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Survey Sponsor's Address/Phone *500 S BRONOUGH ST, TALLAHASSEE, FLORIDA*
Survey Sponsor's Code *Florida Division of Historical Resources, ex-DAHRM*
Log Sheet Recorder's Name (last name first) *ERBE, BRIAN*
Date Log Sheet Completed *06/14/2001*
Is this a continuation of a previous project? *No Prior Phase I or Other Ongoing Work's Been Done*
If "YES," previous survey #(s) (FMSF only) *** blank ***

MAPPING

County Surveyed *** blank ***
USGS 7.5' Map for Surveyed Area: Name/Latest Revision Date *** blank ***

DESCRIPTION

Field Work Start Date *01/01/2000*
Field Work End Date *01/01/2000*
Number of Distinct Tracts Surveyed *1*
Total Area Surveyed (hectares; 1 acre= 0.405 ha) *-1.00*
Total Area Surveyed (acres; 1 hectare=2.47 acres) *-1.00*
Corridor Width (meters; 1 ft=0.3048 meters) *-1*
Corridor Width (feet; 1 meter=3.281 feet) *-1*
Corridor Length (kilometers; 1 mile=1.609 km) *-1.00*
Corridor Length (miles; 1 kilometer= 0.622 miles) *-1.00*

RESEARCH AND FIELD METHODS

Types of Survey *Archaeological survey (at least in part)*
Other types of survey *** blank ***
Preliminary Method Used *Researched this property at the Florida Site File; Researched Florida Site File for past surveys; Florida Archives, excluding Florida Site File*
Archaeological Method Used/Percent *** blank ***
Architectural Method Used/Percent *** blank ***
Scope/Intensity/Procedures *CONDUCTED AN ANALYSIS OF GIS DATA OF FLORIDA.*

SURVEY RESULTS

Sites' Significance Evaluated? *Sites' Significance Was Not Evaluated by Recorder*
Number of Previously Recorded Sites *** blank ***

List of Previously Recorded Sites *** blank ***
Number of Newly Recorded Sites *** blank ***
List of Newly Recorded Sites *** blank ***
Site Form Used *No Sites Located or Tested/No Forms Used*
Origin of Survey Report *Avocational Work not subject to any State Review*
BHP File Number *** blank ***

SURVEY SEARCH

Type of document: *Archaeological field survey; Unpublished overview of specific geographic area*
Other Document Type *** blank ***
Document destination: *** blank ***
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Plottability (2): *** blank ***

6040

ST. JOHNS ARCHAEOLOGICAL PROJECT PHASE I: A GIS APPROACH TO REGIONAL PRESERVATION PLANNING IN NORTHEAST FLORIDA

Kenneth E. Sassaman
J. Christian Russell
Jon C. Endonino

Department of Anthropology
University of Florida
Gainesville, Florida 32611

November 2000

MANAGEMENT SUMMARY

Digital records of archaeological sites and surveys provided by the Florida Bureau of Archaeological Research (BAR) were combined with background environmental data from the Florida Geographic Data Library (FGDL) to generate data relevant to long-term historic preservation planning in the St. Johns region of northeast Florida. Digital layers of regional topography, hydrology, and soils were analyzed to establish an empirical, random basis for detecting nonrandom locational patterning in archaeological sites and surveys.

Digital records for 893 survey projects in the project area were analyzed for nonrandom tendencies and to establish the extent to which recorded sites are accounted for by extant survey coverage. This project did not endeavor to detect and control for variation in archaeological survey quality or intensity.

Digital records for 3608 prehistoric sites in the project area were analyzed for components present, patterns of site reoccupation, and nonrandom locational tendencies. Artifact assemblages housed at the Florida Museum of Natural History were examined to refine component data from BAR files. At a regional scale, number of components at sites covaries inversely with elevation and distance to running water. Irrespective of component count, site locations display clear nonrandom patterning with respect to soil drainage and capacity for nonirrigated agriculture. Nonrandom diachronic trends in site location are expressed in increased use of riverine and coastal sites through time. Expanded use of interriverine locations is evident in the distributions of sites with St. Johns I and II components.

Recent and modern land-use coverage was analyzed for conversion of rural uses to urban uses from 1970 to 1995. The 123 percent conversion rate over this period has impacted 828 recorded archaeological sites, only a small fraction of which has come under archaeological review. Geographic buffers around centers on ongoing urban sprawl can be integrated with archaeological sensitivity data to prioritize survey efforts over the next few decades. The predictive efficacy of such an effort, however, will depend on the development of more fine-grained approaches to locational analyses than those reported here.

ACKNOWLEDGMENTS

This project has been financed in part with historic preservation grant assistance provided by the Bureau of Historic Preservation (BHP), Division of Historical Resources, Florida Department of State, assisted by the Historic Preservation Advisory Council. However, the contents and opinions do not necessarily reflect the views or opinions of the Florida Department of State, nor does the mention of trade names or commercial products constitute endorsement or recommendation by the Florida Department of State.

Ms. Vicki L. Cole, and her successor Ms. Ellen Andrews, of the Grants and Education Section of the BHP are thanked for helping to guide us through the entire grant process. Mr. Fred Gasky and Mr. Robert Taylor of the BHP are likewise acknowledged for their assistance and advice. At the University of Florida, Ms. Karen Jones of the Department of Anthropology and Ms. Rosita Chen of the Department of Sponsored Research provided expert local administration of the grant.

Matching funds for this project were provided by the Department of Anthropology and the Office of Research and Graduate Education at the University of Florida. Our thanks to Anthropology Department Chair Dr. Allan F. Burns and to Dean James Dufty for making these funds available.

Dr. Marion F. Smith of the Bureau of Archaeological Research generously provided the digital data on archaeological sites and surveys that form the core of the analyses reported here. Dr. Smith is to be personally congratulated for having the foresight years ago to develop site files data into digital format. The Florida Master Site Files program under Smith's leadership is truly a world-class operation.

The early stages of this project benefited from the technical expertise of Dr. Ryan Williams, formerly of the Department of Anthropology, University of Florida. Mr. Joe Aufmuth of the Government Documents Department of Smathers Library, University of Florida also provided valuable technical assistance. Staff of the GeoPlan Center of the University of Florida are likewise acknowledged for availing technical resources and advice to this project.

The analyses reported herein were conceived, interpreted, and written up by the senior author. All Geographic Information Systems analysis for this project was conducted by Mr. Christian Russell. Mr. Jon Endonino reviewed all records and collections housed at the Florida Museum of Natural History and authored most of Chapter 3. Access to collections at the FLMNH was enabled by Dr. Jerald T. Milanich, Ms. Elise LeCompte, and Mr. Scott Mitchell, whose collective assistance we greatly appreciate.

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CHAPTER 1
RESEARCH ORIENTATION

Archaeological sites in the St. Johns region of northeast Florida have drawn the attention of antiquarians and archaeologists since the middle eighteenth century. The first director of Harvard's Peabody Museum, Jeffries Wyman, excavated in the region to prove its many shell heaps were of human origin, not simply the natural phenomena his colleagues presumed. Philadelphian Clarence B. Moore began a two-decade tour of Florida mounds with investigations at St. Johns river and nearby coastal sites (Moore 1892-94). One of Florida's first regional syntheses was John Goggin's (1952) effort to systematize St. Johns prehistory. Irving Rouse (1951), John Griffin (P. Griffin 1996), Barbara Purdy (1987), and other prominent figures made significant contributions from field work in the St. Johns. And of course Ripley Bullen, among the most productive Florida archaeologists of the last century, devoted considerable resources to testing sites throughout the region, many the victims of shell mining and related insults of the state's rampant 20th-century development.

With few exceptions, investigators before the mid-1900s dug where the digging was most productive. Moore, for instance, was notorious for targeting sites well endowed with rich, exotic artifacts, and he was quick to abandon sites that yielded little. The St. Johns region was good to him in this respect. Earthen mounds such as Shields near Jacksonville and Mount Royal near Lake George bore some of the Southeast's greatest artifact assemblages. Moore was equally intrigued by the many shell mounds with ancient human burials and sherds of some of the oldest pottery in North America. His work showed, as did Wyman's before and others' has since, that the St. Johns region is unquestionably among the richest archaeological regions in the southeastern U.S., indeed in the world.

The circumstances that enabled the awakening to St. Johns archaeology in the last two centuries likewise contributed to its endangerment. Despite the good work of Wyman, Moore and others, the questions we have today about the sites they dug cannot always be satisfied with the notes, drawings, and collections they made. Many of the sites they investigated were destroyed long ago, if not by their own action then by the drag lines and steam shovels of early Florida development. It must have seemed to Moore and Wyman, maybe even to Goggin, that St. Johns sites, especially the shell mounds, were too numerous to dig into extinction. Certainly many such mounds in the region were spared from the ravages of early excavators, looters, and development, but many more were destroyed or severely damaged.

Laws to protect archaeological resources from development and other destructive elements, including unjustifiable excavations, have been in place only since the 1960s. The result of this work is manifold. For one, the choices of where to look for sites and where to dig are determined by modern land use. This has resulted in archaeologists working in locations long overlooked, and, in turn, has fostered a greater awareness of the diversity and density of sites in the region. The inventory of sites in the region now exceeds 4000.

The rationale for excavating archaeological sites has likewise changed. Curiosity alone justified the wholesale destruction of sites in years past. Today the allocation of permits and resources for field investigations hinges on arguments of site significance and public good. Federal law mandates protocols for assessing site significance, and generally this involves the potential contribution a site has to provide data important to our understanding of prehistory and history. Concepts like "importance" and "understanding" are rendered meaningful in the context of the larger body of literature and data that have accumulated over the years, coupled with the abilities of archaeologists to explore the limits of accepted knowledge with original, innovative questions. Questions deemed important and the potential a site has to provide information relevant to those questions both change as our knowledge base develops and priorities change.

The growth in number and types of sites, combined with the need to problematize investigations, has caused something of an information crisis for archaeologists. Legislative and regulatory actions at state and federal levels have tried to avert the crisis through a variety of initiatives. Centralized repositories for site records are among the more widespread solutions, and computerized versions have improved access and manipulation of such data in many states, Florida among them (Smith 1995). Similarly, many states have sponsored projects to synthesize extant knowledge in documents known as "historic contexts." The first generation of Florida's contexts was assembled in the early 1990s. In addition to summarizing what we know and do not know about the state's archaeology, the Florida contexts outline research questions that are useful for assessing the research potential (i.e., significance) of sites.

As useful as site files and historic contexts are, they alone fall short of providing sufficient resources for proactive site preservation and long-range planning. The chief missing element in Florida is information on modern land use and its potential for impacting sites of potential significance. Clearly, this is a level of archaeological management that is best implemented at the subregional or local scale, because land use and development vary wildly across the state. Archaeological resources in Florida are equally varied. It follows that effective planning tools for site preservation must be predicated on empirical records of sites, land use, and environmental features, not gross generalizations.

The primary goal of the work reported here is the compilation and integration of data necessary for the long-range management of archaeological resources in St. Johns Basin of northeast Florida. Many sorts of data come into play in this effort. Site files under the stewardship of Florida Bureau of Archaeological Research (BAR) are a rich and reliable source of computerized data on site location, age, and type. In addition, BAR staff have recently issued computerized records of archaeological survey coverage for the state. Both types of data are encoded in Geographic Information Systems (GIS) software, a program that enables analysis of the distributions of sites in three-dimensional space. When integrated with background data from the Florida Geographic Data Library (FGDL), sites data can be examined for patterned variation in associations with landscape features (soils, water, landforms, etc.), cultural features (roads, towns), and historic and modern land use. The identification of locational patterning in site distributions is a necessary step in long-range preservation planning as it enables predictions to be made about the likelihood of a given site type or site density to occur under a given set of environmental circumstances.

The Florida Department of State grant-in-aid proposal to fund the present research listed four objectives:

(1) compile and integrate Geographic Information Systems data for the entire St. Johns Basin, including soils, hydrology, topography, land use, and cultural resources;
(2) create a comprehensive data layer of archaeological survey coverage in the basin, coded for information on methods and results;
(3) analyze the locations of existing archaeological sites for associations with environmental features;
(4) integrate data on modern land use/ownership with predictive values for site locations to design a 10- to 15-year program of survey and testing.

We were successful in meeting most, but not all of these objectives. Our efforts in meeting the second objective were rendered somewhat redundant, thankfully, by the work of BAR personnel to digitize and encode survey tracts in our study area. We failed to expand on these data by coding for methods and results, as we had hoped to do. Otherwise, we enjoyed considerable success with spatial analysis of site locations, environmental features and land use, owing, in large measure, to the tremendous resources of the FGDL.

Our work here is only a beginning, and we anticipate throughout this report the various lines of inquiry to pursue in future work. The timing for development of long-range preservation planning in the St. Johns Basin could not be better. Northeast Florida includes some of the least developed areas of the state, but it is bordered by three rapidly growing urban centers: Jacksonville, Daytona, and especially Orlando. Whereas the rate of growth in some of these centers pale in comparison to parts of south Florida, the projected per capita rate of urban land conversion for the north exceeds that to the south. This is the case not simply because regions like the St. Johns have the greatest room for growth, but because as urban areas such as Miami become larger and more mature, the price of development increases and urban growth becomes more compact (Reynolds 1992). Thus, the largely undeveloped tracts of northeast Florida represent the cheaper solution. In a state experiencing about twice the rate of urban land conversion as the entire United States, massive development in northeast Florida seems inevitable. Fortunately, the combination of long-term archaeological research in the region and modern technology for data management and analysis ensure that preservation planning can indeed keep pace with, and serve the needs of, urban development.

We note before proceeding with this report that our efforts here are confined to archaeological resources. Standing architecture, cemeteries, industrial infrastructure and related historic resources are not included in the foregoing analyses. In fact, the analyses reported here are decidedly biased toward prehistoric archaeological resources. As we discuss in the final chapter, a GIS-based preservation plan dedicated exclusively to historic resources is warranted. Such a project could incorporate digitized versions of historic maps and photographs, as well as the usual landscape and archaeological distributions.

STUDY AREA DEFINED

Florida is a large state whose archaeological cultures are as diverse as the natural environs they inhabited. Archaeologists attempting to summarize Florida's prehistory have usually divided the state into distinct culture areas. Although the specific divisions proposed are matters of ongoing debate among specialists, archaeologists generally agree that after about 2500 years ago, Florida's prehistoric cultures diverged in ways that justify a localized or subregional approach to archaeological systematics. Indeed, relatively unique cultural expressions are apparent in the technology, subsistence practices, and mortuary ceremonialism of many of Florida's late prehistoric peoples, including those of the St. Johns Basin.

Jerald T. Milanich, among the most prolific and influential writers on Florida prehistory, includes the St. Johns Basin in his "east and central" region (Milanich 1994:xix; Figure 1-1). This geographic division follows from an earlier synthesis authored by Milanich and Charles H. Fairbanks (1980:22). In an even earlier effort at synthesis, John Goggin (1952) divided the St. Johns Basin into several subregions, but Milanich and Fairbanks (1980:28) found little reason for abiding by his scheme.

We take a similarly broad view of the "east and central" region of Florida in this study. As defined herein, the region consists of 19 counties that comprise the entire St. Johns Basin and some adjacent locales (Figure 1-1). The river basin itself encompasses 14 counties, from its headwaters in Indian River and Okeechobee counties to its mouth in Duval County. In addition, our study area includes Nassau County, which is bordered to the north by the St. Marys River. Russo (1992) provides a strong case for treating the St. Marys drainage as a culture area apart from the St. Johns. We choose to include Nassau County in the present analysis to avoid truncating what may well be a "transitional" zone in terms of culture history.

We also include in our study area the coast and lagoon system of the Atlantic strand south to the Indian River inlet of St. Lucie County. The southern portion of this strand and the adjacent headwaters of the St. Johns were defined by Rouse (1951) as the Indian River archaeological area. Sites of the prehistoric Glade cultures occur along the Atlantic coast south of Cape Canaveral and southwesterly throughout much of south Florida in what Milanich (1994) refers to as the Circum-Glades or simply Glades region (see also Milanich and Fairbanks 1980:22-23). In the counties of Okeechobee, Indian River, and St. Lucie, evidence of these Glade-adapted cultures blends with the southern extent of post-2500 B.P. St. Johns cultures, so, again, it is difficult to demarcate a St. Johns study area within impinging on other bona fide culture areas.

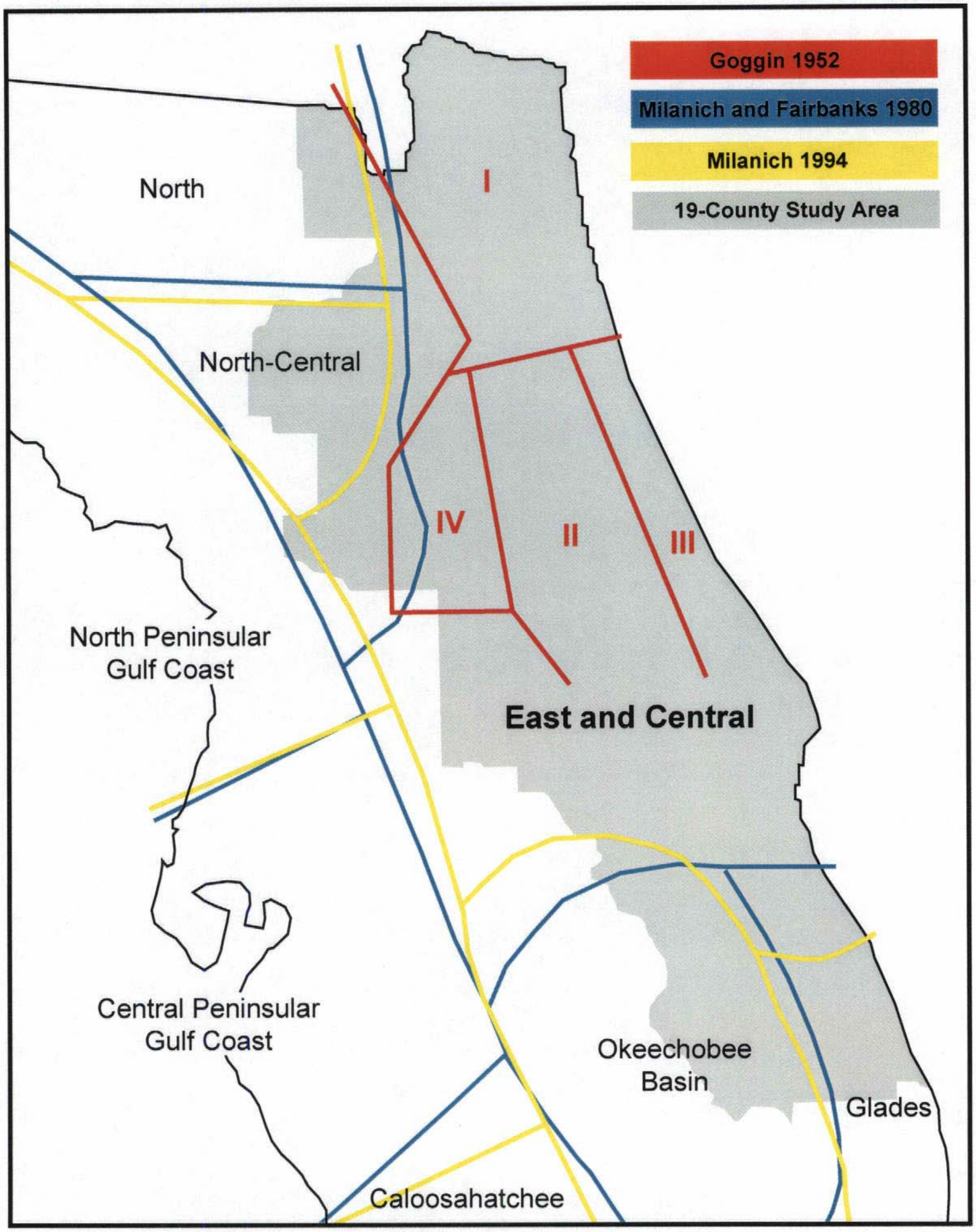

Figure 1-1. Alternative schemes for dividing northeast Florida into archaeological culture areas

Defining the western margin of the St. Johns Basin is likewise problematic. From a physiological standpoint, the Central Highlands comprising the interior core of peninsular Florida demarcates the St. Johns and its associated wetlands from relatively high, dry terrain. However, the central portion of the basin is bordered to the west by a region of lakes and prairies whose aquifer systems are either exposed or thinly confined by an overlying geological unit (Miller 1997). In addition to the numerous lakes that dot principally Orange and Lake counties are the headwaters of the Oklawaha River, a major tributary of the St. Johns that occupies much of Marion County. This hydrologic complex and its associated environs apparently enabled lifestyles similar to those of the St. Johns River. As Milanich and Fairbanks (1980) note, archaeological remains from east-central Florida are enough like those in the St. Johns proper to warrant inclusion in the same culture area.

Cultural differences are more apparent farther south along the western margin of the St. Johns Basin. From the Kissimmee River southward to Lake Okeechobee are found elements of the Belle Glade culture. These features blend into those of the Glade cultures to the west, forming something of a cultural boundary from Lake Okeechobee to the east coast.

The St. Johns region is no more easily defined in hydrologic terms than it is in archaeological terms. As a nonalluvial river, the St. Johns defies the usual characteristics of fluvial systems. Besides flowing northward instead of toward the equator like most rivers, the St. Johns occupies such a low gradient that it transports very little sediment despite being about 3 km wide for much of its length. Disjointed drainage characterizes most of the area to the immediate west of the St. Johns Basin, notably between the St. Johns and Oklawaha rivers. Consisting of many small streams that do not connect into integrated systems, disjointed drainage is typical of karst areas like peninsular Florida. Individual streams in karst landscapes typically flow into sinkhole lakes, where they join underwater "rivers" and sometimes reemerge at the surface as springs. Drawing surface boundaries around these sorts of drainages is nearly impossible.

On the opposite side of the St. Johns Basin, the Atlantic drainage systems are relatively well integrated, but this owes more to modern engineering than it does to geomorphic qualities. Perhaps more so than any other portion of the study area, the coastal strand and lagoon system has undergone the most change in human time, not only due to modern channelization, but also post-Pleistocene sea level change, storm surge, and relentless tidal action. Of course, many of these same features also have had dramatic effects on the St. Johns River, as we shall see in Chapter 2.

Table 1-1 provides a breakdown of the major and minor drainages found in each of the 19 counties included in this study. The St. Johns Basin comprises the majority of land area in only six counties, seven if the Oklawaha is included. Other integrated drainage basins comprising the majority of six counties include the St. Marys, Sante Fe, Kissimmee, and St. Lucie rivers. Three counties are dominated by disjointed drainages, and an equal number by coastal drainages. In all, the study area goes well beyond the hydrologic boundaries of the St. Johns Basin to include both coastal and interior

Table 1-1. Majority and Minority Drainage Basins of Counties in Study Area (counties whose majority basin is the St. Johns are emboldened).

County	Majority Basin	Minority Basin(s)
Alachua	disjointed drainages	Sante Fe, Oklawaha
Baker	St. Marys	Sante Fe, St. Johns, disjointed drainages
Bradford	Sante Fe	disjointed drainages
Brevard	coastal integrated drainage	St. Johns
Clay	St. Johns	Sante Fe, disjointed drainages
Duval	St. Johns	St. Marys, coastal integrated drainage
Flagler	St. Johns	coastal integrated drainage
Indian River	St. Johns	disjointed drainages , coastal integrated drainage
Lake	Oklawaha	St. Johns, disjointed drainages
Marion	disjointed drainages	Oklawaha, St. Johns
Nassau	St. Marys	coastal integrated drainage
Okeechobee	Kissimmee	St. Johns, disjointed drainage, Lake Okeechobee integrated drainage
Orange	disjointed drainages	Kissimmee, St. Johns, Econlockhatchee
Osceola	Kissimmee	St. Johns, disjointed drainages
Putnam	St. Johns	Oklawaha, disjointed drainages
St. Johns	coastal integrated drainage	St. Johns
St. Lucie	St. Lucie	disjointed drainages, coastal integrated drainage, Lake Okeechobee integrated drainage
Seminole	St. Johns	Econlockhatchee, disjointed drainages
Volusia	coastal integrated drainage	St. Johns, disjointed drainages

drainages of the surrounding landscape. None of the St. Johns Basin is excluded from the study area as defined.

SOURCES OF DATA

Three major sources of data are brought to bear in our efforts to analyze the relationships among archaeological site location, environmental features, and modern land use: State Site Files, State Survey Records, and data layers of the Florida Geographic Data Library. In addition, several sets of ancillary data are incorporated in the analysis, many derived from the Florida Museum of Natural History.

State Site Files

State Site Files are maintained by the Florida Bureau of Archaeological Research (BAR) in Tallahassee. Over 100,000 known archaeological sites and standing historic structures are on record in both hard copy and electronic files, organized by county. For this project, Site Files Manager Marion F. Smith permitted and arranged for electronic transfer of the 4000+ archaeological site records for the 19 counties of our study area.

Electronic versions of site records include shape files readable through ArcView GIS software, as well as attached data on site number, name, type, and components present. As with any site file data, the level of detail and accuracy varies, especially as regards components present. To check possible biases in the site files data, study area collections housed at the Florida Museum of Natural History were inspected for diagnostic artifacts. Discrepancies between the site file data and the museum collections are actually rather minimal, owing perhaps to the fact that the site files originated with records maintained at the Museum. Nevertheless, it is clear that as sites are revisited and materials added to existing collections, site files are not always updated. We note these sorts of biases where appropriate.

Survey Records

Along with site files, Florida BAR maintains records of archaeological and architectural surveys conducted in the state. Recently BAR made available digitized versions of survey tracts. Attached to these shape files are information on project title, report authorship, and other nominal data. Information on the methods and results of surveys are not included. We intended to review all published surveys for this project to compile such data, but determined that this was simply not feasible. Many reports, particularly older reports, fail to provide specific information on where survey was actually conducted within project tracts. At best one could code for whether or not a given survey involved subsurface testing, but even then many (older) reports fail to provide details on the depth and interval of testing. In lieu of methodological detail, we treat all survey records as a subset of the regional landscape for which some archaeological work was conducted and then examine how well this subset reflects a random set of locational parameters, and how well it accounts for the projected density of sites for the entire study area.

Florida Geographical Data Library

The Florida Geographic Data Library (FGDL) is an rich source of satellite imagery, aerial photographs and spatial (GIS) data for the state of Florida. Maintained and distributed by the GeoPlan Center at the University of Florida, FGDL data are organized by county on CD-ROM. Well over 200 layers of GIS data currently exist for Florida counties, including data on geology, soils, hydrology, topography, and bathymetry, as well as roads, zoning, schools, and other cultural features, and historic and modern land use. GeoPlan compiles information from all sorts of data-collecting agencies and ensures that they are projected and integrated in a consistent fashion. The lead agency in developing FGDL data has been the Florida Department of Environmental Protection, but the Florida Department of Transportation has also contributed much to the program.

ORGANIZATION OF THE REPORT

Natural history of the St. Johns region is the subject of Chapter 2. As with any archaeological endeavor involving deep time, paleoenvironment is arguably of greater relevance than modern environment. And yet, for a project such as this, the modern landscape is our main field of reference. We are especially concerned here with the relationship between modern land use and prehistoric sites, so we cannot simply dismiss today's "built" environment as analytical noise. Modern and ancient landscapes are equally relevant.

Chapter 3 takes up the cultural history of the St. Johns region. One of the defining features of the region's prehistory is cultural continuity. Since at least late Middle Archaic times, the inhabitants of much of the St. Johns region occupied sites along the river, exploited shellfish, collected nuts, hunted deer, and generally did not involve themselves in agriculture after it became an option. Of course, this is a gross simplification, one that could send a roomful of regional specialists into a month-long debate. However, compared to many other regions in the Southeast, St. Johns prehistory is generally continuous. We will find that most of the confusion about cultural boundaries and continuity occurs at the edges of the study area, as one might expect. As we noted earlier, other culture areas come into play here.

In Chapter 4 we begin our GIS analysis with characterization of the study area using environmental data deemed relevant to archaeological site locations (elevation, distance to water, soils, etc). To enable analyses of nonrandom tendencies in archaeological site locations, we generate a set of random points throughout the study area and characterize them using the same set of environmental variables. These data provide an unbiased, random baseline for detected patterned variation in site locations.

Chapter 5 addresses the extent to which archaeological site distributions are merely an artifact of where archaeologists have worked. Whereas this is something of a truism in archaeology, the long history of work in the St. Johns, coupled with a very active constituency of avocational archaeologists means that many of the sites in the state site files got there through means other than systematic (and reported) survey. We determine the degree of overlap between the record of surveyed land and the sites record, and then determine the statistical biases of survey land relative to the randomly generated set of environmental data. The important goal of this effort is to eliminate sources of bias in our understanding of the locational tendencies of archaeological sites.

The core of our analysis is reported in Chapters 6 and 7, where we look at the distributions of archaeological sites by type and by component to seek out patterned variation across space and through time. All biases aside, enough data exist to offer first-order analysis of regional patterning in site locations to both interpret prehistoric land use and to generate probabilistic statements about site locations in areas heretofore not surveyed.

Recent historic and modern land-use patterns are the subjects of Chapter 8. We aim to describe the distribution of known sites relative to land use, and to examine how many such sites have been impacted by recent changes in land conversion. Not surprising, the extent of impact is actually quite high. Projected rates of urban land-use conversion can be compared to locational tendencies for sites and survey history to prioritize state-funded efforts to locate and assess sites before being impacted by development.

A long-range plan for site preservation in the St. Johns Basin is the ultimate goal of this research. Although we fail to provide a comprehensive, ready-made plan, the results reported herein are a necessary first step toward this goal. We recommend that continuing efforts at regional preservation planning ought to be directed toward development of predictive models that are sensitive to environmental patterning at scales commensurate with prehistoric human land use. Although regional patterning of site locations is useful for exploring broad trends in demography, changing land use, and cultural boundaries, subregional or localized models are required to effectively integrate predictive qualities of site distributions with projections of land conversion, and hence long-range management plans.

CHAPTER 2
MODERN AND ANCIENT LANDSCAPES OF THE ST. JOHNS REGION

At 310 miles (500 km) in length, the St. Johns is Florida's longest river. It is also one of the widest rivers in the world. For much of its lower reaches, the St. Johns is wider than the Mississippi, North America's largest river. Its dimensions are deceiving, however, for the St. Johns actually discharges only about 6000 cubic feet of water per second (Tanner 1992). In comparison, the Apalachicola River of west Florida discharges four times that amount, the Mississippi 103 times that amount. The great width of the St. Johns is owed to the relatively low gradient of its basin. Flow velocity is extremely low, so a wide channel is needed to accommodate a relatively small amount of water.

The characteristics that make the St. Johns unique among Florida rivers are those that make Florida different, physiographically, than other southeastern U.S. states. On a foundation of igneous rock lies a thick mantle of limestone known as the Florida Platform that formed over millions of years through marine deposition. On this deep geological structure lie marine sediments that were deposited and reworked whenever the sea covered the land. The tandem forces of marine erosion and deposition have left their mark in the swamps, plains, terraces, and ridges of Florida's older topography, as well as the active coastal regimes of marshes, lagoons, dunes, barrier islands, and beaches. Chemical dissolution of underlying limestone has been equally integral in shaping the land. Sinkholes and related collapse features reflect a geological history of fluctuating water tables attending sea level change. Together these structural and geomorphic processes have resulted in a low-sloping, virtually flat terrain with surface geology consisting of easily eroded sediment and negative spaces. Naturally, when sea level is high (as it is now) and climate is moist, the terrain is well watered. In addition to the rivers, swamps, and marshes so common to Florida are over 7700 lakes greater than 10 acres in size.

As with any landscape, northeast Florida is a dynamic place whose surface features change constantly, if usually very slowly, with ongoing processes of erosion and deposition. Although human presence in northeast Florida is recent by geological standards, many changes in the land have occurred recently, and continue to occur through a combination of natural and human forces. Among the more dramatic have been transgressions of sea with overall rising levels since the end of the Ice Age (ca. 10,000-12,000 years ago). Indeed, the St. Johns as we know it today owes much to geomorphic changes wrought by sea level rise since the Pleistocene.

In this chapter we review the present-day landscape of the St. Johns region, as well as some of the more significant changes that have elapsed since humans entered the region some 12,000 or more years ago. Because both ancient and recent landscapes are a product of geological history, we often delve into deep time to describe some of the structural attributes of landforms and landscape change. We also consider aspects of climate and biota, as these are of obvious importance to humans throughout prehistory. Our goal, however, is not to provide a comprehensive treatise on the natural history of the St. Johns region. Rather, we are interested in identifying and describing environmental features that will help in detecting patterned variation in site locations for purposes of long-range preservation planning and research.

PHYSIOGRAPHY

About one half of the Florida Platform is subaerially exposed today as the state of Florida (see Schmidt 1997 for a cogent summary of the state's physiography). The other half is submerged beneath the waters of the Atlantic Ocean and the Gulf of Mexico. The submerged platform is also known as the continental shelf; seaward from the edge of shelf is the continental slope. The shelf assumes a relatively steep gradient on the Atlantic Coast, dropping as much as 600 ft in under 10 km from the coast north of Miami. The gradient is increasingly gentler farther north along the Atlantic coast of Florida, but still steep compared to the Gulf coast, where one must travel 150 km west of Tampa to find water 600 ft deep. One of many implications about this contrast in shelf morphology is that much greater expanses of land were submerged with rising sea level on the Gulf coast than on the Atlantic coast. Conversely, during periods of lower sea level, the Gulf coast was much farther seaward from its present location than was the Atlantic coast.

Elevations in Florida are relatively low. Its highest point is 345 ft (104 m) in the panhandle of west Florida, and well below 200 ft throughout most of the study area. Elevational zones throughout the state are largely the result of ancient ocean transgressions, which left diagnostic erosional scarps at their leading edges (Schmidt 1997). Eight marine terraces have been identified from correlations of the scarps (Healy 1975). Four terraces in the study area occur at roughly 10, 30, 100 and 150 ft above mean sea level (amsl). Minor units of higher and older terraces occur along the western margin (central highlands) of the study area. Remnant lagoonal and near-shore swales parallel the escarpments of terraces and serve to channel portions of the area's rivers.

Finer physiographic divisions of the study area were defined by Cooke (1939), whose scheme continues to be widely accepted. The roughly two dozen physiographic units of Cooke can be grouped in two major zones: the Central Highlands and the Atlantic Coastal Lowlands.

Central Highlands

The Central Highlands consist of dissected sedimentary remains of fluvial, deltaic, and shallow-water marine origins (Schmidt 1997:7). Eroding from the southeastern Coastal Plain, these sediments prograded southward with transgressions of the sea, eventually spilling over the shallow waters of the carbonate platform and forming the clayey sands of the spine of the northern peninsula. Subsequent reworking of these sediments by near-shore currents of ancient coasts created the many elongated ridges of the upland unit. Trail Ridge, Mount Dora Ridge and Lake Wales Ridge together define the eastern margin of the Central Highlands, and lesser ridges assume coast-parallel locations in the adjacent lowlands of the St. Johns basin and coastal zone.

Karst features of the Central Highlands include sinkholes on the ridges and other upland landforms, some that are deep and steep-walled, such as Devil's Millhopper in Alachua County. Many of the region's springs are sinkholes that became charged with rising water levels in the Holocene. The largest, Silver Spring, is the source for the Oklawaha River in the Central Highlands. As the main tributary of the St. Johns River, the Oklawaha occupies the so-called Central Valley of the interior peninsula, being sandwiched between the Sumter Uplands to the west and the Mount Dora Ridge to the east. East of the Mount Dora Ridge is the Marion Upland unit, followed by the St. Johns River. This midsection of the St. Johns basin is known as the "offset" (White 1970; see below), a stretch of some 90 km that captured the headwaters of the river during low sea levels of the Pleistocene. The upland ridge that was stranded by this offset—the Crescent City Ridge—is the only part of northeast Florida containing sinkholes.

Coastal Lowlands

Most of the study area consists of terrain that is broadly defined as the Atlantic Coastal Lowlands. The division is deceiving for it includes not only the barrier islands, beaches, lagoons, and ridges of the coast proper, but also the Osceola Plain and associated ridges, the Eastern Valley and St. Johns River offset, the Crescent City and Deland ridges, the St. Mary's meander plain, and a variety of lesser ridges. However, very little of this terrain exceeds 75 ft amsl; the vast majority of it is well below the 50-ft contour.

The majority of the Atlantic Coast in Florida is dominated by barrier beaches, barrier islands and spits, and overwash fans (Schmidt 1997:4). A series of elongated, broad lagoons parallel the coast roughly 25 km north and south of St. Augustine. Another tidal-inlet system is situated southward, beginning about 20 km north of Daytona Beach and expanding into the back-barrier regime that dominates the coastline all the way to south Florida. These independent lagoonal systems are today connected by the Intercoastal Waterway.

The most conspicuous geomorphic feature of the Atlantic coast of Florida is Cape Canaveral, a huge cuspate landform that projects seaward 20 km from the general coastal trend (Davis 1997). This feature marks the southern limits of the Georgia Bight, the concave strand of coastline extending from Cape Canaveral to the Outer Banks of North Carolina. Barrier morphology common to the Bight is influenced by a combination of wave action and tidal energy. Tidal range is greatest at the center of the Bight, approximately 3 m in South Carolina, and decreases towards its northern and southern limits. Thus, tidal range is relatively small in northeast Florida. From Cape Canaveral southward, the barrier system is largely wave-dominated.

The longest lagoonal system in Florida is Indian River, extending from just north of Cape Canaveral to the St. Lucie-Martin county line, an expanse of over 200 km. At its northern end Indian River is over 8 km wide. Its middle and southern portions are considerably narrower and generally straight. Indian River is separated from the ocean by a low barrier dune-beach complex of varying width and elevations under 10 ft amsl.

The northern portion of the study area differs from the barrier system of the coast in its riverine and estuarine geomorphology. The mouths of the St. Marys and St. Johns rivers distinguish this subarea with broad tidal channels and salt marshes. The intervening Nassau River Basin drains only a small portion of the Coastal Lowlands, but its position between the two larger systems contributes significantly to the extent and quality of estuarine habitat. As we will see, this portion of the coastal zone in the study area supported some of the most intensive and sustained human subsistence economies in the Southeastern U.S.

The St. Johns River in the Eastern Valley of the Coastal Lowlands is comprised of three distinct segments. The southern segment includes its headwaters, which are essentially poorly integrated braided streams across a broad expanse of undifferentiated, flat terrain. Drainage in this headwater has been affected in recent decades by channelization and other modifications that render the area more conducive to agriculture and development.

The middle segment consists of the "offset," essentially a westward rerouting of an older channel to the east. Coast-parallel topographic features of the Coastal Lowlands (e.g., relict lagoons) are generally believed to have determined the flow of the St. Johns River. Surface flow then penetrated underground and dissolved limestone to form a series of sinks that connect into a relatively straight channel (Schmidt 1997:12). The middle stretch of the river, between Sanford and Palatka, deviates from this pattern in being offset some 20 km west of the relict channel. Crescent Lake, just south of Palatka, occupies the northern portion of the relict channel; lesser bodies of water mark the remaining expanse of relict channel. Factors believed to have enabled the establishment of the offset channel include tectonic uplift of limestone, solution of carbonate sediments, and enhanced artesian flow (Schmidt 1997:12). Irrespective of the factors creating the offset channel, when sea level was low, the new channel captured the headwater flow of the St. Johns. Geologists estimate that this process occurred during the late Tertiary to early Pleistocene (White 1970; Pirkle 1971 cited in Schmidt 1997:12). Thus, the relict channel of the middle St. Johns was never active during human occupation of the region. Nevertheless, its associated lakes, wetlands, and adjacent sand bodies almost certainly supported human populations, including perhaps intensive habitation. The offset itself includes a number of lakes, most notably Lake George, the largest in the drainage.

The northern or lower segment of the St. Johns cuts east at Palatka (i.e., the northern end of the offset segment) and then flows north to Jacksonville, where it empties into the Atlantic Ocean. This lower segment is essentially a drowned estuary. Its incredibly broad channel is flanked by relatively steep bluffs and levee formations that render access difficult to many parts of the river. Being tidally influenced throughout, the lower St. Johns is especially dynamic in terms of salinity levels, current velocity and direction, and faunal communities.

HYDROLOGY

We have already summarized some of the basic features of channelized surface flow in the Coastal Lowlands. Most of the surface water of the region, however, consists of various types of wetlands. Especially abundant and highly diverse, wetlands in northeast Florida include marshes, estuaries, river floodplains, low-relief plains (e.g., Osceola Plain), areas with near-surface water tables, and areas fed by artesian springs.

Drainage in the Central Highlands is largely disjointed and local. Where limestones are close to the surface and water tables are low, surface runoff is minimal. Water drains through sinkholes or seeps into the limestones through permeable sands (Schmidt 1997:5).

Precipitation is the source of all freshwater in Florida (Miller 1997:69). Most of the precipitation is returned to the atmosphere via evapotranspiration, but some moves directly into lakes, rivers, and streams as runoff, and some percolates through soil to both near-surface and deeper aquifers. Throughout the state, precipitation outstrips runoff, so much of it is available to recharge aquifers.

Surface water levels in Florida's rivers, lakes, and wetlands is directly related to aquifer levels. Florida has five principle aquifers. The deepest and most extensive is the Floridan Aquifer, which not only covers the entire state, it also underlies portions of Georgia, Alabama, and South Carolina. Despite its expansiveness, the Floridan system is exposed at or near the surface only in the western margin of the study area. A clayey confining unit caps the system in the area of the middle St. Johns. Remaining portions of the study area consist of surficial aquifer systems (Miller 1997:71). The surficial systems are predominately unconsolidated sands. Except where clay beds create locally confined conditions, water in the surficial aquifers is unconfined (Miller 1997:74). Local precipitation is the source of most recharge, and most of this is locally discharged into streams of lakes. The Floridan Aquifer, in contrast, is recharged by regional precipitation, and its limestone confining units enable long flow paths. Clearly the surficial aquifers are much more vulnerable to localized droughts than is the Floridan system.

Sinkholes in the study area are most common where the Floridan system is thinly confined or unconfined, namely in the area of the Central Highlands and middle St. Johns. Springs that issue directly from the Floridan Aquifer include all of the first-magnitude springs, including Silver Spring, Silver Glen Springs, and Blue Springs.

The karst topography of the Central Highlands involves a dynamic relationship between groundwater and limestone that greatly affects the size and accessibility of surface water. Limestone underlying lakes is gradually eroded by circulating groundwater. After periods of drought and concomitant lowering of the water table, once-buoyed cavern roofs underlying sinkholes sometimes collapse and thus drain the sink of impounded water. An example of a massive "disappearing lake" is Paynes Prairie in Alachua County (Schmidt 1997:11).

CLIMATE, SOILS, AND BIOTA

The climate of the study area is humid subtropical. Some 50 inches of rain per year falls mainly in the summer months, when thunderstorms prevail. Summer precipitation is greatest near the coast. Occasional hurricanes and tropical storms punctuate an otherwise monotonous pattern of afternoon thundershowers from June to September. Droughty conditions are not unusual during the remainder of the year, particularly during the spring and fall in the interior.

Seasonal temperatures follow rainfall patterns, with hot summers and mild winters interspersed with short transitional periods. Average annual temperature for Jacksonville is about 68 degrees Fahrenheit; at nearly 72 degrees, Titusville in Brevard County and Ocala in Marion County have slightly higher averages. Freezing temperatures occur occasionally during the late fall and winter months, although very rarely do temperatures remain below freezing for more than a few hours.

Soils in the study area can be broadly divided into those of the poorly drained, low-lying terrain of the Coastal Lowlands and wetlands of the Central Highlands, and the moderately to well drained soils of the coastal dune-beach complex and the uplands of the Central Highlands. The former are mostly spodosols, which are dominated by nearly level, poorly drained sandy soils with dark sandy substrate. The latter are mostly entisols, which are dominated by nearly level to sloping, well drained, thick sands. Among them are some of the best agricultural land in the study area.

Vegetation across the study area has been greatly affected by modern land use practices and is thus difficult to characterize without abundant qualification. In general the coastal zone consists of pioneer herbs and shrubs on sand dunes, with small areas of cabbage palm hammock and sand pine (Davis 1967). Coastal marshes and mangrove swamp forests occur in areas where estuaries are extensive, such as the mouth of the St. Johns. Excessively drained relict dunes of the coastal strand support sand pine scrub forest. The area between the coast and St. Johns River is dominated by pine flatwoods (longleaf, slash, and/or pond pines) with understories of herbs, saw palmetto, wax myrtle, and wiregrass. Interspersed throughout the flatwoods are small hardwood forests, cypress and bay tree swamps, marshes, and pariries.

Longleaf pine forests occur along much of the middle to lower St. Johns, especially on the high terraces. The well drained relict dune soils of the Marion Upland (Ocala National Forest) support an expansive sand pine forest. Well drained soils of the Central Highlands support shrubby evergreen oaks with occasional sand or slash pine overstory, and "high pine" communities consisting of longleaf pine interspersed with deciduous oaks and a wiregrass surface cover. Cypress swamp forests dominate low-lying, wet terrain along the river and associated lakes. Other swamp forests dominated by hardwoods such as bay and gum are associated with wetlands throughout the region.

The salt marshes of the Atlantic coast in the study area have long been an abundant source of foods for human consumption. These are nursery grounds for many species of fish and shellfish, as well as rookeries for migratory birds. Associated beaches are the nesting ground for loggerhead turtle, as well as many species of sea birds. Inshore marine habitat exists along the entire stretch of the lower St. Johns. Many fish and shellfish spend their entire life cycle in this habitat, most notably shrimps, blue crabs, and spotted seatrout. Upstream the freshwater component of the St. Johns has long-been home to a variety of shellfish species, most notably members of the genus *Viviparus*, as well as apple snail and bivalves. Fish and turtle species are likewise abundant and diverse. Lakes in the study area also supported mollusks of importance to humans, along with some 40 species of native fishes. The many swamps of pine flatwoods supported rich faunal communities, including invertebrates, fishes, amphibians, reptiles, birds, and mammals.

Terrestrial fauna of the pine flatwoods consists of white-tailed deer, black bear, and numerous other smaller mammals of economic importance to humans, as well as an array of reptiles and birds. Similar assemblages are found in the scrub and high pine forests of the Central Highlands.

CHAPTER 3
ARCHAEOLOGICAL BACKGROUND

Syntheses of northeast Florida prehistory have been issued periodically since 1952, when Goggin published his treatise on northern St. Johns archaeology (Goggin 1952). Among the syntheses are "historic contexts" that were commissioned by the state of Florida at the behest of the federal government. Florida Historical Contexts were written by various authors under the direction of Jerald T. Milanich in 1990. The Florida Division of Historical Resources later added illustrations and uploaded the documents on its internet site (**http://dhr.dos.state.fl.us/bar/hist_contexts/index.html**). Our review of the prehistoric archaeology of northeast Florida draws heavily on these sources (Borremans 1990, Russo 1990a, 1990b), as well as the work of James J. Miller (1991, 1998), and the statewide syntheses of Milanich (1994) and Charles H. Fairbanks (1980). Rather than duplicate these efforts, however, our intent is simply to review the defining aspects of regional prehistory, particularly as it relates to changing land use.

Our review is divided into two major sections. In the first section we highlight the archaeological sequence specific to the St. Johns Basin. Like the rest of the state, the St. Johns sequence begins with the Paleoindian period and is followed by the Archaic. The emergence of a tradition of fiber-tempered pottery during the Late Archaic period begins to distinguish the St. Johns region from surrounding areas. The namesake St. Johns I and II periods that follow continue what appears to have been a historically continuous cultural sequence through European contact.

The second section of this chapter reviews cultural traditions peripheral to the St. Johns Basin proper, specifically the Woodland period sequences of the Central Highlands, south Atlantic coastal, and Okeechobee subregions.

THE ST. JOHNS SEQUENCE

Paleoindian Period

First to colonize the western hemisphere, Paleoindian populations had no antecedent historical roots in the "New World." When members of these founding populations reached Florida some 11,500 years ago, the environment was significantly different than it is today. Sea levels were 60-100 m lower (Gagliano 1977) and the Gulf shoreline extended 40-70 miles farther west. Climate was significantly drier and cooler than at present. Potable water in the interior of the state was found primarily in "water holes, lakes, and prairies fed by rainfall and very deep sinkholes that were fed at least occasionally by ground water from springs" (Milanich 1994:39). With limits to the amount of available moisture and cooler climate, vegetative communities were patchy. Xeric scrub covered the southern part of the peninsula, while the northern portion was covered with pine forest mixed with oak and hickory stands. Coastal areas are thought to have been dry and supported savannah and dune communities (Borremans 1990).

Due to the generally poor preservation of organic materials outside of aquatic contexts, stone tools and lithic debris from their manufacture and use are the defining elements of Paleoindian material culture. In addition, items of bone and ivory attributable to the Paleoindian period have been recovered in the rivers and springs of north and central Florida (e.g., Dunbar and Webb 1996; Dunbar et al. 1989). Many of these items may prove to be highly diagnostic of late Pleistocene technological traditions.

Paleoindian lithic technology placed an emphasis on high quality lithic resources and is characterized by "fine workmanship" (Borremans 1990:4). Projectile points such as the Clovis, Suwannee, and Simpson types are diagnostic of this period, as are a variety of other formal unifacial tools such as the endscraper. Informal, expedient tools, such as utilized flakes, are also common in Paleoindian assemblages. In general, these materials reflect a technology designed to be flexible and multipurpose (Daniel and Wisenbaker 1987). Other Paleoindian artifacts include abraders and hones of sandstone, groundstone tools, and egg-shaped bola weights (Milanich and Fairbanks 1980:39). Other items of Paleoindian material culture not made from stone include a host of organic tools such as bi-pointed bone tools, beveled ivory points/foreshafts, socketed antler projectile points, worked shell, and bone beamers, awls, and anvils (Borremans 1990; Clausen et al. 1979; Dunbar and Webb 1996; Milanich 1994; Milanich and Fairbanks 1980).

Old models of Paleoindian adaptations emphasized a subsistence regime based on the hunting of Pleistocene megafauna such as mammoth and mastodon. Current thinking has shifted emphasis to a subsistence strategy emphasizing a broader foraging pattern (Borremans 1990; Milanich 1994). Indeed, Paleoindians exploited a number of smaller animals as well as plant foods (Milanich 1994:47). Thought to have been highly mobile groups composed of extended families, Paleoindians may have moved frequently from place to place, perhaps on a seasonal basis, to take advantage of certain resources. Aside from food availability, locations where Paleoindians camped were influenced by two major factors: water and siliceous stone (Dunbar and Waller 1983; Milanich 1994).

In the Florida Historical Context for the period (Borremans 1990), four Paleoindian site types are recognized: base camps/villages, short-term camps, quarries, and kill sites. Base camps/villages are defined by relatively large size with diverse and dense assemblages of material culture. Artifacts at various stages in their use-lives are present, spanning early manufacturing stages to discard. As residential locations, such sites have the potential to yield knowledge on population size and social organization. Few base camps/villages are known for the Paleoindian period, but two likely candidates are Harney Flats (8HI507) in Hillsborough County and the Butler Site (8SU2/8GI1) at the mouth of the Santa Fe River (Borremans 1990:9)

Quarry sites are locations where lithic raw materials (chert) were acquired and processed for tool manufacture. Sites of this type occur where chert is exposed at or near the ground surface. Nodules, cores, and debitage indicative of decortication and initial tool manufacture are present. North-central Florida, the central Gulf-coast, and north Florida along the Santa Fe, Suwannee, and Aucilla rivers have numerous quarry sites owing to the presence of Crystal River, Tampa/St. Marks, and Suwannee limestone formations in the area. These formations contain the greatest amounts of chert of all the limestone formations in Florida (Borremans 1990:9).

Short Term Camps are small sites, described as lithic scatters that are generally interpreted as hunting and gathering sites occupied for a short duration. These may very well be kill sites where the remains of the game taken has decomposed completely, leaving no evidence of its presence. Artifacts typically recovered from short-term camps consist of expedient tools and debitage. Many such sites have no doubt gone unrecognized as Paleoindian for a lack of diagnostic artifacts, namely formal bifaces.

Kill sites are those locations where Paleoindian artifacts have been found in association with butchered animal remains. The artifact inventory is similar to short-term camps and includes projectile points, utilized flakes, and debitage from tool maintenance. Submerged riverine finds in Florida are thought to be kill sites, although these are often deflated and mixed contexts where the association of bones and artifacts is equivocal (Borremans 1990:9).

By and large, Paleoindian sites are most numerous in areas where water and lithic resources coincided in the Late Pleistocene (Dunbar and Waller 1983). Often referred to as the "oasis hypothesis," this model predicts that Paleoindians were more or less tethered to areas where these resources were available. Inasmuch as the distribution of Paleoindian artifacts shows a strong association with karst topography in about one-third of the Florida peninsula (north-central and gulf coast) (Dunbar and Webb 1983), this model appears valid. In the St. Johns Basin Paleoindian sites are much fewer, suggesting that occupation of the region was sporadic, possibly reflecting an environment not suitable for prolonged habitation (Miller 1998:51-53). The few Paleoindian sites known from the region are generally associated with "spring fed rivers of the Tertiary karst region" (Miller 1998:51).

Paleoindian sites in the St. Johns Basin ought to occur in areas where surface water would have been available, such as places where sinkholes penetrated the Floridan Aquifer. Possible spring sources of water in the St. Johns Basin include Salt Springs, Silver Glen Springs, Juniper Springs, Fern Hammock Springs, Green Cove Springs, Beecher Springs, and Blue Springs (Miller 1998:54). Neill (1964) reports the presence of Suwannee points at Silver Glen Springs, a first-magnitude spring in eastern Marion County that flows into Lake George. Another possible location for Paleoindian sites in the St. Johns Basin would be ridges containing uplands environments and sinkholes adjacent to the river. An example of this situation would be the Crescent City Ridge with its many sinkholes possibly providing "reliable water sources during the Late Pleistocene Epoch" (Miller 1998:55). Systematic searches of these potential site locations have yet to be conducted.

Archaic Period

The Archaic Period of Florida can be divided into three subperiods, Early (10,000-7000 B.P.), Middle (7000-5000 B.P.), and Late (5000-2500 B.P.), based largely on changes in projectile point styles. The appearance of fiber-tempered pottery signals the beginning of the Late Archaic Orange Tradition at about 4200 B.P. The appearance of semi-fiber-tempered pottery of the so-called Transitional Period of 3200-2500 B.P. marks the end of the Orange and the beginning of the St. Johns I period. Because lifeways remained virtually unchanged over the span of the Orange and Transitional periods, we agree with Milanich (1994:35) that the Late Archaic be extended to 2500 B.P. In general, a fishing-hunting-gathering lifestyle was followed by all Archaic Period peoples. Social formations are thought to be essentially egalitarian, and regional populations levels appear to have increased from early to late periods.

Early Archaic. The Early Archaic immediately followed the Paleoindian period and is distinguished from it by the appearance of notched and then stemmed hafted biface forms after ca. 10,000 B.P. In general, the Early Archaic was characterized by wetter conditions than the preceding Paleoindian period and as a result of more surface water there are more Early Archaic sites in more locales. A change in subsistence practices also accompanied the environmental changes that contributed to the extinction of many Pleistocene animals. Despite the changes, many Early Archaic sites are found at the same locations as earlier Paleoindian sites (Milanich 1994:63).

With the exception of projectile point types, Early Archaic material culture is very similar to that discussed for Paleoindians. Numerous formal unifacial tools and expedient flake tools are present in Early Archaic lithic assemblages. Projectile point types diagnostic of this period include the side- and corner-notched Bolen, with stemmed types such as the Kirk Serrated, Hamilton, and Arredondo appearing later. Some investigators (Bullen 1975; Milanich 1994; Milanich and Fairbanks 1980; Purdy 1980) consider the Bolen type to be Late Paleoindian in age despite pan-southeastern similarities among well-established Early Archaic projectile point types. Big Sandy, Taylor, and Kirk Corner Notched points from Georgia and South Carolina, as well as the Autaga type from Alabama, bear many similarities with Florida Bolens.

As was the case for the Paleoindian period, few Early Archaic sites are recorded in the study area, although among them is arguably the most spectacular in the Southeast, namely the Windover Pond cemetery in Brevard County (Doren and Dickel 1988). In general, Early Archaic sites are found at springs and high ground overlooking wetlands such as site 8SJ3135 in St. Johns County, located on a sand ridge overlooking a swamp (Miller 1998:61). Land use patterns for the Early Archaic, as they relate to the St. Johns Basin, are poorly documented, and we have little insight regarding the movement of populations between the Central Highlands, the St. Johns, and the Atlantic Coast. Presumably, the St. Johns Basin and Atlantic Coast were still not extensively utilized by Early Archaic populations for the same reason they were underutilized by Paleoindian groups. Yet, given an increase of surface water, especially perched sources rather than deep sources associated with the Floridan Aquifer, greater utilization during the Early Archaic period is expected. Perhaps the limited number of Early Archaic sites in the St. Johns Basin is more a result of poor sampling in the region, ineffective models for settlement and site location, and the inability to detect sites that may be buried or inundated beyond the reach of standard archaeological site-detection methods.

Middle Archaic. A general environmental trend toward wetter conditions and more and larger surface water sources characterized the Middle Archaic period. These environmental changes are thought to be responsible for changes in Archaic lifeways, resulting in different settlement, subsistence, and technological systems from previous periods. The beginning of the Middle Archaic is generally placed at about 7000 B.P. and its terminus around 5000 B.P. (Milanich 1994). As with all other prehistoric periods without ceramics, changes in projectile point styles signal the beginning of the Middle Archaic and are used as temporal indicators in assigning sites to particular traditions. Within the St. Johns Basin, the late Middle and preceramic Late Archaic is defined by the Mount Taylor culture, an archaeological construct derived from the Mt. Taylor site of Volusia County (Goggin 1952).

Compared to sites of previous periods, Middle Archaic sites are widely distributed throughout Florida, and it is during this period that shell middens began to accumulate along the St. Johns River and the Atlantic and Gulf coasts. Numerous sites are found in upland, riverine, coastal, and wetland locations and are suggestive of growing populations.

Sites dating to the Middle Archaic consist of at least four types: base camps, special use sites, quarry sites, and cemeteries. Base camps are generally large in size, covering several acres and containing hundreds of tools composed of several types and tens of thousands of pieces of debitage (e.g., Bullen and Dolan 1959). The diversity of tool types present at base camps may be indicative of a greater range of activities carried out there. The shell middens of the late Middle Archaic (Mount Taylor) period may indeed represent base camp functions, although independent evidence to verify this (e.g., traces of habitation structures) has yet to be found. Special use sites on the other hand contrast sharply with base camps with regard to their size and material content. Such sites often contain a modest assemblage of lithic debitage and a few tools or tool fragments. The small size and limited assemblages of these sites suggest short-term occupation and limited or specialized activities. Special use sites are interpreted often as temporary campsites or extractive locations.

Quarry sites are among the Archaic sites classified as special use or extractive sites. However, base camps or special use sites are occasionally associated with quarries. Generally quarry sites are characterized by outcrops of chert or silicified coral with associated assemblages of cores, quarry blanks, performs, failed performs and bifaces, and copious amounts of debitage.

Several Middle Archaic cemeteries have been investigated, most of which are subaqueous pond burials (e.g., Beriault et al. 1981; Clausen et al. 1979; Wharton et al. 1981). Although such sites are located to the west of the study area, the precedent of subaqueous burials at Windover suggests that this mortuary tradition was both widespread and long-lived in Florida. Other Middle Archaic cemeteries involve midden burials, such as those from the base of the Harris Creek shell mound at Tick Island (Aten 1999; Jahn and Bullen 1978).

Middle Archaic hunter-gatherers utilized a diversity of resources, and here again the importance of wetlands and other aquatic environments becomes apparent. Clearly, the presence of numerous shell middens along the St. Johns, Atlantic, and Gulf coasts attests to the use of shellfish by Middle Archaic hunter-gatherers after about 6000 B.P. Numerous fish bones, as well as reptile and amphibian remains, likewise speak to the importance of aquatic resources in the subsistence regime. Terrestrial faunal resources were also consumed by Middle Archaic peoples as is evidenced by the presence of deer, raccoon, opossum, and gopher tortoise, among other vertebrate remains (Russo 1990a). Important plant foods likely included hickory nuts, acorns, saw palmetto, persimmon, and a variety of other plant resources.

Middle Archaic material culture is represented in a number of media: stone, bone, shell, and wood. Perhaps the best known and most studied are the stone artifacts, specifically projectile point types. In general Middle Archaic points are stemmed, broad bladed, and triangular. The most distinctive is the Newnan point, but Marion, Putnam, and Hillsborough points are also typical of the period. One technological trait of great importance in the Middle Archaic is thermal alteration. The effects of intentional, controlled heating on chert are well documented (Purdy 1981). This procedure reaches its zenith during the Middle Archaic, and is thought to be an adaptation to reduced band ranges and a means of improving the flaking quality of mediocre and poor lithic resources (Ste. Claire 1987).

Other than the point types just mentioned, Middle Archaic lithic assemblages are lacking in formal tool types. Rather, expedient and informal types are the norm. Common tools found in Middle Archaic lithic assemblages are utilized flakes, bifacial scrapers, hammerstones, perforators, drills, and a number of tool forms made from the reworked basal portion broken points. Bone tools from the Middle Archaic have been recovered from midden sites along the St. Johns River and its tributaries as well as the subaqueous cemeteries mentioned earlier. Bone artifact types include decorative pins, points, awls, perforators, atlatl triggers, socketed antler points, and fish hooks (Russo 1990a). Also found in middens along the St. Johns are shell tools. Common Archaic types include adzes, celts, columnella chisels and planes, and hafted conch tools (Goggin 1952; Milanich 1994; Milanich and Fairbanks 1980). Wooden artifacts are quite rare, as are other artifacts made of perishable materials. From the Republic Groves cemetery wooden stakes, cordage, and matting were recovered (Wharton et al. 1981)

Late Archaic. The Late Archaic period begins at about 5000 B.P. and ends by about 2500 B.P. Changes in projectile point styles herald the beginning of this period and the manufacture of St. Johns and sand tempered pottery mark its end. While stemmed projectile point forms typify the Middle Archaic, the Late Archaic is characterized by basal- and corner-notched forms. The Late Archaic is divided into preceramic and ceramic subperiods. The preceramic subperiod ends when fiber-tempered pottery of the Orange tradition began to be produced after about 4200 B.P. The production of this pottery marks the beginning of the Orange period which itself is sub-divided into five sub-periods based on ceramic attributes (Bullen 1972).

Environmental trends that began during the Middle Archaic reached essentially modern conditions in the Late Archaic. Increasing surface water and productive coastal environments led to the occupation of almost every habitable locale in the state, particularly in east Florida (Milanich 1994:89). One possible exception is the interior uplands which, according to Milanich (1994), appear to have fewer Late Archaic sites than in the preceding Middle Archaic. This is thought to be due to the focus of Late Archaic peoples on wetland environments and the lack of extensive wetlands in the interior of the same nature as those in the St. Johns River basin and the Atlantic and Gulf coasts.

In contrast to the interior uplands, the St. Johns Basin and the Atlantic coast saw dramatic increases in the number of sites during the Late Archaic (Milanich 1994:87). While permanent or semi-permanent Middle Archaic sites may have existed on the coast (Russo 1996), such sites were certainly present by the Late Archaic. Site types of the Late Archaic are essentially much the same as they were in the Middle Archaic, with the exception that there were more of them in coastal locations and they may have been occupied for longer periods of time. According to Milanich (1994:85), Late Archaic sites of considerable size are found in a number of locations: along the northeast coast and inland waterway from Flagler County north, along the southwest coast from Charlotte Harbor south into the Ten Thousand Islands, and the braided river-marsh system of the central St. Johns River below Lake George. In these areas, sites are large, densely clustered and associated with sedentary, or at least semi-sedentary populations.

Large populations, semi-sedentary villages, and the development of regionalization are some of the more important developments during the Late Archaic. During this time regional populations began to take on characters of their own, possibly as a result of adaptations to different ecological zones in which they were located. Several regional Late Archaic cultures have been identified by Milanich (1994) and are distributed along the coasts and in the St. Johns Basin. One regional entity is situated along the Atlantic coast and St. Johns Basin, another along the Gulf coast in Northwest Florida, the Greater Tampa Bay area, and the southwest Gulf coast. In each of these areas preceramic Middle and Late Archaic and Orange period sites have been identified and differences in material culture and subsistence practices have been observed.

Fiber-tempered pottery of the Orange tradition began to be made and used by Late Archaic communities of the study area after about 4200 B.P. According to Milanich (1994:86) there was little change in the basic lifeways of Late Archaic peoples following the introduction of pottery. Material culture from Late Archaic sites is much the same as that of the preceding Middle Archaic. Besides pottery, the only notable changes in material culture are changes in projectile point styles. Point types typically found in Late Archaic sites are the Culbreath, Lafayette, Clay, and Levy types (Milanich 1994; Milanich and Fairbanks 1980), often in association with Orange pottery (Cumbaa and Gouchnour 1970). Preceramic Late Archaic sites containing these same points are also known, the most notable being the Culbreath Bayou site (Warren et al. 1967).

Fiber-tempered pottery is clearly the most diagnostic item in Late Archaic material culture inventories from northeast Florida. Orange pottery is widely distributed and easily recognized. According to Bullen (1972), during the Orange 1 subperiod (4000-3650 B.P.), pottery was manufactured by hand modeling and unadorned with surface decoration. Vessels were flat bottomed and rectangular in shape (Bullen 1972). During Orange 2 (3650-3450 B.P.) incised designs appear on pottery in the Orange Incised and Tick Island types. Vessel forms are thought to be the same as Orange 1. Orange 3 (3450-3250 B.P.) is characterized by the appearance of rounded vessels with flat bottoms. Incised designs persist and rims are thickened and flanged. Sand appears in the pastes during Orange 4 (3250-3000 B.P.) and simple incised motifs are common. By Orange 5 sandy and chalky ware pastes are common and bowl forms predominate. Originally coiling as a method of manufacture was thought to begin during this subperiod (Bullen 1972), but a radiographic analysis of Orange period sherds from the St. Johns Basin has shown that this practice began as early as Orange 2 (Endonino 2000). Many other details of Bullen's (1972) Orange sequence have yet to be verified. One recent project at the Summer Haven site (8SJ46) produced a large assemblage of Orange sherds whose physical and decorative attributes would, according to the Bullen sequence, postdate by several centuries the C14-age of ca. 3840-4000 for associated oyster shell (Janus Research 1995). Refinements in Orange chronology and typology are clearly necessary.

Before closing this section of the Late Archaic we would be remiss to overlook the so-called Transitional Period of ca. 3000-2500 B.P. As originally conceived by Bullen (1959), the Transitional Period is a taxonomic bridge between the Orange period and the era of regional cultures that begins with the St. Johns period at 2500 B.P. In this sense, the Transitional period is synonymous with the Orange 5 subperiod. One of the defining characteristics, according to Bullen, is the use of fiber-tempered pottery and pottery with a mixture of fiber and sand. However, the diagnostic specificity of "semi-fiber-tempered" wares has never been substantiated, nor is it clear that the Transitional period truly represents lifeways or cultural identities distinct from what either preceded or postdated it. Milanich (1994:88) suggests that the Transitional Period be discarded. Whereas we are persuaded to agree with this suggestion, we preserve the site files records for Transitional components in the interest of exploring spatial patterning unique to this ambiguous construct. As we show later, very few site records for northeast Florida actually include Transitional components.

St. Johns Period

Following the Late Archaic/Orange/Transitional period is the long-lived St. Johns period. Beginning around 2500 B.P. and ending with European contact, St. Johns chronology is divided into two periods, St. Johns I (2500-1250 B.P.) and St. Johns II (1250 B.P. to contact). These periods are further divided into St. Johns I (2500-1900 B.P.), Ia (1900-1500 B.P.) and Ib (1500-1250 B.P.); and St. Johns IIa (1250-950 B.P.), IIb (950-487 B.P. [A.D. 1050-1513]), and IIc (A.D. 1513-1565). These divisions are based on internal changes and responses to regional influences in pottery technology, mortuary ritual, and, late in the period, European contact. The appearance of chalky, spiculate ceramics marks the onset of the St. Johns I period; check stamping on chalky, spiculate pottery ushers in the St. Johns II period. The St. Johns IIc people are the various Timucuan-speaking groups described by European chroniclers (Milanich 1994:247).

Environmental conditions during the St. Johns I period were essentially like those of their Late Archaic and Orange ancestors. Archaeological surveys have demonstrated that Orange and St. Johns period components are found in the same locales and often at the same sites (Milanich 1994:254-255; Miller 1998:80). Wetlands in both coastal and riverine settings were still as important as they were during the preceding periods. Additionally, numerous sites are found around the many lakes and wetlands of central and east-central Florida (Milanich 1994:254). Along the coast, lagoons, barrier islands, and marsh environments attracted St. Johns peoples. Inland, the St. Johns River, its tributaries, and marshes also proved to be attractive to St. Johns peoples. According to Milanich (1994:254) the basic life-way of St. Johns peoples "seems to have been little changed from their Late Archaic, Orange period predecessors." Similarly, there is also a significant degree of continuity between the locations of St. Johns I and St. Johns II sites (Miller 1998:80-82). Populations increased through time from Orange to St. Johns II as indicated by an increase in the number of sites for each period per century (Miller 1991, 1998).

Continuity of site occupation from one period to the next underscores the importance of wetlands to peoples of the St. Johns region (Milanich 1994:263). The dietary regime and procurement strategies used by St. Johns I peoples were continued by St. Johns II peoples. Maize agriculture, which was important to populations in Northwest and North Central Florida, does not seem to have played an important role in the subsistence strategy of St. Johns II groups. Evidence for maize agriculture is almost nonexistent in the St. Johns region. One cultigen that has been identified as being used by St. Johns II populations, and was probably used by previous populations, is the bottle gourd (*Langeria siceria*). These were probably not a major food source, but were used instead as containers. More that 2000 seeds and rind fragments were recovered from Hontoon Island by Purdy (1991; Newsome 1987).

Populations during the St. Johns II period evidently were larger than those in St. Johns I period (Miller 1998:85) and, with this growth came the development of complex sociopolitical system like those of the Ft. Walton and other Mississippian period societies (Milanich 1994:263). It is not certain whether chiefdom level societies could be supported by the economic system of this region. St. Johns IIb mounds at Shields, Mount Royal, and Thursby—all along the St. Johns River—mirror the mounds of Mississippian chiefdoms in morphology and artifact content, suggesting widespread ideological influences. Conversely, the local St. Johns IIb economies apparently did not involve intensive food production, specifically maize farming.

Material culture during the St. Johns I period differs significantly from that of the Archaic periods. As noted earlier, the appearance of chalky, sponge-spiculate pottery marks the onset of the St. Johns ceramic tradition. St. Johns I village ceramics are plain or otherwise display incising, pinching, or punctations. Some Deptford tradition ceramics, or local copies, also occur. In the St. Johns Ia period, surface decoration disappears as nearly all wares are plain. St. Johns Ib village ceramics are still almost all plain. Nonlocal ceramics are present throughout St. Johns I, I a, and Ib times, but they are often restricted to burial contexts.

The St. Johns II period is marked by the appearance of check-stamped pottery, and this has allowed archaeologists to distinguish between St. Johns I and II sites and/or occupations at the same site. About the same time that check-stamped ceramics first appeared in the St. Johns region, they also appeared in regions of the Weeden Island culture (Milanich 1994:262). Some archaeologists speculate that the appearance of check-stamped ceramics coincides with the spread of maize agriculture, although evidence to substantiate this is lacking at present (Milanich 1994:263). St. Johns IIb ceramic assemblage diversified to include extraregional trade goods and stylistic motifs of Mississippian-influenced cultures found along the Gulf Coast and to the north.

Stone tools in St. Johns sites are similar to those in earlier sites in the St. Johns Basin with the exception of projectile point forms. Overall during this period, points tend to be smaller (Bullen 1975:3) and not as well made as earlier forms. Diminutive representations of Archaic forms are still manufactured, as are new ones. New point types include the Jackson, Florida Copena, Bradford, Columbia, Broward, Taylor, Westo, Florida Adena, Gadsen, Sarasota, and Ocala types (Bullen 1975). According to Purdy (1981:47-48) other stone tool forms from the late ceramic period tend to be nondescript and resemble Archaic specimens. Drills, microtools, blades, hafted end scrapers, and other tool forms were also made.

Similar lithic artifact types are found in both St. Johns I and II. An exception worthy of mention is the transition from the Columbia, Bradford, Duval, Leon, and O'Leno points to the Pinellas, Ichetucknee, and Tampa points types around St. Johns IIa or IIb times (Bullen 1975:6). Tools of shell and other materials were also made during this period. Shell adzes, celts, picks, hammers, and cutting tools have been recovered from numerous sites, as have ornamental shell items, such as beads and gorgets. Wood was also utilized to make a host of items. Purdy (1991) recovered large numbers of wood chips in her Hontoon Island investigations. These chips are thought to be the result of wood-working activities such as making dugout canoes, paddles, bowls, tool handles, and small points, among other things (Milanich 1994:266). Cordage, fabric, and matting were also made as in earlier periods as evidenced by the presence of fabric impressions on the bottom of ceramic vessels (Milanich 1994:259). St. Johns IIc period sites contain European objects such as nails, chisels, glass beads, and ceramics.

Ceremonialism in the St. Johns area appears to combine indigenous elements with extraregional aspects of practices from within and without Florida (Milanich 1994:260). Generalized Middle Woodland burial mound ceremonialism has been recognized in the St. Johns cultural area. Low truncated cone-shaped burial mounds appear for the first time during St. Johns I (Milanich 1994: 247). Mounds grew in size during the St. Johns II period. Local copies of Deptford and Swift Creek ceramics appear in burial mounds, as do exotic trade items by St. Johns Ia (Milanich 1994:247). These exotic items include copper discs, cymbal shaped ear spools, mica and galena, greenstone celts, quartz plummets, and bird effigy elbow pipes (Milanich 1994:261).

By St. Johns Ib, Swift Creek-Weeden Island ritual and belief spread and are reflected in the types of ceramics found in mounds (Milanich 1994:262). Late varieties of Swift Creek Complicated-Stamped and Weeden Island Incised and Punctated ceramics are present, as are St. Johns Plain and Dunns Creek Red. Smaller truncated cone-shaped burial mounds decline through St. Johns IIa. Exotic trade goods are present and Hopewellian influenced ceremonialism is still present. St. Johns IIb mounds are multi-stage mounds, which is considered to be evidence for intensified ceremonialism. Fort Walton and Safety Harbor Check-Stamp ceramics appear alongside exotic trade goods and Southern Cult motifs in ceremonial burial contexts. Toward the end of St. Johns IIb, Cult motifs and truncated mounds increase. Gold and silver appear in mounds and indicate contact with South Florida Indians who had contact with Europeans. Burial and temple mound building continued into St. Johns IIc, but European influences in the form of missionization and disease eventually ended their construction.

EXTRALOCAL SEQUENCES

Portions of three major archaeological regions coterminus with the St. Johns Basin are included in our study area. The "north central" region, as defined by Milanich (1994:xix), was home to Woodland cultural traditions that included the Deptford, Cades Pond, and Alachua cultures. At the southern extreme of the St. Johns region lies the Indian River area. The local Malabar tradition of the Indian River area, as defined by Rouse (1951), has clear affinity to both the St. Johns cultures to the north and Glades cultures to the south and west. A third archaeological region, the Okeechobee Basin, supported the south Florida Belle Glade culture, which likewise has affinities to both Glades and Malabar. Our brief reviews of these extralocal traditions are derived largely from Milanich (1994) and Milanich and Fairbanks (1980).

Deptford

Deptford culture was first identified along the Georgia coast near Savannah at a site bearing the same name (DePratter 1991). Geographically Deptford culture is recognized along the Atlantic coast from Cape Fear North Carolina southward to the mouth of the St. Johns River. Along the Gulf Coast, sites of Deptford culture are found from the Florida-Alabama border south to Tampa Bay and slightly beyond (Milanich and Fairbanks 1980:66). Sites with Deptford components are also found in the interior uplands of north-central Florida, but these are few in number. Temporally, Deptford is believed to have begun some time around 2500 B.P. and ended at about 1400 B.P. Along the Atlantic Coast Deptford Culture persisted longer than on the Gulf Coast (Milanich and Fairbanks 1980:66). Gulf Coastal Deptford terminated somewhat earlier, around 1800 B.P., when it was replaced by the Swift Creek and Weeden Island cultures.

Characterized as a coastal dwelling culture, Deptford peoples made extensive use of food resources along the coastal strand. As such, Deptford sites are mostly found in these locations. Villages are "nearly always located in live-oak-magnolia hammocks that are adjacent to the salt marshes" (Milanich and Fairbanks 1980:68).

Deptford sites are rarely large in areal extent or deeply stratified (Milanich 1994). Sites of small size horizontally and vertically are generally interpreted as short-term residence or resource extraction sites. Sites that have experienced little disturbance exhibit "circular, often overlapping, shell middens...probably represent the natural accumulation of refuse next to individual house locations. Often, closer to the marsh, a larger, possibly communal dump is also present" (Milanich and Fairbanks 1980:72-73). Sites with long occupational histories often have overlapping house middens making it difficult to discern individual domestic deposits.

The relationship between coastal and the interior Deptford sites in Florida are somewhat ambiguous. A number of small sites can be found throughout the interior Coastal Lowlands and Central Highlands. Whether these represent seasonal movements or short-term extractive sites is unclear (Milanich and Fairbanks 1980:72). In the interior uplands in the central part of the state, small Deptford deposits are found overlying Archaic deposits and beneath Alachua tradition occupations.

Pottery is the most diagnostic item of Deptford material culture. Tempered with sand and marked with carved or cord-wrapped paddles, or left plain, Deptford vessels include deep, cylindrical or conoidal jars with slightly flared or straight rims. Surface decorations include check-stamped, linear check-stamped, and simple-stamped designs. Podal supports, tetrapods, are another characteristic of Deptford pottery and are believed to have been influenced from other Woodland cultures of the piedmont to the north as well as the Tchefuncte and Bayou La Batre cultures of the western Gulf Coastal Plain (Milanich and Fairbanks 1980:79).

Swift Creek

Originally identified at a site bearing the same name near Macon, Georgia during the 1930s, Swift Creek culture came to be recognized by the complicated-stamped pottery that dominates village and ceremonial pottery assemblages (Williams and Elliott 1998). Soon after its initial recognition, researchers in other parts of the southeast were reporting similar complicated-stamped pottery. In Florida, Swift Creek is a Woodland period culture found primarily in northern Florida along the Gulf coast and in the interior. When found in northeast Florida, Swift Creek pottery has been viewed as a trade ware (Goggin 1952) because the area is peripheral to core of Swift Creek site distributions. Recent work, however, suggests that local Swift Creek populations were responsible for making some, if not most of the pottery found at midden and mound sites in Duval County (Ashley 1998).

As noted, Swift Creek sites are found in both coastal and inland settings. Along the Gulf coast, sites are found "either immediately adjacent to the salt marshes or back from them in the hardwood hammocks" (Milanich and Fairbanks 1980:117). Greater numbers of villages are to be found "in the interior highland forests, especially the Tallahassee Red Hills in the panhandle" (Milanich and Fairbanks 1980:117). Although the greatest distribution of sites is in the northern, non-peninsular portions of Florida, small campsites have been identified as far south as Alachua County, though these are rare. Village sites tend to be situated on ecotones: at the edge of river valleys and mixed hardwood forests in the interior, and at the edge of salt marsh and hammocks in the coastal zone (Milanich and Fairbanks 1980).

Cades Pond

Originally defined by Goggin (1949), Cades Pond culture is named after a mound site near Lake Santa Fe in Alachua County. Dating from ca. 1900-1200 B.P., Cades Pond has strong affinities to contemporaneous St. Johns and Weeden Island cultures. Cades Pond peoples are thought to be descended from Deptford populations who had previously inhabited the region on a limited basis. After 1900 B.P., they began to establish permanent villages in north-central Florida. The exact reasons for the change in settlement pattern are uncertain, but population pressures along the Gulf coast, rising sea levels, or the inundation of estuaries may have been responsible (Milanich 1994:228).

Cades Pond sites are distributed within an area bounded to the north by the Santa Fe River and to the south by Orange Lake, just south of the Alachua-Marion county line. Primarily, sites are located in eastern Alachua and western Clay and Putnam counties, corresponding to the wetter regions of these counties (Milanich and Fairbanks 1980:98). "All known villages" are located "adjacent to extensive swamp areas and/or large lakes," such as Paynes Prairie, and Newnan's, Orange, and Lochloosa lakes (Milanich and Fairbanks 1980:98). Faunal samples from the Melton village indicate that approximately 90 percent of species taken came from lake or marsh habitats (Cumbaa 1972).

Cades Pond site distributions generally consist of groupings of villages and extractive sites associated with burial mounds, some of which appear to be planned. Milanich (1978) was able to seriate these clusters to propose a model of growing settlement in the region. As villages were established and grew, new villages budded off in locales with good access to wetlands. From the establishment of two early clusters (Cross Creek/River Styx and north Levy lake/southwest Paynes Prairie), the Cades Pond population grew to six communities, each with villages and mounds (see also Milanich 1994:235-236).

Material culture from Cades Pond sites includes ceramics, bone and stone tools, and fossil and non-fossil shark teeth (Milanich 1994:232). Cades Pond period ceramics are dominated by plain wares, comprising from 85-95 percent of the village ceramic inventory at these sites. St. Johns, Deptford, and Weeden Island ceramics are also present, but are most often found in mound contexts (Milanich 1994:228). Lithic tools manufactured by Cades Pond people include a variety of projectile points, flake tools, and other patterned formal tools. Projectile points found at Cades Pond sites include Columbia, Jackson, and Duval types (Milanich 1994, Milanich and Fairbanks 1980).

Alachua

Following Cades Pond, the Alachua tradition began at about 1200 B.P. and lasted through the early historic era (A.D. 1700) (Milanich and Fairbanks 1980:169). The Alachua Tradition is divided into four subperiods: Hickory Pond (1200-800 B.P.), Alachua (800-400 B.P.), Potano I (A.D. 1600-1630) and Potano II (A.D. 1630-1700). These divisions are based on ceramic changes in the case of Hickory Pond and Alachua, the appearance of Spanish artifacts in Potano I, and a decrease in lithic artifacts and the appearance of pottery from Georgia in the case of Potano II (Milanich and Fairbanks 1980:170-171).

In north-central Florida, Alachua Tradition sites are distributed from the Santa Fe River to Belleview and bounded on the east and west by coastal scrub flatlands (Milanich 1994; Milanich and Fairbanks 1980:169). Alachua peoples are believed to have replaced or displaced Cades Pond populations. The origins of the Alachua Tradition may have been in the Wilmington and Savannah cultures of southeastern and coastal Georgia (Milanich and Fairbanks 1980:169).

Alachua site locations contrast sharply with those of the preceding Cades Pond culture. Though often in close proximity, sites of these two cultures are never contiguous (Milanich 1994:335). The distribution of Alachua sites corresponds to the distribution of upland hardwood forests of north-central Florida. Also coinciding with the distribution of Alachua sites are loamy, fertile, and well drained soils. Alachua sites are generally located "on higher ground close to lakes, ponds, and other freshwater sources" (Milanich 1994:338).

Originally defined by Goggin (1949) as a sedentary agricultural tradition, Alachua was characterized by extensive villages in areas of good soil with infrequent burial mounds, no temple mounds, and characterized by cord-marked and cob-marked pottery. Numerous Alachua sites have been investigated in north-central Florida, particularly in Alachua County. Sites are often found in clusters, possibly representing the budding off of new villages, or the relocation of old ones as local soils lost fertility (Milanich 1994:337). Despite the apparent importance of soil fertility, evidence for maize agriculture is slim. Only one late pre-Columbian/early colonial period site (Richardson) has yielded charred cobs and kernels. Other evidence in the form of cob-marked pottery and Spanish accounts suggests maize agriculture (Milanich 1994:339).

Material culture of the Alachua Tradition consists of a number of ceramic, stone, and bone artifacts. Alachua culture ceramics are characterized by quartz sand-tempered pastes, and earlier in the Hickory Pond period clay lumps as well, and two distinctive surface treatments, cord marking and cob marking (Milanich 1994). Although present in both early and later Alachua culture, Prairie Cord Marked pottery was most prevalent during he Hickory Pond period. The appearance of cob-marked pottery signals the beginning of the Alachua period. Other surface decorations present on Alachua culture pottery include Prairie Fabric Marked and Lochloosa Punctate. Vessel shapes included both cylindrical pots and small bowls with orifice diameters less than 25 cm (Milanich and Fairbanks 1980:176). Stone tool types used by Alachua culture peoples include small triangular projectile points such as the Pinellas, Ichetucknee, and Tampa types.

Malabar

Located at the southern end of the St. Johns region in the Indian River area in Brevard, Indian River and St. Lucie counties, Malabar culture overlaps with the St. Johns culture to the north but is separate and distinguishable from its northern neighbor. The Malabar culture area "encompasses the Indian River, a coastal lagoon, from near Merritt Island to St. Lucie Inlet" and includes the "wet marshlands, braided stream system, and lakes that comprise the St. Johns River basin ten to twenty miles inland from the coast" (Milanich 1994:249). Defined by Rouse (1951), Malabar chronologically parallels St. Johns culture to the north. Malabar I is characterized by plain sand-tempered pottery and Malabar II by the presence of St. Johns Check-Stamped pottery.

Inhabiting the wetlands inland from the Atlantic coast, and the Atlantic coast as well, Malabar peoples exploited marshlands, coastal lagoon, barrier islands, and portions of the mainland adjacent to the coast (Milanich 1994:249-254). Archaic populations made less extensive use of the interior marshlands due to the drier conditions that prevailed at that time (Russo 1986). By the beginning of Malabar I, wetter conditions emerged and water levels rose resulting in an abundance of resources which made this area attractive and able to support larger human populations. Sites found within these interior marshlands are of several types. Small artifact scatters with little cultural material and scarce animal remains are interpreted as single-use, short-term resource extraction sites or camps. Other sites are multicomponent and appear to have been used intermittently for short periods of time. Sites of this type are usually less than a quarter-acre in extent and located away from permanent settlements. Extensive, dense midden deposits and a greater diversity of tools characterize permanent settlements (Milanich 1994:251-252). All site types of the Malabar settlement system are found in both the interior marshland areas and along the coast. The relationship between these two areas is somewhat uncertain, but the prevailing view is that populations were moving between the coastal areas and the interior marshlands (Milanich 1994:252-253).

Material culture associated with Malabar culture is mostly ceramic. Although St. Johns tradition ceramics are present in the Indian River area, Malabar culture is distinguished by the presence of "significant amounts of undecorated pottery tempered with quartz sand" (Milanich 1994:250). This plain undecorated ware reached its highpoint of popularity in the middle of the Malabar I period (Cordell in Sigler-Eisenberg et al. 1985). Even though pottery is used as a line of evidence for treating the Indian River region as a discrete culture area, the use of local clay sources to manufacture both St. Johns and Malabar pottery has been cited as evidence to suggest that "one group made both wares" (Milanich 1994:250).

Belle Glade and Glades

The Lake Okeechobee area was home to peoples of Belle Glade culture beginning as early as 2500 B.P. The Lake Okeechobee basin is a low-relief, poorly drained catchment that houses Florida's largest freshwater lake. The present study area includes only a small portion of the basin. However, the channelized Kissimmee River and the lake from which it originates includes archaeological remains that fit comparably within the Belle Glade tradition, enabling regional specialists to include the Kissimmee drainage in the Okeechobee region (Milanich 1994:281). This northern portion of the region exhibits much more topographic relief than the Okeechobee basin proper, owing to a southern protrusion of the Central Highlands (Milanich 1994:280).

As is evident at earthwork complexes like Fort Center, Tony's Mound, Big Mound City, and the namesake Belle Glade site, Belle Glade culture involved some massive alterations of the land. Many such earth-moving projects—canals, ditches, embankments—were apparently aimed at altering the flow of surface and ground water, presumably to enhance or sustain food production. It remains uncertain whether maize agriculture was a significant component of Belle Glade economies (Milanich 1994:297-298). Irrespective of farming, landscape modifications clearly went beyond the mundane to include ceremonial constructions. At Fort Center, for instance, a mortuary complex dating to Belle Glade II (1800-1400 B.P.) consisted of a platform mound and charnel structure, an adjacent artificial pond, a dense midden, and a surrounding earthwork (Sears 1982).

The Glades region is the name given to the enormous portion of south Florida east and south of the Okeechobee Basin, including the Everglades. Archaeological sites exist throughout the Glades region, although the vast majority are coastal. Interior sites exist on the numerous hammocks and other raised areas that dot an otherwise extremely wet terrain. Archaeological cultures of the Glades are defined primarily by variations in pottery (Goggin 1949). Changes in surface treatment and lip morphology are the basis for a sequence that begins with Glades I at ca. 2500 B.P. and continues through the 16th century. The Caloosahatchee sequence of southwest Florida, home to the historic-era Calusa, is the best known of the Glades cultures. Comparatively little is known about Glades cultures of the south Atlantic coastal zone. The present study area includes but small portion of the Glades region, east of Lake Okeechobee.

CONCLUSION

This brief overview of the archaeological sequences of northeast Florida and adjacent regions provides a minimal backdrop to the diachronic analysis of site distributions. In closing this chapter we recapitulate some of the broad patterns of prehistoric land use.

Paleoindian sites in Florida are concentrated in locations that have good access to siliceous rock and sources of water. These critical resources co-occur throughout much of the northwest Florida, from Tampa Bay to the eastern Panhandle. In addition, good potential exists for sites near the first-magnitude springs of the middle St. Johns and Oklawaha rivers, as well as the karst topography of Crescent City Ridge. Lacking suitable lithic resources, these latter areas may contain minimal inorganic assemblages, even if Paleoindian occupations were substantial.

Early Archaic sites are found at springs and high ground overlooking wetlands. Surface water appears to have been more widely available compared to the Paleoindian period, but still a limiting factor. Utilization of near-shore locations of the Atlantic Strand is apparent with sites such as Windover in Brevard County, although the occurrence of sites east of the St. Johns River remains small.

The trend toward wetter conditions and more and larger surface water sources characterized the Middle Archaic period. Sites are now more widely distributed, albeit sparsely, across the entire study area, including the Atlantic Lowlands. After 6000 B.P. sites assigned to the Mount Taylor phase began to form along the middle St. Johns and Oklawaha rivers. These constitute the first freshwater shell deposits in the region. Parallel developments likely occurred with saltwater resources of the Atlantic Coast, but rising sea levels have obscured much of the evidence.

Sites classified as Late Archaic are widely distributed across the study area, owing again to moister conditions that enabled broader patterns of land use. Orange period sites of the last millennium of the Late Archaic are more numerous that generic Late Archaic sites. Clearly the addition of diagnostic fiber-tempered pottery to the Orange inventory enhanced archaeological visibility, thereby accounting for the apparent increase in site frequency. Irrespective of artifact visibility, Orange sites include a large fraction of shell middens, mounds, and coastal rings with conspicuousness all their own. Shell-bearing sites are distributed along the Atlantic coast, the mouth of the St. Johns, along the middle and upper St. Johns, and along the Oklawaha.

Sites with St. Johns components are the most numerous in the study area. St. Johns I sites include an expanded array of freshwater and saltwater shell sites, along with hundreds of more widely distributed habitation and special-activity locations across northeast Florida. Many St. Johns period components are found in the same locales and often at the same sites as Orange components. In addition, numerous new sites are found around the many lakes and wetlands of central and east-central Florida.

The continuity between Orange and St. Johns I sites extends into the St. Johns II period. Numerous sand mounds and other earthen constructions are added to the inventory at this time, including examples in the lower third of the St. Johns seemingly devoid of shell deposits. Whereas elements of ritual and ceremony appear to have enhanced in novel ways sacred uses of the land, the basic pattern of coastal and riverine settlement begun in the Middle Archaic continues and culminates in the St. Johns II record.

In addition to the St. Johns sequence, the Central Highlands, Okeechobee, and Glades regions have cultural sequences that have varying levels of influence in northeast Florida. Sites of Deptford culture have coastal manifestations in northeast Florida, with habitation sites in live-oak-magnolia hammocks that are adjacent to the salt marshes. The interior counterpart to Deptford culture is poorly understood although it has appreciable expression in Alachua and Marion counties.

Like Deptford, Swift Creek sites are found in both coastal and inland settings. Many Swift Creek sites are located in the lower reaches and adjacent salt marshes of the St. Johns in Duval County. To the west, village sites are common in the eastern panhandle region, while comparatively few, small sites are known from the Central Highlands of the study area. Sites with Weeden Island components are much more common in the latter region.

Cades Pond site distributions generally consist of groupings of villages and extractive sites associated with burial mounds, some of which appear to be planned. All such known clusters are located in Alachua and Marion counties. Communities in these counties occur in locations that offer access to two of more major wetlands resources such as the well-drained locale between Paynes Prairie and Cross Creek in Alachua County.

Alachua Tradition site locations contrast with those of the Cades Pond culture. Alachua sites corresponds to the distribution of upland hardwood forests and loamy, fertile, and well drained soils of north-central Florida. Alachua sites are generally located on higher ground overlooking freshwater sources.

To the south, in the Indian River region, Malabar peoples were exploiting marshlands, coastal lagoon, barrier islands, and portions of the mainland adjacent to the coast. The upper St. Johns, which is within 20 km to the Atlantic coast, was likewise targeted for habitation during the Malabar period.

Sites of Glades affiliation generally overlap the Malabar distribution in the southeast portion of the study area. Although the vast majority of Glades sites are coastal, interior sites exist on the numerous hammocks and other raised areas that dot an otherwise extremely wet terrain of South Florida. The wider and better-known portions of the Glades site distribution exist to the west, outside the study area.

Belle Glade sites of the Okeechobee Basin cluster around Florida's largest lake and the Kissimee River that drains into it. This latter portion, the only portion within the study area, exhibits much more topographic relief than the Okeechobee basin proper and seems to have led to more selective land use with fewer landscape modifications, such as canals and embankments, that are known for complexes adjacent to Lake Okeechobee.

CHAPTER 4
ST. JOHNS REGION DIGITIZED

Florida is endowed with a rich source of digital imagery and data on its geography—physical, cultural, economic, and historical. The Florida Geographic Data Library (FGDL) is a mechanism for collecting, standardizing, and issuing digital spatial data to anyone with interests or responsibilities in land-use management, planning, and research. The FGDL is administered by the GeoPlan Center of the University of Florida, a teaching and research institute specializing in Geographic Information Systems (GIS). GeoPlan strives to make the FGDL available to users in government, as well as the private and public sectors, and to ensure the standardization and reliability of its data. Several agencies at the federal, state, and local levels have provided imagery and data for the FGDL and work with GeoPlan to update resources as they become available.

Currently, the FGDL contains some 240 GIS data layer, ranging from physical attributes such as soils, topography, and hydrology, to tax records and voting districts, historic and modern land use, and remotely sensed images from satellites and planes, among many other things. These data exist at various scales, but generally they are packaged by county and made available on CD ROM. For this project, version 2.0 of the FGDL was purchased from GeoPlan for the 19 counties designated as the study area. Version 3.0 became available recently, but we chose to continue with v. 2.0 because of the considerable investment of time and money already made. Differences between the two versions are inconsequential to the aims of this project.

Among the myriad data layers available on the FGDL, only a handful is integral to our analyses. Chief among them are layers on topography, surface water, soils, and land use. Individual files for each of the 19 counties were merged into regional maps and databases for each of the layers. In certain cases both the shape files for spatial data and the associated data tables grew to enormous proportions. The merged files for specific soils (SSOILS), for instance, resulted in a file of over 190,000 lines of data. In each case, however, the user is able to choose among a variety of attributes relevant to his or her particular problems. For example, each of the 190,000+ soil mapping units in our study area is coded for soil type, texture, permeability, bulk density, water capacity, mineralogy, flood susceptibility, crop yield, drainage, pH, cation exchange, depth to watertable, shrink-swell capacity, and a host of other attributes. For our purposes, data on soil drainage and nonirrigated agriculture capability were sufficient for first-order analyses.

A final word on the quality of FGDL data is necessary before proceeding with our use of them. Any data gathering operation at the scale of the FGDL is prone to inconsistencies in its data, especially when many individual counties are unioned into a large regional database. We encountered missing data, redundant data, and occasional miscoded attributes such as contour lines with elevation values of 777 or 999 feet above mean sea level. Yet, we had no trouble locating and eliminating problematic values, and do not consider these problems unusual for such a large set of data. GeoPlan is careful in its on-line documentation to warn users about potentially unreliable data, and ultimately it is up to the user to ensure data quality and consistency before attempting analyses. Problems with some of the data clearly exist, and some no doubt went unnoticed. Still, we submit that at the scale of a 19-county study area, analytical noise that arises for the occasional errant value should not obscure the emergent properties of robust geographic patterning.

DIGITALLY CHARACTERIZING THE STUDY AREA

This and the next four chapters employs FGDL data to analyze the spatial distributions of archaeological sites and surveys relative to a series of environmental and land-use attributes. Our objective in this chapter is to characterize the distributions of environmental attributes in the study area in order to establish a comparative baseline for discerning nonrandom patterning in the locations of archaeological sites. Given the preliminary nature of this effort, we keep the analyses deliberately simple. Our selection of environmental variables include only elevation, distance to nearest source of running water, soil drainage, and capacity for nonirrigated agriculture. In the previous chapter we addressed the rationale for examining site locations relative to these variables, so we simple restate here that sufficiently drained soil, access to potable water, and proximity to productive terrestrial and aquatic resources are presumed to be among the chief criteria for prehistoric site selection, at least in terms of sustained and/or repeated habitation.

Our choice of environmental attributes involves both continuous and discrete variables. The latter consists of soil mapping units, essentially those of USDA county soil surveys plotted on 1:24,000 aerial photographs. Characterizing soils in the study area is simply a matter of totaling the area represented by all soil mapping units coded for a given value (e.g., poorly drained) of a given attribute (e.g., drainage). Although this indeed is a relatively simple task, with over 190,000 soil mapping units, this would be virtually impossible without digital data and computers with abundant RAM and quick processors.

Continuous data present a different challenge. Characterizing elevation and distance to water values for the study area requires a set of randomly generated points. Each such point is a location that can be characterized as a discrete value for continuously distributed variables (i.e., elevation, distance). The number of points must be large enough to adequately characterize the full range of variation for selected variables, but not so large as to create redundancy. Ideally, the number of random points would be equal to the number of actual points—in this case sites—so that the statistical qualities of the two populations of points can be compared to detect nonrandom patterning in the latter. Although over 4000 sites are recorded for the study area, for many of the comparisons that follow, the site count is well below 1000. Accordingly, we first generated data on elevation and distance to water for 1000 random points, then reran the analysis for 2000 independent points to determine if redundancy was achieved. We begin our analysis with the data generated on random points.

Random Points

A display of 1000 randomly generated points is provided in Figure 4-1. Few lacunae are apparent, as the distribution provides widespread, albeit sparse, coverage of the entire study area. The second array of 2000 points is not illustrated herein, but as one might imagine, it provides similarly widespread sampling of the study area.

Elevation. Elevation values for random points were calculated from the topographic data layer derived from USGS 7.5 minute quad sheets. Summary statistics for the 1000- and 2000-point samples are given in Table 4-1. Note that the values are reported in English units (i.e., feet) because these are the standard units of USGS quads.

Mean, standard deviation, minimum, and maximum values are very similar for the two random samples. A difference of means test reveals no significant difference between the two samples ($t = 0.885$ unpooled variance; 0.881 pooled variance). This level of similarity suggest that the 1000-point sample is adequate for characterizing elevational variation in the study area.

In comparing randomly generated data with archaeological site locations, the shapes of the respective distributions are much more instructive than statistics on central tendency and variance alone. Accordingly, the frequency distribution of 1000 random points is provided in Figure 4-2. The distribution assumes a distinctly bimodal, almost trimodal pattern, with major modes centered on the 21-30 ft and 61-70 ft intervals, and a minor mode at the141-150 ft. interval. The distribution of 2000 random points (not shown here) assumes a nearly identical pattern.

These modal patterns in elevation are rather easy to explain. Virtually all points falling in the east half of the study area, essentially all points from the St. Johns River eastward, lie on landforms with elevations less than 50 ft. The only exception are points falling on Welaka Hill on Crescent City Ridge, a landform with small portions exceeding 100 ft in elevation. To the west are landforms of the Penholoway, Wicomico, Sunderland, and Okefenokee terraces, with elevations in the 42 to 200+ ft range. Certainly some low-lying terrain in the interior uplands falls below 40 ft, but in essence,

Table 4-1. Summary Statistics on Elevation (ft amsl) for 1000 and 2000 Random Points in the Study Area.

	1000 points	2000 points
mean	58.6	57.1
standard deviation	43.6	44.1
minimum	0.0	0.0
maximum	228.2	226.1

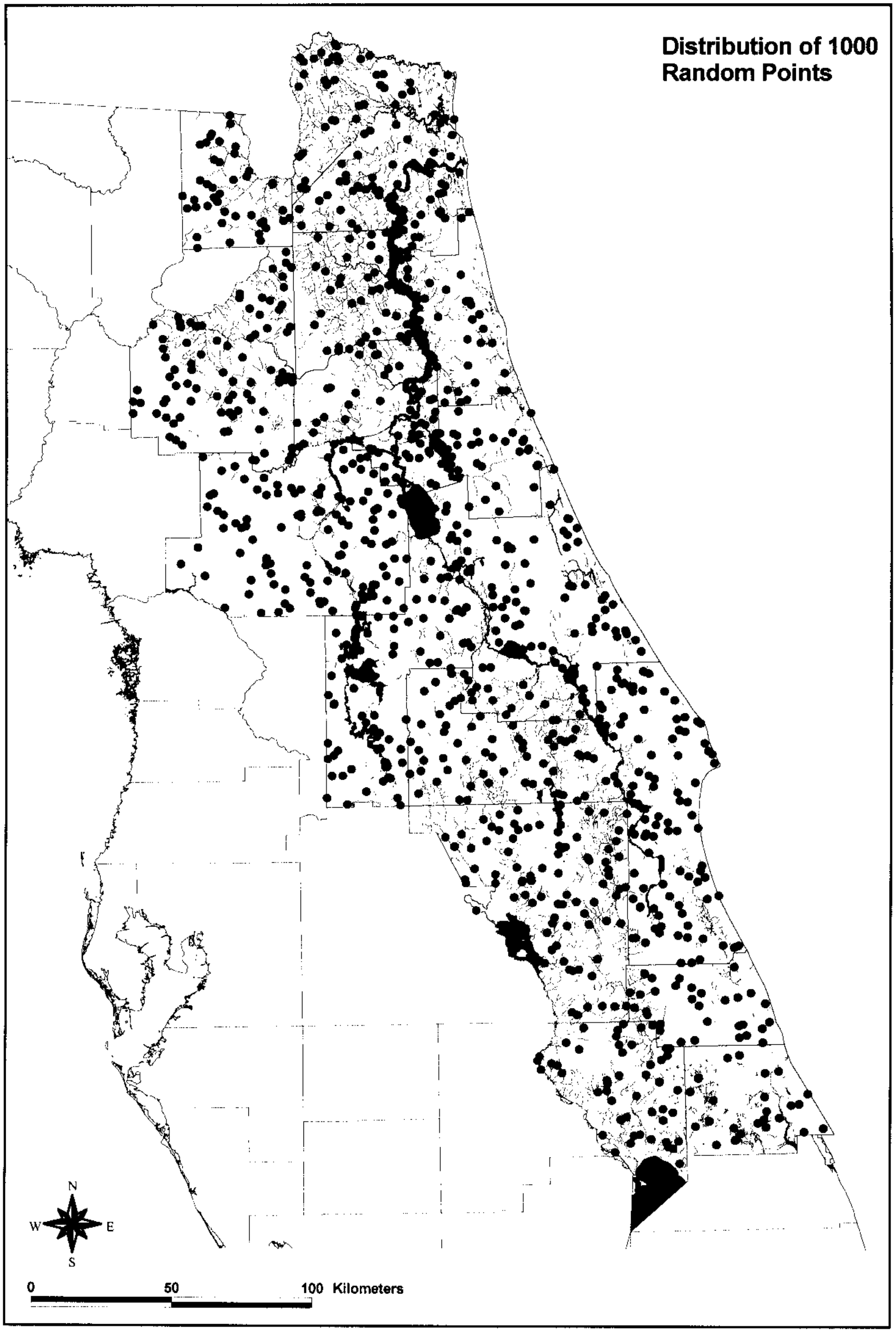

Figure 4-1. Distribution of 1000 random points in study area.

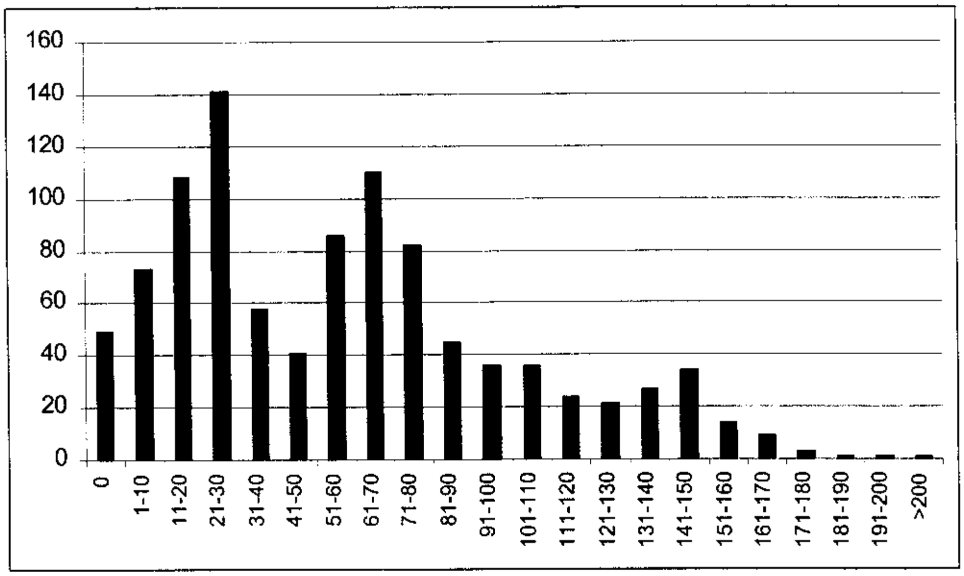

Figure 4-2. Frequency distribution of 1000 random points by elevation (ft amsl).

virtually all points in the low mode of Figure 4-2 are from the eastern or Coastal Lowland half of the study area, and those of the second mode and greater come from the Central Uplands. Thus, the frequency distribution of elevation is a good proxy for the most general physiographic division of the study area. These modes divide the frequency distribution of random points into roughly two equal halves; any deviations from this bimodality in the distribution of archaeological sites will reflect nonrandom tendencies in regional settlement, survey bias, or both.

Distance to Water. With thousands of lakes, over 2000 miles of coastline, and over 4000 square miles of wetlands, no location in Florida is far from water, if not actually in it. However, freshwater sources are not so pervasive in many parts of the state, and many of Florida's lakes have been well-watered only since about 6000 B.P. Access to fresh *running* water, that is, streams and rivers, is even more limited. In parts of northeast Florida, for instance, a source of fresh, running water can be as much as 20 km away.

The distribution of 1000 random points across a digital landscape that includes all natural sources of water and wetlands stands in marked contrast to sources of freshwater alone. The average distance to any source of water, salt- or freshwater is a mere 257.2 m and no point is more than 5.2 km away. Thirty percent of all points are actually in water, more than half of these in marsh, swamp or other wetlands.

As one might imagine, distance to water increases markedly if we eliminate all saltwater sources, freshwater wetlands, and ponds that are contained in disjointed drainage systems (see Chapter 1)—generally those of Alachua, Marion, and Orange counties. The reconfigured digital landscape of only fresh, running sources of water is illustrated in Figure 4-3. On this layer average distance of 1000 random points increases to 2367.7 m, with a maximum value of 20,809.9 m (Table 4-2). Thirty-four of these points fall directly in water, 25 of these in lakes, such as Lakes George and Kissimee, that are part of integrated river systems.

The vast majority (87.7%) of random points are closest to streams that drain into rivers, estuaries, or lakes (Table 4-2). Small tributary streams are concentrated in the lower (northern) third of the St. Johns Basin, where drainage is truly dendritic. Elsewhere streams are often disjointed, many emanating from springs and flowing into wetlands or ponds. Random points closest to rivers are mostly near the St. Johns and Oklawaha rivers, but several other rivers and creeks are represented by two to six points.

A second random sample of 2000 points does little to alter the distribution or central tendencies of values observed for 1000 points. A difference of means test reveals no significant difference between the two samples ($t = 0.570$ unpooled variance; 0.577 pooled variance). The biggest deviations occur in the proportion of points residing

Table 4-2. Absolute Frequency of 1000 and 2000 Random Points by Source of Nearest Running Water and Summary Statistics on Distance (m) to Running Water.

	1000 points	2000 points
Nearest Running Water		
Undesignated Stream	877	1697
St. Johns River	38	95
Oklawaha River	24	44
Econlockhatchee River	6	11
Sante Fe River	5	10
Withlacoochee River	5	29
Tomoka River	4	9
Spruce Creek	4	10
Palatlakaha River	3	10
Nassau River	3	6
St. Marys River	2	1
Wekiva River	2	5
Black Creek	2	6
St. Lucie River	0	4
Kissimee River	0	2
Points in Lakes on Rivers	25	61
mean	2367.7	2302.3
standard deviation	2996.2	2887.2
minimum	0.0	0.0
maximum	20,809.9	19,887.5

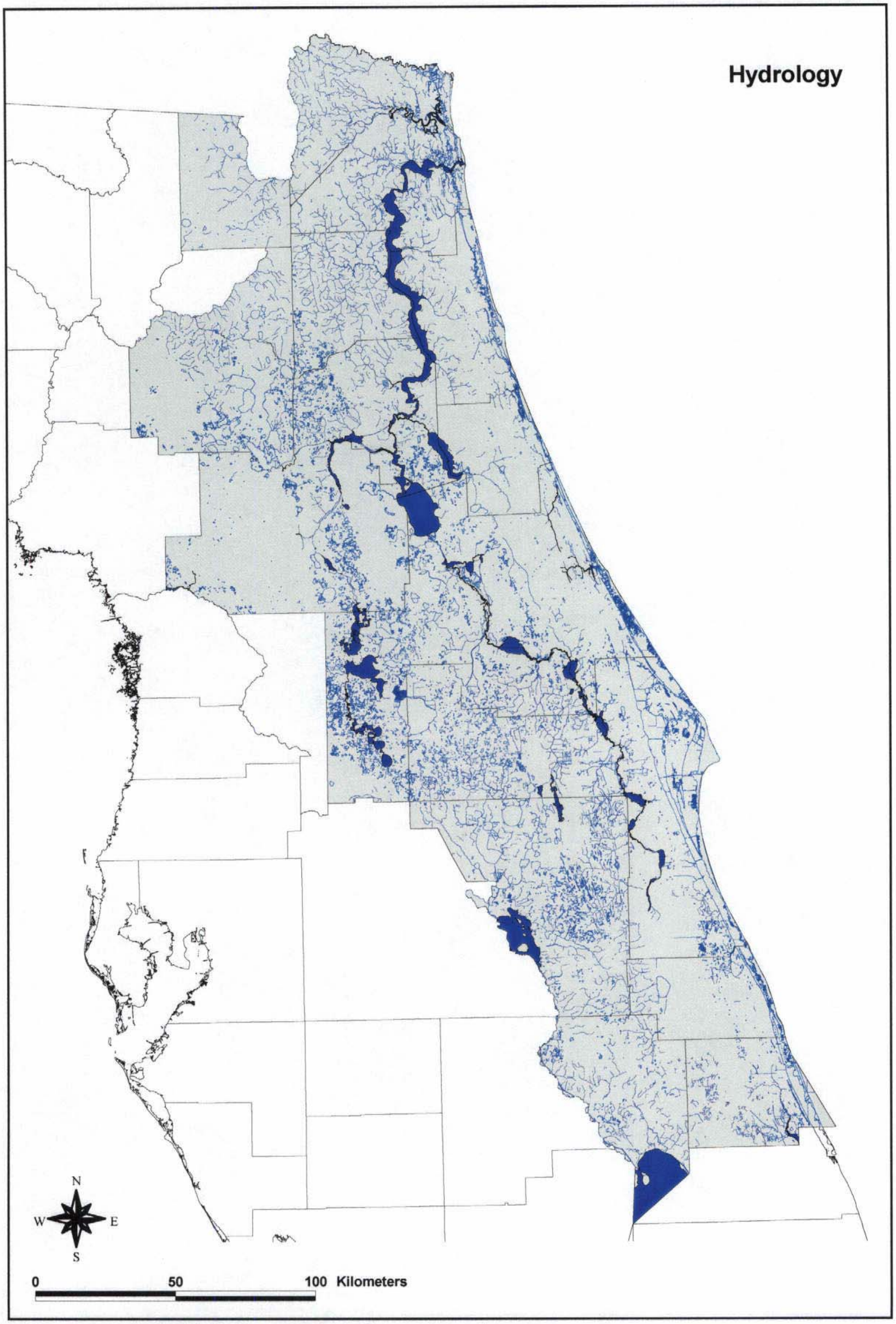

Figure 4-3. Running freshwater sources of water in study area.

closest to undesignated streams. Relatively fewer such points occur in the 2000-point sample, and, correspondingly, proportionally more points occur along rivers and in lakes. The biggest increase involves the Withlachoochee River, with a nearly sixfold increase over the 1000-point sample. Lesser proportional increases are observed for the St. Johns, Palatlakaha, Tomoka, and Wekiva rivers, as well as Black and Spruce creeks. Also, the 2000-point sample includes minor occurrences on the St. Marys and St. Lucie rivers, two waterways not represented in the 1000-point sample. The relatively greater representation of rivers and creeks in the larger random sample may prove significant in our effort to find nonrandom tendencies in prehistoric site location. Specifically, we must be careful about drawing spurious conclusions about tendencies for settlement near rivers if proportions of such locations are indeed numerically dependent on samples in excess of 1000 points, survey bias notwithstanding. Statistical values for distance to sources of running water are apparently not similarly affected.

In sum, the most meaningful hydrological landscape for detecting nonrandom patterning in site locations is fresh sources of running water. This includes all rivers and streams, as well as any lakes integrated into these drainages. By eliminating saltwater marshes, freshwater swamps, and many of the regions isolated lakes and ponds, we are dismissing much of the relevant water resources for human exploitation and travel. However, these features are so pervasive that the vast majority of point locations are within a couple hundred meters of water even if randomly distributed. Indeed, a full 75 percent of random points in a sample of 1000 are closer to any source of water than the average distance of 257.2 m. As we will see in Chapter 6, recorded prehistoric sites are actually much farther on average from any source of water than random points, but not because these resources were unimportant to prehistoric populations, but because archaeologists generally do not survey in areas of vast wetlands, where 30 percent of random points lie. We could eliminate all wetlands from the universe of randomly sampled space, but this would skew the comparative basis for seeking nonrandom patterns in site location for purposes of predictive modeling. Given the changes attending wetland ecology since the late Pleistocene we would be remiss to eliminate all modern wetland because of analytical constraints. The simple solution is to instead consider all area and seek nonrandom patterning in the distribution of archaeological sites relative to fresh, running water and their affiliated, natural lakes.

Soil Mapping Units

Soil attributes derived from United States Department of Agriculture (USDA) Soil Surveys in Florida counties comprise a detailed set of FGDL data for characterizing the study area. Two chief soils layers reside on FGDL files. A general soils layer (GSOILS) provides shape files and data on soil associations by county. Most counties have some 8 to 12 associations. These mapping units and the data attached to them are, by definition, highly generalized and not too useful for specific site planning, construction, and agricultural purposes.

A second layer of data (SSOILS) provides specific soils information and shape files. This dataset is a digital representation of the County Soil Survey maps published by the USDA Natural Resources Conservation Service. The maps have a scale of 1:24,000 and provide resolution of soil mapping unit down to an acre or less, although the level of map detail and ground truthing varies by county, as does some of the nomenclature. Still, these are the best maps available on soils and they are accompanied by a robust set of attribute data. Only a few gaps exist in the coverage for this layer. Missing data include all of Duval County and small portions of Broward, Marion, and Osceola counties.

Over 190,000 specific soil mapping units comprise the merged dataset for our 19-county study area. These units are distributed among 692 different soil types and 238 different soil associations. This level of detail is too great to display in a regionwide map.

As provided the USDA Soil Survey reports, the FGDL dataset includes dozens of attributes and detailed descriptive data for each soil type and association. For our purposes only two of the many soil attributes are considered: soil drainage class and nonirrigated agricultural capability.

Soil Drainage. USDA classification for soil drainage involves seven classes to describe general drainage properties of soils (Figure 4-4). Listed in Table 4-3, these classes serve as a good proxy for the duration and frequency of periods when a soil is free of saturation. As such, drainage class refers most directly to topographic position relative to surface water and the water table, but also implicates permeability, texture, and clay content. As we discussed in Chapter 3, the operative aspect of soil drainage is degree of inhabitability, with well drained soils preferable over poorly drained soils. We acknowledge that soils coded today as "poorly drained" may have been described as "well drained" if mapped in 8500 B.P. The potential for analytical noise caused by changes such as this will be considered in our analysis of diachronic trends in settlement location in Chapter 6.

Table 4-3. Distribution of Soil Mapping Units by Drainage Class for Study Area[1].

	#Mapping Units	Area (ha)	Percent Area
Drainage Class			
Excessively	11,281	40,8412.4	10.2
Somewhat Excessively	203	2207.2	0.1
Well	9422	182,838.3	4.6
Moderately Well	15,115	202,759.9	5.1
Somewhat Poorly	31,525	738,571.0	18.4
Poorly	47,962	1,186,280.2	29.6
Very Poorly	63,413	861,606.8	21.5
Water	2134	116,233.8	2.0
Urban, Pits, Dumps	13,359	311,226.9	7.8
Total	194,414	4,010,136.6	100.0

[1] excludes mapping units for areas of missing data, amounting to 1919 mapping units, including all of Duval County.

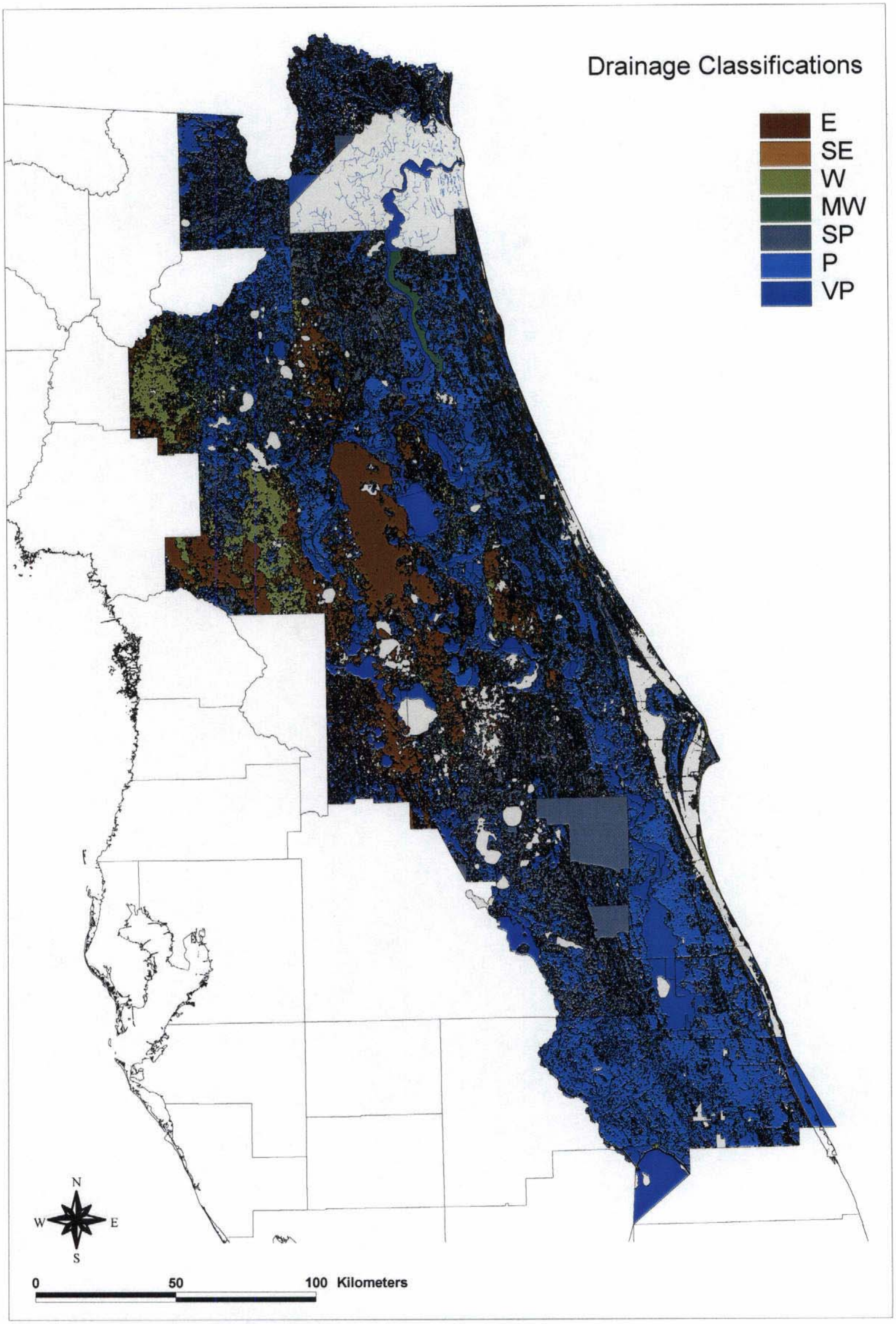

Figure 4-4. Distribution of soils in study area coded by drainage class.

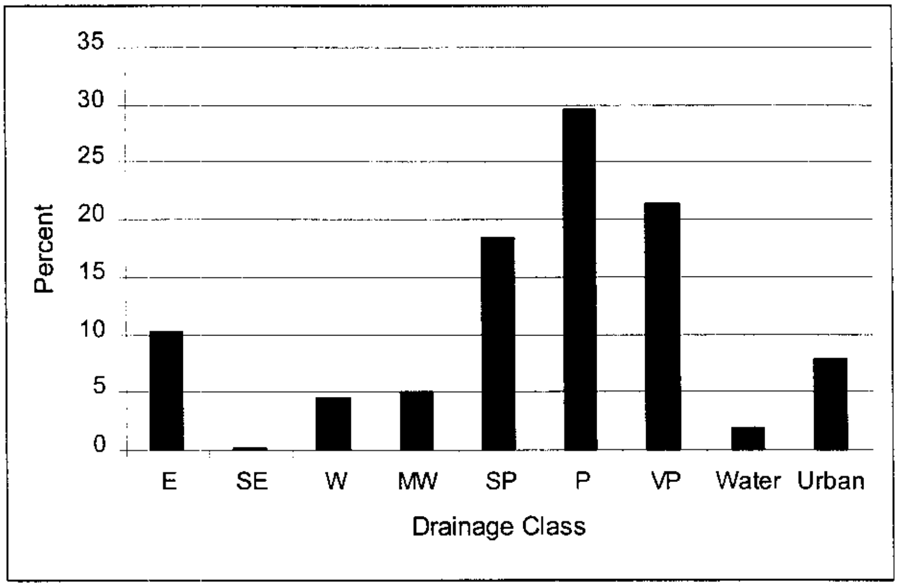

Figure 4-5. Relative frequencies of soil mapping units (ha) in study area by drainage class (E = excessively; SE = somewhat excessively; W = well; MW = moderately well; SP = somewhat poorly; P = poorly; VP = very poorly)

As is evident in Figure 4-5, the study area is dominated by poorly drained soils. Nearly 30 percent of total mapped area is classified as poorly drained, another 21.5 percent very poorly drained. Figure 4-4 shows that most of these wet soils are distributed in the eastern and southern portions of the study area. More widely, albeit sparsely distributed soils classified as somewhat poorly drained comprise another 18.4 percent of mapped area. As one might expect, soils with better drainage are concentrated in the uplands and ridges, but all told, these amount to only 20 percent all mapped area. We note again that many soil mapping units with poor drainage today were better drained in ancient times, so the proportional values in Table 4-3 and Figure 4-5 cannot be extrapolated without qualification.

Mapping units coded as "water" comprise only 2.0 percent of all mapped area, and "urban" units nearly four times that fraction. We note that if soils data for Duval County were available, the proportions of water and urban areas would be considerably greater. We should also note that "urban" in this sense includes not only developed land, but also pits, dumps, and other major surface alterations.

Nonirrigated Agriculture Capability. FGDL soils data include a host of attributes relevant to agriculture, among them a measure of agricultural capability without irrigated. This attributed is coded as a ranked value ranging from 1 to 8, the number indicating progressing greater limitations for agriculture. Thus, low values reflect good agricultural potential, high values low potential. By extension, this attribute serves as a proxy for the capability of a given soil to support hardwood forests and other woodland communities whose productivity depends partially on soil fertility, moisture, and chemistry.

Figure 4-6 provides the distribution of soil mapping units in the study area coded by nonirrigated agriculture capability. Table 4-4 provides a summary of the areal distribution of these same soil mapping units. Note that the number of missing values are greater for this attribute than for soil drainage because urban areas and water are not coded for agricultural potential. Again, Duval County data are missing entirely.

Relative frequencies of mapping units by nonirrigated capability are displayed in Figure 4-7. Three aspects of this distribution are noteworthy. First, no mapping units in the study area have the highest rating, and only a small fraction rate second best. This reflects generally the overall mediocre to poor quality of soils in the study area.

Second, over 60 percent of the mapping units are coded for moderate capability (values 3 and 4). These units are widely distributed as small tracts of land across much of the northern two-thirds of the study area.

Third, a second major cluster of units is coded for low nonirrigated capability (values 6 and 7). These are generally coincident with very poorly drained soils of the Costal Lowlands, particularly in the southern third of the study area.

It is instructive to consider the extent to which nonirrigated agriculture capability values recapitulate the soil drainage data. Mean values for nonirrigated capability by drainage class suggests that covariation between the two is weak at best (Figure 4-8). Excessively, somewhat excessively, and very poorly drained soils have expectedly high values for (and thus limited) nonirrigated capability, whereas soils with moderate drainage (well through poorly drained) have lower mean values. However, mean values for soils with moderate drainage hide the fact that soils in each of these classes vary in

Table 4-4. Distribution of Soil Mapping Units by Nonirrigated Agriculture Capability (1 = high, 8 = low) for Study Area[1].

Potential	#Mapping Units	Area (ha)	Percent Area
1 (high)	0	0.0	0.0
2	4960	67,410.7	1.9
3	46,762	946,094.8	26.1
4	44,401	1,371,425.2	37.8
5	2696	94,585.9	2.6
6	26,637	431,391.0	11.9
7	52,314	595,293.8	16.4
8 (low)	3847	121,267.1	3.3
Total	181,581	3,627,468.6	100.0

[1] excludes mapping units for areas of missing data, amounting to 14,752 mapping units, including all of Duval County, all water, and most urban units.

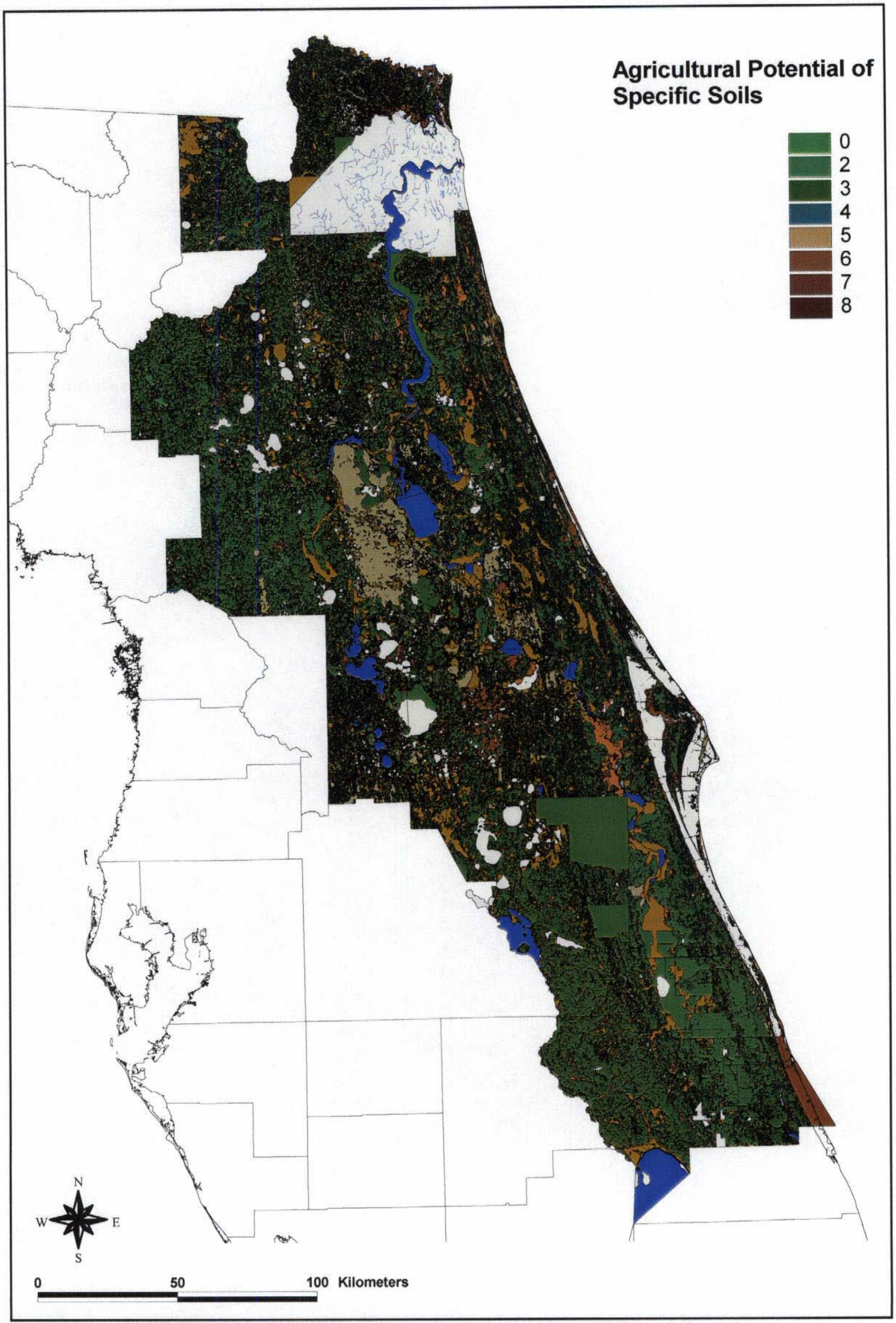

Figure 4-6. Distribution of soil mapping units in the study area coded by nonirrigated agriculture capability.

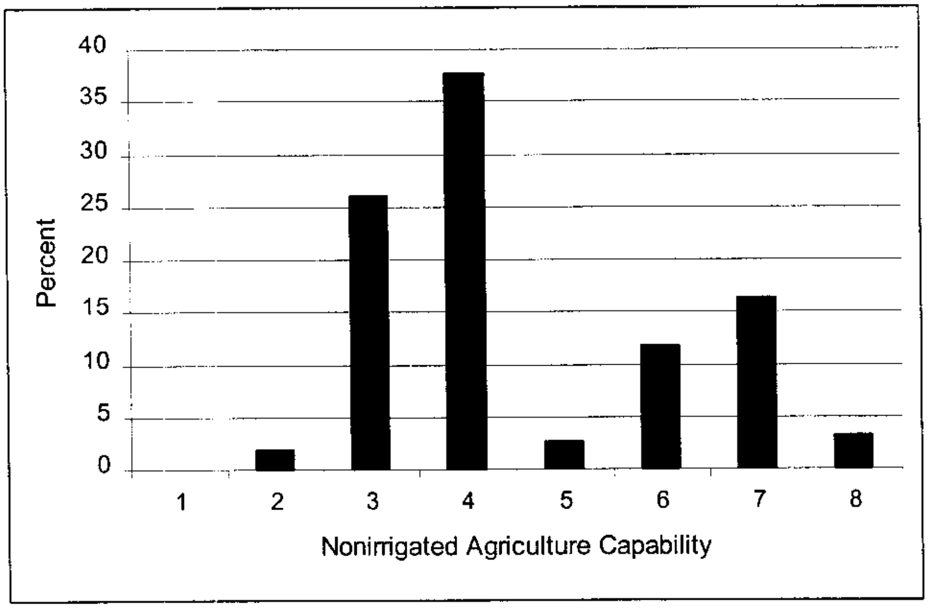

Figure 4-7. Relative frequency of soil mapping units (ha) by nonirrigated agriculture capability (1 = high capability; 8 = low capability)

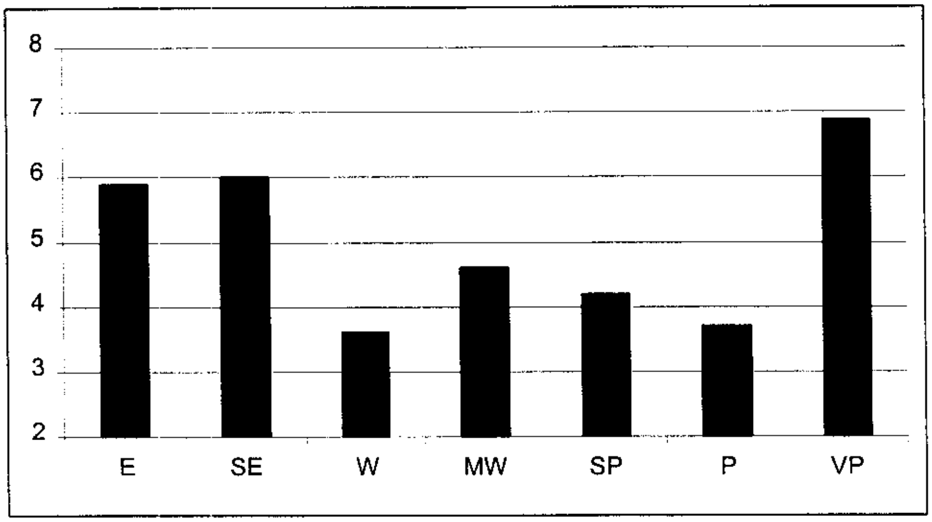

Figure 4-8. Mean nonirrigated agriculture capability by soil texture class (E = excessively; SE = somewhat excessively; W = well; MW = moderately well; SP = somewhat poorly; P = poorly; VP = very poorly).

their nonirrigated capability much more so than those of extreme drainage values. Coefficients of variation (CV) for well, moderately well, and somewhat poorly drained soils are between 0.26 and 0.32, whereas end members have CVs of only 0.15 and 0.09. With a CV of 0.19, poorly drained soils fall between these two groups.

In short, data on nonirrigated agriculture capability is monitoring a greater range of variation in soils than does the drainage data alone. Far from being redundant, nonirrigated capability data will serve to discriminate amongst soils that otherwise have similar drainage ratings.

CONCLUSION

The rich digital resources of the Florida Geographic Data Library enable large-scale analyses of nonrandom tendencies in archaeological distributions. In the chapter we described data layers for four key environmental variables: elevation, distance to running water, soil drainage, and soil capacity for nonirrigated agriculture. Random points were generated across the entire study to collect data on continuously distributed variables, whereas values for discrete variables were derived from the compilation of data from all 19 counties. This environmental baseline provides an objective, statistically reliable measure for detecting nonrandom tendencies in survey and site locations, a necessary step in our effort to promote long-term preservation planning for northeast Florida.

CHAPTER 5
SURVEY COVERAGE

In addition to site files, the Florida Bureau of Archaeological Research (BAR) collects and curates data on archaeological surveys in the state. These data were recently adapted to GIS format and made available for this project by Marion Smith of BAR. The inventory of survey records for the 19-county study area consists of 893 projects dating from 1952 to 1999 (Figure 5-1, Table 5-1). Whereas this indeed constitutes a robust dataset, not all surveys are included. Notably absent from the inventory are surveys of the Ocala and Osceola National Forests, select research projects, and surveys predating the 1970s.

In this chapter we describe and evaluate the survey database for its statistical representativeness of the 19-county study area. We are unable at this time to effectively assess the survey intensity of individual projects. Clearly projects varied wildly in their use of subsurface testing, systematic sampling, and biases of surface conditions. Thus, we cannot draw definitive conclusions about the adequacy of survey coverage. Our intent here is simply to explore possible nonrandom tendencies in survey coverage so as to avoid spurious inferences about the locational patterning of archaeological sites. It goes without saying that a tendency for sites to be located within 500 m of running water is meaningless if the only places surveyed are within 500 m of running water. Our interest here is to not only control for potential biases such as this, but to determine whether we are yet in a position to generalize about site locations in the St. Johns region from the extant site inventory.

SURVEY DATABASE

Table 5-1 provides an inventory of survey projects for the study area, tabulated by year. Note that the project years reported in Table 5-1 are dates of publication for survey reports, not necessarily the year field work was conducted. Obviously publication follows fieldwork by months, if not years, so these data cannot be taken as an absolute record of survey history. Still, as a relative chronology of survey, the publication dates suffice. We note as well that the inventory for 1999 is only a partial record; at the time of this writing reports dated 1999 and later were still arriving at BAR.

The nearly 900 surveys recorded since 1952 involve a total of 509,060.3 ha distributed across 1443 survey tracts. Survey tract size spans an enormous range, from a fraction of a hectare to over 50,000 ha. The average survey tract is 352.8 ha.

Before proceeding we must note that total survey coverage in the study area is artificially inflated because scores of small tracts are located within larger tracts. Thus the raw total of survey tracts includes some area that was counted twice. When all redundant tracts are removed, total survey coverage is reduced to 449,294.7 ha. This figure represents 10.6 percent of the entire study area (42,312.82 km^2). Again, not all tracts in this sample fraction were equally well surveyed. Still, 10.6 percent is a sizable sample fraction, survey bias notwithstanding.

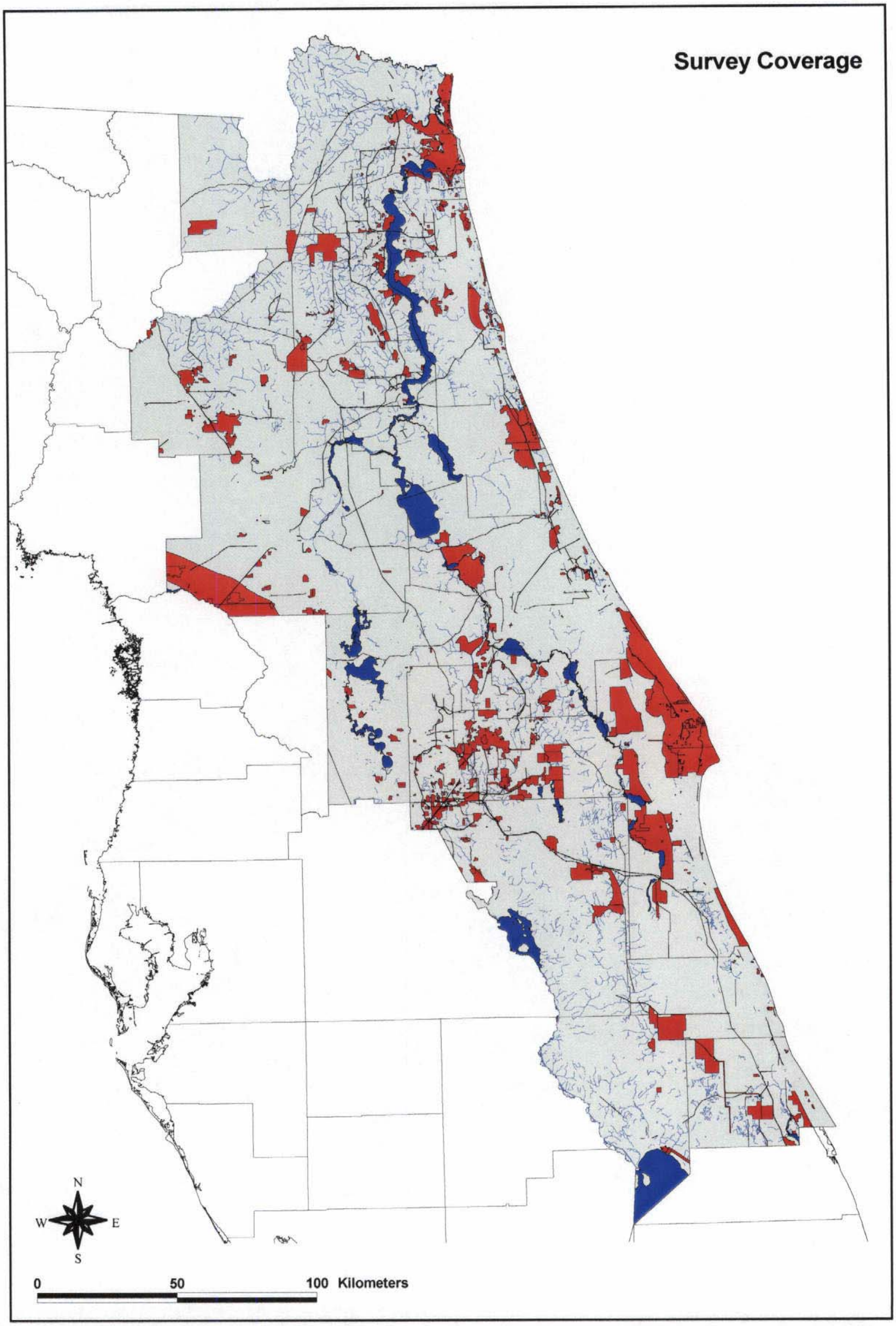

Figure 5-1. Locations of surveys on file with Florida Bureau of Archaeological Research (1952-1999).

Table 5-1. Inventory of Survey Records on File with BAR for the Study Area by Year of Publication with Statistics on Size (ha) of Survey Tracts.

	projects	survey tracts	total	hectares per survey tract			
year	(n)	(n)	ha	mean	st. dev.	minimum	maximum
1952	1	1	5997.3	-	-	5997.3	5997.3
1966	1	2	103.6	51.8	16.0	40.4	63.1
1969	1	1	39.7	-	-	39.7	39.7
1970	1	1	60.7	-	-	60.7	60.7
1973	2	2	1336.9	668.5	98.0	599.2	737.8
1974	5	7	2614.2	373.5	470.4	2.7	1320.6
1975	7	7	623.7	89.1	153.3	4.4	409.9
1976	13	28	25,004.2	893.0	3904.9	0.1	20,629.9
1977	21	35	28,588.9	816.8	2546.3	0.1	12,029.0
1978	16	30	81,267.7	2708.9	9409.8	0.1	50,823.7
1979	9	14	3351.3	239.4	527.1	0.3	1667.3
1980	17	26	13,035.5	501.4	1394.7	0.1	6983.1
1981	21	28	11,430.2	408.2	723.8	0.2	3097.2
1982	15	28	2310.9	82.5	145.7	1.1	686.5
1983	13	26	4592.8	176.6	372.2	0.7	1677.1
1984	17	41	33,914.7	827.2	1752.9	0.6	8296.0
1985	17	31	9030.1	291.3	597.6	0.3	2563.8
1986	13	27	3461.4	128.2	405.6	0.1	2128.0
1987	32	44	6533.0	148.5	363.3	0.3	2312.9
1988	62	82	19,448.5	237.2	503.2	0.5	2892.1
1989	38	54	13,586.9	251.6	520.6	0.1	2734.5
1990	60	94	74,053.3	787.8	2574.0	0.3	18,158.3
1991	62	121	54,699.8	452.1	3128.6	0.7	32,909.0
1992	73	106	13,113.8	123.7	545.4	0.3	5163.2
1993	58	75	36,834.0	491.1	1730.8	0.1	11,419.2
1994	57	70	10,487.9	149.8	526.4	0.3	3954.3
1995	57	88	5765.5	65.5	181.7	0.1	1528.5
1996	64	115	11,106.7	96.6	449.2	0.1	3844.5
1997	66	150	30,244.1	201.6	863.1	0.2	8034.7
1998	67	99	5940.9	60.0	154.3	0.3	1070.1
1999	7	10	482.4	48.2	82.7	0.3	210.9
Total	893	1443	509,060.3	352.8	2029.9	0.1	50,823.7

Historical Trends

Some interesting patterns attend the distribution of surveys by year. As might be expected, the annual number of survey projects (Figure 5-2) has risen steadily over the period in question as federal legislation was enacted and increasingly enforced, and as the pace of development in Florida quickened. Reports have been issued regularly since the mid-1970s, when critical federal regulations for archaeology were issued. However, the steady growth of the mid-1970s was curtailed during most of the 1980s, owing, in part, to a presidential administration that had at the helm of its Interior Department a man (James Watt) who considered preservation moot because of impending Armageddon.
Thankfully, the late 1980s brought a return to rational thought, with an annual rate of at

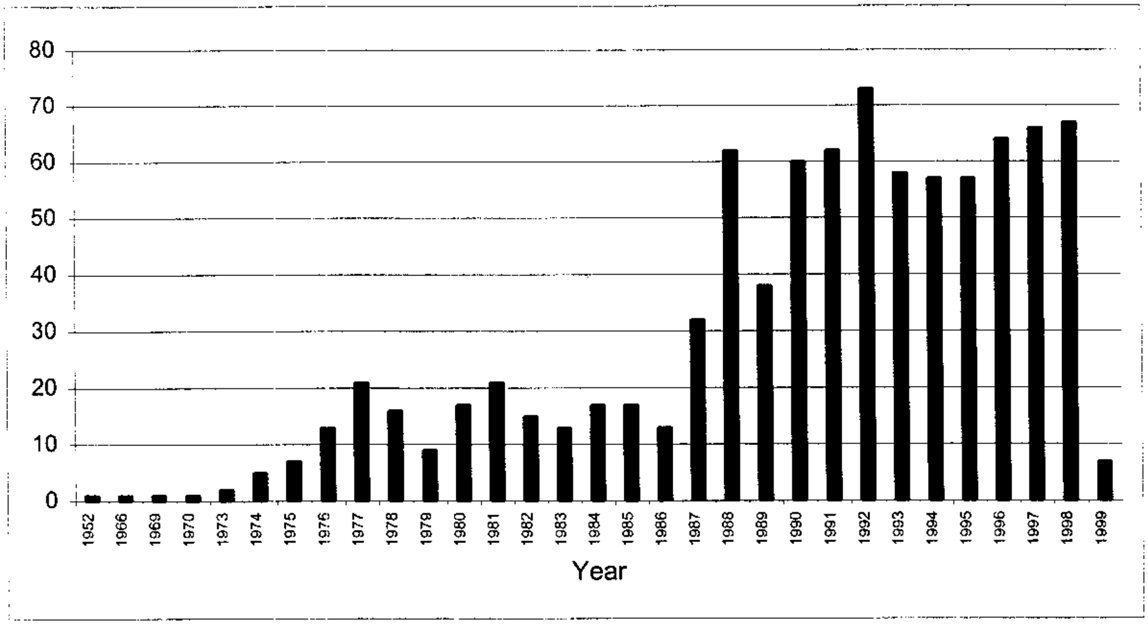

Figure 5-2. Absolute frequency of survey projects in study area by year.

least 30 projects through the remainder of the decade. At least 50 surveys a year have been completed through the eight-year reign of the Clinton administration.

Although executive branch politics cannot possibly account for all of the observed yearly variation in survey projects, federal department policy, where historic preservation legislation is implemented, is clearly consequential. To account for all of the variation in project rates, we would have to take into account the circumstances of state and local governments, as well as the health of federal, state, and local economies. Idiosyncrasies, such as the will of regulatory agents to uphold the law and the shrewdness of others to circumvent it, are equally relevant.

Data on the scale of surveys since 1952 show a much different pattern than do the rate of survey projects (Figure 5-3). Total annual survey acreage exhibits an irregular pattern, with no particular historical trends. Over the 30 years reported (excluding 1999), the average number of hectares surveyed a year is 16,952.6. However, variation around this mean is not distributed normally, as only nine years have above-average values. In fact, three peak years—1978, 1990, and 1991—skew the average upwards with annual values in excess of 54,000 ha each. Three projects account for nearly three-quarters of the total acreage reported in these three years. The 58,625-ha reconnaissance of Merritt Island National Wildlife Refuge, reported in 1978 (Griffin and Miller 1978), is the largest project of the study area. A close second is the 52,441-ha survey of six large tracts in Brevard County, reported in 1990 (Bense and Phillips 1990). The third exceptionally large project is the 41,367-ha survey for the Florida Turnpike Extension from Wildwood to Lebanon Station, reported in 1991 (Johnson et al. 1991).

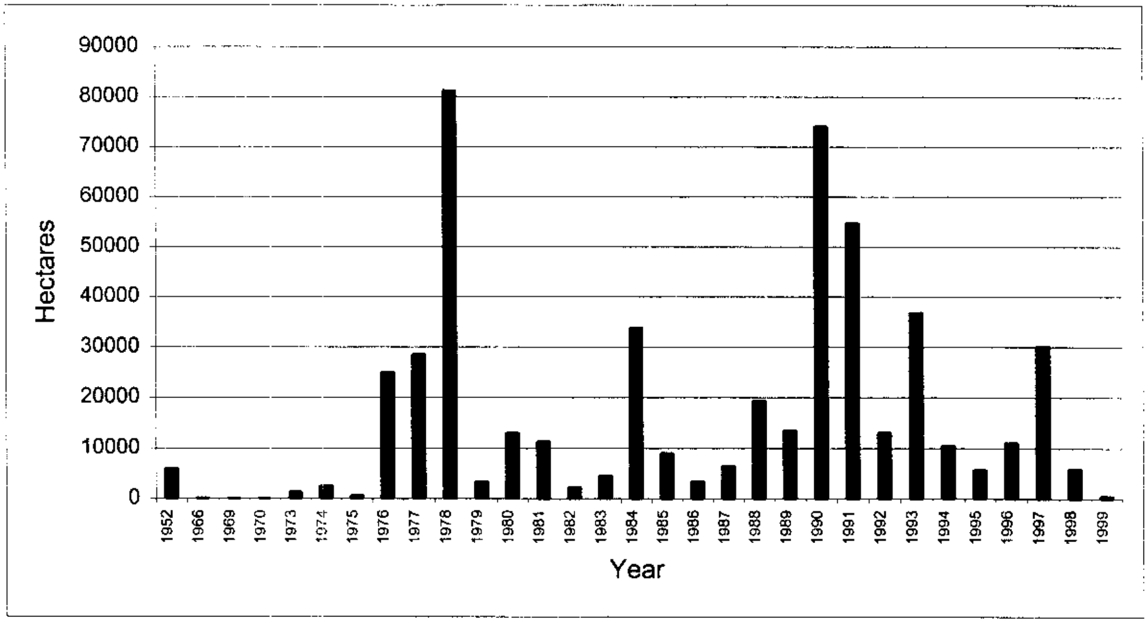

Figure 5-3. Total survey coverage (ha) in study area by year.

These three surveys and all others in excess of 4000 ha in size are listed in Table 5-2. Total area for these 21 projects is 269,112.3 ha, 52.9 percent of the reported survey coverage for the entire study area. (Note that two of three reports of projects at Cape Canaveral are not counted in this total because they consist of surveys of the same 6892.0 ha). These surveys include federal installations, federal and state wildlife refuges, state forests, rights-of-way for roads and transmission lines, and grant-funded projects, among others. They also run the gamut from reconnaissance to intensive survey, some involving systematic subsurface testing, others simply pedestrian survey.

Sample Representativeness

Survey projects are distributed widely, if not evenly, across the entire study area. At 26.6 km^2, Bradford County has the lowest absolute coverage; Brevard County tops the ranking at 1171.3 km^2 of survey reported. Numerous factors account for county-level differences in survey coverage, including, of course, differences in the size of counties. With some exceptions, county size and survey coverage vary positively. As a fraction of total county area, survey coverage ranges from a low of 1.5 percent in Okeechobee County to a high of 34.8 percent for Brevard County. Most counties fall in the range of 6-16 percent coverage, but five counties—Baker, Bradford, Lake, Nassau, Okeechobee, and Putnam—have survey fractions of no more than 3.4 percent. With several of the most extensive surveys reported, Brevard County eclipses all other counties in both absolute and relative coverage. Removing it from consideration, the relationship between county area and survey coverage for the remaining 18 counties is moderately positive (r = 0.625) (Figure 5-4).

Table 5-2. Inventory of Survey Projects in Study Area with 4000+ Hectare Tract Totals.

Sur. #	Hectares	Report Title	Year	Lead Author
260	58,625.3	Cultural Resource Reconnaissance of Merritt Island National Wildlife Refuge.	1978	Griffin, J. W.
2391	52,441.0	Archaeological Assessment of Six Selected Areas in Brevard County: A First Generation Model.	1990	Bense, J. A.
2243	41,367.7	Cultural Resource Assessment Survey of the Florida DOT FL Turnpike Extension Study from Wildwood to Lebanon Station.	1991	Johnson, W. G.
1339	20,632.7	Canaveral National Seashore: Assessment of Archeological and Historical Resources.	1976	Ehrenhard, J. E.
3648	19,610.6	The Timucuan Ecological and Historic Preserve: Phase III.	1993	Russo, M.
296	18,436.2	Cultural Resource Assessment of the Palm Coast Property: Phase I Results.	1977	Miller, J. J.
1152	15,623.7	Reconnaissance Survey in the Upper St. John's River Flood Control Project.	1984	Campbell, L. J.
17	11,490.3	Historical, Architectural and Archaeological Survey of Orlando, FL.	1978	Carr, R. S.
255	8451.6	Cultural Resource Reconnaissance of Lake Woodruff National Wildlife Refuge.	1978	Miller, J. J.
4722	8034.7	Assessment of Cultural Resources at Jennings State Forest	1997	Wheeler, R. J.
439	7400.3	Archeological Survey in the Paynes Prairie State Preserve, Alachua County, Florida.	1977	Mullins, S.
4702	7003.2	An Assessment of Cultural Resources at the Lake George State Forest Including Mount Taylor and the Bluffton Site.	1997	Wheeler, R. J.
158	6983.1	The Sandhill Chase Project St. Lucie County, Florida: An Archaeological Survey and Evaluation.	1980	Chance, M. A.
1150	6892.0	An Architectural and Engineering Survey and Evaluation of Facilities at Cape Canaveral Air Force Station, Brevard Co., FL.	1984	Barton, D. F.
2410	(6892.0)	An Archeological Survey of Cape Canaveral Air Force Station, Brevard County, Florida.	1984	Levy, R. S.
3820	(6892.0)	Historic Properties Survey, Cape Canaveral Air Force Station.	1993	Cantley, C. E.
3502	6850.2	A Cultural Resources Assessment Survey of the Seminole Plant-Keystone-Jea Firestone 230 Kv Transmission Line Corridor in Putnam, Clay, and Duval Counties, Florida.	1991	Williams, J. R.
539	5997.3	An Archaeological Survey of Amelia Island, Florida.	1952	Bullen, R. P.
3348	5413.1	An Archeological and Historical Site Assessment Survey, State Road 312 Extension.	1992	Johnson, R. E.
4443	4779.7	An Archaeological Assessment of the Triple N Ranch Wildlife Management Area, Osceola County, Florida.	1996	Newman, C. L.
1852	4447.3	Archaeological Site Types, Distribution, and Preservation within the Upper St Johns River Basin, Florida.	1985	Sigler-Eisenberg, B.

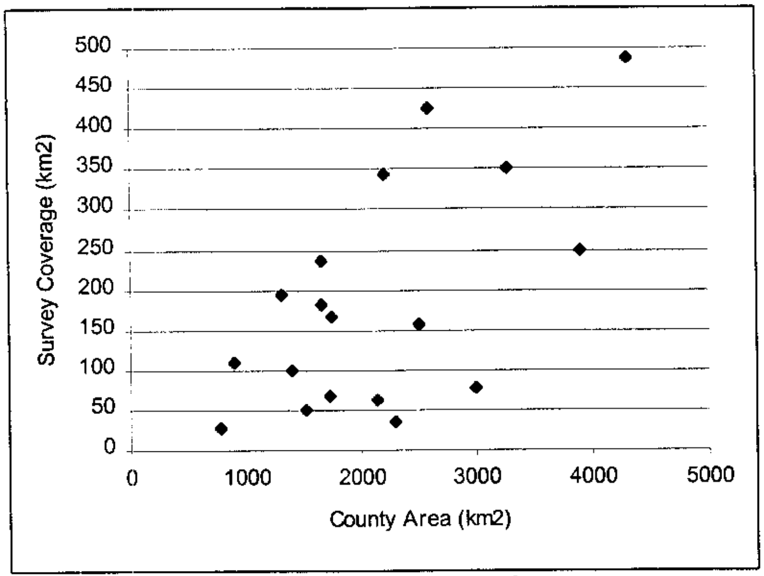

Figure 5-4. Survey coverage (km^2) by county area (km^2), far all counties in study area except Brevard County ($r = 0.625$).

To assess sample representativeness at the regional level we developed the same environmental data for survey tracts that we used to characterize the study area in Chapter 4. For the continuous variables (elevation, distance to water), we generated a series of 1000 random points across the 4,492.9 km^2 (449,294.7 ha) area of survey coverage and calculated individual point values. Data on soils were generated by simply clipping the FGDL specific soils layer with the survey polygons and summing the values.

Elevation. The mean elevation for 1000 random points in survey tracts is significantly lower than the mean elevation of 1000 random points distributed across the entire study area (Table 5-3; $t = 4.097$; prob. < 0.0005). The difference is clearly due to the disproportionately large number of survey points in the range of 1-10 ft amsl (Figure 5-5). Nearly one-fourth of all random points in survey tracts fall in this range, and the vast majority of these are contained in Brevard County surveys. Reciprocally, the deflated number of survey points in classes ranging from 51 to 70 ft amsl are due to relatively low survey fractions in the interior upland counties of Alachua, Baker, and

Table 5-3. Comparison of Summary Statistics on Elevation (ft amsl) for 1000 Random Points across the Entire Study Area and within Survey Tracts.

	Study Area	Survey Tracts
mean	58.6	50.3
standard deviation	43.6	46.9
minimum	0.0	0.0
maximum	228.2	238.0

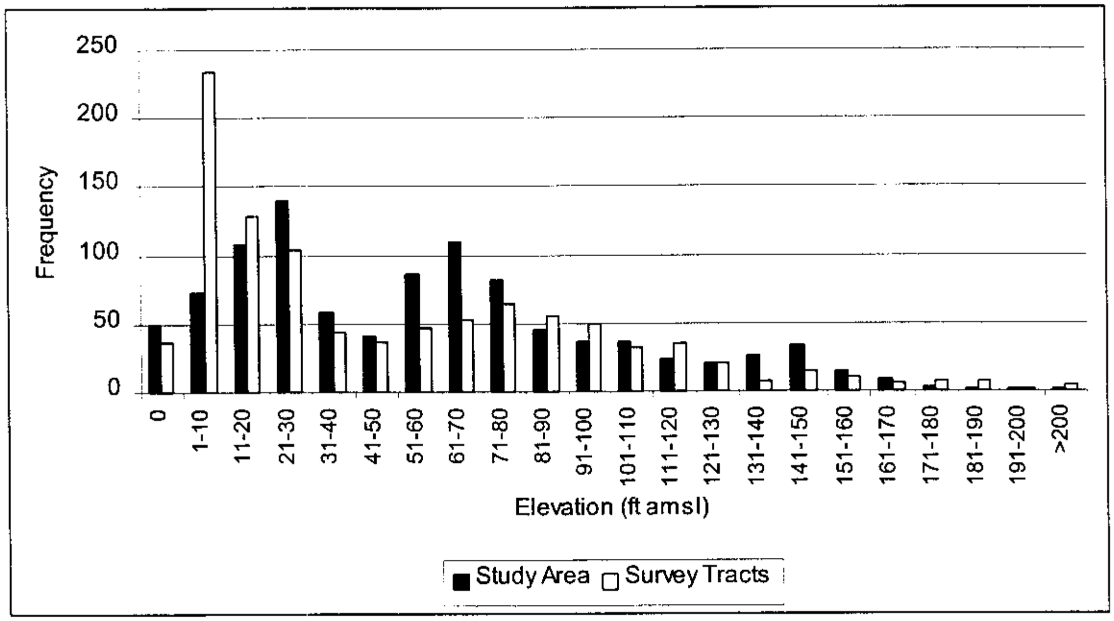

Figure 5-5. Comparison of the absolute frequencies of elevation values for random points across the entire study area and in survey tracts.

Bradford. Aside from these glaring discrepancies, the sample of random points in surveys does not deviate markedly from random values for the entire study area. Thus, with the provision that certain portions of the sample are decidedly biased in terms of elevation, survey results have the potential to inform accurately on regional patterning.

Distance to Water. Like elevation, average distance to water for random points in survey tracts is significantly lower than the average of random points distributed across the entire study area (Table 5-4; $t = 4.887$; prob. < 0.0005). In terms of distributions across distance classes, the survey points comprise a consistently larger fraction of all classes 1000 m or less, except for only one, compared to points across the entire study area. Clearly, random points in survey tracts are not randomly distributed with respect to the entire study area. This bias must be kept in mind when considering distance values for archaeological sites.

Table 5-4. Comparison of Summary Statistics on Distance to Water (m) for 1000 Random Points across the Entire Study Area and within Survey Tracts.

	Study Area	Survey Tracts
mean	2367.7	1767.0
standard deviation	2996.2	2472.8
minimum	0.0	0.0
maximum	20,809.9	19,586.3

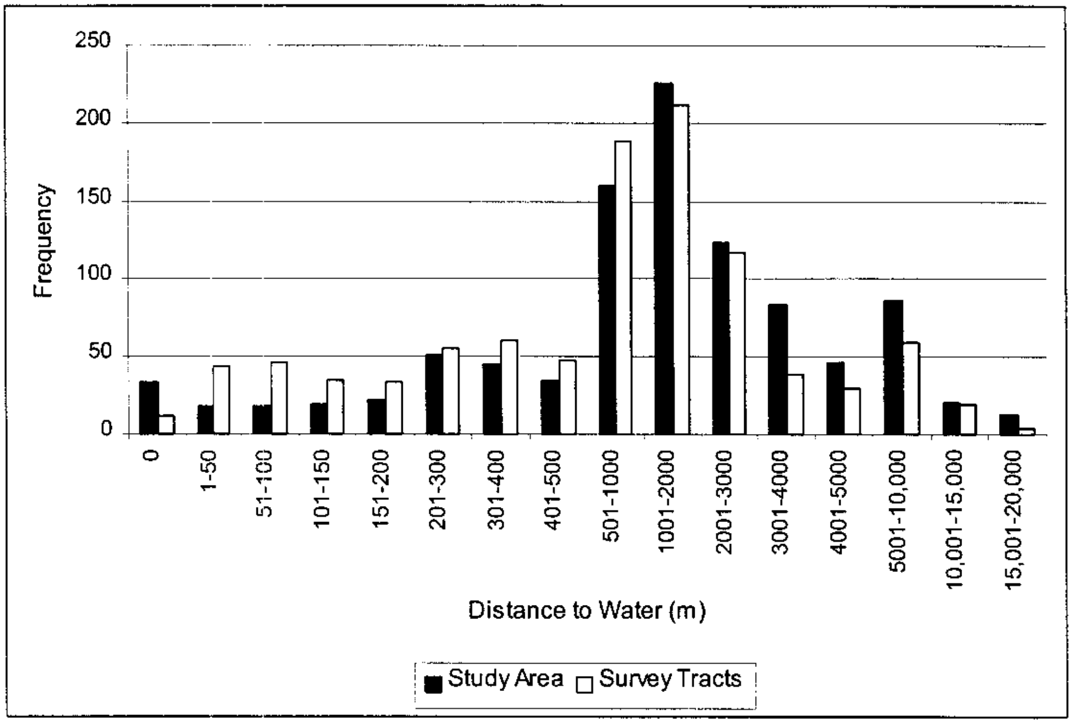

Figure 5-6. Comparison of the absolute frequencies of distance to water values for random points across the entire study area and in survey tracts.

Considering the nearest source of water, regionwide random points and those from survey tracts are comparable in most respects (Table 5-5). Because this comparison involves specific water features, the discrepancies here are indicative of specific locational biases in survey. Notably, the St. Johns, Withlachochee, Tomoka, and St. Lucie rivers are overrepresented, whereas the Oklawaha and Sante Fe rivers and lakes on rivers are underrepresented. Irrespective of specific sources of water, both samples are dominated by undesignated streams, and in roughly the sample proportion. Thus, the survey tracts do not deviate markedly from regionwide random sample in nearest sources of water, although they clearly do in terms of distance to nearest water.

Soil Drainage. Table 5-6 provides a breakdown of drainage classes for soil mapping units across all survey tracts. As is the case with the study area in general, survey tracts are dominated by poorly drained and very poorly drained soils. In fact, survey soils include a slightly higher percentage of very poorly drained soils than do all soils in the study area (Figure 5-7). Survey tracts also contain a greater number of mapping units in water and correspondingly fewer units in urban locations. Otherwise, the drainage values between survey points and regionwide soils are remarkably similar. Nonrandom tendencies in the distribution of survey soils are not apparent.

Table 5-5. Comparison of Absolute Frequency of 1000 Random Points across the Entire Study Area and within Survey Tracts for Source of Nearest Water.

	Study Area	Survey Tracts
Nearest Running Water		
Undesignated Stream	877	864
St. Johns River	38	50
Oklawaha River	24	11
Econlockhatchee River	6	6
Sante Fe River	5	0
Withlacoochee River	5	12
Tomoka River	4	12
Spruce Creek	4	7
Palatlakaha River	3	4
Nassau River	3	7
St. Marys River	2	2
Wekiva River	2	0
Black Creek	2	5
St. Lucie River	0	4
Points in Lakes on Rivers	25	16

Table 5-6. Distribution of Soil Mapping Units by Drainage Class for Survey Tracts[1].

	#Mapping Units	Area (ha)	Percent Area
Drainage Class			
Excessively	2731	42,531.9	10.8
Somewhat Excessively	57	397.2	0.1
Well	1298	13,424.7	3.4
Moderately Well	3488	21,301.0	5.4
Somewhat Poorly	6970	74,369.1	18.8
Poorly	10,542	111,768.0	28.3
Very Poorly	10,331	97,270.8	24.7
Water	1011	24,122.2	6.1
Urban, Pits	819	9371.0	2.4
Total	37,247	394,556.0	100.0

[1] excludes mapping units for areas of missing data, including all of Duval County.

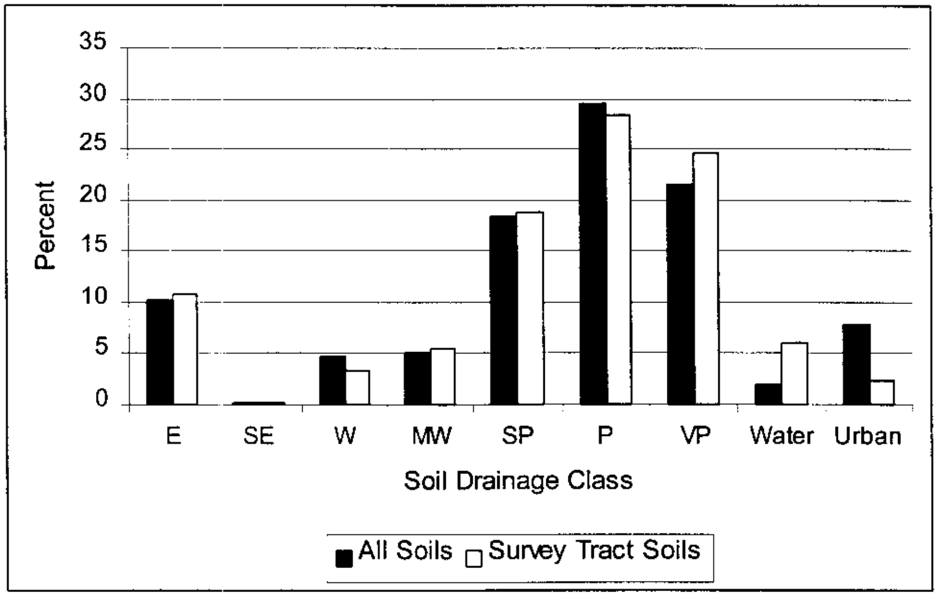

Figure 5-7. Comparison of relative percentage of soil mapping units (ha) in study area and survey tracts by drainage class (E = excessively; SE = somewhat excessively; W = well; MW = moderately well; SP = somewhat poorly; P = poorly; VP = very poorly).

Nonirrigated Agriculture Capability. Survey soils also compare favorably with regionwide soils with respect to nonirrigated agriculture capability (Table 5-7; Figure 5-8). The only noteworthy difference is a slightly greater fraction of class 8 soils for the survey distribution and correspondingly lower fractions of classes 2 and 3 compared to regional soils. This difference is due almost exclusively to the disproportionate fraction of beachfront in a survey sample dominated by Brevard County projects. Even so, the differences are rather slight and will not appreciably affect the detection of nonrandom patterning among sites.

Table 5-7. Distribution of Soil Mapping Units by Nonirrigated Agriculture Capability (1 = high, 8 = low) for Survey Tracts[1].

Potential	#Mapping Units	Area (ha)	Percent Area
1 (high)	0	0.0	0.0
2	407	2212.0	0.6
3	8953	86,888.4	23.8
4	10,652	138,458.8	37.9
5	647	8818.5	2.4
6	5524	41,559.2	11.4
7	8587	62,164.7	17.0
8 (low)	1461	24,913.0	6.8
Total	36,231	365,014.6	100.0

[1] excludes mapping units for areas of missing data, including all of Duval County, all water, and most urban units.

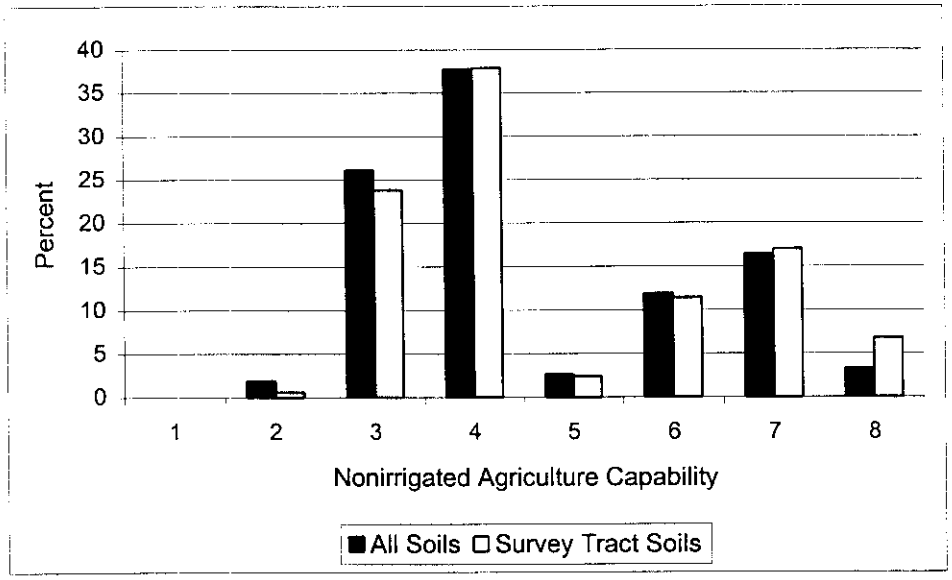

Figure 5-8. Comparison of relative percentage of soil mapping units (ha) in study area and survey tracts by nonirrigated agriculture capability.

SITES IN SURVEY TRACTS

Survey tracts in the project area do not encompass the locations of all know sites, but, as one might expect, they account for a disproportionate fraction of them. Specifically, 1697 or 47.0 percent of 3608 sites in the database fall within the polygons of recorded survey tracts. Thus, nearly half of all know sites fall within roughly 10 percent of all land in the project area.

We can extrapolate from these preliminary figures to the entire region to estimate the minimum numbers of expected sites. At 1697 sites for 449,294.7 ha of survey, the density of sites in survey tracts is one site per 264.8 ha. Dividing this figure into the total area for the region (4,231,282 ha), we arrive at an estimated 15,979 sites regionwide. Given the inconsistencies of survey intensity across projects, this projected count is conservative and should be considered a minimum estimate.

CONCLUSION

Before considering nonrandom patterning in archaeological site distributions, one has to know something about the sampling parameters of archaeological survey. The Florida Bureau of Archaeological Research maintains records for 893 survey projects in the St. Johns region. Comparisons of locational attributes of tracts from these projects with random and regionwide data show no major lacunae in survey representativeness. Minor nonrandom tendencies among survey tracts have been noted and will be incorporated into our analysis of site locations in Chapter 7. Overall, the survey tracts provide reasonably widespread and random sampling of the project area. It remains to locate and describe nonrandom tendencies in site locations.

CHAPTER 6
SITE FILES OF THE ST. JOHNS REGION

Florida archaeological site files housed at the Bureau of Archaeological Research in Tallahassee contain 4,765 records for the 19 counties of the St. Johns region. Attached to each of the records in the electronic versions of these files are 27 fields of data. Besides the shape files data that enable GIS manipulation, the fields include data on site number and name, type (7 fields), culture/component (8 fields), survey number, surveyor's evaluation, SHPO's evaluation, and dates of survey and entry.

Ostensibly, the site files data enable geographic analyses of both site functional patterning and diachronic trends in settlement. For reasons elaborated below, the site type data are of limited analytical value. Data on components at sites are, in our opinion, more dependable than the site type data if simply because the recognition of a given component requires nothing more than a diagnostic artifact, whereas inferences about site type generally require much more information. Even so, data on components at sites are fraught with a number of analytical and sampling biases that must be addressed before proceeding with distributional analyses.

In this chapter we describe the means by which site files data were adapted for regionwide GIS analysis. We begin with an overview of the regional record, describing the coding scheme for component definition and the adjustments we made to streamline it. We then compare component data from several hundred collections housed at the Florida Museum of Natural History to site files data for potential biases. After incorporating new component information into the database we examine diachronic trends in component frequency. We close with brief consideration of the site type data encoded on site files and develop criteria for including some of these data in our GIS analysis.

SITE FILES DATA

The 4,765 lines of site file data transferred from Tallahassee to Gainesville were culled from a much larger database of county-specific records that include historic architectural records, as well as data on prehistoric and historic archaeological sites. After downloading files from BAR's FTP site, the records for each county were merged into a master database. Iterative sorting of the eight data columns with information on "culture" (i.e., component) enabled the entire database to be subdivided into three groups: exclusively historic-era sites (i.e., post-16th century; n = 1157), exclusively prehistoric sites (n = 3172), and sites with both prehistoric and historic components (n = 436). Our interests hereafter are largely centered on the latter two subgroups, a database of 3608 site records.

Components Present

Table 6.1 lists the full range of entries for prehistoric "cultures" observed in the eight columns given to component definition. Note that specific codes for historic

Table 6-1. List of "Cultures" Coded on State Site Files for 19-County Study Area.

- Alachua (A.D. 1250-1600)
- Hickory Pond (A.D.800-1250)
- Safety Harbor (A.D. 100-1500)
- Leon-Jefferson (unspecified)
- Belle Glade (700 B.C.-A.D. 1700)
  - Belle Glade IV
  - Belle Glade II
  - Belle Glade I
- Glades (1000 B.C.-A.D. 1700)
  - Glades III
    - Glades IIIa
  - Glades II
    - Glades IIa
  - Glades I
    - Glades Ib
    - Glades Ia
- Malabar (unspecified)
  - Malabar II
  - Malabar I
- St. Johns (700 B.C.–A.D. 1500)
  - St. Johns II (A.D. 800-1500)
    - St. Johns IIc
    - St. Johns IIb
    - St. Johns IIa
  - St. Johns I (700 B.C.-A.D. 800)
    - St. Johns Ib
    - St. Johns Ia
- Weeden Island (A.D. 450-1000)
  - Weeden Island IV
  - Weeden Island III
  - Weeden Island II
  - Weeden Island I
- Cades Pond (300 B.C.-A.D. 800)
- Swift Creek, Late
- Swift Creek (300 B.C.-A.D. 450)
- Deptford (700-300 B.C.)
- Transitional (1000-700 B.C.)
- Orange
- Mt. Taylor
- Mississippian
- Woodland
- Early Woodland
- Late Archaic
- Middle Archaic
- Early Archaic
- Archaic, unspecified
- Paleoindian
- Possible Paleoindian
- Prehistoric with pottery
- Prehistoric lacking pottery
- Prehistoric unspecified
- Indeterminate
- Unknown
- Other
- Unspecified
- Seminole
- (various historic-period components)

components are not included in this inventory. We also note that this list is not exhaustive of all possible entries for sites in northeast Florida; rather, it consists of the literal record of 3608 sites in the region.

The entries in Table 6.1 are identical to those provided on Florida State Site File. detailed. With the potential to code components to the subperiod or phase, Florida's site files record is structured for relatively detailed chronological information. Obviously, with only eight places of data entry per site, only eight components can be entered on a record for a given site. This does not appear to be a problem, however, as only three of 3608 sites in the study area reach this limitation with eight components each. Over two-thirds of the sites are listed as having only one component and over half of these are either unspecified or coded as nondiagnostic "lithic" or "pottery." Thus, as is the case with site files records nationwide, the vast majority of sites cannot be coded for specific time periods.

Whereas roughly one-half of the site records have inadequate data for many purposes, another half offers much with which to work. To begin developing these data for our purposes we reviewed each of the coded records for component information and developed a more generalized scheme. A review of the data proved tricky because not all records are structured the same way and some of the records involve redundant or contradictory information. For instance, every entry for St. Johns I was followed in the adjacent column by its date range (i.e., 700 B.C.-A.D. 800), thereby appearing to constitute two component entries. Another common problem was a site coded for having a specific prehistoric component in one column and the generic "prehistoric unspecified" in the next, making it difficult to know whether the second entry actually constituted a component different than the first. Occasionally, the only indication a site had a prehistoric component was from an entry in one of the "site type" columns, such as "habitation (prehistoric)."

Table 6-2 details the classification we adopted for streamlining site files component data. Many of our categories are literal renditions of the site file classes. The exceptions are as follows. First we choose to generalize the chronological specificity of some of the culture periods. The effected units include St. Johns I, St. Johns II, Weeden Island, Glades, Belle Glade, and Malabar. Only a small fraction of all sites with components of these culture periods provide information on specific subperiods, so few data are lost in this translation and the level of comparability is enhanced. Second, we combine all occurrences of "Archaic, unspecified," "prehistoric lacking pottery", and "possible Paleoindian" from the site files into a category we labeled simply as "prehistoric without pottery." Third, we combined with the "prehistoric with pottery" category all site file entries for "Woodland" and "Early Woodland." Fourth, we collapsed all other, minority categories of specified prehistoric culture periods into an "other prehistoric" category. Finally, we combined all historic components, including Seminole and Spanish colonial, into a generalized "historic" category.

Some additional adjustments were made to alleviate redundant or contradictory codes. All entries for "unspecified prehistoric" components were erased if it was accompanied by any specified prehistoric component, including the nondiagnostic lithic and ceramic categories. Entries for "prehistoric lacking pottery" were eliminated if they were accompanied by "prehistoric with pottery" entries and a specified ceramic-period component (e.g., St. Johns I, Deptford). If a site was coded for both "prehistoric with pottery" entries and a specified ceramic-period component, the former was removed.

Table 6-2. Classification of Components for this Study and their Site Files Equivalents.

Component Classification (this study)	Site File Equivalents
Paleoindian	Paleoindian
Early Archaic	Early Archaic
Middle Archaic	Middle Archaic
Late Archaic	Late Archaic
Mt. Taylor	Mt. Taylor
Orange	Orange
Transitional	Transitional
St. Johns I	St Johns I, Ia, Ib
St. Johns II	St. Johns II, IIa, IIb, Iic
Deptford	Deptford
Swift Creek	Swift Creek, Santa Rosa
Weeden Island	Weeden Island I, II, III, IV
Cades Pond	Cades Pond
Alachua	Alachua
Hickory Pond	Hickory Pond
Glades	Glades I, Ia, Ib, II, IIa, III, IIIa
Belle Glade	Belle Glade I, II, IV
Malabar	Malabar I, II, unspecified
Mississippian	Mississippian, Safety Harbor
Prehistoric w/o pottery	Prehistoric lacking pottery, Archaic unspecified, Possible Paleoindian
Prehistoric with pottery	Prehistoric with pottery, Woodland, Early Woodland
Unspecified prehistoric	Unspecified, any entry in "site type" columns indicating a prehistoric component when no counterpart was listed in "culture" columns
Other prehistoric	entries not included in above
Historic	all historic-era components, including Seminole, Spanish colonial, British, etc.

After cleaning up the database and recoding records using our generalized scheme, the total component count for 3608 study-area sites with prehistoric components is 4985. Table 6-3 provides a breakdown of these components by culture period.

Evaluating Component Data with FLMNH Collections

To check the accuracy of site files component data, we undertook a review of collections curated at the Florida Museum of Natural History (FLMNH). As the largest repository of archaeological collections from the state, the FLMNH houses assemblages from 761 sites from the 19 counties of our study area. Given the scope of this undertaking, we decided at the onset to limit collections review to only those counties or portions of counties situated directly in the St. Johns Basin and adjacent Atlantic Lowlands. Hence, virtually all of Alachua County and all but the Oklawaha Basin of Marion County were excluded. With Alachua County alone consisting of 385 assemblages, this move effectively cut in half the sample size for collections review.

Table 6-3. Inventory of Components by Culture Period for 3608 Sites in the 19-County Study Area.

Culture Period	Components	Culture Period	Components
Paleoindian	16	Cades Pond	38
Early Archaic	40	Alachua	148
Middle Archaic	56	Hickory Pond	71
Late Archaic	66	Glades	26
Mt. Taylor	27	Belle Glade	28
Orange	283	Malabar	117
Transitional	62	Mississippian	7
St. Johns I	873	Prehistoric w/o pottery	599
St. Johns II	510	Prehistoric with pottery	283
Deptford	173	Unspecified prehistoric	907
Swift Creek	33	Other prehistoric	119
Weeden Island	67	Historic	436

Of the 341 study-area site collections housed at the FLMNH, 48 are assigned site numbers not listed in the electronic version of the state site files. Another 34 collections listed in the accession records could not be located. This leaves us with a sample of 259 site collections for comparison with site files component data.

Jon Endonino spent a large portion of the 1999-2000 academic year examining each of the artifact collections for diagnostic artifacts. Our interest in this effort was simply to note the presence of culture-specific diagnostics; no quantification was attempted. Only unambiguous evidence for a particular component was scored, although possible traces were occasionally noted where appropriate. Notes were also made concerning the presence of unusual or nonlocal materials such as soapstone. In addition to the 259 collections with site-specific provenience, scores of other county-specific collections were coded for components. Of course, none of these latter collections were incorporated into the comparisons with site files data.

The results of collections research indicate that the majority of sites have components that are not recorded in the state site files. In fact, a full three-quarters (n = 196) of the 259 sites with FLMNH collections include one or more additional components. A total of 431 components were added to the site files for 196 sites, an average of just over two components per site. Whereas this appears to render questionable the reliability of site files, very few of the changes involve major components at sites. The vast majority of additions are ceramic components for sites already coded as having St. Johns I and/or St. Johns II components. Also, well over 50 additional Archaic components were added by the presence of one or more diagnostic biface types. New historic components account for 27 of the additional entries.

Overall, the review of FLMNH collections served to refine component data that were already in reasonably good shape. Although sites in the FLMNH collections comprise only about 7 percent of the total site sample, they represent nearly 15 percent of sites with diagnostic components. Thus, the addition of components appreciably refines the time-sensitive indicators for diachronic analysis of site location, albeit for certain culture periods only. Given the proportional changes of additional components, substantial improvements (31 percent of more) in coverage are anticipated for analysis of the Middle Archaic, Late Archaic, Mt. Taylor, Deptford, and Glades culture periods. All other categories were already well represented by the extant site files data.

SITE COMPONENT DATABASE

The effective sample for GIS analysis of site locations in this study amounts to 5416 components at 3608 sites. This total includes the 431 components added from review of FLMNH collections. A breakdown of the sample by county and component is provided in Table 6-4.

Number of Components Per Site

Before proceeding with GIS analysis, some emergent trends in these component data are worth exploring. First we note that the vast majority of sites (n = 2848; 78.9 percent) in the database are single component (Figure 6-1). Conversely, less than five percent of all sites have four or more prehistoric components. Whereas this paltry fraction of multicomponent sites no doubt reflects sampling bias as much as anything else, the distribution of sites with four or more components may evince clear nonrandom tendencies compared to the large fraction of sites with one or a few components.

Second, single component sites with diagnostic components (n = 1110) are unevenly distributed across culture periods (Figure 6-2). Here the effects of sampling bias loom large. All culture periods with single component fractions larger than one-third are either highly diagnostic (Early Archaic, Weeden Island, Alachua), incredibly numerous (St. Johns I), or exist in locations with few known diagnostic types (Belle Glade, Malabar). Aside from this, the distributions of single components sites is worth examining from the standpoint of land-use patterning. All things being equal, we expect single component sites to reflect either specialized site use or truncated settlement patterns indicative of major shifts in population and/or site selection.

Components Per Century

Aside from sample bias, the frequency of components by culture period is the combined result of population, settlement pattern, and time. Numbers of sites does not equate with numbers of people because we cannot control for coresident group size and frequency of resettlement. For instance, it might take ten coeval occupations of the Middle Archaic period to match the population of a single St. Johns II village. What is more, we do not know whether any group of ten Middle Archaic sites are serial occupations by one coresident group, simultaneous occupations by ten groups, or some combination of the two.

Table 6-4. Inventory of Cultural Components by County.

	Alachua	Baker	Bradford	Brevard	Clay	Duval	Flagler	Indian R.	Lake	Marion
Sites	513	154	37	266	111	343	56	74	215	594
Components	739	181	41	424	169	702	70	99	294	763
Paleoindian	7	0	0	0	0	0	0	0	2	3
Early Archaic	7	0	0	0	1	2	0	1	2	21
Middle Archaic	17	3	0	1	2	3	2	0	8	8
Late Archaic	11	4	0	10	4	4	0	1	12	11
Mt. Taylor	0	0	0	0	0	0	0	0	9	5
Orange	4	0	0	38	10	89	2	3	13	30
Transitional	3	0	0	8	0	18	0	0	0	10
St. Johns I	23	2	1	103	26	135	29	4	67	120
St. Johns II	13	0	0	54	19	100	10	9	41	52
Deptford	75	6	0	2	8	86	1	0	0	9
Swift Creek	2	1	0	1	1	34	0	1	2	0
Weeden Island	29	2	3	2	6	10	0	0	3	15
Cades Pond	31	0	0	0	0	0	0	0	0	6
Alachua	119	10	0	0	5	12	0	0	0	9
Hickory Pond	59	0	0	0	0	11	0	0	0	1
Glades	0	0	0	11	0	0	0	10	0	1
Belle Glade	0	0	0	1	0	0	0	1	0	0
Malabar	0	0	0	72	0	0	0	27	0	0
Mississippian	0	0	0	3	0	1	0	0	1	2
Preh. w/o pottery	79	75	11	7	23	12	3	2	52	159
Preh. w/pottery	85	5	7	8	9	37	5	7	9	36
Unspecified Preh.	106	51	15	56	33	57	11	24	48	186
Other Preh.	10	1	0	8	3	37	1	3	1	30
Historic	59	21	4	39	19	54	6	6	24	49

Table 6-4. continued.

	Nassau	Okeechobee	Orange	Osceola	Putnam	Seminole	St. Johns	St. Lucie	Volusia	TOTAL
Sites	96	25	222	155	170	119	161	34	263	3608
Components	195	31	269	198	275	191	306	51	418	5416
Paleoindian	0	0	0	0	0	3	0	0	2	17
Early Archaic	0	0	1	1	3	1	1	1	1	43
Middle Archaic	2	1	5	4	5	4	2	1	8	76
Late Archaic	5	1	4	4	6	7	2	0	10	96
Mt. Taylor	0	0	1	0	9	1	1	0	12	38
Orange	20	0	9	1	19	29	25	2	24	318
Transitional	2	1	3	0	3	8	4	0	2	62
St. Johns I	32	1	70	28	59	57	65	2	138	962
St. Johns II	23	0	21	14	43	38	53	2	75	567
Deptford	20	0	0	0	2	0	13	0	4	226
Swift Creek	9	0	0	0	0	0	4	0	0	55
Weeden Island	4	0	0	2	2	0	0	0	1	79
Cades Pond	0	0	0	0	1	0	0	0	0	38
Alachua	3	0	0	0	2	0	0	0	0	160
Hickory Pond	0	0	0	0	0	0	0	0	0	71
Glades	0	0	0	4	0	0	4	3	3	36
Belle Glade	0	20	0	5	0	0	0	0	1	28
Malabar	0	0	1	9	0	0	0	16	1	126
Mississippian	0	0	0	0	0	0	0	0	0	7
Preh. w/o pottery	3	1	57	65	17	10	8	2	16	602
Preh. w/pottery	11	0	22	9	10	5	10	3	6	284
Unspecified preh.	29	1	58	38	60	16	42	9	68	907
Other preh.	15	1	5	0	5	2	18	3	12	155
Hist. w/preh.	17	4	12	14	29	10	54	7	35	463

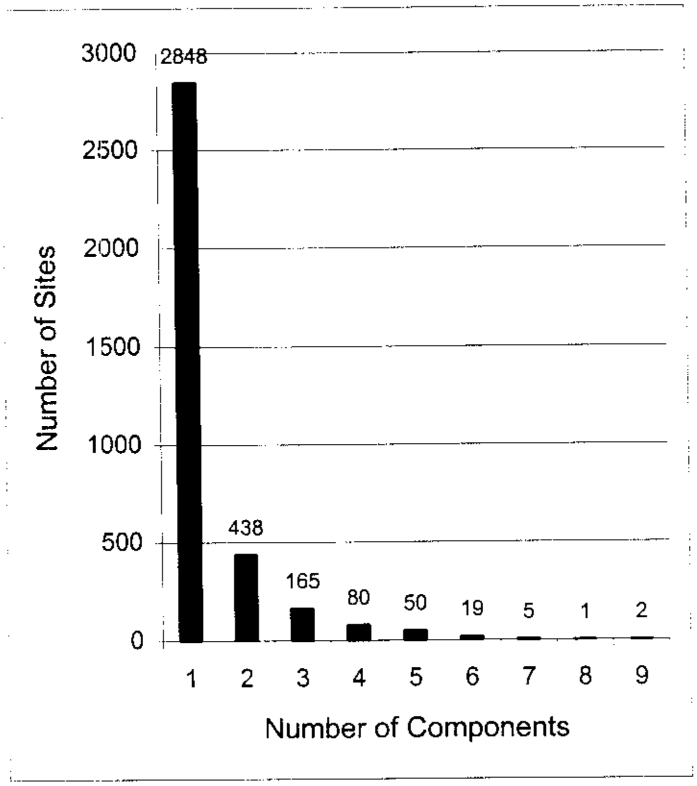

Figure 6-1. Absolute frequency of sites by number of prehistoric components.

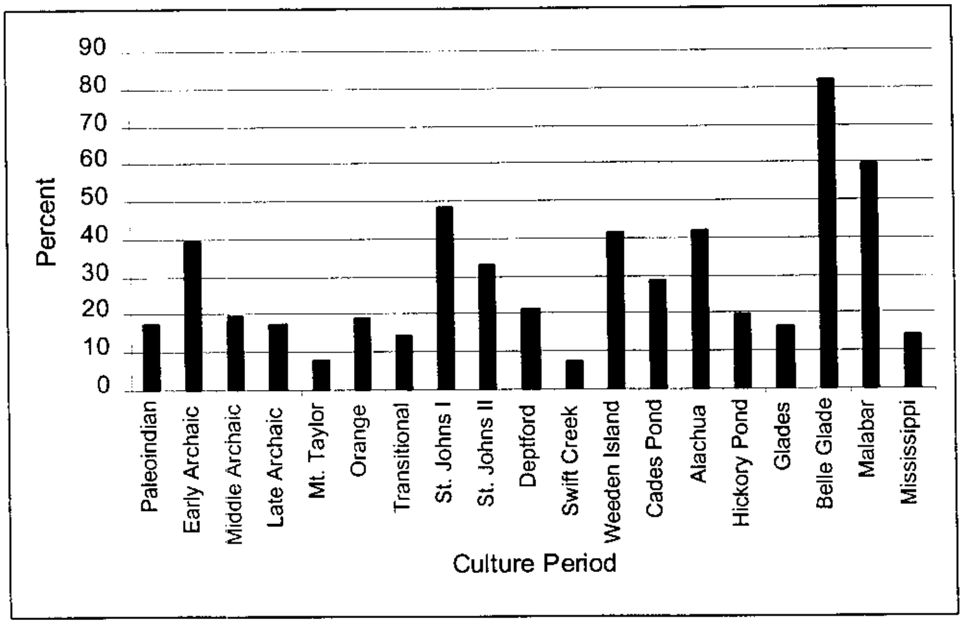

Figure 6-2. Relative frequency of single component sites by culture period.

We can, however, control for differences in the duration of culture periods to standardize frequencies of components per unit time (i.e., centuries). We do this simply by dividing the number of components for a given culture period by the duration of that period. The result is a trend of rapidly increasing component frequency per century after 3000 B.P. (Figure 6-3). With 962 components, the St. Johns I period alone accounts for much of the punctuated increase, although all other post-3000 B.P. components come into play, many existing outside the core of the St. Johns region.

A more refined comparison of components per century is possible for the cultural sequence of the St. Johns proper (Figure 6-4). This exercise remains necessarily regional in scope, especially regarding early prehistoric populations whose settlement ranges may have encompassed large portions of the study area and beyond. After about 6000 B.P., however, we can focus on a sequence starting with Mt. Taylor and continuing through St. Johns II that is truly centered on the St. Johns river and adjacent Atlantic strand. For this purpose we combine Late Archaic and Mt. Taylor into a period of 2000 years in duration (6000-4500 B.P.). Likewise, we collapse the Orange and problematic Transitional period into a 1500-year period (4500-3000 B.P.). All other periods retain their individual identity with the following durations: Paleoindian, 1500 years (11,500-10,000 B.P.); Early Archaic, 2000 years (10,000-8000 B.P.); Middle Archaic, 2000 years (800-6000 B.P.); St. Johns I, 1800 years (3000-1200 B.P.); St. Johns II, 800 years (1200-400 B.P.).

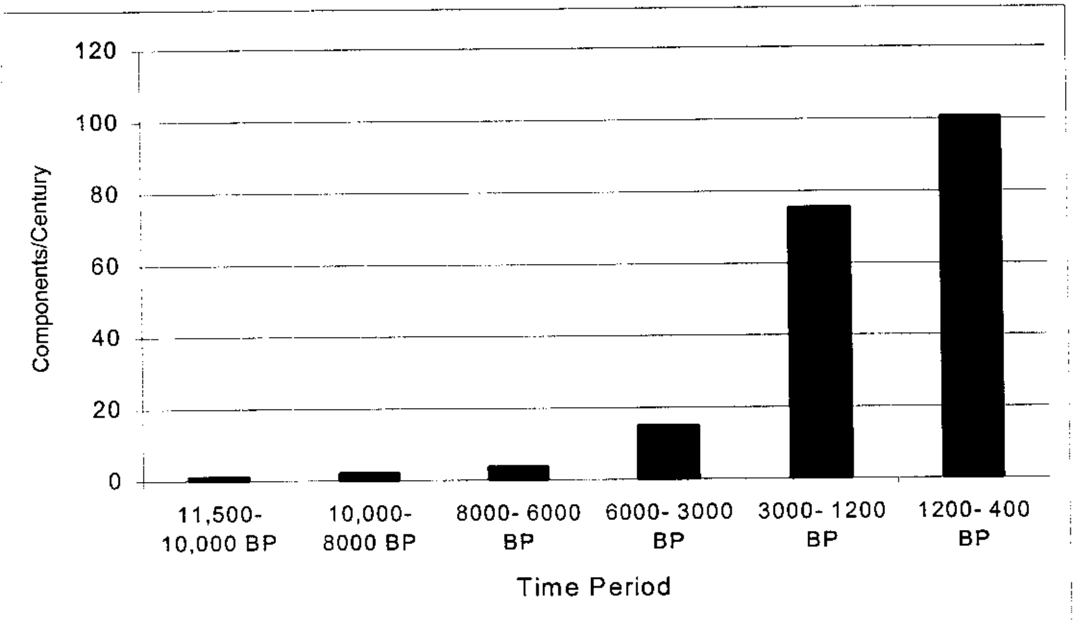

Figure 6-3. Number of components per century for generalized culture periods of entire study area.

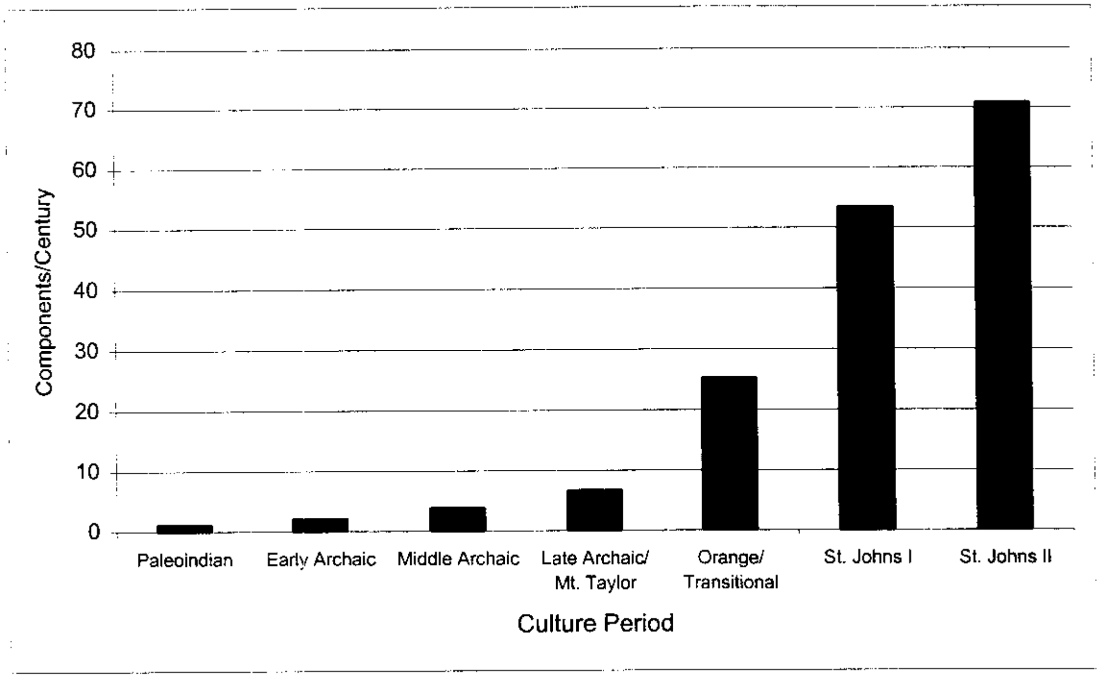

Figure 6-4. Number of components per century for culture periods of the St. Johns sequence.

As seen in Figure 6-4, the overall trend in component frequencies is for slow, gradual increase through the Paleoindian and Archaic periods, followed by marked, more rapid increases from the Orange period forward. Clearly the introduction of pottery as the chief diagnostic artifact class after 4500 B.P. contributes to the rapid increase in components. Equally influential is the widespread occurrence of St. Johns wares after 3000 B.P., in this case the part of the growth reflects greater spatial scale over the previous period. All this aside, most analyst would agree that in large measure we are witnessing in these data increases in regional population.

Patterns of Reoccupation

These same data can be adjusted for insights on site reoccupation in the region. Simple counts of the incidence of coterminus components (e.g., Orange/Transitional and St. Johns I) is one expression of site reoccupation (Table 6-5). However, such ratios can be deceiving unless each of the paired component samples is of roughly the same size. This is especially problematic for paired samples in which the early period is represented by much fewer components than the late component. For instance, the percentage of St. Johns I sites with components of the preceding Orange/Transitional period is constrained by the maximum number of Orange/Transitional components (n = 380), in this case 39.5 percent of all sites with St. Johns I components (n = 962).

Table 6-5. Data on Site Reoccupation by Culture Period.

	Number Comps.	Number w/ Previous Comp.	Percent w/ Previous Comp.	Reoccupation Ratio[1]
Paleoindian	17	-	-	-
Early Archaic	43	7	16.3	41.2
Middle Archaic	76	4	5.3	9.3
Late Archaic/Mt. Taylor	134	43	32.1	56.6
Orange/Transitional	380	48	12.6	36.0
St. Johns I	962	215	22.3	56.6
St Johns II	567	312	55.0	32.4

[1] calculated by dividing the total number of components of the previous period into the number of sites with both components and multiplying by 100

To alleviate this bias, let us consider the incidence of reoccupation as a ratio of sites with coterminus periods to the total number of components of the early period. The results of this "reoccupation ratio" are reported in Table 6-5 and displayed graphically alongside normal percentages for coterminus components in Figure 6-5. One abrupt break in reoccupation occurs between the Early and Middle Archaic periods, where less than 10 percent of sites of the latter period contain components of the former period. The

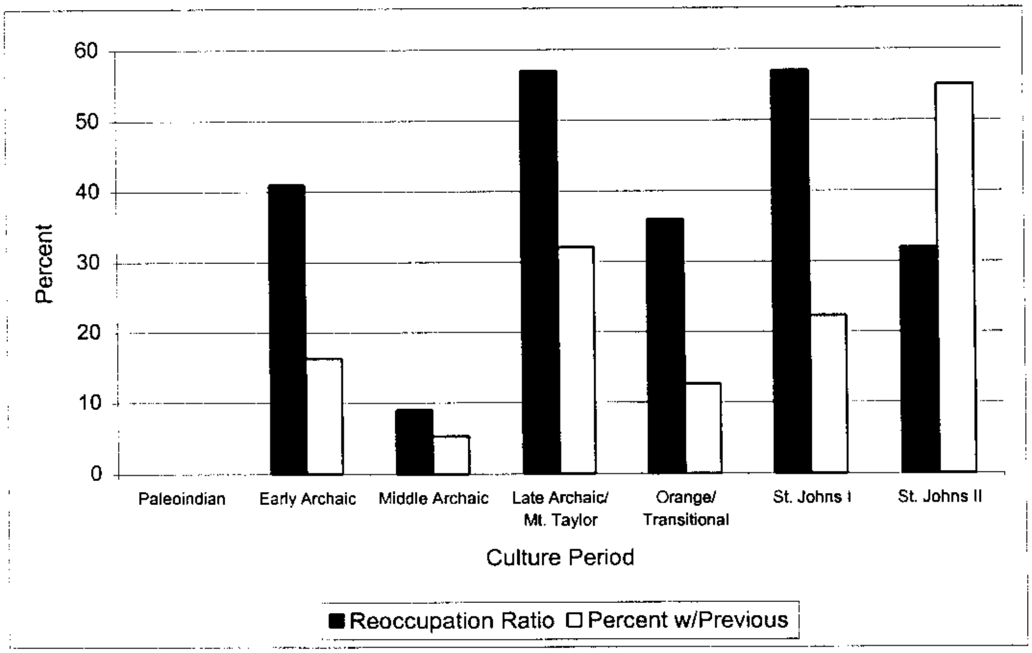

Figure 6-5. Relative frequencies of reoccupation by culture period.

subsequent Late Archaic/Mt. Taylor period climbs to 56.6 percent reoccupation, and the following Orange/Transitional period drops down to 36.0 percent. Repeating the cycle, the St. Johns I period climbs to 56.6 percent reoccupation, and its successor drops to 32.4 percent. This final period, St. Johns II, is affected most directly by the reoccupation ratio because the preceding period has nearly 400 more components. As seen in Figure 6-5, the apparent trend for increasing reoccupation starting with the Orange/Transitional period is deceptive; when we consider that there are more than enough sites with St. Johns I components to accommodate all St. Johns II sites, the actual rate of 55 percent for reoccupation seems low.

In sum, the trends in site reoccupation expose some potentially meaningful breaks in land use patterns over the roughly 12,000-year span of prehistoric occupation in the region. One abrupt break is evident in the transition from the Early to Middle Archaic. Less conspicuous though noteworthy are discontinuities between the Late Archaic/Mt. Taylor and Orange/Transitional periods, and between the St. Johns I and II periods. High frequencies of single component sites help to explain these discontinuities for the Early Archaic and St. Johns I periods. The break marking the onset of the Orange period is not so readily explained. In the chapter that follows we take a closer look at the specific environmental circumstances accompanying these changes.

SITE TYPE/FUNCTION

As indicated at the opening of this chapter, Florida site files contain relatively detailed codes for site type or function. Table 6-6 lists all the codes used to describe site type/function for the 3608 prehistoric sites in the study area. These codes are a mix of criteria on function (e.g., habitation), composition (e.g., shell midden), condition (e.g., destroyed), and specificity (e.g., indeterminate).

Potential biases in the coding of site type/function are legion. Determining whether a site is a "habitation" or "procurement" site presupposes adequate data recovery, usually including subsistence remains, data on seasonality, duration of occupation, and coresident group composition. Deciding whether a site is a "low" or "hi" density scatter presupposes adequate knowledge of the extent of artifact distributions at sites and a frame of reference for relative density. Whereas BAR provides abundant guidance for making these decisions, variations in the intensity of field work, sampling, analytical methods, and investigator bias ensure that determinations of site function or type are woefully inconsistent.

Irrespective of these problems, at least three site attributes are relatively invulnerable to most biases. Sites with shell deposits comprise a sizable fraction of all prehistoric sites in the region. Tabulating all sites described as (1) shell midden, (2) shell mound, or (3) shell scatter, the study area inventory contains 654 shell-bearing sites. We suspect that very few of these sites are misidentified as "shell-bearing," when in fact they lack shell deposits. Conversely, several sites known to contain shell lacked an appropriate code. We added codes for shell in our database, where appropriate, to arrive at a total inventory of 667 shell-bearing sites.

Table 6-6. Codes for Site Type or Function (in alphabetical order) Included on Files for Sites of Study Area.

Aboriginal boat
Burial mound
Campsite (Preh.)
Cave or rockshelter
Ceramic scatter
Destroyed (totally)
Domiciliary mound
Habitation (Preh.)
Hi density scatter
Indeterminate
Inundated land site
Land-terrestrial
Lithic no pottery
Lithic, not quarry
Low density scatter
No field investigation
Other
Platform mound (Preh.)
Preh. burial(s)
Preh. Earthworks
Preh. midden(s)
Preh. mound(s)
Preh. shell midden
Preh. shell mound(s)
Preh. shell scatter
Procurement site
Quarry-Preh.
Redeposited site
Scatter
Single artifact or isolated find
Specified to be unknown
Subsurface features are present
Underwater disposal midden
Variable density scatter of artifacts
Wetland-palustrine

A second code that ought to be relatively invulnerable to miscoding is "prehistoric midden." Each of the shell-bearing sites that lacked an appropriate code in the site file record was coded as "prehistoric midden." Thus, "midden" is often not specific enough, but we assume it consistently signifies the anthropogenic accumulation of organic refuse, and, as such, should often reflect intensive land use. A total of 449 sites in the database fit this description.

Finally, 491 sites are described as having some sort of (prehistoric) mound other than "shell mound." Many such features were long ago destroyed, but given the extensive records of late 19th-century antiquarians such as C. B. Moore, the record of mounds is likely reliable.

In sum, shell deposits, midden, and mounds are features at sites in the region whose record in the site files are deemed adequate for first-order GIS analysis. Undoubtedly each of these categories is beset with their own peculiar sampling biases. Compared to inferences of site type based on artifacts alone, however, observations on middens and mounds often much better hope for isolating subsets of sites whose functions or occupational histories involved locational specificity.

CONCLUSION

Florida state site files are a robust dataset for exploring nonrandom tendencies in location. Good potential exists for diachronic analyses of component data; fewer possibilities are enabled by site files data on site function or type. Either way, all recorded sites in the study area have been digitized as actual polygons and its associated data are fully accessible through GIS software for purposes of geographic analysis. In this chapter we described the means by which site files data were adapted for GIS analysis, the subject of Chapter 7.

CHAPTER 7
LOCATIONAL ANALYSIS OF SITES

Patterned variation in the location of archaeological sites is at once a reflection of prehistoric land use and a basis for predictive modeling. In this chapter we examine the distributions of sites relative to a series of environmental variables to identify nonrandom tendencies in location for purposes of predictive modeling. We begin with a preliminary assessment of nonrandom tendencies among all prehistoric sites in the study area. The number of recorded components per site provides a means for comparing occupational intensity/history against environmental variation. We then consider some of the more conspicuous attributes of site type, namely the presence of shell midden and earthen mound constructions. Finally, diachronic trends in site locations are examined with an eye toward the interpretive potential of regional-scale distributions for understanding changes in prehistoric land use.

REGIONWIDE PATTERNING

Frequency distributions of sites across counties in the study area offer a generalized perspective on site density and the myriad factors affecting distributions aside from prehistoric land-use patterns. As shown in Table 7-1, the frequency of recorded sites ranges from a low of 25 in Okeechobee County, to a high of 594 in Marion County. Among the modern causes for variation in site counts across counties are differences in county size, urban development, and archaeological sampling.

County Size

As is expected if sites were randomly distributed, differences in county area account for much of the variation in site frequencies across counties (Figure 7-2). This relationship has a correlation coefficient of 0.658, indicating that county size accounts for roughly 43 percent of variation in site counts. If only land area and not total county area (water included) were considered, the coefficient increases to 0.709, a value accounting for slightly more than half of site count variation.

Four of 19 counties deviate markedly from the linear relationship between area and site counts. Okeechobee and Osceola have fewer sites than expected from county area alone. In the case of Okeechobee, surface water is among the leading factors, but equally important are limited urban development and, in turn, survey spawned by development. Excessive surface water also plays a role in the low site densities for Osceola County, but development and survey are lesser factors, at least in the northern margins of the county, which has been subject to the urban sprawl of Orlando.

Two counties with more sites than expected from area alone are Alachua and Duval. The former is partly a function of the activity of University of Florida archaeologists. The latter is likely a combination of urban development and truly high

Table 7-1. Absolute and Relative Frequencies of Sites by County, along with Data on Area, Population, and Survey Coverage that Potentially Account for Variation in Site Frequency across Counties.

	Sites		Total Area[1]		Population[2]		Survey Area[1]	
	n	%	n	%	n	%	n	%
Alachua	513	14.2	2510.7	5.9	198,811	4.8	157.4	3.5
Baker	154	4.3	1526.0	3.6	20,346	0.5	50.6	1.1
Bradford	37	1.0	776.7	1.8	24,393	0.6	26.6	0.6
Brevard	266	7.4	3363.7	7.9	447,444	10.8	1171.3	26.1
Clay	111	3.1	1667.6	3.9	121,680	2.9	236.5	5.3
Duval	343	9.5	2205.9	5.2	720,424	17.4	342.4	7.6
Flagler	56	1.6	1315.3	3.1	37,376	0.9	193.7	4.3
Indian River	74	2.1	1403.1	3.3	100,727	2.4	100.1	2.2
Lake	215	6.0	2996.0	7.1	177,925	4.3	78.3	1.7
Marion	594	16.5	4305.0	10.2	226,011	5.5	488.0	10.9
Nassau	96	2.7	1724.3	4.1	49,291	1.2	67.5	1.5
Okeechobee	25	0.7	2307.1	5.5	33,078	0.8	35.6	0.8
Orange	222	6.2	2601.8	6.1	762,611	18.5	425.7	9.5
Osceola	155	4.3	3899.2	9.2	137,977	3.3	248.2	5.5
Putnam	170	4.7	2142.4	5.1	69,795	1.7	62.3	1.4
Seminole	119	3.3	893.3	2.1	326,321	7.9	110.6	2.5
St. Johns	161	4.5	1743.0	4.1	98,800	2.4	165.9	3.7
St. Lucie	34	0.9	1656.4	3.9	172,291	4.2	180.9	4.0
Volusia	263	7.3	3274.8	7.7	405,121	9.8	351.3	7.8
Total	3608	100.0	42,312.8	100.0	4,130,422	100.0	4492.9	100.0

[1] measured in km^2

[2] estimated population in 1995; source: Fernald and Purdum 1992:268

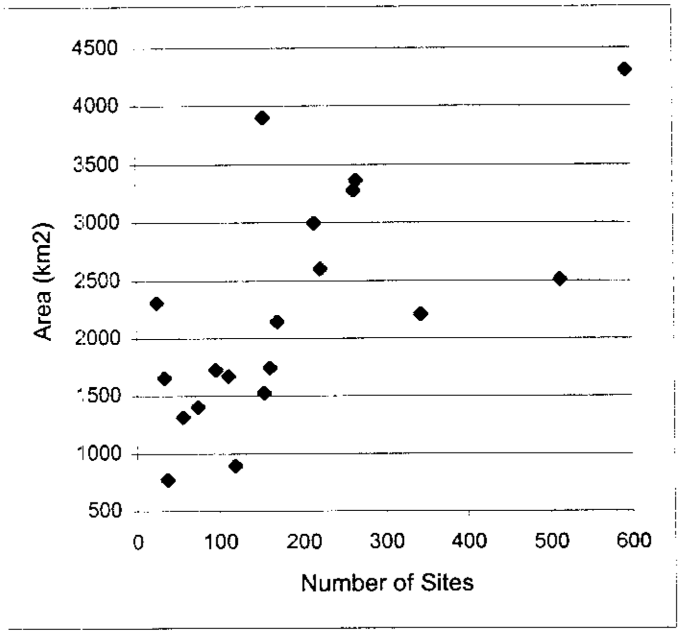

Figure 7-1. Bivariate plot of county area (km^2) by number of archaeological sites.

site densities in some of the most extensive and rich estuarine habitat on the Atlantic coast.

If we remove these four counties from consideration, the correlation between county size and site counts strengthens enough ($r = 0.891$) to account for 79 percent of the variation. In short, these data reflect the fact that prehistoric sites in northeast Florida are distributed widely, with no major gaps in county-level coverage.

Urban Development

Historic and modern land use are considered in greater detail in Chapter 8. For the purpose of exploring relationships between site density and urban development, simple population counts are a proxy for development. County population figures do not recapitulate county size, as the latter accounts for only 10 percent of the variation of the former ($r = 0.319$). Rather, population clearly is a function of urban development.

Figure 7-2 displays the bivariate plot of site counts and population figures for 1995. The linear relationship between these variables is positive, but weak ($r = 0.416$). Counties with the two largest populations, Duval and Orange, have high site counts, but not nearly as high as modern population alone might predict. Conversely, Alachua and Marion counties have the two largest inventories of sites but their populations are only about one-fourth the size of Duval and Orange counties. Apart from these exceptions, the relationship between site counts and population is still very weak, as a wide range of site frequencies are observed among several counties with comparable population sizes.

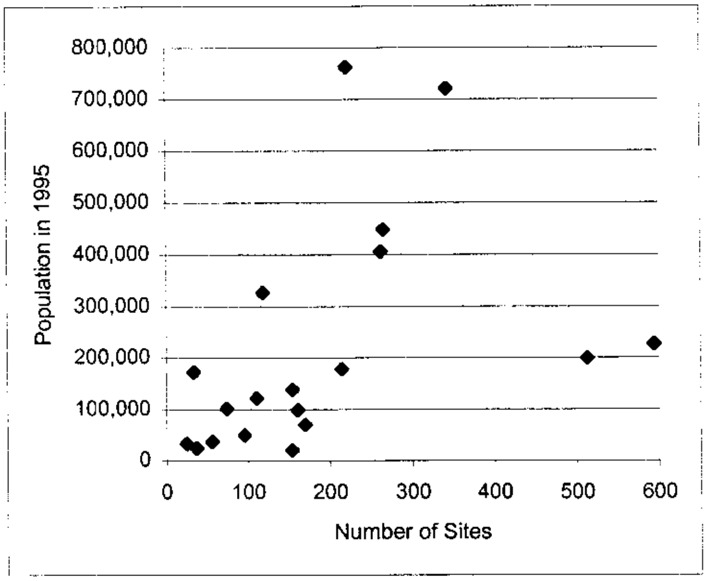

Figure 7-2. Bivariate plot of county population in 1995 by number of archaeological sites.

Evidently, urban development and its attendant population growth are insufficient to explain variation in site frequencies. Whereas development involving federal licensing or funds since the mid-1970s has invoked archaeological review, private development often has not. Some of the urban sprawl of Orange County took place under the latter circumstances, and much of the development of Duval County predated legislative protection for archaeological resources.

Survey Coverage

In Chapter 5 we explored distributional parameters of survey coverage in the region, noting only minor nonrandom tendencies. Given that survey coverage for the region accounts for 47 percent of all sites, it stands to reason that variation in survey coverage across counties accounts for much of the variation in site frequencies. Although positive, the relationship is actually relatively weak (Figure 7-3; $r = 0.415$). Brevard County is an extreme outlier with nearly 1200 km^2 of recorded survey coverage, little of which was intensive. The other major outlier is Alachua County, which has the opposite condition: limited survey coverage but a large site inventory due to incidental reporting, mostly by UF researchers.

If we remove these two outliers, the relationship between site frequencies and survey coverage improves significantly ($r = 0.748$), enough to account for 56 percent of the variation. If survey coverage for the Ocala National Forest were added, the ratio of coverage to sites would increase for Marion and Lake counties, strengthening the relationship even further. Thus, although survey coverage is insufficient to explain fully

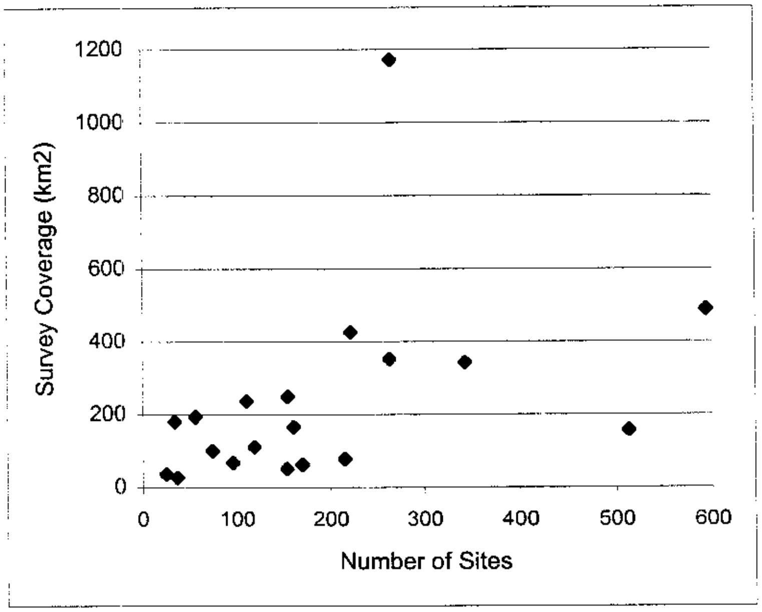

Figure 7-3. Bivariate plot of survey coverage (km^2) by number of archaeological sites.

variation in site frequency, together with county area, it accounts for most of the variation. Put in common terms, archaeological sites in northeast Florida are found virtually wherever one looks for them, at least at the county level.

Elevation

Values for site elevation are not terribly meaningful at the scale of the entire study area, for, as we have seen already, sites are widely distributed. Still, average elevation for all 3608 sites is significantly lower than for 1000 randomly generated points (Table 7-2; $t = 2.269$ unpooled variance; 2.205 pooled variance). The difference is due largely to a disproportionately large number of sites in the 1-10 ft range (Figure 7-4). Because this peak in the distribution mimics the survey tract data (see Chapter 5), it cannot be taken as a nonrandom tendency of site locations.

Table 7-2. Summary Statistics on Elevation (ft amsl) of all Recorded Prehistoric Sites and 1000 Random Points in Study Area.

	n	mean	st. dev.	min.	max.
All Sites	3608	54.2	48.8	0.0	245.0
Random Points	1000	58.6	43.6	0.0	228.2

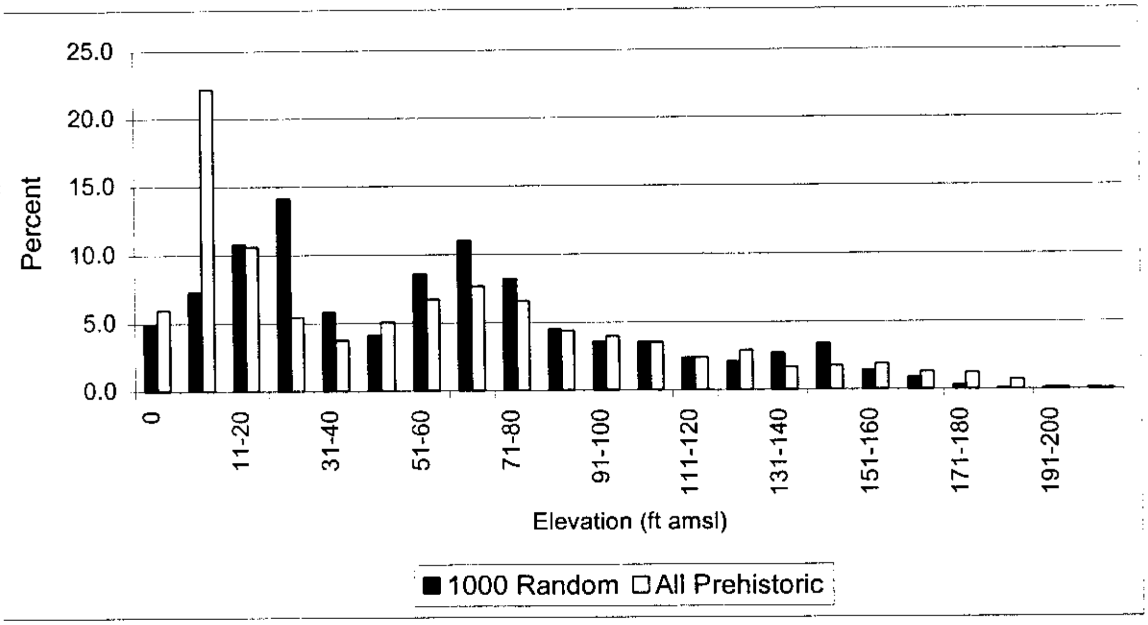

Figure 7-4. Comparison of the absolute frequencies of elevation values for 1000 random points across the entire study area and all archaeological sites.

Meaningful pattering in site elevation emerges when we divide sites by the number of components present (Table 7-3). Single component sites are statistically similar to random points, but as components are added, mean elevation drops to a low of 18.7 ft amsl for sites with five components. (Sites with more than five components are actually higher, on average, than sites with five, but sample error must be considered as only 27 sites are coded for more than five components.) At one standard deviation, the range of these subsamples overlap considerably. Nevertheless, the relationship between elevation and component frequency is unequivocal. This gives us cause to be optimistic that site files indeed provide valid data on site locations relative to measures of occupational intensity.

The relationship between elevation and site componency is further clarified by a comparison of physiographic zones. Specifically, the average number of components per site varies from a high of 1.6 for the Coastal Lowlands, to a low of 1.2 for Central Highlands. Sites in the St. Johns Basin are intermediate at 1.4 components/site. Thus, average number of components per site is inversely related to interzonal elevation, as well as differences within zones.

Distance to Water

Although average elevation for all sites does not deviate markedly from the value for random points, averages for distance to water are vastly divergent (Table 7-4; *t* = 5.814 unpooled variance; 5.912 pooled variance). But as with elevation, the difference does not necessarily reflect nonrandom patterning, for the average distance to water of all sites is not statistically different than random points in survey tracts (see Chapter 5; *t* = 0.847 unpooled variance; 0.802 pooled variance).

Physiographic differences are especially marked as regards distance to water. Sites in the St. Johns Basin (n = 1547) average 1237.4 m from water, whereas coastal

Table 7-3. Summary Statistics on Elevation (ft amsl) of Sites by Number of Components.

	n	mean	st. dev.	minimum	maximum
1	2848	59.0	49.2	0.0	245.0
2	438	39.9	44.2	0.0	186.9
3	163	34.2	43.1	0.0	165.0
4	80	31.1	43.3	0.0	178.6
5	50	18.7	23.4	0.0	120.0
>5	27	30.2	32.3	0.0	122.9

sites (n = 876) average 1632.0 m and Central Highland sites (n = 1185) average 2791.1 m. Clearly the latter, larger subsample skews the entire sample upwards.

Taking source of running water into consideration (Table 7-4), the site sample represents substantially greater fractions of sites along large rivers, notably the St. Johns, and fewer along undesignated streams than random points. In this regard modern survey bias is not to blame, as the distribution of random points in survey tracts generally duplicates project-wide random points. The site bias for rivers, particularly the St. Johns, can be at least partly attributed to historical investigative bias for large shell middens and mounds.

Mean distance to running water, like elevation, decreases sharply with increased number of components at sites (Table 7-5). Put another way, the average number of components per site decreases with increased distance to water (Table 7-6). The relationship between mean number of components and distance to water assumes something of a step-like distribution (Figure 7-5). Sites within 100 m of running water have an average of about 1.6 components/site. Sites located 101 to 500 m from running water average about 1.4 components/site. Distances of 501-4000 m average 1.3

Table 7-4. Absolute Frequency of 2000 Random Points and All Sites by Source of Nearest Running Water and Summary Statistics on Distance (m) to Running Water.

	2000 Random Points		3608 Prehistoric Sites	
	n	%	n	%
Nearest Running Water				
Undesignated Stream	1697	84.9	2752	76.3
St. Johns River	95	4.8	410	11.4
Oklawaha River	44	2.2	130	3.6
Econlockhatchee River	11	0.6	14	0.4
Sante Fe River	10	0.5	17	0.5
Withlacoochee River	29	1.5	86	2.4
Tomoka River	9	0.5	16	0.4
Spruce Creek	10	0.5	15	0.4
Palatlakaha River	10	0.5	12	0.3
Nassau River	6	0.3	13	0.4
St. Marys River	1	0.1	9	0.2
Wekiva River	5	0.3	21	0.6
Black Creek	6	0.3	11	0.3
St. Lucie River	4	0.2	1	0.0
Kissimee River	2	0.1	2	0.1
Lakes on Rivers	61	3.1	99	2.7
mean	2302.3		1843.6	
standard deviation	2887.2		2722.7	
minimum	0.0		0.0	
maximum	19,887.5		19,970.9	

Table 7-5. Summary Statistics on Distance to Nearest Running Water (m) by Number of Components.

	n	mean	st. dev.	minimum	maximum
1	2848	1979.4	2794.4	0.0	19,944.4
2	438	1632.1	2704.8	0.0	19,685.8
3	163	1137.9	2077.7	0.0	12,242.3
4	80	981.5	1440.9	0.0	8817.2
5	50	716.9	1234.7	0.0	6044.4
>5	27	781.2	1064.2	0.0	4351.2

Table 7-6. Summary Statistics on Number of Components at Sites by Distance to Water.

Distance to Water (m)	n	mean	st. dev.	minimum	maximum
0	244	1.61	1.06	1	7
1-50	183	1.63	1.20	1	9
51-100	185	1.61	1.35	1	9
101-200	256	1.42	0.95	1	8
201-300	182	1.38	0.80	1	6
301-400	183	1.43	0.97	1	7
401-500	156	1.44	0.95	1	6
501-1000	473	1.34	0.85	1	7
1001-2000	569	1.28	0.82	1	6
2001-3000	380	1.28	0.68	1	5
3001-4000	211	1.31	0.78	1	6
4001-5000	140	1.16	0.63	1	6
5001-10,000	272	1.18	0.54	1	5
10,001-15,000	43	1.21	0.51	1	3
15,001-20,000	31	1.10	0.30	1	2

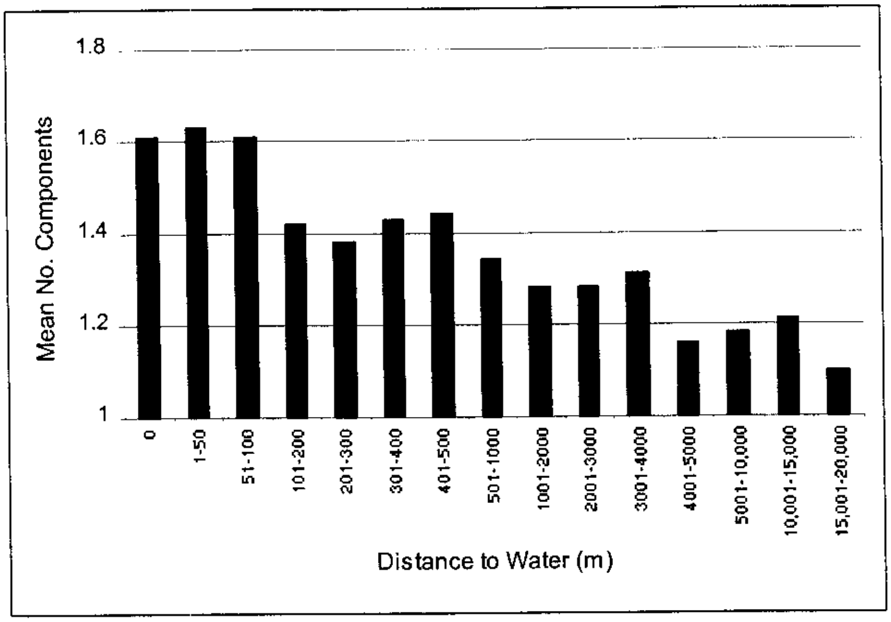

Figure 7-5. Mean number of components per site by distance to running water (m).

components/site, and sites greater than 4000 m from running water average 1.2 components/site.

The increased tendency for multicomponent sites to be located along the St. Johns River is one of the major contributing factors for this trend. Only 8.7 percent of single component sites and 17.7 percent of double component sites are in close proximity to the St. Johns, compared to 28.4 percent of sites with three or more components. The lower reaches of the St. Johns in and around Jacksonville is home to a large cluster of multicomponent sites. Collectively, sites whose nearest source of running water is the St. Johns are among the closest to water overall (Table 7-7). Other rivers and creeks (Palatlakaha, Nassau, St. Marys, and Kissimmee rivers, and Black and Spruce creeks) have lower averages, although none involve more than 15 sites, so sample error cannot be dismissed. The extremely high distance averages for the Oklawaha and Withlachochee rivers is due to the large number of sites in interriverine portions of Marion County.

Soil Drainage

The distribution of all sites across soil mapping units reveals clear nonrandom tendencies for better-drained soils (Table 7-8; Figure 7-6). Although only 38.4 percent of all soils in the study area are classified as "somewhat poorly drained" or better (see Chapter 4), these soils constitute 64.9 percent of the area encompassed by archaeological sites. Survey bias is not a factor here, as soils with these drainage ratings in survey tracts comprise only 38.5 percent of total survey coverage (see Chapter 5).

Table 7-7. Summary Statistics on Distance to Running Water (m) to Nearest Source.

	n	mean	st. dev.	min.	max.
Undesignated Stream	2752	1956.6	2531.3	0.0	19,633.4
St. Johns River	410	330.0	860.0	0.0	8835.7
Oklawaha River	130	3299.1	5164.3	0.0	19,970.9
Econlockhatchee River	14	528.4	337.0	40.1	1344.0
Sante Fe River	17	626.6	740.2	0.0	1960.0
Withlacoochee River	86	5520.8	5011.7	0.0	18,649.4
Tomoka River	16	1339.9	2179.8	0.0	6174.9
Spruce Creek	15	124.8	181.0	0.0	573.2
Palatlakaha River	12	297.4	250.2	13.8	692.1
Nassau River	13	251.5	316.8	0.0	843.4
St. Marys River	9	302.5	222.7	0.0	731.9
Wekiva River	21	342.0	734.6	0.0	3214.1
Black Creek	11	289.8	231.0	0.0	822.9
St. Lucie River	1	-	-	236.9	236.9
Kissimee River	2	0.0	0.0	0.0	0.0
Lakes on Rivers	99	1726.7	2194.4	0.0	8002.9

Component frequency per site does not correlate with soil drainage in the fashion of elevation and distance to water. Roughly 65 percent of sites are comprised of soils with ratings of "somewhat poorly drained" or better, whether they have only one component or are multicomponent.

Table 7-8. Distribution of Soil Mapping Units by Drainage Class for All Prehistoric Sites[1].

	#Mapping Units	Area (ha)	Percent Area
Drainage Class			
Excessively	856	1038.4	12.9
Somewhat Excessively	10	15.9	0.2
Well	494	671.9	8.3
Moderately Well	1014	1066.9	13.2
Somewhat Poorly	1342	2447.9	30.3
Poorly	1338	1674.3	20.7
Very Poorly	1187	1005.7	12.5
Water	150	40.1	0.5
Urban, Pits, Dumps	105	109.8	1.4
Total	6496	8070.9	100.0

[1] excludes mapping units for areas of missing data, including all of Duval County.

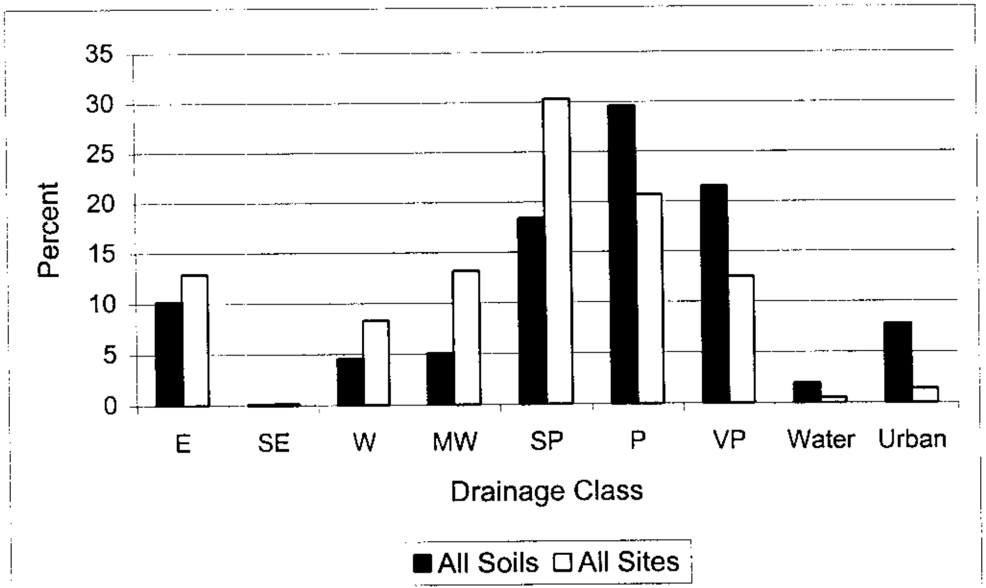

Figure 7-6. Comparison of relative percentage of soil mapping units (ha) in study area and archaeological sites by drainage class (E = excessively; SE = somewhat excessively; W = well; MW = moderately well; SP = somewhat poorly; P = poorly; VP = very poorly).

Nonirrigation Agriculture Capability

Nonrandom patterning is likewise apparent in the distribution of sites across ratings for nonirrigated agriculture capability (Table 7-9; Figure 7-7), although the differences in this respect are more subtle than with drainage. The biggest deviation occurs with Class 3 soils, which comprise 46.1 percent of all prehistoric sites, but only 26.1 percent of all soils in the study area. This tendency is due largely to the disproportionate fraction (64.6 percent) of Class 3 soils in Central Highland sites. As we discuss below, Woodland period components in the Central Highlands (i.e., Alachua, Cades Pond, Hickory Pond) are biased toward soils with good agricultural capabilities and moderately well to poorly drained soils.

As with drainage values, distributions of values for nonirrigation agriculture capability do not covary with numbers of components. Single component sites have a capability average of 4.6 and sites with seven components average 5.8, but intermediate classes vary erratically. It is interesting that neither of the soils variables examined here duplicates the patterned relationships between site componency, elevation, and distance to water. Apparently, these variables are sensitive to different scales of patterning, which may be useful for fine-tuning the predictive qualities of site locational data.

Table 7-9. Distribution of Soil Mapping Units by Nonirrigated Agriculture Capability (1 = high, 8 = low) for All Prehistoric Sites.

Potential	#Mapping Units	Area (ha)	Percent Area
1 (high)	0	0.0	0.0
2	165	181.1	2.3
3	2018	3598.5	46.1
4	1601	1797.3	23.0
5	130	216.0	2.8
6	1215	1122.2	14.4
7	742	551.1	7.1
8 (low)	309	345.1	4.4
Total	6180	7811.3	100.0

[1] excludes mapping units for areas of missing data, including all of Duval County, all water, and most urban units.

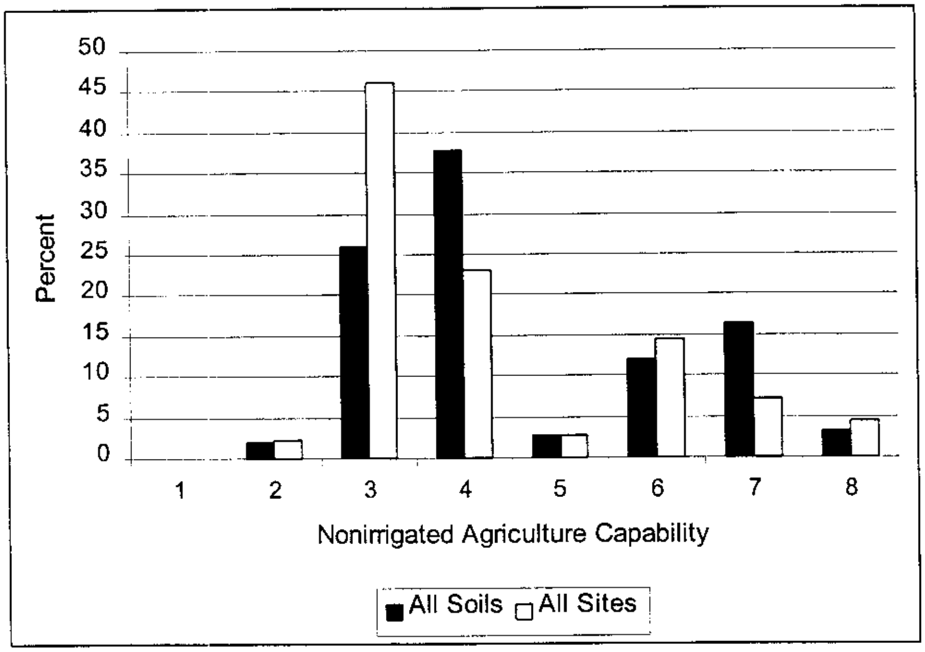

Figure 7-7. Comparison of relative percentage of soil mapping units (ha) in study area and archaeological sites by nonirrigated agriculture capability.

SITE FUNCTIONAL VARIATION

In Chapter 6 we reviewed site files data on site type or function and concluded that only codes for "shell," "midden," and "mound" are unambiguous enough to warrant locational analysis. We hasten to add that not all sites in the database that actually contain shell, middens, and/or mounds are consistently coded as such, only that few sites with such codes are expected to be entirely misidentified.

Shell-Bearing Sites

Six-hundred-sixty-seven sites coded for shell are distributed along the entire coastal strand of the study area, most of the upper two-thirds of the St. Johns River and many of its major tributary stems, and in isolated pockets in the western and southern extremes of the study area (Figure 7-8). In essence, the distribution is split between the saltwater shell deposits of the coast and lower St. Johns and the freshwater complexes of the middle and upper St. Johns. A distinctive gap in the distribution of the shell sites occurs in the stretch of the lower St. Johns occupying Clay, St. Johns, and southern Duval counties. Shell sites are not completely absent in this stretch, but they are decidedly rare, at least as far as site files records are concerned. C. B. Moore (1892) commented on the lack of freshwater shell deposits along the lower stretch of the river, speculating that the admixture of salt and freshwater was perhaps detrimental to shellfish productivity. The extent to which tidal influence and related ecological factors affected the potential for shell fishing and long-term occupation cannot be determined at this point, but it seems unlikely that sample error alone accounts for this bias. Indeed, numerous sites lacking shell have been located along the lower third of the St. Johns, including many late prehistoric sand mounds (see below).

Considering locational variation in shell-bearing sites with respect to elevation, access to water, and soils, it is useful to divide the database into two subsets: St. Johns and coastal (Table 7-10). Shell-bearing sites along the St. Johns average only 284.6 m from running water; nearly two-thirds of these sites are situated directly on the St. Johns River or one of its integrated lakes. Elevational tendencies recapitulate proximity to water data.

Given the inherent position of freshwater shell-bearing sites in close proximity to large sources of running water, we can expect that soil associations will be biased toward poorly drained soils. Indeed, nearly three-quarters of the freshwater shell-bearing sites are situated on soils rated as poorly or very poorly drained, compared to only one-third of all St. Johns drainage sites. Ratings for nonirrigated agricultural capability are equally biased toward poor soils: shell-bearing sites are twice as often located on soils with rating of 6 or greater compared to sites lacking shell. These results remind us that locational tendencies for sites in general may overshadow statistical trends in functionally or typologically distinct subsamples of sites. Specifically, shell-bearing sites have soils properties that fall outside the modal tendencies for sites in general and thus have the potential to be overlooked in predictive models based on modal soils. Fortunately, by adding distance to water and elevation to predictive models, all shell-bearing sites are captured irrespective of soils.

Middens

Four-hundred-forty-nine sites are coded as having "midden" components (Figure 7-9). Ninety-nine of these sites are likewise coded as having "shell" deposits, so this group and the preceding group are hardly mutually exclusive. What is more, an appreciable number of sites coded as having "midden," but not shell indeed contain shell.

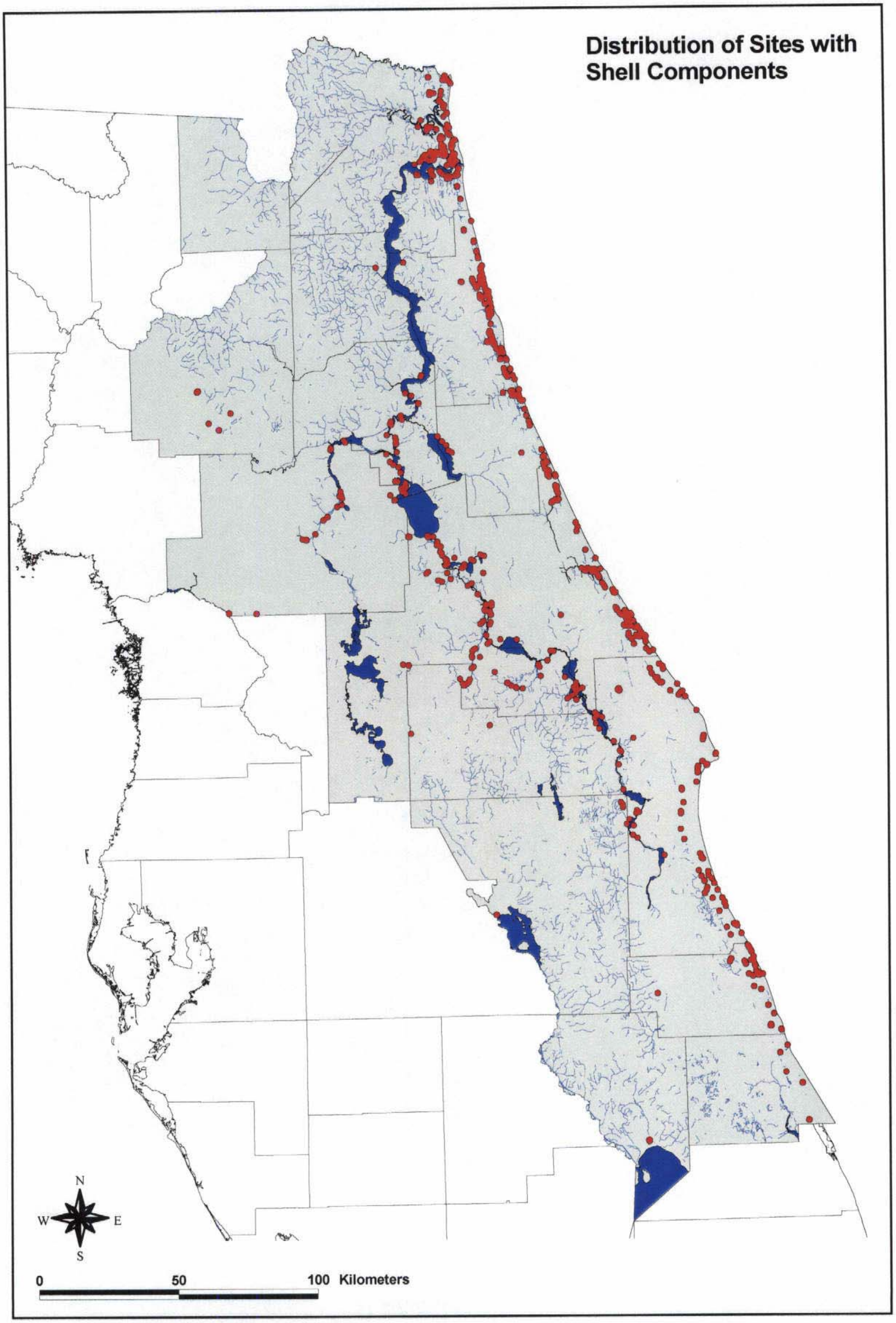

Figure 7-8. Distribution of sites with shell deposits.

Table 7-10. Summary Statistics on Elevation (ft) and Distance to Water (m) for Shell-Bearing Sites along the St. Johns River and Its Tributaries and the Coastal Zone.

	Elevation (ft)	Distance to Water (m)
St. Johns shell sites		
n	210	210
mean	12.5	284.6
st. dev.	13.5	589.6
minimum	0.0	0.0
maximum	75.0	4402.8
Coastal shell sites		
n	446	446
mean	7.3	1357.5
st. dev.	7.6	1912.1
minimum	0.0	0.0
maximum	50.0	14,613.7
All shell sites		
n	667	667
mean	9.8	1021.1
st. dev.	13.2	1681.1
minimum	0.0	0.0
maximum	160.5	14,613.7

The actual number miscoded as such cannot be determined at present, but it clearly is more than a handful.

Given the actual 22 percent overlap between "midden" and shell-bearing sites, as well as the presumed additional overlap with miscoded sites, it is not surprising that the distribution of "midden" sites largely duplicates the distribution of shell-bearing sites. The only noticeable difference is an increased number of "midden" sites in the Central Highlands and Okeechobee areas. Average distance to water is very similar to shell-bearing sites, and average elevation for "middens" is only slightly higher due to increased Central Highland sites. The distribution of sites across soil classes is virtually identical.

One noteworthy aspect of the distribution of "midden" sites is the general lack of occurrences along the lower third of the St. Johns River. This pattern duplicates the distribution for shell-bearing sites, further substantiating that this pattern cannot be attributed to sample bias alone.

Mounds

Four-hundred-ninety-one sites in the study area are coded for containing (or having once contained) an earthen mound or mounds (Figure 7-10). This subset is virtually exclusive of shell-beating sites; only 13 sites coded for having mounds are also

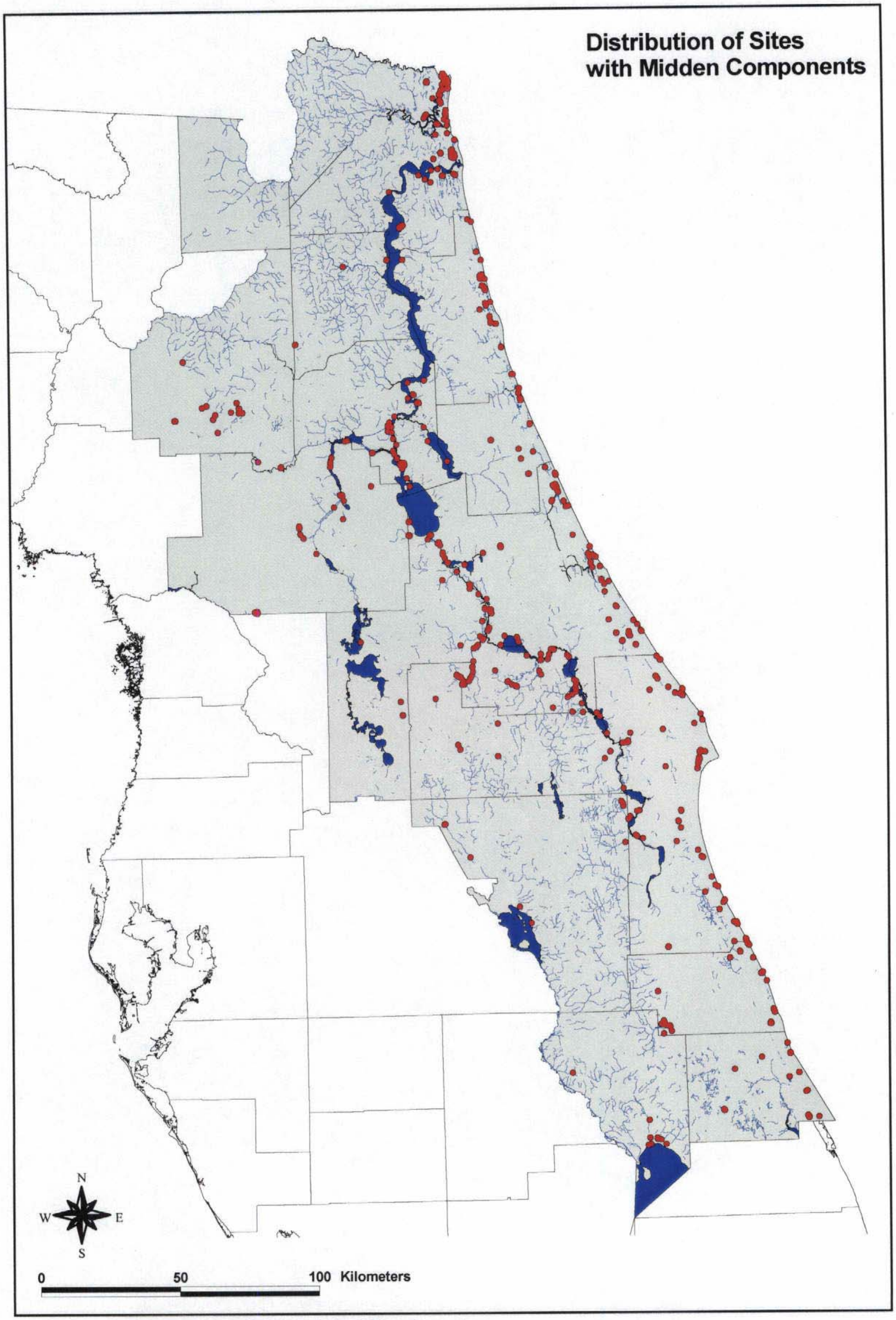

Figure 7-10. Distribution of sites with midden deposits.

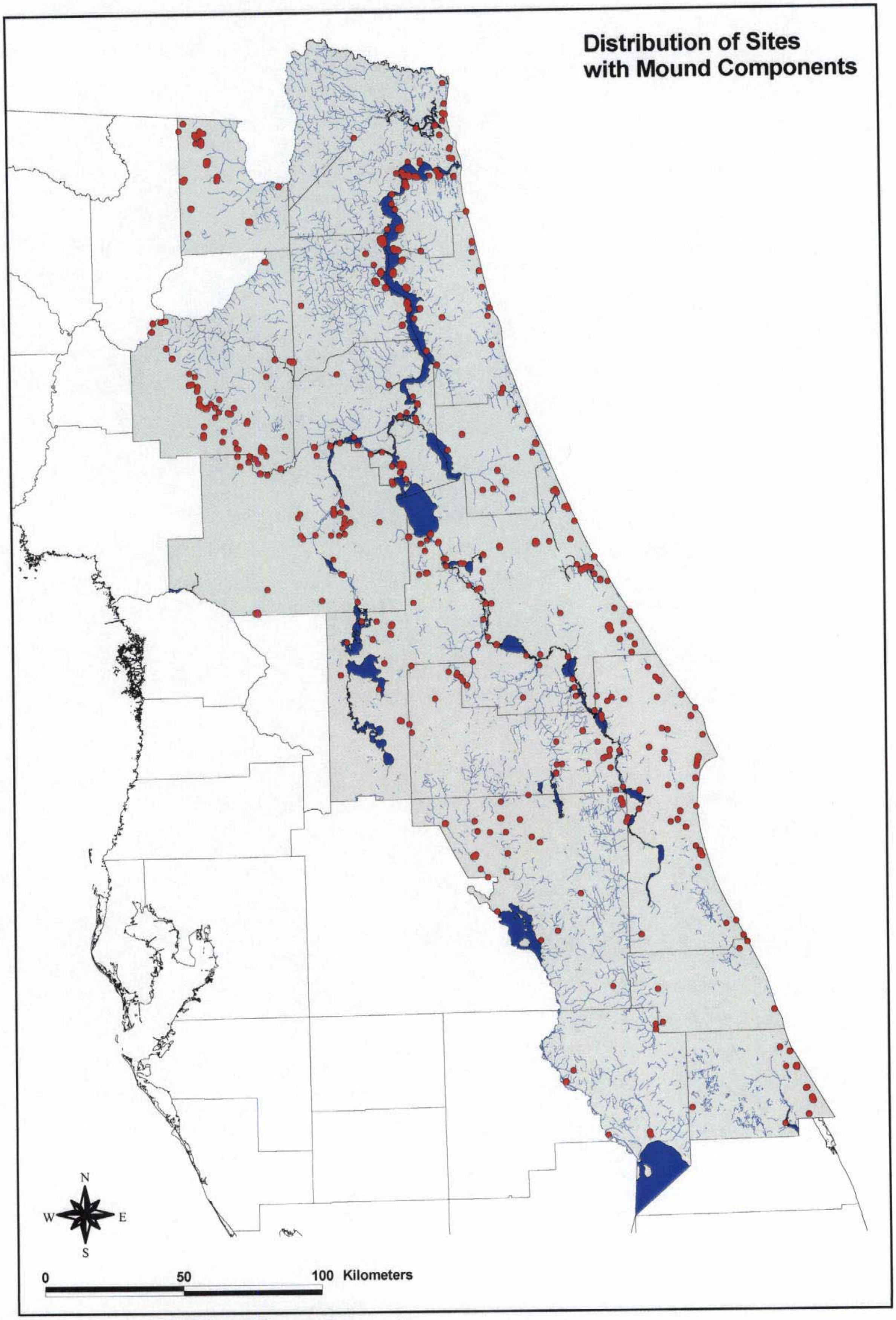

Figure 7-10. Distribution of sites with mounds.

coded for shell. Certainly some miscoding must be acknowledged, but generally these are mutually exclusive samples. A quick comparison of the distributions of shell-bearing and mound sites corroborates this: whereas shell-bearing sites are inherently riverine and coastal in distribution, the array of mounds encompasses much of the noncoastal and interriverine landscape of the study area. Clusters of mounds in Baker, Alachua, Marion, Lake, Orange, and Osceola counties deviate markedly from the shell-bearing site distribution. Moreover, the stretch of the lower St. Johns River virtually devoid of shell-midden deposits is rife with St. Johns period sand mounds, many the subjects of C. B. Moore's investigations.

Locations of mounds with respect to elevation and distance to water are not dramatically all that different from the distribution of sites in general (Table 7-11). On average, mound sites are lower in elevation and closer to water compared to the entire population of sites, but not for sites with at least three components. Soils values are even less distinctive. As a minority subset of the entire site inventory, mound sites duplicate the bias for relatively well-drained soils with good nonirrigated agriculture capabilities. Sixty-nine percent of mound sites lie on soils with drainage no worse than "somewhat poorly drained," and 70.9 percent of these sites have nonirrigated agriculture values of 4 or less. Actually, soils data for mound sites are not terribly revealing of the local conditions at individual sites. Many of the polygons for mound sites encompass only the mound proper; thus, the soils codes refer strictly to anthropogenic conditions.

Table 7-11. Summary Statistics on Elevation (ft) and Distance to Water (m) for Sites with Earthen Mounds in the Study Area.

	Elevation (ft)	Distance to Water (m)
n	491	491
mean	39.7	1376.3
st. dev.	41.6	1939.5
minimum	0.0	0.0
maximum	210.0	10.564.4

DIACHRONIC TRENDS IN LOCATION

Site component data described in Chapter 6 enable a first-order analysis of diachronic trends in site location in the study area. Tables 7-12 through 7-15 provide summary statistics for locational variables by temporal components. In the sections that follow we examine broad trends in site location by culture period. As in Chapter 3, we divide the culture periods into two groups: those of the St. Johns Basin proper and those of peripheral areas.

Paleoindian

The 17 known Paleoindian sites in the study area concentrated in two areas: the western margin of the study area, in the Central Highlands, and in southern portion of the

Table 7-12. Summary Statistics on Elevation (ft amsl) of Sites by Component.

	n	mean	st. dev.	minimum	maximum
Paleoindian	17	57.3	54.6	0.4	163.4
Early Archaic	44	75.1	53.3	7.3	190.0
Middle Archaic	76	54.2	48.0	0.0	186.9
Late Archaic	96	42.4	40.2	0.0	159.8
Mt. Taylor	38	11.9	17.2	0.0	80.0
Orange	318	17.9	22.5	0.0	122.9
Transitional	62	34.7	34.5	0.0	186.0
St. Johns I	962	30.2	34.8	0.0	195.0
St. Johns II	567	24.9	30.6	0.0	166.8
Deptford	226	48.5	50.3	0.0	185.0
Swift Creek	55	25.9	32.0	0.0	155.0
Weeden Island	79	74.6	51.7	0.0	185.3
Cades Pond	38	93.6	33.6	60.0	190.0
Alachua	160	96.7	48.6	0.0	182.8
Hickory Pond	71	99.3	51.4	3.7	185.0
Glades	36	14.6	17.7	0.0	56.9
Belle Glade	28	32.9	20.2	0.1	80.0
Malabar	126	11.9	13.3	0.0	95.6
Mississippian	7	43.4	38.3	10.0	97.8
Preh. w/o pottery	602	87.1	44.0	0.0	245.0
Preh. w/ pottery	284	67.0	50.7	0.0	195.0
Unspecified Preh.	907	55.7	48.5	0.0	210.0
Other Preh.	155	38.2	42.8	0.0	178.8
Historic	463	50.7	54.0	0.0	245.0
Total sites	3608	54.2	49.0	0.0	245.0

Table 7-13. Summary Statistics on Distance of Water (m) from Site by Component.

	n	mean	st. dev.	minimum	maximum
Paleoindian	17	1188.3	1812.0	0.0	6342.2
Early Archaic	44	4143.8	6248.0	0.0	19,970.9
Middle Archaic	76	1342.1	1653.0	0.0	8700.2
Late Archaic	96	1126.6	1801.7	0.0	10,017.9
Mt. Taylor	38	712.1	1763.8	0.0	8835.7
Orange	318	797.5	1607.5	0.0	9586.9
Transitional	62	1110.7	1652.0	0.0	6772.4
St. Johns I	962	1357.5	1978.5	0.0	14,235.5
St. Johns II	567	1104.0	1839.4	0.0	11,324.3
Deptford	226	1112.7	1806.9	0.0	14,633.27
Swift Creek	55	545.3	864.7	0.0	4448.1
Weeden Island	79	1641.7	2895.7	0.0	18,073.0
Cades Pond	38	2877.9	4404.0	0.0	17,470.3
Alachua	160	1871.1	2173.0	0.0	17,680.2
Hickory Pond	71	1752.1	1724.7	0.0	8652.1
Glades	36	2194.6	2273.1	56.9	9012.1
Belle Glade	28	678.8	1572.1	0.0	8450.3
Malabar	126	2644.6	3335.9	0.0	14,613.7
Mississippian	7	2170.5	3058.8	0.0	8228.5
Preh. w/o pottery	602	2550.5	3235.2	0.0	18,649.4
Preh. w/ pottery	284	1778.2	2382.3	0.0	16,159.3
Unspecified Preh.	907	1880.4	2675.9	0.0	18,603.2
Other Preh.	155	2411.2	4300.5	0.0	19,633.4
Historic	463	2021.4	3030.1	0.0	16,501.1
Total sites	3608	1843.6	2722.4	0.0	19,970.9

Table 7-14. Relative Frequencies of Area of Soil Mapping Units by Drainage Class and Component.

	E	SE	W	MW	SP	P	VP	Water	Urban
Paleoindian	34.8	0.0	4.9	23.0	13.7	10.1	6.4	1.3	5.7
Early Archaic	33.4	0.0	8.3	19.0	21.8	10.1	6.9	0.3	0.2
Middle Archaic	4.9	0.0	6.5	27.0	18.3	27.3	11.5	1.0	3.6
Late Archaic	12.2	0.0	4.2	13.1	38.9	12.4	17.0	0.1	2.0
Mt. Taylor	15.6	0.0	0.8	9.8	22.3	24.0	27.6	0.0	0.0
Orange	10.4	0.0	3.4	15.8	33.1	19.5	16.6	0.6	0.7
Transitional	7.4	0.0	0.9	18.6	16.2	47.0	8.5	1.5	0.0
St. Johns I	16.7	0.0	6.4	16.2	25.2	18.0	15.6	0.5	1.3
St. Johns II	15.2	0.0	4.7	11.7	33.0	16.2	17.2	0.4	1.5
Deptford	13.4	0.0	6.9	20.4	14.6	33.0	7.2	2.5	2.1
Swift Creek	35.7	0.0	0.0	15.8	12.0	28.7	7.7	0.0	0.0
Weeden Island	26.3	8.0	10.5	22.3	9.9	11.8	8.4	0.7	2.1
Cades Pond	3.6	0.0	10.0	31.8	7.6	34.4	8.1	1.8	2.7
Alachua	6.1	0.0	8.6	27.4	17.4	30.0	6.3	3.1	1.3
Hickory Pond	2.0	0.0	15.5	29.6	14.9	31.7	2.4	2.2	1.6
Glades	5.7	0.0	27.5	3.6	20.3	8.2	31.9	2.7	0.0
Belle Glade	0.0	0.0	16.9	3.6	12.1	17.5	46.2	3.6	0.0
Malabar	6.3	0.0	12.9	5.9	32.8	17.9	19.4	1.3	3.5
Mississippian	27.4	0.0	2.2	19.3	0.0	31.9	19.3	0.0	0.0
Lithic w/o pottery	12.3	0.0	6.7	5.4	38.6	28.2	8.5	0.1	0.1
With Pottery	19.6	0.2	22.0	15.6	15.3	17.4	8.1	0.9	0.9
Unspecified	10.7	0.0	8.1	14.0	34.1	16.2	14.6	0.2	2.1
Other	21.9	0.0	7.2	17.8	13.9	25.3	12.2	0.0	1.7
Historic	11.6	0.0	12.9	10.0	37.3	13.4	13.3	0.6	0.9

Table 7-15. Relative Frequencies of Area of Soil Mapping Units by Nonirrigated Agriculture Capability and Component.

	1	2	3	4	5	6	7	8
Paleoindian	0.0	4.2	41.6	42.5	2.6	4.1	5.0	0.0
Early Archaic	0.0	9.6	28.4	30.8	0.0	22.5	8.6	0.0
Middle Archaic	0.0	0.3	53.0	25.2	0.6	9.8	11.0	0.0
Late Archaic	0.0	0.2	44.3	25.0	0.3	15.9	13.3	1.1
Mt. Taylor	0.0	0.4	25.7	24.6	0.0	29.3	18.9	1.1
Orange	0.0	0.2	39.4	24.9	0.6	18.3	12.7	4.0
Transitional	0.0	0.1	44.4	26.3	0.0	22.7	6.3	0.1
St. Johns I	0.0	0.1	34.5	22.3	0.6	26.9	8.8	6.7
St. Johns II	0.0	0.7	27.1	23.5	0.8	27.8	11.3	8.8
Deptford	0.0	4.9	54.1	19.9	1.6	10.7	4.0	4.8
Swift Creek	0.0	0.0	35.6	37.7	1.0	9.7	8.3	7.6
Weeden Island	0.0	2.8	49.1	36.5	1.7	6.3	3.4	0.2
Cades Pond	0.0	1.5	69.6	17.8	0.0	4.0	7.0	0.0
Alachua	0.0	1.3	67.7	20.6	0.5	6.0	2.2	1.7
Hickory Pond	0.0	5.0	87.1	5.6	0.0	1.3	1.0	0.0
Glades	0.0	0.0	4.3	20.2	0.0	31.5	14.2	29.7
Belle Glade	0.0	0.0	27.5	16.7	6.3	6.8	42.7	0.0
Malabar	0.0	0.0	9.9	17.4	0.3	37.5	10.3	24.6
Mississippian	0.0	0.0	21.9	54.0	1.5	5.8	16.8	0.0
Lithic w/o pottery	0.0	3.1	64.8	17.4	1.4	7.3	4.8	1.1
With Pottery	0.0	6.6	44.2	31.1	1.0	8.3	8.3	0.4
Unspecified	0.0	1.2	41.3	25.9	6.2	12.6	5.9	6.9
Other	0.0	4.8	40.2	19.3	0.9	22.0	10.7	2.0
Historic	0.0	2.3	37.1	24.1	5.0	16.3	6.9	8.3

middle St. Johns Basin (Figure 7-11). As we discussed in Chapter 3, Paleoindian sites statewide show a strong bias toward the karst terrain of west-central and northwest Florida, a crescent-shaped swath of land extending from Tampa Bay to the eastern Panhandle. This region houses both abundant water supplies and cryptocrystalline rock, two essential elements for long-term Paleoindian land use.

The exception to this overall pattern is the area of first-magnitude springs in the middle St. Johns region. The six sites along the middle St. Johns fit this localized pattern. Another small cluster west of the Oklawaha River is centered on Silver Spring, another first-magnitude spring. None of these are more than isolated finds, although efforts to locate buried Paleoindian components have yet to be mounted. A third potential area for Paleoindian sites in the St. Johns Basin is the Crescent City Ridge, an upland landform with karst features. No Paleoindian components are recorded for this area to date.

With a predominance of locations in the Central Highlands, it stands to reason that Paleoindian sites have high average elevation. Average distance to water, however, is relatively low owing to the fact that no location is more than 6.3 km from a source. Associated soils are among the better drained in the region; more than a third of the area encompassed by these sites are classified as "excessively drained." Only Swift Creek period sites have a higher percentage of this class. Despite the tendency for excessive drainage, values for nonirrigated agriculture capacity are relatively good.

Early Archaic

Forty-four sites with Early Archaic components show the same bias as Paleoindian sites for the Central Highlands, although locations widely scattered throughout the rest of the study area account for a sizable minority of the sample (Figure 7-12). The first-magnitude springs that apparently attracted Paleoindians to the middle St. Johns are no longer a major factor. Instead we find the first occurrences of sites in the headwater region and lower reaches of the basin, as well as increased use of the coastal strand.

Average elevation increases over the earlier period, owing in large part to the cluster of Central Highland sites in Marion County. This cluster likewise accounts for the sharp increase in mean distance to water. Soil drainage patterns match the Paleoindian sample, but much less area occupied by Early Archaic sites consists of soils with good capacity for nonirrigated agriculture.

Middle Archaic

The 76 Middle components on record are distributed widely across the entire study area (Figure 7-13). The only sizable clusters of sites is in the Central Highlands of Alachua County and in the middle St. Johns Basin. Comparatively few sites are located in the uplands of Marion County, a noticeable contrast with the preceding Early Archaic distribution.

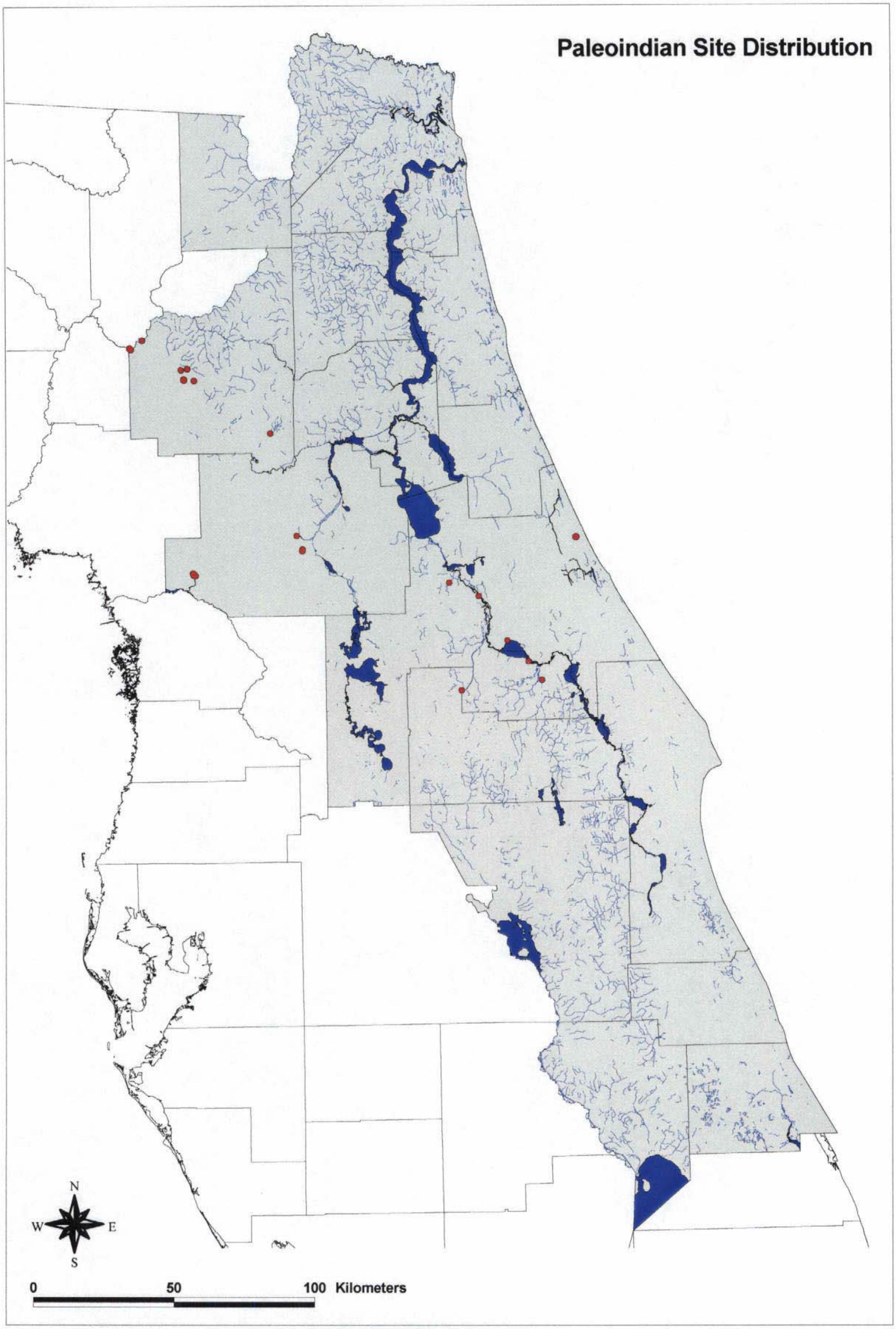

Figure 7-11. Distribution of sites with Paleoindian components.

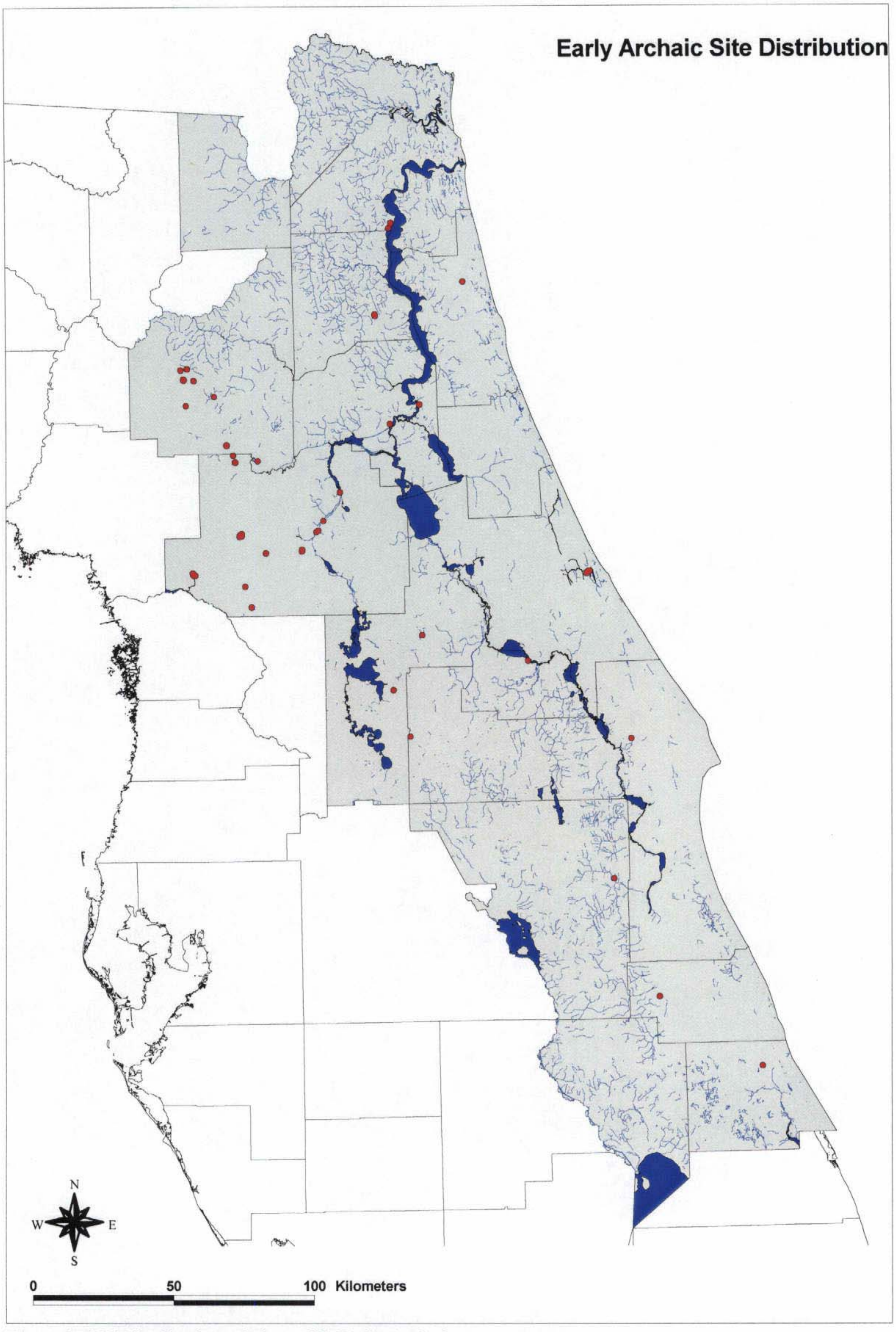

Figure 7-11. Distribution of sites with Early Archaic components.

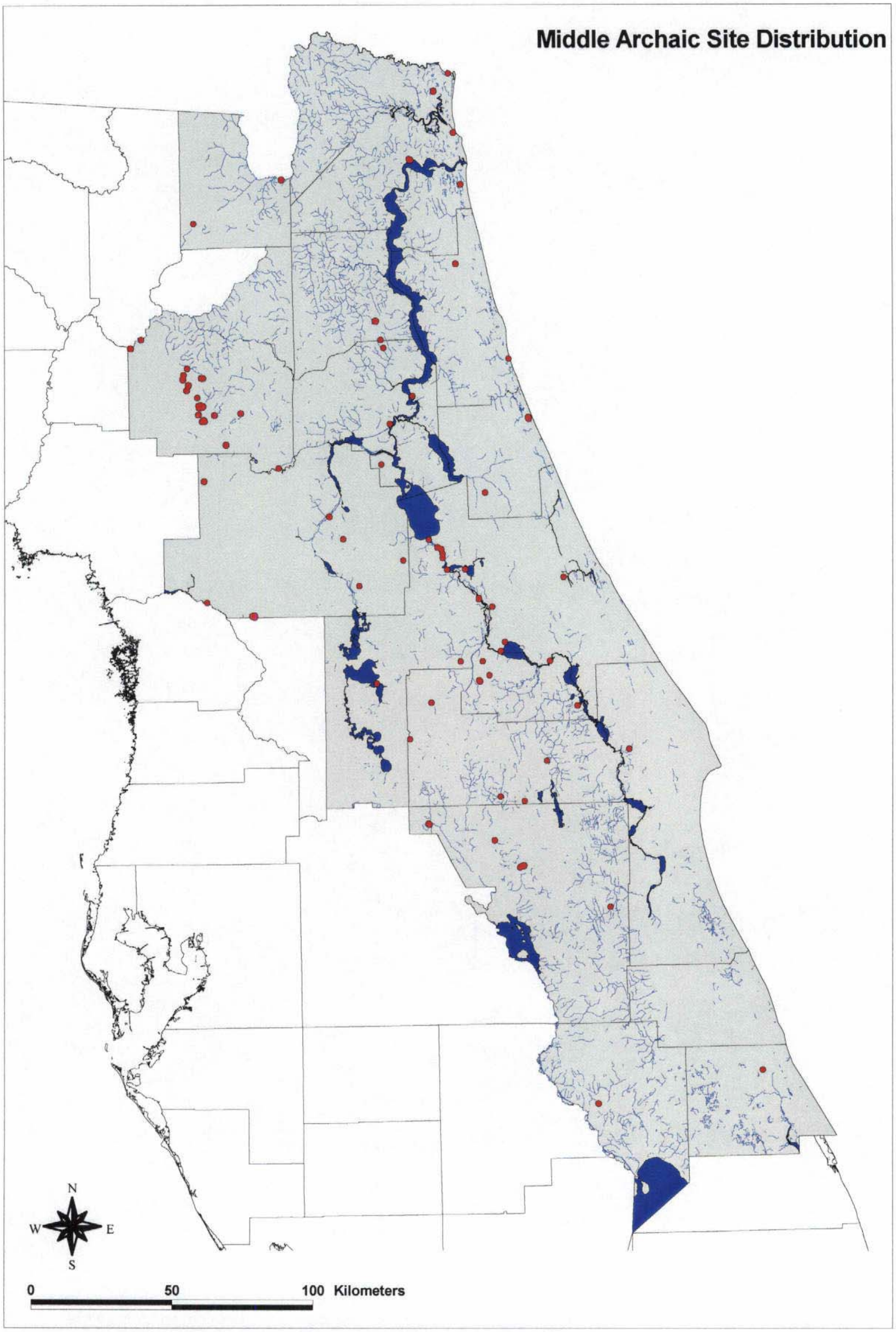

Figure 7-11. Distribution of sites with Middle Archaic components.

With the relative decrease of sites in the Central Highlands, average elevation for Middle Archaic sites is down compared to the Early Archaic. Average distance to water reflects a dramatic drop, and there is a significant shift from locations of excessively to well drained soils to locations of moderate to poorly drained soils. A corresponding increase in the nonirrigated agriculture capability is evident. In Chapter 6 we presented calculations for incidence of site reoccupation that showed only 10 percent of the Middle Archaic components co-occurred with Early Archaic components. The differences in environmental variables show that Middle Archaic sites were not only established in new locations, but in new *kinds* of locations.

Late Archaic

Late Archaic components at 96 locations generally mimic the Middle Archaic distribution, although the former tend to be located more directly along the main stem and tributaries of the St. Johns River, particularly in the upper half of the drainage (Figure 7-12). We remind the reader that components coded as Late Archaic do not include either Mount Taylor or Orange components.

The tendency for increased riverine orientation of Late Archaic locations is evident in the lower average values for elevation and distance to water compared to the preceding period. Distributions across soils suggest that Late Archaic locations are situated across the full range of drainage and fertility values. They are hardly randomly distributed, however. The area encompassed by Late Archaic sites includes more than twice the proportion of somewhat poorly drained soils that random locations. In fact, the Late Archaic sample comprises the highest relative percentage (38.9%) of this drainage class for all culture periods. They likewise reflect a corresponding higher percentage of soils with good nonirrigated agriculture capability compared to random locations.

Mount Taylor

Thirty-eight Mount Taylor components reflect a decided tendency for locations along the middle St. Johns Basin (Figure 7-13). To some extent this distribution is a taxonomic bias. Mount Taylor components in the middle St. Johns are often defined by their stratigraphic position below Orange strata at shell-bearing sites, rather than diagnostic artifacts such as Newnan points.

Bias toward the middle St. Johns yields extremely low mean values for elevation and distance to water for Mount Taylor sites. A correspondingly high percents of soils with somewhat to very poorly drained conditions prevails. Capacity for nonirrigated agriculture is split between good and poor values.

Orange

With 318 components, Orange period sites represent the first large subsample in the study area. As shown in Figure 7-14, Orange sites are distributed along the entire length of the St. Johns River, with a major clusters at its mouth. Orange sites are likewise

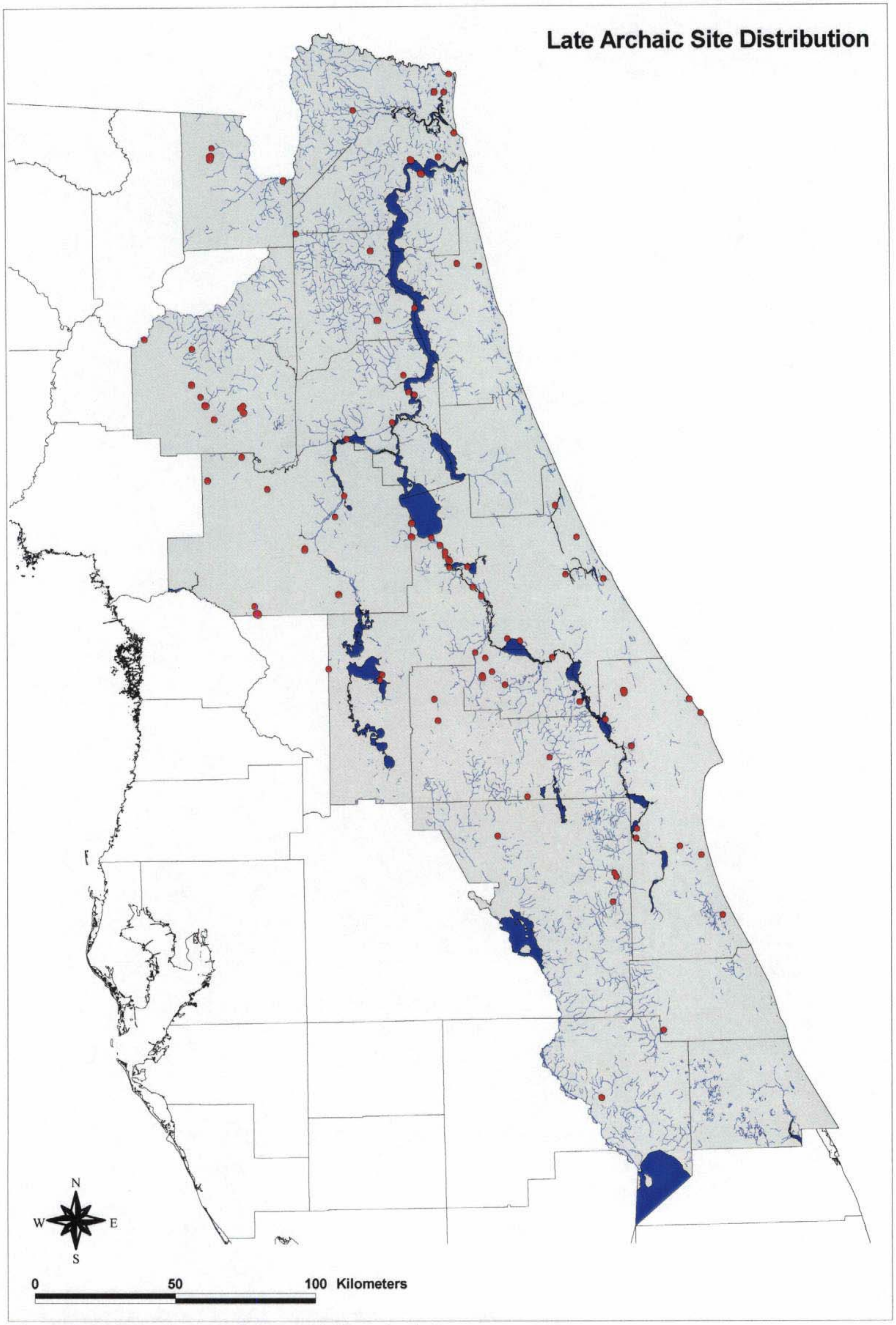

Figure 7-12. Distribution of sites with Late Archaic components.

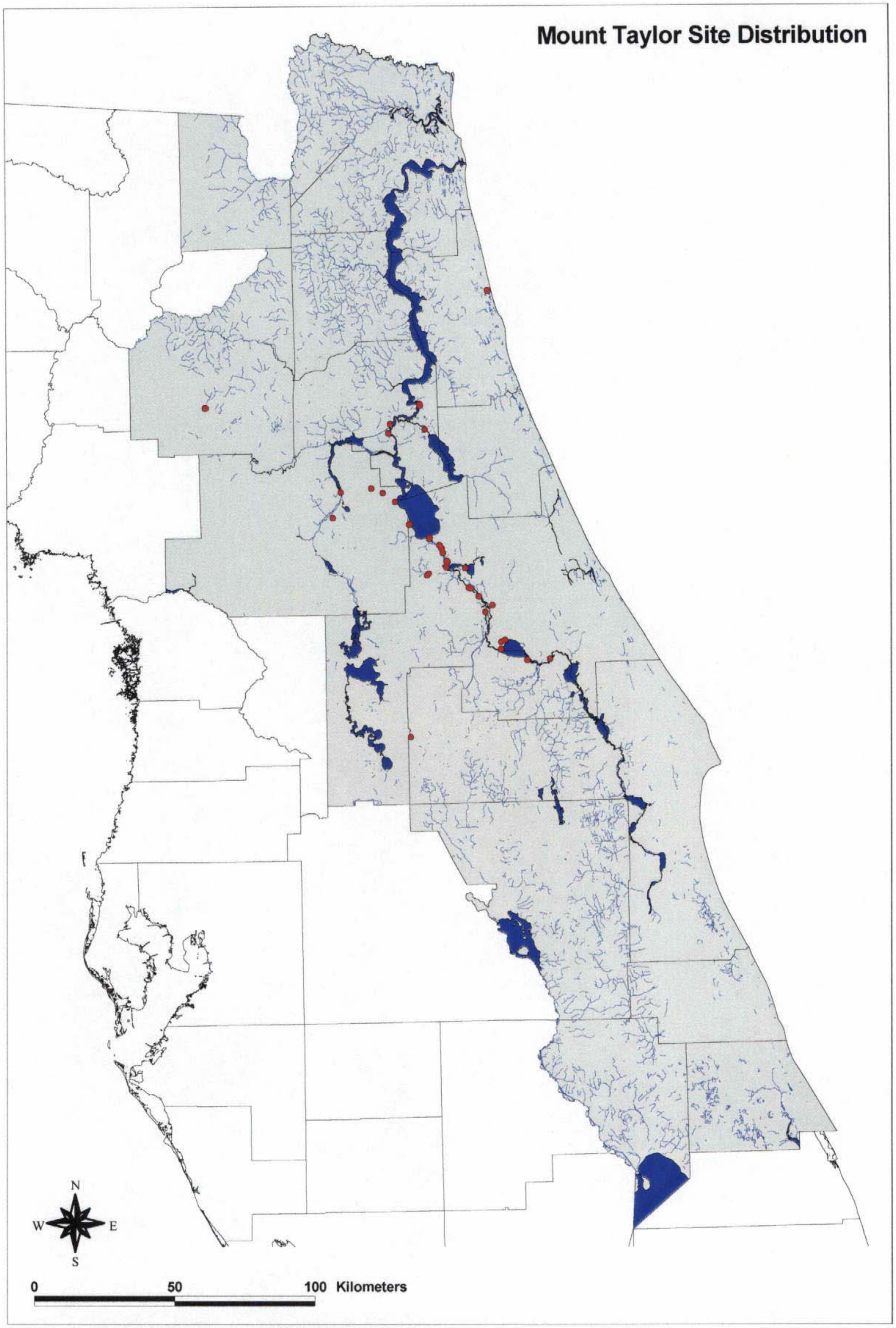

Figure 7-13. Distribution of sites with Mount Taylor components.

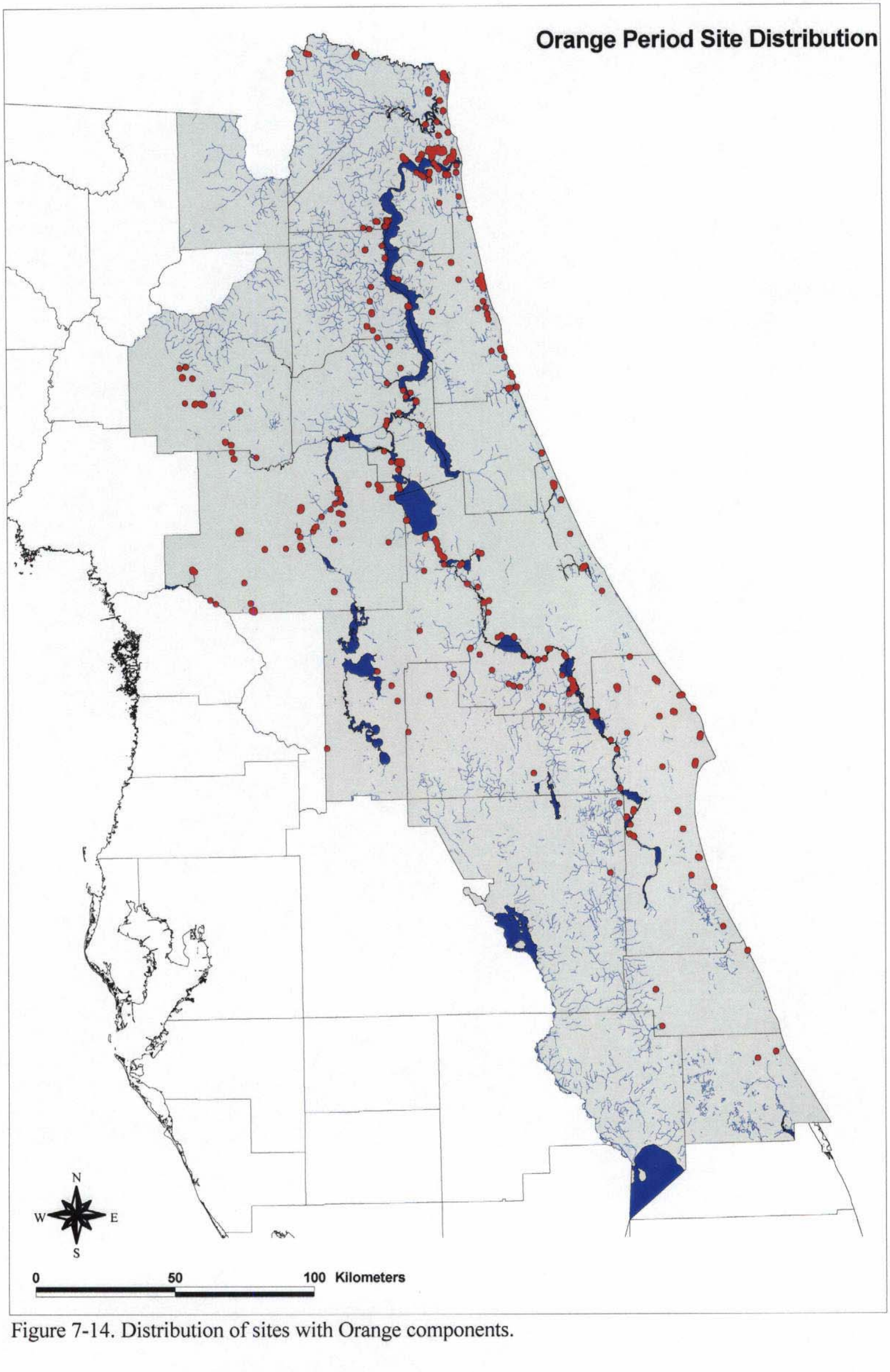

Figure 7-14. Distribution of sites with Orange components.

widespread along the coast, although at lower density than the riverine sites. Central Highlands sites are also well represented in both Alachua and Marion counties.

One especially noteworthy aspect of the Orange distribution is the cluster of sites in the lower third of the river, between Palatka and Jacksonville. This is the stretch of river virtually devoid of shell-bearing sites. The relationship of these nonshell sites to their freshwater and saltwater shell counterparts is unknown to us, but clearly the lack of shell middens in this area does not preclude the possibility of riverine habitation. The many Orange sites located back from the main channel of the river in this stretch of the drainage are a consequence of surveys in these areas and should not be construed as a regionwide pattern. Parenthetically, it is interesting to note the overall lack of Orange components recorded for the interriverine area between the Oklawaha and St. Johns rivers (i.e., the Ocala National Forest). Considering the large number of St. Johns I components recorded for this area (see below), the lack of Orange sites suggests that use of the interriverine zone was indeed very limited, at least as regards the deposition of pottery.

The increased diversity of locations of Orange components yields slightly higher mean values for elevation and distance to water over the previous period. Soils with somewhat poorly drained conditions and good nonirrigated agricultural capability comprise the majority of Orange-period sites.

Transitional

The poorly defined Transitional period is represented by 62 components dispersed sparsely across the entire study area (Figure 7-15). The only appreciable clusters exist at the mouth of the St. Johns, the middle Oklawaha drainage, and in northwest Seminole County, near the Wekiva River. Given the difficulty area researchers have expressed in defining Transitional-period components (e.g., Miller 1998:76), the distribution displayed in Figure 7-x may reflect nothing more than investigative bias.

With proportionally fewer sites along the main stem of the St. Johns, and along the coast, Transitional site locations have increased mean elevation and distance to water over those of the Orange period. And yet, Transitional sites comprise the highest percentage of poorly drained soils of all components in the study area. Capacity for nonirrigation agriculture is varied.

St. Johns I

The large dataset for sites with St. Johns I components has decidedly riverine and coastal orientation, but also considerable interrivine representation (Figure 7-16). The coastal distribution is especially impressive, with a nearly continuous array from southern Brevard County to the border with Georgia. As might be expected, sites density along the coast is greatest at inlets and lagoons, with comparatively limited site counts along strands of featureless beachfront. A dense cluster exists at the mouth of the St. Johns in Duval County, and within the estuarine environs of the Nassau River.

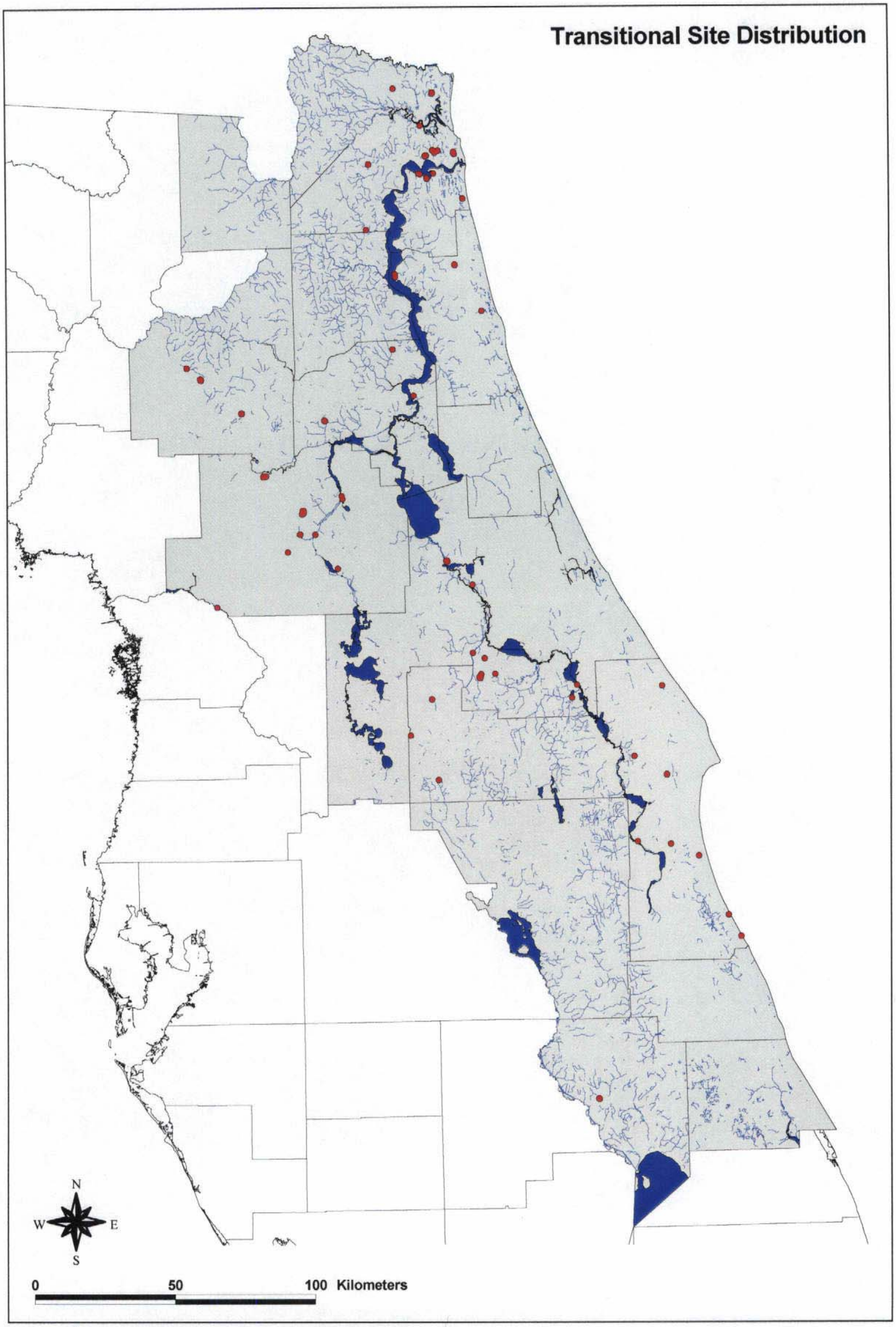

Figure 7-15. Distribution of sites with Transitional components.

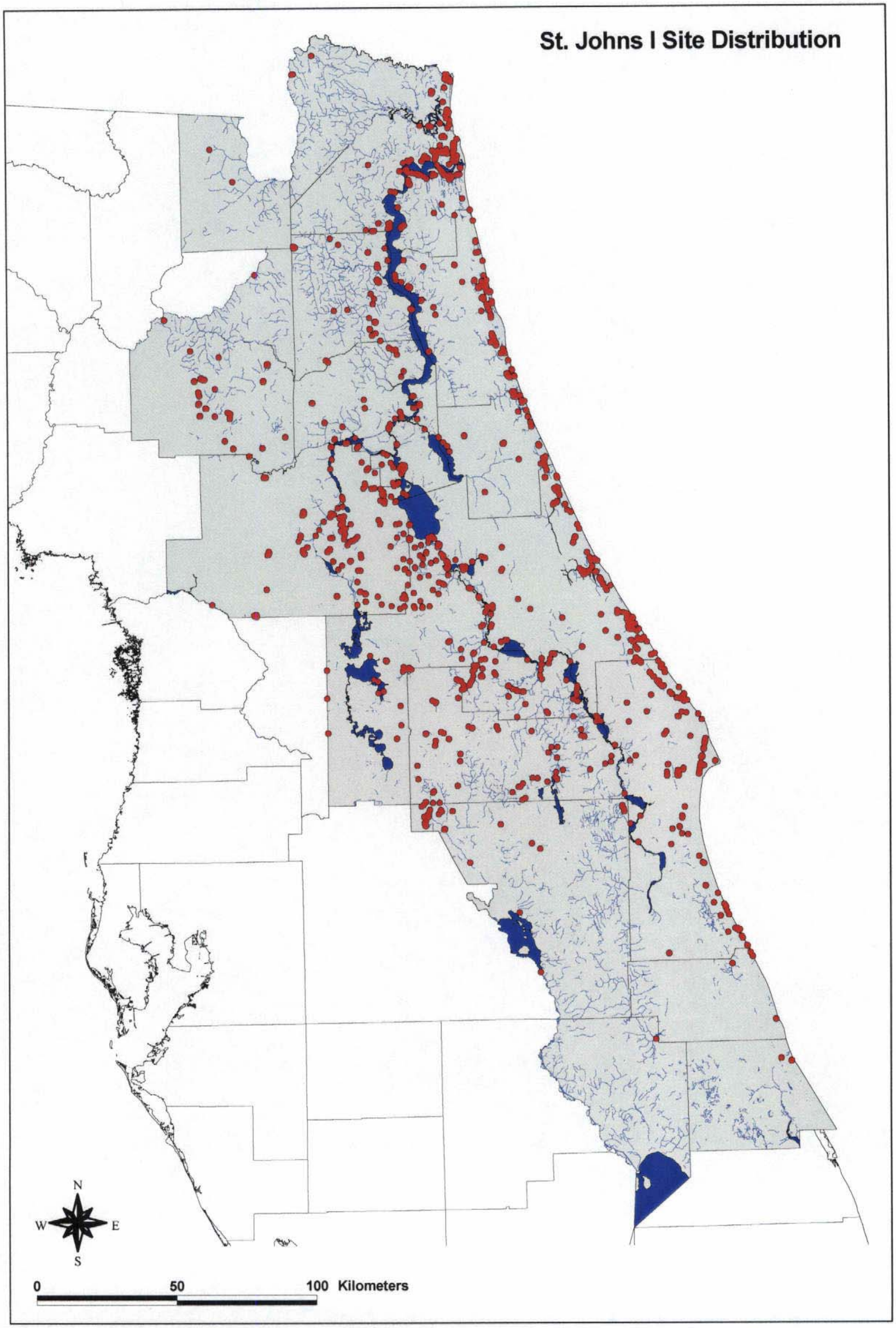

Figure 7-16. Distribution of sites with St. Johns I components.

Sites along the St. Johns are nearly as dense and continuous as those of the coast. The lower third of the river supports sufficient numbers of sites to suggest that conditions preventing shell-midden formation in this part of the river did nothing to preclude intensive use otherwise. As we noted earlier, many of the St. Johns (II?) sand mounds of the region are located along this stretch of the river.

A cluster of sites along the eastern margin of Crescent Lake is coupled with an intermittent array of sites through central Volusia County to suggest increased use of sand ridges along the relict channel(s) of the St. Johns River during the St. Johns I period. The small number of sites along this relict riverine habitat is perhaps more a symptom of limited survey coverage than it is actual land use patterning. Still, it hardly seems coincidental that this part of the landscape was apparently overlooked or underutilized until St. Johns times. Indeed, use of this part of the Coastal Lowlands may have been one consequence of the apparent increase in population implied by that so many St. Johns I sites.

Another noteworthy aspect of the St. Johns I site distribution is the large number of locations in the interriverine uplands between the Oklawaha and St. Johns rivers. This, of course, is the area occupied today by the Ocala National Forest. Although the extent of survey coverage or intensity in the forest has not been addressed in this study, the large number of St. Johns sites is testimony to the recent activity of Forest Service archaeologists. Because comparatively few sites of earlier age are known for the forest suggests that expansion into the interriverine uplands was among the responses to increased population after 2500 B.P. Alternatively, these upland locations might reflect limited or specialized use, perhaps strictly short-term extractive functions.

Mean elevation for 962 St. Johns I sites is 30.2 ft amsl and mean distance to water is 1357.5 m. Both values are substantially less than the values for all prehistoric sites, reflecting the coastal and riverine orientation of St. Johns sites in general. However, these values are considerably greater than those for the Orange and Transitional periods, indicative of the expanded use of interriverine areas. The areal distribution of sites across soils shows patterning that is not radically different than random points would allow. Slight tendencies for better-drained and higher fertility soils are apparent nonetheless.

St. Johns II

Aside from a reduction in the total number of components on record, the St. Johns II distribution is very similar to the St. Johns I distribution (Figure 7-17). No gaps in coverage observed, as sites are still largely coastal and riverine in orientation but with good representation in interriverine locales.

Average elevation and distance to water for St. Johns II sites are slightly lower than those of St. Johns I sites. Differences between the two in terms of soil drainage and nonirrigated agriculture capacity are negligible.

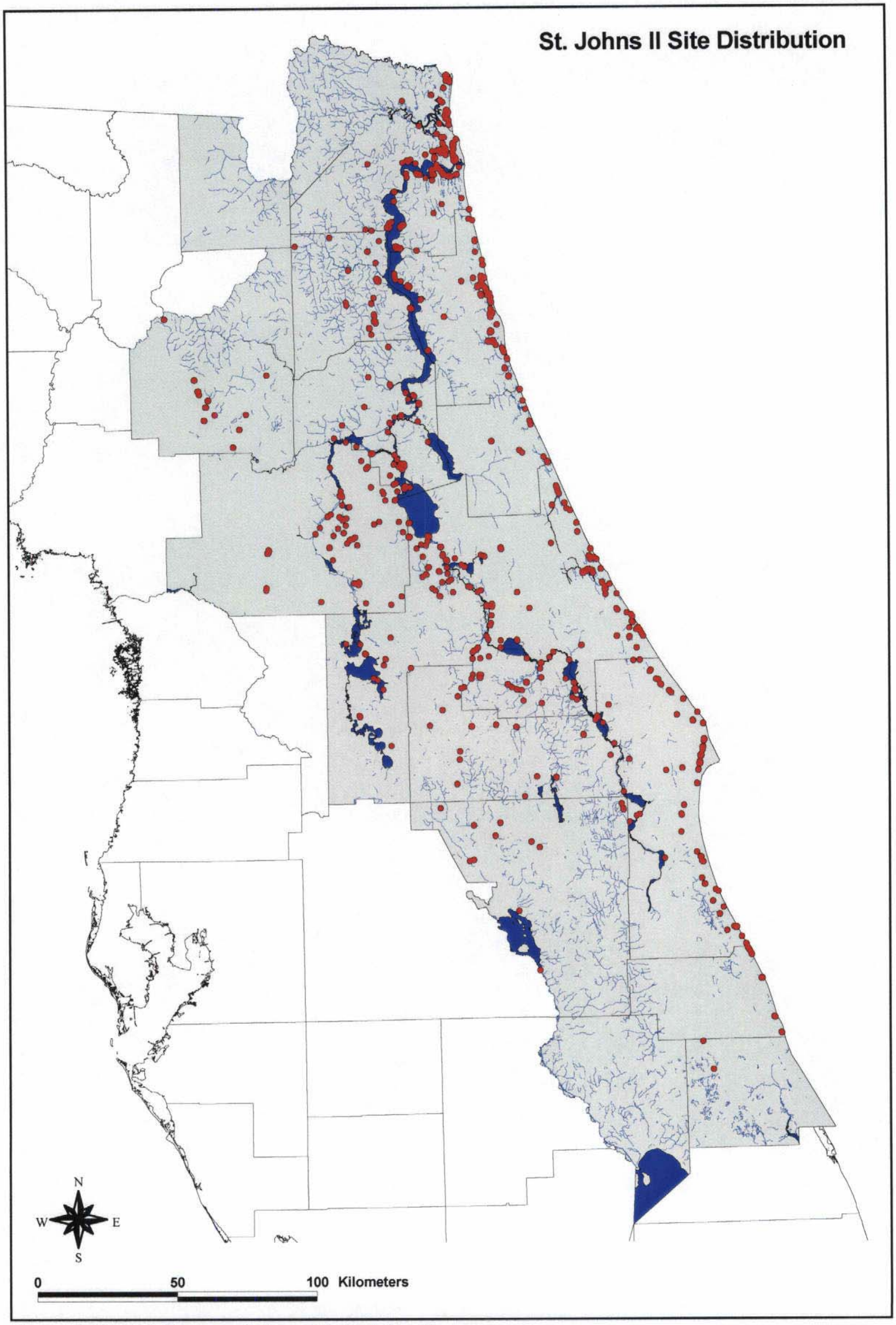

Figure 7-17. Distribution of sites with St. Johns II components.

Locational Trends in Peripheral Areas

Figures 7-18 through 7-29 displays the distributions of sites with components of cultural periods/traditions centered in locations outside the St. Johns Basin. Data on environmental location for these components are provided in Tables 7-12 through 7-15. Rather than recount the details provided by these maps and tables, we simple highlight a few interesting patterns in these data.

Components classified as Cades Pond, Hickory Pond, and Alachua are concentrated in the Central Highlands of Alachua County. Although investigative bias emanating from the University of Florida contributed to this clustered effect, the regional distribution of diagnostic artifacts of these traditions is indeed the north-central Highlands. Incidences of cordmarked pottery at the mouth of the St. Johns—shown in Figure 7-22 as Alachua—likely include some examples of other cordmarked traditions.

As expected, mean elevation for these Central Highlands sites is high, in fact, the highest of the regionwide sample. Except for Cades Pond, however, distance to water does not deviate from a sample of random points regionwide. More distinctive are the soils associations. All three distributions center on moderately well to poorly drained soils with good nonirrigated agriculture capacity. With 92.1 percent of its soils rated 3 or better, Hickory Pond sites are especially focused on the area's best farming soils.

Sites of the Deptford and Weeden Island traditions are split between Central Highland and north-coastal clusters. The Deptford distribution is much of tightly clustered than is the Weeden Island distribution. A couple of dozen Deptford sites are scattered along the Atlantic coast and across the north-central portion of the interior, but the vast majority are centered on Alachua County and the mouth of the St. Johns River. The chronological and cultural-historical relationships between these two major clusters are unknown. Swift Creek sites in the study area are almost exclusively clustered at the mouth of the St. Johns River. Although traditionally believed to be an import ware from Georgia, Swift Creek pottery at northeast Florida sites is probably locally manufactured (Ashley 1998).

Turning to the south, site distributions for the Malabar and Glades traditions are, as expected, centered on the Coastal Lowlands of the southern portion of the study area. The Okeechobee Region to the west supports sites of the Belle Glade culture. Even though Malabar and Glades site distributions diverge in many respects, both yield extremely low means for elevation and extremely high values for distance to (fresh) water. Glades locations comprise a greater fraction of well drained soils than do Malabar locations, but ratings for nonirrigated agriculture capability are generally poor for both groups. Belle Glade sites are statistically distinguished from their coastal counterparts in having greater mean elevation, much smaller mean distance to water, and very poorly drained soils. Nonirrigated agriculture capacity for Belle Glades soils is split between moderate to very poor values.

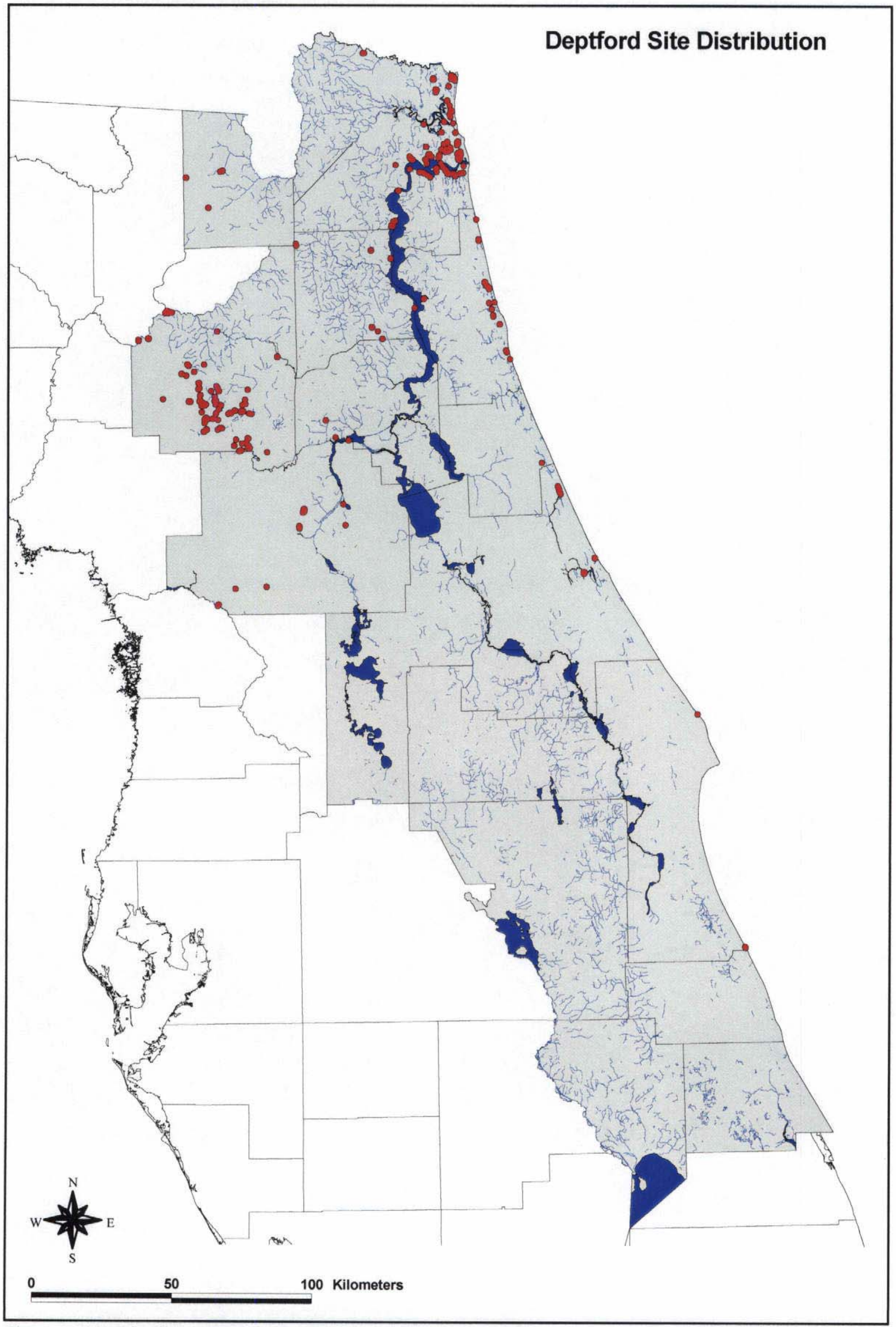

Figure 7-18. Distribution of sites with Deptford components.

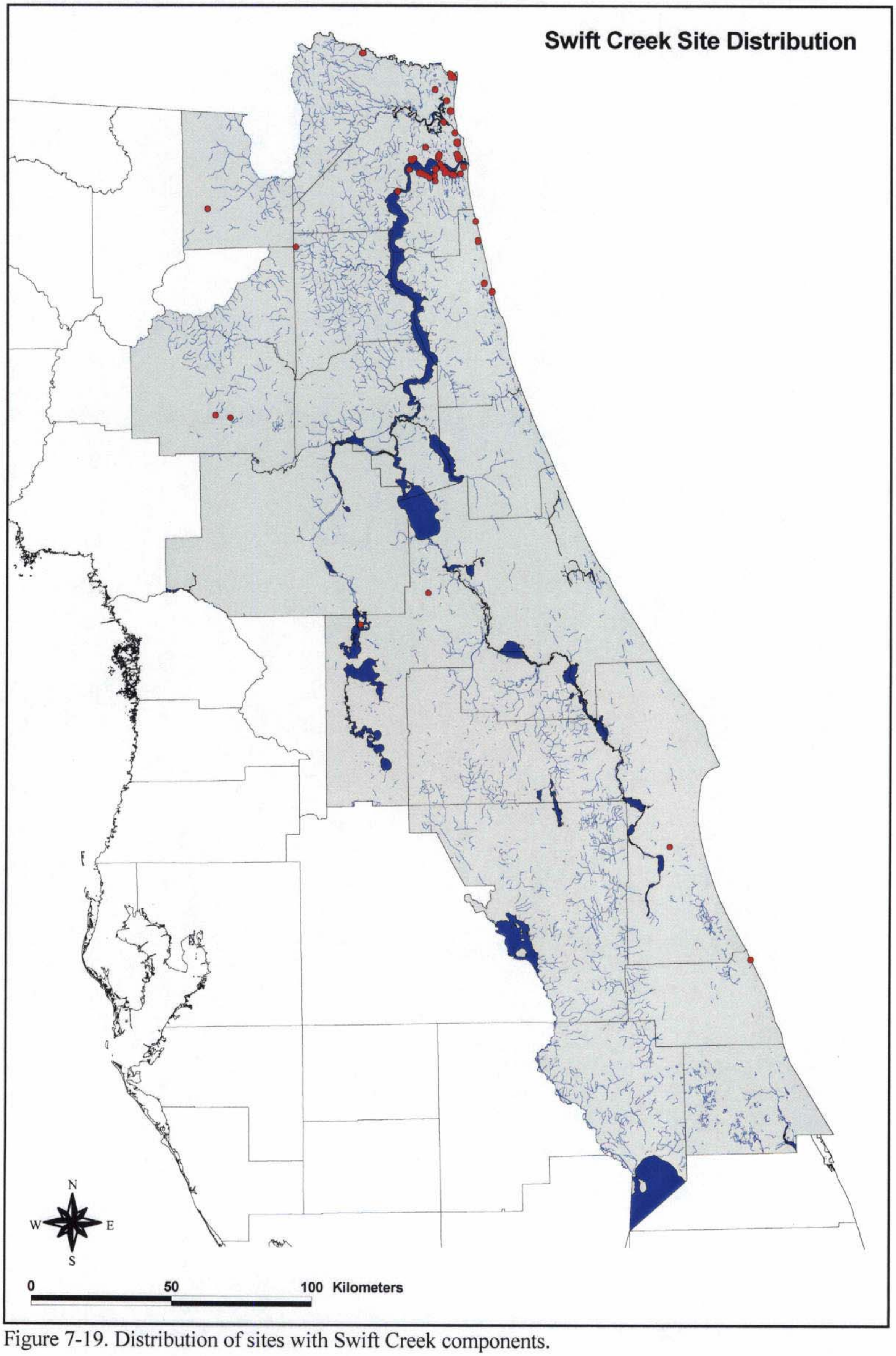

Figure 7-19. Distribution of sites with Swift Creek components.

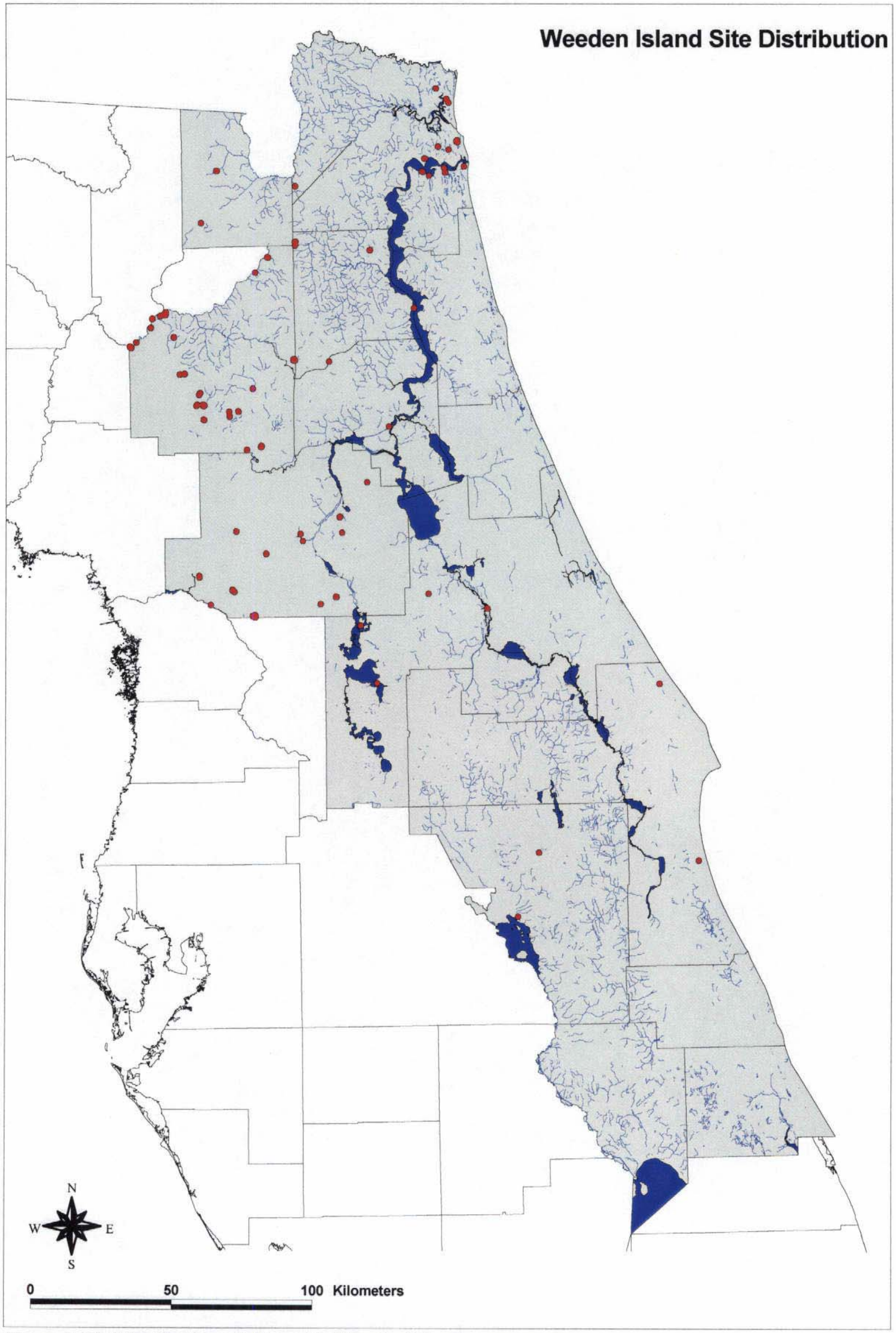

Figure 7-20. Distribution of sites with Weeden Island components.

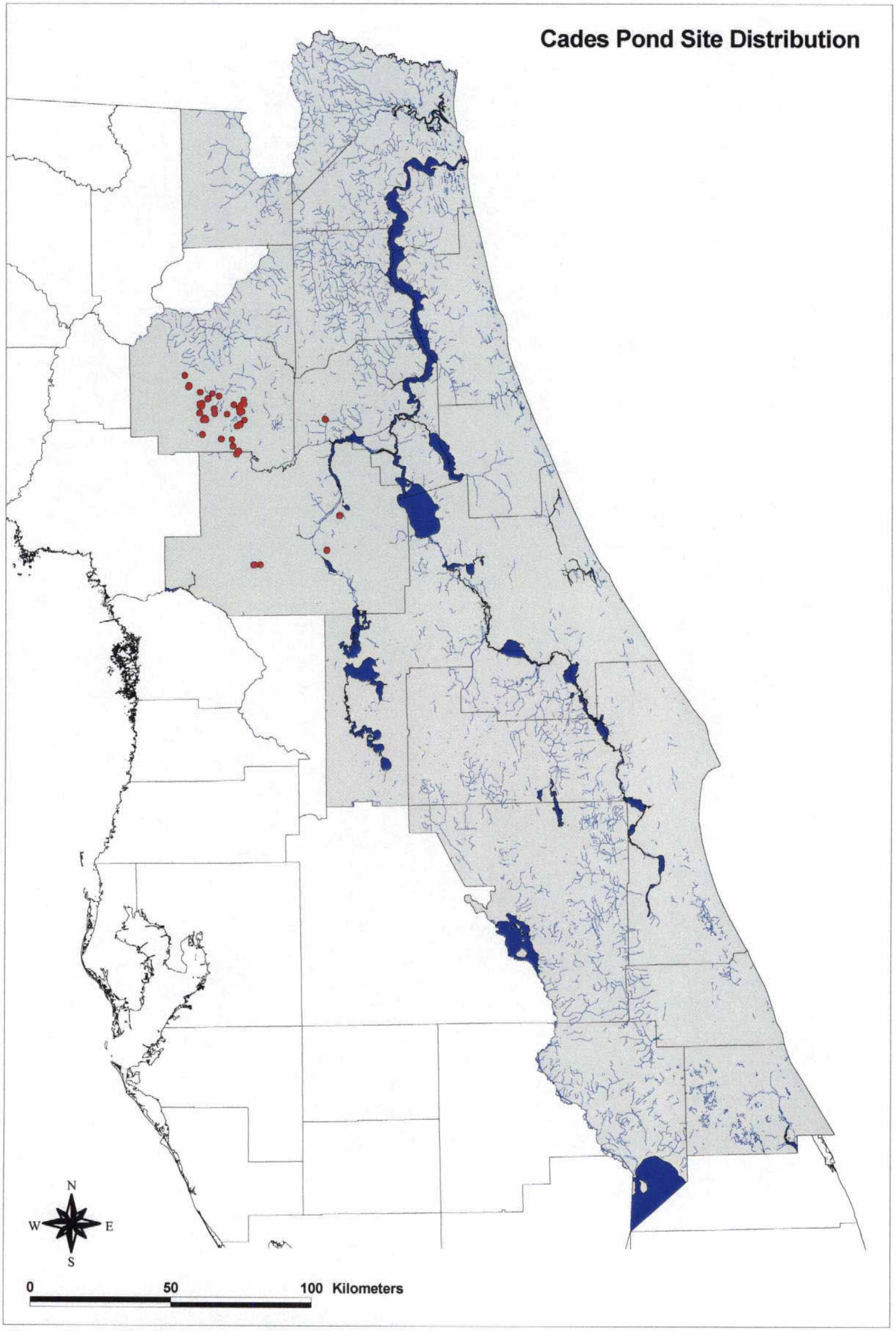

Figure 7-21. Distribution of sites with Cades Pond components.

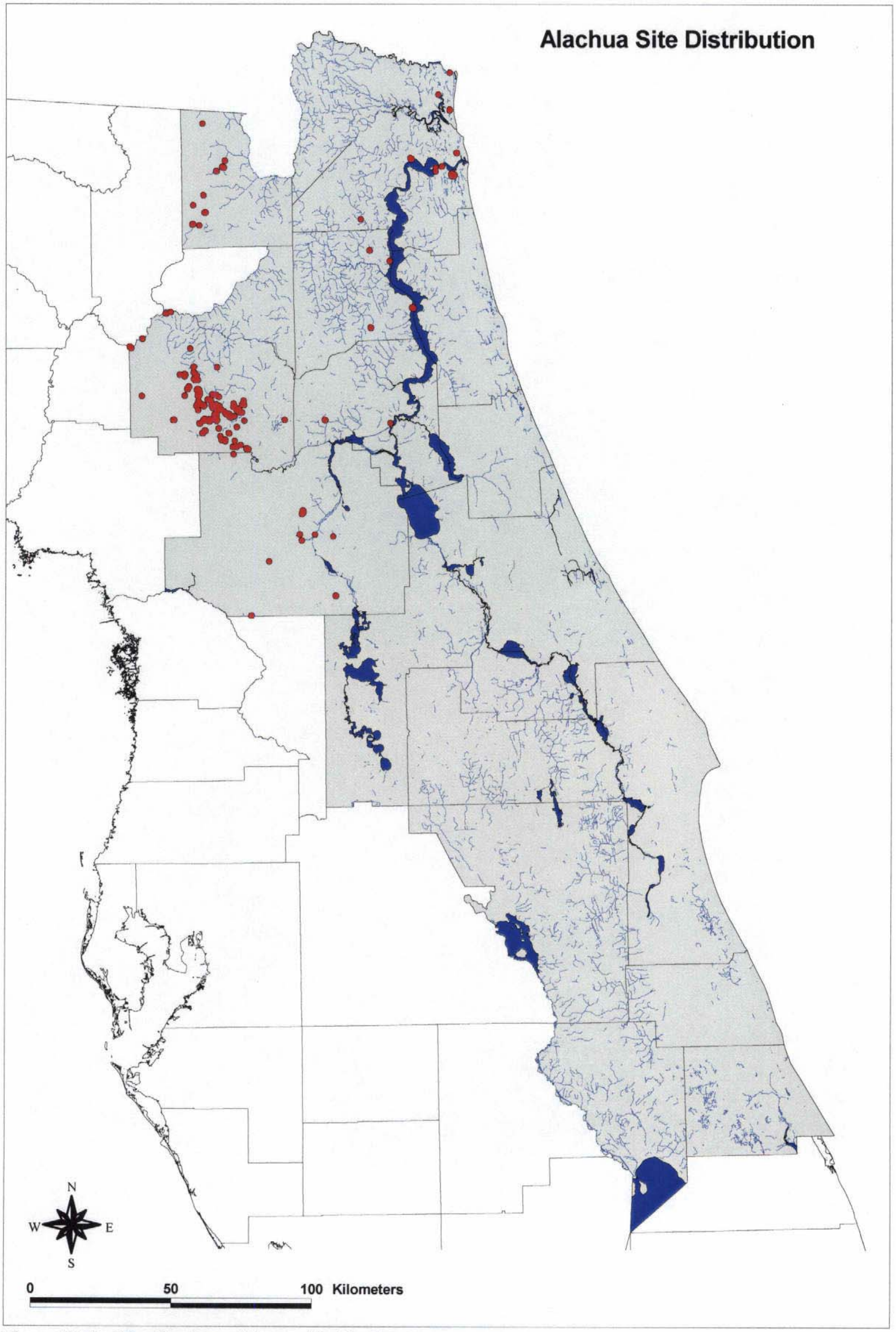

Figure 7-22. Distribution of sites with Alachua components.

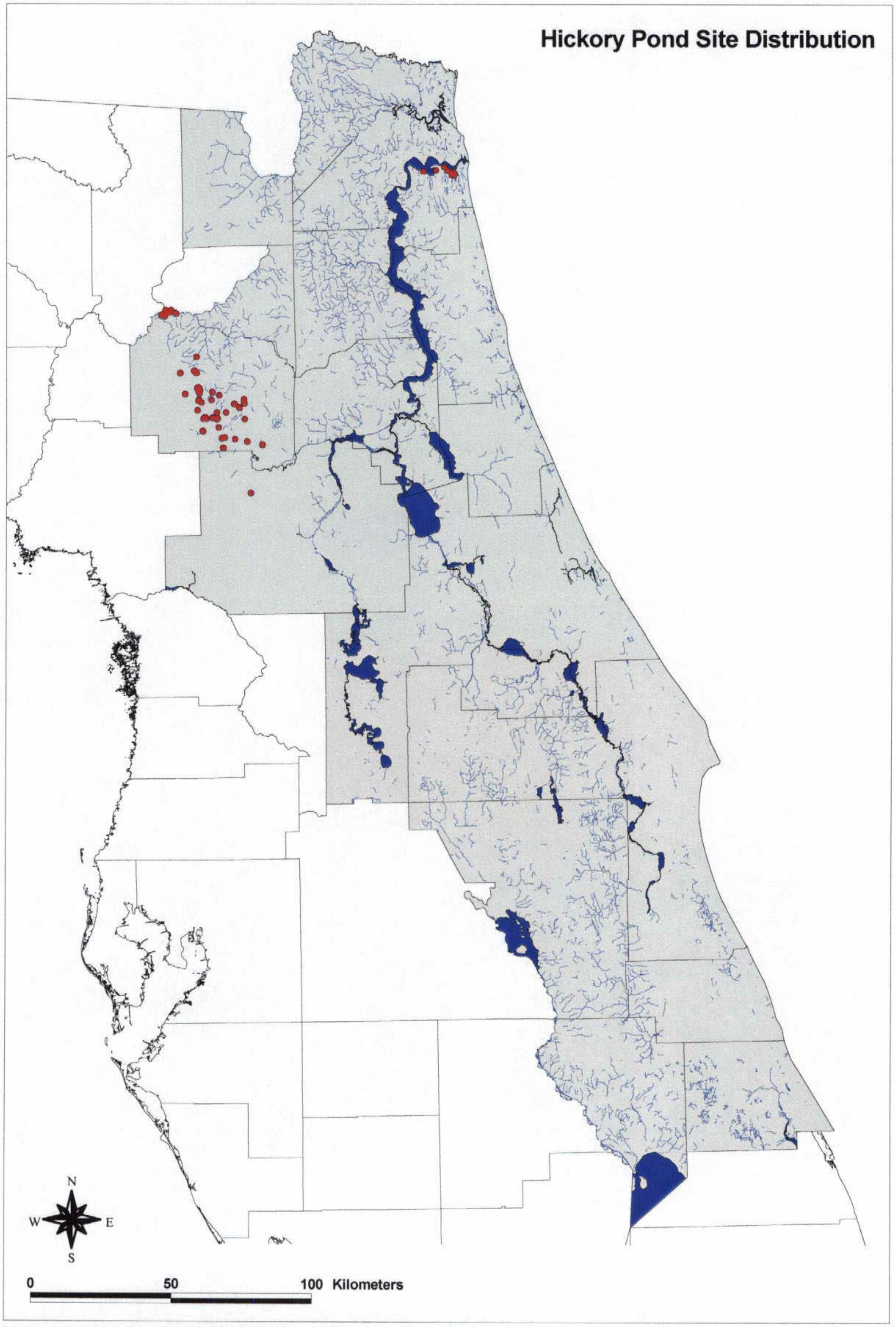

Figure 7-23. Distribution of sites with Hickory Pond components.

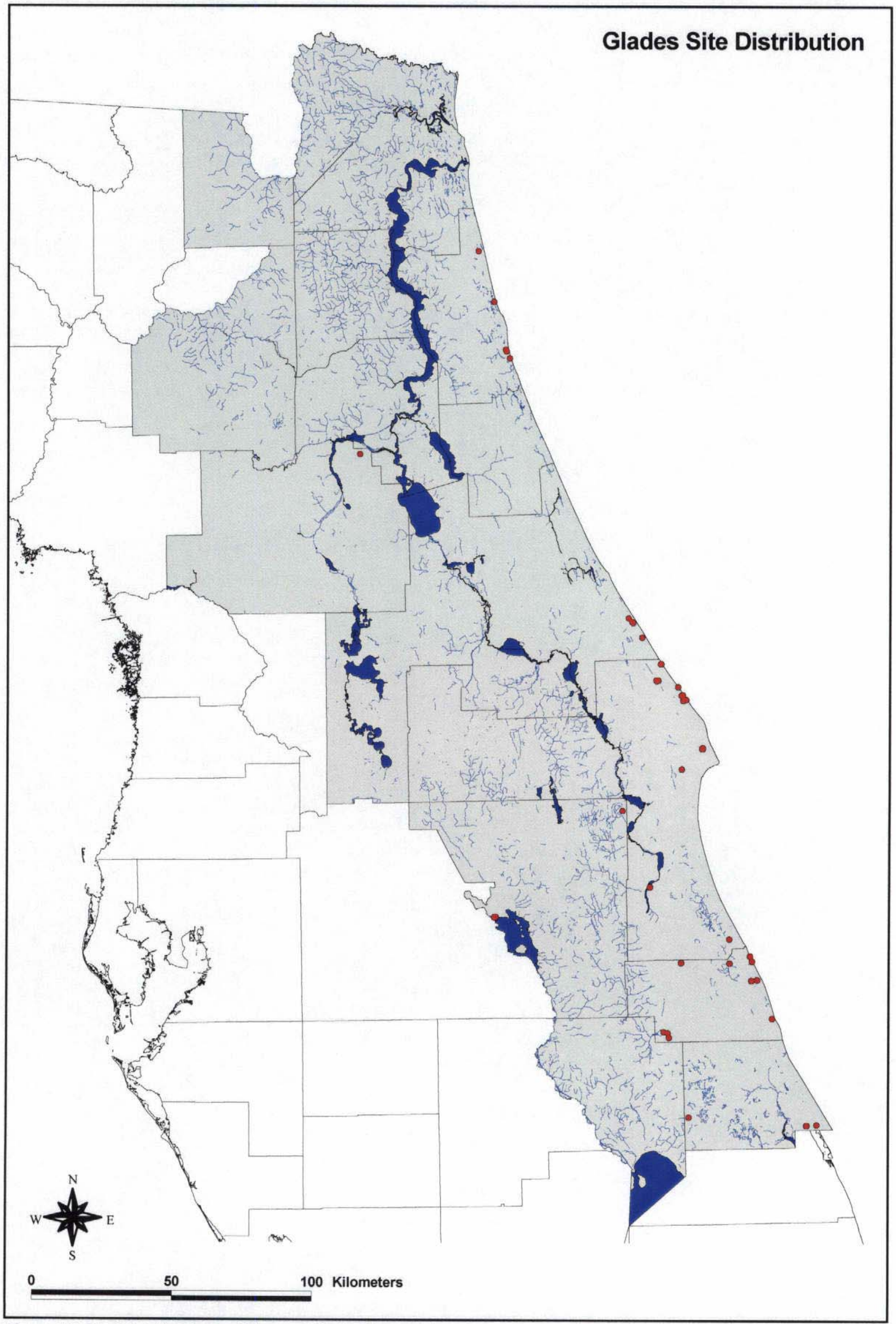

Figure 7-24. Distribution of sites with Glades components.

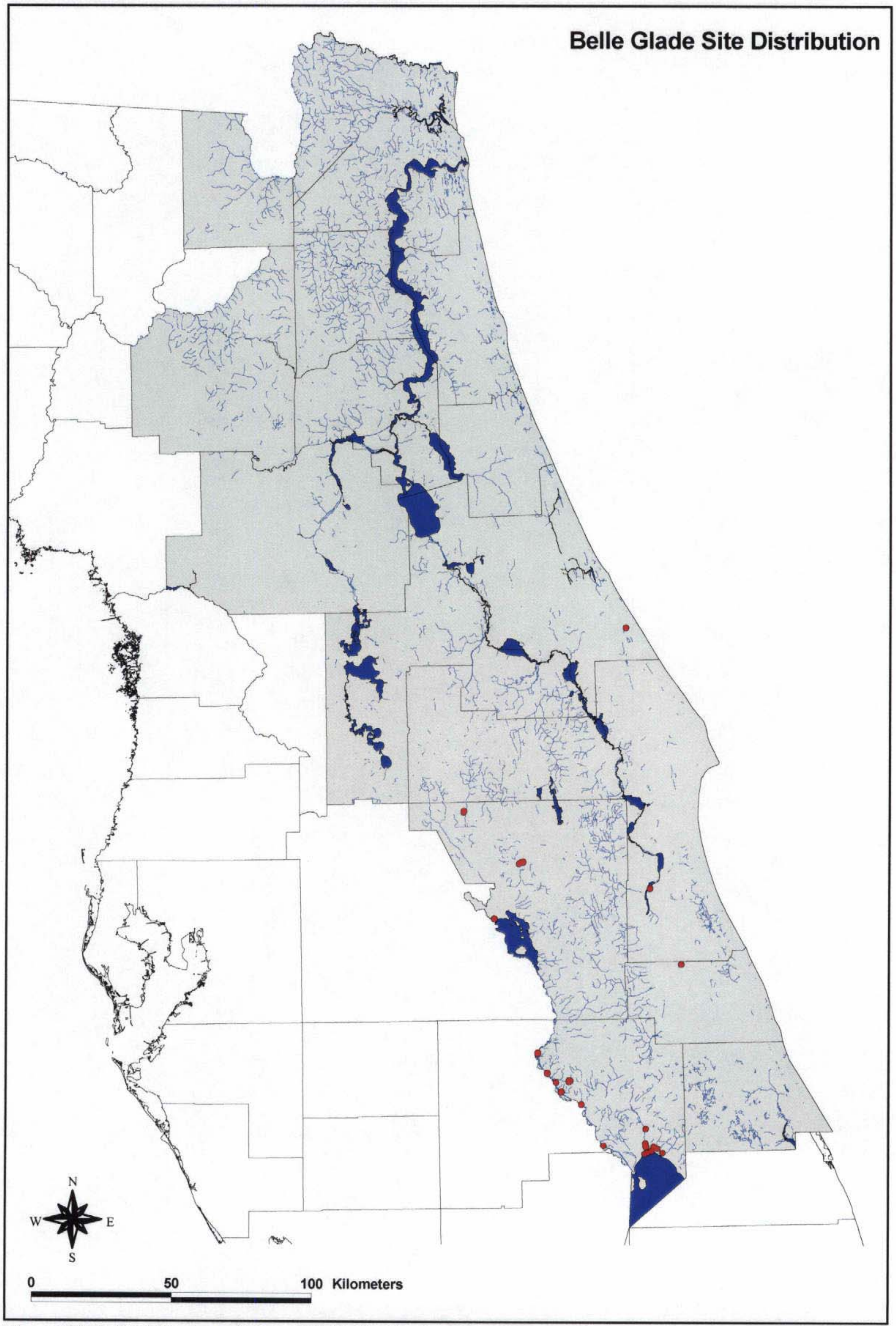

Figure 7-25. Distribution of sites with Belle Glade components.

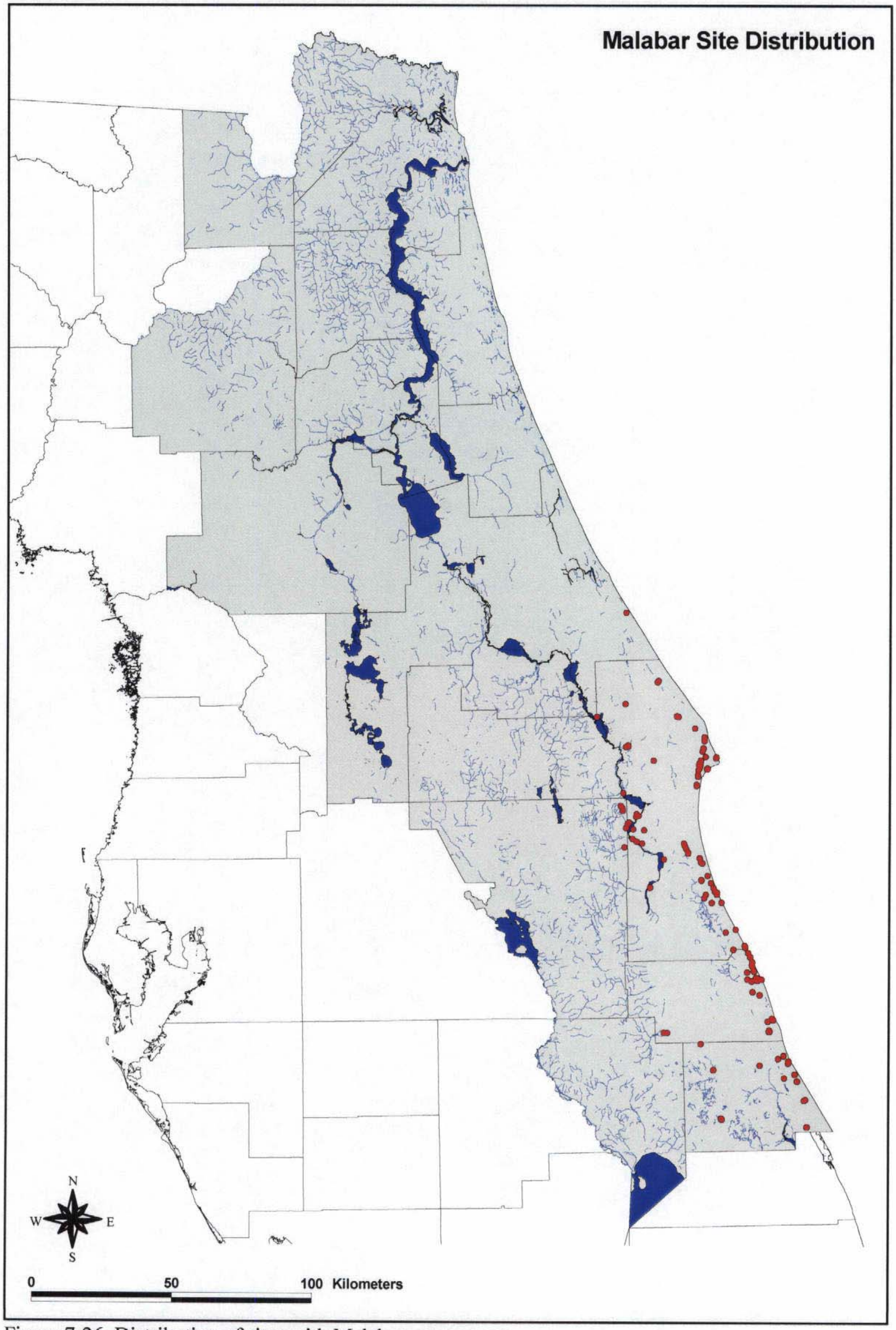

Figure 7-26. Distribution of sites with Malabar components.

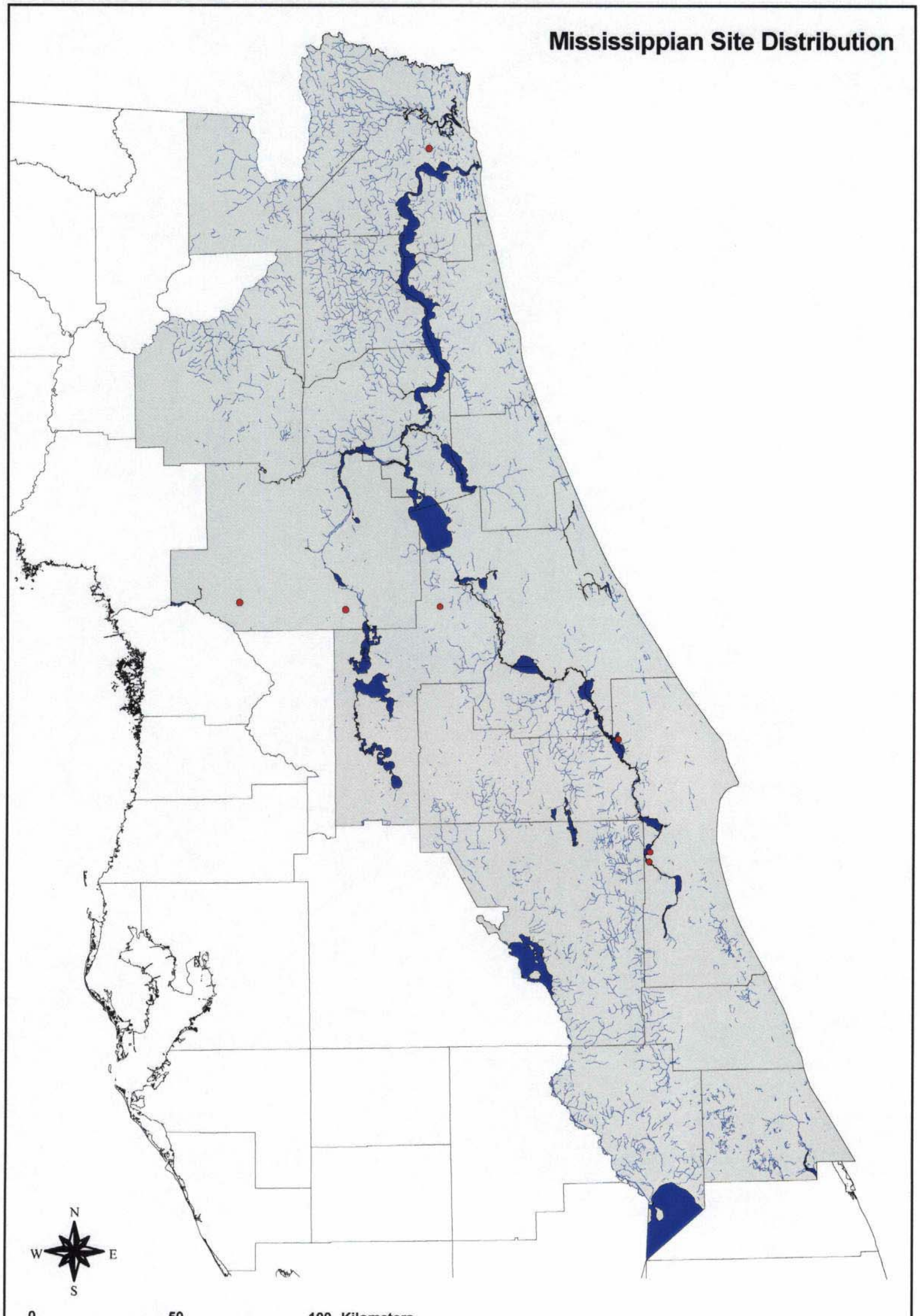

Figure 7-27. Distribution of sites with Mississippian components.

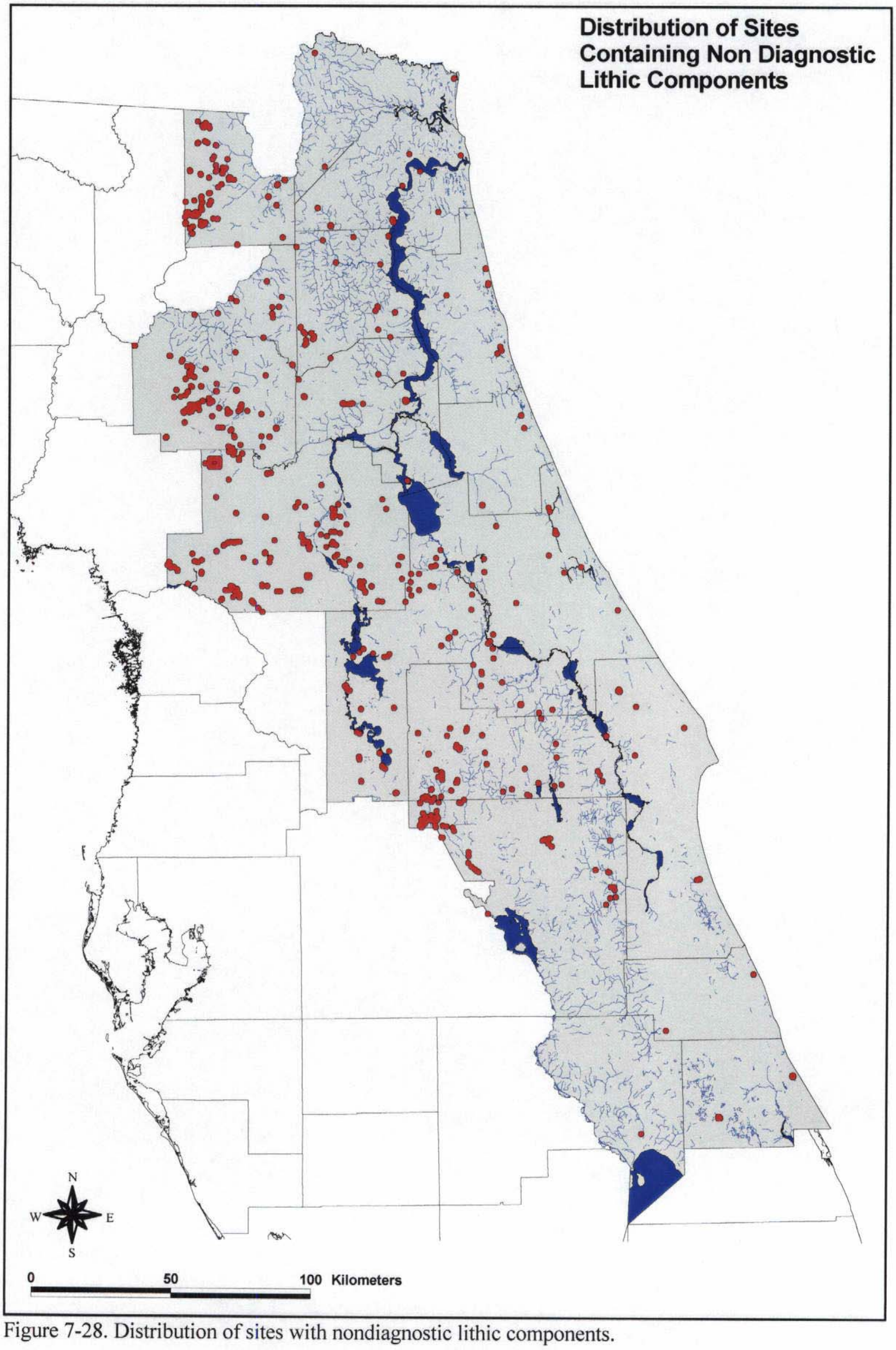

Figure 7-28. Distribution of sites with nondiagnostic lithic components.

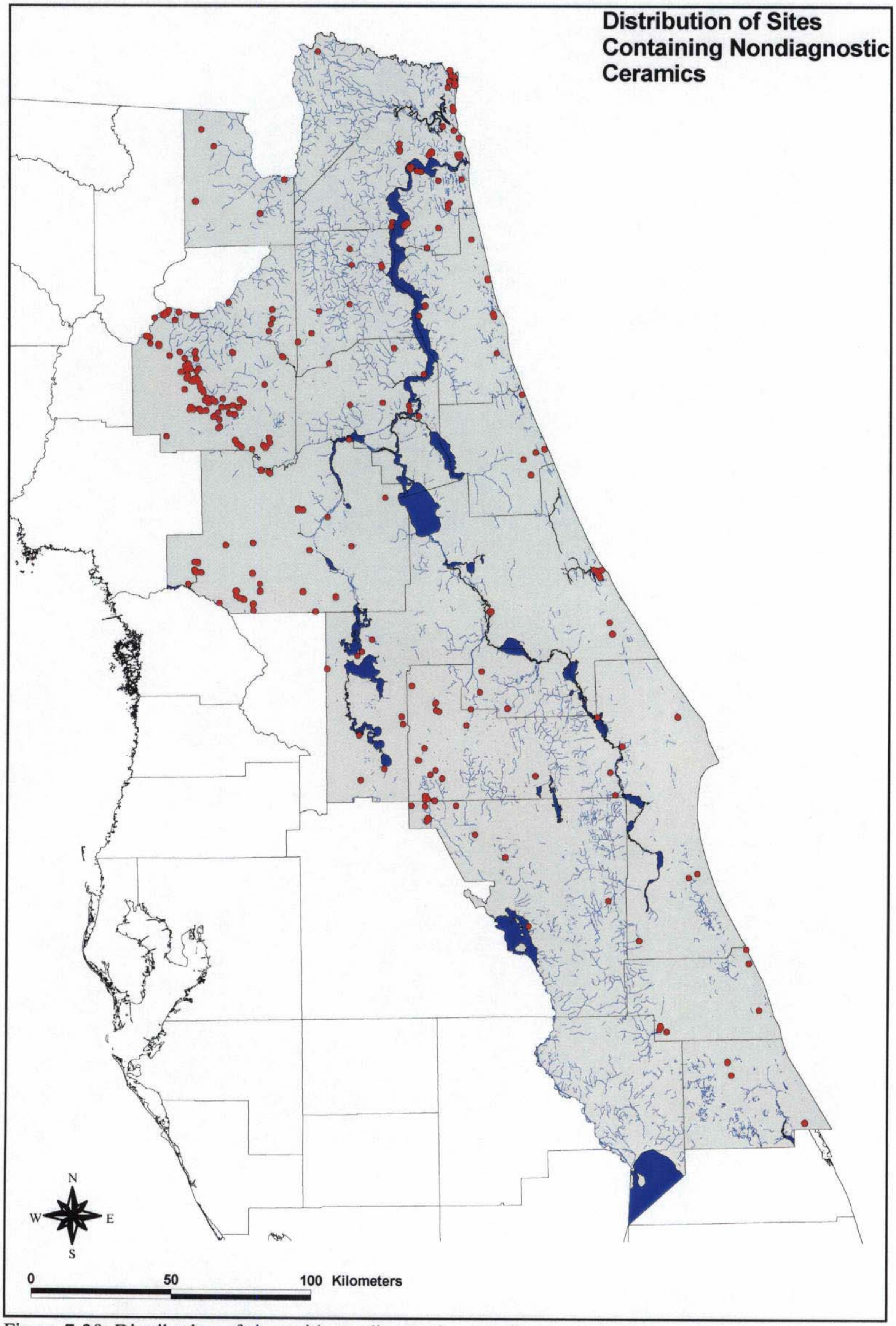

Figure 7-29. Distribution of sites with nondiagnostic ceramic components.

CONCLUSION

With some exceptions, frequencies of archaeological sites by county covary positively with county area and level of archaeological survey, indicating that sites in northeast Florida are widespread, with no major gaps in occurrence at this coarse-grained level of observation.

Archaeological sites in northeast Florida exhibit nonrandom tendencies for elevation, distance to water, soil drainage, and nonirrigated agriculture capacity. Survey bias accounts for much of the nonrandom patterning of elevation, but survey bias alone cannot explain the remaining trends, especially as regards soil attributes. We take this to mean that soils data may provide the strongest variables for predictive modeling.

Mean values for distance to water and elevation covary inversely with number of components at sites. Whereas soils data reflect clear nonrandom patterning for sites in general, they do not vary predictably with number of components. Given that mean number of components per site increases from the Central Highlands, to the St. Johns to the coast, the composite values for soils data must be obscuring meaningful patterning. Clearly any future effort to develop predictive data on site locations must subdivided the study area into more sensitive soils "zones."

Site functional analyses were limited to comparisons of sites with shell, midden, and mounds. The lack of shell deposits in the lower St. Johns noted by Moore (1892) is borne out in site files data. Incidences of sand mounds and nondescript components dating from Orange to St. Johns II in age attest to prehistoric use of this stretch of the river. The lack of shell deposits, as noted by Moore, may be due to ecological limitations in this tidally-influenced channel.

Sites with mounds mimic the nonrandom tendencies of sites in general. The lack of more marked tendencies for better soils may be attributed to our methods for analyzing soil association. If, as we expect, mound sites are disproportionately distributed among well drained and productive soils, a catchment approach to soils analysis may be warranted. In other words, although site-specific soils at mound sites may not be all that different from any other site type, soils in the greater area of mounds may be better than average. A catchment approach to the soils of all site types may be instructive.

Diachronic trends in site location reveal an increasing use of riverine and coastal locations from the early to mid-Holocene as site counts increased. Biases of rising sea level and water tables undoubtedly contribute to this apparent trend. By Orange times sites are decidedly coastal and riverine in focus, and survey bias is not likely to remain a significant factor in this patterning. Increased site counts through the St. Johns periods are presumed to represent increased population and with it more widespread use of interriverine zones. Notable in this respect is the first intensive use of the interriverine uplands occupied by the Ocala National Forest and the sand ridges of the relict channel of the St. Johns by St. Johns I times. This later area has witnessed virtually no systematic survey and hence represents the lingering “black box” in our perspective of regional site distributions.

CHAPTER 8
MODERN LAND USE AND PRESERVATION PLANNING

Land-use coverage in the Florida Geographic Data Library (FGDL) includes 1970s data compiled by the U.S. Geological Survey and 1990s data compiled by Florida's Water Management Districts. By overlaying the 1990s and 1970s data we can estimate the rate and pattern of land-use conversion, notably the conversion of "rural" land to urban uses. Adding data on archaeological site distributions enables us to estimate the rate of site impact and project into the future the rate and pattern of impact from continuing urban sprawl. Such data are essential elements to long-term preservation planning as they enable us to establish priorities for archaeological assessment in advance of development. In this final chapter we present the results of a time-series analysis of land conversion and provide some direction for implementing long-term preservation plans for northeast Florida.

LAND USE COVERAGE

Because land-use data layers in the FGDL were derived from sources with different scales and projections, we include in the sections that follow some discussion of the sources, structure, and biases of the data layers. This information was adapted from the documentation provided on line for the FGDL.

1970s Land-Use Coverage

The oldest set of digitized land-use data in the FGDL is part of a nationwide dataset developed by the U.S. Geological Survey (USGS) in the 1970s and 1980s. These nationwide data were derived from NASA High-Altitude Photography and USGS 1:250,000 topographic base maps. Because these are coarse-grained data, FGDL recommends that they be used for regional or statewide analyses only.

Land-use data in the 1970s is structured to reflect the Level II categories of a classification system developed by USGS (Anderson et al. 1976). Level I categories encompass the more specific Level II categories and include Urban/Built-Up, Agricultural, Rangeland, Forest, Water, Wetlands, and Barren and two classes (Tundra and Perennial Snow/Ice) that have no bearing on Florida coverage. All polygons of the digital layer depict the actual boundaries of given land-use classes but they have minimal parameters that render comparisons with more recent layers problematic. Minimum size of polygons for Urban/Built Up, Water, and certain Level II classes of Agricultural and Barren is 4 ha. All other categories have minimum polygon sizes of 16 ha. In the Urban/Built Up and Water categories, the minimum width of for a feature to be shown is 200 m; for all other categories the minimum width is 400 m.

Inconsistencies between the 1970s coverage and later 1990s coverage are greatest among Level II categories. Because our primary interest here is detecting urban land-use conversion, Level I categories are more than sufficient. The only exceptions are that the Level II category "strip mines, quarries, and gravel pits" was extracted from the Level I

"Barren" category and included with "Urban/Built Up" because it reflects substantial ground-disturbing activity. Also, the Level II "Transitional" categories was extracted from the "Barren" category and enumerated as a separate Level I category.

Finally, the projection of both 1970s and 1990s land-use data conforms to the boundaries of the St. Johns Water Management District. Thus, peripheral portions of the 19-county study area are excluded from analysis. Namely, the land-use coverage does not include southwest Baker County, virtually all of Bradford County, northwest Alachua County, western Marion County, southwest Lake County, south-central Orange County, west Osceola County, southwest Okeechobee County, and all of St. Lucie County. Despite these omissions, the entire St. Johns Basin is included in the land-use coverage.

The projection of Level I 1970s data is illustrated in Figure 8-1. Absolute and relative frequencies for area represented by Level I categories are provided in Table 8-1. As is evident in the map and the table, forested land comprised over one-third of the study area in the early 1970s. Forest cover was especially prevalent in the north half of the study area. The largest tract of forested land is the Ocala National Forest of Putnam, Marion, and Lake counties. A portion of the Osceola National Forest in Baker County likewise accounts for large tracts of forest. Other large tracts include Camp Blanding in Clay County, and several State Forests and Wildlife Management Areas.

Agricultural land cover comprises the second largest fraction of area in the early 1970s. Along with Rangeland, Agricultural land constitutes the majority cover in the south half of the study area. Especially conspicuous is the dominance of agricultural land in the Central Highlands. Farther south the coverage is a mosaic of farmland (mostly citrus), rangeland, and wetlands.

Urban land use in the early 1970s centers on the major hubs of Jacksonville and Orlando, and lesser loci such as Gainesville, Ocala, Palatka, St. Augustine, Daytona Beach, Deland, Sanford, Titusville, Cocoa Beach, Melbourne, and Vero Beach. Overall, the core of the St. Johns Basin—basically the area between Orlando and Jacksonville--was largely undeveloped 30 years ago, at least with respect to urban land uses, including residential uses.

1990s Land-Use Coverage

Two data layers in the FGDL contain Level III values for land use in 1990 and 1995. These data were developed by the St. Johns Water Management District using an on-screen digitizing approach with orthrectified color-infrared photography converted to a scale of 1:12,000.

After a rigorous review and correction process, the 1990s data layers are a detailed and generally accurate source of land use and land cover. Level III data enable fine-grained discrimination among, for instance, pine flatwoods, longleaf pine, and sand pine stands of Upland Coniferous Forest (Level II) or Upland Forests (Level I).

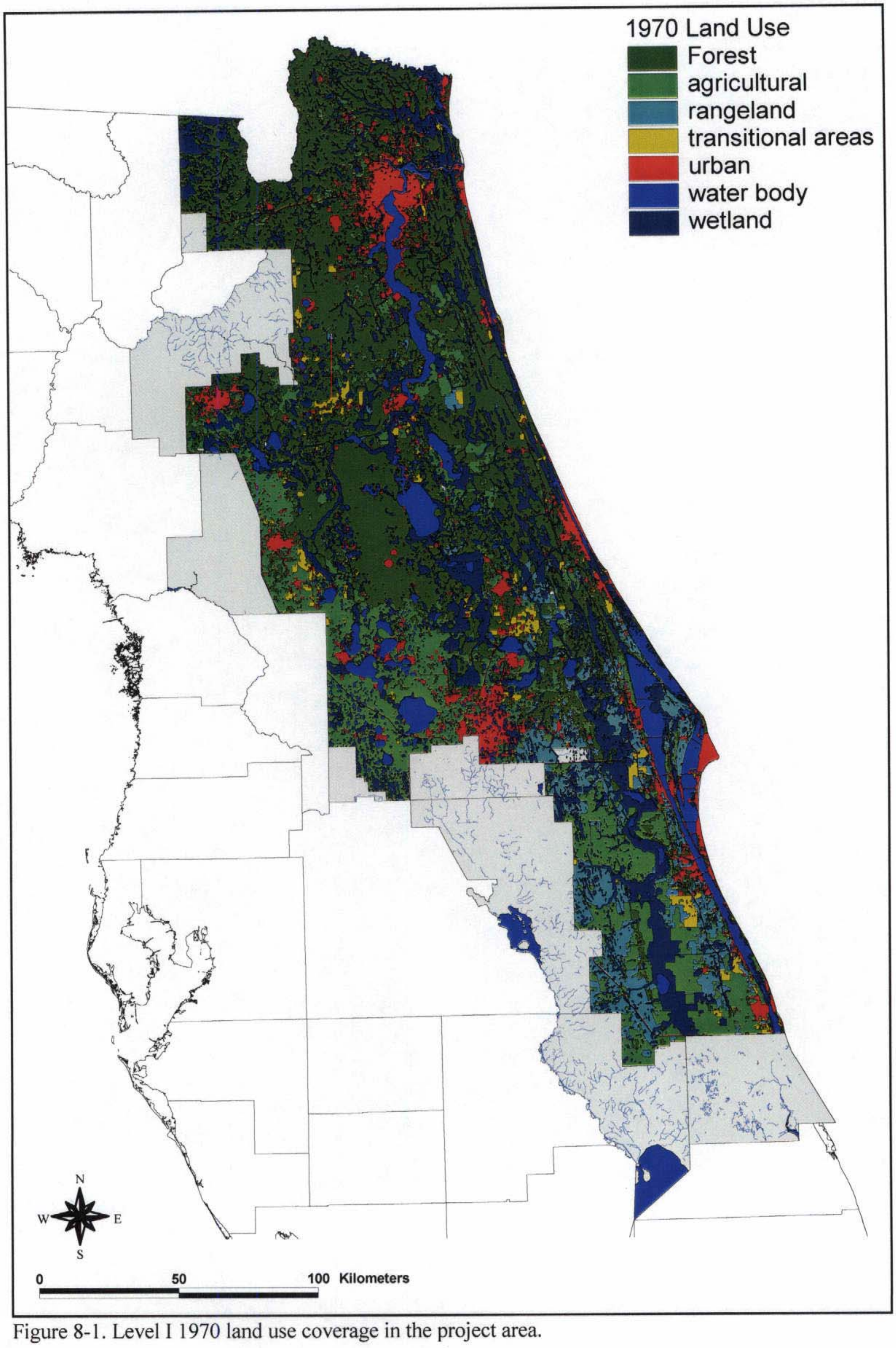

Figure 8-1. Level I 1970 land use coverage in the project area.

Table 8-1. Absolute and Relative Frequencies of Area (ha) of Land-Use Coverage in 1970 and 1995 by Level I Categories.

	1970		1995	
	Hectares	%	Hectares	%
Forest	1,147,263.2	36.5	1,002,107.9	30.0
Agricultural	580,558.8	18.5	506,164.1	15.2
Rangeland	207,048.6	6.6	166,488.7	5.0
Transitional	72,219.2	2.3	11,577.7	0.3
Urban	234,240.1	7.5	521,894.2	15.6
Water body	285,157.0	9.1	298,459.6	8.9
Wetland	615,556.0	19.6	830,009.0	24.9
Total	3,142,042.8	100.0	3,336,701.3	100.0

To enable gross comparisons with 1970s data, however, only Level I data are useful. Minor adjustments were made to the 1990s data to bring them into conformity with the 1970s categories. All analyses reported herein rely strictly on the 1995 coverage of modern land use.

Figure 8-2 provides a graphic display of 1995 land use coverage; Table 8-1 lists the absolute and relative frequencies of areal values by Level I categories. The finer resolution of 1995 data is apparent in the mosaic quality of coverage values compared to those from 1970. Irrespective of resolution, two features of the 1995 coverage are conspicuous. First, the dominance of forest cover in the north half of the state is diminished over the 1970s distribution. Whereas forest still dominates the landscape in a 50 to 75-km radius around Jacksonville, the only expansive tracts of unbroken forest (pine plantation) are confined to the Ocala National Forest. The second conspicuous change is the expanded area of urban land use, notably in the Orlando area, but also throughout the project area. Urban coverage has, in fact, more than doubled as a percentage of total area. Relative reduction in both forest and agricultural coverage totals some 18 percent of 1970 values.

Land-Use Conversion

Changes in land use are the primary means by which archaeological sites are found and destroyed. Most relevant in this regard is the conversion of land from "rural" or "undeveloped" uses (forest, agriculture, rangeland, wetlands) to urban uses. By urban we mean any land use that involves substantial surface modification. As listed in the FGDL Level II categories, "urban" land use includes residential, commercial, industrial, extractive, institutional, and recreational lands. We add to this list transportation corridors and facilities (e.g., airports), communications infrastructure, and utilities (electrical, water, sewage).

Land use coverage for 1995 were compared to 1970 coverage to extract area subject to urban land-use conversion in the intervening 25 years. Figure 8-3 displays all such area, a total of 287,654.1 ha. A small fraction of this area consists of urban land use

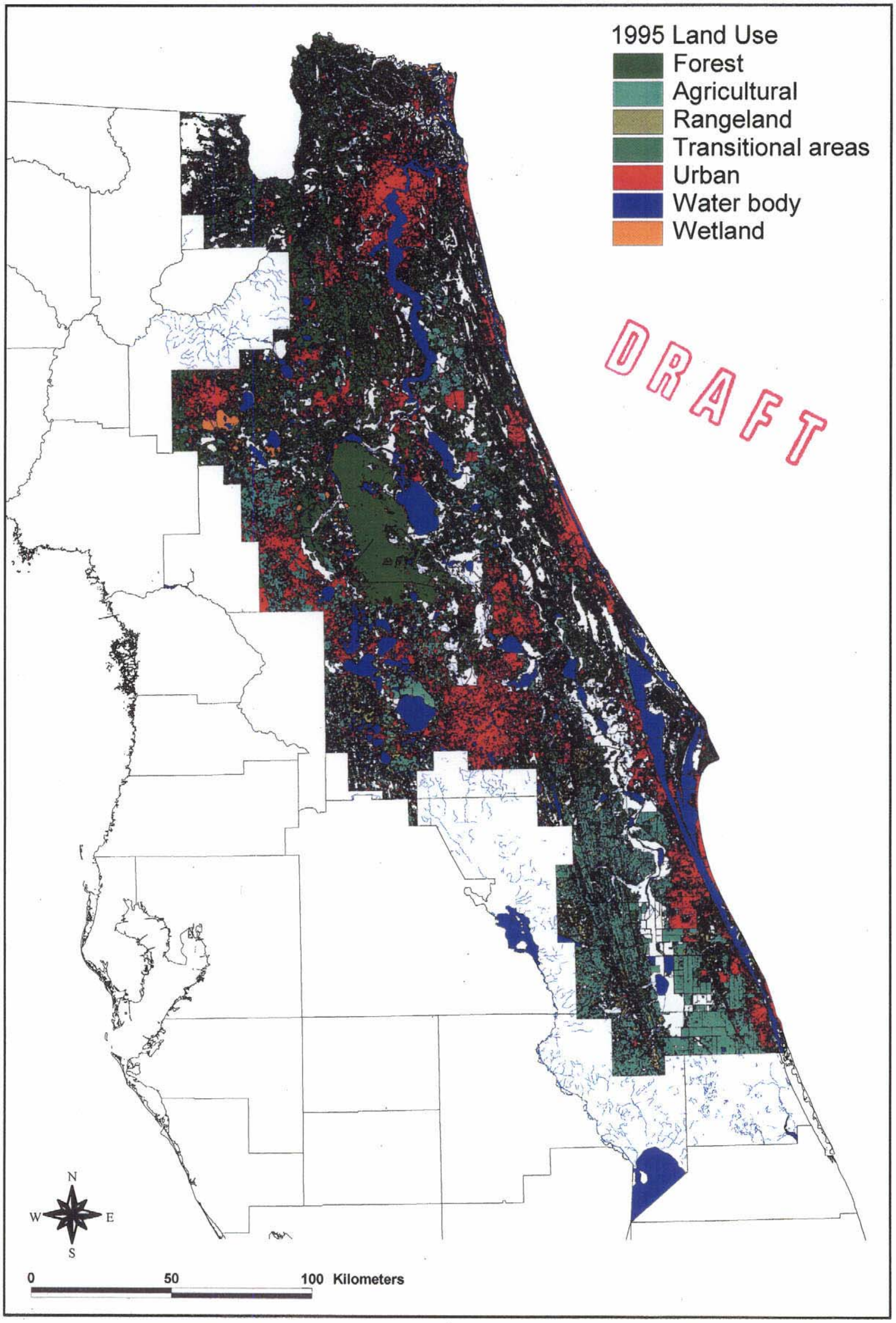

Figure 8-2. Level I 1995 land use coverage in the project area.

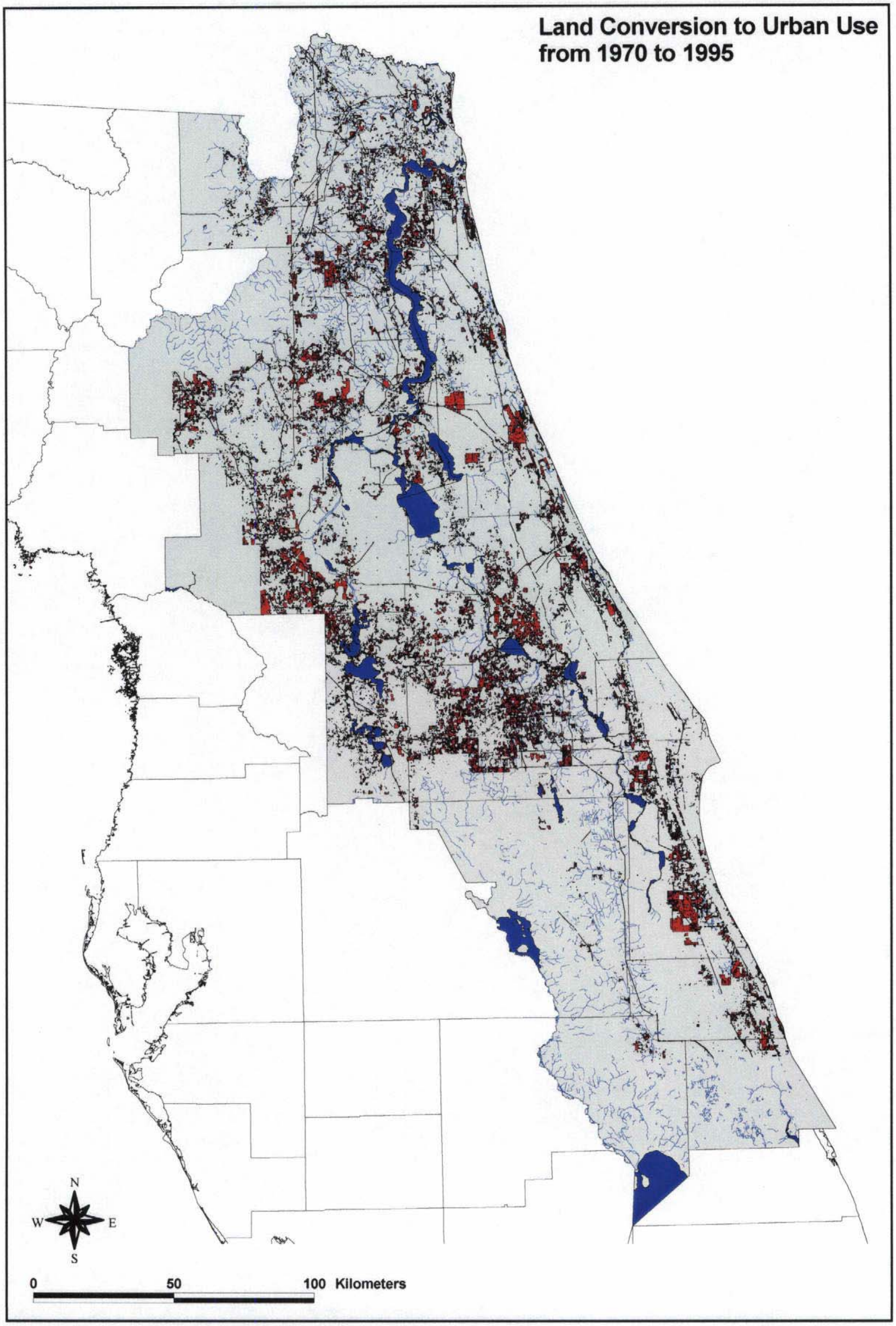

Figure 8-3. Land converted to urban uses from 1970 to 1995.

that was excluded from the 1970 data layer. The vast majority consists of actual urban conversion.

Clearly the core of urban sprawl in northeast Florida is Orlando. Urban sprawl in and around this city has not only encapsulated the nearby towns of Winter Park and Altamonte Springs to the north, but two enormous tracts of land diverging to the northwest and the northeast. Residential development in the former direction is linking Ocala with Orlando via the intermediate towns of Leesburg and Tavares. To the northeast of Orlando is a comparable string of residential development linking Deland, Orange City, and Sanford with the core city. Only the Ocala National Forest prevents this process from engulfing the entire 100-km radius north of Orlando. To the south, outside the scope of the land-use coverage fort this project, the sprawl of development in the Kissimmee-St. Cloud area is even more dramatic.

More moderate, yet significant rates of urban developments have been realized from centers such as Gainesville, western Putnam County (Interlachen), central Clay County, and Jacksonville. The latter center has actually experienced modest growth, considering its initial size, and most growth has centered on eastern and southern margins of the city.

Coastal development has patterning all its own. Urban development in coastal cities and towns is generally linear, expanding south and north or core locations like Jacksonville Beach, Flagler Beach, Daytona Beach, New Smyrna Beach, and Vero Beach. Locations such as St. Augustine have expanded to the interior, with commercial (outlet malls) and industrial development, as well as residential expansion. Others have sprawled inland as a consequence of nearby expanding centers like Bunnell in Flagler County. The area south of Melbourne in Brevard County has experienced an advanced level of interior urban conversion.

As might be expected, the rate of urban land-use conversion is matched by population growth for the study area. Population for the 19-county area in 1995 was approximately 4,130,422 (Fernald and Purdum 1996:268). This is an increase of 2,259,169 people since 1970, when population totaled 1,871,253 (Fernald 1981:260). This amounts to a 121 percent increase in population over 25 years. The rate of urban conversion over this same period was a comparable 123 percent.

Rates of population growth and attendant urban sprawl vary widely across counties of the study area. Over 200 percent growth in population from 1970 to 1995 has occurred in Clay, Flagler, Marion, Osceola, St. Johns, St. Lucie, and Seminole counties. Flager County tops the list at 739 percent growth; Osceola is second highest at 446 percent growth. Counties under 100 percent growth include Alachua, Bradford, Bevard, Duval, and Putnam. Remarkably, Duval County, at only 36 percent, experienced the lowest rate of growth in the study area.

ARCHAEOLOGICAL IMPACTS OF LAND-USE CONVERSION

Given the nature of American archaeology since the 1970s, it goes without saying that the record of site locations is biased toward locations of cultural resource assessment. But to what extent has urban land-use conversion in northeast Florida involved intensive archaeological review? A comparison of the urban conversion layer with the coverage for archaeological surveys (see Chapter 5) shows that only 14 percent of converted land fell within the boundaries of archaeological surveys. As small a percentage as this is, we note that not all of this area was surveyed in response to planned urban development; certainly some undetermined amount of converted land was surveyed for purposes other than urban development. Still, the intersection of urban conversion and archaeological survey gives us some feel for the extent that urban sprawl is impacting sites without adequate assessment and documentation.

A total of 828 sites in the study area were impinged upon in some fashion by urban land-use conversion. This is some 23 percent of all sites, a fraction that would increase appreciably if we counted only those sites falling within land-use coverage. Even so, the fraction of sites falling in survey tracts (47%) is the larger of the two figures, reflecting the fact that urban land-use conversion has not routinely involved adequate archaeological assessment.

Without question, the greatest culprit in site impact is residential development. Table 8-2 lists the number of sites impacted by each of the major Level II categories under the Level I Urban land-use class. A full four-fifths of all sites impacted by urban conversion were victims of residential development. More than a third were impacted by development associated with residential expansion (e.g., transportation, commercial, utilities, etc.). Industrial and institutional development has had a comparative minor role in site impact.

Because of the dominance of residential development in urban conversion, we are in a reasonably safe position to generalize about the rate of impact to archaeological sites that increased population and urbanization has wrought. Given an increase in population of 2,259,169 between 1970 and 1995, and a total of 828 sites in converted land over this same period, we estimate that one (prehistoric) archaeological site was impacted by urban development for every 2729 new northeast Florida residents. We consider these extremely conservative estimates.

Planning for Future Development

Continued growth and urban sprawl in northeast Florida is inevitable. If the past 25 years is any indication, population will easily double again by 2020 and urban land-use conversion will keep pace unless radically different approaches to urban development emerge. Barring such radical changes and anticipating that much develop will take place without adequate archaeological assessment, a proactive approach to predictive modeling and prioritized archaeological survey is warranted.

Table 8-2. Number of Archaeological Sites Impacted by Urban Land-Use Conversion (note that sites are counted more than once if two or more different urban conversions occurred).

Urban Land-Use Conversion	#Sites
Residential	663
Utilities	96
Transportation	89
Recreational	85
Other*	50
Institutional	30
Commercial	36
Industrial	25

* includes cemeteries, inactive developed land, open land, and reclaimed land

Patterning evident in archaeological site locations in northeast Florida should enable predictive modeling inasmuch as we have representative samples of the full range of archaeological variation. Our assessment of survey coverage suggests that northeast Florida has been adequately sampled across the environmental dimensions we investigated. We are unable to address the *quality* of survey coverage for lack of comparable data on subsurface testing, sampling interval, and ground cover. Only a detailed review of the 800+ survey reports filed with BAR in Tallahassee will enable one to assess survey quality, and even then, many reports no doubt will lack sufficient information to make these assessments. Rather than bemoan the lack of sufficient data, we instead maintain that survey has been widespread and robust enough to have a relatively sound handle on the full range of archaeological resources in the region.

Parlaying samples of sites into predictive models is a formidable challenge. At the scale of 19 counties, the environmental data we generated for site locations are too coarse grained to serve the needs of predictive modeling. Indeed, our analysis shows that sites occupy nonrandom locations on the landscape, but every archaeologist and most relict collectors already know this. Quantifying these nonrandom tendencies requires scales of analysis smaller than that attempted here. Virtually every variable we measured produced central tendencies that were nonrandom, but ranges that encompassed most of the variance of random data. In other words, we sampled so broadly as to capture in archaeological sites across the region most of the variation that would enable predictive statements about localized or subregional distributions. Ultimately we want to be able to predict the kinds of sites that will be found under given environmental conditions.

To do so, the project area as defined herein needs to be divided into at least seven subregions: the Lower St. Johns, the middle St. Johns/Oklawaha, the upper St. Johns, the Central Highlands, the Okeechobee area, the coastal strand between Jacksonville Beach and Cape Canaveral, and the south coast. Of course, the first three subregions are of central interest, but, as we noted at the onset of this report, it is unwise to delineate the St.

Johns Basin as a study area without also including coterminus portions of adjacent subregions.

At the level of subregions, variations in soil, distance to water, elevation will be much more sensitive to site locations than they are regionwide. Even without greater sensitivity, however, we are certainly encouraged that measures of occupational intensity covary with environmental variables in predictable fashion. Here we refer specifically to covariation between number of components and distance to running water. This sort of patterning not only shows that predictive qualities of site locations can be gleaned for simple, univariate dimensions of the environment, but that site files data are indeed worthy of locational modeling.

Apart from developing more localized and sensitive environmental data on site locations, the patterns of urban sprawl over the past 30 years can be used to predict future development and thus potential impacts to sites. Technically, this involves buffering extant urban centers with radii of projected development. Projected development is simply an extrapolation of the rate of development over the past 30 years. Ideally a model of future development would incorporate the plans of individual municipalities, some of which no doubt have long-range projections in digital format. Against these buffers one can then apply predictive parameters for archaeological sites to stratify the buffered area into high, medium, and low probability.

Buffers around urban centers would likewise assist in decisions about resource acquisition by the state. The state's CARL program has already acquired some very important sites in northeast Florida. With information on rates and patterns of urban conversion, CARL staff could prioritize efforts to acquire and protect sites. Certainly the potential for negative impacts to sites is integral to assessing site significance when acquisition and long-term preservation are priorities.

In developing predictive models at the subregional scale, it is imperative that we cultivate reliable data on site content and integrity. Here we encounter the problem of insufficient sample size for sites with detailed assemblage analyses. The handful of well documented, large-scale investigations is clearly insufficient to extrapolate to the level of subregion. Short of waiting for a sufficient number of sites to be excavated, we must look for proxies for site content that will enable reliable assessments of potential significance. Number of components at a site appears to be one possible means to this end, as it clearly represents sites that attracted humans repeatedly over long spans of time and, simultaneously, reflects nonrandom tendencies for location vis-à-vis modern environmental variables. We hasten to add, however, that multicomponent sites, while absolutely important in terms of redundant human land use, are not always the best places to investigate individual components because they suffer the lack of clarity that intensive use and reuse entails. Single component sites with good integrity are, in many ways, much more valuable resources for reconstructing lifeways, chronology, and site structure.

Another consideration in predictive modeling is change in human land use. Our analysis confirmed what many Florida archaeologists have long known: patterns of land use changed through time as environments, populations, and cultural traditions changed. A model that effectively captures the full range of significant variation for St. Johns II sites may have little to no overlap Paleoindian distributions. Indeed, for predictive modeling to work effectively it must incorporate a diachronic dimension. At a minimum, a time-series model that involves the expanded use of riverine habitat starting in the Middle Archaic period is warranted.

One particularly important area for investigating changing prehistoric land use is the relict channel of the St. Johns River associated with the so-called "offset." Our preliminary diachronic analysis of site locations suggest that as populations expanded from the Mount Taylor though St. Johns periods, locations along the old relict channel(s) began to be utilized. Unfortunately, none of this stretch of old river has been surveyed professionally. And, it is among the most threatened areas in the St. Johns due to rapid urban sprawl north of Orlando. If there is one major gap in our knowledge of prehistoric land use in the middle St. Johns, it is clearly the use of the relict channel area that borders and extends beyond the bounds of the Crescent City Ridge.

Also related to the issue of changing land use is the Spanish colonial and EuroAmerican archaeological records of northeast Florida. In this project we set aside these important resources to focus on the prehistoric record. Our logic here is that sites of the historic era are best analyzed apart from prehistoric sites because land use during the historic era was influenced so heavily by local and extralocal politics, the built environment (e.g., ports, roads), and technologies (e.g., wells) that rendered environmental limitations more or less moot. Thus, an effective preservation model for historic era sites would begin by digitizing all maps and plats and developing time-series databases for projecting displays of roads, towns, homesteads, etc. for any given decade. Overlays of such resources could help to improve cartographic resolution and thus aid in efforts to locate sites ahead of development.

Completely untapped sets of data for northeast Florida are the remotely sensed images of the FGDL and other sources. Good potential exists for discerning spectral signatures for sites like shell middens and mounds and incorporating these data into predictive models. The robust dataset of extant shell midden sites, for instance, is prime raw material for false-color satellite imagery analysis.

The potential for effective predictive modeling and long-range preservation planning in northeast Florida is immense. Out effort here is but a modest beginning toward this effort. We trust it shows that digital resources for the region are diverse, robust, and highly accessible. With desktop computers and appropriate software, any archaeologist, land manager, and regulatory agent ought to be able to acquire, analyze and display spatial data relevant to historic preservation efforts. The Florida Bureau of Archaeological Research (BAR) has made incredible strides developing and making accessible to bona fide parties the locations of sites and surveys across the state. The FGDL data distributed by GeoPlan is a rich source of background data. Together these resources are the basis for effective and efficient resource management. All land managers, regulatory agents, and archaeologists working in historic preservation have access to these resources. The extent to which all such parties work with the same data, projected at the same scale, and interpreted with the same criteria, is not for us to say. We are more than willing to share the data we have assembled in the hopes that multiple users with diverse needs will serve to improve the overall efficacy of this GIS approach.

The St. Johns River was designated an American Heritage River by President Clinton on July 30, 1998. A consortium of federal agencies, state agencies, and local communities agreed to work together to preserve water quality, and ecological and cultural resources along the river. The initiative is also designed to stimulate economic development. A steering committee met in December 1999 to discuss program goals and devise means for integrating the diverse interests of participating agencies. To our knowledge, archaeological interests have not been sufficiently promoted. Archaeological sites in the St. Johns Basin are among Florida's most significant. They are likewise among our most vulnerable. The time is right to ensure that long-range planning initiatives, such as the American Heritage Rivers program, involve archaeology and historic preservation to the fullest extent possible.

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