop a conservation plan targeting impacted streams in Pennsylvania or West Virginia, there are standards to quickly combine with and overlay these on other design-relevant information, such as percent impervious surface. Standardizing the assessments will offer the ability to integrate these data into designs more completely.

Third, the two databases are somewhat similar in terms of the chronology of sites included. For example, both state databases have roughly 20% historic period features in the archaeological database (Table 1). Additionally, both databases have about 30% of features broadly listed as prehistoric. This designation is used where no specific chronological information is available, which presents unique challenges in regard to research contexts. The Florida data, however, contains unique chronological information for post-Archaic sites that is based specifically on the archaeological cultures of Florida. Because of this, comparison of the two databases requires creating an additional data field—which we labeled "RTime," for regional time—that converts the Florida-specific post-Archaic chronology to the general chronology used for the broader southeastern United States (Anderson and Sassaman 2012). The chronological comparison in Table 1 is based on this field. From a landscape conservation design perspective, having comparative information about past cultural information tied to broad regional chronologies could offer transformative potential for integrating what we are learning about past coupled natural and human systems into future designs. Having these cues in databases offers designers new models for considering the shape and structure of landscape conservation designs.

Fourth, spatial representation is critical for landscape conservation design. Significant variation in the spatial distribution of features is an important point to consider here. In Pennsylvania, historic resources that are not classified as archaeological resources are predominantly found near or adjacent to urban areas. Fifty percent of historic sites are found within 10 km of urban areas in Pennsylvania. By contrast, only 20% of archaeological features are found within 10 km of urban areas in Pennsylvania (Table 1).

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

TABLE 1. Comparison of Florida and Pennsylvania Cultural Resource Databases.

Florida Master Site File			**Pennsylvania Cultural Resources GIS**		
Category	**# of Sites**	**% of Total Sites**	**Category**	**# of Sites**	**% of Total Sites**
Demolished/Destroyed	unknown	unknown	Demolished/Destroyed	594	2.56
NRHP Eligible	1,156	3.27	NRHP Eligible	518	2.24
NRHP Potentially Eligible	571	1.62	NRHP Ineligible	1,255	5.42
NRHP Ineligible	10,790	30.56	Insufficient Information	16,985	73.32
Insufficient Information to Evaluate	2,894	8.20	NRHP Listed	154	0.66
Not Evaluated by SHPO	19,891	56.35	National Historic Landmark (NHL)	14	0.06
NRHP Listed[1]	162	0.46			
Total	***35,302***	***100.00***	***Total***	***23,164***	***100.00***
Category	**# of Sites**	**% of Total**	**Category**	**# of Sites**	**% of Total**
Paleoindian	293	0.60	Paleoindian	117	0.51
Paleoindian/Archaic	80	0.17	Archaic	4,094	17.67
Archaic	5,742	11.85	Transitional	617	2.66
Transitional	320	0.66	Woodland	2,497	10.78
Woodland	6,247	12.89	Late Woodland/Iroquoian	1,169	5.05
Woodland/Mississippian	4,255	8.78	Protohistoric	34	0.15
Mississippian	2,752	5.68	Contact/Historic	52	0.22
Prehistoric	16,229	33.49	Prehistoric	6,597	28.48
Historic	10,502	21.67	Historic	4,162	17.97
Modern	120	0.25	Modern	47	0.20
Other	1,328	2.74	Not Available	3,778	16.31
Indeterminate	586	1.21			
Total[2]	***48,454***	***100.00***	***Total***	***23,164***	***100.00***
Land Cover Class	**# of Sites**	**% of Total Sites**	**Land Cover Class**	**# of Sites**	**% of Total Sites**
Multiple	1,094	3.07	Multiple	116	1.31
Agriculture	977	2.74	Agriculture	2,942	33.22
Pasture	2,053	5.75	Pasture	1,330	15.02
Developed	7,561	21.19	Improved Surface	21	0.24
Barren Land	514	1.44	Landscaped Areas	15	0.17
Grasses/Brush	1,289	3.61	Lawn	654	7.38
Shrub/Scrub	3,472	9.73	Barren Land	312	3.52
Forest	9,502	26.62	Grasses/Brush	513	5.79
Wetland	9,228	25.86	Thicket/Shrub	748	8.45
			Forest	2,205	24.90
Total	***35,690***	***100.00***	***Total***	***8,856***	***100.00***
Spatial Distributions - Area Type	**# of Sites**	**% of Total Sites**	**Spatial Distributions - Area Type**	**# of Sites**	**% of Total Sites**
City Center (1 km buffer)	1,482	4.20	City Center (1 km buffer)	65	0.28
City Center (5 km buffer)	14,626	41.43	City Center (5 km buffer)	1,401	6.05
City Center (10 km buffer)	27,565	78.08	City Center (10 km buffer)	4,291	18.52
Rivers, Creeks, Sloughs, Streams (100 m buffer)	5,321	15.07	Streams(100 m buffer)	9,046	39.05
FWC Wildlife Management Areas	9,413	26.66	State Game Lands	366	1.58
National Wildlife Refuges	1,470	4.16	Preserves	41	0.18
State Park	2,086	5.91	State Park	315	1.36
State Forest	958	2.71	State Forest	112	0.48
Managed Areas[3]	15,807	44.78	Wild & Natural Areas	26	0.11
			PA Wilds	1,912	8.25

[1]Cross-listed in the NRHP Eligible category; not used in the calculation of totals.
[2]Based on the number of site components identified in the CULTURE and RTIME fields.
[3]There is no spatial data for Florida classified strictly as "Wild" or "Natural" areas. The managed areas of Florida include national parks, national forests, national wildlife refuges, state forests, state parks, ecological restoration areas, wildlife management areas, and more.

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

Archaeological features in Pennsylvania are also highly correlated with streams and inland water, with 39% of the features found within 100 m of a stream (using the USGS National Hydrography Dataset). Florida, on the other hand, is dominated by resources within 10 km of urban areas. Importantly, nearly 30% of these resources are found within protected or managed areas, which differs drastically from Pennsylvania where only 3.6% of archaeological resources are within protected state lands. Understanding differences in land tenure, administrative boundaries, and socioecological contexts that encompass important archaeological sites and resources is critical to advancing their conservation and interpretation. The spatial distribution of resources when compared to modern settlements can influence conservation design. The cultural, topographic, hydrological, and ecological landscapes of Florida and Pennsylvania are fundamentally different, and this observed spatial variation is critically important for policies and decision-making as related to landscape conservation design and planning.

DISCUSSION

As we initiated our landscape cooperative study, the Society for American Archaeology (SAA) published the important findings of its three task forces created to address issues related to landscape-scale cultural resource management and archaeological resources (Altschul 2016; Doelle et al. 2016; McManamon et al. 2016; Wilshusen et al. 2016). These task forces individually addressed three separate but interrelated issues: "1) survey data quality, durability, and use; 2) incorporating archaeological resources in regional land-use plans; and 3) valuing archaeological resources" (Altschul 2016:102). The issues addressed by the first two task forces are closely aligned with the work we are conducting. For example, the work reported here is an applied evaluation of the first issue, with the purpose of contributing to the second (Altschul 2016).

Our comparison of the Florida and Pennsylvania databases reinforces several of the issues elucidated by Wilshusen and colleagues (2016) in their evaluation of the quality and durability of survey data managed by SHPOs across the United States. They note the need for standardization in the forms of digital data collected and managed to increase the efficacy of data sharing among different agencies at regional and national scales. Such standardization would also increase the ease of compiling and analyzing data from multiple agencies to create regional syntheses of the archaeological record as well as building more efficient models for archaeological survey (see also Doelle et al. 2016). The critical need for standardization may be well understood at the SHPO offices. We conclude, however, that attempting to apply the data in a different professional context not only reinforces this need but offers a purpose and directionality for the standardization. For example, if the intended purpose of standardization is a regional predictive model of site locations for different time periods, clear tasks about site definition emerge in practice. On the other hand, if the regional coordination is focused on designing conservation districts for broadly perceived cultural resources, site definition may not be as relevant as clear definitions of site boundaries or an assessment of site disturbance. In simple terms, while we can discuss theoretically the need to standardize, one way to standardize effectively and practically is to apply these datasets to problem-solving.

Applying archaeological GIS databases in a landscape conservation design framework offers unique insights into how these databases and the information that they provide could be leveraged more effectively and earlier in the conservation design and planning processes. We argue that doing so offers new possibilities for archaeological practice in landscape conservation design. First, learning from systematic comparisons of statewide databases will help define the process of standardization. Second, analyzing the application of these databases where they are potentially needed helps to identify opportunities for growth in archaeological practice.

Standardization

We concur with Wilshusen and colleagues (2016), who state that standardization across archaeological databases is necessary. We conclude that it is easiest to identify standardization needs by applying multiple databases to different needs. In our case, we used the lens of design and planning. A lack of standardization across state boundaries is not a new assessment provided by our work, but some interesting opportunities emerge when applying these data to landscape conservation design methods. Pennsylvania and Florida vary in the structure of the databases, assessment of the resources, and chronological/cultural associations of those resources. Each offers challenges and opportunities for design and planning.

First, there are key differences in the way the databases are structured, which determines how data can be accessed and used by designers as well as how archaeologists can collaborate with design teams. It would be a massive undertaking for the Florida and Pennsylvania staff, but coordination of these two spatially distinct databases could have transformative value. Although relational databases are more cumbersome to work with in GIS, they are more robust in terms of the amount and types of data recorded. This, in turn, increases the durability of that data and decreases the need for resurvey, which is noted by Wilshusen and colleagues (2016) as being problematic. Transferring the Florida database to a full relational database would allow for the creation of robust connections to other statewide datasets that are important for landscape conservation design, such as the Florida Natural Areas Inventory or the Florida Water Management Districts. Conversely, a more complex approach to classifying chronology and cultural context like the one provided in the Florida data would improve the design application utility of the Pennsylvania database.

Second, as noted above, there are differences in the frequency of sites identified as having "Insufficient Information" for evaluation for listing on the NRHP. These differences may be related to different conceptualizations of the definition of or criteria for labeling a site with this term. Florida's database differentiates between sites that have "Insufficient Information" and those that are "Not Evaluated by SHPO." The Florida database has an additional eligibility classification of "Potentially Eligible for the NRHP." These are all problematic designations. Under the legislation of Section 106 and Section 110 of the National Historic Preservation Act of 1966, sites deemed ineligible and as having insufficient information are not mandated protections in the planning process (King 2013). The Potentially Eligible classification is especially problematic because an agency is able to "ignore its impacts on a property until the

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

SHPO/THPO or the keeper or maybe God determines it eligible" (King 2013:143).

As such, we recommend that all states using these classifications of NRHP eligibility reevaluate sites thus identified. It is important to maintain a standardized language in regard to determining the eligibility of sites for listing on the NRHP, but the large-scale designation of standard classifications that are of no use in affording legislative protections only increases the problem that most states face when it comes to requiring resurvey of a property (Wilshusen et al. 2016). As Wilshusen and colleagues (2016:111) note, the resurvey of properties is a substantial burden on many states, and it "comprises between 11 and 30 percent of all inventory work." While much of the need for resurvey stems from SHPO offices restructuring the requirements for survey and data recording, thereby making those requirements more rigorous and strict, there are other efforts that are more fruitful than resurvey to which we can allocate time and money for the betterment of the discipline of archaeology in terms of both preservation and research (see Larralde et al. 2016; Schlanger et al. 2013; Wilshusen et al. 2016:11).

Third, one of the major differences between these databases is related to cultural and chronological associations. For creative integration into landscape conservation design processes, it is important to start thinking on a continental scale how to build archaeological databases where meaningful comparisons can be made across the geographies of managing agencies. This is not just important for preservation of particular chronological or cultural resources, but also for finding ways to have information about the past that can inform the present and future of landscape conservation design. Neither of these databases is designed for such an integration. Florida's database, however, offers a critical perceptive window into how these data could be incorporated. Peninsular Florida was its own defined cooperative. Various combinations of the cultural and chronological associations exhibit important variation on the landscape that potentially offer clues about how we need to manage these landscapes in the future. Developing analytical datasets that speak to that insight could transform design thinking in a region.

Conversely, Pennsylvania's database only includes a generalized chronological framework. In contrast to the Florida database, this makes regional work more efficient, but it limits the potential ability of the data to inform design. Finding ways to integrate references to complex cultural and chronological associations along with summarized information would allow for design and planning at multiple scales.

Different Design and Planning Contexts

Landscape conservation design—and frankly all design and planning projects—in Peninsular Florida and the Appalachian Region are structured differently and are influenced by different economic forces. They also illuminate the differences in site preservation between these two areas due to the presence of very different resource threats. In landscape conservation design, we seek spatially explicit models through which both priorities and threats are exposed. It is critical to identify not only where conservation priorities lie but where the intersection of those priorities with threats occur. For example, Florida faces major development projects from the private sector that are influenced by population growth and pressure. Development in this manner is dispersed, fragmented, and localized. In Pennsylvania, the threats to resources are largely driven not by settlement expansion across the state, but through natural resource extraction (Murtha et al. 2015; Orland and Murtha 2015).

With funding, archaeologists have an opportunity to participate proactively in planning and design, first by developing consumable databases to match the trending development threat, allowing a move beyond curation, management, and reaction. Perhaps the opportunity is ripe for us to also develop an archaeological database similar to the USGS GAP program, a nationwide spatially explicit model for planning for habitat biodiversity (Davis et al. 1990; Scott et al. 1993). The program was initially focused on mapping the habitats of common species state by state, but now it has regional orientation and asks the question, "How well are we protecting common plants and animals?" (USGS 2019). But, in this case, we would be asking, "How well are we protecting cultural resources?" Archaeological sites and information should be a foundational element of any GAP-like cultural resource program. Programs such as the Digital Index of North American Archaeology could offer critical potential for starting such a program quickly (Kansa et al. 2018).

Related, future non-development-oriented threats are at the core of all landscape conservation designs. Climate change is one example that offers challenges for site preservation and management. Mapping out those challenges can become central elements of landscape conservation designs. For example, in Florida, climate change and rising sea levels are imminent threats to the many coastal sites in the state. Archaeologists in Florida are already taking similar action, led by the Florida Public Archaeology Network, a state-funded agency whose mission includes assisting the Florida Division of Historical Resources as well as local governments in preservation efforts (https://www.flpublicarchaeology.org/about/). This has led to two major projects aimed at site preservation in the face of sea-level rise: the Tidally United Summit and the Heritage Monitoring Scouts. The former is a summit that brings together archaeologists from around the state with city planners, government officials, climatologists, and the Florida Division of Historic Resources staff (https://www.flpublicarchaeology.org/projects/tidally.php). The latter is a program focused on documenting changes to sites deemed "at risk" from sea-level rise, and it does this through public engagement and training the public (i.e., citizen science) to record those changes for the Division of Historic Resources (https://www.flpublicarchaeology.org/projects/HMSflorida.php). The latter also includes a citizen science opportunity for communities to report on site preservation.

CONCLUDING REMARKS

Several years ago we started a project to develop processes for integrating cultural resources in landscape conservation design. Early on, it was clear that archaeological information and state databases offered the critical leverage to develop these processes. Although our work is ongoing, there are several conclusions that emerged when we applied our research to Florida and Pennsylvania site file GIS databases.

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

First and foremost, archaeological databases offer tremendous potential for use in design and planning, but there is much work to be done. We believe that this need for adapting cultural resources databases for use in emerging arenas such as landscape planning can provide the impetus for obtaining grant funds for both evaluating the information in the databases and restructuring them. Framing the need for restructuring in terms of its ability to increase the efficiency of landscape-scale planning may provide the medium for locating funds outside of the traditional sources for archaeological research (i.e., funding from state planning organizations, etc.). Building on trends in Pennsylvania and Florida, such as web-based access to GIS data by planning professionals in Pennsylvania and the Florida Public Archaeology Network's efforts to develop public databases and awareness of the threats to coastal resources, new investment could bring about new products that provide information during the design process—not after construction plans have been developed.

Second, there is an opportunity to open new doors of archaeological practice in design and planning. In the foreword to Paul Brace's *Archaeological Resources and Land Development,* O'Donnell wrote, "The fields of landscape architecture and archeology share a common ground—land with a history of human use" (Brace 1984:v). In the technical publication, Brace (1984) describes how landscape architecture could more effectively integrate archaeological resources in site analysis and states that archaeological resources are our keys to understanding cultural landscapes. Brace's (1984) technical document has not been updated in 35 years. With the emergence of important landscape-scale conservation design and planning programs, such as the Landscape Conservation Cooperatives, there are diverse opportunities for integrating archaeological information in design and planning. Statewide databases hold exceptional promise as first steps in creatively bridging landscape planning and archaeology in practice.

Acknowledgments

This work would not have been possible without the support of the National Park Service, the Wildlife Management Institute, and the Appalachian Landscape Conservation Cooperative. Jean Brennan, Daniel Odess, and Perry Wheelock provided support and assistance. We would also like to acknowledge the Pennsylvania and Florida SHPO offices and, in particular, the staff who provided early support and access to each statewide database.

Data Availability Statement

All data used in this analysis are public in nature but are legally restricted by the respective states from which they were obtained. For the Florida archaeological resources GIS data, permission may be obtained by contacting the Florida Master Site File, a division of the Florida Department of State's Florida Division of Historic Resources, and submitting the appropriate request forms. For the Pennsylvania cultural resources GIS data, visit https://www.dot7.state.pa.us/CRGIS to access the public data. Site location and information is password protected in this database. To obtain a password, you must either (a) provide a curriculum vitae demonstrating you meet the Secretary of the Interior's Professional Qualification Standards as an archaeologist or (b) submit a job description and letter from an agency providing proof that you are part of a ground-disturbing development planning project.

REFERENCES CITED

Altschul, Jeffrey H.
2016 The Society for American Archaeology's Task Forces on Landscape Policy Issues. *Advances in Archaeological Practice* 4:102–105.

Anderson, David G., and Kenneth E. Sassaman
2012 *Recent Developments in Southeastern Archaeology: From Colonization to Complexity.* SAA Press, Washington, DC.

Baldwin, Robert F., Stephen C. Trombulak, Paul B. Leonard, Reed F. Noss, Jodi A. Hilty, Hugh P. Possingham, Lynn Scarlett, and Mark G. Anderson
2018 The Future of Landscape Conservation. *BioScience* 68:60–63.

Brace, Paul
1984 *Archaeological Resources and Land Development: A Guide to Assess Impact.* Landscape Architecture Technical Information Series 7, Vol. 5 (1). American Society of Landscape Architects, Washington, DC.

Brown, Madeline, and Timothy Murtha
2019 Integrating Natural and Cultural Resources in North American Large-Landscape Conservation. *Environmental Practice* 21:57–68. DOI:10.1080/14660466.2019.1601935.

Crumley, Carole, and William H. Marquardt
1990 Landscape: A Unifying Concept in Regional Analysis. In *Interpreting Space: GIS and Archaeology*, edited by Kathleen Allen, Stanton Green, and Ezra Zubrow, pp. 73–79. Taylor and Francis, London.

Davis, Frank W., David M. Stoms, John E. Estes, Joseph Scepan, and J. Michael Scott
1990 An Information Systems Approach of Biological Diversity. *International Journal of Geographical Information Systems* 4:55–78.

Doelle, William H., Pat Barker, David Cushman, Michael Heilen, Cynthia Herhahn, and Christina Rieth
2016 Incorporating Archaeological Resources in Landscape-Level Planning and Management. *Advances in Archaeological Practice* 4:118–131.

Endonino, Jon C.
2008 The Thornhill Lake Archaeological Research Project: 2005–2008. *Florida Anthropologist* 29:49–59.
2010 *Thornhill Lake: Hunter-Gatherers, Monuments, and Memory.* PhD dissertation, Department of Anthropology, University of Florida, Gainesville.

Goldberg, Lacey, Timothy Murtha, and Brian Orland
2018 The Use of Crowdsourced and Georeferenced Photography to Aid in Visual Resource Planning and Conservation. In *Visual Resource Stewardship Conference Proceedings: Landscape and Seascape Management in a Time of Change*, edited by Paul Gobster and Richard Smardon, pp 116–127. General Technical Report: NRS-P-183. U.S. Department of Agriculture, Forest Service, Northern Research Station, Newtown Square, Pennsylvania.

Jones, Grant R.
2007 *Grant Jones/Jones & Jones: ILARIS: The Puget Sound Plan.* Princeton Architectural Press, New York.

Kansa, Eric C., Sarah Whitcher Kansa, Joshua J. Wells, Stephen J. Yerka, Kelsey Noack Myers, Robert C. DeMuth, Thaddeus G. Bissett, and David G. Anderson
2018 The Digital Index of North American Archaeology (DINAA): Networking Government Data to Navigate an Uncertain Future for the Past. *Antiquity* 92:490–506. DOI:10.15184/aqy.2018.32.

King, Thomas F.
2013 *Cultural Resource Laws and Practice.* 4th ed. AltaMira Press, Lanham, Maryland.

Larralde, Signa, Martin Stein, and Sarah H. Schlanger
2016 The Permian Basin Programmatic Agreement after Seven Years of Implementation. *Advances in Archaeological Practice* 4:149–160.

LCC (Landscape Conservation Cooperative)
2018 Landscape Conservation Cooperative Network. Electronic document, https://lccnetwork.org, accessed December 12, 2018.

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press

Leonard, Paul B., Robert F. Baldwin, and R. Daniel Hanks
2017 Landscape-Scale Conservation Design across Biotic Realms: Sequential Integration of Aquatic and Terrestrial Landscapes. *Scientific Reports* 7:14556. DOI:10.1038/s41598-017-15304-w.
Mazurczyk, Tara, Lacey Goldberg, and Timothy Murtha
2018 Integrating Visual and Cultural Resource Evaluation and Impact Assessment for Landscape Conservation Design and Planning. In *Visual Resource Stewardship Conference Proceedings: Landscape and Seascape Management in a Time of Change*, edited by Paul Gobster and Richard Smardon, pp 149–161. General Technical Report: NRS-P-183. U.S. Department of Agriculture, Forest Service, Northern Research Station, Newtown Square, Pennsylvania.
McManamon, Francis P., John Doershuk, William D. Lipe, Tom McCulloch, Christopher Polglase, Sarah Schlanger, Lynne Sebastian, and Lynne Sullivan
2016 Values-Based Management of Archaeological Resources at a Landscape Scale. *Advances in Archaeological Practice* 4:132–148.
Milanich, Jerald T.
1994 *Archaeology of Precolumbian Florida*. University Press of Florida, Gainesville.
Milanich, Jerald T., and Charles H. Fairbanks
1980 *Florida Archaeology*. Academic Press, New York.
Murtha, Timothy
2017 Appalachian LCC Integrating Cultural Resources Research Webinar. Electronic document, https://applcc.org/news/appalachian-lcc-integrating-cultural-resources-research-webinar, accessed December 10, 2018.
Murtha, Timothy, Richard Hammond, Brian Orland, and Lacey Goldberg
2015 Probabilistic Modelling and Complex Energy Landscape Design and Planning: An Experimental Approach. In *Proceedings of Digital Landscape Architecture Conference 2015 at Anhalt University of Applied Sciences*, edited by Erich Buhmann, pp. 238–246. Wichmann/VDE Publisher, Berlin.
NASEM (National Academies of Sciences, Engineering, and Medicine)
2016 *A Review of the Landscape Conservation Cooperatives*. National Academies Press, Washington, DC.
Orland, Brian, and Timothy Murtha
2015 Show Me: Engaging Citizens in Planning for Shale Gas Development. *Environmental Practice* 17:245–255.
PHMC (Pennsylvania Historic Museum Commission)
2018 Pennsylvania Historic Museum Commission Cultural Resource Geographic Information System. Electronic document, https://www.dot7.-state.pa.us/CRGIS, accessed December 18, 2018.
Randall, Asa R., Kenneth E. Sassaman, Zackary I. Gilmore, Meggan E. Blessing, and Jason M. O'Donoughue
2014 Archaic Histories beyond the Shell "Heap" on the St. Johns River. In *New Histories of Pre-Columbian Florida*, edited by Neill J. Wallis and Asa R. Randall, pp. 18–37. University Press of Florida, Gainesville.
Sassaman, Kenneth E.
2010 *The Eastern Archaic, Historicized*. AltaMira Press, Lanham, Maryland.
Schlanger, Sarah H., George MacDonell, Signa Larralde, and Martin Stein
2013 Going Big: The Permian Basin Memorandum of Agreement as a Fundamental Shift in Section 106 Compliance. *Advances in Archaeological Practice* 1:13–23.
Scott, J. Michael, Frank Davis, Blair Csuti, Reed Noss, Bart Butterfield, Craig Groves, Hal Anderson, Steve Caicco, Frank D'Erchia, Thomas Edwards Jr, Joe Ulliman, and R. Gerald Wright
1993 Gap Analysis: A Geographic Approach to Protection of Biological Diversity. *Wildlife Monographs* 123:1–41.
Trombulak, Stephen C., and Robert Baldwin (editors)
2010 *Landscape-Scale Conservation Planning*. Springer, New York.
USGS (United States Geological Survey)
2019 United States Geological Survey GAP Analysis Program. Electronic document, https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap, accessed April 15, 2019.
Wallis, Neill J., and Asa R. Randall (editors)
2014 *New Histories of Pre-Columbian Florida*. University Press of Florida, Gainesville.
Wilshusen, Richard H., Michael Heilen, Wade Catts, Karen de Dufour, and Bradford Jones
2016 Archaeological Survey Data Quality, Durability, and Use in the United States. *Advances in Archaeological Practice* 4:106–117.

AUTHOR INFORMATION

Timothy M. Murtha ■ Center for Latin American Studies, Department of Landscape Architecture, Florida Institute for Built Environment Resilience, University of Florida, PO Box 115702, Gainesville, FL 32611-5702, USA (tmurtha@ufl.edu, corresponding author) https://orcid.org/0000-0002-1931-1226

Nathan R. Lawres ■ Department of Anthropology, University of West Georgia, Antonio J. Waring Jr. Archaeological Laboratory, 1601 Maple St., University of West Georgia, Carrollton, GA 30118, USA

Tara J. Mazurczyk ■ Department of Geography, Penn State University, 328 Walker Building, University Park, PA 16801, USA

Madeline Brown ■ Florida Institute for Built Environment Resilience, University of Florida, PO Box 115702, Gainesville, FL 32611-5702, USA

https://doi.org/10.1017/aap.2019.32 Published online by Cambridge University Press