ABSTRACT

The Myaamia Mapping Project

by Brett Governanti

This was a community-driven practicum project assisting the Miami Tribe in achieving the spatial reconstruction of their traditional pre-removal landscape using geographic information systems. This project applies the Miami conception of their pre-removal landscape to multiple digital map layers. The results are considered a preliminary phase in the mapping of the Miami landscape that will result in greater understanding of Miami ethnohistory. Project deliverables empower the Tribe with spatially accurate digital map layers of their historic landscape and its biophysical features. The organization of these digital map layers allows the Tribe to examine how the historic Miami Tribe operated within the geographic space of their historic homelands. The Miami are now passing the project on to continue to identify the historic Miami cultural landscape from their perspective. The map database is provided to the Tribe for continuation of the project at their discretion using large capacity DVD-R media.
The Myaamia Mapping Project

A practicum submitted to the faculty
of Miami University
in partial fulfillment of
the requirements for the degree of
Master of Environmental Science
Institute of Environmental Sciences

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2005

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Acknowledgements

The author wishes to extend the greatest thanks to Dr. Adolph Greenberg and Dr. George Esber, Jr. for their guidance throughout this practicum and in the preparation of this manuscript. Sincere appreciation goes to Dr. Gene Willeke for assistance in the completion of this practicum and for his leadership in the Institute for Environmental Sciences’ master degree program. The author would like to thank Dr. Avram Primack and Dr. Thomas Klak of the Institute of Environmental Sciences and the Geography Department, respectively, for their valuable input and technical assistance. Special thanks to Daryl Baldwin and the Miami Tribe for the opportunity to complete this practicum project on their behalf.
Introduction

The Miami Tribe of Oklahoma is embracing geospatial technologies to assist the efficiency and effectiveness of self-governance initiatives. The Tribe is using these technologies (GIS, Global Positioning Systems) within their government, business, and environmental offices to assist the management of their lands and resources and to administer programs amongst their people. Wishing to expand their use of geospatial technologies to their cultural preservation department, the Miami Tribe of Oklahoma decided to utilize geospatial technologies to help achieve their Native language and cultural revitalization goals. The Myaamia Mapping Project applies the same mapping technologies currently in use by the Tribe to catalogue their pre-removal landscape using geographic information systems (GIS). In the summer of 2003, the Miami Tribe of Oklahoma, working through Daryl Baldwin of the Myaamia Language Office located on the campus of Miami University, requested assistance from Miami University’s Dr. Avram Primack in the organization of various digital map layers of their historic landscape as it existed prior to the Tribe’s removal to reservations West of the Mississippi in 1846. This report describes the mapping project that emerged from this inquiry. The author was approached with this project possibility and agreed to manage the project and assist the Miami Tribe in the creation of their historic pre-removal landscape and its features using GIS. The project assists the Miami Tribe’s understanding of their ethnohistory and pre-removal geography during their occupation of the Midwestern region of present day North America circa 1650-1850.

This mapping project was undertaken as a collaborative effort between members of Miami University’s Institute of Environmental Sciences, the Departments of Botany and Geography, and the Miami Tribe to determine the Tribe’s pre-removal landscape and assist the completion of this practicum project. A research team was assembled for this purpose including Dr Thomas Klak as project coordinator, Dr. Avram Primack as GIS adviser, Daryl Baldwin as Miami Tribal contact, Brett Governanti as GIS technician, and Billy Terry as project assistant. Applied ethnographers Dr Adolph Greenberg and Dr. George S. Esber, Jr. provided ongoing evaluation of the project. Dr. Gene Willeke, Director Emeritus of the Institute of Environmental Sciences, also provided invaluable guidance and commentary throughout the project.
The actions performed to fulfill the Tribe’s request included the manipulation of spatial data to conform to the boundary of the Miami landscape as determined by linguistic and historical evidence of historic Miami use and occupancy and research into the historic context of the Miami Tribes as well as researching Indigenous mapping initiatives and methods. The Myaamia Mapping Project’s digital map layers in the geospatial database include: a landscape polygon, a hydrologic line layer, Miami-Illinois hydrology annotation, pre-settlement vegetation layers, and an elevation raster. Database structure, digital map layers, landscape display preferences, label properties, and layouts of output maps have been organized according to the perspective of the Miami Tribe. The project database, research documents, and project report are provided to the Tribe using large capacity DVD-R media for their continued analysis, modification, and revision. Project deliverables allow the Tribe to formulate a greater understanding of their historic cultural landscape during the time of their historical occupancy within the landscape’s geographic area. The continued addition of additional features to the base layers of this historic landscape will allow the Miami to further realize their ethnohistory as it played out within geographic space and allow them to operate more fully in culturally appropriate ways (Carson 2002, 770).

Spatial data manipulation was achieved using the ARC suite of GIS software produced by the Environmental Systems Research Incorporated Company (ESRI). The digital map layers and associated attribute data created during this project will be used by the Tribe for several applications including:

- Enhancement of cultural education for Tribal members and others interested in the history and survival of the Miami Tribe
- Identification and cataloguing of Miami history and knowledge
- Location of cultural information originating from Miami-centered research, language revitalization projects managed by the Tribe, and historical sources within geographic space
- Provision of a legally acceptable map aid to assist the resolution of the Miami Tribe’s Native American Graves Protection and Repatriation Act (NAGPRA) claims
- Integration of the Miami Ethnobotanical Database with the digital map layers of pre-settlement vegetation
Problem Statement

The Myaamia Mapping Project represents the mapping of the Miami pre-removal landscape, the geographic area of their historic use and occupancy using GIS. The historic Miami Tribe suffered and survived the arrival of Europeans and subsequent United States political control and associated societal pressures. The act of removal combined with subsequent assimilation and termination agenda of the United States Government and its people has divided the Tribe between those removed to reservations West of the Mississippi River in 1846 with full tribal status and those Miami families allowed to remain in Indiana without tribal status (Baldwin 2004). This tumultuous period in Native American history resulted in the loss of not only much of the pre-settlement Indigenous population in the New World but also of much of the diverse languages and traditional ecological knowledge that had been cultivated during thousands of years of experience with specific biophysical landscapes prior to Western expansion.

Maintaining their survival throughout these hardships, the Miami Tribe of Oklahoma remains a sovereign nation in charge of their self-determination. As such, the Miami of today actively engage in research and education projects aimed at revitalizing their language and culture and teaching Tribal members of their heritage in order to revive what has been lost of their language and traditional ecological knowledge. However, before the initiation of this project, the Miami Tribe of Oklahoma realized that they did not have a map of their original territory nor any framework for applying either historic or emergent cultural information to that map if it was in existence. The Myaamia Mapping Project was initiated to provide Tribal members a visual representation of their historic landscape. The resolution of the Miami Tribe’s NAGPRA claims will also be assisted by the location and mapping of places from which Miami cultural materials have been collected. A digital map layer corresponding to the location, nature, and history of Miami Indian human remains, funerary objects, sacred objects and objects of cultural patrimony can be organized by the Tribe within this project’s GIS framework to assist in the repatriation of these materials. The project also enhances current Tribal-led research and cultural revitalization projects by allowing the mapping of Miami historical information and elements of the Miami language within the project’s digital map layers.
Furthermore, Miami Tribal culture is not part of the curriculum in the public school system of Oklahoma. Responsibility for the enculturation of Miami Tribal members of their heritage, language, and culture rests solely with the Tribe. Cultural preservation and revitalization are also important for the further realization of Tribal identity (the understanding of what it means to be a Miami Indian) and how this identity can be applied by the Tribe in the present. The education of the historic Miami way of life is important for tribal members because it allows them to act in ways appropriate to their ancestral culture. The significance of this reconstruction of identity for Tribal members lies in the further restoration of pride and sovereignty within the Tribe by allowing them to control the creation of their own maps for their own purposes. Thus, the continued addition of Miami cultural and historical information to the GIS will assist these education and cultural revitalization efforts by locating relevant information within the map’s spatial coordinate system and allowing for their analysis and study.

**Research Goals**

The Myaamia Mapping Project revolved around conducting a community-based mapping project organized according to the perspective of the Miami Tribe. Project objectives undertaken to attain the project goal of delivering resulted in a culturally appropriate digital map database for the Tribe to use for their ends. Objectives included formation of digital map layers requested by Daryl Baldwin of the Miami Tribe and research into Miami history during the time period of their occupancy within their historic landscape. The mapping project objectives included:

1. Manipulation of the digital map layers to include a polygon of the areal extent of the pre-removal Miami Landscape
2. Formation of a pre-settlement vegetation layer
3. Formation of a 1:2,000,000 hydrographic layer within the landscape
4. Creation of an annotation layer of Miami-Illinois river names
5. Symbolization of Miami-Illinois named rivers in an obvious style
6. Organization of a color scheme and layout to depict the landscape and its features in tones and appearance approved by the Tribe
7. Inclusion of the Miami-English river names table, the map title, and descriptive information according to Miami preferences
8. Assembling and manipulating digital elevation data to achieve a digital elevation model layer for the landscape’s extent

9. Further goals include the provision to the Tribe of the geodatabase of collected spatial information and digital map layers, a listing of free or close to free web-based spatial data clearinghouses utilized in the project’s execution, and basic instruction of the methods used to manipulate the data within the ArcMap geographic information system as requested

**Miami Context**

The historically known Miami Tribe lived and practiced their culture within the present-day states of Ohio west of the Scioto River, Southern Michigan below the St. Joseph River, Southern Wisconsin below the Fox River, and the land areas of Indiana and Illinois, from the mid 17th century throughout the mid 19th century. Evidence of the Miami comes mostly from the assemblage of the accounts of traders, explorers, and priests after the Miami were added to the record of history (Anson 1970, 3). First recorded outside knowledge of the existence of the Miami came from Gabriel Druillettes, a Jesuit missionary arriving west of Lake Michigan near present day Green Bay, Wisconsin in 1658. He was told of the Miami by a group of Chippewa Indians that referred to the Miami as the “Oumamik” or “people of the peninsula” (Anson 1970, 4). The Miami from this period referred to themselves as the “Twaatwa” or “Ta-way” mimicking the alarm cries of the sandhill crane (Shriver 1989, 1). In the 1670’s, Father Jacques Marquette recorded the group’s name as “Miami”. Despite the early refusal of the British to endorse the French term “Miami”, instead preferring the British version of the Twaatwa term “Twightwee”, the name “Miami” has remained through the present (Shriver 1989, 1).

Early Miami settlement locations included present day Chicago, at the headwaters of the Fox River in Wisconsin, and along the St. Joseph River. The wide range of Miami occupancy indicates the likelihood that the Miami inhabited a geographic range much greater than the “people of the peninsula” label given by the early Jesuit missionaries (Horr 1974, 33). The Miami were living in regions of Wisconsin and Michigan largely as a result of member groups fleeing from Iroquois war parties invading their territories beginning in 1649 (Pare 1930, 1). As Iroquois aggression gradually lessened after these conflicts, Miami groups began migrating back into the areas of the Midwest with settlements concentrating near the Wabash, Tippecanoe, Eel River, Mississinewa, and Maumee watersheds of Indiana (Shriver 1989, 2).
The Iroquois Confederacy of the Five Nations looked to take control of the extensive fur resources in the Midwest after almost completely exhausting the beaver population of their home ranges in New York State and nearby Canada (Belting 1958, 1). The Iroquois, attempting to enhance their alliance with the French and benefit from the quality of furs from the Midwest, began to move into the lands of the Miami and other Tribes around 1650 (Swader 1999, 2). Their lust for the quantity and quality of beaver pelts from the Midwest was fueled by the increasing dependency upon European goods and firearms and the necessary maintenance and replacement of these non-native implements (Richter 1983). As a result, the Iroquoian groups violently and successfully pushed into the Midwest during the mid-17th century in an offensive known as the Beaver Wars, attempting to secure the rich quality of beaver pelts available in the Midwest to establish better trade relations with the French as middlemen in the fur trade (Richter 1983).

The Illinois Tribes moved into areas of the current states of Illinois and Missouri around 1650, the same time the Miami Tribes were moving back into the areas included in their historic landscape (Blasingham 1956). The close connection of the Miami-Illinois language and the many cultural similarities of the groups blurred the lines between the groups. The Miami are of the Illinois branch of the Central Algonquin linguistic group. Classification of Indian bands into one grouping or another was simply a strategy for the discovering nations to initiate the transfer of land tenure from Indigenous control to the control of the expanding colonial states by providing for specific signatories, i.e. “tribes”, for the treaty process and its expropriation of land from Indigenous use. The tribal category process lumped groups together using criteria including alliances, linguistic similarities, and comparable cultural traits. Groups such as the Miami, the Ojibwa-Potawatomi-Ottawa, Mesquaki-Kickapoo, and Shawnee are members of the same linguistic branch and share many similarities both in language and culture. The Illinois grouping of Indians spoke a language very similar to the Miami language. Languages shifted and changed as groups splintered off main linguistic branches and modified once-shared cultural and linguistic features. The languages of these groups may be considered as dialects of the same language. A map by Sturtevant (1967) of the general layout of the various Indigenous linguistic stocks (Figure 1) is provided online in *.jpg format from the University of Texas (see Web based data sources for web link).
The Miami Tribe has survived debilitating adversity and loss imposed on them by the French, British, and American societies. To label it as adversity alone would be an understatement as they suffered through periods of disease, war, and the loss of their traditional lands after first contact with the non-native, dominant societies. The Miami Indians and other tribes also experienced a growing cycle of dependence on Western technologies that necessitated the reliance on manufactured goods and the continued loss of traditional methods of subsistence.

The idea of ‘tribe’ was not embraced by the Indigenous peoples it claimed to represent. This classification system was imposed on Indigenous peoples by the newly arrived Euro-American influences. The non-native classification of individual tribes into larger groups failed
to realize that the Indigenous peoples understood their complex political and cultural affinities. In the place of Indigenous understandings of identity, the Western tribal concept related groups with cultural and linguistic similarities. Despite the label, native groups understood their social organization and had no trouble understanding where one tribal group ended and another began.

The purpose of the “discovering nations” was to appropriate the lands of North America in any way possible. While, the discovering nations of France and Britain recognized Indian occupancy within the North American continent, these nations did not consider the rights of the indigenous peoples in the splitting of lands into territories and claiming ownership of land areas (Thomas 1899). With the independence of the United States in 1777, the stage was set for a new kind of adversity much different than that posed by the proselytizing missionaries or low population densities of frontier settlements. The US Government was coming under fire for allowing the control of such large geographic spaces and associated natural resource and settlement potential to individual Indian groups. Thus the impossibility of the co-habitation of Indians and Whites was initiated by a combination of factors. The policies of removal, assimilation, and finally termination in response to ‘manifest destiny’ and the waves of expansion and immigration of US citizens and businesses west of the Appalachian Mountains (Olund 2002) created a situation of cultural genocide for the Indigenous Peoples of North American resulting in the loss of the ability of the “other” to live as sovereign peoples in control of their own cultures and destinies.

Waves of whites traveled west of the Appalachian Mountains to settle the new frontier. As new groups increasingly immigrated from the East and non-native populations rose, so did disputes over native “control” of such large geographic areas. The treaty process was initiated by the United States Government to “legally” claim title to Indian-controlled lands in exchange for goods or promises of annuity payouts (Olund 2002). The reduction of the Tribal landbase and subsequent forced migrations of Native Americans from their respective territories proved devastating for tribes by removing them from their ancestral geographies. Removal broke the connection to a knowledge base that had grown for thousands of years in response to ecological, spiritual, and functional bonds that had materialized through close relationship to specific landscapes. The Miami Tribe was not a passive victim of these currents of change and readily adapted to changing social and political situations by accepting or rejecting methods and materials of their choosing. Becoming efficient traders, fierce warriors, and eloquent diplomats,
the Miami were able to wage an active and somewhat successful resistance to the negative influences of native aggression and non-native settlement, defending their territories and culture to the best of their best ability (Anson 1970). Nevertheless, the periods of warfare and disease marked by the arrival of missionaries, the Iroquois aggression, non-native encroachment into their lands, and the commencement of anti-Indian policies proved too significant to defend against.

Removal of the Miami Tribe to reservations west of the Mississippi was outlined in the Treaty of 1840 signed at The Forks of the Wabash near present day Huntington, IN. It was stipulated under this treaty that the Miami would begin moving westward to the lands allotted for their reservation five years after the signing of this treaty of 1840. The actual forced removal of the Miami began in 1846. Figure 2 shows the Congressional document that effected the removal of the Miami to reservation lands.

Figure 2 Record of legislation regarding the extinguishment of the Miami and Pottawatamie Indian Tribes (American State Papers 1836)
Figure 3 shows the Congressional record of the final treaty struck by the Miami before their removal that is included in the American State Papers report of 1899. This treaty relinquished the Tribe’s last remaining lands in the Midwest, and agreed to the emigration of tribal members to reservations reserved for them west of the Mississippi (Anson 1970). Removal would divide the Miami community as the Tribe moved west to the newly established reservations and a smaller grouping of Miami families who were exempt from removal to remain in Indiana without tribal status (Baldwin 2004).

![Congressional record of Miami removal](image)

**Figure 3** Congressional record of Miami removal (American State Papers 1899)

### Determination of Landscape Boundaries

The Miami describe their historic land area after migration to the Midwest as *myaamionki*, “the place of the Miami”, in the Miami language. Map outputs of the land area are labeled as the “Miami Presettlement Landscape” to stress that while the land area constitutes the extent of Miami activity during this time period, the same area was also shared with many other tribes. Using “landscape” to define Miami use and occupancy areas during this period helps as well to stress the importance for the Miami to conceptualize the land area in terms of a holistic whole of natural biophysical systems. The digital map layers are organized as much as possible to represent the landscape as the historic Miami Tribes named and understood the homelands of their ancestors as much as possible.

Determination of the landscape boundaries was achieved in two particular ways. The Greenville Treaty, drafted after the General Anthony Wayne’s decisive defeat of the Indian
forces at the Battle of Fallen Timbers in 1794, provided an opportunity for the description of the geographic area the Miami considered part of their historic landscape. Mishkinakwa, Chief Little Turtle of the Miami, gave a geographic description of Miami territory in words he spoke at the signing of the Greenville Treaty of 1795 (Figure 4). His speech helped conceptualize the initial boundaries of the landscape area. In this famous speech to the tribes and the US Government officials present at the signing of the Greenville Treaty, Mishkinakwa declared “…my forefathers kindled the first fire at Detroit; from thence, he extended his lines to the head waters of Scioto: from thence, to its mouth; from thence, down the Ohio, to the mouth of the Wabash; from thence to Chicago, on Lake Michigan…” (US Congress 1998).

Secondly, a linguistic criterion conceives the landscape boundary to extend to those regions for which the Miami have placenames. The existence of placenames identifies areas relative to historic occupation, movement, and land use within a geographical region. In response to the high number of placenames, the boundaries of the landscape were extended to include the Southern parts of Wisconsin below Green Bay, Southern Michigan below Detroit and the St. Joseph River, and Lake St. Clair and its Walpole Island in the extreme North East extent of the map to fulfill this requirement. After removal the Miami began to have placenames outside their original landscape as they found significance in new areas and features that were experienced as the Tribe moved to the west (Baldwin 2004a).

**Figure 4** The Greenville Treaty
Non-Native Maps of Miami Occupancy

Early French and British maps of the Midwest note the location of the Midwestern Indian Tribes including the Miami. In each of these maps, Miami and Illinois tribal influence is shown in Indiana and Northern Ohio. For example one map (Figure 5) locates both the Illinois and the Miami Tribes in proximity to the Maumee/Wabash watersheds. Here Bowen identifies the Miami proper as the Twightwies. Many of the early maps of North America of French, British, or US creation locate the Miami culture within a similar geographic region and use a variety of spellings to identify the Tribe (see Bonne 1783; Bowen 1784; Arrowsmith 1811; Cary 1806).

Figure 5 Early map of North America referring to the Miami referred to as the ‘Twightwies’ (Bowen 1784)
The Tribe’s location in the eastern woodlands prior to removal was mapped within the compilation of the ethnohistorical accounts of Midwestern Tribal occupancy (Horr 1974) pursuant to the American Indian Claims Commission of 1946 (60 Stat. 1049; 25 U.S.C. § 70). The Indian Claims Commission conducted this research to identify the original geographic regions occupied by Midwestern Tribes to determine rightful claims of ‘aboriginal title’ to specific regions (Horr 1974) and to make good upon unpaid or unsettled treaty provisions.

The historic descriptions of native habitation represented within the claims reports are not necessarily an accurate assessment of actual geographic regions utilized by a particular native group. While reports such as these help to define the Miami from a European interpretation, it is important to emphasize that these and other accounts of the Miami derive from non-native observations.

An output of this ethnohistorical accounting is included within the ethnohistorical report a map of Miami-Illinois occupancy (Figure 6). The Miami-Illinois range depicted in this map is quite different from the landscape created during this mapping project. A possible reason for this is that while both non-native researchers and indigenous peoples often utilize the same historical resources, their respective agendas can be quite different.

Figure 6 Map of the range of the Miami-Illinois-Peoria Peoples (Horr 1974) included within the Aboriginal Claims Commission report
The resources consulted during this research and the methodologies used in creating this map were not provided in the ethnohistorical report of 1974. The reasons why some areas, such as the area extending to Green Bay along Lake Michigan and the area of Western Ohio, are not included in the ethnohistorical mapping of tribal occupancy is unknown. Possible reasons for this and other inconsistencies between historical evidence of Miami occupancy and the current form of the landscape may emerge as the result of inaccurate or incomplete historical documentation of tribal settlements and band affinities. The notion of “tribe” as a foreign construction to classify Indians into categories might not have realized political and cultural differences and similarities recognized by the many Indian groups it attempted to classify. Furthermore, potential Euro-American misunderstandings of the continual reorganizations and movements of semi-nomadic peoples may have promoted inaccurate or incomplete understandings of tribal occupancy.

**Conceptual Framework**

The tribe’s main objective in this mapping process involved the creation of a more exact and workable delineation of their pre-settlement landscape and its biophysical characteristics using digital map layers. The tribe retains the authority to decide what features of importance are to be included in the map and how they are displayed. As such, the creations of the geodatabase and output maps resulting from this mapping project are determined through the Miami perspective and are dependent upon Miami criteria and display requirements.

Indigenous peoples benefit through community-driven research that preserves and protects local knowledge systems, intellectual property rights, and the inherent right of self-governance. The use of digital mapping technologies by and for indigenous peoples simultaneously builds communities’ capacity for self-reliance and protects indigenous knowledge (Goes In Center 2001). While digital mapping and remote sensing technologies are often used in the context of Western scientific, governmental, and management spheres, indigenous peoples are adopting the use of these technologies to create maps including elements of importance to their respective needs and individual applications.

Geospatial technologies are becoming increasingly available and accessible for Indigenous groups because of several factors. Decreasing costs of computer work stations and
increased processing power and data storage capabilities enables the setup of mapping labs within a reasonable budget. Governmental and professional training and capacity building seminars (such as those provided through the USEPA or ESRI) disseminate the expertise needed to run effective mapping projects. Low cost or free clearinghouses for geospatial data are widely available over the World Wide Web for download and manipulation. Finally, the use of geospatial technologies by and for Indigenous peoples helps meet the ever present need to manage their lands as well as to preserve and protect their cultural heritage.

GIS provides a framework for spatial data organization that orients many different kinds of information within a common coordinate system, providing the ability for overlay analysis and layered display of many data types. Native cultures commonly stress the importance of relationship and responsibility to the land and its inhabitants. Geographic information systems can incorporate the worldviews of Native peoples in that they can provide a framework for the representation, output, and analysis of relationships between various data that, if set up and managed with a native perspective in mind, can be aligned with the holistic outlook of Indigenous worldviews of human interrelation with the natural world.

A GIS is capable of organizing, manipulating, and layering multiple themes within a common coordinate system. GIS has a wide range of applicability and is used within many contexts including market research, conservation of natural resources, and government to name just a few. It combines the “where things are” with “what things are” (ESRI 2002). Spatial data of different features are referenced within the system under the same coordinate system. This allows for the analysis of interactions and relationships between distinct data themes as they overlay one another within space revealing spatial relationships not possible using a non-spatial database (Johnson 1997). Information about the features within each theme is stored as attribute data, tabular information describing characteristics of map features (ESRI web glossary), connected to the points, lines, or polygons representing the features within the visual display.

Indigenous Peoples the fastest growing user groups of geospatial technologies in the context of and their management of their lands and Indigenous knowledge (Johnson 1997). The possible inclusion of many different data types into a GIS project is attractive to Indigenous peoples because individual worldviews can be identified and represented through the making of maps, the content of which remain under the control of the map maker. While the benefit at first
glance may seem to be only the arrangement of a mapping program for a group of people, the benefits of the project’s results are more far-reaching. Mapping, at least in the western cartographic sense, has historically been the guarded secret of colonial societies. The map has often been considered as an objective resource that conveys value-free information to the map reader. However, the elements within the map are dependent upon what the creator considers significant enough for inclusion. Indigenous Peoples, while employing their own methods to map their landscapes or resources of importance, have been left out of the development of Western cartography (James 2002). As such, the maps we view within our own US culture are devoid of features that may be of importance to other sovereign “domestic dependent nations” operating within the United States borders. Harley raises the question of ‘silences in maps’ and the importance of considering what is left out of a map display. In his essay Harley discusses map making in medieval Europe and in the nascent United States of America where mapping areas was used as much for political purposes (such as raising interest in the settlement of the lands West of Appalachia or for claiming jurisdiction and ownership of areas) as for the standard uses of orientation and travel. In the case of the Indigenous Peoples of the United States, maps created during the establishment of the territories that would become the states of the US consistently denied the existence of Indians within their display and effectively wiped the landscape clean of the other even before they were actually removed (Harley 1988).

In his thesis, Ben Johnson describes the application of mapping technologies within an indigenous context. The creation of maps in the Western cartographic sense, Johnson points out, has allowed for their acceptance as rarely questioned, objective sources of information. Johnson refutes the inherent objectivity in printed maps, observing that the decisions made concerning what to include in a map are subjectively based upon the needs or agendas of the culture from which they emerge. Maps, Johnson explains, are necessarily reductionist in nature for the simple fact that reality cannot be adequately recreated within the confines of a geographic database. Far too many details would be necessary to create a map of this kind that would be intelligible to any degree. Maps then must condense the complexity of reality to allow for intelligibility of features of importance to the map’s purpose (Johnson 1999). The choice of elements included in a map is therefore determined by a subjective process that bolsters the opinions of the creating group. Empowerment arrives through the mapping of cultural information for the simple fact that the
elements of importance included within the GIS and its outputs can be determined and controlled by the group that has created the map.

The project empowers the Miami to continue to map their traditional territory and its features as they see fit using their already established GIS capabilities. The project is an application of unique utility to the Miami Tribe in that it represents a jumping off point for continued examination and analysis of known Miami history and knowledge as applied to the spatial extent of their historic landscape. Through continuous addition and revision, the GIS will grow and reveal the Miami cultural landscape as it was historically understood. The capacity for the Miami to investigate and realize their history, language, and culture as it existed within geographic space is achieved by allowing for the Miami to continue this project at their control within the GIS system.

In “Boundaries of Home: Mapping for Local Empowerment,” Doug Aberley describes the process of expanding the ability to map using geographic information systems to indigenous peoples. Aberley describes the key to empowerment through mapping the experience of place, the realization of cultural interaction with the ecosystems of a specific geographic extent, through bioregional mapping (Aberley 1993, p. 14). The benefits of this type of mapping process for Indigenous peoples come from the ability of the system’s users to decide what elements of importance should be included within maps. Empowerment is achieved as groups use the powerful mapping and analysis software to enhance the understanding of cultural history while increasing the effectiveness of self-government.

The Importance of Place

For the many distinct Native American groups, both those living and those that have not survived, the connection to land and place is integral to their individual knowledge, language, and cultures. The historically known Miami Tribe also was fundamentally enmeshed within the physical and ecological environment in which they practiced their respective ways of life before the establishment of the European Territories and the United States. From this close relationship with a geographic space and its characteristic ecology and biology, place-based knowledge about that specific region grows over time. This place-based knowledge is defined by Brockman, et al., as Traditional Ecological Knowledge. Brockman continues to describe the consequences of
displacing a people from its knowledge base by linking the social upheavals suffered in Native America and increased levels of suicide, alcoholism, and health problems to the loss of identity and self-esteem caused in large part from the removal of these peoples from their historic landscapes (Brockman 1998).

The policy of Indian Removal was enacted to conclude the Indian Wars and divide the Indians from encroaching White civilization by placing them within the reservation system. Indian removal authorized and carried out by the United States Government proved tremendously damaging to Miami place-based culture. Reflecting on the significance of Indian removal in terms of the native perspective of its effects, Carson describes that “...it [removal] upset the spiritual systems of ritual and power that Native Americans had written into the landscape… [Their] understanding of land and their relationship to it is vitally important to their cultures and histories.” (Carson 2002). The removal of the Tribe remains the Miami’s most significant hardship, splitting the Tribe between those allowed to remain in Indiana without tribal status and those removed to reservations west of the Mississippi with tribal status. Gregory Cajete, a Tewa Indian from Santa Clara Pueblo, expands on the idea of place-based culture and the indigenous connection to the land in his book, Native Science, with the statement “…this understanding that Indigenous people have is a very particular and very profound relationship to the natural world…their philosophies, cultural ways of life, customs, and language, all aspects of their cultural being in one way or another are ultimately tied to the relationships that they have established and applied during their history with regard to certain places and to the earth as a whole” (Cajete 2000).

Indian Removal policy acted to destroy or at least significantly impact the retention and perpetuation of the Indigenous ways of life and language for those living as well as for future generations. Even as Native Americans were to be allowed to continue their respective cultures after removal, the US Government and protestant missionaries continued the regulate and proselytize Native communities with the goal of absorbing them into the sphere of Western culture and eradicating their respective ways of living (Brockman 1998). Without the geographic and ecologic space from which Miami culture creatively emerged, significant loss of their language, cultural heritage, and traditional ecological knowledge has occurred. However, The Miami of today have survived these hardships and are pursuing in the revitalization of their culture in spite of the context created from a legacy of historic exploitation.
Reconstituting Place with Maps

The Myaamia Mapping Project represents the initial phase of inquiry into Miami-Illinois ethnohistory using a geographic information systems approach. The significance of Indian Removal lies in the subtraction of Indian influence from the lands sought after by the expanding nation. Removal and the subsequent policies of assimilation and termination acted to erode the Miami Tribe’s traditional ecological knowledge and understanding of their language. By 1946 the Miami Language was considered a “dead language” without any fluent speakers left. Similar stories of knowledge loss can be seen in the organization of the Miami Ethnobotanical Database and the difficulties of finding how the Miami managed and maintained biological communities. The loss of their historic landscape is difficult to reconcile but not impossible. The benefits of this project are far reaching as the power of this venture lies in the continued addition of Miami-specific culturally relevant layers to the geodatabase and the revival of knowledge once thought to be lost but can be recreated within the digital map environment. Much progress has been achieved in restoring Miami heritage through the Miami’s management of language revitalization and cultural preservation projects.

The Tribe manages several such projects aimed at the education of Tribal members and revitalization of their language and cultural heritage to counter the continued loss of Miami knowledge. Some of these efforts include projects to restore wetland habitat on their Oklahoma allotted lands, the hosting of language camps to teach the Miami language, translation of historic Jesuit dictionaries and journals to derive a more complete Miami-Illinois language. Other Miami-centered research projects include the identification and cataloguing of culturally significant plant species and traditional ecological knowledge known by previous generations of Miami Indians, the creation of language resources to aid cultural education and language camps, and the viewing, study, and repatriation of Miami artifacts through the NAGPRA program. Miami-focused revitalization initiatives conducted through the collaboration of the Miami Office of Cultural Preservation, the Myaamia Project, the Institute of Environmental Sciences, and the departments of Geography and Botany are resulting in a growing understanding of the Miami-Illinois language and the cultural history of the Miami Tribe. Results from the Miami Tribe’s research efforts combined with the Tribe’s strong impetus to strengthen and celebrate their language and culture bring success to this and other Miami-oriented research endeavors.
The Miami research projects are revealing data capable of addition into the GIS database. The places associated with river names describing whether a river was rocky or muddy, trail and trade networks, or traditional hunting grounds all have happened “somewhere” and can be mapped. Also, literature concerning the Miami in the works of Anson, Shriver, Blasingham, Mann, Erminie-Voeglin, Tanner and others may be consulted to determine the locations and spaces of features such as: settlement sites, battlegrounds, trail networks, and areas of various treaty cessions. This information provides a foundation for the understanding of Miami activities and relations with other groups throughout their tenure in the Midwest prior to removal and their addition to the spatial database of the GIS. Figure 7 shows an example of a location of Little Turtle’s Miami Village that could be added to the digital map layers and linked to photos of the site.

The continued mapping of Miami specific information will begin to reveal the Miami cultural landscape with increasing complexity and allow much deeper levels of inquiry. Possible additional phases of the project may include, for example, creating new data layers such as settlement locations, trail networks, or additional narrative text written in the Miami language. The project is left open-ended to allow for its continuation at the discretion of the Miami. Daryl Baldwin comments, "The mapping project has become a priority more for its ecological value than for its historic value. What the project has been able to do is create a more accurate representation of Miami land use patterns within a geographic space. This will greatly influence our ecological understandings which we need to live on and care for our current land base in Oklahoma (Baldwin 2004b).”
Methods and Mapping Process

The main contribution of the author to the Myaamia Mapping Project is described in the following sections. The mapping processes used to organize the digital map layers is described in individual sections. The layers completed during the mapping phase of the project include a polygon of the landscape extent, a hydrology layer, a pre-settlement vegetation layer, a digital elevation model, and an annotation layer denoting known Miami river names in the Miami language. Data was collected from state and federal sources of spatial data for the creation of the map layers. The data was then manipulated to conform to the boundaries of the landscape as conceptualized by the Tribe.

Spatial data collection and manipulation was undertaken to formulate the geographic area of the Miami Tribe’s traditional landscape and additional spatial layers to fulfill the Tribe’s requests. Each of the layers were associated with a common coordinate system and added to the representation of actual geographic space represented within the GIS as individual overlaying layers. This required the joining and manipulation of digital map layers of each requested feature type to conform to the culturally understood boundaries of the Miami landscape.

Data sources for these layers were compiled from existing online spatial data clearinghouse hosted by federal government agencies and state environmental offices. Resources consulted include the United States Geological Survey, the USGS Seamless Data Distribution System, the National Geographic Names Information Service (GNIS), the National Hydrography Dataset (NHD), the National Elevation Dataset (NED), the Indiana Department of Natural Resources, the Great Lakes Environmental Assessment project, and Environmental System Research Incorporated (ESRI) datasets. The digital map layers were organized using the Arc GIS platform of ESRI.

Landscape boundaries follow natural features such as rivers whenever possible to avoid the hard lines of anthropogenic invention. A digital elevation model (DEM) makes up the background to show the landscape as a continuous surface of ridges and valleys. Earthen colors were used to display variations in elevation and to represent the map’s background.

Hydrology data was collected from the National Hydrography Dataset and clipped by the Miami landscape polygon to achieve a hydrology layer within the extent of the landscape. The
rivers to be depicted in the map include all hydrology at the 1: 2,000,000 scale. The DEM was collected from the USGS Eros Data Center in the 1-degree format.

Mapping Landscape Boundaries

A GIS consists of features represented as points, lines, or polygons existing within coordinate space. The Miami landscape area is represented by a polygon shape that has been derived from the polygons of 5 contiguous states. Ohio, Indiana, Illinois, Wisconsin, and Michigan state polygons were gained from the ESRI United States data set and were joined to create a single polygon without state boundaries. This polygon was then modified to follow the Miami understanding of their landscape from both the historical geographic account of Little Turtle and the linguistic criteria identified in an earlier section. The landscape is now represented as one polygon existing within the combined areas of the five Midwestern states (Figure 8). This display presents the Miami landscape polygon so that the sections of the states that make it up can be viewed.

An important idea for the Miami Tribe is the creation of digital map layers according to their perspective. The Miami Tribe would like to represent the landscape as they understood it during the period of their recorded occupancy of the area. As such, standard map elements such as scale, political boundaries, or directional information are not included in the map output to meet the Miami requirement of organizing the map according to their viewpoint. However, it was decided that, in order to assist the understanding of the map’s content and geographic location, a sub-map represented in Figure 3 is included to help orient the map reader to the location and extent of the Miami landscape.
The brown area represents the Miami landscape extent as a polygon within the GIS system. The landscape polygon was used to associate other spatial data to the landscape extent through the clipping process. A clipping action within a GIS is much like using a cookie cutter to cut dough. For example, a polygon with the desired boundary extent exists within geographic space. This polygon clips a spatial data set of points, lines, or polygons that are of greater geographic extent, i.e. the dough, so that the layer of points, lines, or polygons now fills only the extent of the original polygon, the cookie cutter. This action was performed for the hydrology, elevation, and vegetation layers.

With the area of the Miami landscape now within the GIS, calculation of the total land area of the landscape polygon in its entirety can be computed within the GIS. Areas were computed within ArcView using the Xtools script. The Xtools script works with spatial data in decimal degrees that has been formatted to a projected coordinate system. The script calculates
perimeter, acres, and hectares of the polygon within the data and adds corresponding fields to the attribute spreadsheet table. Next, the area fields were extracted on their own using the ‘summarize’ command within ArcView and saved as a dbf file with their corresponding state. The summarized dbf was then imported into an Excel spreadsheet and were summed using the autosum function within the program. The resulting land totals are shown in Table 1.

<table>
<thead>
<tr>
<th>State Name</th>
<th>Sum Acres</th>
<th>Sum Hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>36,102,029.1580</td>
<td>14,610,031.2990</td>
</tr>
<tr>
<td>Indiana</td>
<td>23,218,249.6300</td>
<td>9,396,129.8490</td>
</tr>
<tr>
<td>Michigan</td>
<td>2,510,030.0320</td>
<td>1,015,777.1790</td>
</tr>
<tr>
<td>Ohio</td>
<td>11,458,055.6070</td>
<td>4,636,929.1410</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>8,944,628.7900</td>
<td>3,619,777.3260</td>
</tr>
<tr>
<td>Total Area</td>
<td>82,232,993.2170</td>
<td>33,278,644.7940</td>
</tr>
</tbody>
</table>

Table 1 Summed areas of the Myaamia Landscape

Compiling Hydrology

Hydrology datasets were collected from the United States National Hydrography Dataset that is available on the World Wide Web (National Hydrography Dataset 2004). This layer uses 1:2,000,000- scale Digital Line Graph (DLG) data produced by the USGS. The National Hydrography Dataset (NHD) is an online repository that provided the digital line graphs, spatially located datasets of lines representing features, of stream and river coverages used in the project (see http://nhd.usgs.gov/). Data was downloaded for the many watersheds that exist within the Miami landscape and were merged and clipped to conform to the landscape boundaries. The USGS also provided hydrology datasets through its FTP data download section of its website. This website has been taken offline indefinitely and is no longer available.

Spatial hydrology data were collected to cover the complete land area of the Miami landscape using these two sources. The data was downloaded as a series of files representing small areas of rivers categorized by respective township location within each state. The files were of the *.SDTS format, a different spatial data format not used in this project and required
modification. Using the ArcMap format management program, Arc Toolbox, the format was modified into coverage format and projected to North American Datum 1983 to match the other layers in the GIS.

The resulting hydrology layer was then clipped with the Miami landscape polygon to include only those rivers that fell within the extent of its boundary (Figure 9). Miami River Names could now be applied to the hydrologic layer by locating their English equivalent and assigning the Miami name within the attribute database associated with the hydrologic layer.

![Figure 9 Miami landscape with 1:2,000,000 scale hydrology](image)
After continued discussion amongst the research team of Miami river names and their prevalence within specific river basins, an additional layer became necessary. Watersheds are the result of physical geography and the ‘lay of the land’. Through understanding not only the characteristics of the hydrology within the landscape as well as individual watersheds or hydrologic units, further understanding of the Miami settlement patterns will have been achieved. For example, the location of the Miami settlement known as Kekionga, or The Glorious Gate, was so not only because it marked the center an easy eight mile portage between the Maumee and the Wabash rivers which provided easy transportation to the Northeast and the Southwest, respectively. Its location was in part determined by its strategic location amongst the vast swamps of present day Northern Indiana and its highly defensible position.

Watershed boundaries were also manipulated to the extent of the landscape. These spatial data are served from the National Atlas website (http://nationalatlas.gov/atlasftp.html). The display of watershed boundaries helps the reader to be aware of the landscape as a collection of individual concavities and convexities of a rolling terrain, vegetation types, and, insight into how Miami settlements and movements were influenced by the physical geography and ecology of their landscape. To show each bordering watershed in complete size, shape, and geologic influence upon the rivers and streams flowing in the actual landscape, this layer is spatially reduced to only near the Miami landscape. The watershed layer was not clipped to the edge of the landscape boundary to depict the landscape as an amalgamation of river courses determined by each regions’ physical geography. Watershed boundaries are provided to help reach an accurate model of the Miami homelands as it was historically experienced (Figure 10).
Pre-settlement Vegetation

After early vegetation maps composed from the original land surveys were located for each of the five states they were scanned into a digital format. Each digital picture was imported into an image-processing program, Adobe Photoshop, and reformatted and saved into another file so that only the image of the vegetation map was included. This process cut away extra information from the image such as page borders and descriptive information. The resulting state vegetation image by itself was then imported into ArcMap and georectified to the existing layer of the five state polygons. After importing all of the pre-settlement vegetation maps and rectifying them to the map’s coordinate system, each map piece could now be added to the
display and would load according to the coordinates applied to the map in the previous step (Figure 11).

The images were then located within the coordinates of the landscape although they are not in a format capable of analysis within the GIS. In order to further prepare each vegetation map, the polygons of various vegetation associations displayed on the maps would have to be digitized within the GIS and associated with corresponding attribute information (i.e. Oak-Hickory, Beech-Maple, etc.) in order to be useful and ready for analysis. A section of the pre-settlement vegetation map is missing from Michigan and the Canadian section below Lake St. Clair simply because paper vegetation maps were had not been located for these areas.

The approach used to create the pre-settlement vegetation layer was modified when datasets were located from state environmental offices and programs that had already digitized
the information found in the paper maps, allowing for their use within the GIS. Michigan, Ohio, Wisconsin, and Illinois all conducted the creation of pre-settlement vegetation layers from the original land surveys. Indiana, however, has not yet completed a pre-settlement vegetation layer of similar resolution of the other states and has simply created a layer based upon the research of Alton Lindsey, et al (Lindsey, Crankshaw, and Qadir 1965).

A problem was found within these layers as each state had conducted its study as an independent endeavor. The Michigan, Wisconsin, Illinois, and Ohio vegetation layers each have a greater number of classes and higher resolution than the Indiana original map. As a consequence, classes within the one state’s attribute information were not congruent with the other states, precluding the easy combination of vegetation data.

Data on the vegetation of the landscape was sought initially from historic pre-settlement vegetation maps for the individual five US states comprising the Miami landscape. These maps constitute the mapping of vegetation data recorded by the General Land Office surveys of the 19th century. The surveys were the first attempt to subdivide the landscape into individual parcels to allow for the sale or transfer of lands ceded by the Indian tribes through the treaty process. To fulfill this charge, the General Land Office was responsible with surveying and recording characteristics of each survey plat.

The pre-settlement vegetation layer for Indiana, the region of greatest Miami settlement and use, relies on the research of Alton Lindsey and the help of Ben Hellmich of the Indiana DNR. Initially, the pre-settlement vegetation map for Indiana was found in, “Natural Areas of Indiana and their Preservation.” The map contained in this book was rectified within ArcMap to the polygon layer of Indiana. Mr. Hellmich has provided a shapefile created in Indiana that is based upon the research of Lindsey used in the current layer of pre-settlement vegetation.

Indiana DNR completed a significantly higher resolution pre-settlement vegetation layer for the section of Northwest Indiana close to Lake Michigan. The Lake Michigan pre-settlement vegetation area provided by Mr. Hellmich and the IDNR shows how much more refined a pre-settlement vegetation layer for Indiana could be if further study and recreation of Indian General Land Office Surveys is completed. The combined pre-settlement vegetation digital map layers are shown in Figure 12.
Lindsey’s Indiana pre-settlement vegetation map used in the project has five vegetation categories (Quercus-Carya, Fagus-Acer, Fagus-Quercus-Acer-Carya, Wetlands, and Dry Prairie). The Indiana layer lacks the resolution and classifications of all other state pre-settlement vegetation layers. Since the map must continue to conform to its least resolute data source, all other vegetation maps must reduce the resolution of their categories schemes to the level of Indiana’s vegetation attributes. A revision of the Indiana pre-settlement vegetation layer stands as a possible application for a future project phase. However, a discussion of vegetation categories to use within the map that included Daryl Baldwin, Tom Klak, Mike Gonella, Billy Terry, and myself concluded that using the more general categories for vegetation provided by the Indiana layer is adequate. The general categories provided in the Indian layer suffice for a preliminary understanding of the different vegetation associations and their locations throughout
the landscape. However, further work on the vegetation layer is necessary to reduce the differing vegetation categories from the individual pre-settlement vegetation maps into one classification system applied homogenously across the landscape.

**Digital Elevation Model**

Digital Elevation Models were collected for the entirety of the Miami landscape from the Eros Data Center (EDC) of the USGS. The 3 arc-second (or 1:250,000-scale) scale 1-degree DEM datasets correspond to the USGS topographic map series. The files are available for no cost via ftp download through the Eros Data Center’s website (http://edc.usgs.gov/geodata/). Datasets were downloaded in the format provided by the EDC as many individual pieces of elevation data. The individual raster datasets were merged into one file using a MOSAIC command within the command line-driven ArcInfo GIS. The resulting DEM covering the entire area of the Miami landscape is shown in Figure 13.

![Figure 13](image)

*Figure 13* Complete DEM organized for the project before reduction to the Miami landscape extent
Applying Miami-Illinois Hydronyms

Research by Daryl Baldwin and Michael McCafferty established a list of known river names and their English associates. Applying a darker color scheme to the Miami-named rivers and a lighter color scheme to the remaining hydrology shows the existence of rivers as they naturally occur within the landscape while highlighting the Miami-named rivers at the same time. The attribute data of this hydrology coverage includes fields for the length of river segments and several other descriptive fields. Coverages are an ArcInfo dataset comprising three individual file types, polygons, arcs (lines), and attribute information. River names are not included within this attribute data, however, and an important step required editing the hydrology coverage to establish fields for known Miami river names and their English equivalents.

Miami river names were assigned within the hydrology layer as an annotation layer. The attribute information for the hydrology layer was expanded by to allow the inclusion of Miami river names and their English counterparts. The display could be toggled from a Miami language display to an English display and vice-versa to aid in the location of rivers during the organization phase.

Rivers were first located in atlas maps and the corresponding river was determined within the GIS. This process was time consuming and inaccurate when rivers were too small to be represented in Atlas maps or were amidst many other rivers that made choosing the correct one to assign the Miami name difficult. To solve these issues, the Geographic Names Information Service (GNIS) was used to create a hydrologic names point layer within the landscape to assist the location of the correct rivers to assign Miami river terms.

The GNIS is a database of geographic names of many features such as place names, wellhead names, significant feature names, and includes river and stream names for the United States. The database is in text format and includes names for the many different features. The text file was imported into a Microsoft Excel spreadsheet and all river names were chosen from the list of geographic names to save as a *.dbf files capable of being imported into the GIS. Each hydrologic name in the GNIS database is associated with latitude and longitude coordinates and was easily added to the map layers as points referring to respective feature names. With a point shapefile of all river names now in the GIS, location of specific rivers could be completed.
with a high degree of confidence using simple queries of the data. This method proved invaluable as it allowed the location of rivers to be named with both greater speed and accuracy.

After the DEM was reduced to the extent of the landscape a color ramp was applied to the raster dataset to meet the Miami requirement that the background be represented by earthen tones. Across the gradient used to classify the raster data, lighter colors represent areas of higher elevation and darker colors represent lower elevations. The result is shown in Figure 14 with the hydrology layer overlay. The rivers that have been given Miami names are displayed in a bold blue color while the remaining hydrology is shown as faint blue lines.

![Figure 14 DEM background for the landscape and overlaid Miami-named rivers and unnamed hydrology (Miami-named rivers are in bold)](image-url)
The rivers for which the Miami have been able to recover names are in greatest majority in the areas of present day Indiana, most notably Northern Indiana. Evidence exists in the historical recording the importance of this area to the Miami Tribe (see 1774 Wea map in the ‘Future Project Phases’ section). The main Miami settlement and the location of main tribal councils after migration at the close of Iroquois hostilities was a group of villages collectively known as Kekionga located in Northern Indiana, present day Fort Wayne, IN. Kekionga was named “the glorious gate” for its short portage between the Wabash, with access to Lake Erie to the Northeast, and the St. Joseph River of Indiana, headwaters to the Maumee River, which provided access to the Mississippi to the Southwest. This strategic location provided the Miami a safe location to hold tribal councils because it was situated within a location of vast swamps precluding the approach of others without great difficulty (Shriver 1989). With this central location within the heart of the Miami Landscape, Kekionga was considered an important meeting place for all Miami Bands (Shriver 1989).

**Evaluation of Practicum Objectives**

The Myaamia Mapping Project has achieved the organization of the data layers requested by Daryl Baldwin and the Miami Tribe. The landscape polygon, its hydrology, pre-settlement vegetation, elevation, and the Miami-Illinois annotation layers have been completed. The project database and research documents are being provided to the Tribe using large format DVD-R media for the continuation of the project at the discretion of the Miami.

Sharing of output maps of the final layout has been met with approval from Tribal members during the annual Stomp Dance of 2004 in Miami, Oklahoma. All layers requested have been formulated according to the extent of the landscape polygon. However, there are some project objectives that were unable to be completed during the course of the project due to difficulties in acquiring adequate information for their solution.

For instance, the formation of a single pre-settlement vegetation polygon of a common classification scheme has yet to be completed. Difficulty arose when attempting to locate information about classification schemes used in the individual states’ vegetation mapping. Also, the vegetation classification scheme of each state is incongruent with that in use by any other state in question. Without necessary metadata about the attribute information of each
state’s pre-settlement vegetation layer, accurate reconfiguring of the layers to make one continuous polygon extending across the totality of the landscape polygon was impossible.

Also, location of altered features and the recreation of their original conditions was also unable to be completed save for the collection of a few scanned map resources that may be used to identify zones of human modification. Further research into features that have been modified since the removal of the Miami will stand as an important stage in recreating the landscape as the historic Miami Tribes understood it.

Instruction in the methods used to map features within the map was conducted in a one afternoon session with Tom Ward, then (February 2004) head of the Miami Environmental Office. Further instruction could be easily arranged and carried out. The following paragraphs describe a preliminary explanation of mapping procedures.

I instructed Mr. Ward on some data mining techniques and sources for free spatial data from governmental geospatial data clearinghouses during a visit to the Miami Nation’s lands in Oklahoma during their annual Stomp Dance of 2004. I described the process used to locate rivers for which a known Miami name exists by querying the GNIS digital map layer for its English name and then adding fields to the attribute database so as to assign the Miami term.

As a quick example of the techniques of spatial data manipulation, we downloaded spatial data of Oklahoma Indian reservations, Oklahoma hydrology, and city locations from the Geocommunity website, an online provider of geospatial data. I showed how a user would first reduce the spatial data to the boundary of interest, this time Ottawa County, Oklahoma (the Location of the Miami Nation), and clip the other layers using the county polygon.

We downloaded the GNIS name data for Ottawa County cities and hydrology. Next, I instructed Mr. Ward how to easily create a spatial data layer from a text file that includes latitude and longitude coordinates. I showed him how to import the GNIS text file into an Excel spreadsheet and how modify the latitude and longitude columns’ properties to allow for extra decimal places. I explained that this step must be completed before converting the spreadsheet into the *.dbf recognized by our GIS software so as not to lose important locational information. Next, we added an event theme within ArcMap to achieve a layer of named points within the Ottawa County polygon.
Mr. Ward explained that even as he and members of his staff go to ESRI conferences and training seminars often, they hardly learn as much as he had learned during this short session. This comment speaks to the difficulty of teaching GIS technology through large-group seminars and the implementation of effective GIS applications within communities new to the concepts of spatial manipulation. However, within a short one-on-one session, Mr. Ward understood and could apply some of the explained techniques without trouble.

**Empowerment through Digital Mapping**

Groups are empowered by the ability and create maps and data from their own experience, group knowledge, and oral histories that match the accuracy and the same “data standards and mapping techniques used by state and federal governments” (Goes In Center 2001). Many Native communities around the world have realized the power of maps and are utilizing GIS to settle land claims, conserve their resources, and record culturally relevant information. Geographic information systems therefore can and should be utilized in a Native context to increase their control of resources and traditional knowledge systems to benefit their “objectives, knowledge, and points of view” (Goes In Center 2001).

The project sets up the baseline digital map layers for a historical, Miami-centered traditional use and occupancy study and for further realization of the Tribe’s traditional ecological knowledge. As described by Collier in “A Voice On the Land”, a traditional use and occupancy study identifies features of “traditional” use such as sacred sites, burial grounds, and place names. The occupancy component deals with the location of important features such as trail corridors, settlement locations, and hunting sites. Traditional ecological knowledge on the other hand is the result of the close connection to place and continued observation of the many elements of natural systems and the compilation of lessons learned from this relationship. In the context of native communities, this knowledge is often kept within the realm of stories that pass on this knowledge via verbal transmission.

As the medium for securing and actualizing the concepts of use, occupancy, and traditional knowledge, the use of GIS by Indigenous peoples is creating a new type of story. This new story empowers communities with an effective model for self-determined cultural and
natural resource management. Janis Alcorn comments on the benefits of Indigenous mapping and its empowering effects:

Maps allow participation in arenas dominated by the maps of governments and corporations. Where democratic processes are weak, maps are good tools for challenging development projects that hurt communities. Using maps, community members can evaluate the impacts of an imposed concession, for example, and weigh the costs and benefits of taking action to stop it. Armed with maps, they can demand accountability for the imposition of development (Alcorn 2000).

The expansion of mapping skills to Indigenous communities is important for continued improvements of self-governance initiatives. In “Researching the Indian Land Question in B.C.,” a manual on mapping research for Aboriginal peoples, the Union of British Columbia Indian Chiefs remark on the benefits of using the mapping approach for improved self-determination: “Well executed cultural mapping research and harvest studies can be extremely powerful tools for Indian nations seeking a greater role in the management of their land base and cultural resources” (Ogston 1998, 85).

Furthermore, greater control of the resources and boundaries of the respective Indigenous land bases is important because of the mostly non-urban nature of these land areas. Consequently, industrial, public, and private interests are looking for access to these resources. Respectively, Indigenous communities must be prepared to map their boundaries and assess their resource bases in order to effectively secure them for protection or economic pursuits.

As a result of the power of maps, such maps are being utilized in a legal context to protect the resources present within Indigenous groups’ lands. In this sense, mapping technologies are being increasingly embraced by Indigenous communities because of the perceived objectivity of the mapping process and the adherence to accepted data standards and spatial accuracy. Thus, maps created by and for Indigenous communities provide a powerful resource capable of proving Indigenous use and occupancy and a medium for the transmission of this information to necessary parties.
Continuation of the Project by the Miami Tribe

This mapping project represents the expansion of the Miami use of GIS to assist their language and cultural revitalization objectives. The system provides a virtually unlimited capacity for the addition of new digital map layers of significance to the Tribe. The GIS framework represents a base for the continued understanding of the history and legacy of the Miami Tribe within geographic space. The digital map deliverables assist Miami-centered research and education efforts by providing a more exact representation of the historic landscape of the Miami Tribe and allowing for the addition of new data with the completion of future project phases. Integration of various data types within the spatial framework of the GIS allows for the overlay analysis of the interaction of both the cultural and biophysical features of the historic landscape and increased understanding of their influence on the Miami culture. The mapping project also serves the Miami objective of expanding available opportunities for Miami University students to expand on the project with additional phases. Thus, the project’s continuation will strengthen the mutually beneficial relationship between the Tribe and Miami University by providing the foundation for additional students to pick up where this project leaves off.

Miami-focused revitalization initiatives conducted through the collaboration of the Miami Office of Cultural Preservation, the Myaamia Project, Miami University’s Institute of Environmental Sciences, and the Departments of Botany and Geography, result in a growing understanding of Miami language and cultural history. Current Miami-centered research projects include the identification and cataloguing of culturally significant plant species and ecological knowledge known by previous generations of Miami Indians, the creation of language resources to aid cultural education and language camps, and the viewing, study, and repatriation of Miami artifacts. Results from the Miami Tribe’s research efforts combine with the Tribe’s strong impetus to strengthen and celebrate their language and culture bring success to this and other Miami-oriented research endeavors.

The wealth of information provided within these accounts and the accounts of past research can be applied to the map layers to further elucidate Miami history within visual display. The Miami cultural landscape, how the Tribe understood their world within the
environment of their pre-settlement use and occupancy areas, will continue to be uncovered as these data are applied to the database of digital map layers.

The Miami research projects generate data capable of addition into the GIS database. The places associated with river names describing whether a river was rocky or muddy, trail and trade networks, or traditional hunting grounds all have happened “somewhere” and can be mapped. This historical information is retrieved, the data is mapped according to geographic location, and this adds to our understanding of the Miami cultural landscape.

This emergent information will be included in future project phases, contributing to the database of Miami cultural information. Possible additional phases of the project may include, for example, creating new data layers such as settlement locations, trail networks, or additional narrative text written in the Miami language, (Table 2). Daryl Baldwin comments, "The mapping project has become a priority more for its ecological value than for its historic value. What the project has been able to do is create a more accurate representation of Miami land use patterns within a geographic space. This will greatly influence our ecological understandings which we need to live on and care for our current land base in Oklahoma” (Baldwin 2004b). Thus, the project’s continuation will allow the Tribe to achieve a greater depth of understanding of Miami place-based culture within its historic geographic context while providing opportunities to work with a contemporary Native American Tribe.

<table>
<thead>
<tr>
<th>Type of information</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural and social sites</td>
<td>Meeting places, trail networks, hunting grounds</td>
</tr>
<tr>
<td>Ancestral sites</td>
<td>Traditional land tenure, historic tracks</td>
</tr>
<tr>
<td>Archaeological sites</td>
<td>Village locations</td>
</tr>
<tr>
<td>Sacred sites</td>
<td>Historic burial sites, sacred areas</td>
</tr>
<tr>
<td>Indigenous placenames</td>
<td>Placenames, meanings, movement patterns</td>
</tr>
<tr>
<td>Biophysical resources</td>
<td>Landforms, soils, flora and fauna, elevation</td>
</tr>
<tr>
<td>Special plants</td>
<td>Locations of specific plants used for building materials, subsistence, ritual, or medicinal use</td>
</tr>
<tr>
<td>Land cessions</td>
<td>Treaty lands exchanged for compensation such as annuities or goods</td>
</tr>
</tbody>
</table>

Table 2 Potential layers of the Miami landscape (Harmsworth 1998)
Potential Future Project Phases

Several projects can be initiated using the data found during the formation of this project. Much information concerning the Miami Tribes and their movements within the landscape and their relations with colonial governments and other tribes can be found in the historical accounts of Anson, Shriver, Wheeler-Voeglin, Hutchins’ maps, other early maps, and other historical resources. Many references are made within these works of settlement locations, battles, meetings with government officials, treaty signings, etc. As described in an above section, this information can be researched and located within the map’s boundaries as additional layers for the landscape, further elucidating the Miami cultural landscape.

Some suggestions for further project phases are given below.

1. The Library of Congress provides historic maps of the early United States and the specific treaties that were presented to Native groups to secure lands in exchange for goods and annuities (http://hdl.loc.gov/loc.gmd/g3701em.gct00002). A future project could make the investigation of the treaties and their physical locations and extents a project goal (see Figure 14). The treaties shown in the Indian Land Cession Maps are accompanied with a reference number linked to a treaty and the signatories of that treaty. An interesting application of the treaty maps would be to digitize the treaty zones as polygons within the GIS database and inputting attribute information within that layer to include what tribes signed the treaty, the year of acquisition, and the size of each land area (Figure 15).
Figure 15 Rectified land cession maps within the Miami Landscape (incomplete)
2. Further study can be conducted with the pre-settlement vegetation layers. Future research can combine information from the growing Miami ethnobotany database with the locations of the pre-settlement vegetation types provided in the historic vegetation layer. The scale and species resolution of the pre-settlement vegetation layer would not include many of the plants of importance to the Miami Tribe. However, the locations of each vegetation category included in the pre-settlement vegetation layer may assist the researcher in locating the probable location and distribution of important species. First, one should redefine the divergent categories of the individual state pre-settlement vegetation maps to achieve a standard classification scheme for all. Adding soils and a geologic substrate layers can further elucidate the location of ecoregional variations within the landscape may allow the vegetation project to move from a macro level to a micro level. Research into the original land surveys of each zone of importance may yield important information not included in the vegetation maps. To assist this possible objective, a layer has been modified to the extent of the Miami Landscape including the survey plats of the original land surveys conducted in each of the five states that make up the landscape (Figure 16).
3. A cultural mapping inquiry can also be undertaken. Research into the specific locations of sacred sites, settlement areas, and trail networks will add a great deal to the understanding of the movements of the Miami Tribes and of specific areas of special importance. The 1774 Wea map and others like it can be examined for information that correlates to the locations of known features (Figures 17 and 18). At the very least, these maps can be included in the map layout with descriptive text in the Miami language and its English translation to assist in the education of both native users and non-native researchers of Miami history prior to removal. The Wea map provides a look at how the Miami conceptualized their territory. The Wabash River was considered the most important transportation route for the Miami. Because of its importance the Wabash River is drawn in the center of the map and extends completely to the Mississippi River.
Figure 17 1774 Wea map from the British Museum collection
The identification of altered or man-made features such as roads, rivers, drainage tiles, urban areas, coastlines, etc and research into their original states will provide another important digital map layer. One layer can represent how modified...
features exist in the present. Another layer can show the original states individual features in their pre-modified states. A project can be initiated to recreate the original shape/location of features using historic maps or other archival resources such as land survey records (Figure 19).

Figure 19 Source map showing the original flow of the Chicago River

5. Preliminary discussions have been held with Mr. Robert A. Kubat, Miami University Registrar, concerning the display of the Miami landscape within a university building. Miami University has made plans to organize a Miami Tribe-centered display in the atrium of the university’s Campus Avenue Building, home to all school services. Miami University would like to make a display within this high traffic area to honor the Miami Indians and their heritage. The display will include Miami-made artifacts and artwork. Mr. Kubat would like to include a large format printed map of the Miami landscape to explain the Miami landscape and provide understanding of the Tribe’s legacy. This display could also be a deliverable of a new project phase.
Summary

The results of the mapping project are now available for the continuation of the project by Tribal students or Miami University students interested in mapping in an Indigenous context. The completion of the Myaamia Mapping Project establishes the base layers for the continuation of this historical GIS. Spatial data has been collected for the layers requested by the Tribe. The database has been manipulated within the GIS to prepare for addition to the GIS. A common coordinate system has been established for all layers. The digital map layers and associated attribute information within the GIS may be continuously updated, revised, or modified as new data associated to place within the landscape emerges or if the objectives of the Tribe change. The geodatabase of spatial datasets as well as many of the resources utilized during the project are provided to the Tribe for the continuation of this historic mapping initiative. The mutually beneficial relationship between the Miami Tribe and Miami University of Ohio will provide much opportunity for other students to carry on the torch of mapping the historic cultural landscape for the Miami Tribe and provide the digital map layers needed for its realization. In this way, students will benefit, as I have, from working with the Miami People to assist them in their cultural revitalization efforts, understand and learn from Tribal members, and develop real-world skills needed to assist cultures in the attainment of their objectives.
References


James, T. C. (2002). "Ethnogeography and the Native American Past." Ethnohistory 49(4): 769-


Web-based resources

The American State Papers, comprising a total of thirty-eight physical volumes, contain the legislative and executive documents of Congress during the period 1789 to 1838. The collection includes documents that cover the critical historical gap from 1789 to the printing of the first volume of the U.S. Serial Set in 1817. http://memory.loc.gov/ammem/amlaw/lwsp.html


http://www.nativemaps.org/abstracts/all_peoples.pdf

David Rumsey Collection.  


http://memory.loc.gov/gmd/gmd370/g3700/g3700/ar075600.sid.  Must download a *.sid image viewer to view (see http://www.lizardtech.com for download and installation help).


The David Rumsey Historical Map Collection Archive of 18th and 19th century North and South America maps and other cartographic materials. http://www.davidrumsey.com/


http://www.miamiindiansofindiana.com

USGS DEM downloads.  1:250,000-scale Digital Elevation Models (DEM):  


The Geocommunity website. Online provider of free or mostly free geospatial data.  
http://www.geocomm.com/

Geographic Names Information Service.  

Glenn A. Black Laboratory of Archeology. The Ohio Valley-Great Lakes Ethnohistory Archives: The Miami Collection  
http://www.gbl.indiana.edu/home.html

The Greenville Treaty. Original scanned document. Available online at:  
http://earlyamerica.com/earlyamerica/milestones/greenville/1.html

Great Lakes Assessment Project: Michigan and Wisconsin land cover - early European settlement vegetation.  

Indiana Land Records- Databases  
http://www.in.gov/icpr/archives/databases/land/indiana_.html

http://www.greenmapping.org/archive?category=11&n=100&submit=Submit&state=&county=

Land Cover of Illinois in the Early 1800's. PDF files.  
http://www.inhs.uiuc.edu/cwe/maps/glo.html

http://memory.loc.gov/ammem/gmdhtml/gmdhome.html


National NAGPRA Online Database.  http://www.cast.uark.edu/other/nps/nacd/

National NAGPRA Miami Indian material record (sample).  
http://www.cast.uark.edu/other/nps/nagpra/nagpra.dat/nic0350.html

The Ohio Valley – Great Lakes Ethnohistory Archive: The Miami Collection. This Tribal History Documents Collection contains primary resources of Indian/White relations for the 16 tribal groups in the Ohio Valley-Great Lakes region:
http://www.gbl.indiana.edu/archives/menu.html


- Document text: http://memory.loc.gov/cgi-bin/query/r?ammem/hlaw:@field(DOCID+@lit(ss40154)):#40150009
- Scanned document images: http://memory.loc.gov/cgi-bin/ampage?collId=llss&fileName=4000/4015/llss4015.db&recNum=129
- Maps: http://memory.loc.gov/cgi-bin/query/r?ammem/gmd:@field(NUMBER+@band(g3701em+gct00002))

Sturtevant, W. C. (1967)."Early Indian Tribes, Culture Areas, and Linguistic Stocks of the Eastern U.S." University of Texas Library. Online map resource: http://www.lib.utexas.edu/maps/united_states/early_indian_east.jpg

Thomas, Cyrus (1895). Introduction to Charles Royce’s “Indian Land Cessions in the United States.” http://memory.loc.gov/cgi-bin/query/r?ammem/hlaw:@field(DOCID+@lit(ss40154)):#40150009


Appendix A: Miami-Illinois Hydronyms

<table>
<thead>
<tr>
<th>Miami Hydronyms</th>
<th>English Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>aankwaahsakwa siipiwi</td>
<td>White River-East Fork and Driftwood River</td>
</tr>
<tr>
<td>aašipehkwa siipiwi</td>
<td>Rock Creek (Carroll County)</td>
</tr>
<tr>
<td>ahpwaakana siipiwi</td>
<td>Pipe Creek</td>
</tr>
<tr>
<td>aciipihkatwi siipiwi</td>
<td>Root River (Wisconsin)</td>
</tr>
<tr>
<td>ahpwaakana siipiwi</td>
<td>Pipe Creek</td>
</tr>
<tr>
<td>ahsenaamiši siipiwi</td>
<td>Sugar Creek</td>
</tr>
<tr>
<td>ahsenisiipi</td>
<td>Great Miami River</td>
</tr>
<tr>
<td>kaanseenseesiipi</td>
<td>Ohio River</td>
</tr>
<tr>
<td>alamooni siipiwi</td>
<td>Vermilion River (tributary of the Illinois River)</td>
</tr>
<tr>
<td>apeehsia siipiwi</td>
<td>Little Deer Creek (Cass County) Indiana</td>
</tr>
<tr>
<td>apeehsionki</td>
<td>Deer Creek (Carroll County)</td>
</tr>
<tr>
<td>alamooni siipiwi</td>
<td>Vermilion River</td>
</tr>
<tr>
<td>ceenkihtiwa</td>
<td>Fall Creek</td>
</tr>
<tr>
<td>eecipaankwaawisiipi</td>
<td>Butternut Creek: <em>Outside current landscape.</em></td>
</tr>
<tr>
<td>eehsipana siipiwi</td>
<td>Big Raccoon Creek</td>
</tr>
<tr>
<td>eemihkwani siipiwi</td>
<td>Spoon River</td>
</tr>
<tr>
<td>kaanseeseepiwi</td>
<td>Ohio River (Currently using this form)</td>
</tr>
<tr>
<td>kihcikami</td>
<td>Lake Michigan</td>
</tr>
<tr>
<td>kineepikomeekwa siipiwi</td>
<td>Eel River</td>
</tr>
<tr>
<td>kinwikami</td>
<td>Calumet River</td>
</tr>
<tr>
<td>kiteepihkwana siipiwi</td>
<td>Tippecanoe River</td>
</tr>
<tr>
<td>kociihsapakwasiipi</td>
<td>Beanblossom Creek</td>
</tr>
<tr>
<td>kóhchisasiipi</td>
<td>St. Joseph River</td>
</tr>
<tr>
<td>mahkohpina siipiwi</td>
<td>Macoupin River</td>
</tr>
<tr>
<td>mahweehkiki siipiwi</td>
<td>Kankakee River</td>
</tr>
<tr>
<td>mameewa siipiwi</td>
<td>St. Mary’s River</td>
</tr>
<tr>
<td>masaana siipiwi</td>
<td>Mazon River</td>
</tr>
<tr>
<td>meehe scaffiwi</td>
<td>Wisconsin River</td>
</tr>
<tr>
<td>meenkahsenahkiki</td>
<td>Lake Maxinkuckee</td>
</tr>
<tr>
<td>mihkohpina siipiwi</td>
<td>Potato Creek</td>
</tr>
<tr>
<td>mihšiiwiateehi siipiwi</td>
<td>Elkhart River</td>
</tr>
<tr>
<td>mishisipiwi</td>
<td>Mississippi</td>
</tr>
<tr>
<td>mihsoolatenwi</td>
<td>Mont Jolliet: ‘canoe hill’</td>
</tr>
<tr>
<td>myaalamewekwa siipiwi</td>
<td>Rock Creek ‘catfish river’ (trib. of Rock River) (proto-historic)</td>
</tr>
<tr>
<td>neekwikami</td>
<td>Aboite River</td>
</tr>
<tr>
<td>nimacihsinwi siipiwi</td>
<td>Mississinewa River</td>
</tr>
<tr>
<td>Omsaalamoonakamiiki</td>
<td>Yellow River (modern form per Jake Dunn)</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Omsaalamooni siipiwi</td>
<td>Salamonie River</td>
</tr>
<tr>
<td>Omsaasiipi</td>
<td>Yellow River <em>oomsaasiipi</em> (older attested form in French document)</td>
</tr>
<tr>
<td>Pwaawikamisiipi</td>
<td>Little Wabash River</td>
</tr>
<tr>
<td>Piiyihsa</td>
<td>Piasa (rock cliffs at Alton, Illinois)</td>
</tr>
<tr>
<td>Peekamiiki</td>
<td>Iroquois River (it is muddy water)</td>
</tr>
<tr>
<td>Peekihtanki siipiwi</td>
<td>Pecatonica (‘it-mud-flows’)</td>
</tr>
<tr>
<td>Peekihtanwi</td>
<td>Pecatonica (‘it-mud-flows’) should be this form</td>
</tr>
<tr>
<td>Pimiteewi</td>
<td>Lake Peoria and sites thereon: ‘it burns by’</td>
</tr>
<tr>
<td>Pinšiwa amootayi siipiwi</td>
<td>Wildcat Creek</td>
</tr>
<tr>
<td>Šikaakwa</td>
<td>Des Plaines River (early historic)</td>
</tr>
<tr>
<td>Šiihišiikwia siipiwi</td>
<td>St. Joseph River</td>
</tr>
<tr>
<td>Šikaakonki</td>
<td>Chicago town: ‘at the wild leak’ (middle and late historical)</td>
</tr>
<tr>
<td>Šikaawka siipiwi</td>
<td>Des Plaines River : ‘wild leak river’(early historical)</td>
</tr>
<tr>
<td>Taawaawa siipiwi</td>
<td>Maumee River after 1734</td>
</tr>
<tr>
<td>Waapaašiiki siipiwi</td>
<td>Wabash River</td>
</tr>
<tr>
<td>Waapikamiiki</td>
<td>White River-West Fork</td>
</tr>
<tr>
<td>Waapikamii</td>
<td>Whitewater River</td>
</tr>
</tbody>
</table>
Appendix B: The Miami Landscape and Pre-settlement vegetation output displays

Scale bars and directional arrows are not included in this output map so as to preclude the use of Western mapping concepts within the displays. As greater understanding of these concepts is achieved, perhaps more directional and scale information can be included in the map outputs. As this project was conducted in the interest of the Miami Tribe, the inclusion or omission of these identifying elements is left completely to the Tribe.

The map layouts on the following pages are the result of the Myaamia Mapping Project’s initial phase. The first map is the full Miami Landscape image. However, to assist the map reader in understanding the map’s geographic location, a smaller map frame is included placing the Miami Landscape within the current US state political boundaries. The next maps show various outputs from the system including: the pre-settlement vegetation display and legends, watershed boundaries, and a georectified Indian land cession maps (Royce 1899) within the landscape to show a potential future mapping phase.
myaamiaki eehi mihtoseeniwiciki
Where the Miami culture was practiced and Maintained, circa 1650-1850
Miami Landscape overlaid with hydrologic unit boundaries (watersheds)

* Miami-Illinois named rivers/lakes are in bold
Indian Land Cession Maps by Royce, 1899 (incomplete)