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Discerning Empirical Relationships Between The Natural Environment and Prehistoric Site Location: An Example From the Watts Bar Reservoir, East Tennessee

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I am submitting herewith a thesis written by Kenneth Paul Cannon entitled "Discerning Empirical Relationships Between The Natural Environment and Prehistoric Site Location: An Example From the Watts Bar Reservoir, East Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Walter E. Klippel, Major Professor

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Jefferson Chapman, Charles H. Faulkner

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DISCERNING EMPIRICAL RELATIONSHIPS BETWEEN THE NATURAL ENVIRONMENT AND PREHISTORIC SITE LOCATION: AN EXAMPLE FROM THE WATTS BAR RESERVOIR, EAST TENNESSEE

A Thesis
Presented for the
Master of Arts
Degree
The University of Tennessee, Knoxville

Kenneth Paul Cannon
December 1989

Dedicated

to

my parents

Patricia A. Cannon

and

Gerald L. Cannon

ACKNOWLEDGEMENTS

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While many individuals, named and unnamed, contributed to the successful completion of this project, I must take full responsibility for its inadequacies and shortcomings.

ABSTRACT

The Watts Bar Reservoir study area is an artificially defined region of 13,815 hectares, demarcated by the reservoir boundary of the Tennessee Valley Authority. Following completion of the Watts Bar Dam in 1942, the reservoir impounded 95 river miles of the main Tennessee River, in addition to portions of the Clinch, Emory and Piney rivers, as well as several smaller tributaries. Since the mid-nineteenth century archaeological investigations have been conducted in the region. However, the sporadic nature of these research endeavors has created a somewhat fragmented picture of the region's prehistory.

Following Smith's (1978b) model of the linear banding of environmental zones adjacent to the course of meandering streams, this thesis addresses site location in the reservoir. Specifically, the main river channels of the Tennessee and Clinch rivers were divided into one kilometer tracts in order to delineate the natural distribution of environmental variables. A comparison of tracts containing archaeological sites and those without sites was made using the Kolmogorov-Smirnov goodness of fit test. Although the use of random sampling methods to obtain negative information has been strongly advocated (i.e., Binford 1964; Thomas 1973; Kvamme 1985; Kellog 1987), I chose to use all tracts to offset the biases in the archaeological record due to the sporadic nature of the region's research. A separate and additional test was conducted for the delineation of patterns of natural shelter selection.

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CHAPTER I

INTRODUCTION

A pervasive issue in contemporary anthropology is how human groups organize themselves in relation to the natural features of the environment (e.g., Yellen 1977; Isaac 1981; Jochim 1981; Winterhalder and Smith 1981). The study of the organization of cultural systems was recognized as a first step in understanding human cultural behavior (e.g., Chang 1958; Sears 1961; Trigger 1968). Initially, the study of human settlement was defined "as the way man disposed himself over the landscape on which he lived" (Willey 1953:1). More recently, anthropologists have begun to emphasize the study of human organization in terms of economic optimization strategies--maximization of net return while minimizing net energy expenditure (Moore 1981:200). It is the intent of this thesis to identify patterns of human organization (i.e., settlement) with respect to features of the natural environment. Utilizing statistical techniques, is it possible to identify quantitative differences between areas that were selected for site location and those areas that were not?

Background

The pursuit of developing models concerning the relationship of human groups to the natural environment has had a long history among students of American aboriginal societies. Steward (1938:2) argues that the cultural system acts as a response to the dynamic features of the environment. Topography, climate, plant and animal distribution, and the occurrence of water are important factors of the environment that influence human cultural behavior. Location, size, distribution, seasonality, and permanency of population aggregates reflect the interaction of human groups with the ecological parameters of natural resources.

Large, regional studies of settlement patterning received little attention until the late 1940s when Willey (1953) conducted a settlement survey and analysis as his part of the Viru Valley project. This classic study emphasized the disposition of archaeological remains with reference to features of the terrain:

> . . . the way in which man disposed himself over the landscape on which he lived. It refers to dwellings, to their arrangement, and to the nature and disposition of other buildings pertaining to community life. These settlements reflect the natural environment, the level of technology on which the builders operated, and various institutions of social interaction and control which the culture maintained. Because settlement patterns are, to a large extent, directly shaped by widely held cultural needs, they offer a strategic starting point for the functional interpretation of archaeological cultures" (Willey 1953:1).

Willey's emphasis was placed on the functional classification of sites. His study was organized in an effort to examine the development of specific sites and how they were integrated into the overall community pattern of different time periods (Willey and Sabloff 1980:148).

More recently, statistical techniques have been utilized to assess the possible relationship of site locations to a variety of environmental phenomena (e.g., Williams et al. 1973; Roper 1979). However, these studies have usually failed to provide objective evidence that specific features of the environment are actually related to site location (Kvamme 1985:208).

Roper's (1979) study of Middle and Late Woodland site selection in the Sangamon River Valley of central Illinois is a case in point. Specifically, numerical taxonomy and cluster analysis were used to evaluate environmental variables in order to formulate preliminary models of Woodland patterns for the area.

One of the basic problems faced by Roper was her inability to apply appropriate statistical techniques. The use of numerical taxonomy assumes variable independence (Thomas 1972). How can factors influencing site selection be isolated when the variables being used are interrelated aspects of the environment (i.e., topography-drainage, drainage-soil, soil-floral communities)? By not isolating independent variables Roper's conclusions are invalidated!

More appropriate to understanding the process of site selection is to contrast environmental data from known archaeological sites to random areas within the region that are known to lack sites. This procedure allows the use of negative data sets for isolating environmental features selected by prehistoric groups in locating their sites (Kvamme 1985:209).

The analysis of prehistoric land use patterns is not a unique or new approach to understanding the dynamics of the prehistory of East Tennessee (e.g., Lewis and Kneberg 1946). Previous studies of prehistoric settlement in the region can be classified into three general categories. The first is focused upon regional temporal patterning based upon excavated site data (e.g., Lewis and Kneberg 1946; McCollough and Faulkner 1973). The second category focuses upon intrasite patterns (e.g., Kimball 1981; Schroedl et al. 1983). And more recently, the study of patterns of broad prehistoric land use based upon data collected from probabilistic surveys (Kimball and Baden 1980; Davis 1985) has become the major focus in the region.

While each of the above mentioned studies has provided important information concerning prehistoric patterns of land use, none provides an objective means for assessing the process of site selection. It is my intention to approach the problem of prehistoric site location by contrasting environmental data collected from areas of known site location to those areas where prehistoric sites are absent.

Organization

The organization of this thesis is designed first to provide a synthesis of the extant archaeological record of the Watts Bar Reservoir, and second, to establish a preliminary model of prehistoric site location.

The first sections deal with background information concerning the natural and cultural history of the region. Modern and archaeological data are utilized in an attempt to provide a model of the environment prior to Euro-American settlement.

A synthesis of regional paleoenvironmental data provides a general description of the changes that have occurred since the end of the Pleistocene. Although the model is presented on a region-wide scale (i.e., the Midsouth), it does provide insight into the dynamic nature of the environment and its probable effects upon human settlement and subsistence.

The third chapter provides an overview of the prehistoric cultures of the region. Although evidence of all cultural periods have been identified in the eastern Tennessee Valley, investigation of the dynamics of certain periods have been more extensively developed than others.

Chapters IV, V and VI deal with the historical background of archaeological research in the region and how these formative studies have influenced our current understanding of the region's prehistory.

In keeping with the major focus of this study, a survey of 37 natural shelters was undertaken to test the hypothesis that site selection was not a random process. Morphological data, as well as information concerning the local environment, were collected in an attempt to discern differences between utilized and nonutilized shelters.

While natural shelter selection may indicate patterns for more specialized sites, habitation or multifunction sites along the main river channels may reflect different patterns. Chapter VIII deals with empirical testing of these site types in reference to important natural resources. It is assumed that specific features of the environment provide important resources for exploitation, and decisions concerning site selection are keyed into these factors. Basically, the hypothesis tested argues that sites were located in order to minimize net energy expenditure while maximizing net return.

In order to address this issue, the Tennessee and Clinch rivers were divided into one kilometer tracts and identified as cultural or noncultural based on information collected from state site forms. Environmental information was collected from a number of sources including 7.5 minute topographic maps and county soil survey maps. Statistical analysis of tracts was conducted utilizing the Komolgorov-Smirnov goodness of fit test. Basically, this test plots the cumulative distribution functions of the two samples and calculates the maximum distance between them. If the maximum deviation is below 0.05, then the two distributions are judged to be statistically different. Both synchronic and diachronic patterns of site location are analyzed.

Chapter X provides a summary of the findings of this thesis.

CHAPTER II

MODERN ENVIRONMENT

The Watts Bar Reservoir study area is an artificially defined region of 13,815 hectares (10,405 acres), demarcated by the Tennessee Valley Authority's reservoir boundaries. The reservoir was formed in 1942 following the completion of Watts Bar Dam and the subsequent impoundment of the Tennessee River and its tributaries. The 95 river miles of the Reservoir flow through four counties in East Tennessee--Loudon, Meigs, Rhea and Roane--and extend from Watts Bar Dam upstream to Fort Loudon Dam on the Tennessee River, and to Melton Hill Dam on the Clinch River. Watts Bar also includes portions of the Emory and Little Emory rivers, as well as the Piney River (TVA 1986:2; see Figure 1).

The major focus of this study is the relationship of prehistoric site location to the linearly-defined microenvironmental zones adjacent to the main river channel of the Tennessee and Clinch rivers. The study area is within an exceedingly rich environment of the meandering river system. Early Euro-American visitors in the region characterized the valley as the "American Canaan" (DeBrahm in Williams 1928:193). This sentiment was reiterated by Lewis and Kneberg (1946:42-43) in their description of the upper Tennessee River Valley as "particularly adapted to aboriginal life in the richness and variety of wild food products, and was capable of supporting rather large populations on this basis alone." Therefore, in order to more adequately understand

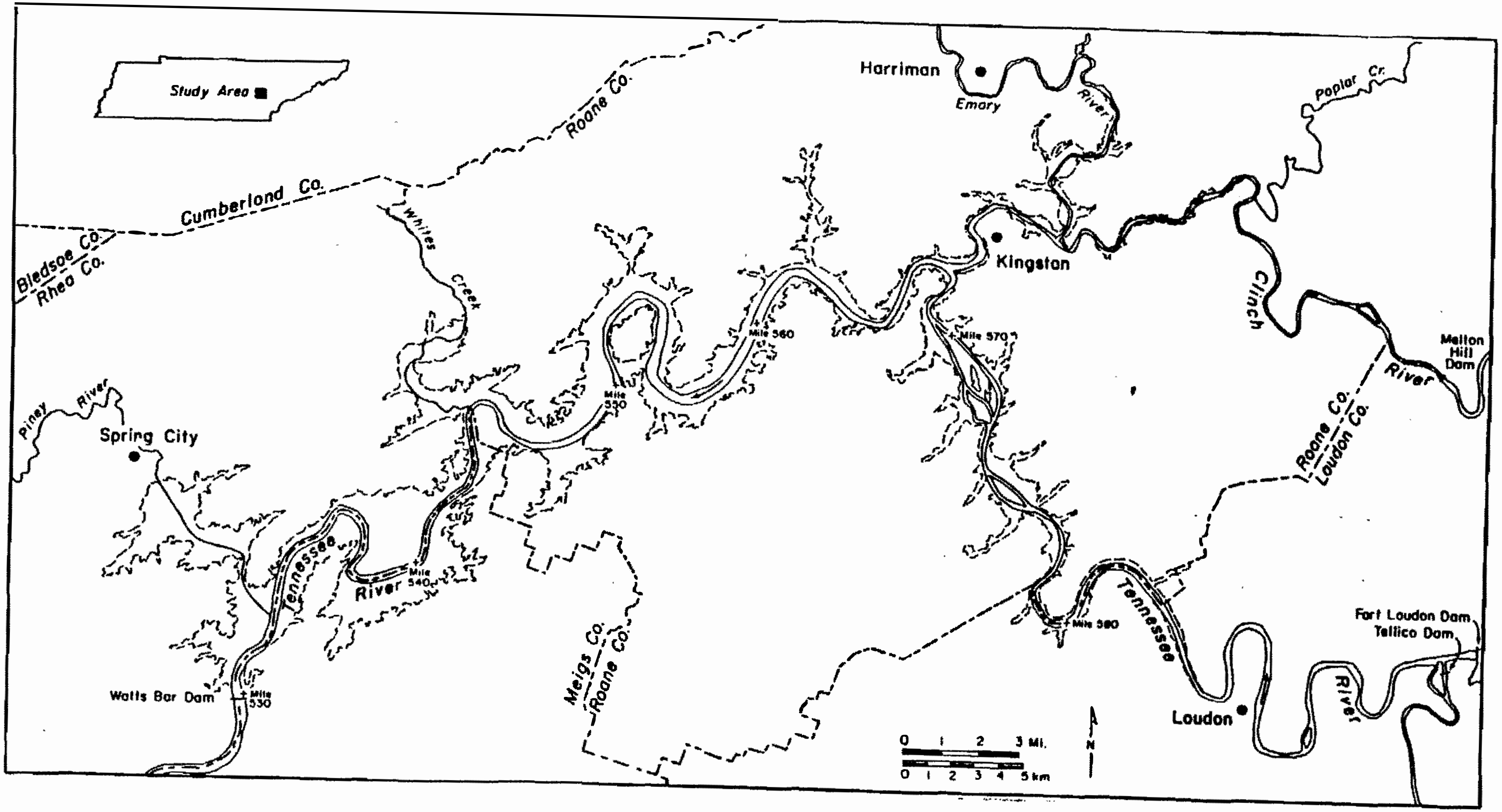


Figure 1. Location map of Watts Bar Reservoir study area.

prehistoric human settlement in the region, a view of the environmental context within which its inhabitants interacted is paramount.

Physiography

The Watts Bar Reservoir study area is located within the Carolinian biotic province, which forms the central portion of the great deciduous forest of the eastern United States (Dice 1943:16). Topographically, the region is located in the Ridge and Valley physiographic province which extends 1931 km from the St. Lawrence Valley in the north to the Gulf Coastal Plain in the south. At its maximum width, the province is 129 km; however, in East Tennessee it narrows to about 64 km, bordered on the east by the Blue Ridge physiographic province and on the west by the Appalachian Plateau physiographic province (Fenneman 1938:195; see Figure 2).

In general, the morphology of the Ridge and Valley province can be described as a lowland surrounded by even-topped longitudinal ridges, either of which may predominate (Fenneman 1938:196). In the southern section, the province narrows and the valley floor predominates with more distinct, lower and less abundant ridges than in the northern or middle sections. As a result, the boundaries against the highlands are more abrupt (Fenneman 1938:265).

The topographic features of the Ridge and Valley province are the result of four major tectonic processes: (1) general peneplaning; (2) upwarping; (3) reduction of the weaker rocks to plains at lower levels; and (4) further uplift and dissection (Fenneman 1938:197; see Figure 3).

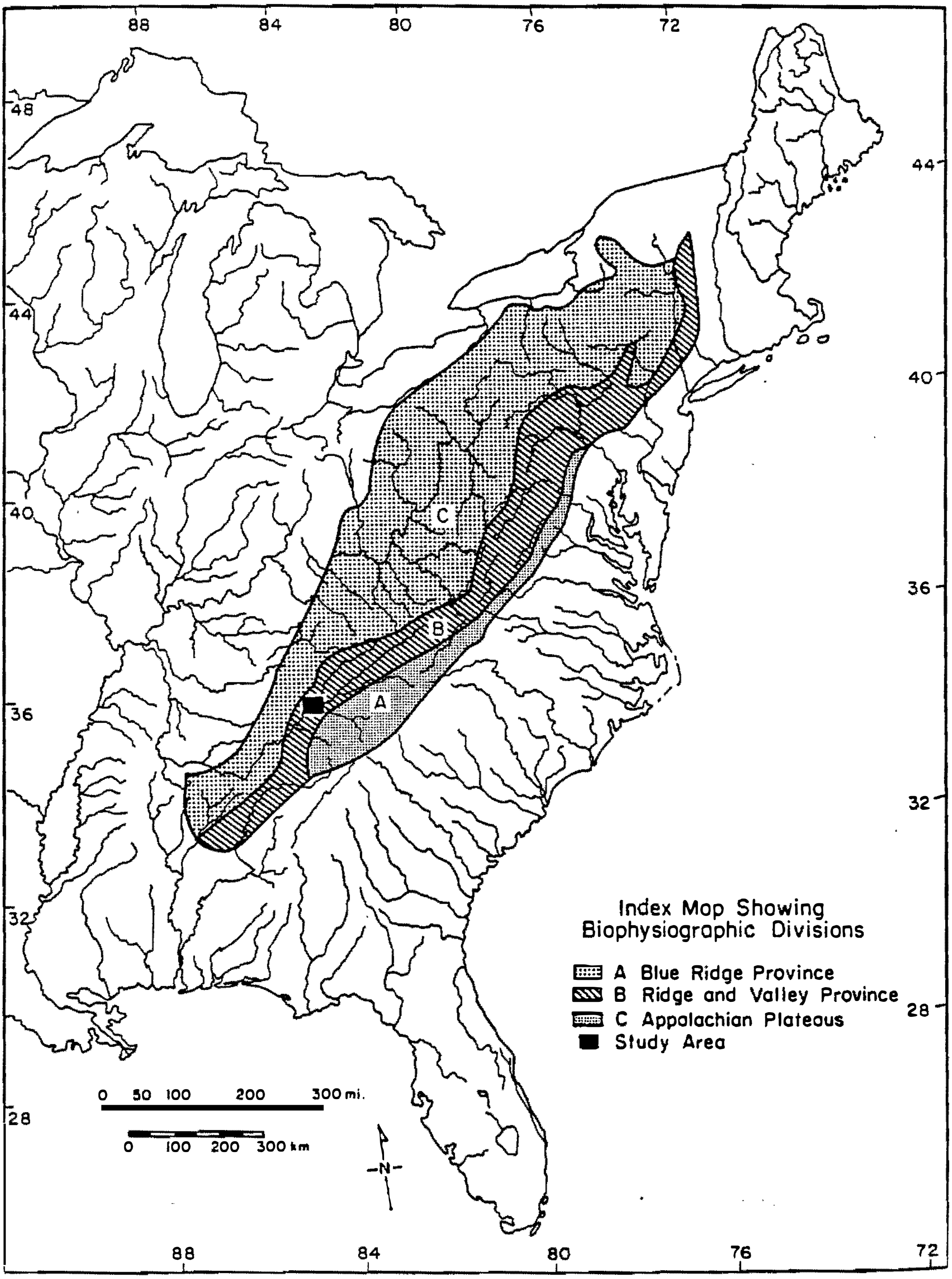


Figure 2. Map of physiographic provinces in relation to study area.

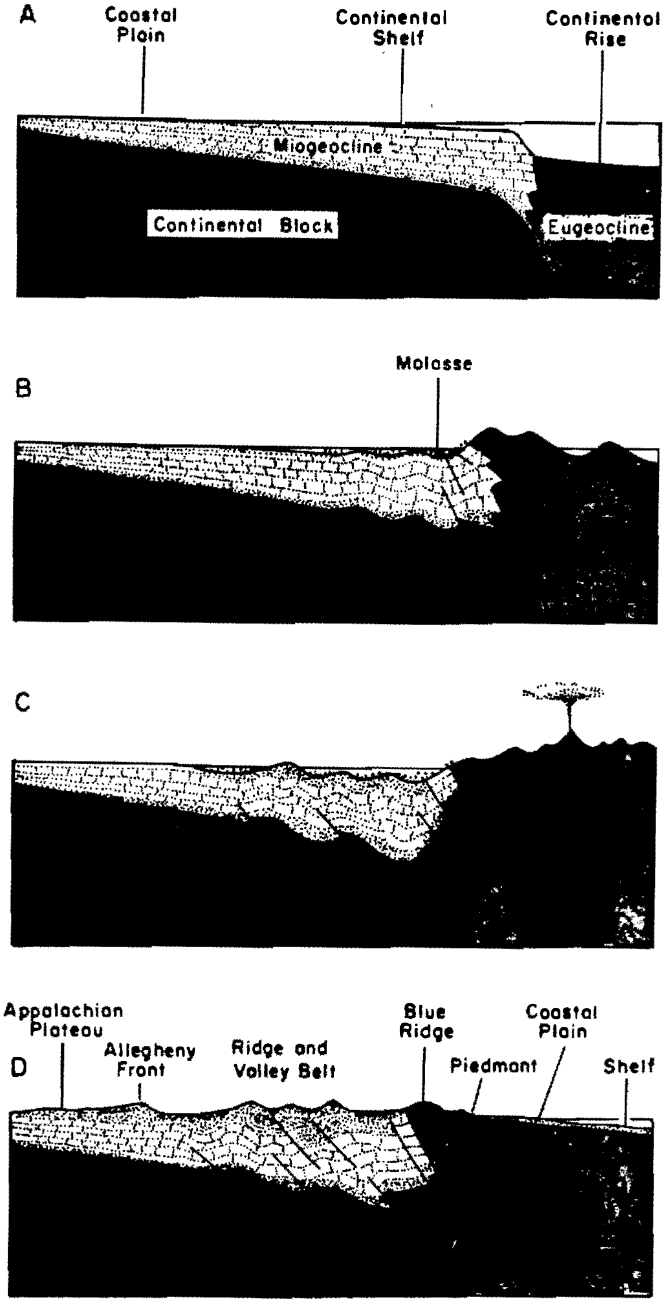


Figure 3. Cross section of formation processes responsible for Appalachian Mountains and Ridge and Valley. A. Sedimentary rock formation of Late Precambrian and early Paleozoic times. B. Movement of the African continental plate causes compression and warping of sediments. C. Further compression and warping of provinces (Modified from Dietz 1972).

The folding of Paleozoic rocks has produced outcroppings that have been subjected to selective erosional processes. Due to the varying hardness of the lithology, only a small number of these formations have survived to make a large number of the ridges. Three geologic groups are of significance: (1) the Medina sandstone at the base of the Silurian formation; (2) the Pocono (Mississippian) and the Pottsville (Pennsylvanian), both of which consist of sandstone and conglomerate; and (3) the Oriskany and Chemung sandstones (Devonian). However, within the southern section only the Pottsville and Pocono formations are of importance. These formations are also responsible for the Cumberland Plateau to the west (Fenneman 1938:195-196).

Where extensive areas are underlain by soft or soluble deposits, surface agencies leave little relief. This is generally true of the southern (Great Valley) section of the province (Fenneman 1938:200). Therefore, although ridges are a predominant feature of the province, the valley floor has been poorly developed.

The main valley of the study area was carved by the Tennessee River, which, from its origin 8 km east of Knoxville at the confluence of the Holston and French Broad rivers to about the city of Loudon (River Mile 592), flows roughly parallel to the strike of the rocks (see Figure 4). The Knox dolomite, Chickamauga limestone, and some underlying shale formations are responsible for this flow pattern; however, both the Knox and the Chickamauga formations are, in general, fairly soluble and thereby give rise to numerous sinks and caves (TVA 1936:67).

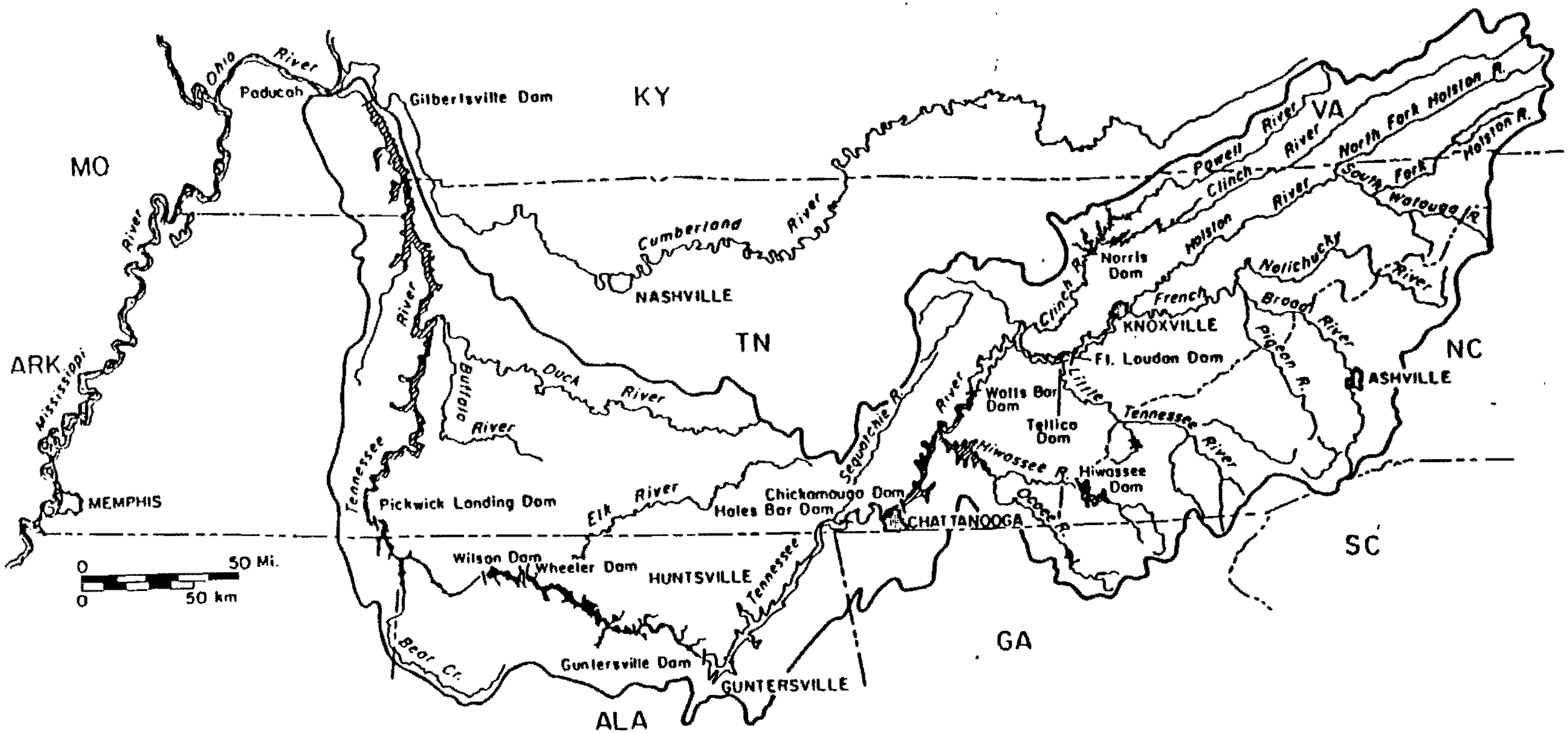


Figure 4. Map of the Tennessee River and its tributaries (Modified from TVA 1936).

Following a course parallel to the formations south of Loudon (River Mile 592) to Kingston (River Mile 570), the river crosses several faults. Not only are the Knox dolomite and Chickamauga limestone formations exposed, but also several shales and sandstones of various ages (TVA 1936:67). In the southern end of the upper Tennessee River, before it leaves the State at Chattanooga, the river again flows parallel to the formations, with the Knox dolomite being of most importance (TVA 1936:67).

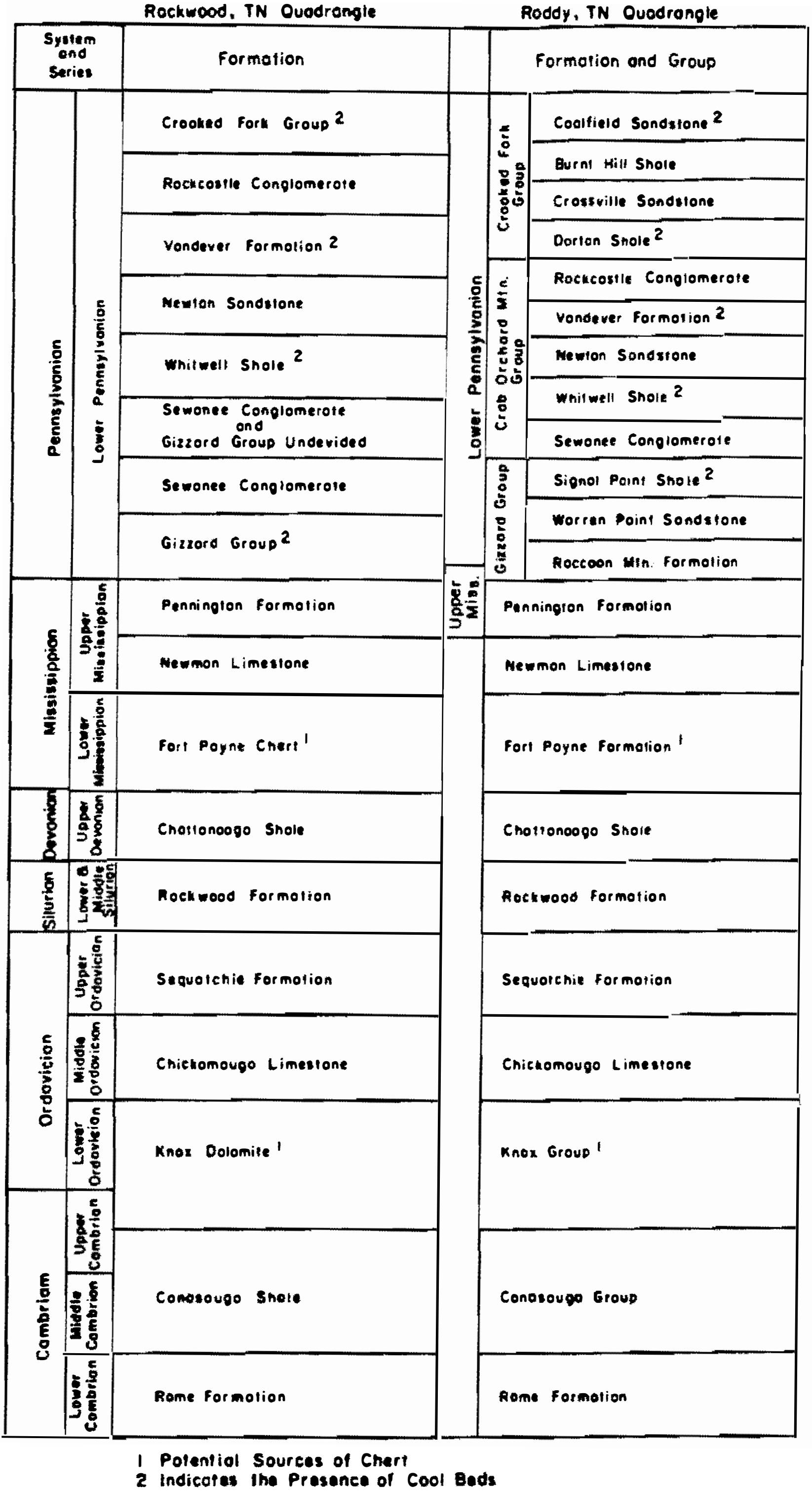
The geomorphic formation processes of the Ridge and Valley province have influenced not only topography, but also biotic aspects of the local environment. This environment of alternating lowlands and valleys has created unique microenvironmental habitats (Martin 1971), that have facilitated the development of a rich and diverse region for prehistoric human exploitation.

Geology

The geologic formations of the Ridge and Valley and its washboard topography are intimately related. The selective erosional process of the region is quite severe, and, as previously mentioned, folding may repeatedly bring the same stratum to the surface several times. In the humid climate of the eastern United States, limestone (unless cherty) is generally wasted away most rapidly; shale is usually more resistant, but both are weak. The well-cemented siliceous sandstone and conglomerate are the most resistant. As a result, a small number of strong formations suffice to make a great number of the ridges characteristic of this biogeographic province.

The underlying limestones and dolomites of the Great Valley were a major resource to the aboriginal peoples of the region, for they furnished the raw material for their lithic technology. In general, chert is found as nodules or lenses embedded in the residual clay overlying the bedrock. Other sources of chert for the peoples of the region were the gravel bars in the stream beds and the terraces where the erosion resistant chert pebbles and nodules are concentrated by alluvial processes (Kellberg 1963). The differential character and availability of the raw materials are an essential aspect of the lithic procurement strategy and therefore intimately tied to settlement patterns (Kimball 1984:88; see Figure 5). Despite the intensity of archaeological investigations in East Tennessee (specifically in the Tellico Reservoir region), few quarries or chert outcrops have been reported. In the Watts Bar region proper, Jolley (1982) identified five lithic extraction sites. Kimball (1984:88) argues this situation is the result of several factors, ranging from a lack of research interest and sampling biases to a general attitude that fine quality cherts are ubiquitous and that there is little variation within the Great Valley.

However, due to the complex geology of the region, considerable variability in lithic raw material is apparent, both in quality and spatial distribution. In addition to the faulting and folding processes that have created local patterns of drastically variable



Rockwood, TN Quadrangle

System and Series		Formation
Pennsylvanian	Lower Pennsylvanian	Crooked Fork Group[2]
		Rockcastle Conglomerate
		Vandever Formation[2]
		Newton Sandstone
		Whitwell Shale[2]
		Sewanee Conglomerate and Gizzard Group Undevided
		Sewanee Conglomerate
		Gizzard Group[2]
Mississippian	Upper Mississippian	Pennington Formation
		Newman Limestone
	Lower Mississippian	Fort Payne Chert[1]
Devonian	Upper Devonian	Chattanooga Shale
Silurian	Lower & Middle Silurian	Rockwood Formation
Ordovician	Upper Ordovician	Sequatchie Formation
	Middle Ordovician	Chickamauga Limestone
	Lower Ordovician	Knox Dolomite[1]
Cambriam	Upper Cambrian	Conasauga Shale
	Middle Cambrian	
	Lower Cambrian	Rome Formation

Roddy, TN Quadrangle

	Formation and Group	
Lower Pennsylvanian	Crooked Fork Group	Coalfield Sandstone[2]
		Burnt Hill Shale
		Crossville Sandstone
		Dorton Shale[2]
	Crab Orchard Mtn. Group	Rockcastle Conglomerate
		Vandever Formation[2]
		Newton Sandstone
		Whitwell Shale[2]
		Sewanee Conglomerate
	Gizzard Group	Signal Point Shale[2]
		Warren Point Sandstone
		Raccoon Mtn. Formation
Upper Miss.		Pennington Formation
		Newman Limestone
		Fort Payne Formation[1]
		Chattanooga Shale
		Rockwood Formation
		Sequatchie Formation
		Chickamauga Limestone
		Knox Group[1]
		Conasauga Group
		Rome Formation

1 Potential Sources of Chert
2 Indicates the Presence of Coal Beds

Figure 5. Geologic formations present within the Watts Bar Reservoir study area.

chert distributions, the processes of erosion, deposition and igneous intrusion have created a "local" source for exotic material in the river gravels (Kimball 1984:91).

The most abundant cherts in East Tennessee are from the Knox group formations. The Copper Ridge dolomite is most pervasive of this local group. This dolomite group constitutes a number of ridges (Phillips Ridge, Black Oak Ridge, Copper Ridge and Chestnut Ridge), which are dissected numerous times by the Tennessee and Clinch rivers and so should have provided an important source for prehistoric peoples of the region (Hardeman et al. 1966). In addition to the Knox group cherts, there are several other utilized lithic materials that derive from this region: dolomite, limestone, sandstone, shale, siltstone, crinoids and possibly hematite (Kimball 1984:95).

Another characteristic of the Great Valley is its karst features. The steeply dipping limestone beds on the flanks of the valley often have very little soil cover, which expose the solutionally corrugated surface of the limestone to climatic and erosional processes. Because of the underlying lithology, the Great Valley has an extensive number of sinkholes, swallow holes and sinking creeks, making it one of the major karst regions of the United States (Thornbury 1965:120; see Figure 6). Rockshelters and caves, a product of the karst topography, provided the potential for human occupation and use (e.g., Faulkner, ed. 1986).

The underlying geology and its geomorphic processes combined to create an environment of various natural resources which offered the

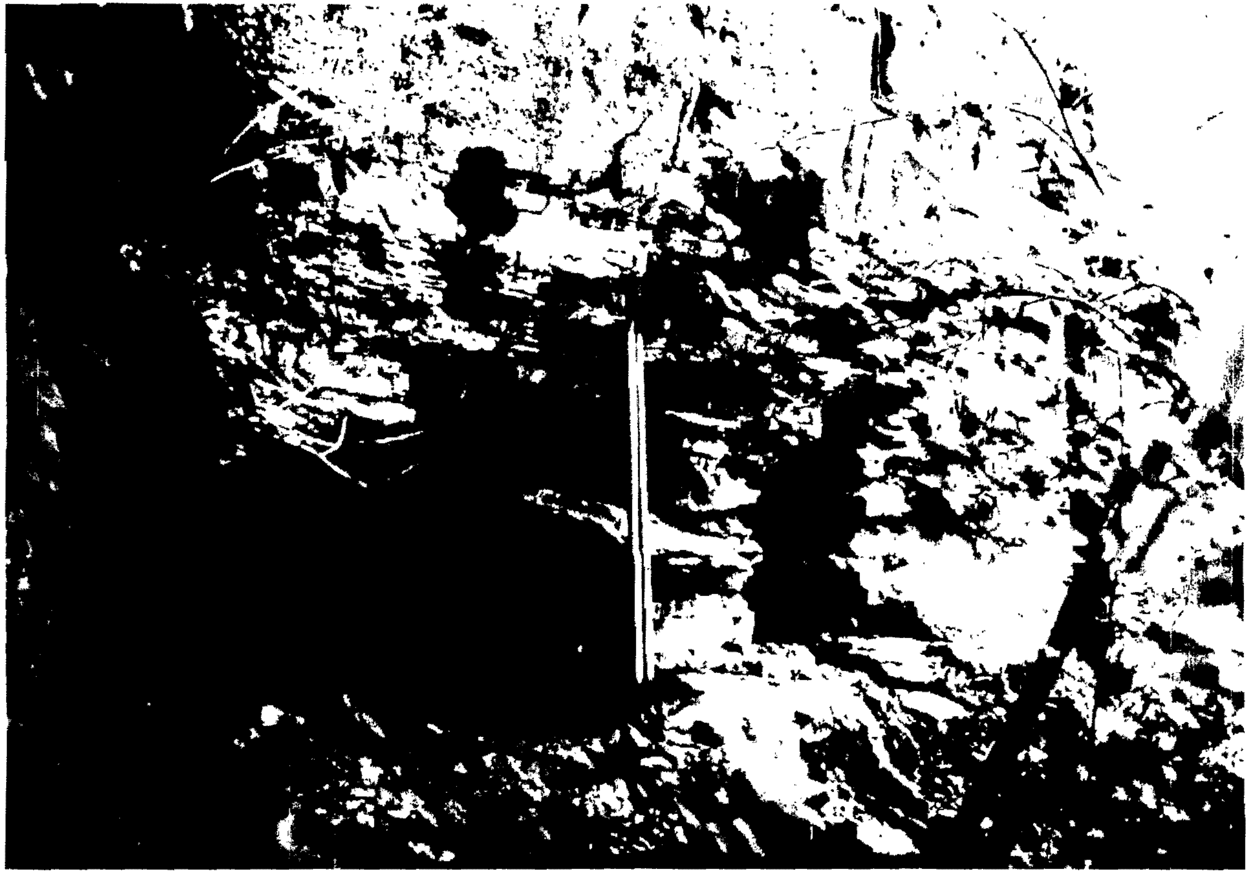


Figure 6. Typical natural shelter of the Great Valley.

potential for prehistoric peoples of East Tennessee to exploit for both technological raw materials and habitation.

Soils

Through time, soil characteristics have been important in determining human settlement, especially in the recent past when agriculture became the predominant pattern of subsistence. Such soil characteristics as texture, consistence, reaction, fertility, moisture conditions, relief and degree of stoniness and erosion potential (which influence productivity and workability), have profoundly influenced prehistoric settlement (Ward 1965; Webley 1972) and historically contributed to the prevailing local differences in social and economic conditions (Swann et al. 1942:17-18).

In the four-county area (Loudon, Meigs, Rhea and Roane) of the reservoir, soil conditions vary widely but can be classed topographically into four groups: (1) soils of the uplands; (2) soils of the colluvial lands; (3) soils of the terraces; and (4) soils of the bottomlands (Swann et al. 1942). However, in general, the soils of the region are representative of the Podzolized and Melanized Lateritic group (Braun 1974:25). Topography and parent materials of the soils, in concert with climate, vegetation and micro- and macro-organisms, influence soil genesis and thereby account for some of the differences in the soils of the region (Hasty et al. 1948:175-176).

The soils of the uplands have developed from residual parent materials released by the weathering of the underlying sedimentary rocks of which four kinds can be identified: (1) acid shale; (2) sandstone and sandstone interbedded with acid shale; (3) limestone; and (4) cherty dolomitic limestone. In general, the upland soils are classified as clayey or friable with a tough plastic subsoil, although local conditions create varying degrees in morphology and productivity (Swann et al. 1942:22; Hasty et al. 1948:24; Elder et al. 1961; Warren 1974:4-11).

The soils of the colluvial lands are the product of local alluvium and colluvium deposited at the foot of slopes where erosion is active. These soils are friable, acid in reaction, and fairly well to very well drained. Sandstone and limestone are, for the most part, the parent materials of these colluvial soils, with a minor percentage derived from shale (Swann et al. 1942:62; Hasty et al. 1948:29; Elder et al. 1961; Warren 1974:5-6).

Terrace soils occupy ancient floodplains that formed in the geologic past when the present rivers and streams flowed at considerably higher levels and deposited gravel, sand and clay. Progressive aggradation gradually formed new floodplains at lower levels, thereby leaving the older, higher floodplains above the overflow stage of the present streams. They are frequently referred to as terraces, second bottoms, or benches. Prior to impoundment, these older floodplains were periodically inundated with general stream alluvium that was washed from the uplands, which are underlain by limestone, sandstones and shales. The soils of the terraces are either very well or moderately well drained, acid in reaction, contain small to moderate quantities of water-worn gravel, and are of the highest productivity (Swann et al. 1942:687-69; Hasty et al. 1948:31; Elder et al. 1961; Warren 1974:7-11).

The bottomlands or modern floodplain, recently inundated by impoundment of the reservoir, are those areas along the streams that are presently subject to overflow and, as a result, are generally influenced by the character of the parent material and drainage conditions. All the soils of the bottomlands are young and immature and have not been stable long enough for the dynamic forces of soil genesis to develop distinct horizons. In general, these soils consist of material washed chiefly from soils overlaying limestone, sandstone and shale. Bottomland soils are variable, ranging from poorly drained to well drained and neutral to strongly acidic. Most are either silty clay or silty clay loam. As a result of this constant alluvial process and periodic rejuvenation, these soils are highly productive (Swann et al. 1942; Hasty et al. 1948:33; Elder et al. 1961; Warren 1974:11).

Although limited archaeological investigations of the Watts Bar Reservoir have been performed, extrapolating from other sites in East Tennessee in general and the Watts Bar area in particular, it is apparent that the most extensive area of aboriginal human occupation is in the bottomlands (T-1) and the inactive terraces (T-2) (McCollough and Faulkner 1973:30; Schroedl 1978:1; Delcourt 1980:121). By far these soils are the most attractive to both prehistoric and historic peoples of the region.

Climate

The regional climate of the Ridge and Valley is described as temperate continental, and, according to Thornewaite's (1948) classification, the area is humid and mesothermal with periods of drought at any season being of minimal consequence. Table 1 and Figure 7 present data from both Loudon and Oak Ridge, two stations within the study area, representing a 24 year period from 1931-1955 (Dickson 1974:370-384). Based on a Student's t-test (X^2=0.01, p>2.819, d.f.=22), no statistically significant difference between temperature and precipitation from the two recording stations exists (Zar 1984:484). However, local topographic variables, such as slope aspect, have been demonstrated to significantly influence temperature and associated microenvironmental communities (Shanks and Norris 1950). Therefore, although mean climatic conditions are equal across the region, local topographic variables can influence local weather patterns and biotic communities.

The average temperature for the region is 15.28°C. December is the coldest month with an average temperature of 4.94°C, while July represents the warmest month at 26.11°C. The length of the growing season is intimately linked to temperature and is usually defined as the number of days between freezes (temperatures of 0°C or below). From data collected at Loudon, the average growing season is 197 days, from about April 10 to October 24 (Dickson 1974:370-384).

Precipitation amounts and frequency are important variables for both plant and animal life. For this region the principal source of

Table 1. Mean precipitation (cm) and temperature (°C) for the Watts Bar Reservoir study area.[a]

Month	Precipitation		Temperature	
	Loudon	Oak Ridge	Loudon	Oak Ridge
January	14.15	12.48	5.17	4.22
February	13.34	13.23	5.83	5.22
March	14.07	14.33	8.72	9.06
April	9.75	10.90	14.44	14.28
May	9.60	9.60	19.83	18.89
June	8.69	10.62	24.56	23.44
July	13.59	12.27	26.11	24.83
August	9.07	11.30	25.56	24.11
September	6.96	7.54	22.44	21.72
October	6.63	7.04	16.11	15.17
November	9.04	10.01	8.89	8.61
December	12.19	13.23	4.94	4.50
Annual	127.08	133.05	15.28	14.50

[a] 24 year record (1931-1955) from Dickson 1974.

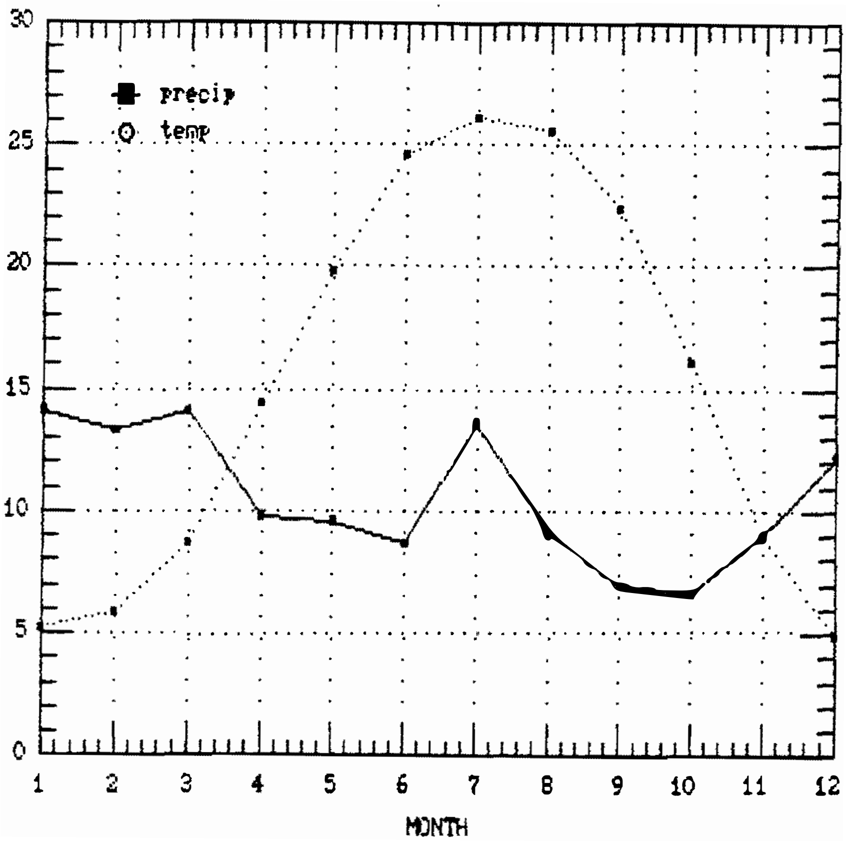


Figure 7. Line graph of average monthly temperature (°C) and precipitation (cm) from Oak Ridge and Loudon.

moist air is the Gulf of Mexico, and during the winter and early spring frequent large scale storms track over and near the region, making these months the periods of heaviest precipitation. However, a secondary period of maximum precipitation occurs in the midsummer when thunderstorm activity is greatest. Average snowfall in the valley varies in response to topography, but annual averages of 10 to 15 cm can be expected. Due to the relatively mild temperatures of the winter, a snow cover rarely lasts more than a few days (Dickson 1974:371). Specifically, the average annual total of precipitation is 127 cm. January represents the wettest month with 14 cm of precipitation, while October is the driest, receiving only about 6.5 cm. The average relative humidity is 70.25% (Dickson 1974:375).

Although severe storms in the valley are rare, periodic flooding has occurred. Therefore, prior to the Tennessee Valley Authority's flood-control program, the valley was subject to periodic inundation due to summer flash floods caused by heavy thunderstorms. Heavy seasonal rains from December through March also caused periodic flooding. The greatest flood known to have occurred in the valley was in the vicinity of Lenoir City on March 7-8, 1867 (TVA 1964:2,4). Although the cataclysmic results of floods are all too apparent, the periodic flooding provided constant rejuvenation of the floodplain soils (Smith 1978b:485), as well as the creation of temporary shallow water areas that could have provided easy exploitation of stranded fish species as they have in other areas of the Southeast (Smith 1978b:435; Limp and Reidhead 1979). Tables 2 and 3 provide flood data for the study area.

Table 2. Annual maximum flood elevation of the Clinch and Tennessee rivers at Kingston, Tennessee 1867-1957.[a]

Date	Crest Stage (Ft.)	Elevation
	Clinch River	
March 1867	43.4	745.6
February 1875	38.8	741.0
January 17, 1885	16.9	719.1
March 31, 1886	33.8	736.0
February 15, 1887	17.5	719.7
March 30, 1888	15.6	717.8
February 19, 1889	18.5	720.7
February 28, 1890	28.5	730.7
February 12, 1891	24.3	726.5
January 15, 1892	25.4	727.6
February 19, 1893	22.6	724.8
February 5, 1894	17.4	719.6
January 11, 1895	21.7	723.9
March 19, 1896	11.5	713.7
February 24, 1897	27.0	729.2
September 4, 1898	13.0	715.3
March 21, 1899	27.1	729.3
February 14, 1900	15.0	717.2
December 31, 1901	28.8	731.0
March 2, 1902	28.3	730.5
April 9, 1903	23.4	725.6
March 25, 1904	13.1	715.3
February 10, 1905	13.1	715.3
November 20, 1906	22.6	724.8
June 16, 1907	13.9	716.1
February 16, 1908	15.4	717.6
May 2, 1909	15.3	717.5
February 19, 1910	9.5	711.7
April 7, 1911	19.5	721.7
April 3, 1912	21.0	723.2
March 28, 1913	22.8	725.0
December 27, 1914	18.4	720.6
December 19, 1915	20.8	723.0
July 19, 1916	19.8	722.0
March 6, 1917	33.0	735.0
January 31, 1918	29.0	731.2
January 4, 1919	19.5	721.7
April 3, 1920	27.0	729.2
February 12, 1921	18.8	721.0
January 2, 1922	20.3	722.5
February 6, 1923	20.4	722.6

Table 2. (continued)

Date	Crest Stage (Ft.)	Elevation
January 4, 1924	15.5	717.7
January 13, 1925	13.4	715.6
December 26, 1926	23.5	725.7
February 25, 1927	19.2	721.4
July 1, 1928	21.6	723.8
March 24, 1929	27.0	729.2
March 20, 1930	11.6	713.8
April 7, 1931	13.2	715.4
December 30, 1932	23.3	725.5
February 16, 1933	19.9	722.1
March 5, 1934	21.8	724.0
	Tennessee River	
March 28, 1935	21.6	721.5
March 28, 1936	24.8	724.7
January 4, 1937	20.3	720.2
July 25, 1938	13.6	713.5
February 16, 1939	20.0	719.9
August 17, 1940	16.0	715.9
April 5, 1941	9.0	708.9
March 4, 1942		745.45
January 1, 1943		744.25
April 12, 1944		742.0
April 26, 1945		740.71
May 15, 1946		742.9
May 23, 1947	42.2	742.24
April 25, 1948	43.63	743.63
May 2, 1949	44.8	744.8
May 15, 1950	45.0	745.0
May 6, 1951	42.5	742.5
May 31, 1952	42.59	742.59
May 3, 1953	44.2	744.2
December 30, 1954	42.9	742.9
March 4, 1955		742.12
April 17, 1956		743.48

[a] Tennessee Valley Authority 1957.

Table 3. Greatest known floods on the Tennessee River at Loudon, Tennessee.[a]

Date	Crest Stage (Ft.)	Elevation
March 8, 1867	47.8	774.1
February 27, 1875	44.6	770.9
April 1, 1886	38.1	764.4
March 5, 1917	32.5	758.8
April 3, 1920	31.3	757.6
April 2, 1896	29.3	755.6
November 20, 1906	28.9	755.2
January 15, 1892	27.7	754.0
February 28, 1890	26.7	753.0
July 19, 1916	26.7	753.0

[a] Tennessee Valley Authority 1964.

The most important function of wind is the transportation of moisture from the ocean or other large bodies of water to land, where it condenses and is precipitated in some form of moisture for the sustenance of plant and animal life. In addition, winds can have an important physiological aspect. Depending on the temperature, winds can be blessing or a major problem due to the chilling effect air movement has upon the body. Within the study area prevailing winds vary seasonally, although winds from the southwest are most common with an average velocity of 7.14 kph. At McGhee-Tyson Airport, maximum winds of 114 kph were recorded in April 1944 (Dickson 1974).

Faunal Resources

The diversified topography of the Ridge and Valley, in close proximity to the uplands of the Cumberland Plateau to the west and the Unakas to the east, provided a rich environment for the peoples of this region. Wild game was abundant and included many species of small and large mammals and wild fowl of various kinds (Timberlake in Williams 1927). However, the riverine environment of the Tennessee River and its many tributaries was the main focus, not only for the availability of food resources it offered, but also for habitation.

The meandering course of the Tennessee and Clinch rivers, constrained by erosion resistant lithologies, created a linear band of microenvironmental areas that were easily accessed and exploited. Seasonal and long term shifts in the riverine regime provided the economic center for prehistoric settlement and an impetus for socio-economic change (i.e., Binford 1968; O'Brien 1987). The following section incorporates modern and archaeological data in an attempt to provide an overview of the modern environment prior to the arrival of Euro-American settlers.

The rivers and streams of the valley, with their alternating patterns of swift water (i.e., shoals and bars) and deep pools, maintained a very high biomass. In addition, sloughs and seasonal backwaters, created during annual flood cycles, provided an economically efficient protein source. Prior to impoundment and channelization, the introduction of exotic species, and extensive pollution, tremendous quantities of fish were available for exploitation (Fitz 1968). Table 4 provides a partial list of the species found in the study area.

Because all native species are probably edible, the paucity of species in the archaeological record is perplexing. Suckers (family Catostomidae), gar (Lepisosteus sp.), bullhead catfish (Ictalurus sp.) and freshwater drum (Aplodinotus grunniens) are the taxa of fish which appear in archaeological contexts in numbers significant enough to suggest their importance as a food resource (Parmalee 1973:Table 7; Bogan 1980:51-53; see Table 5). Poor preservation of the fragile skeletons of fish, excavation techniques (i.e., flotation techniques) (Limp and Reidhead 1979), and the seasonal conflict with other hunting activities (Bogan 1980:54) may provide reasons for the severe lack of fish remains in East Tennessee archaeological sites.

Table 4. Modern aquatic resources of the Watts Bar Reservoir study area.[a]

Scientific Name	Common Name
FISH	
Acipenser fulvescens	Lake sturgeon
Lepisosteus oculatus	Spotted gar
Lepisosteus plattostomus	Shortnosed gar
Hiodon alosoides	Goldeye
Dorosoma cepedianum	Gizzard shad
Alosa chrysochloris	Skipjack herring
Cycleptus elongatus	Black horse
Ictiobus bubalus	Smallmouth buffalo
Ictiobus cyprinellus	Bigmouth buffalo
Carpiodes cyprinus	Quillback
Carpiodes carpio	Carpsucker
Carpiodes velifer	Highfin carpsucker
Catostomus commersonnii	White sucker
Minytrema melanops	Spotted sucker
Erimyzon succetta	Chub sucker
Moxostoma duquesnii	Black redhorse
Moxostoma erythrurum	Golden redhorse
Moxostoma anisurum	Silver redhorse
Moxostoma carinatum	Redhorse
Pimephales notatus	Bluntnosed minnow
Notemigonus crysoleucas	Golden shinner
Campstoma anomalum	Stone roller
Phoxinus erythrogaster	Southern redbellied dace
Ictalurus punctatus	Channel cat
Pylodictis olivaris	Mud cat
Ictalurus melas	Black bullhead
Ictalurus nebulosis	Brown bullhead
Ictalurus natalis	Yellow bullhead
Noturus flavus	Brindled stonecat
Noturus eleutherus	Mountain madtom
Noturus gryinus	Tadpole madtom
Esox masquinongy	Muskellunge
Anguilla rostrata	Freshwater eel
Fundulus catenatus	Studfish
Gambusia affinis	Mosquito fish
Aphredoderus sayanus	Pirate perch
Morone chrysops	White bass
Morone mississippiensis	Yellow bass
Perca flavescens	Yellow perch
Stizostedion canadense	Sand pike

Table 4. (continued)

Scientific Name	Common Name
Stizostedion vitreum	Walleye
Etheostoma blenniodes	Southern greensided darter
Etheostoma caeruleum	Rainbow darter
Micropterus salmoides	Largemouthed bass
Micropterus dolomieu	Smallmouth bass
Micropterus punctuletus	Spotted bass
Pomoxis annularis	White crappie
Pomoxis nigromaculatus	Black crappie
Ambloplites rupestris	Rock bass
Lepomis machrochirus	Bluegill
Aplodinutus grunniens	Drum
Cottus carolinae	Banded sculpin

[a] Original list compiled by Kuhne 1939, taxonomic updates following Pflieger 1975.

Table 5. Vertebrate faunal remains recovered from archaeological sites within the Watts Bar Reservoir study area.[a]

	SITE NUMBER AND CONTEXT[c]																	
	40LD45								9RE4	40RH6		VT1RH41		85RH41		93RH41	125RH42	TOTAL
SPECIES[b]	VI	V	IV F12	IV F11	IV Gen.	III	II	I	Lev.2	Lev.8	Lev.7	1	2	1	2	1		
MAMMALS																		
<u>Odocoileus virginanus</u> (White-tailed Deer)	8		5		3		46	65	7	10	5	85	23	476	52	13	36	834
<u>Cervus canadensis</u> (Elk)							1							2				3
<u>Ursus americanus</u> (Black Bear)												4		18	2			24
<u>Canus familiarus</u> (Dog)														17	1			18
<u>Felis concolor</u> (Pumua)														5				5
Indeterminate Fox														2				2
<u>Dedelphis marsupialis</u> (Opossum)														3	2		1	6
<u>Sciurus</u> sp. (Squirrel)							1	1					1	4	2			9
<u>Marmota monex</u> (Woodchuck)														2				2
<u>Sylvilagus floridana</u> (Eastern cottontail)												2		2	1			5
<u>Castor canadensis</u> (Beaver)					1		1	2						3				7
<u>Procyon lotor</u> (Raccoon)												2		10	2			14
<u>Mustela vison</u> (Mink)																	1	1
Indeterminate mammal	58	1	31	202	15	14	530	633		2								1486
AVIFAUNA																		
<u>Melagris gallopavo</u> (Turkey)							2	3		1		10	3	50	1	2	2	74

Table 5. (continued)

	SITE NUMBER AND CONTEXT[c]																	
			40LD45						9RE4	40RH6		VT1RH41		85RH41		93RH41	125RH42	TOTAL
SPECIES[b]	VI	V	IV			III	II	I	Lev.2	Lev.8	Lev.7	1	2	1	2	1		
			F12	F11	Gen.													
cf. *Grus canadensis* (Sandhill Crane)			1															1
Indeterminate bird	1		3				19	21				4		8	2			58
HERPTOFAUNA																		
Chelydra serpentina (Snapping Turtle)								1										1
Trionyx sp. (Soft-shell Turtle)							21	21										42
Sternothaerus odoratus (Musk Turtle)							2	2										4
Terrapene cf. *carolina* (Eastern Box Turtle)	1						13	20										34
Pseudemys, Graptemys, Chrysemys group (Turtle spp.)							20	17										37
Turtle spp.	3			3			88	71	3			26	7	99	20		3	323
Bufo sp. (Toad)							1											1
Indeterminate snake								1										1
FISH																		
Lepisosteus sp. (Gar)							1											1
Family Catostomidae (Sucker)			1															1
Ictalurus sp. (Catfish/Bullhead)			1															1

Table 5. (continued)

	SITE NUMBER AND CONTEXT[c]																	
	40LD45								9RE4	40RH6		VT1RH41		85RH41		93RH41	125RH42	TOTAL
SPECIES[b]	VI	V	IV			III	II	I	Lev.2	Lev.8	Lev.7	1	2	1	2	1		
			F12	F11	Gen.													
Aplodinotus grunniens (Freshwater Drum)	33		1				8	5										47
Indeterminate Fish	1						6	4				1	1	19	2		30	64
TOTAL	119	1	38	203	18	14	760	866	10	13	5	134	35	720	87	15	43	3106

[a] References: Parmalee 1973; Calabrese 1976; WPA sites from files at McClung Museum.

[b] Species counts represent NISP.

[c] Context: 9RE4 - Level 2 Woodland; 40RH6 - Level 8 Middle/Late Woodland; 40RH6 - Level 7 Woodland; VT1RH41 - Stratum 1 Late Mississippian; VTIRH41 - Level 2 Early Woodland; 85RH41 - Stratum 1 Mouse Creek; 86RH41 - Stratum 2 Early Woodland; 125RH42 - Woodland.

Molluscan fauna are another seasonally available food resource that was exploited aboriginally. Although the quantity of molluscan valve remains are ubiquitous in many prehistoric sites in the southeastern United States, the use of this resource as a primary food source has been disputed (Parmalee and Klippel 1974). Analysis of the molluscan remains from the study area (40LD45, 40LD46 and 40RE108) indicates that a minimum of 52 species was exploited (Charles 1973:149; Parmalee and Bogan 1986; Parmalee n.d.). This number of exploited species is in contrast to the 75 species that have been identified from collections made in the upper Tennessee River system, both prior to and following impoundment (see Table 6). The disparity in the temporal and spatial distribution of species from the modern and archaeological collections is somewhat ambiguous, but is probably related either to differences in subsistence patterns, cultural preference, seasonality, environmental change, or specific species habitat (Charles 1973:157; Parmalee, Klippel and Bogan 1982; Warren 1975). Detailed analysis of habitat requirements of prehistorically exploited molluscan species can provide insight about past aquatic environments (e.g. Matteson 1958; Parmalee 1956), and also of shifts in human food resource exploitation (i.e., Klippel et al. 1978).

Turtles were another important supplement in the diets of the aboriginal peoples of the area, and of the seven aquatic species known in the Tennessee River at least four are represented in the archaeological record (Parmalee 1973:146; see Table 7). From the Higgs

Table 6. Molluscan species identified from archaeological collections and modern collections in the upper Tennessee River system.

Species[a]	Collection[b] Prehistoric	Ortmann	Hickman	Scruggs	Stansberry	Isom	Bates	Pardue
Megalonaias gigantea								x
Cumberlandia mondonta		x	x					
Lemiox remosus[1]	x	x						
Oromus dromas[1]	x	x	x					x
Fusconaia barnsiana		x	x					
Fusconaia subrotunda	x	x	x	x	x			
Fusconaia pilaris	x	x	x					
Fusconaia cuneolus		x	x					
Actinonaias lingamentina	x							
Actinonaias carinata	x							
Amblema costata			x	x				x
Amblema plicata	x	x						
Cyclonaias tuberculata	x	x	x	x	x	x		x
Cyprogenia irrotata	x	x	x					x
Cyprogenia stegaria	x							
Elliptio dilatatus	x		x	x	x	x		x
Elliptio crassidens	x	x	x	x	x	x	x	x
Ptychobranchus fasciolaris	x							
Ptychobranchus subtentum[1]	x	x						
Quadrula intermedia[1]		x	x					
Quadrula metanerva		x		x	x			x
Quadrula postulosa	x	x	x	x		x	x	x
Quadrula cylindrica	x	x	x					
Quadrula sparsa[1]	x							
Epioblasma turulosa turulosa[2]	x	x	x					
Epioblasma torulosa propinqua[2]	x	x	x					
Epioblasma capsaeformis	x	x						
Epioblasma lewisi[2]		x	x					
Epioblasma perplexa	x							
Epioblasma cf. *obliquata*[1]	x							
Epioblasma stewardsoni[2]	x	x						
Epioblasma arcaeoformis[2]	x	x						
Epioblasma interupta		x						
Epioblasma florentina[2]	x							
Epioblasma lenior[2]		x	x					

Table 6. (continued)

	Collection[b]							
Species[a]	Pre-historic	Ortmann	Hickman	Scruggs	Stansberry	Isom	Bates	Pardue
Epioblasma triquetra	x	x	x					
Epioblasma haysiana[1]	x	x						
Epioblasma brevidens	x		x					
Plethobasus cicatricosus[1]	x							
Plethobasus cyphus	x	x	x	x			x	x
Plethobasus cooperianus	x	x		x				
Pleurobema clava	x							
Pleurobema obliquum		x						
Pleurobema plenum[1]	x				x			
Pleurobema cordatum	x	x	x	x	x	x	x	x
Pleurobema obliquum rubrum		x						
Pleurobema pyramidatum	x		x		x			
Pleurobema oviforme		x						x
Lexingtonia dolabelloides	x	x						
Obovaria olivaria	x			x				
Obovaria subrotunda	x	x						
Hemistena lata		x						
Lasmigona costata		x	x					
Alasmidonta marginata		x	x					
Strophitus undulatus		x						
Ellipsaria fasciolaris		x						
Ellipsaria lineolata		x		x	x			x
Obliquaria reflexa		x		x		x	x	x
Actinonaias carinata		x	x	x				
Actinonaias pectorosa		x						
Truncilla truncata		x						
Leptodea leptodon		x	x					
Leptodea fragilis		x	x					x
Proptera alata		x	x	x	x	x		x
Proptera laevissima							x	
Toxolasma lividens		x						
Medionidus conradicus		x	x					
Villosa fabalis		x						
Villosa nebulosa		x						
Villosa vanusemensis		x						
Villosa trabalis	x							
Villosa cf. *tarniata*	x							

Table 6. (continued)

Species[a]	Collection[b] Prehistoric	Ortmann	Hickman	Scruggs	Stansberry	Isom	Bates	Pardue
Legumia recta	x	x	x	x	x			x
Lampsilis ovata	x	x	x	x	x			x
Lampsilis fasciola		x						
Lampsilis orbiculata		x			x			x
Tritigonia verrucosa				x			x	x
Anodonta corpulenta							x	x
Anodonta suborbiculata							x	
Anodonta grandis								x
Total Species Identified	46	58	33	17	14	7	8	21

[a] Superscript numbers alongside certain species denotes present status (Stansberry 1971; Bogan and Parmalee 1983): [1]endangered; [2]extinct.

[b] Collections were made from the upper Tennessee River drainage between TRM 498 and ca. 620 (Chickamauga, Watts Barr and Ft. Loudon reservoirs). Hickman's (1937) collection was made from the Clinch River in the vicinity of Norris Dam. Collection locations: Prehistoric collections from sites 40LD45, 40LD46, 40LD49, 40LD50 and 40RE108 (Charles 1973; Parmalee n.d.; Parmalee and Bogan 1986; Parmalee n.d. Ortmann (1918) TRM ca. 620-614, Hickman (1937) ca. CRM 80, Scruggs (1960) TRM 498-519, Stansberry (1964) TRM 515-521, Isom (1969) TRM 1969) 471-529.9, Bates (1975) n/a, Pardue (1979) TRM 514.2-528.9.

Table 7. Modern herptofauna of the Watts Bar Reservoir study area.[a]

Scientific Name	Common Name	Habitat[b]
HERPTOFAUNE		
Rana palustris	Pickerel Frog	aquatic
Rana clamituns melanota	Green Frog	aquatic
Rana catesbeiana	Bullfrog	aquatic
Acris crepitans crepitans	Northern Cricket Frog	aquatic
Pseudacris triseriata feriarum	Upland Chorus Frog	semi-aquatic
Hyla cruciter	Spring Peeper	terrestrial
Hyla versicolor versicolor	Eastern Gray Treefrog	terrestrial
Rane pipiers pipiers	Northern Leopard Frog	terrestrial
Gastrophryne carolinensis	Eastern Narrow-Mouthed Toad	semi-aquatic
Bufo terrestris americanus	American Toad	semi-aquatic
Bufo woodhousei fowleri	Fowler's Toad	aquatic
Scaphiopus holbrookii holbrookii	Eastern Spade-foot Toad	
Rana pipiers sphenocephala	Southern Leopard Frog	
Ambystoma maculatum	Spotted Salamander	semi-aquatic
Ambystoma opacum	Marbled Salamander	terrestrial
Ambystoma tigrinum tigrinum	Eastern Tiger Salamander	semi-aquatic
Diemictylus viridescens viridescens	Red-spotted Newt	aquatic
Desmognathus fuscus fuscus	Northern Dusky Salamander	aquatic
Plethodon cinereus cinereus	Red-backed Salamander	terrestrial
Plethodon glutinosus glutinosus	Slimy Salamander	terrestrial
Hemidactylium scutatum	Four-toed Salamander	semi-aquatic
Pseudotrition ruber ruber	Northern Red Salamander	aquatic
Eurycea bislineata bislineata	Northern Two-lined Salamander	aquatic
Eurycea longicauda longicauds	Long-tailed Salamander	aquatic
Eurycea lucifuga	Cave Salamander	caves
Chelydra serpentina serpentina	Common Snapping Turtle	aquatic
Trionyx muticus	Smooth Softshelled Turtle	aquatic
Trionyx spiniter spiniter	Eastern Spiney Softshelled Turtle	aquatic
Kinosternon subrubrum subrubrum	Eastern Mud Turtle	semi-aquatic
Chrysemys picta picta	Eastern Painted Turtle	terrestrial
Graptemys geographica	Map Turtle	aquatic

Table 7. (continued)

Scientific Name	Common Name	Habitat[b]
Pseudemys scripta	Pond Slider	aquatic
Terrapene carolina carolina	Eastern Box Turtle	terrestrial
Sceloporus undulatus hyacinthinus	Northern Fence Lizard	terrestrial
Lygosome laterale	Ground Skink	terrestrial
Eumeces laticeps	Broad-headed Skink	terrestrial
Eumeces fasciatus	Five-lined Skink	terrestrial
Cnemidophorus sexlineatus	Six-lined Racerunner	terrestrial
Natrix sipedon sipedon	Northern Water Snake	aquatic
Natrix septemvittata	Queen Snake	aquatic
Natrix rhombifera rhombifera	Diamond-backed Water Snake	aquatic
Thamnophis sirtalis sirtalis	Eastern Garter Snake	terrestrial
Heterodon platyrhinos	Eastern Hognose Snake	terrestrial
Agkistrodon contortrix controtrix	Southern Copperhead	terrestrial
Agkistrodon piscivorus piscivorus	Eastern Cottonmouth	semi-aquatic
Crotalus horridus horridus	Timber Rattlesnake	terrestrial

[a] Tennessee Valley Authority 1972.

[b] Conant 1975. Habitats were identified from instruction in Conant (1975) and generalized to terrestrial or aquatic depending on the species' most common habitat.

site, seven taxa of turtle are represented: snapping turtle (Chelydra serpentina), musk turtle (Sternothaerus odoratus), eastern box turtle (Terrapene carolina), slider (cf. Pseudemys), softshell (Trionyx sp.), and the genera Gramtemys and Chrysemys (Parmalee 1973:Table 7; see Table 5).

While the role of riverine resources is contentious, probably due to sampling biases or preservation, the significance of mammals as a resource is indubitable, with white-tailed deer (Odocoileus virginianus) representing the primary source of meat protein in the diet of prehistoric peoples in the Southeast (Hudson 1982:15). In the mid-eighteenth century, Timberlake observed an abundant array of species, including bison, bear, deer, panthers, wolves, foxes, squirrels, raccoons, rabbits and opossums (Williams 1927:71; see Table 8). The East Tennessee archaeological record supports the prehistoric presence of these mammal species and indicates the importance placed on mammal species and indicate the importance placed on mammals for food, tools, exchange items, and socio-religious items (Parmalee 1973:Table 7; Bogan 1980:Tables 2, 13; see Table 5). In addition to the mammals of the region, birds constituted an important economic resource. Although the eastern Tennessee River Valley is not within a major flyway, several species of migratory birds are seasonally common, as well as, several species of resident avifauna (see Table 9). Turkey (Meleagris galloparo) and various other species of birds were important for their meat, feathers and bones (Bogan 1980:Tables 2, 13; see Table 5).

Table 8. Modern faunal resources of the Watts Bar Reservoir study area.[a]

Scientific Name	Common Name	Habitat[b]
Didelphis virginia	Virginia Opossum	woodlands, streams
Scalopus aquaticus	Eastern Mole	terraces
Cryplotis parva	Least Shrew	open fields, marshes
Blarina brevicauda	Shorttail Shrew	diverse habitats
Sorex longirostris	Southeastern Shrew	open fields
Sorex fumeus	Smoky Shrew	woodlands
Myotis keeni	Keen Myotis	caves, hollow trees, wooded areas
Myotis lucifugus	Little Brown Myotis	caves, hollow trees
Myotis sodalis	Indiana Myotis	caves, hollow trees
Myotis austroriparius	Southeastern Bat	caves, hollow trees
Myotis grisescens	Gray Myotis	caves
Nycticeius humeralis	Evening Bat	hollow trees
Pipistrellus subtlovus	Eastern Pipistrel	caves, wooded areas
Eptesicus fuscus	Big Brown Bat	caves, hollow trees, wood areas
Laslurus cinereus	Hoary Bat	wooded areas
Lasiurus borealis	Red Bat	wooded areas
Lasiomycteris noctivagers	Silver-haired Bat	wooded areas
Corynorhimus macrotis	Eastern Big-eared Bat	caves
Procyon lotor	Raccoon	along streams
Mustela frenata	Longtail Weasel	diverse, but near water
Mustela erminea	Shorttail Weasel	wood areas
Mustela vison	Mink	along streams and lakes
Lutra canadensis	River Otter	along streams and lakes
Spilogale putorius	Spotted Skunk	wooded areas near water
Mephitis mephitis	Striped Skunk	mixed woods
Vulpes fulva	Red Fox	mixed forest and open country
Urocyon cinereoargenteus	Gray Fox	open forests
Lynx rufus	Bobcat	swamps and forests
Marmota monax	Woodchuck	open woods
Tamias striatus	Eastern Chipmunk	deciduous forests
Sciurus carolinensis	Eastern Gray Squirrel	hardwood forests, floodplains
Sciurus niger	Eastern Fox Squirrel	open forests
Glaucomys volans	Southern Flying Squirrel	forests
Castor canadensis	Beaver	wooded floodplains

Table 8. (continued)

Scientific Name	Common Name	Habitat[b]
Reithrodontomys humulis	Eastern Harvest Mouse	marshes, wet meadows
Peromyscus leucopus	White-footed Mouse	wooded areas
Peromyscus nuttalli	Golden Mouse	forests
Peromyscus gossycpinus	Cotton Mouse	wooded areas
Oryzomys palustris	Rice Rat	marshy areas
Sigmodon hispidus	Hispid Cottonrat	moist open fields
Neotoma floridana	Eastern Woodrat	hummocks, swamps
Synaptomys cooperi	Southern Bog Lemming	bogs and meadows
Pitymys pinetorum	Pine Vole	pine forests
Ondatra zibethica	Muskrat	along lakes, streams
Sylvilagus floridanus	Eastern Cottontail	forests, open areas
Odocuileus virginianus	White-tail Deer	open forests, swamps

[a] Tennessee Valley Authority 1972.

[b] Burt and Grossenheider 1976.

Table 9. Modern avifauna and seasonal information of the Watts Bar Reservoir study area.[a]

Scientific Name	S	S	A	W[b]	Common Name
Gavia immer	u		u		Common Loon
Gavia stellata	x		x		Red-throated Loon
Colymbus auritus	u		u	f	Horned Grebe
Podilymbus podiceps podiceps	u	x	u	f	Pied-billed Grebe
Pelecanus erythrohynchos	x		x		White Pelican
Thalacrocorax auritus	o		o	o	Double-crested Cormorant
Ardea herodias	f	u	f	f	Great Blue Heron
Butorides virescens virescens	f	c	f	x	Green Heron*
Florida coerulea coerula	x	o	o		Little Blue Heron
Casmerodis albus egretta	o	o	o	x	Common Egret
Bubulcus ibis	x				Cattle Egret
Nycticorax nycticorax	u	u	u	u	Black-crowned Night Heron*
Nyctanassa violacea	o				Yellow-crowned Night Heron
Ixobrychus exilis exilis	o	o	o		Least Bittern
Botaurus lentiginosus	o		o		American Bittern
Mycteria americana	x				Wood Ibis
Guara alba		x			White Ibis
Cygnus columbianus				x	Whistling Swan
Branta canadensis	u		u	u	Canada Goose
Chen hyperborea	o		o	o	Snow Goose
Chen caerulescens	o		o	o	Blue Goose
Anas platyrhynchos platyrhynchos	f	x	f	c	Mallard
Anas rubripes	f	x	f	c	Black Duck
Anas strepera	f		f	f	Gadwall
Anas acuta	u	x	u	f	Pintail
Anas carolinensis	u		u	u	Green-winged Teal
Anas discors	f		f	u	Blue-winged Teal
Mareca americana	f		f	f	American Widgeon
Spatula clypeata	f		f	o	Shoveler
Aix sponsa	f	u	f	u	Wood Duck
Aythya americana	u		u	u	Redhead
Aythya collaris	f		f	c	Ring-necked Duck
Aythya valisineria	u		u	u	Canvasback
Aythya marila nearctica	o			u	Greater Scaup
Aythya affinis	f	x	f	c	Lesser Scaup
Glaucionetta clangula americana	u			f	Common Goldeneye
Glaucionetta albeola	u		u	u	Bufflehead
Clangula hyemalis				o	Oldsquaw
Melanitta deglandi			x	o	White-winged Scoter

Table 9. (continued)

Scientific Name	S	S	A	W^b	Common Name
Melanitta niger		x			Common Scoter
Erismatura jamaicensis rubida	u		u		Ruddy Duck
Lophodytes cucullatus	u		u	u	Hooded Merganser
Mergus merganser americanus	o		o	o	Common Merganser
Mergus serrator	o		o		Red-breasted Merganse
Cathartes aura	f	u	f	u	Turkey Vulture
Coragyps atratus	u	u	u	u	Black Vulture
Accipiter striatus velox	u		u	u	Sharp-shinned Hawk
Accipiter cooperii	u	u	u	u	Cooper's Hawk
Buteo jamaicensis	f	f	f	f	Red-tailed Hawk
Buteo lineatus	u		u	u	Red-shouldered Hawk
Buteo platypterus platypterus	f	f	f		Broad-winged Hawk
Buteo lagopus				x	Rough-legged Hawk
Aquila chrysaetos canadensis			x		Golden Eagle
Haliaeetus leucocephalus	u	o	o	u	Bald Eagle
Circus cyaneus hudsonius	u		u	u	Marsh Hawk
Pandion haliaetus carolinensis	u	x	u		Osprey
Falco peregrinus	x		x	x	Peregrine Falcon
Falco columbaris columbaris	x		x	x	Pigeon Hawk
Falco sparverius	f	f	f	f	Sparrow Hawk
Bonasa umbellus	o	o	o	o	Ruffed Grouse
Colinus virginianus	c	c	c	c	Bobwhite
Grus canadensis	o		o	x	Sandhill Crane
Rallus elegans elegans	o	u	o	x	King Rail
Rallus limicola limicola	o		o		Virginia Rail
Prozana carolina	u		u		Sora
Coturnicops noveboracensis noveboracensis			x		Yellow Rail
Porphyrula martinica	x		x		Purple Gallinule
Gallinula chloropus cachinnans	x	x	x		Common Gallinule
Fulica americana	f	x	f	c	American Coot
Charadrius hiaticula semipalmatus	u		u	x	Semipalmated Plover
Charadrius melodus		x			Piping Plover
Charadruis vociferus vociferus	c	c	c	c	Killdeer

Table 9. (continued)

Scientific Name	S	S	A	W[b]	Common Name
Pluvialis dominica dominica	u		u		Golden Plover
Squatarola scuatarola			u		Black-bellied Plover
Arenaria interpres morinella			x		Ruddy Turnstone
Philohela minor	u	u	u	u	American Woodcock
Capella gallinago delicata	f		u	f	Common Snipe
Bartramia longicauda	o		o		Upland Plover
Actitis macularia	f	u	f		Spotted Sandpiper
Tringa solitaria solitaria	f	u	f		Solitary Sandpiper
Catoptrophorus semipalmatus	x		x		Willet
Totanus melanoleucus	u		u		Greater Yellowlegs
Totanus flavipes	u		u	x	Lesser Yellowlegs
Erolia melanotos	u		u		Pectoral Sandpiper
Erolia fuscicolis			x		White-rumped Sandpiper
Erolia minutilla	f		f		Least Sandpiper
Erolia alpina pacifica	x		x		Dunlin
Limnodromus griseus			x		Short-billed Dowitcher
Limnodromus scolopaceus	x		o		Long-billed Dowitcher
Micropalama himantopus			o		Stilt Sandpiper
Vireo gilvus gilvus	u	u	u		Warbling Vireo
Mniotilta varia	f	f	f		Black-and-white Warbler
Protonotaria citrea	u	u	u		Prothonotary Warbler
Limnothlypis swainsonii			x		Swainson's Warbler
Helmitheros vermivorus	f	f	f		Worm-eating Warbler
Vermivora chrysoptera	u		u		Golden-winged Warbler
Vermivora pinus	u		u		Blue-winged Warbler
Vermivora peregrina	u		c		Tennessee Warbler
Vermivora celata celata	u		o		Orange-crowned warbler
Vermivora ruficapilla ruficapilla	u		u		Nashville Warbler
Parula americana	u	u	u		Parula Warbler
Dendroica petechia	f	f	f		Yellow Warbler
Dendroica magnolia	u		f		Magnolia Warbler
Dendroica tigrina	u		u		Cape May Warbler
Dendroica caerulescens	u		u		Black-throated Blue Warbler
Dendroica coronata coronata	c		c	c	Myrtle Warbler
Dendroica virens	f		f		Black-throated Green Warbler
Dendroica cerulea	f	u	u		Cerulean Warbler

Table 9. (continued)

Scientific Name	S	S	A	W^b	Common Name
Dendroica fusca	f	x	f		Blackburnian Warbler
Dendroica dominica	f	u	u		Yellow-throated Warbler
Dendroica pensylvanica	u		f		Chestnut-sided Warbler
Dendroica castanea	f		f		Bay-breasted Warbler
Dendroica striata	c		u		Blackpoll Warbler
Dendroica pinus	u	u	u	o	Pine Warbler
Dendroica discolor	f	f	u		Prairie Warbler
Dendroica palmarum	f		f	o	Palm Warbler
Seiurus aurocapillus	f	u	u		Overbird
Seiurus noveboracensis	u		u		Northern Waterthrust
Seiurus motacilla	f	f	u		Louisiana Waterthrush
Oporornis formosus	f	f	u		Kentucky Warbler
Oporornis agilis	o		o		Connecticut Warbler
Oporornis philadelphia	o	x	o		Mourning Warbler
Geothlypis trichas	c	c	f		Yellowthroat
Icteria virens virens	c	c	f		Yellow-breasted Chat
Wilsonia citrina	f	f	u		Hooded Warbler
Wilsonia pusilla pusilla	u		o		Wilson's Warbler
Wilsonia canadensis	u		u		Canada Warbler
Setophaga ruticilla	f	u	f		American Redstart
Passer domesticus domesticus	c	a	c	c	House Sparrow
Dolichonyx oryzivorus	c		c		Bobolink
Sturnella magna	a	a	a	a	Eastern Meadowlark
Sturnella neglecta	x				Western Meadowlark
Agelaius phoeniceus	a	a	a	a	Red-winged Blackbird
Icterus spurius	c	c	u		Orchard Oriole
Icterus galbula	f	o	f	x	Baltimore Oriole
Euphagus carolinus	u		u	u	Rusty Blackbird
Quiscalus quiscula	a	a	a	a	Common Grackle
Molothrus ater ater	c	c	c	c	Brown-headed Cowbird
Piranga olivacea	u	u	u		Scarlet Tanager
Piranga rubra rubra	f	f	f	x	Summer Tanager
Richmondena cardinalis	a	a	a	a	Cardinal
Pheucticus ludovicianus	f		f	x	Rose-breasted Grosbeak
Guiraca caerulea caerulea	u	u	u		Blue Grosbeak
Passerina cyanea	c	a	c		Indigo Bunting
Spiza americana	u	u	u		Dickcissel
Hesperiphona vespertina	u			u	Evening Grosbeak
Carpodacus purpureus	f		f	f	Purple Finch
Acanthus hammea				x	Common Redpoll
Spinus pinus pinus	u		u	u	Pine Siskin
Spinus tristis tristis	c	c	c	c	American Goldfinch

Table 9. (continued)

Scientific Name	S	S	A	W[b]	Common Name
Loxia curuirostra	o			o	Red Crossbill
Loxia leucopter leucoptera	x			x	White-winged Crossbill
Pipilo erythropthalmus	c	c	c	c	Rfous-sided Towhee
Passerculus sandwichensis	f		f	f	Savannah Sparrow
Ammodramus savannrum	u	u	u	x	Grasshopper Sparrow
Passerherbulus caudacutus	x			x	LeConte's Sparrow
Passerherbulus henslowii			x		Henslow's Sparrow
Ammosplza caudacuta			x		Sharp-tailed Sparrow
Pooecetes gramineus gramineus	f		f		Vesper Sparrow
Chondestes grammacus	x		x		Lark Sparrow
Aimophila aestiualis	o	o	o		Bachman's Sparrow
Junco hyemalis	a		c	a	Slate-colored Junco
Junco oreganus				x	Oregon Junco
Spizella arborea arborea	o			o	Tree Sparrow
Spizella passerina passerina	c	c	c	o	Chipping Sparrow
Spizella pusilla pusilla	a	a	a	a	Field Sparrow
Zonotrichia leucophrys	u		u	u	White-crowned Sparrow
Zonotrichia albicollis	a		a	a	White-throated Sparrow
Passerella iliaca iliaca	u		u	u	Fox Sparrow
Melospiza lincolnii lincolnii	o		o	x	Lincoln's Sparrow
Melospiza georgiana	f		f	f	Swamp Sparrow
Melospiza melodia	a	a	a	a	Song Sparrow
Calcarius lapponicus lapponicus			x		Lapland Longspur

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[a] Tennessee Valley Authority 1972.

[b] Season: S - March-May; S - June-August; A - September-November; W - December-February. Abundance: a - abundant, over 25 individuals on a given day; c - common, 5-25 individuals/day; f - fairly common, at least one individual/day; u - uncommon, at least one individual/season of occurrence or several individuals/year; o - occasional, one individual/year or less; x - rare, has occurred in the county previously at least once, but is not to be expected.

Floral Resources

The Great Valley of East Tennessee is in the Carolinian biotic province and a temperate deciduous forest is characteristic (Dice 1943:16). More specifically, Braun (1974:192) has described the region as being in the oak-chestnut forest which is coextensive with the Ridge and Valley biogeographic province. Shelford (1963:38-39) more specifically characterized the forest as the oak-deer-chestnut faciation; however, following the local introduction of the chestnut blight and extensive lumbering, the original forest has been destroyed. Prior to the local introduction of the chestnut blight, large tracts of chestnut were present on the ridges of East Tennessee (Killebrew and Safford 1874). In more recent years the chestnut has been replaced by oaks as a single dominant (Kuchler 1964). In the present forest region, white oak (Quercus alba) dominates on the valley floor and white oak-black oak-hickory forest communities commonly occur on the low shaley ridges (Braun 1974:237-238). Toward the southern end of the Great Valley there is an increase in pine, evidence of a transition between the oak- chestnut and oak-pine forest regions (Braun 1974:237-238).

Local topographic variables (exposure, slope, aspect), the result of geologic and physiographic formation processes, influence floral compositions, creating locally important microenvironments (Martin 1971:15). As a result, Martin (1971) has identified and described three major environmental zones within the Great Valley of East

Tennessee: the recent alluvial terrace community, the older alluvial terrace community, and the uplands community (see Table 10).

On the basis of drainage, the recent alluvial terrace community is further subdivided by Martin (1971:275-281) into two microenvironments: the bottomland hardwood community immediately adjacent to the river and the green ash-sycamore community along the streams.

The bottomland hardwood community is located in the poorly drained floodplains, where flooding occurs periodically (especially during the winter months); however, "slow drainage early in the growing season may present an environment that is occupied by taxa adapted to low aeration" and constituents may vary spatially (Martin 1971:275). Specifically, willow oak (Quercus phellos) is dominant, though white oak and sweet gum (Liquidambar styraciflua) are major constituents. Chestnut oak (Quercus michauxii) is also present.

The green ash-sycamore community is basically a permanently flooded community, where the water table is consistently at or near the surface. Green ash (Fraxinus pennsylvanica), sycamore (Platanus occidentalis) and black willow (Salix nigra) are the dominant taxa. Other important taxa present in the bottomland hardwood community include: red maple (Acer rubrum), swamp black gum (Nyssa sylvatica), shortleaf pine (Pinus echinata), southern red oak (Quercus falcata) and white elm (Ulmus americana).

The local environment of the older alluvial terraces is characterized by the white oak-scarlet oak community (Quercus coccinea) (Martin 1971:Table 15). Other important taxa include southern red oak,

Table 10. Modern floral resources of the Watts Bar Reservoir study area and ecological information.

Scientific Name	Common Name	Habitat[b]	Resource[c]	Season
TREES				
Liquidambar styracitlua	Sweetgum	RAT	Gum	
Liriodendron tulipifera	Yellow Poplar	UP		
Quercus alba	White Oak	RAT, OAT, UR	Nut	Autumn
Carya cordiformis	Bitternut Hickory	OAT	Nut	Autumn
Acer rubrum	Red Maple	RAT, UR	Sap	Early spring
Prunus serotina	Black Cherry	OAT	Fruit	Late summer
Nyssa sylvatica	Black Gum	OAT	Fruit	Autumn-winter
Quercus coccinea	Scarlet Oak	OAT, UR	Acorn	Autumn
Quercus falcata	Southern Red Oak	RAT	Acorn	Autumn
Quercus stellata	Post Oak	UP	Acorn	Autumn
Quercus velutina	Black Oak	OAT, UP	Acorn	Autumn
Cornus florida	Flowering Dogwood	RAT, OAT, UP		
Oxydendrum arboreum	Sourwood	UP	Leaves	Summer
Juniperus virginiana	Eastern Red Cedar	UP		
Quercus phellos	Willow Oak	RAT	Acorn	Autumn
Carpinus caroliniana	Blue Beech			
Fagus grandifolia	American Beech	RAT	Nut	Autumn
Pinus virginiana	Virginia Pine	UP		
Pinus echinata	Shortleaf Pine	UP		
Platanus occidentalis	Sycamore	RAT		
Quercus rubra	Northern Red Oak	UP	Acorn	Autumn
Diospyros virginiana	Persimmon	OAT	Fruit	Autumn
Quercus marilandica	Blackjack Oak	OAT	Acorn	Autumn
Ulmus alata	Winged Elm	RAT		
Fraxinus pennsylvanica	Green Ash	RAT	Cambium	Early spring
Ulmus americana	American Elm	RAT		
Betula nigra	River Birch	RAT		
Celtis oecidentalis	Hackberry	OAT	Fruit	Late summer-winter
Cercis canadensis	Eastern Red Bud	OAT, UP		
Quercus muehlenbergii	Chinquapin Oak	RAT, OAT, UP	Acorn	Autumn
Rhus copallina	Shining Suman	OAT	Fruit	Late summer-early autumn
Rhus glabra	Smooth Sumac		Fruit	Late summer
Rhus copallina	Winged Sumac	UP	Fruit	Late summer
Carya glabra	Pignut Hickory	OAT	Nut	Autumn
Carya tomentosa	Mockernut Hickory	OAT	Nut	Autumn

Table 10. (continued)

Scientific Name	Common Name	Habitat[b]	Resource[c]	Season
Castanea dentata	American Chestnut	OAT, UR	Nut	Autumn
Gleditsia triacanthos	Honey Locust	OAT	Pods	Autumn-late winter
Juglas nigra	Black Walnut	OAT, UR	Nut	Autumn
Morus rubra	Red Mulberry	OAT	Fruit	Summer
Quercus michauxii	Swamp Chestnut Oak	RAT	Acorn	Autumn
Quercus prinus	Chestnut Oak	OAT, UR	Acorn	Autumn
Quercus shumardii	Shumard Oak	OAT	Acorn	Autumn
Robinia pseudoacacia	Black Locust	OAT	Seeds	Autumn
Carya cordiformis	Bitternut Hickory	UP, RAT	Nut	
Celtus laevigata	Sugarberry	RAT		
Prunus serotina	Black Cherry	UP	Fruit	Late summer
Rhus radicans		RAT		
Ulmus rubra	Slippery Elm	RAT, OAT, UP	Cambium	
Smilax hispida		RAT		
Salix caroliniana		Slough		
Sassafras albidum	Sassafras	UP	Leaves	Spring
SHRUBS AND GRASSES				
Allium canadensis	Meadow Garlic	RAT	Bulb	Late Spring
Amphicarpa bracteata	Hog Peanut	RAT	Underground fruit	Late autumn & early spring
Arisaerua triphyllum	Jack-in-the-pulpit	RAT	Root	Late autumn & early spring
Arundinaria gigantea	Giant Cane	RAT	Shoots & grain	Spring
Asimia triloba	Pawpaw	OAT	Fruit	Autumn
Carex sp.	Sedge	RAT, OAT, UR	Stem & tuberous base	Spring (?)
Dentaria diphylla	Crinkle-root	RAT	Root	Spring
Gaylussacia baccata	Black Huckleberry	UR	Berry	Summer
Ipomea lacunosa	Morning Glory	RAT	Root	Late autumn-early spring

Table 10. (continued)

Scientific Name	Common Name	Habitat[b]	Resource[c]	Season
Lycopus virginicus	Bugle-weed	RAT	Root	Late autumn-early spring
Panicum dichotomum	Panic Grass	RAT	Seed	Autumn
Parthenocissus quinquefolic	Virginia Creeper	RAT, OAT, UR	Dambium & fruit (?)	Spring-summer
Phytolacca americana	Common Pokeberry	RAT	Leaves & stalks	Spring
Polygonum pennsylvanicum	Pinkweed	RAT	Seed	Autumn
Polygonum punctatum	Knotweed	RAT	Seed	Autumn
Polygonum bitlorum	Small-solomon-seal	OAT, UR	Rhyzomes	Autumn
Pteridium aquilinum	Bracken	UR	Stalk	Early spring
Rubus arundelanus	Blackberry-Raspberry	RAT	Fruit	Summer
Rubus argutus	High-bush Blackberry	RAT	Fruit	Summer
Rubus flagellaris	Dewberry	RAT	Fruit	Summer
Rumex crispus	Curly Dock	RAT	Leaves & seeds	Spring
Sagittaria engelmanniana	Arrowhead	RAT	Tuber	Late summer & autumn
Scirpus americanus	Bullrush	RAT	Root	Autumn
Smilax glauca	Saw-brier	RAT, OAT, UR	New shoots & roots	May-August (new shoots), spring & autumn (roots)
Smilax herbacea	Carrion Flower	UR	Shoots	Spring
Smilax rotunditolia	Greenbrier	RAT, OAT, UR	New shoots & roots	May-August (new shoots), spring & autumn (roots)
Smilax tamnoides	Chinabrier	RAT	New shoots & roots	May-August (new shoots), spring & autumn (roots)
Smilacina racemosa	Wild Spikenard	RAT, OAT, UR	Roots & berries	Late summer
Uvularia putoliata	Straw-bell	UR	Young shoots & roots	Spring
Vaccinium vaccillans	Dryland Blueberry	UR	Berry	Summer

Table 10. (continued)

Scientific Name	Common Name	Habitat[b]	Resource[c]	Season
Vaccinium stamineum	Deerberry	UR	Berry	Summer
Verbena utricifolia	Vervain	RAT	Berry	Late summer
Viburnum peunifolium	Black-haw	OAT, UR	Fruit	Autumn
Viburnum rutidulum	Southern Black-haw	OAT	Fruit	Autumn
Vitis aestivalis	Summer Grape	RAT, OAT, UR	Fruit	Autumn
Vitis riparia	Wild Grape	RAT, OAT, UR	Fruit	Autumn
Vitis rotunditolia	Scuppernong	RAT, OAT, UR	Fruit	Late summer
Agrimonia parviflora		UP, RAT, OAT		
Alnus serrulate		RAT		
Ambrosia artemisiifolia	Ragweed	RAT		
Amorpha truticosa		RAT		
Anisostichus capreolata		UP		
Asplenium resiliens		RAT, UP		
Bacopa sp.		RAT		
Campsis radicans	Trumpet Creeper	RAT, UP		
Cephalanthus occidentalis		RAT		
Cornus amonum	Silky Dogwood	RAT	Fruit	Late spring-early summer
Cornus stolonitera	Red-osier Dogwood	RAT	Fruit	Late spring
Crataegus sp.		UP	Fruit	Autumn
Diodia virginiana	Buttonweed	RAT		
Diospyros virginiana	Persimmon	RAT	Fruit	Autumn
Duchesnea indica		RAT	Fruit	Autumn
Eleocharis sp.		RAT		
Eupatorium serotinum		RAT		
Galium americana		UP		
Gleditsia triacanthos	Honeylocust	RAT	Pods	Late spring-early summer
Gnaphalium purpureum		RAT		
Ipomoea purpureum		UP, RAT		
Funcus effusus	Rush	RAT		

Table 10. (continued)

Scientific Name	Common Name	Habitat[b]	Resource[c]	Season
Lespedeza sp.		RAT		
Ligustrum sinense		UP		
Ligustrum vulgare		RAT		
Maclura pomifera		RAT		
Mimulus ringens		RAT		
Myosotis macrosperma		RAT		
Phyla lanceolata		RAT		
Plantago virginia		RAT		
Plantanus occidentalis		RAT		
Prunella vulgaris	Selfheal	RAT	Whole plant	Late summer
Ranunculus sceleratus		RAT		
Rhamnus caroliniana		UP		
Robinia pseudoacacia		UP		
Rosa sp.		RAT	Fruit	Late spring-summer
Ruellia caroliniensis		UP		
Sisyrinchium mucronatum		RAT		
Solanum carolinense	Horse-nettle	RAT		
Vernonia fasciculata		RAT		
Evonymous americana	Strawberrry Bush	UP		
Desmodium sp.	Beggar's Lice	UP		
Chimaphila maculata	Pipsissewa	UP		
Vaccinium corymbosum	Highbush Blueberry	UP, RAT, OAT	Berries	Summer
Rhus radicans	Poison Ivy	UP		
Impatiens capensis	Jewel Weed	RAT		
Cassia fasciculata	Partridge Pea	UP, RAT		
Aster pilosus	Frost Cater	UP		
Erigeron strigosus	Fleabane	UP		
Erigeron canadensis	Horseweed			
Gnaphalium obtusifolium	Rabbit Tobacco	UP		

Table 10. (continued)

Scientific Name	Common Name	Habitat[b]	Resource[c]	Season
Rolymnia uredalia	Bearsfoot	UP		
Verbesina occidentalis	Crown Beard			

[a] Tennessee Valley Authority, 1972.

[b] Fowells 1965. UR = Upland Ridge; OAT = Older Alluvial Terrace; RAT = Recent Alluvial Terrace; UP = Uplands.

[c] Yanovsky 1986.

black oak (Quercus velutina), mockernut hickory and pignut hickory (Carya glabra) (Martin 1971:190). As was previously mentioned, the American chestnut (Castanea dentata) was also an important constituent prior to the local introduction of the chestnut blight around 1925 (Anderson 1974).

The uplands have also been subdivided by Martin according to variables of the soils parent material. Associated with the Rome formations and Allen and Jefferson fine sandy loam soils is the white oak-oak community, which is dominated by white oak and chestnut oak (Quercus prinus) (Martin 1971:175). The American chestnut (Castanea dentata) was also a major constituent, as represented by the number of dead stumps, particularly in areas of cherty soils (Martin 1971:189, Table 13). Other important taxa include red maple, sugar maple (Acer saccharum), pignut hickory (Carya glabra), mockernut hickory, dogwood (Cornus florida), tuliptree (Liriodendron tulipifera), sweet gum, black gum (Nyssa sylvatica), sourwood (Oxydendrum arboreum), scrub pine (Pinus virginiana), southern red oak (Quercus falcata) and red oak (Quercus rubra).

The ridge sites, dominated by cherty dolomitic limestone and Fullerton soils from the Copper Ridge dolomite, maintain white oak-chestnut oak communities. Although the dominants white oak and chestnut oak are present in both upland communities, differences in percentages of the sub-dominants pignut hickory, sourwood (Oxydendrum arboreum) and scarlet oak do exist, which allowed Martin (1971:Table 13) to subdivide the upland community. However, others have decided to condense the two communities into one upland community (McCollough and Faulkner 1973). For the purposes of this study one upland community will be considered.

In general, the floristic communities of this region share many constituents, although spatial and temporal variations in percentages do exist, not only in response to dynamic and stable ecological factors, but also to human settlement and exploitative patterns. A cursory examination of the archaeobotanical remains from archaeological sites within the study area indicates extensive exploitation of floral resources from all the identified microenvironmental zones (see Table 11).

To summarize, the abundance and diversity of natural resources from the region provided a considerable population of aboriginal peoples economic security and self-sufficiency. The variety of ways in which the resources were exploited is considerable both spatially and temporally. The differences in subsistence can be attributed to many factors, including the dynamic patterns of the environment, cultural preferences and taboos, the nutritional quality of the resource, seasonality, and abundance. Although our knowledge of the subsistence patterns of these aboriginal groups is biased by the limits of preservation (though it can be supplemented by the ethnographic record), it is apparent that all of the microenvironments of the region were exploited at least to a certain degree in order to maintain a secure and self-sufficient local economic base.

Table 11. Paleoethnobotanical remains from archaeological sites within the Watts Barr Reservoir study area.

	Site and Context[a]								
	40LD45		40LD45		40RE108	40RE124	40RH6	40RH6	40RH6
Species	Late Archaic Wt. (gms)	N	Early Woodland Wt. (gms)	N	Early Woodland	Late Woodland	T. Archaic N	T. Arch./ M. Wood. N	Early Woodland N
Wood Carcoal	65.3		73.6						
Acer sp. (Maple)					+				
Arundinaria sp. (Cane)					+				
Carya glabra (Pignut Hickory)					+				
Carya Ovata (Shagbark)					+				
Carya sp. (Hickory)			8.02	921	+	+	5		
Castanea dentata (American Chestnut)						+			
Catalpa speciosa (Catalpa)					+				
Clandrastris lutea (Yellowwood)					+				
Celtis occidentalis (Huckberry)					+				
Diospyros virginiana (Persimmon)					+				
Fraxinus americana (White Ash)					+				
Gleditsia triacanthos (Honey Locust)					+				
Gymnocladus dioicus (Kentucky Coffee Tree)					+				

Table 11. (continued)

	Site and Context[a]								
	40LD45		40LD45		40RE10B	40RE124	40RH6	40RH6	40RH6
Species	Late Archaic Wt. (gms)	N	Early Woodland Wt. (gms)	N	Early Woodland	Late Woodland	T. Archaic N	T. Arch./ M. Wood. N	Early Woodland N
Juglans nigra (Black Walnut)					+				
Juglans sp. (Walnut)			0.64	39					
Juglans anerea (Butternut)								2	6
Juniperus virginiana (Cedar)					+				
Liriodendron tulipifera (Yellow Poplar)					+				
Morus rubra (Red Mulberry)					+				
Pinus sp. (Pine)					+				
Platanus occidentalis (Sycamore)					+				
Populus deltoides (Cottonwood)					+				
Prunus serotina (Black Cherry)						+			
Quercus alba (White Oak)					+				
Quercus rubra (Red Oak)					+				
Quercus sp. (Acorn)	1.3	60			+	+			
Robinia pseudoacacia (Black Locust)					+				

Table 11. (continued)

	Site and Context[a]								
Species	40LD45 Late Archaic Wt. (gms)	N	40LD45 Early Woodland Wt. (gms)	N	40RE108 Early Woodland	40RE124 Late Woodland	40RH6 T. Archaic N	40RH6 T. Arch./ M. Wood. N	40RH6 Early Woodland N
Tsua canadensis (Hemlock)					+				
Ampelopsis sp. (Pepperine)						+			
Galium sp. (Bedstraw)						+			
Indeterminate Legume						+			
Chenopodium sp.	0.3		360						
Helianthus annuus (Sunflower)	0.4		110						
Phytolacca americana (Pokeberry)					+	+			
Polygonum cf. *punctatum* (Smartweed)					+				
Rubus occidentalis (Raspberry)						+			
Stellaria sp. (Chickweed)					+				
Vitis sp. (Grape)						+			

[a] References: Brewer 1973; Calabrese 1976; Schroedl 1976.

Botanical remains from 40RE108 and 40RE124 have not been quantified and are presented merely as a list of species present.

CHAPTER III

HOLOCENE DYNAMICS

Following the lead of Julian Steward (1938) and A. L. Kroeber's (1939) concepts of the interrelationship of environmental parameters and North American aboriginal cultures, anthropologists have increasingly emphasized the explication of the archaeological record within the rubric of cultural ecology. As Steward (1955:31) emphasizes, humans share the same biological needs with all animals, and as such, the cultural system acts as a direct response, through economic, ideational and technological aspects, to the constraints of the ecosystem (White 1959; Binford 1962; Rappaport 1968). As a result, there has been an increasing need to understand the variation in the natural environment through time and how the archaeological record reflects such changes (McMillan and Klippel 1981:240). Specifically, postglacial environments have been of interest not only to Quaternary scientists (e.g., Wright 1976; Delcourt and Delcourt 1981), but also to archaeologists in terms of how they have influenced prehistoric cultures (i.e., McCollough and Faulkner 1973; Johnston 1981, 1983).

Correlating paleoclimatic and paleovegetational data for a broad-scale reconstruction of eastern North America provides a dynamic model of environmental changes south of the Laurentide Ice Sheet beginning at ca. 16,500 years B.P. (Delcourt and Delcourt 1984:263). As a result of changing climatic regimes, there has been a significant displacement of floral and faunal species, at both the micro- and macro-environmental levels (Delcourt and Delcourt 1981; Klippel and

Parmalee 1982, 1984). Through our understanding of the dynamic climatic and vegetational changes that have occurred since the end of the Pleistocene, we will better be able to explicate the archaeological record in terms of:

1. prehistoric adaptive responses to changes in the environment (e.g., settlement);

2. the environment in which cultural groups exploited and interacted;

3. delineating periods of settlement change.

Environmental Change

Delineating the development of prehistoric cultures or ecosystems within the context of the dynamics of the Holocene environment has become a major focus of current North American archaeological research (e.g., Wood and McMillan 1976; O'Brien, Warren and Lewarch 1983; McMillan and Klippel 1981; Stoltman and Baerris 1983). Multidisciplinary research techniques and models have been employed in attempting to define temporal and spatial patterning of biotic communities for the late Quaternary, when human groups began interacting in this area (i.e., Chapman et al. 1982; Wood 1976; Warren and O'Brien 1982). In the preceding chapter, a description of the modern environment was presented that provides an appropriate model for nineteenth and twentieth century settlement of the region. However, following climatic amelioration about 12,500 years B.P., shifting climatic conditions and associated biotic shifts produced dynamic changes in the Holocene environment and, presumably human settlement and subsistence.

Broad-scale late Quaternary paleoclimatic changes have been interpreted from palynological records (Watts 1980; Wright 1983; Delcourt and Delcourt 1984), alluvial deposits (Saucier 1974, 1981; Knox 1983), marine core samples (Kennett and Shackleton 1975; Cline and Hays 1976), and faunal records (Lundelius 1974; Klippel and Parmalee 1984), all of which suggest dramatic shifts in predominant airmasses.

Paleoenvironmental reconstruction for the unglaciated eastern United States by Delcourt and Delcourt (1984) was interpreted from eight sites situated between 32° and 38° N latitude with late Quaternary fossil-pollen records. In addition, four sites in Tennessee, a paleontological site, Cheek Bend Cave (40MU261) (Klippel and Parmalee 1982), and pollen cores from Icehouse Bottom (40MR23), and Black Pond (Monroe County) (Cridlebaugh 1984) provide insight into the dynamics of environmental change for the late Quaternary.

During the late Wisconsinan glacial maximum, about 18,000 years B.P., a broad boreal forest region was predominant south of the Laurentide ice sheet to about 33° N latitude (Delcourt and Delcourt 1981:145). In the deep South, a temperate forest ecosystem was present, centered about 33° N latitude. A narrow ecotone representing a mixture of cool-temperate coniferous and deciduous tree species was present, separating these two distinct ecosystems. This abrupt ecotonal boundary has been interpreted as representing the mean-annual position of the Polar Frontal Zone, a stable climatic boundary which separates the Pacific Airmass immediately to the north from the Maritime Tropical Airmass immediately to the south (Delcourt and

Delcourt 1984:276; see Figure 8a). Interpretations of these climatic conditions suggest that July 18,000 years B.P. climate of the southeastern United States was about 12° C colder than today (Watts 1980:391). Paleontological data, specifically from Cheek Bend Cave (40MU261), Tennessee, support this model (Klippel and Parmalee 1982).

The insectivore assemblage, represented in Stratum II of Cheek Bend Cave, has boreal or broad habitat tolerance (Klippel and Parmalee 1982:455) and is therefore congruent with Delcourt's model of a jack pine-spruce-fir forest being coextensive with the region south of the Laurentide to 33 °N latitude (H. R. Delcourt 1979:268). Apparently, the Arctic Airmass did not directly influence the paleoclimate of the eastern United States south of the Laurentide ice sheet (Delcourt and Delcourt 1984:276) and this resulted in more moderate extremes of winters and summers that Klippel and Parmalee (1982:450) conclude allowed "mammals with present day allopatric and/or parapatric distributions [to be] sympatric during the Wisconsinan."

By about 16,500 B.P. climatic amelioration resulted in the initial disintegration and eventual northward retreat of the Laurentide ice sheet (Dreimanis 1977). During this period, ca. 16,500 B.P. to 12,500 B.P., the ecotone between boreal and warm-temperate forests broadened latitudinally (Delcourt and Delcourt 1984:276), and cool-temperate mixed conifer-northern hardwoods expanded northward and eastward, replacing the jack pine-spruce-fir forest of the full glacial (H. R. Delcourt 1979:276). During this period the Polar Frontal Zone remained

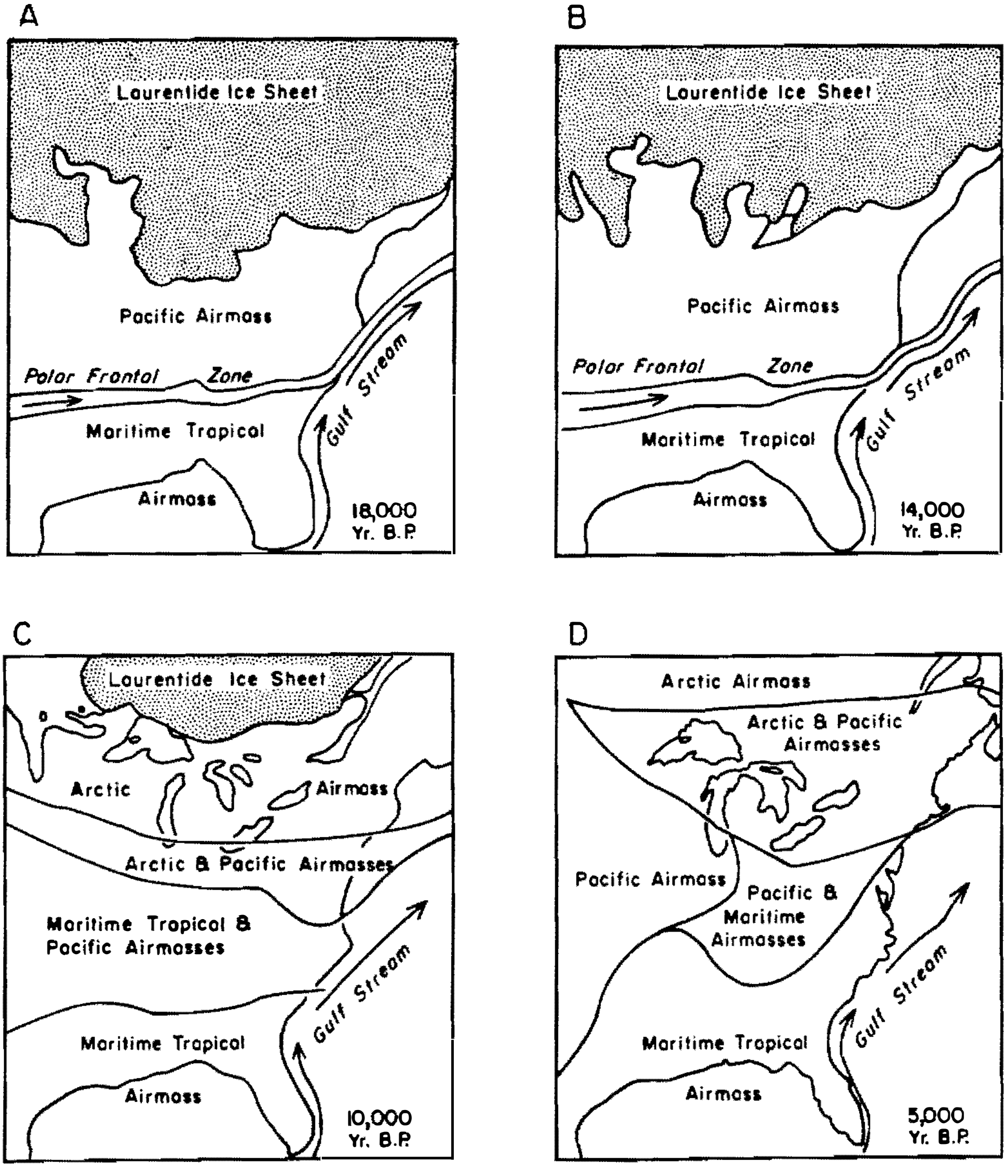

Figure 8. Paleoclimatic reconstruction for predominant airmasses of eastern North America.
A. Glacial maximum at 18,000 B.P. B. The late glacial interval at 14,000 G.P. C. The early Holocene interval at 10,000 B.P. D. The mid-Holocene interval at 5,000 B.P. (Modified from Delcourt and Delcourt 1984).

relatively stable across eastern North America, although a southward displacement in sea-surface isotherms near the western Atlantic Coast occurred, an indication of mass wasting of continental glaciers (Delcourt and Delcourt 1984:276;see Figure 8b). Additional evidence of climatic amelioration is present from Stratum III at Cheek Bend Cave, where a reduced diversity in boreal soricids is interpreted as a result of a warming trend. Warmer temperatures made it increasingly difficult for boreal species to survive, while more heat tolerant species began to advance into this abandoned niche for the first time following the glacial maximum (Klippel and Parmalee 1982:455).

During the mid-Holocene, about 8500 to 4000 B.P., an increased zonal influence of the Pacific Airmass expanded the midcontinental region of warmth and aridity to within the zone of predominant westerlies (P. A. Delcourt 1985:20; see Figure 8d). The increased zonal influence of the Pacific Airmass diminished the influence of the Arctic and Maritime Tropical air-masses across eastern North America--the result of which was extremes in summer warmth and drought stress which favored the eastward expansion of prairie vegetation at the expense of woodlands (Delcourt and Delcourt 1984:278). At Cahaba Pond, in northeastern Alabama, vegetational changes concur with droughty climatic conditions of evapotranspirational stress of the Hypsithermal--a result of either a decrease in absolute precipitation or an increase in summer warmth (Delcourt et al. 1983:884). The pollen record from Anderson Pond indicates forests became more xeric, dominated by oaks, hickories and ashes (H. R. Delcourt 1979:227).

Although the extent of the climatic stress from the mid-Holocene Hypsithermal is unknown in the study area, archaeological investigations in the Little Tennessee River Valley provide some indications. Archaeobotanical remains dated to this time period from Early and Middle Archaic site contexts suggest a plant food collecting strategy focused upon xeric species (hickory nuts and acorns) (Chapman and Shea 1981:77). This increase in xeric species is also suggested by the pollen record at Anderson Pond (H. R. Delcourt 1979:227). Incision of the modern channel by the Little Tennessee River, the result of a diminished sediment load (P. A. Delcourt 1980:121; Chapman et al. 1982:117), may also reflect this climatic trend. Cultural evidence from the Little Tennessee River Valley of "pronounced floodplain sites (with assumed residential base or multiple re- use)" between 4500 and 3000 B.C., indicates a possible shift to a more dispersed settlement pattern in response to climatic stress (Chapman 1985:148-149).

During the last 4000 years of the Holocene, increased meridional flow has characterized the modern climatic regime, reflecting the seasonal effects of the Arctic, Pacific and Maritime Tropical air-masses in eastern North America (P. A. Delcourt 1985:20; Delcourt and Delcourt 1984:281). Establishment of the modern climatic regime provided abundant precipitation throughout the growing season. In response, vegetational adjustments occurred establishing the modern oak-chestnut forest as dominant in the central and southern Appalachians, including the Great Valley (Delcourt and Delcourt 1981:150). However, anthropogenic impact, inferred from palynological and macrofossil evidence indicates a mosaic of horticultural fields, early successional forests, and deciduous forest remnants becoming more prominent through time (Chapman et al. 1982:119; Cridlebaugh 1984:120-121; Chapman and Shea 1981:79).

Moreover, climatic conditions influenced not only biotic responses of the environment, but also landscape response (Saucier 1981). Dynamic patterns of Holocene climate, responsive vegetative adjustments, and physiography influence characteristics of runoff and sediment yield, which in turn are the principal determinants for the physical properties of alluvial channels and floodplains (Knox 1983:26). More specifically, the evolution of Holocene river systems can be assessed in terms of response to both the direct effects of climatic events and the indirect effects of vegetation as it controls runoff and erosion. Differential patterns of climatic and vegetational change between the early Holocene and the middle and late Holocene reflected in adjustments in Holocene river systems suggest a model of direct response to local climatic events, as opposed to indirect responses to regional climate and vegetational changes (Knox 1983:27; see Figure 9).

From East Tennessee, P. A. Delcourt's (1980) geomorphological research in the Little Tennessee River Valley concurs. He argues climatic fluctuations during the glacial-interglacial cycles modulated "the mechanical production of rock debris under periglacial conditions and the subsequent reworking of sediment downslope with valley aggradation during late-glacial and interglacial times" (Delcourt 1980:120).

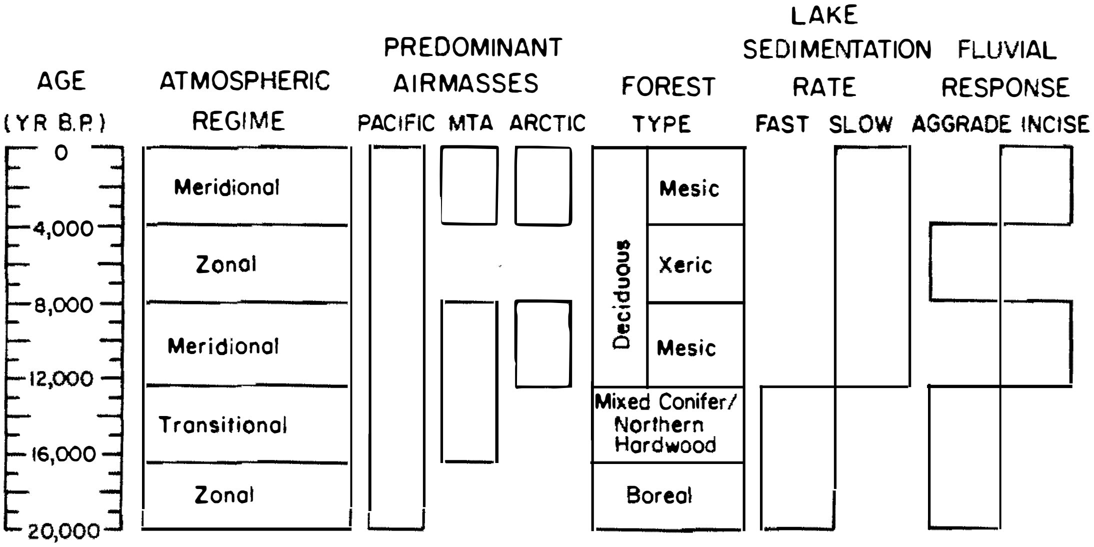

Figure 9. Lacustrine and alluvial paleohydrologic responses to climatic and vegetational influences of the unglaciated portion of eastern North America between approximately 35° and 40° North latitude (Modified from P. A. Delcourt 1985).

During glacial maximum, periglacial environments prevailed in the Great Smoky Mountains (King 1964), promoting the development of massive blockfields and blockstreams and colluvial fans. The predominant freeze-thaw processes, a consequence of periglacial conditions, promoted "mechanical disintegration of exposed bedrock and the production of substantial quantities of rock debris strewn across unstable slopes" (Delcourt 1980:120).

Climatic amelioration of the Pleistocene-Holocene transition (ca. 12,500 B.P.) eliminated periglacial conditions in the southern Appalachians and increased warmth and absolute precipitation, which facilitated transport of rock debris downslope as slopewash. These processes produced rapid aggradation of the floodplain (T-1) surface. Expansion of the deciduous forest, following the initial flushing of sediment from the mountain slopes, also accelerated soil development (Delcourt 1980:120). Extrapolating from Delcourt's (1980:120-121) terrace model for the Little Tennessee River to the Tennessee River, the peak rates for valley aggradation occurred during late-glacial and early-Holocene times with an increase in sedimentation rates during middle and late Holocene times. By 3000 B.P., river readjustments to the diminished sediment load and abandonment of the T-1 caused the river to incise its modern channel and establish the modern floodplain.

Understanding the dynamics of the rapid aggradation of the T-1 provides a two-fold pattern, not only for understanding diachronic and synchronic patterns of settlement, but also for the discovery of early prehistoric sites. First, there is a reduced probability of finding in situ Paleoindian occupations due to the energetics of initial T-1 deposition destroying the late Pleistocene occupations (Chapman 1985:144-145). And second, the expectation of Archaic period sites being discovered buried within the T-1 sediments is highly probable (Chapman 1985a:145), a model that has held true for research throughout the eastern Tennessee Valley (Faulkner and Graham 1966; Calabrese 1976; Chapman 1977, 1978).

In sum, dynamic climatic and environmental changes during the late Quaternary have produced periods of ecological stress. As a result, the biotic and human communities have sought adaptive responses in order to survive. Recent archaeological investigations have addressed this issue and postulated such human cultural responses as technological innovation, changes in settlement patterns and changes in subsistence. However, while local paleoenvironmental conditions are unknown for the Watts Bar study area, specifically for the early to middle Holocene period, broad scale patterns for eastern North America provide an applicable model in which archaeological research in the region can be couched.

CHAPTER IV

CULTURAL DYNAMICS

The investigation of aboriginal cultures in the Tennessee Valley has been conducted for more than 100 years. Beginning with the initial descriptive studies of the aboriginal remains and speculations upon the relationship of historic and prehistoric cultures, archaeological investigations in the valley developed from an avocation of antiquarians into the scientific inquiry regarding prehistoric peoples. During this period of research, all of the cultural developments described for the southeastern United States have been recognized in the Tennessee Valley (see Table 12). However, investigation of the dynamics of certain periods have been more developed than others. The following is a brief overview of our current understanding of the 10,000 years of human occupation in the eastern United States, and more specifically for the eastern Tennessee Valley.

Paleoindian Period

The Paleoindian culture represents the earliest documented human occupation of North America. Although dates prior to 15,000 B.C. (Williams and Stoltman 1964:669) have been suggested, recent reviews place the movement of these people into eastern North America at about 12,000 years B.P. (e.g., MacDonald 1983:97). The controversy surrounding the first humans in the New World is extensive, and covers such topics as the first arrival time (Fladmark 1983), the specific

Table 12. Cultural chronology of the southeastern United States and local archaeological manifestations in the eastern Tennessee Valley.

Time	Southeastern U.S.	Eastern Tennessee Valley
A.D. 1300-1700	Late Mississippian	Mouse Creek (Lewis and Kneberg 1946) Dallas (Polhemus 1987)
A.D. 1100-1300	Middle Mississippian	Hiwassee Island (Schroedl 1978a)
A.D. 1000-1100	Early Mississippian	Martin Farm (Schroedl et al. 1983)
A.D. 700-1000	Late Woodland	Hamilton (Schroedl 1978a)
A.D. 400-700	Middle Woodland	Connestee (Chapman and Keel 1979) Candy Creek (McCollough and Faulkner 1973)
1000 B.C. - A.D. 400	Early Woodland	Long Branch (McCollough and Faulkner 1973) Watts Bar (McCollough and Faulkner 1973)
2000-1000 B.C.	Terminal Archaic	Ledbetter/Iddins/Otarre (Faulkner and Graham 1966; Chapman 1981; Schroedl 1978b)
4000-2000 B.C.	Late Archaic	Savannah River/Appalachian Stemmed (Chapman 1981)
6000-4000 B.C.	Middle Archaic	Guilford Lanceolate (Chapman 1985) Morrow Mountain (Cridlebaugh 1977) Stanly Phase (Chapman 1976) Kirk Stemmed (Chapman 1978)

Table 12. (continued)

Time	Southeastern U.S.	Eastern Tennessee Valley
9900-6000 B.C.	Early Archaic	Bifurcate (Chapman 1975)[b] Kirk (Chapman 1975)[c]
10,500-9900 B.C.	Transitional Dalton	Dalton[a]
12,000-10,500 B.C.	Paleoindian	Clovis[a]

[a] Isolate surface finds.

[b] Chapman (1985a) further defines this traditon to include St. Albans, LeCroy, and Kanawha phases.

[c] Kirk has been further defined into Upper and Lower phases (Chapman 1977).

origins of various groups (F. Smith 1976; Spuhler 1979; Lampl and Blumberg 1979), and settlement/subsistence patterns (Gardner 1974, 1976, 1979; Stoltman and Williams 1964). In the eastern United States there have been sporadic discoveries of Paleoindian projectile points and tool kits (Stoltman and Williams 1964), some in association with extinct fauna (Webb et al. 1984; Graham et al. 1981). In the eastern Tennessee Valley isolated surface finds of Clovis points have also been recorded (Lewis 1955, 1958; Guthe 1964, 1965, 1966).

In eastern North America, several notable sites have been excavated that have yielded tantalizing evidence of the lifeways of these early peoples. These include Meadowcroft Rockshelter in southwestern Pennsylvania (Adovasio et al. 1978, 1980), Warm Mineral Springs and Little Salt Springs in Florida (Cockrell and Murphy 1978; Clausen et al. 1979), in addition to the Harney Flats site in Florida (Daniel and Wisenbaker 1983, 1984).

Another important study has centered around the Thunderbird site and the surrounding area in Virginia. In a series of papers, Gardner (1974, 1977) has defined the Flint Run Complex based on a stratified jasper industry tradition lasting 3000 years--Early (Clovis), Middle and Late (Dalton). Five functionally distinct sites have been isolated: (1) the quarry; (2) quarry reduction stations; (3) quarry-related base camp; (4) periodically revisited food procurement sites; and (5) sporadically visited hunting sites.

From these excavations, Gardner has presented a view of Paleoindians contrary to the highly mobile big-game hunters that has been so pervasive in the literature. He envisages the population as being mobile, but within a more prescribed territory, with the eventual return to a central base--a model he argues is applicable to all of the eastern Paleoindian sites (Gardner 1977:262).

Although no stratified Paleoindian sites have been found in the Watts Bar area, the Higgs site (40LD45) produced the proximal end of a small Clovis point in Stratum VIII (McCollough and Faulkner 1973:44-45). Additional discoveries of fluted Clovis-type points from land-surface deposits confirms the existence of these people in the region (Lewis 1955, 1958; Guthe 1964, 1965, 1966). In the Little Tennessee River Valley, Chapman (1978) and P. A. Delcourt (1980) proposed a geological strategy for the discovery of buried Paleoindian sites within the youngest (T-1) river terrace. However, deep-site testing of the first terrace produced no evidence of Paleoindian sites (Chapman 1978). Although this general pattern of geomorphology is applicable to the Ridge and Valley province, Chapman (1985:144-145) is skeptical that in situ Paleoindian components will be present in the early T-1 due to the destructive energetics of the later T-1 deposition as discussed in the previous chapter.

Dalton Transition

The Pleistocene-Holocene transition in the eastern United States was a period of rapid climatic change, reflected not only in biotic displacement (Delcourt and Delcourt 1984), but also human adaptive patterns (e.g., settlement, technological, and socioeconomic).

Characteristic of these changes is the Dalton tradition from the Midwest and southeastern United States, dated roughly from 10,500 to 9900 B.C. (Goodyear 1982).

Southeastern sites, such as the Nuckolls site in Tennessee (Lewis and Kneberg 1958), the Hardaway site in North Carolina (Coe 1964), and the Stanfield-Worley Bluff Shelter in Alabama (DeJarnette et al. 1962), are among the earliest recorded sites that yielded evidence for a technological continuity between Dalton tool forms (other than projectile points) and earlier Paleoindian lithic assemblages (Goodyear 1982:384).

The stratigraphic overlap with Early Archaic tool assemblages, in addition to the large number of unifacial tool forms shared by Dalton with both Paleoindian fluted point and Early Archaic notched point assemblages, led to the proposition that the Dalton complex was a transitional phase in eastern United States prehistory (Mason 1962; DeJarnette et al. 1962; Willey 1966; MacDonald 1971; Stoltman 1978; Goodyear 1982).

In addition to paleoenvironmental data that provide evidence of dynamic environmental change, faunal and floral evidence indicates that Dalton groups were subsisting essentially on modern species (McMillan 1976; McMillan and Klippel 1981; Smith 1986). Although the exploitation of extinct species may have still been occurring during Dalton times, no evidence has yet been found to document this assumption (Goodyear 1982:391).

Settlement patterns suggested by the environmental distribution of artifacts and site locations offer further evidence of adaptive changes that were occurring during the Dalton transition. Specifically, the Dalton peoples were the first major occupants of caves and rockshelters in upland environments in the Midwest and Southeast (Goodyear 1982:391). In the southern Piedmont, Dalton point distribution indicates the initial utilization of the interriverine zones, followed by an intensive utilization by groups using Early Archaic notched points (Goodyear et al. 1979). From the Mississippi Alluvial Valley in northeastern Arkansas, Morse (1973) and Morse and Morse (1983) have defined a settlement shift from the earlier fluted point sites, which were confined to two major drainages, to the more widespread Dalton sites in interfluvial and fluvial environments.

The isolated finds of Dalton tradition points from the T-1, older alluvial terraces, and uplands in the southern Ridge and Valley provide no clear evidence of a settlement strategy (Chapman 1985a:145). Due to this lack of evidence, Chapman (1985a:145) proposes that the region was less densely populated than the plateau and basin to the west.

Archaic Period

The concept of the Archaic Period in the Southeast can be traced to the 1940s when archaeological investigations in the Pickwick (Webb and DeJarnette 1942) and Kentucky (Lewis and Kneberg 1947; Lewis and Lewis 1961) reservoirs and along the Green River (Webb 1946), provided evidence of this riverine-focused culture.

Lewis and Kneberg (1959:161) define the temporal boundaries of the Archaic Period in the Middle South as "beginning over 8000 years ago during the Anathermal and extending through the Altithermal and Medithermal periods into the second Thermal Maximum of the early centuries of Christian era." However, their contention that "climatic fluctuations appear to have had only minor influences upon the culture" (Lewis and Kneberg 1959:161) is in sharp contrast to our current understanding of the dynamic paleoenvironment and its consequences on human subsistence and settlement (McMillan and Klippel 1981; Williams and Stoltman 1964; Morse and Morse 1983). In the eastern Tennessee Valley the influence of the environment on Archaic Period settlement and subsistence has not been fully explicated.

The settlement model put forth for the Archaic is based on differential seasonal availability of food resources. Lewis and Kneberg (1959; later modified in Lewis and Lewis 1961) postulate a three tier subdivision for the Archaic Period based upon a seasonal settlement model derived from their excavations at the Eva site in the Kentucky Basin. In general, Archaic peoples lived in small, sedentary communities, probably representing patrilocal or matrilocal joint families, along the rivers exploiting "all the resources of the environment in order to maintain [their] pattern of life" (Lewis and Kneberg 1959:163). Temporal shifts in classes of vertebrates and quantity of shellfish delineate the three subdivisions of Eva--Eva, Three Mile and Big Sandy. A clear change in subsistence is indicated by a greatly increased use of shellfish, fish, and birds in the diet and by the decline in the percentage frequency of deer bones. Lewis and Lewis (1961:17-20) attribute this quantitative change to such dynamic environmental conditions as (1) climatically induced change in forest composition from an open forest to dense underbrush; (2) marked increase in predators; or (3) anthropomorphic influences of overhunting or forest fires that destroyed the deer's habitat. Moreover, changes in environmental conditions, in concert with human activities, caused an increased dependence upon riverine resources by the Three Mile culture of the Archaic period as indicated by excavations at the Eva site.

However, for the eastern Tennessee River Valley, Lewis and Kneberg conclude that no Archaic occupation had occurred (Lewis and Kneberg 1941, 1946; Kneberg 1952). They suggest that "the meager evidence of Archaic culture in eastern Tennessee suggests that Paleoindians remained undisturbed in that area until the advent of Woodland peoples around 1000 B.C. or perhaps earlier" (Lewis and Kneberg 1957:20).

The contemporary concept of the Archaic Period in the Southeast is provided by Coe (1964) from excavations at several deeply buried sites in the North Carolina Piedmont. In this seminal work, Coe provided a well-documented temporal sequence of the Archaic cultural complex. This long sequence of the Archaic Period is confirmed by Broyles (1966, 1971) at the St. Albans site in West Virginia.

In the eastern Tennessee Valley, evidence of the Archaic Period became clearer with the excavations in the Nickajack Reservoir. Mitigative activities at four sites in the reservoir produced deeply buried Archaic strata (Faulkner and Graham 1965, 1966a, 1966b). In the Watts Bar Reservoir, McCollough and Faulkner (1973) excavated two Late Archaic living floors.

The most recent and most extensive work conducted on Archaic Period sites comes from the Lower Little Tennessee River Valley, in conjunction with the construction of the Tellico Dam and subsequent impoundment of the Little Tennessee and Tellico rivers (Chapman 1985:142). Excavations at several buried, stratified Archaic sites (Chapman 1977, 1978, 1979, 1981) within the reservoir provided important insights into behavioral patterns of these people (i.e., Davis 1985).

Subsistence strategies of the Archaic period are the subject of some controversy; however, the various models are similar in that they assume seasonal movement for maximum exploitation of different environments (i.e., Cleland 1976:70-71). In general, the Archaic period in East Tennessee represents a period of increasing sedentism through time with seasonal exploitation of various ecosystems. Base camps were situated on aggrading alluvial surfaces of first terraces and were probably occupied from summer through autumn. During the Late Archaic a form of incipient horticulture began to emerge. Archaeobotanical remains recovered from sites in the Lower Little Tennessee River Valley provide an important model for food collecting strategies. Although some sites within the Watts Bar study area have yielded comparable remains (see Table 11), the record is not nearly as complete. The assumption is made, however, that strategies were analogous.

Specific patterns of food collecting strategies from archaeobotanical remains indicate Early and Middle Archaic exploitation focused upon upland habitat species, such as acorns (*Quercus*) and hickory nuts (*Carya*) (Chapman and Shea 1981:77; Delcourt et al. 1986:337). Upland, as well as bottomland species, were also exploited for their fruits and seeds. Important taxa included grape (*Vitis*), goosefoot (*Chenopodium*), persimmons (*Diospyros virginiana*), legumes (*Leguminosae*), as well as other species (Delcourt et al. 1986:335).

During the Late Archaic period, walnut (*Juglans*) becomes an important resource (Delcourt et al. 1986:337). Acorns and hickory nuts are also important resources, although *Quercus* nutshells decrease significantly during this period. Fewer taxa of fruits and seeds are represented in the Late Archaic archaeological record, with grape, *Gramineae* and maygrass (*Phalaris caroliniana*) being dominant (Delcourt et al. 1986:335). However, the exploitation of cultigens, such as cucurbits, are among the earliest from the archaeobotanical record in eastern North America and the initial evidence of changing subsistence patterns (Chapman and Shea 1981:77).

Unfortunately, poor preservation of bone (e.g., acidic soils) in the region has made it impossible to document the faunal resources exploited by Archaic peoples. Faunal assemblages from other sites in the Southeast indicate a broad range of species utilization similar to more recent prehistoric periods (Smith 1986:10, Table 12).

The Early Archaic (ca. 9900-6000 B.C.) represents the earliest in situ occupations identified in the eastern Tennessee Valley (Chapman 1985:147). From deeply stratified sites in the Little Tennessee River Valley, Chapman (1977, 1975, 1978, 1979) has been able to define a seven-phase temporal sequence for the Early Archaic based on diagnostic projectile point types (Chapman 1985a:Table 7-1).

The generalized settlement for the Archaic appears to have been established early during this period. Specifically, residential bases were

> . . . situated in areas of maximum microenvironmental diversity and/or adjacent to lithic sources. Close to these sites are riverine resources, sloughs, backwaters, creeks, broad floodplains, valley slopes and uplands. These base sites, in turn, probably articulated with a number of field camps elsewhere on the floodplain and in the uplands" [Chapman 1985a:148].

During the Middle Archaic (ca. 6000-4000 B.C.) a hiatus in large floodplain sites in the Little Tennessee River Valley suggests a possible settlement shift that has made site location more difficult for the archaeologist. This more dispersed pattern may be the result of population readjustments to the warmer and drier climatic period known as the Hypsithermal (Chapman 1985a:148-149).

The Late Archaic Period (ca. 4000-2000 B.C.) in the eastern Tennessee Valley is somewhat of an enigma in relation to the rest of the Middle South. Specifically, the lack of shellmounds and middens, like those from the middle and western Tennessee Valley (Lewis and Lewis 1961) and the Green River Valley in Kentucky (Webb 1946) that came to characterize this period, are lacking from the eastern valley

(Lewis and Lewis 1959:180; Chapman 1985a:150). However, while there is a general lack of Late Archaic shellmounds in the valley (Chapman 1981), other material remains (i.e., diagnostic projectile points) are ubiquitous in the floodplain deposits (Chapman 1985a:150). Additional archaeological excavation of Late Archaic sites in the valley should provide further insight into the lifeways of these people. Although excavations at the Iddins site (Chapman 1981) provided evidence of pronounced midden and feature density that suggests a diversity of residential activities, its representativeness of the region is unknown without additional research (Chapman 1985a).

An additional aspect of the Late Archaic is the initial establishment of an exchange network in the eastern United States (Winters 1968). Evidence of this network is suggested by the exchange and movement of lithic materials between the valley and western North and South Carolina (Chapman 1985:151).

The end of the Archaic period in East Tennessee has been defined by Faulkner (1967:17) as the Terminal Archaic and dated at the Higgs site (40LD46) between 800 and 900 B.C. (McCollough and Faulkner 1973:65). This temporal period is characterized by an increasing dependence on domesticated plants, such as sunflower, and the introduction of ceramics (Graham and Faulkner 1966b:124-125).

Early Woodland Period

The Early Woodland period (ca. 1000 B.C.- A.D. 100) in East Tennessee is marked by the introduction of crushed quartz- or sandstone-tempered fabric or cord-marked Watts Bar phase ceramics (McCollough and Faulkner 1973:93). The final phase of Early Woodland is characterized by a technological change to limestone-tempered pottery--Long Branch fabric marked (McCollough and Faulkner 1973:93; Lewis and Kneberg 1957). With the introduction of pottery during the Watts Bar phase came extensive exploitation of arboreal seed crops, in addition to the continued practice of horticulture, and a more permanent settlement pattern. It appears that a degree of residential stability was found in the eastern Tennessee Valley by the end of the first millennium B.C. (McCollough and Faulkner 1973:100).

In addition to new technological developments (e.g., ceramics), other important aspects of the culture show strong continuities with earlier groups (B. D. Smith 1986:41). From the Calloway Island site (40MR41) in the Little Tennessee River Valley, the continuation of the pan-regional trade network is suggested. Specifically, this interaction with Early Woodland-Adena cultures in the north is evidenced by certain artifacts, raw materials, and burial patterns (Chapman 1979:257).

Middle Woodland Period

Two Middle Woodland phases have been recognized in the eastern Tennessee Valley--the Candy Creek phase, characterized by limestone-tempered pottery, and the Connestee phase represented by sand-tempered pottery and Hopewellian traits (McCollough and Faulkner 1973:95). Initially proposed by McCollough and Faulkner (1973) as representing early and late phases of the Middle Woodland Period, excavations at Icehouse Bottom (40MR23) could not discern temporal differences between the two (Cridlebaugh 1981:182).

At Icehouse Bottom (40MR23) the recovery of exotic artifacts and Chillicothe Rocker-stamped, Plain Rocked and Georgia Swift Creek complicated stamped ceramics indicate participation in the Hopewell Interaction Sphere by these people (Chapman and Keel 1979). However, a paucity of domestic sites from the Middle Woodland cultural period has afforded very little opportunity to study the settlement patterns and the domestic lives of these peoples. All our knowledge has been biased by this apparent lack of site types, especially since excavations in the past have been largely confined to ceremonial centers, mounds, and burials (C.H. Faulkner 1985:personal communication).

Although a general continuity in exchange networks, burial practices, and settlement systems is apparent for this time period, a number of significant changes in subsistence-related technology occurred (Smith 1986:42). From across the Southeast, there is some evidence for an intensification in the use of arboreal seed crops after 2500 B.P. The increased reliance on this resource is reflected in the numerous storage pits dated to this time period and the abundant amounts of charred acorns, nuts and other vegetable matter that have been excavated from them (Chapman and Shea 1981; Delcourt et al. 1986; Smith 1986:42). The increased utilization of these resources may not be a response to environmental or cultural dynamics, but rather the result of the improved ability to process them for consumption (McCollough and Faulkner 1973:98-99; Smith 1986:42-43).

Specific patterns of subsistence change in the valley include the appearance of maize around A.D. 175 (Chapman and Crites 1987). Although only a minor constituent during this period, maize becomes increasingly more important through time. Another resource that begins to appear in significant numbers during the Middle Woodland period is the freshwater mussel (Charles 1973; Parmalee and Bogan 1986). Environmental change, food stress from increased populations, and the lack of preservation (Chapman 1981:155) in earlier deposits have all been proposed to explain the rather sudden appearance of large quantities of molluscan remains in Middle Woodland archaeological deposits of the upper Tennessee River Valley. The ability to more efficiently exploit, process, and store wild and cultivated plant foods encouraged a greater labor investment in more substantial structures, the winter occupation of these settlements, and the shift in settlement to higher terraces that were less prone to flooding (Faulkner 1977; Smith 1986:43).

Late Woodland Period

The Late Woodland Hamilton culture was originally described by Lewis and Kneberg (1946:44) from their excavations in the Chickamauga Reservoir. Generally, the numerous small shell middens were interpreted as being dispersed habitation sites permanently occupied by extended family groups who subsisted primarily on shellfish (Lewis and

Kneberg 1946:36-37). The demise of the Hamilton culture is explained by the rapid replacement by the Mississippian culture (Lewis and Kneberg 1946:37).

Following excavations at the Doughty (40LD46) site, McCollough and Faulkner (1973:124) dispute this earlier interpretation and suggest these midden sites represent seasonal occupation for the effective exploitation of shellfish. These seasonal camps were occupied for a short period of time by small family groups during the winter and early spring when food resources were scarce on the floodplain and lower terraces. These seasonal camps were tied to larger semipermanent settlements in the floodplain (McCollough and Faulkner 1973:124). However, the lack of evidence of structures and the few discovered features made it impossible to estimate population size or specific domestic activities at the Doughty site (McCollough and Faulkner 1973:126).

From these data, McCollough and Faulkner (1973:127-128) propose a three-phase seasonal settlement model for the Hamilton phase in the eastern Tennessee Valley. Summer and fall settlements of band size were located in the floodplain zone where incipient horticulture was practiced and the wild plants and animal foods of the riverine environment could be exploited. During the winter and spring nuclear or extended families dispersed to higher terraces to avoid seasonal flooding, while continuing to exploit riverine resources. Hunting parties established camps in coves and valleys of the uplands, often utilizing caves and rockshelters. After the flood season was over on the lower terraces and the floodplain became the most productive zone, these families congregated once more at the floodplain settlements.

Emergent Mississippian

The recognition of Late Woodland components in East Tennessee has been difficult due to similarities in Middle Woodland and Late Woodland ceramic assemblages (Chapman 1973; Kimball and Baden 1985). Further complications include the strong bias of excavated and radiocarbon-dated burial mounds, as opposed to occupation sites, which show continued use (A.D. 700 to A.D. 1200) well into the Mississippian Period (Schroedl and Boyd 1985:4). Faulkner (1973), and later Schroedl and Boyd (1985), contend that the continuity in these factors argues for a model of in situ cultural development of Mississippian cultures in East Tennessee.

The important influence of this cultural change was probably the integration of maize into the already existing horticultural system (Ford 1981; Chapman and Shea 1981; Delcourt et al. 1986). The increased productive yield of the horticultural system without a significant increase in energy expenditure may have allowed the population threshold to extend beyond its previous optimal mean. As a result, Late Woodland sociopolitical and socioreligious organizations became stressed. The only solution being greater social differentiation with the control of resources by increasingly fewer individuals or groups, in addition to more explicitly defined social roles. Once established this system became self-regulating until it reached optimal efficiency during the Late Mississippian Period (Schroedl and Boyd 1985:9).

Mississippian Period

This late prehistoric period represents an important reorganization in sociopolitical and socioreligious organizations in the Southeast. Generally, defined under the term "Mississippian", for its origination in the Mississippi Alluvial Valley, this 500 year period (ca. A.D. 900-1600) constitutes the best-documented and most-detailed portion of the southeastern archaeological record (Smith 1986:57). Several recent models have been offered concerning general patterns of subsistence (Smith 1975, 1984a), settlement (Smith 1978a, 1978b), sociopolitical organization (Pebbles and Kus 1977; Smith 1978b) and ideology (Brown 1976) of these alluvial valley peoples.

Certain material characteristics have been used to define this cultural tradition:

(1) Shell-tempered ceramics and the appearance of thin-walled vessels, in addition to more sophisticated vessel shapes and designs (i.e., effigy vessels and handles).

(2) Change in structure form from the Woodland wall-post structure to the Mississippian pattern of inserting wall posts into trench foundations. This created a much more substantial structure and suggests a greater degree of village permanence.

(3) Development of the Southern Cult religious iconography which has been attributed to Mesoamerican influence. Widespread use of

motifs depicting serpents, dancing warriors, eye-in-hand, and skull and crossbones suggest a more complex socioreligious organization.

(4) Intensification of horticulture, specifically the increase in maize remains from archaeological context, and the addition of beans, provides a new balance to the diet.

(5) The development or possible intensification of ranked societies as indicated by structured community pattern and burial treatment.

Hiwassee Island represents a local manifestation of the early Mississippian cultural period in the eastern Tennessee Valley (Lewis and Kneberg 1946). The cultural sequence at Hiwassee Island during the period was little different from the numerous other localities in the Southeast. The transitional Early Mississippian, or Martin Farm type site (40MR20) (1000-700 years B.P.) in the Little Tennessee River Valley (Schroedl et al. 1985), is represented by the introduction of ceramics tempered with limestone and crushed mussel shells. Kneberg (1956:24) identified the artifact assemblage as including small, triangular Hamilton and Madison projectile points, steatite earspools, limestone-tempered and shell-tempered ceramics. Mound building and wall-trench structures are also characteristic of this period. However, it was not until recently that the specific identity of the Early Mississippian Martin Farm component was explicated (Schroedl et al. 1985).

Shifts in residential location away from the seasonally flooded floodplain to the higher terraces is represented during the Early

Mississippian Period. This settlement shift has been argued as representing a means by which the more permanent structures could be protected from seasonal flooding, as well as the increased need for fertile, tillable soils of the first terraces for intensive maize agriculture (Schroedl et al. 1985:466-467).

The later Dallas phase (700-300 years B.P.) represents a gradual introduction of new traits (e.g., negative-painted ceramics), increased social complexity, and population increase. Initially this phase was attributed to the arrival of Dallas people into the region (Lewis and Kneberg 1946); however, recent work attributes sociopolitical changes to in situ development from earlier cultures (Faulkner 1973; Schroedl and Boyd 1985). At the Toqua site (40MR6) in the Little Tennessee River Valley, as well as other sites in the Southeast, archaeological investigations have indicated that certain sites became centers from which social, economic, and religious activities could be coordinated through a network of allied sites which formed polities or chiefdoms (Polhemus 1987).

The regional organization of the Mississippian polity network in the Southeast has been viewed "as shifting networks of conflict and alliance, each of which involved a number of neighboring river valley polities" (Smith 1986:58). This shifting cycle between extremes of "minimal organization" (fragmented segmentary tribes) and "maximum sociopolitical complexity" (large complex or regional-level chiefdoms) has been argued as a general developmental model for the Southeast, although there is no evidence to suggest that these cycles were temporally synchronized or causally linked (Smith 1986:58).

European contact and the spread of infectious disease (Milner 1980), in addition to climatically influenced precontact change (Brose 1984; Green and Munson 1978), have been advanced as potential causes for dramatic and abrupt changes in sociopolitical organization in the Southeast during the sixteenth and seventeenth centuries (Smith 1986:58-59).

CHAPTER V

HISTORY OF REGIONAL ARCHAEOLOGICAL INVESTIGATIONS

Archaeological investigations in the eastern Tennessee River Valley in general, and the Watts Bar Reservoir study area in particular, have been active for over one hundred years. However, initial interest in the aboriginal remains of the region was not aimed at scholarly insight; instead, it was a destructive search by collectors for "buried treasure" (Whiteford 1952:207).

The pattern of research in the region can be divided into two general periods. The initial period coincides with Willey and Sabloff's (1980) Classificatory-Descriptive period. It is characterized by museum and scientific-society sponsored expeditions seeking to identify aboriginal remains. Although these investigations were basically descriptive, they provided our initial view of the richness of the prehistoric cultures of North America, thereby providing the basic stimulus and chronology on which contemporary archaeology has been built. The last 50 years have been characterized by federally mandated and sponsored mitigative programs. The following is a synopsis of these research endeavors (see Table 13).

John Haywood's (1959) "The Natural and Aboriginal History of Tennessee . . .," originally published in 1823, presented one of the earliest descriptions of the aboriginal remains in the Watts Bar study area. The following description is of two sites, the Bell site or Huffine Island (40RE1) and the DeArmond site (40RE12), both of which

Table 13. Previous investigations within the Watts Bar Reservoir study area.

Investigator	Date*	Research Focus
E. O. Dunning	1872	Investigation of aboriginal remains.
Cyrus Thomas	1894	Origin of aboriginal mounds.
C. B. Moore	1915	Identify and investigate all aboriginal sites and mounds.
M. R. Harrington	1922	Define the archaeological complex of the region and the relationship of the Cherokee.
C. H. Nash	n.d.a	Survey of the reservoir prior to impoundment and the explication of the Woodland complex.
Wendall C. Walker	n.d.a	Federally sponsored excavations of Woodland and Mississippian village and burial mounds (40RH41).
Chandler W. Rowe	n.d.a	Federally sponsored excavation of Woodland burial mounds (40RH42).
Alden C. Hayes	n.d.a	Federally sponsored excavation of Woodland burial mounds (40RH42).
T.M.N. Lewis	n.d.	Federally sponsored excavations of Mississippian mound complex (40RE1).
Wendall C. Walker	n.d.b	Federally sponsored excavation of Woodland burial mounds (40RE4).

Table 13. (continued)

Investigator	Date*	Research Focus
Alden C. Hayes	n.d.b	Federally sponsored excavation of Woodland mounds (40RE6).
C. H. Nash	n.d.b	Federally sponsored excavation of mound and village components (40RE8).
John Alden	n.d.	Federally sponsored excavation of mound complex (40RE12).
Wendall C. Walker	n.d.c	Federally sponsored excavation of Middle Mississippian village (40RE12).
Alden C. Hayes	n.d.c	Federally sponsored excavation of Mississippian village and mound (40RE12).
Chandler W. Rowe	n.d.b	Federally sponsored excavation of Early Woodland and Early Mississippian components (40RE17).
Chandler W. Rowe	n.d.c	Federally sponsored test excavation of Dallas phase village (40RE19).
C. H. Nash	n.d.c	Federally sponsored excavation of Late Woodland site (40RE33).
Wendall C. Walker	n.d.d	Federally sponsored test excavation of Woodland and Mississippian village and burials (40RE53).

Table 13. (continued)

Investigator	Date*	Research Focus
Chandler W. Rowe	n.d.d	Federally sponsored test excavation of village site and associated shell midden (40RE53).
Loudon County Chapter of the Tennessee Archaeological Society (see Chapman 1982)	1982	Investigation of the "Great Midden" at Bussell Island (40LD17).
Loudon County Chapter of the Tennessee Archaeological Society (see Quimby 1975)	1975	Excavation of a Dallas phase burial at the Henry site (40LD53).
G. F. Schroedl	1972-1976	Survey and test of sites within the Clinch River Breeder Reactor Project area.
McCollough and Faulkner	1973	Mitigation excavation within I-75 right-of-way. Terminal Archaic and Early-Middle Woodland subsistence and settlement.
G. F. Fielder, Jr.	1974	Survey and test of sites within Oak Ridge reservation.
G. F. Fielder, Jr.	1975	Survey and test of sites within the Exxon Nuclear Plant boundary.
F. A. Calabrese	1976	Investigation of Archaic and Woodland cultural sequences.
J. Chapman	1976	Backhoe testing of midden at Bussell Island (40LD17).

Table 13. (continued)

Investigator	Date*	Research Focus
P. M. Thomas	1977	Investigatory excavations at Ft. Southwest Point (40RE119).
L. Chapman	1977	Site testing at Blair Bend. Late Archaic to Mississippian components.
G. F. Schroedl	1978	Investigation of Late Woodland-Early Mississippian transition.
Davis, et al.	1982	Test excavations at Late Mississippian/proto-Historic site (40LD18).
R. L. Jolley	1982	Site testing within the Clinch River Breeder Reactor Project area.
C. C. Boyd, Jr.	1982	Modified Phase I testing along Southern Railway lead track right-of-way (Blair Bend).
W. O. Autrey, Jr.	n.d.	Survey and evaluation of sites within Tennessee Synfuels Associates project area.
S. D. Smith	1985	Archaeological investigation for the reconstruction of Ft. Southwest Point (40RE119).

Table 13. (continued)

Investigator	Date*	Research Focus
K. P. Cannon	1986	Assessment of archaeological resources within the reservoir.

*Indicates date of publication. Federally sponsored work refers to TVA and WPA projects conducted during the late 1930s and early 1940s. These excavations have only been reported as descriptive summaries of excavation methods and artifacts recovered and are on file at the McClung Museum, Knoxville. Other unpublished reports are on file at McClung Museum and with the funding agency.

were excavated by the University of Tennessee during the 1930's and 1940's.

> Ten miles above Southwest Point, in Roane County in East Tennessee, on the south side of the Tennessee River, and about 20 poles from the bank of the river, stands a mound about 30 feet high, with a flattened top, which contains upwards of one-fourth of an acre, with a regular ascent from the bottom to the top on each side [40RE1]. Immediately at the end of the ascent is a stone wall, which is continued all around the summit, and is at this time about two feet high. [The stone wall was removed or destroyed during cultivation of the area.] On the north side of the river is a high bluff [Paint Rock Bluff] jutting over the western end, and . . . fronting the mound, on the face of which are cut three images, painted with black and red colours from the waist upwards, one of which figures is the representation of a female. About six miles below Southwest Point, on the south side of the Tennessee, are five large mounds [40RE12] in the bend in the river, all of which stand in one acre of ground nearly. One of them is much larger than the rest, and the top flat, with a stone wall like the one before mentioned, and to the east from the other four. The whole are enclosed with a wall raised up, composed of dirt, two or three feet high. [By the time of the excavation of the site by the University of Tennessee the stone wall had been destroyed and only one mound remained.] Many carvings of the rocks are in the vicinity, and lately human bones have been found here [Haywood 1959:135-136].

Although antiquarians, such as Haywood, had long been interested in the archaeological remains of the eastern Tennessee Valley, scientific inquiry was not initiated until the latter part of the nineteenth century. It was during these formative years that fieldworkers such as E. O. Dunning (1872), under the auspices of the Peabody Museum, and J. W. Emmert, under the direction of Cyrus Thomas for the Bureau of American Ethnology, began to investigate the ethnic origin of the mounds and other earthworks of the eastern Tennessee Valley (Thomas 1894:21).

Results of the work by Thomas (1887, 1890, 1891, 1894) and Holmes (1894) conclude that the archaeological remains of the region were products of ancestral American Indians. Specifically, this work helped dispel the theory of an extinct race of "Mound Builders" and argued for a strong connection between the prehistoric cultures and the later Cherokee.

Following these initial investigations, C. B. Moore began a more ambitious program to enumerate and investigate all sites and mounds along the Tennessee River and its tributaries from its mouth at Paducah, Kentucky, upriver to Knoxville, Tennessee (Moore 1915:181). Travelling along the Tennessee River and its tributaries in the steam-powered boat "The Gopher," Moore and his associates investigated 40 sites with at least 140 components within the Watts Bar study area. Twenty-eight or 20 percent of the components were excavated (Moore 1915:399-419; see Figure 10). Although an extensive amount of archaeological investigation was conducted, the results were almost entirely descriptive and no attempt was made to synthesize the material remains into cultural complexes or explain their similarities and differences.

Following C. B. Moore, M. R. Harrington conducted numerous excavations along the Tennessee River in the area of the confluence of the Little Tennessee and the Hiwassee rivers in a serious attempt to define the archaeological complexes and the relation of the Cherokee to earlier components (Harrington 1922). As a result of Harrington's work, the archaeology of eastern Tennessee began to unfold, albeit slowly. However, with the creation of the Tennessee Valley Authority and the government funds made available through Federal Emergency

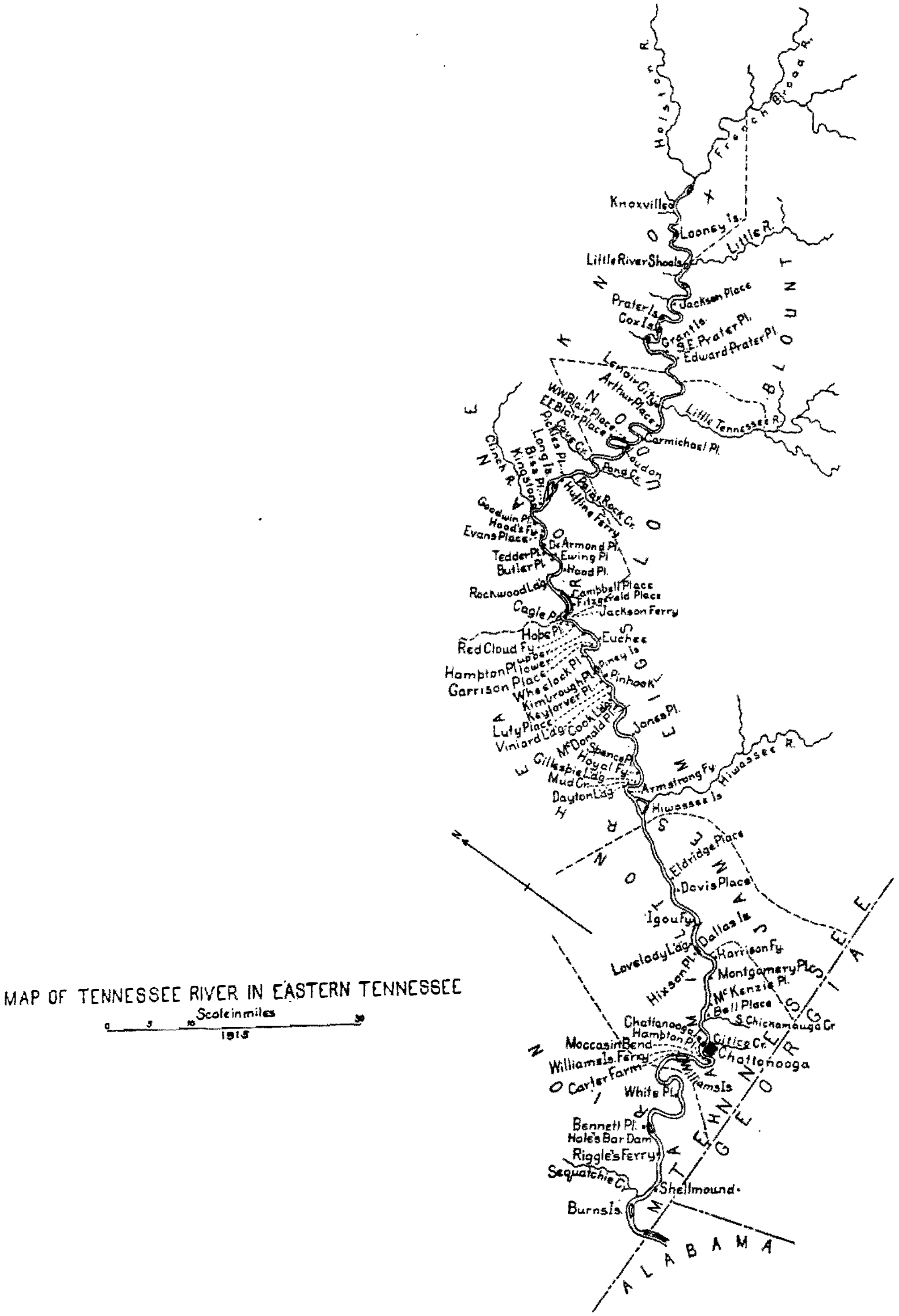

Figure 10. Map of upper Tennessee River sites recorded by C. B. Moore (after Moore 1915:333).

Relief, especially the Works Progress Authority (WPA), extensive excavations were conducted in the region (Whiteford 1952:207-208).

Although not within the study area, the excavations by Nash and others, and reported by Lewis and Kneberg (1946), at Hiwassee Island was one such project. Based on the work at Hiwassee Island, and other work within the Chickamauga Basin, Lewis and Kneberg formulated a model of settlement and subsistence for the Woodland cultural period, through Mississippian times, and into the Historic Period. This historical sequence allowed them to formulate a model of cultural change, which was facilitated by the intrusion of Dallas-phase peoples about 700 years ago. And although recent research within the valley has contested Lewis and Kneberg's migration theory (e.g., Faulkner 1973; Kimball 1980; Schroedl and Boyd 1985), the Hiwassee Island study was a formative beginning in explicating the dynamics of cultural change within the eastern Tennessee River Valley.

The creation of the Tennessee Valley Authority, and its implementation of an aggressive program of water control, was a major impetus for continued investigation of the archaeological remains of the area (Whiteford 1952:208). These federally sponsored "salvage" programs characterize the last fifty years of archaeology within the region. Specifically, the construction of Watts Bar Dam, and the subsequent impoundment of the Tennessee and Clinch rivers in 1942 created a need to document and excavate archaeological sites in danger of damage from impoundment.

In response to the eminent destruction of the archaeological record by impoundment, Nash's (n.d.) survey during the late 1930s and early 1940s was conducted by the University of Tennessee. The survey was focused towards locating sites that would provide information for the explication of the Woodland Period in the eastern Tennessee Valley (Nash 1941). Due to the onset of the Second World War, his work was never synthesized or published.

Continued funding by the Tennessee Valley Authority and the associated government funds made available during the Depression Era (i.e., Works Progress Authority), provided the impetus for several extensive excavations within the Watts Bar Reservoir. From 1935 to 1942, 15 excavations at 11 sites were conducted, the main focus of which was the investigation of Woodland and Mississippian mound complexes (see Table 1). The results of these excavations, however, have never been thoroughly analyzed, and remain filed as field notes in the McClung Museum.

Following a hiatus of thirty years, archaeological investigations in the study area were renewed in the 1970s in the wake of several major construction projects. Mandated by federal legislation (i.e., National Environmental Protection Act, Executive Order 11593, the Department of Transportation Act, among others), these projects sought to identify, test, and propose mitigation strategies for cultural resources that were in danger of impact. The archaeological research conducted during these CRM projects was hampered and at times impaired by temporal, boundary, and monetary restrictions.

In the late spring and summer of 1972, excavation of two sites, the Higgs (40LD45) and the Doughty (40LD46) sites, was funded by the Tennessee Department of Transportation and the Federal Highway Administration prior to construction of I-75 (McCollough and Faulkner 1973). These sites yielded a cultural sequence from the Late or Terminal Archaic to the Late Woodland-Hamilton phase. Although the excavation provided some insight into the culture history of the upper Tennessee River Valley, it only increased the contention that our knowledge of this region was decidedly lacking.

The expansion of the Oak Ridge Reservation and several associated projects on the Clinch River necessitated a series of survey and testing programs (e.g., Schroedl 1972-1976; Fielder 1974, 1975; Jolley 1982; Autrey n.d.). In general, the project methodologies combined surface- and subsurface-survey techniques--controlled surface collection, shovel tests, strategically placed test units, and backhoe trenching--to discover, identify and assess the research potential of all sites encountered. Although confined to specifically defined study areas, several of the surveys were able to address the problem of prehistoric exploitation of upland and valley slope areas (e.g., Jolley 1982). Two of the major projects, the Clinch River Breeder Reactor (Schroedl 1972-1976) and the Exxon Nuclear Facility (Fielder 1975), have been abandoned, thereby cutting funds for analysis and synthesis of collected data.

From 1970 to 1974, periodic excavations were conducted at Bussell Island (40LD17) by the Loudon Chapter of the Tennessee Archaeological Society in consultation with the University of Tennessee Department of Anthropology. Excavations consisted of systematic removal of deposits from the "Great Midden" in one foot arbitrary levels. The deposit was trowel sorted, but not screened. In November 1974 excavations ceased (Chapman 1982). This group was also involved in the excavation of a Dallas phase burial on the Henry Farm site (40LD53) (Quimby 1975).

Additional investigation of Bussell Island was conducted in December 1976 as part of the Tellico Archaeological Project. Five backhoe trenches were dug to discern the nature of the deeply buried Archaic deposits. In 1977 the Bussell Island site was placed on the National Register of Historic Places (Chapman 1982). In the Fall of 1981 investigation of the mainland village site (40LD18), adjacent to Bussell Island was conducted. Although considerable disturbance to the site was apparent, test excavations revealed intact midden and feature deposits were still present. Artifacts recovered from the site indicate an Early Mississippian, and Late Mississippian/proto-Historic occupation. Davis et al. (1982:583) judged the site to be significant based on the potential for it to yield archaeological data pertinent to settlement and subsistence patterning.

Also in Loudon County, Lloyd Chapman (1977) conducted a program of survey and testing at the site of the Blair Bend Industrial Park. Funding was provided by the City of Loudon and entailed the discovery and evaluation of sites in danger of impact by construction processes.

In particular, two sites, 40LD56 and 40LD58, were recommended for inclusion on the National Register of Historic Places. Both provided in situ remains of Late Archaic, Woodland and Mississippian components that heretofore had not been discovered in the eastern Tennessee River Valley (L. Chapman 1977:12). Specifically, unique faunal preservation at 40LD56 has the potential to yield insight into Middle Woodland subsistence, a sharp contrast to the poor preservation at similar sites within the valley (e.g., Chapman 1973:117).

In November of 1981 additional investigations were conducted along Blair Bend in response to the construction of the Southern Railway lead track right-of-way. Boyd (1982) conducted a modified Phase I investigation to assess the integrity and significance of cultural deposits associated with the Henry site (40LD53). Controlled surface collections in plowed areas and two test units failed to encounter any intact deposits within the right-of-way. Therefore, Boyd judged no further mitigation was warranted.

During the summers of 1973 and 1974, initial archaeological investigations were conducted in an attempt to locate Fort Southwest Point (40RE119), a late eighteenth and early nineteenth century military outpost initially involved in the protection of white settlers along the frontier. Local history placed the fort atop a hill south of Kingston at the confluence of the Clinch and Tennessee rivers. Specifically, the goals addressed by the study entailed: (1) determining the actual presence of the fort; (2) substantiating the exact location of the fort; (3) gathering information for interpreting the fort size, its configuration and the method of construction; and (4) conducting exploratory excavations of interior structures (Thomas 1977:17). This initial excavation not only documented the presence and location of the fort, but also the existence of a previously unknown late prehistoric Indian village (Thomas 1977:3).

Continuation of the Fort Southwest Point investigations did not begin again until 1984 when the Tennessee Division of Archaeology, under the direction of Samuel Smith, proposed a three phase project for documentation and reconstruction of the fort. The project goals proposed included: (1) additional archaeological investigation; (2) the development of reconstruction recommendations, plans and specifications; and (3) reconstruction of some portion of the site (Smith 1985:1). Analysis of the excavated material and recently discovered historic documents are currently being undertaken and will be presented in a forthcoming report by the Division (Smith 1985).

Prior to the beginning of construction of the Watts Bar Nuclear Power Plant in Rhea County, TVA funded the excavation of the Early Mississippian period Leuty mound (40RH6) and five Late Woodland Hamilton phase mounds (40RH7) (Schroedl 1978). Radiocarbon dates indicate a continued cultural sequence from ca. A.D. 700 to A.D. 1200. Schroedl (1978:iv) interpreted this continued use of burial mounds as being "compatible with the interpretation that the development of Mississippian period culture in East Tennessee is largely due to gradual internal change beginning in Late Woodland times."

Also in Rhea County, the University of Tennessee-Chattanooga conducted excavations in conjunction with the construction of the Watts Bar Nuclear Power Plant (Calabrese 1976). Excavation was undertaken at 40RH6, a multicomponent habitation site from Archaic times (dated 1000 to 1500 B.C.) into the Mississippian cultural period (A.D. 1100), located on McDonald Bend in the Tennessee River.

Two additional surveys were conducted in association with the Watts Bar facilities during this time period. Burnett and Coverdale (1973) conducted a supplemental survey to Calabrese's (1976), but it did not reveal any significant findings. Bass and Lenhardt's (1980) survey was more ambitious than Burnett and Coverdale's (1973) and entailed not only controlled surface collection, but also deep-site testing at 40RH64. Buried cultural deposits at 40RH64 revealed diagnostic components dating from Middle Archaic to Late Archaic/Early Woodland times and included a probable Early Archaic component. This extensive site was recommended for inclusion on the National Register of Historic Places (Bass and Lenhardt 1980:1).

In an effort to document the cultural resources of the reservoir, the Tennessee Valley Authority contracted the University of Tennessee to conduct an above pool survey of TVA-owned lands (Cannon 1985c). In addition to TVA designated land management tracts, a 10 percent stratified random sample of the main river terrace was also examined for evidence of human occupation. This sample of areas allowed examination of most, if not all, of the microenvironmental zones (i.e., river terraces, uplands and bluffs) within the region in an effort to delineate a cursory pattern of human land use (Cannon 1986).

An opportunistic survey of the region was organized in an effort to efficiently examine as much of the reservoir as time and money allowed. The survey employed several techniques, including pedestrian survey, subsurface testing, and examination of erosional areas and cut banks during winter drawdown, in an effort to meet these needs. A total of 71 management tracts and 43 randomly selected tracts was examined which led to the documentation of 30 new sites. In addition to the identification of new sites, 75 previously recorded sites were reexamined to assess their state of preservation (Cannon 1986).

As was previously stated, archaeological investigations in the region have been conducted for over 100 years; however, characteristics of research orientation, especially during the earlier period, and funding restrictions have created serious biases in the study of the region's prehistory (Cannon 1985b, 1986). Specifically, the general lack of indepth analysis and synthesis has hampered the understanding of the prehistory of the eastern Tennessee Valley in general and the Watts Bar Reservoir in particular.

CHAPTER VI

CHRONOLOGY

A total of 39 radiocarbon dates has been obtained from sites within the Watts Bar Reservoir study area. Table 14 provides a listing of these dates, their context and respective reference. An examination of the dates indicates a bias towards the Early Woodland (31%) and Late Woodland-Mississippian (46%) cultural periods. The absence of Early Archaic, Middle Archaic and Middle Woodland dates probably are the result of several factors including differential preservation at sites, specific research interests or the scope and funding of mitigation projects. Despite the gaps in the chronology from Watts Bar, the radiocarbon dates provide an important contribution to the region's prehistory.

The first radiocarbon dates from the Watts Bar study area were submitted by T.M.N. Lewis of the University of Tennessee from material excavated during the 1940's. The first date (M-730) was obtained from charred wood excavated from Mound 4 at the Alford site (40RE4). The date obtained was 930±150 radiocarbon years B.P., placing it within the Late Woodland-Mississippian transition. Ceramics excavated from the site were predominantly Hamilton Plain (Crane and Griffin 1961:114).

Another date was obtained from material excavated during the WPA days from the DeArmond site (40RE12). Charcoal from a burned roof of an Early Mississippian structure provided a date of 670±150 radiocarbon years B.P.(M-731). Ceramics from the site are indicative of the

Table 14. Radiocarbon dates obtained from sites within the Watts Bar Reservoir study area.

Site	Age (RC Yrs BP)	Sigma	Uncalibrated Dates	Dates*	Lab Number	Context	Reference
LATE ARCHAIC							
40LD45	3870	250	1920 BC	2885-1885 BC	CWRU-84	Stratum VI	McCollough and Faulkner 1973
40RH6	0328	190	1330 BC	1985-1120 BC	GX-2915	F-15	Calabrese 1976
40RH6	3020	260	1070 BC	1875-630 BC	GX-2916	G-20	Calabrese 1976
TERMINAL ARCHAIC							
40LD45	2970	155	1020 BC	1560-830BC	UGa-547	Stratum VI	McCollough 1973
40LD45	2870	85	900 BC	1340-805 BC	UGa-517	St. IV Feat. 11	McCollough and Faulkner 1973
40LD45	2730	110	780 BC	1220-640	CWRU-27	St. IV Feat. 12	McCollough and Faulkner 1973
EARLY WOODLAND							
40RE108	2525	220	565 BC	1050-190 BC	GX-3452	I-6	Schroedl in Kimball 1984
40RE108	2470	160	520 BC	850-210 BC	GX-3454	I-6	Schroedl in Kimball 1984
40LD45	2355	85	405 BC	775-185 BC	UGa-515	St. II Feat. 18	McCollough and Faulkner 1973
40LD45	2100	85	150 BC	395 BC-AD 185	CWRU-30	St. IV Feat. 11	McCollough and Faulkner 1973
40LD45	1700	135	AD 250	AD 20-595	CWRU-31	St. II Feat. 3	McCollough and Faulkner 1973
40RE108	1700	185	AD 250	125 BC-AD 620	GX-3458	I-8	Schroedl in Kimball 1984
40LD45	1660	80	AD 290	AD 70-585	CWRU-28	St. II Feat. 18	McCollough and Faulkner 1973
40RE108	1600	275	AD 350	155 BC-AD 895	GX-3456	I-9	Schroedl in Kimball 1984
40LD45	1550	95	AD 400	AD 240-620	CWRU-29	Stratum VI	McCollough 1973**
40LD45	1475	165	AD 475	AD 240-790	UGa-548	St. II Feat. 17	McCollough and Faulkner 1973
40LD45	1310	110	AD 640	AD 580-890	CWRU-26	St. II Posthole 9	McCollough and Faulkner 1973
MIDDLE WOODLAND							
40RE108	1210	170	AD 740	AD 590-1050	GX-3457	I-9	Schroedl in Kimball 1984
LATE ARCHAIC							
40LD45	3870	250	1920BC	2885-1885 BC	CWRU-84	Stratum VI	McCollough and Faulkner 1973
40RH6	0328	190	1330 BC	1985-1120 BC	GX-2915	F-15	Calabrese 1976
40RH6	3020	260	1070 BC	1875-630 BC	GX-2916	G-20	Calabrese 1976
TERMINAL ARCHAIC							
40LD45	2970	155	1020 BC	1560-830 BC	UGa-547	Stratum VI	McCollough 1973
40LD45	2850	85	900 BC	1340-805 BC	UGa-517	St. IV Feat. 11	McCollough and Faulkner 1973
40LD45	2730	110	780 BC	1220-640 8C	CWRU-27	St. IV Feat. 12	McCollough and Faulkner 1973
EARLY WOODLAND							
40RE108	2525	220	565 BC	1050-190 BC	GX-3452	I-6	Schroedl in Kimball 1984
40RE108	2470	160	520 BC	850-210 BC	GX-3454	I-6	Schroedl in Kimball 1984

Table 14. (continued)

Site	Age (RC Yrs BP)	Sigma	Uncalibrated Dates	Dates*	Lab Number	Context	Reference
40LD45	2100	85	150 BC	395 BC-AD 185	CWRU-30	St. IV Feat. 11	McCollough and Faulkner 1973
40LD45	1700	135	AD 250	AD 20-595	CWRU-31	St. II Feat. 3	McCollough and Faulkner 1973
40REI08	1700	185	AD 250	125 BC-AD 620	GX-3458	1-8	Schroedl in Kimball 1984
40LD45	1660	80	AD 290	AD 70-585	CWRU-28	St. II Feat. 18	McCollough and Faulkner 1973
40RE108	1600	275	AD 350	155 BC-AD 895	GX-3456	I-9	Schroedl in Kimball 1984
40LD45	1550	95	AD 400	AD 240-620	CWRU-29	Stratum VI	McCollough 1973**
40LD45	1475	165	AD 475	AD 240-790	UGa-548	St. II Feat. 17	McCollough and Faulkner 1973
40LD45	1310	110	AD 640	AD 580-890	CWRU-26	St. II Posthole 9	McCollough and Faulkner 1973
MIDDLE WOODLAND							
40RE108	1210	170	AD 740	AD 590-1050	GX-3457	I-9	Schroedl in Kimball 1984
LATE WOODLAND-MISSISSIPPIAN							
40RH7	1275	105	AD 675	AD 590-900	GX-2604	Mound 0-1	Schroedl 1978a
40RE124	1265	170	AD 685	AD 565-1025	GX-3463	Mound 1	Schroedl 1978a
40RH7	1150	130	AD 800	AD 605-1185	GX-2603	Mound 0-1	Schroedl 1978a
40RH7	1145	120	AD 805	AD 630-1045	GX-2605	Mound 0-2	Schroedl 1978a
40RH7	1135	100	AD 815	AD 635-1045	GX-2596	Mound A-1	Schroedl 1978a
40RE124	1070	180	AD 880	AD 610-1260	GX-3459	Mound 3	Schroedl 1978a
40RH7	1030	95	AD 920	AD 800-1220	GX-2602	Mound B	Schroedl 1978a
49RE124	1030	60	AD 920	AD 885-1155	UGa-738	Mound 2	Schroedl 1978a
40RE124	1020	120	AD 930	AD 860-1225	GX-3462	Mound 2	Schroedl 1978a
40RE4	970	160	AD 980	AD 785-1270	GX-3460	Mound 2	Schroedl 1978a
40RE4	930	150	AD 1020	AD 870-1310	M-230	Mound	Crane and Griffin 1961
40RH7	855	95	AD 1095	AD 925-1305	GX-2606	Mound D-2	Schroedl 1978a
40RH7	850	100	AD 1100	AD 935-1315	GX-2597	Mound A-1	Schroedl 1978a
40RH7	805	95	AD 1145	AD 1035-1330	GX-2600	Mound A-5	Schroedl 1978a
40RH7	795	100	AD 1155	AD 1040-1335	GX-2601	Mound A-5	Schroedl 1978a
40RH7	730	95	AD 1220	AD 1165-1395	GX-2598	Mound A-3	Schroedl 1978a
40RE124	625	160	AD 880	AD 1200-1485	GX-3459	Mound 3	Schroedl 1978a
40RH7	595	100	AD 1335	AD 1245-1425	GX-2599	Mound A-3	Schroedl 1978a
EARLY MISSISSIPPIAN (HIWASSEE COMPONENT)							
40RH6	1500	100	AD 450	AD 265-640	GX-2595	Structure 1	Schroedl 1978a**
40RH6	850	100	AD 1100	AD 935-640	GX-2594	Structure 4	Schroedl 1978a
40RE12	670	150	AD 1280	AD 1065-1430	M-731	N/A	Crane and Griffin 1961

*Klein et al. 1982

Hiwassee Island ceramic complex, specifically Hiwassee Island Red-on-Buff pottery (Crane and Griffin 1961:114-115).

Salvage excavations at the Higgs (40LD45) and Doughty (40LD46) sites, in response to I-75 bridge construction, provided several important radiocarbon dates for the interpretation of Archaic and Woodland cultural deposits in East Tennessee. Assay CWRU-84, the only accurate date obtained from several submitted samples from the sealed living floor of Stratum VI, substantiates the Late Archaic occupation of this short-term camp at about 2000 B.C. (McCollough 1973:64; also see McCollough and Faulkner 1973:46-56).

Two other dates, CWRU-27 and UGa-517, secured from features on the shelter floor at the Higgs site (40LD45), provided additional dates for Terminal Archaic deposits (McCollough and Faulkner 1973:65). Previously, only two other dates had been collected for this cultural period in East Tennessee, one from the Westmoreland-Barber site (40MI11) in the Nickajack Reservoir (Faulkner 1967:17), and the other from the Icehouse Bottom site (40MR23) in the Tellico Reservoir (Gleeson 1970:132-133).

The Early Woodland dates, from features in Stratum II at the Higgs site (40LD45), indicate "two disparate horizons" that have been interpreted as early and late Early Woodland phases characterized by differential frequencies in ceramic types (McCollough 1973:67). An initial date, UGa-515 centered about 405 B.C., is consistent with other regional dates, including 40RE108 (Schroedl in Kimball 1984), the Bacon Bend site (40MR25) (Salo 1969:179), and the Phipps Bend area in the upper Tennessee Valley (Lafferty 1978:142-145) for the early Early Woodland Watts Bar phase which is characterized by a predominance of grit-tempered Watts Bar ceramics (McCollough and Faulkner 1973:78; Schroedl 1978b:191).

Additional dates suggest a late Early Woodland occupation between A.D. 200 and 400 indicative of the Long Branch phase (McCollough 1973:67). Similar components have been dated at the Patrick (40MR40; Schroedl 1978b), Calloway Island (40MR41; Chapman 1979) and 40RE108 (Schroedl in Kimball 1984) sites.

Investigation of burial mound use in East Tennessee during the Woodland and Mississippian periods was a major impetus for the collection of charcoal for radiocarbon dating. Excavations at the McDonald site (40RH7) provided the first radiocarbon dates from Woodland Period burial mounds in East Tennessee in nearly 20 years (Schroedl 1978a:3). These dates, and those obtained from 40RE4 and 40RE124 (Schroedl 1978a), and the Kittrell Mound (40LD183) (Chapman 1987) provided information for determining the age of individual burial mounds, the internal chronology of each mound, and the regional implications of burial mound use (Schroedl 1978a:6). The dates suggest that burial mound use in east Tennessee began about A.D. 500 and possibly lasted as late as A.D. 1200 (Chapman 1987). Implications of this chronology include a proposed model of the origin of the Mississippian culture in East Tennessee as largely a result of in situ development from earlier Middle and Late Woodland traditions (Faulkner 1973; Schroedl and Boyd 1985). This model is in sharp contrast to earlier proposals such as Lewis and Kneberg's (1946) which suggests that Woodland peoples were displaced by the migration of Mississippian peoples into the valley.

Although incomplete in the coverage of prehistory in the valley, the dates from the Watts Bar study area are an important contribution to the archaeology of East Tennessee in particular, the Midsouth in general.

CHAPTER VII

SAMPLING BIASES

The extant archaeological record from the Watts Bar Reservoir study area is the product of over one hundred years of regional research. Therefore, it may be surprising that biases in our knowledge of the region's prehistory are present. The presence of these biases can be attributed to several factors--including the lack of a comprehensive regional research design (a concept that only recently has been advocated; see Lipe 1977), various project orientations, reflective of differential research goals, in addition to monetary, temporal and boundary restrictions defined by funding agencies. Delineation of these biases and its effect upon this study will allow a more accurate assessment of the results.

A comparison of the frequency of cultural components from other East Tennessee reservoirs provides some interesting contrasts and similarities (see Table 15 and Figures 11 and 12). In general the Chickamauga and Watts Bar frequencies are comparable (i.e., the low frequency of early sites, the high frequency of Woodland sites, and the high frequency of indeterminate components), due to their similar archaeological research histories (see Boyd 1986); however, the Tellico data indicate drastic differences, particularly among the earlier Archaic components. These differences can be attributed to a more comprehensive survey and testing strategy for the Tellico Reservoir.

Table 15. Frequency and percentages of cultural components for East Tennessee reservoirs.*

Cultural Component	Watts Bar		Chickamauga		Tellico	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Paleo-Indian	2	.52	0	0	7	.81
Archaic	9	2.35	1	.28	0	0
Early Archaic	7	1.83	3	.84	242	28.11
Middle Archaic	3	.78	1	.28	199	23.11
Late Archaic	26	6.78	27	7.52	124	14.40
Woodland	53	13.84	26	7.24	0	0
Early Woodland	29	7.57	24	6.68	54	6.27
Middle Woodland	47	12.27	24	6.68	149	17.31
Late Woodland	45	11.75	24	6.68	0	0
Mississippian	33	8.62	35	9.75	0	0
Early Mississippian	3	.78	6	1.67	59	6.85
Late Mississippian	6	1.57	6	1.68	27	3.14
Indeterminate Prehistoric	120	31.33	182	50.70	0	0
TOTAL	383	99.99	359	100	861	100

*References: Boyd 1986; Cannon 1986c; Davis 1986.

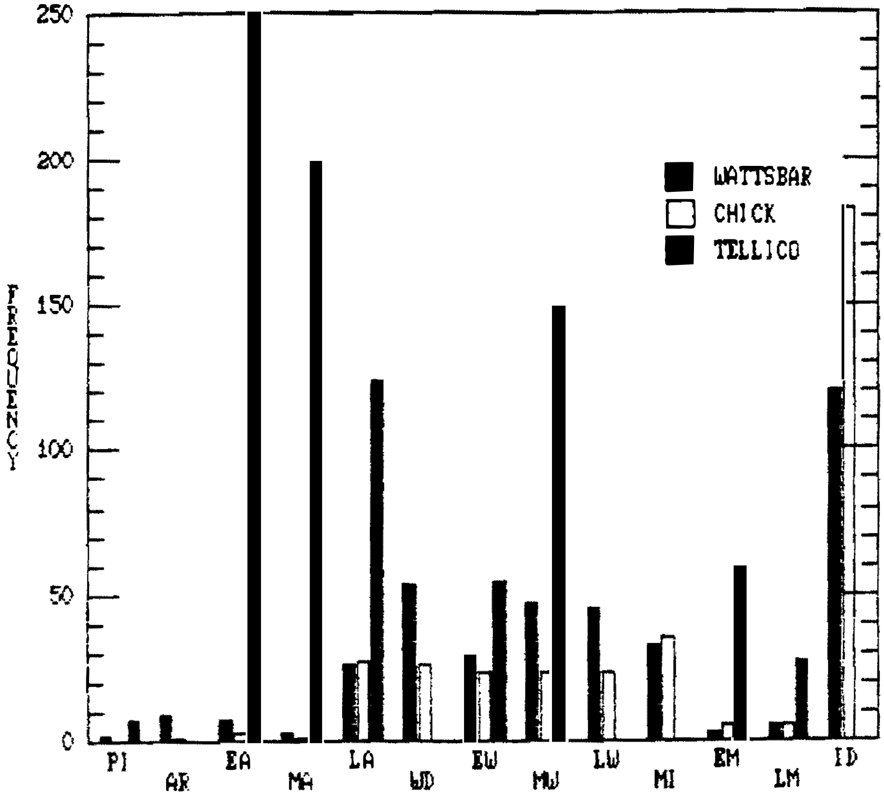

Figure 11. Frequency of cultural components for East Tennessee Reservoirs.

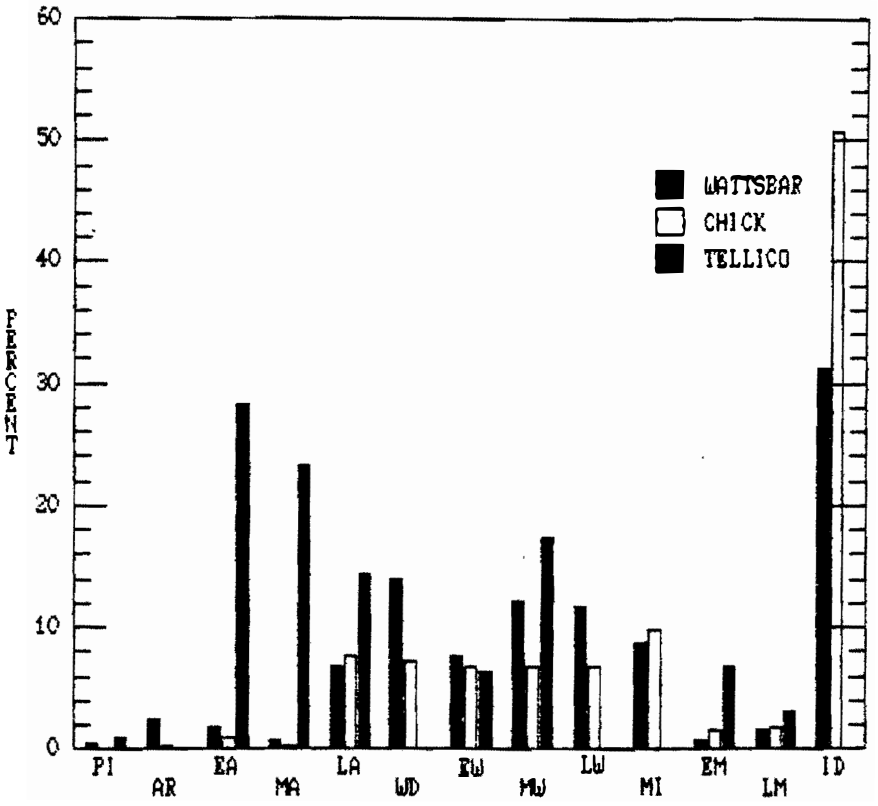

Figure 12. Percentage of cultural components for East Tennessee Reservoirs.

For a more comprehensive explanation of the Tellico Archaeological Project methodology see Chapman (1978), Davis (1980), and Kimball (1984).

In order to more adequately address the issue of sampling biases in the Watts Bar study area, a chi-square test was conducted for site distribution. The tested null hypothesis contended that the universe of known sites is evenly distributed along both river banks. This test allowed a more accurate assessment of site location by discerning any deviations from the random distribution that may influence future results.

The study area was divided into three sections: the first section includes the main Tennessee River channel and its tributaries from the Watts Bar Dam upstream to the mouth of the Clinch River; the second section includes the Clinch River and its tributaries from its mouth upstream to Melton Hill Dam; and the third section includes the main Tennessee River channel from the mouth of the Clinch River upstream to Fort Loudoun Dam. The chi-square test compared the distribution of sites along the left (north) and right (south) banks for the three areas. With an alpha level of 0.01 (d.f.=2; X^2=9.210) we reject the null hypothesis that sites are evenly distributed in the study area (Zar 1984:479). This difference may be the result of several factors: (1) the agrarian economic base of the southern portion in contrast to the more industrialized northern portion (see Table 16; Clio 1984), hence, less intensive surveys in the southern portion of the reservoir;

Table 16. Archaeological sites within the Watts Bar Reservoir study area.[a]

	A		B		C	
	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.
Left bank	63	62.68	46.5	54.13	64	57.69
Right bank	25	28.92	43.5	24.97	12	26.61
TOTAL	88		90		76	
	X^2 = 9.210		d.f. = 2		= 0.01	

[a] A = lower portion of Reservoir from mouth of Clinch River to Watts Bar Dam; B = upper portion of Reservoir from mouth of Clinch River to Ft. Loudoun Dam; C = Clinch River portion of Reservoir.

(2) the effects of impoundment obscuring the archaeological record, particularly below River Mile 555; or (3) differential topographic and geologic features of the reservoir not being conducive to human settlement or exploitation (Cannon 1986c:127).

Based on our understanding of human culture as an adaptive system within the structure of the biophysical environment, we would expect human articulation with the environment to be reflected as a nonrandom distribution of settlement types across the landscape (Struever 1968:287). Such environmental parameters as biotic zonation, location of water sources, landforms, soil types, and seasonal availability of resources will indicate preferential areas for site location. In addition, differential exploitation of many environmental zones is prerequisite to economic security and autonomy (Winters 1969; Cleland 1976; Smith 1978b; Binford 1980).

The analysis of known sites in the Watts Bar Reservoir indicates a distribution of human activity areas across several landforms (e.g., river floodplains, uplands, and islands). In addition, land use appears to change through time. Figures 13-22 provide maps of the distribution of sites through time. To demonstrate this, all archaeological sites with known temporal periods (as indicated by diagnostic artifacts) were tabulated for frequency occurrence by general landform (see Table 17); prehistoric site types were also correlated with general landform (see Table 18). No consideration was given to site size or density of cultural material. In general, the

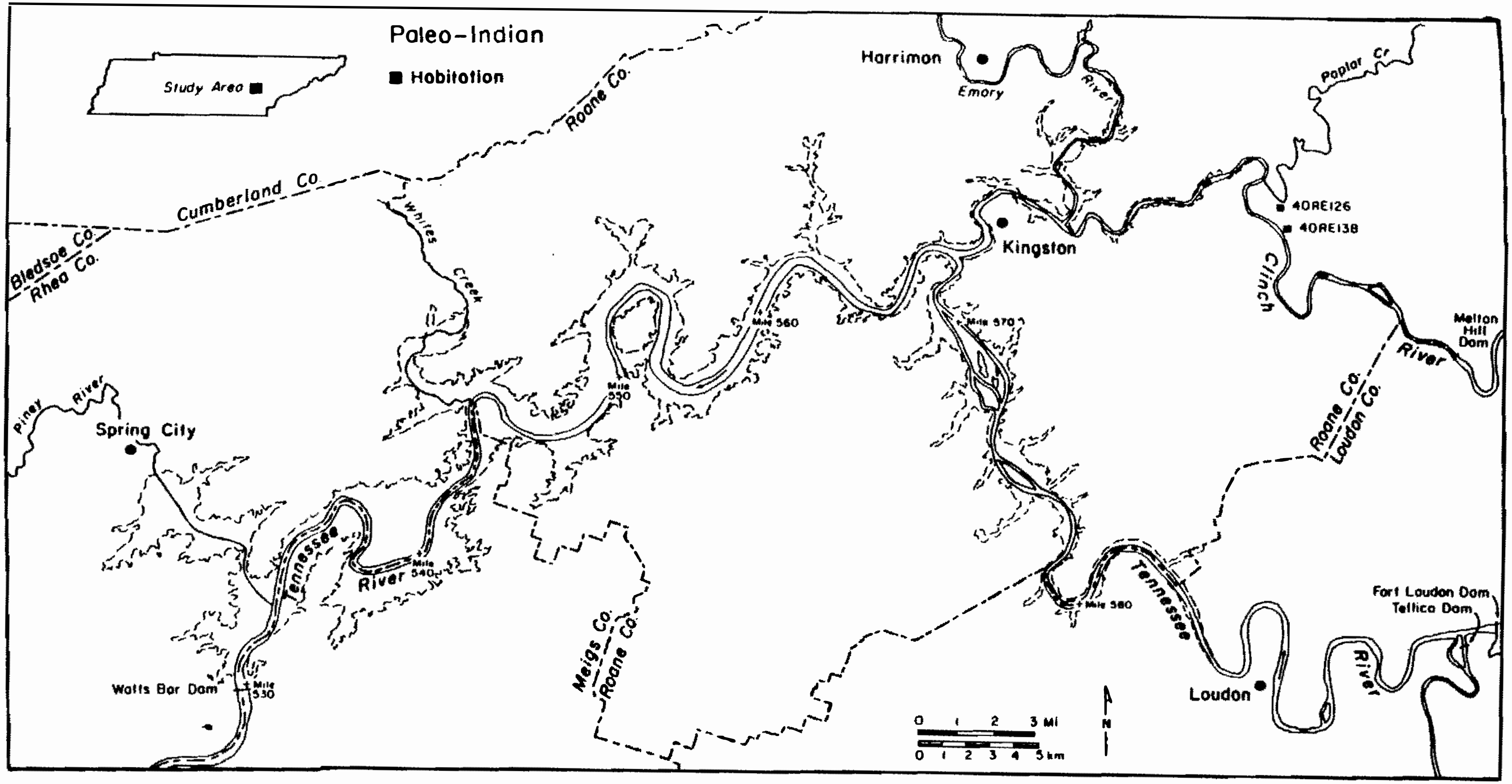

Figure 13. Distribution map of Paleo-Indian sites within the Watts Bar Reservoir study area.

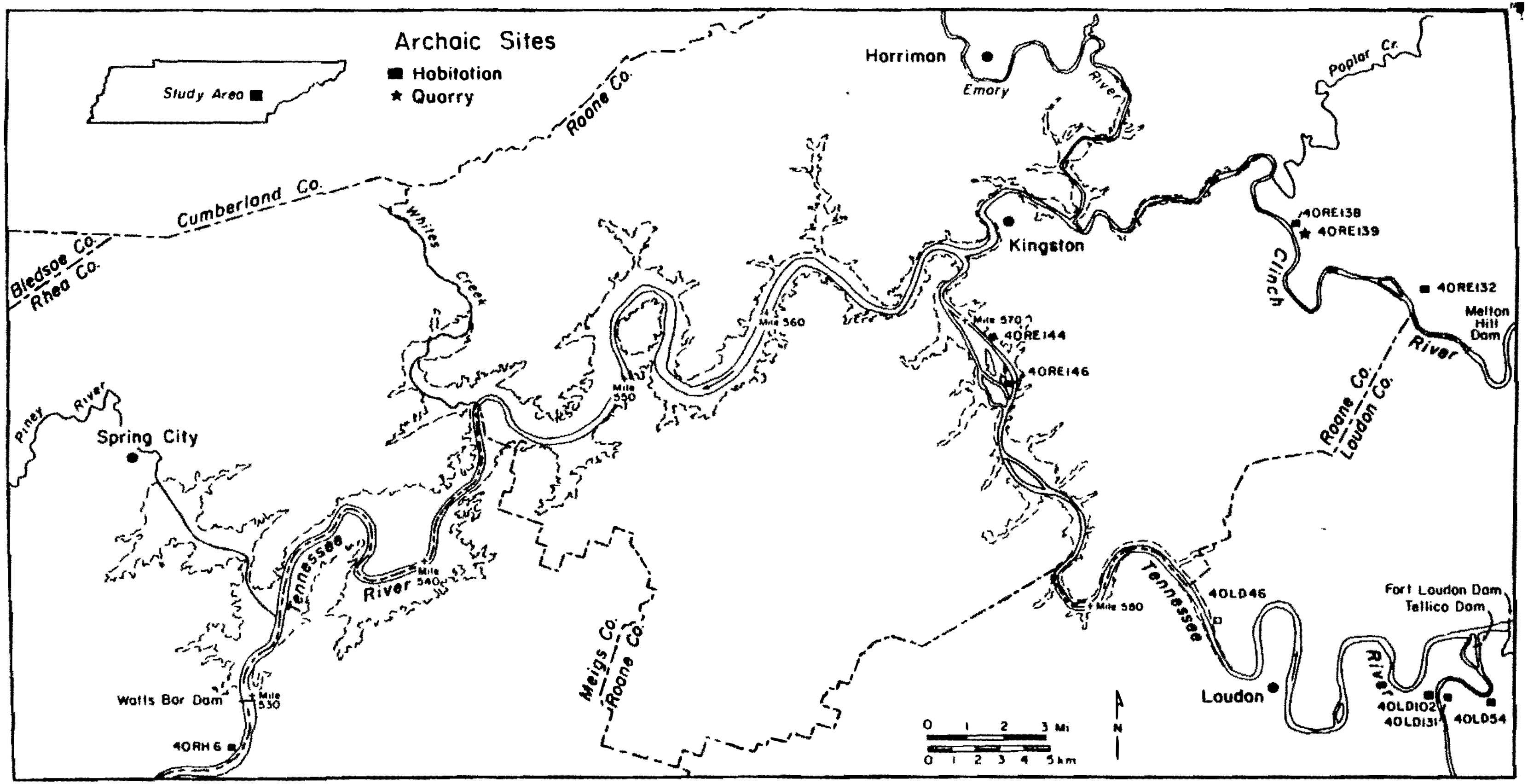

Figure 14. Distribution map of Archaic sites within the Watts Bar Reservoir study area.

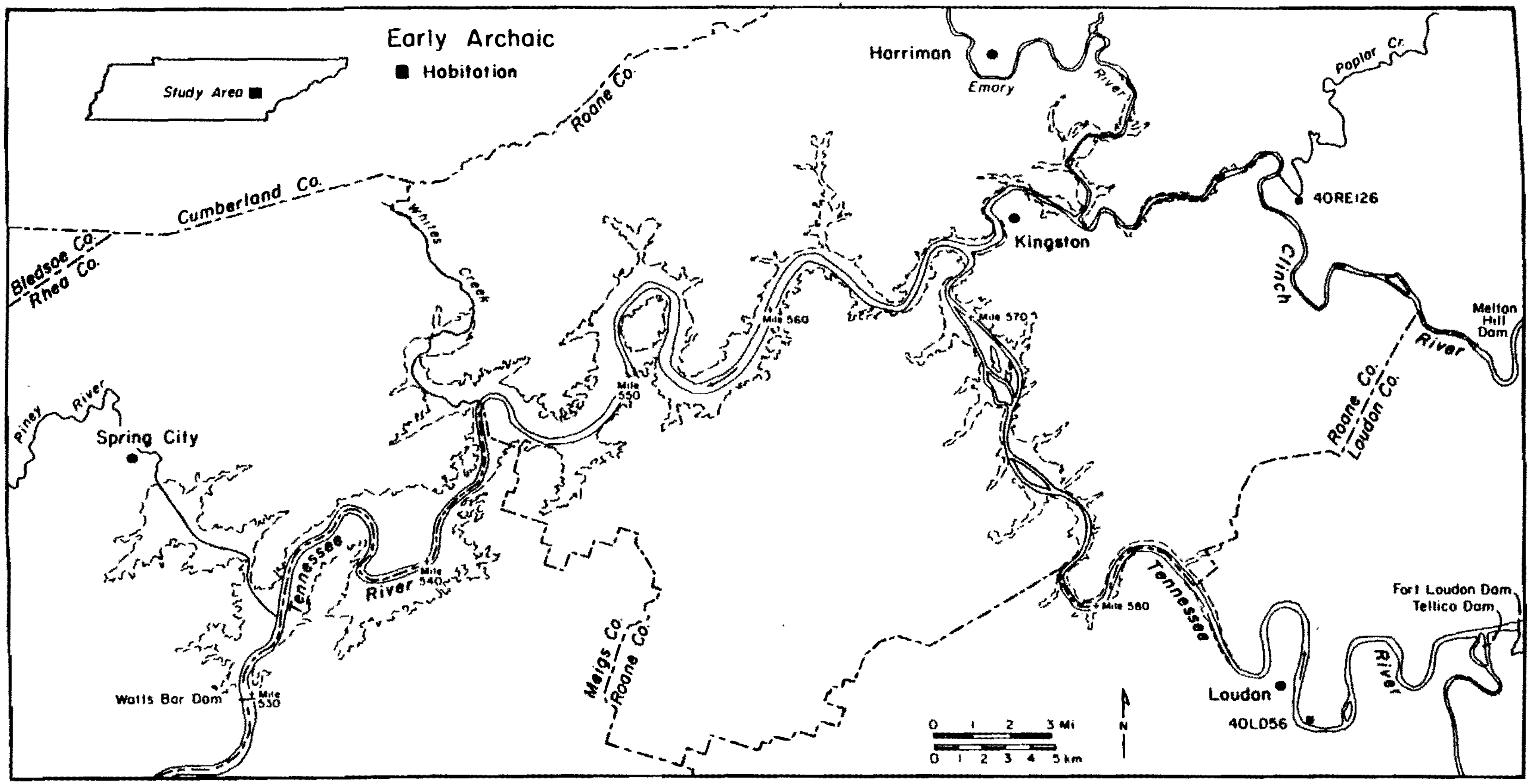

Figure 15. Distribution map of Early Archaic sites within the Watts Bar Reservoir study area.

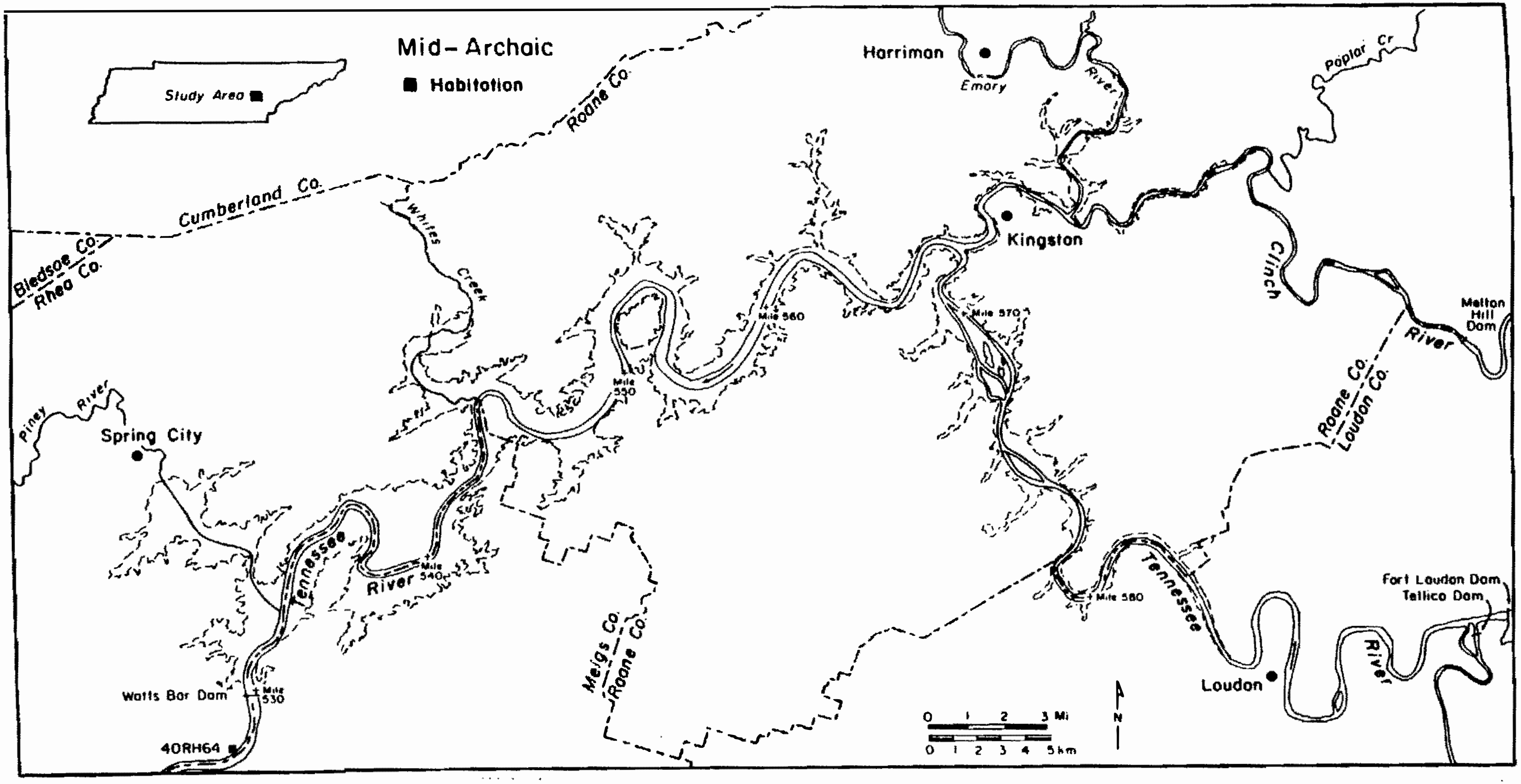

Figure 16. Distribution map of Middle Archaic sites within the Watts Bar Reservoir study area.

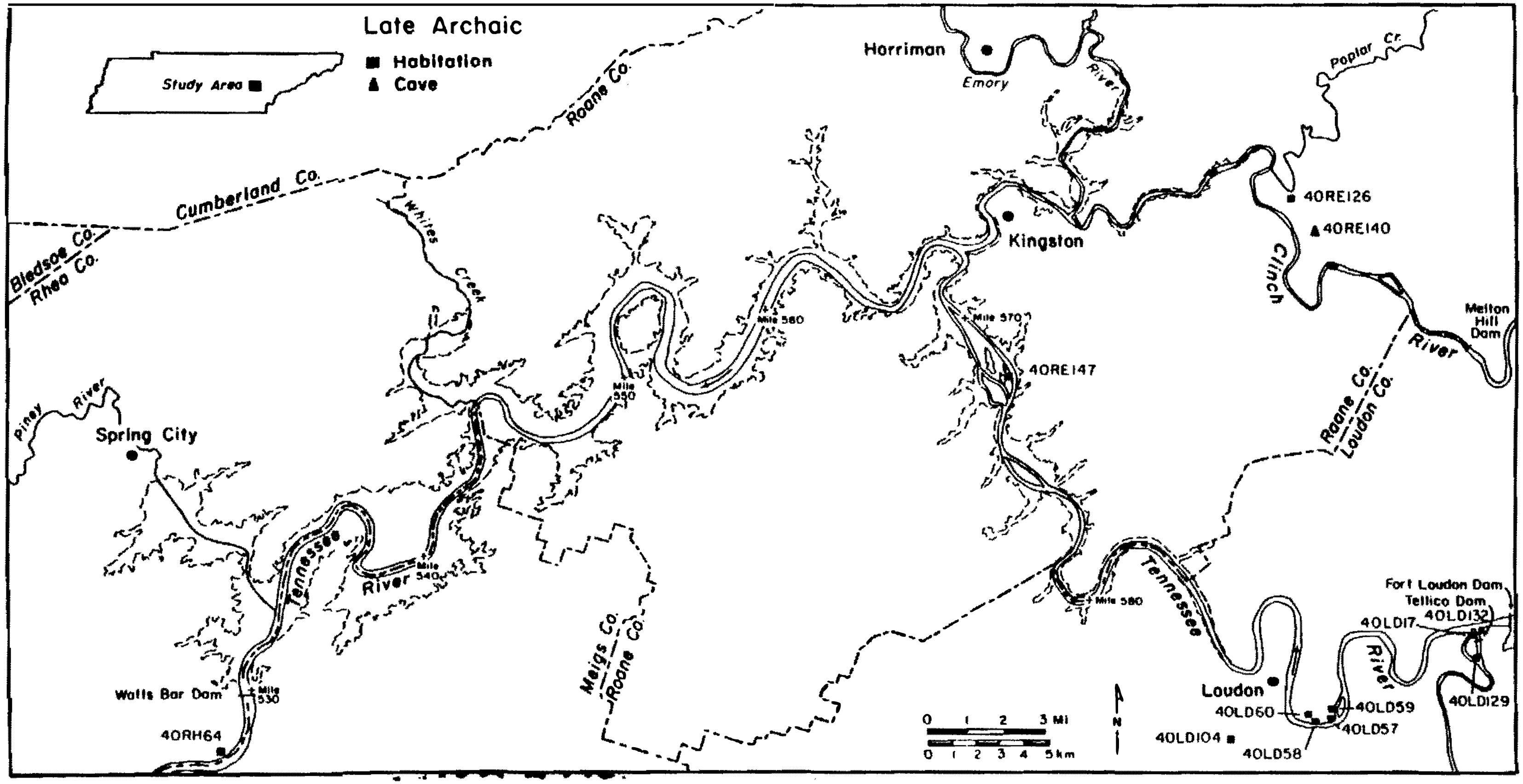

Figure 17. Distribution map of Late Archaic sites within the Watts Bar Reservoir study area.

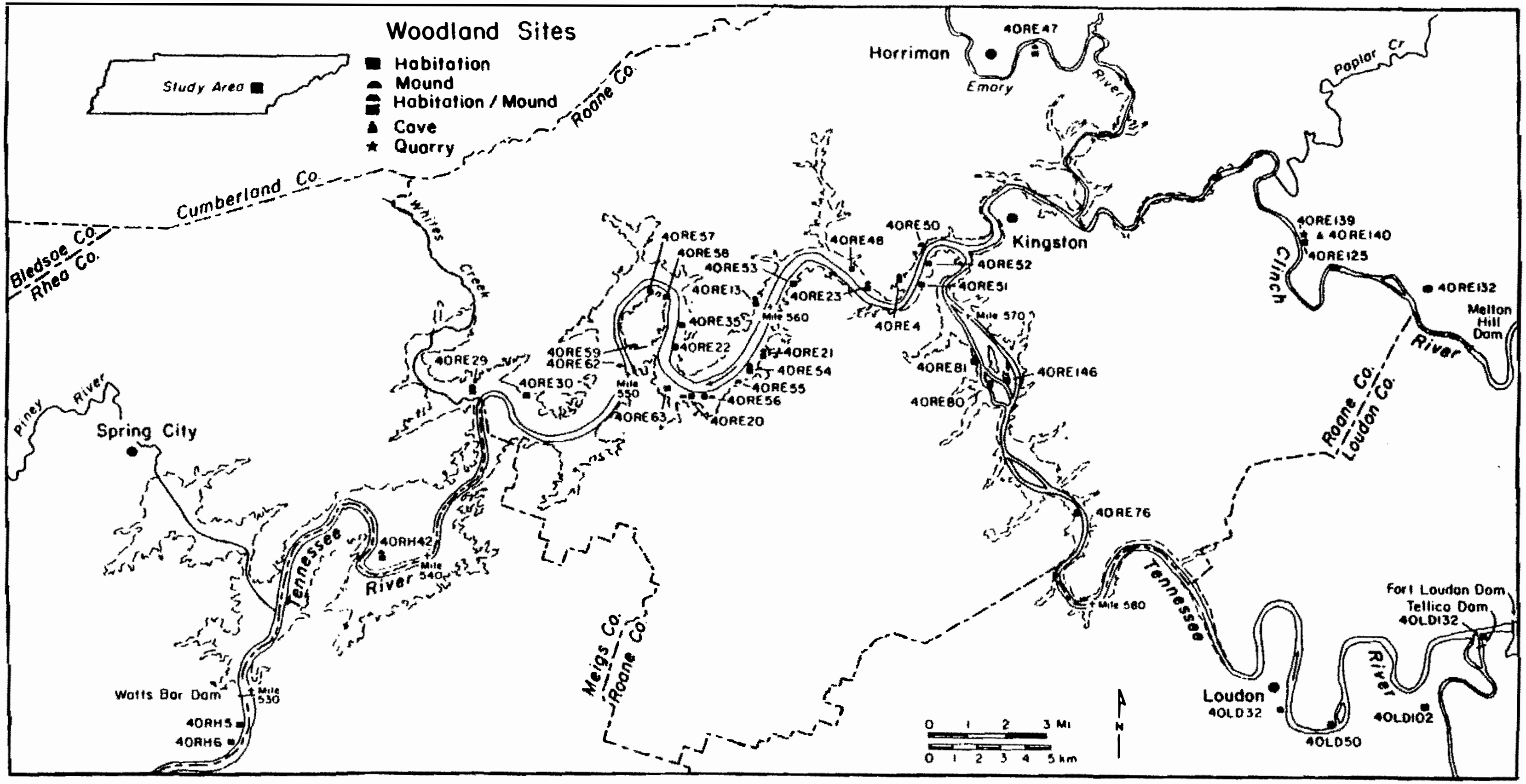

Figure 18. Distribution map of Woodland sites within the Watts Bar Reservoir study area.

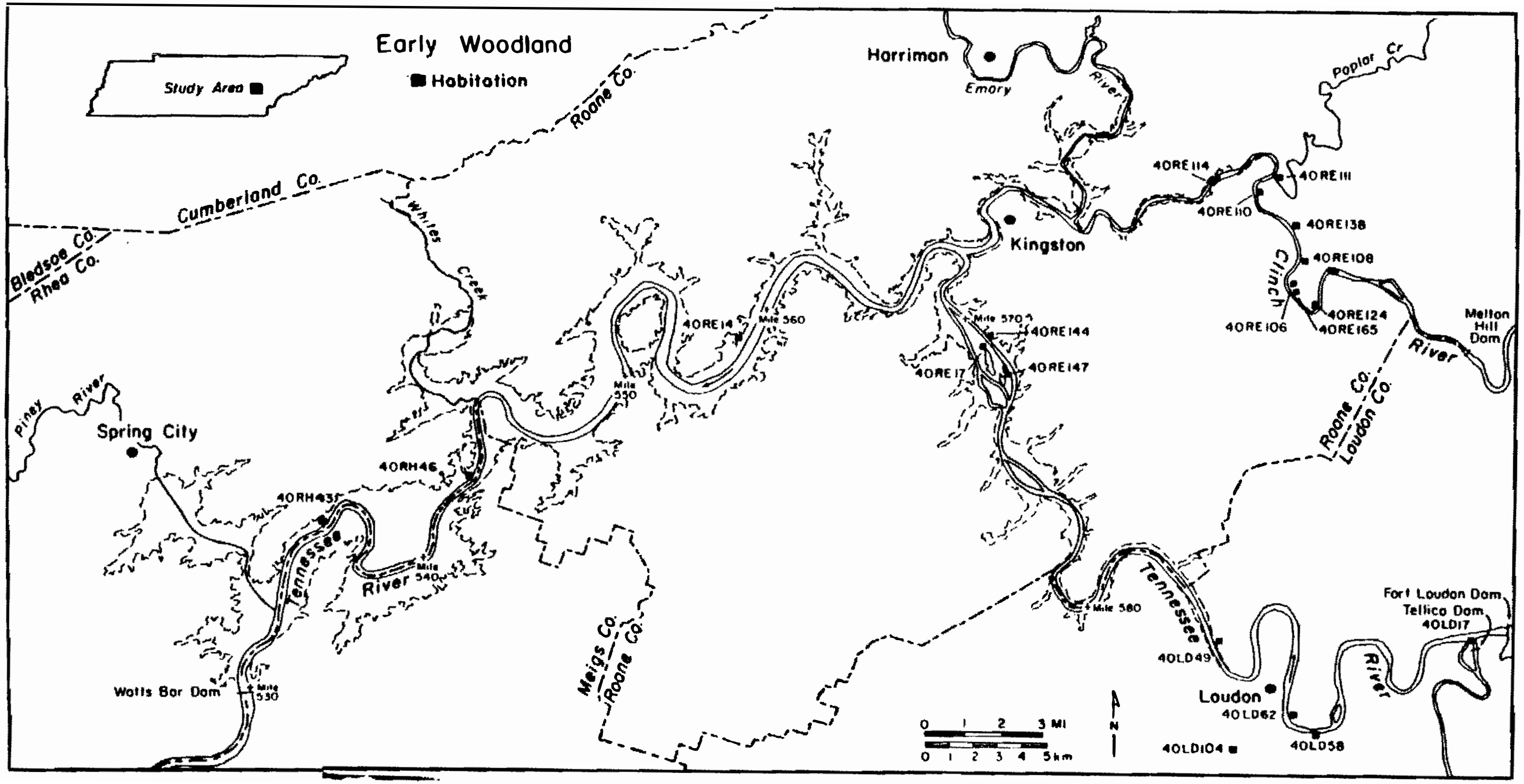

Figure 19. Distribution map of Early Woodland sites within the Watts Bar Reservoir study area.

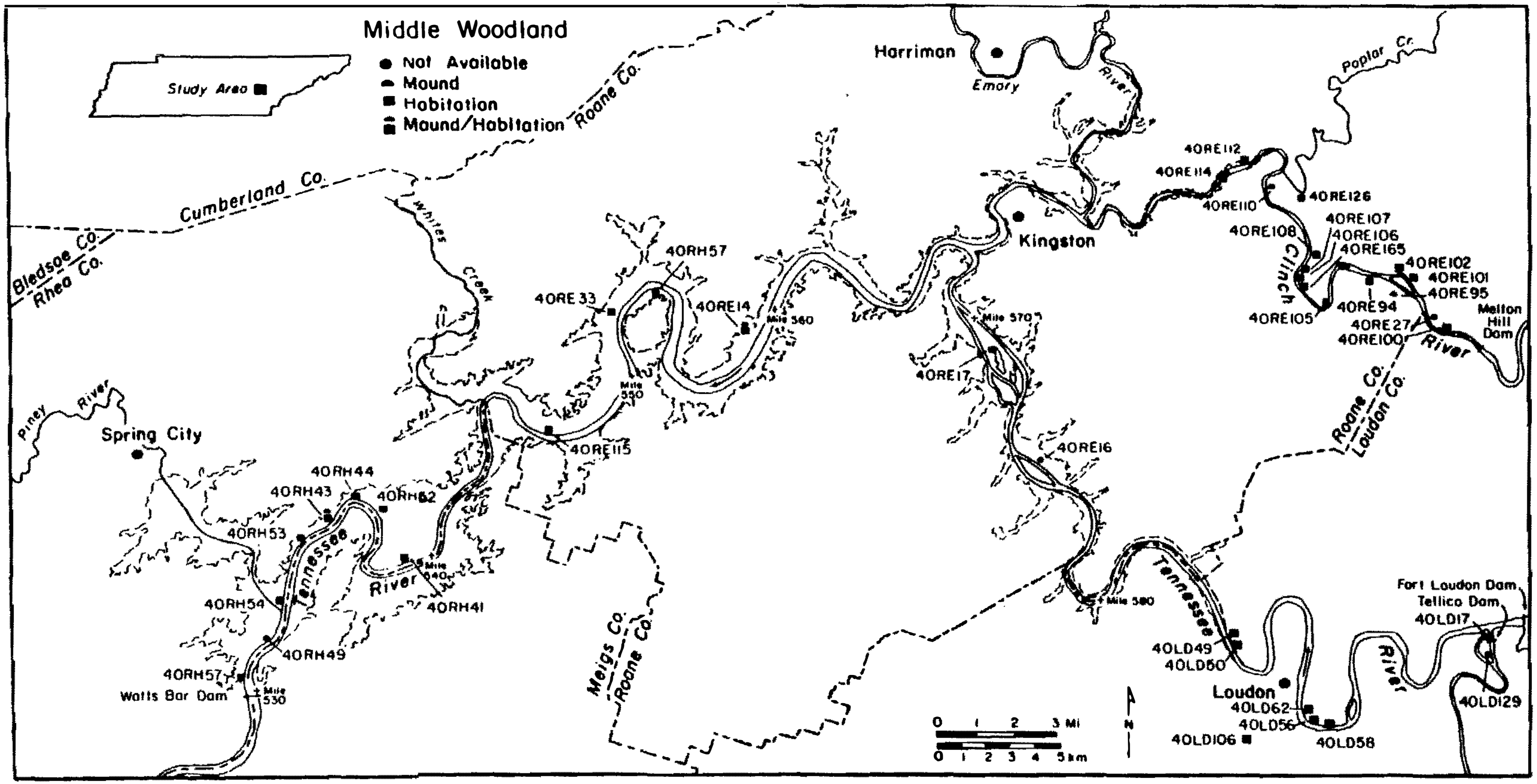

Figure 20. Distribution map of Middle Woodland sites within the Watts Bar Reservoir study area.

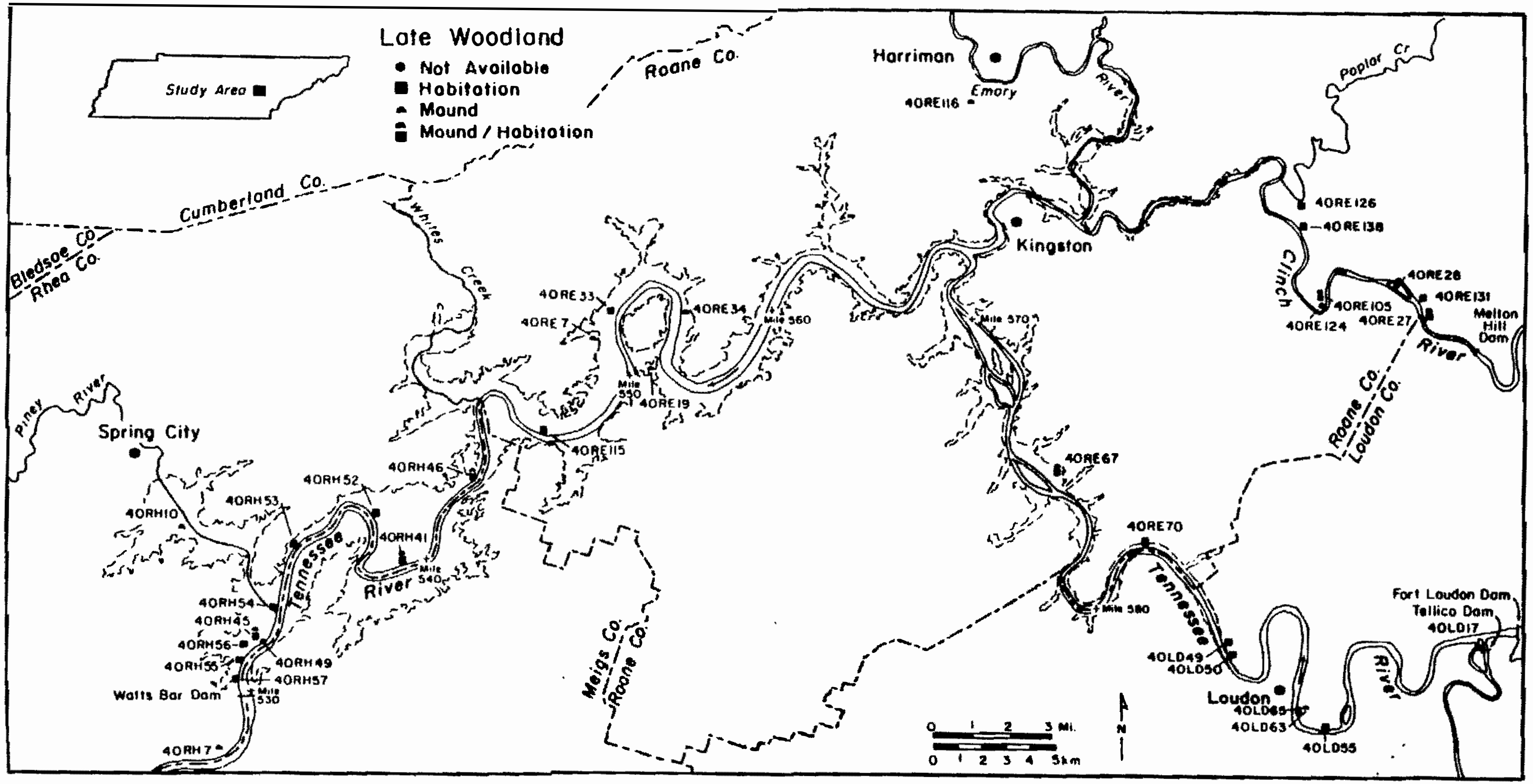

Figure 21. Distribution map of Late Woodland sites within the Watts Bar Reservoir study area.

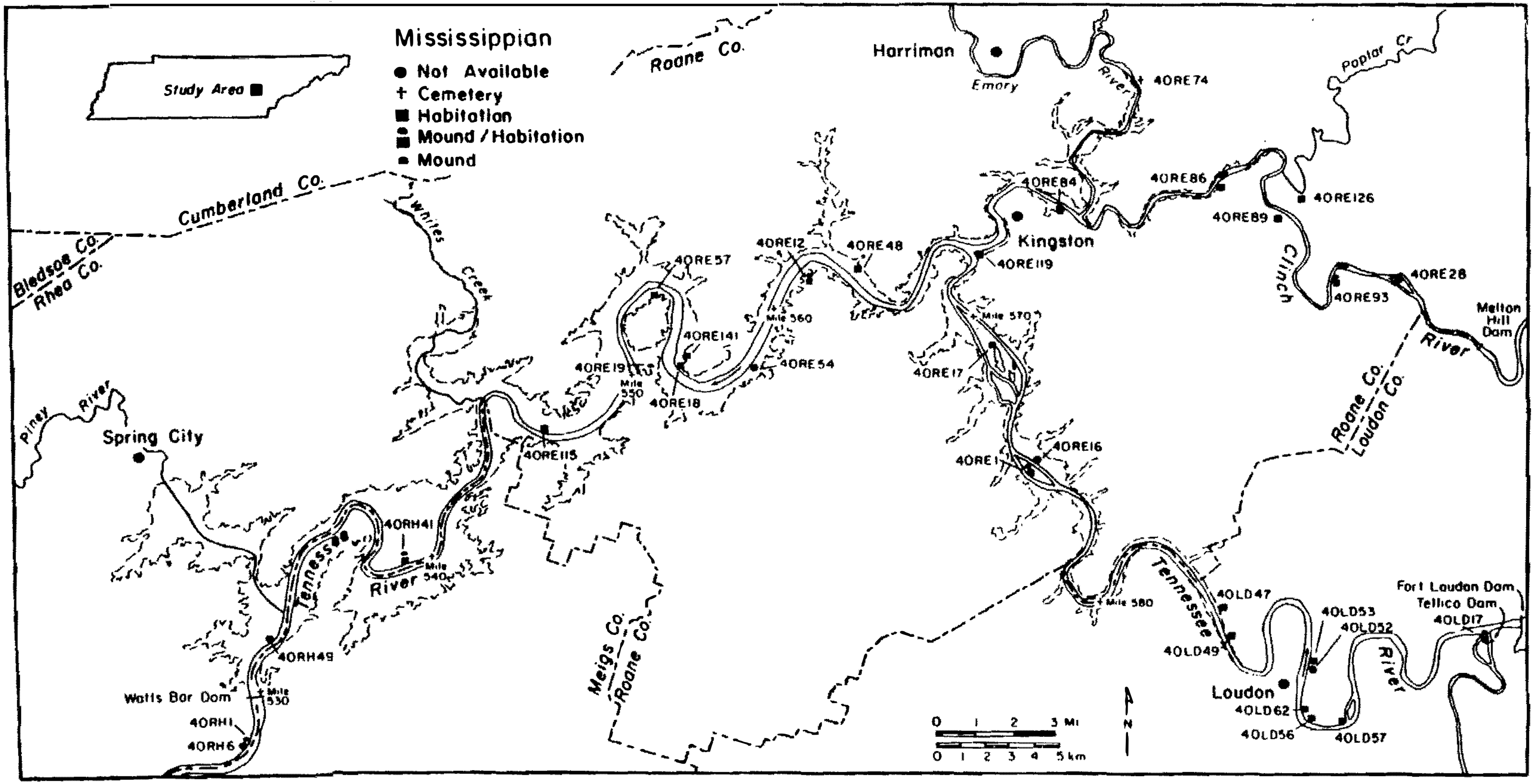

Figure 22. Distribution map of Mississippian sites within the Watts Bar Reservoir study area.

Table 17. Site distribution of cultural period by landform.

	River Floodplain	Recent Terrace	Older Terrace	Tributary Floodplain	Upland	Island	Total
Paleoindian	0	1	0	1	0	0	2
Archaic	2	2	2	2	0	1	9
Early Archaic	1	4	0	2	0	0	7
Middle Archaic	0	3	0	0	0	0	3
Late Archaic	1	4	0	2	4	2	13
Terminal Archaic	1	4	0	2	4	2	13
Woodland	17	9	4	3	17	3	53
Early Woodland	10	11	1	0	3	4	29
Middle Woodland	19	11	3	2	7	5	47
Late Woodland	9	11	3	1	2	2	45
Mississippian	14	11	3	1	2	2	33
Early Mississippian	0	2	0	0	0	1	3
Late Mississippian	0	3	0	0	2	1	6
PrehistoricIndeterminate	31	29	6	3	50	1	120
TOTAL	105	105	21	21	104	27	383

Table 18. Prehistoric site distribution of site type by landform.

	River Floodplain	Recent Terrace	Older Terrace	Tributary Floodplain	Upland	Island	Total
Open habitation	97	90	14	14	25	23	263
Cave/Rockshelter	0	1	0	2	6	0	9
Platform mound	0	1	0	0	1	0	2
Conical/Sub-conical mound	5	0	0	0	3	0	8
Mound-indeterminate	1	11	5	0	58	2	77
Cemetery-prehistoric	0	1	0	0	1	0	2
Earth/Stoneworks	0	0	0	0	0	0	0
Quarry	0	0	0	2	6	0	8
Petro/Pictoglyphs	0	0	0	0	0	0	0
TOTAL	103	104	19	18	100	25	369

following statements can be made about the observed temporal and spatial distribution of sites:

1. There is a general lack of early sites, which may be indicative of sampling biases (i.e., no or limited deep-site testing).

2. There is a general increase in the number of sites through time, particularly during the Woodland periods. This pattern may reflect a bias created by local collectors picking up diagnostic projectile points, while leaving behind "less desirable" ceramic sherds.

3. The main river floodplains and recent alluvial terraces are the preferred location for habitation sites.

4. There is a general lack of sites on the tributaries (i.e., the Piney River and Whites Creek), a probable result of sampling biases caused by impoundment (i.e., reduced visibility of impounded terraces and floodplains).

5. Older alluvial terraces along the main river channels were utilized more frequently during the Woodland periods.

6. Upland areas appear to have been utilized most frequently for specialized activities (i.e., lithic extraction, burial mound location).

7. There is a general lack of late prehistoric sites, which may also be the result of sampling biases.

8. Island sites tend to have later multicomponent occupations, which may reflect population expansion and the increased need for

floodplain and riverine resources or the simple lack of deep-site testing at these locales.

As was previously mentioned, archaeological investigations have been conducted in the Watts Bar region intermittently for the past one hundred years. The impetus behind these studies has ranged from the investigation of the ethnic origin of the "moundbuilders" to the mitigation of impacts from major construction projects (initiated by dam construction in the 1930's). Sampling biases created by varying perspectives, orientations, funding, and temporal restrictions have created gaps in the culture history of the region (Cannon 1985b, 1985c, 1986b, 1986c). Although documentation is incomplete, sites in the Watts Bar Reservoir span the entire range of cultural periods for the southeastern United States and provide an important resource for understanding the dynamics of prehistoric cultures.

CHAPTER VIII

ROCKSHELTER SURVEY

Introduction

Aboriginal utilization of natural shelters (e.g., rockshelters and caves) has long been of interest to researchers working in eastern North America (e.g., Kain 1819; Mercer 1894; Moorehead 1895; Harrington 1909). Therefore, excavations of these shelters have become an integral part of the study of eastern North American prehistory (e.g., Fowler 1959; DeJarnette et al. 1962). Early excavations of rockshelters in Kentucky (Funkhouser and Webb 1929, 1930; Webb and Funkhouser 1936) and Arkansas (Harrington 1924; Jones 1936) revealed the vast potential these resources contained for understanding prehistoric cultures of North America. In Tennessee, natural-shelter exploration has also been conducted in efforts to explicate the dynamics of prehistoric cultures (e.g., Myer 1912; Webb 1938; Lewis 1947, 1948; Hartney 1962; Entorf 1980, 1986; Hall 1985), although the vast majority of excavations have been conducted by amateurs with little or no research orientation beyond a cursory descriptive analysis (e.g., Hogue 1945; Hassler 1946, 1947; Parris 1946; Thomas 1946).

In spite of the fact that locational strategies in site selection (e.g., Trigger 1967; Chang 1968; Williams et al. 1973; Binford 1982) are a major focus in contemporary archaeology, few studies have addressed natural-shelter selection (e.g., Stackhouse and Corl 1962; Lantz 1969; Hall and Klippel 1982; Fergeson et al. 1983). When the topic has been approached, the foci of natural-shelter research in eastern North America have been extremely diverse. Research efforts have included:

(1) Analysis of diachronic and synchronic dynamics of subsistence-settlement systems (e.g., Jones 1936; Fowler 1959; Cleland 1965; Jolly 1974; McMillan and Wood 1976; Cowan 1979; Cowan et al. 1981; McMillan and Klippel 1981; Styles et al. 1983; Manzano 1986).

(2) Diachronic change in site function (e.g., DeJarnette et al. 1962; Styles et al. 1983; Hall 1985).

(3) Diachronic change in material culture (e.g., DeJarnette et al. 1962; Powell 1963).

(4) Lithic tool analysis and resource procurement (e.g., Ahler 1971; Styles et al. 1983).

(5) Paleoecological studies (e.g., Cleland 1965; McMillan and Wood 1976; Guilday et al. 1978; Cowan et al. 1981; Ferrand 1985).

(6) Analysis of human skeletal remains (e.g., Webb 1938, 1939; Hassler 1947; DeJarnette et al. 1962; Bass and Rhule 1976).

Initial studies addressing the problem of natural-shelter selection involved intuitive logic of site quality. Stockhouse and Corl (1962:1) reasoned that exposure to sunlight and protection from prevailing winds were imperatives in natural-shelter selection.

Later studies took a more systematic approach to the problem. In his study, Lantz (1969:1) analyzed shelter utilization in relation to topographic characteristics of the region. He recognized six factors that were important to aboriginal shelter selection: (1) proximity to a permanent water source; (2) proximity to trail systems; (3) slope of floor; (4) dryness of floor; (5) exposure to sunlight; and (6) protection from prevailing winds. Although Lantz outlines some essential characteristics of those shelters selected for utilization, his study is lacking in that it does not quantitatively compare how utilized and nonutilized natural shelters may vary--hence, it does not provide an empirical model for limiting factors of natural-shelter selection.

An outgrowth of the Columbia Archaeological Project on the Duck River in Middle Tennessee was Hall and Klippel's (1982) "polythetic-satisficer" study of natural shelter selection. In an attempt to understand the parameters involved in shelter selection, Hall and Klippel (1982:2) defined shelter acceptability by a polythetic set of determinants which could be satisfied in any given case, although none of the determinants was a necessary or sufficient criterion for selection in itself.

Utilizing common sense criteria for shelter quality (i.e., size, aspect), and applying Jochim's (1976:48) minimum effort hypothesis, Hall and Klippel (1982:4) outlined several variables to test the validity of the null hypothesis "that natural shelters were utilized randomly with respect to a set of measurable variables each with the potential relevance to shelter suitability."

Statistical tests (Student's t-test and Chi-square) were employed in an effort to discern differences between utilized and nonutilized shelters. Statistically significant results were found in the comparison of three sets of variables--aspect, horizontal and vertical distance to water. Specifically, the results of aspect are consistent with the expectation that more culturally utilized shelters face south than north. Hall and Klippel (1982:12) tentatively propose that south-facing shelters utilized in the winter and early spring months would experience maximum exposure to solar radiation due to seasonally denuded trees.

In opposition to the assumption of minimum effort (i.e., shelters being located close to resources), statistical results indicate that utilized shelters were located further away from the river than nonutilized shelters. An alternative hypothesis presented, consistent with a winter and early spring occupation, suggests a need for protection from the constant threat of flood. This hypothesis is further supported by flood data from the region.

More recently, archaeological surveys in the Big South Fork Recreational Area in north-central Tennessee have also addressed the problem of factors influencing natural shelter selection (Ferguson et al. 1986). As in Hall and Klippel (1982), information concerning shelter morphology (i.e., length, width and height), exposure, slope of floor, slope of landform, and distance to water sources was recorded in the field and obtained from topographic quad sheets. Employing the Student's t-test (alpha=0.05), Ferguson et al. (1986:271) statistically concluded that shelter morphology was probably a factor in shelter selection--utilized shelters were morphologically larger than nonutilized shelters. Another interesting pattern that was established is the difference in aspect: although utilized and nonutilized shelters within the Bandy Creek study area showed no statistically difference, utilized and nonutilized shelters within the Blue Heron study area were statistically different (Ferguson et al. 1986:269). Although statistical analyses are not totally conclusive, they do provide a model of selection that can be further applied and tested.

Variables

The study of locational strategies, or the explication of site location (settlement patterns), is an important aspect of contemporary archaeological research. Initially defined by Willey (1953:1) "as the way in which man disposed himself over the landscape on which he lived," the concept of locational strategy has become more complex. Recent studies have sought to delineate specific environmental criteria that may have guided the conscious selection of particular areas for habitation (Trigger 1968:70-71; Thomas 1973; Williams et al. 1973; Hodder and Orton 1976; Binford 1982; Butzer 1982:67). Following Williams et al. (1973; see also Hall and Klippel 1982), specific variables that could be quantitatively assessed were selected in an effort to define criteria that may have influenced natural-shelter selection by prehistoric peoples.

Morphological variables--maximum length, maximum depth, maximum height, and calculated minimum area (length multiplied by height divided by 2), in addition to shelter floor slope--were examined in an effort to understand the quality of the natural shelter (Lantz 1969;

Hall and Klippel 1982:4:Table 19). Several studies have argued that sheltered area is a limiting factor for site function and population size (Butzer 1971:401; Cowan et al. 1981:75; Straus 1979:335; Klippel 1971). For this study it is argued that larger shelters are more conducive to exploitation due to the greater potential to accommodate larger groups conducting a broader range of activities (Hall and Klippel 1982:6).

Exposure of a shelter to prevailing winds and orientation of the sun have been argued as important factors influencing its selection (Stackhouse and Corl 1962:1; Butzer 1971:402; Straus 1979:335; Binford 1982:14). Increased exposure to solar radiation (Jolly 1974:3; Lantz 1969:2), for light and warmth, and protection from prevailing winds (Lantz 1969:3; MacCord 1972:55) would potentially enhance a shelter's quality. Therefore, south-facing shelters would be expected to have been selected more frequently than north-facing shelters in the study area (see Hall and Klippel 1982:5).

Availability and accessibility of water resources are also important environmental variables that may have influenced the suitability of a shelter's location (Lantz 1969:1; Butzer 1971:401). Three measurements were taken in order to assess this assumption. Vertical and horizontal distances to the main river channel were measured in the field. In addition, linear measurements, taken from 7.5 minute quad sheets, to the next nearest water source were calculated. Following Jochim (1976:48), Hall and Klippel's (1982:7)

Table 19. Descriptive statistics for rockshelter survey.

	Cultural					Noncultural				
Variable*	Mean	Min.	Max.	SD	N	Mean	Min.	Max.	SD	N
Wdist	520	300	900	238.75	5	511.88	30	950	168.86	32
Maxlgth	1578	600	3550	1170.9	5	481.41	155	1500	296.35	32
Maxdpth	928	165	2050	728.77	5	214.41	50	560	143.25	32
Maxht	436	130	800	244.4	5	250.22	70	1100	218.19	32
Minarea	36.848	3.3	102.5	40.152	5	3.741	0.35	25.85	6.143	32
Flslp	8.4	5	15	4.775	5	15.476	0	35	9.832	21
Frslp	34.5	24	45	14.849	2	50.16	17	45	7.957	25
Vdist	13.2	6	25	7.328	5	14.956	1.65	30	7.492	31
Hdist	21	5	60	22.192	5	14.713	2.6	30	6.842	31

*Summary statistics for rockshelter survey:

Wdist = Distance to nearest water (meters)
Maxlgth = Maximum length of overhang (centimeters)
Maxdpth = Maximum depth of shelter (centimeters)
Maxht = Maximum height of shelter (centimeters)
Minarea = Minimum area of shelter (square centimeters)
Flslp = Slope of shelter floor (degrees)
Frslp = Slope in front of shelter (degrees)
Vdist = Vertical distance to river (meters)
Hdist = Horizontal distance to river (meters)

assumption of minimization energy expenditure contends that shelters located close to water sources would be more suitable for habitation.

Field Methods

In East Tennessee, geologic formations of uplifting, folding and faulting have created a washboard-like topography that has exposed bedrock formations in several areas. As a consequence of this exposure, erosion by chemical and physical weathering processes (see Laville et al. 1980:46) have created natural shelters (e.g., overhangs and caves).

The process of chemical weathering entails the removal of mineral and rock material by solution (Bates and Jackson 1984:476-477). The chemical process of solution involves the combination of calcium carbonate with carbonic acid, derived from rainwater, to produce calcium bicarbonate, a water soluble salt:

$$H_2O + CO_2 \text{ --- } H_2CO_3$$

water + carbon dioxide=carbonic acid

$$CaCO_3 + H_2CO_3 \text{ --- } Ca(HCO_3)_2$$

calcium carbonate + carbonic acid=calcium bicarbonate

Limestone and dolomite formations are corroded and eventually dissolved (Butzer 1976:41-43).

Physical weathering of the exposed formations can occur by two processes-mechanical fracturing and river incision. Mechanical fracturing of formations by either erosional weakening of structures or tectonic activities can produce sheltered areas. The incision of the river system can also cut into exposed areas of bedrock, creating or enlarging naturally sheltered areas.

These areas of exposed bedrock, identified from soil survey maps or during field examination of survey areas, provide a data set for further testing of the hypothesis that prehistoric human site selection (in this case natural-shelter selection) is not a random decision but based on specific characteristics of the shelter and the surrounding environment that can be quantitatively discerned.

Following the identification of areas with exposed bedrock, a pedestrian examination of these areas ensued (see Figure 23). Following Hall and Klippel (1982:8), a minimum requirement for shelter testing was defined as any area "protected by an uninterrupted projection, overhang, or ceiling, of bedrock." A total of 37 sheltered areas that met this requirement was tested.

Each identified shelter was plotted on a 7.5 minute quad sheet. Morphological measurements of aspect, length, height and depth were collected. Floor slope, measured along the length of the shelter, and slope in front of the shelter were measured using a Brunton pocket transit. Vertical and horizontal distance to the river were also measured in the field.

Shelter floors, and the area immediately adjacent to them were diligently examined for evidence of occupancy. This entailed the examination of any animal-burrow holes, erosional areas, and collector backfill piles. If no evidence of prehistoric occupation was present on the surface, subsurface testing was conducted under the dripline

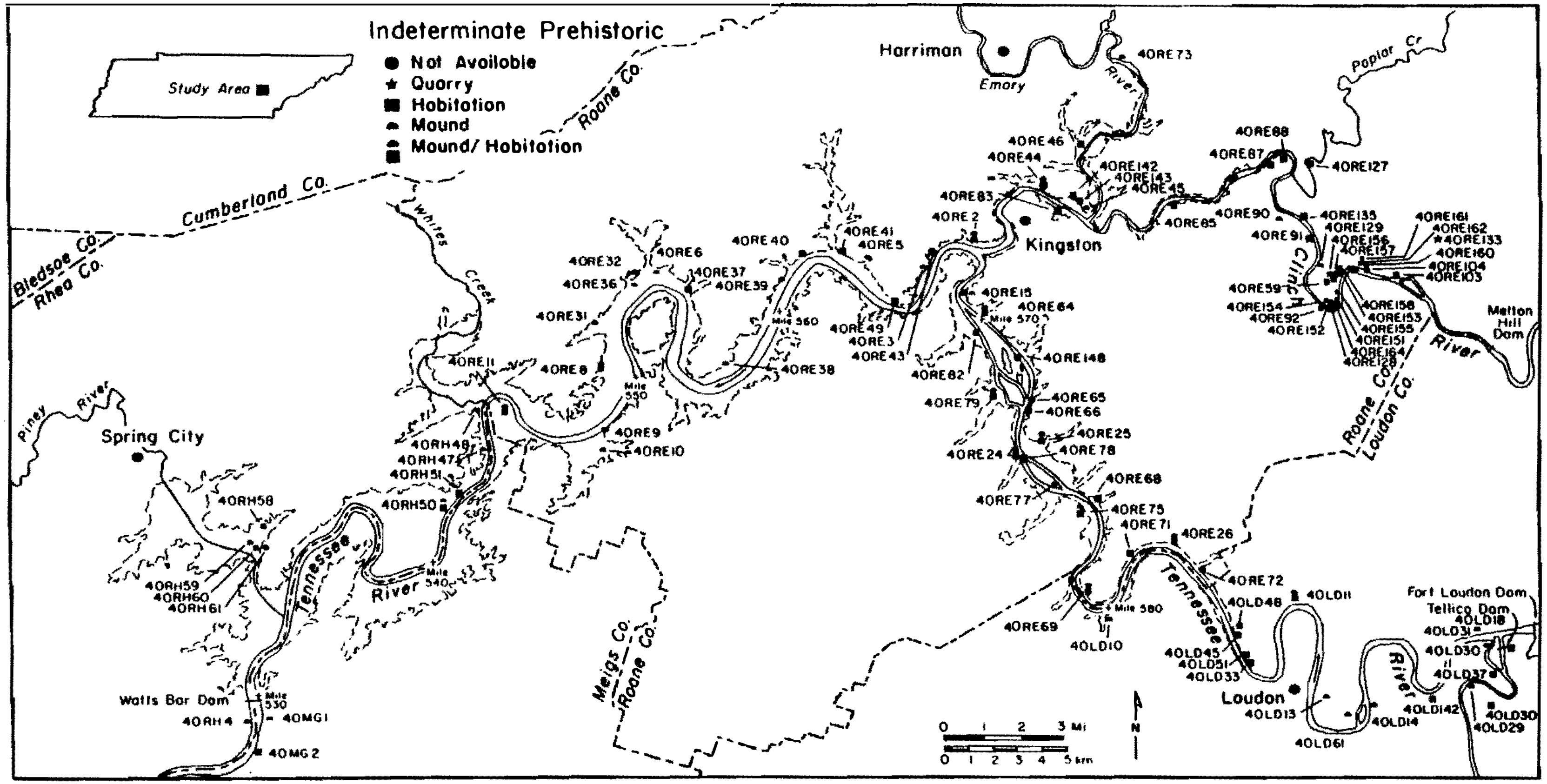

Figure 23. Distribution map of Indeterminate Prehistoric sites within the Watts Bar Reservoir study area.

using a posthole digger. Due to buried obstructions (i.e., breakdown), postholes were often relocated, but occasionally subsurface testing was suspended. Due to the constant presence of breakdown and the shallow deposits a mean depth of only 27.75 cm for subsurface testing resulted. All sediments were dry screened through 0.64 cm^2 (1/4 in) mesh. All cultural material was retained for laboratory identification.

Results and Conclusions

Following collection, data were then coded for computer analysis. Employing the STATGRAPHICS package (Statistical Graphics Corp. 1985) the Student's t-test was utilized in an effort to more precisely interpret possible variables influencing natural-shelter selection.

Three variables were identified that were statistically significant-maximum length, maximum depth and minimum area (see Table 20). The results were consistent with the expectation that larger shelters would be more suitable for utilization.

The assumption of least effort with respect to water resources was not consistent with the results. Mean distance to water sources was greater for utilized shelters than nonutilized shelters. The greater horizontal distance from the river may be a response to seasonal flooding. McCollough and Faulkner (1973:128), as well as Hall and Klippel (1982:17), contend that shelter utilization may have been most predominant in the winter and spring. This contention may reflect the greater probability of flooding during the winter and early spring (see Table 21).

Table 20. Results of student's t-test for rockshelter survey.

Variable	t-value	df	P
Wdist	-0.0948	35	0.9250
Maxlgth	-4.7094*	35	3.8598E-5
Maxdpth	-5.2838*	35	7.0581E-6
Maxht	-1.74541	35	0.0897
Minarea	-4.6663*	35	4.3888E-5
Flslp	1.5483	24	0.1346
Frslp	-0.7080	25	0.4855
Vdist	0.4877	34	0.6289
Hdist	-1.3095	34	0.1992

*Statistically significant difference at an alpha level of 0.05--reject null hypothesis.

Table 21. Monthly flood distribution on the Tennessee River at Loudon, Tennessee (1867-1963).[a]

Month	Frequency	Percent
January	5	15.15
February	6	18.18
March	12	36.36
April	4	12.12
May	1	3.03
June	0	0.00
July	1	3.03
August	0	0.00
September	0	0.00
October	1	3.03
November	1	3.03
December	2	6.06
Total	33	99.99

[a] Tennessee Valley Authority 1964.

It was hypothesized that south-facing (91-270 east of north) would be selected for utilization more often than north-facing shelters (271-90 east of north). In order to empirically test this hypothesis a chi-square test was employed for the nominal scores of shelter aspect. The results of the test failed to reject the null hypothesis at an alpha level of 0.05 (see Table 22). This result was contradictory to Hall and Klippel's (1982:10) results, which may reflect the nature of the geologic formations in the area or a sampling bias (i.e., small sample size).

Although the model tested does provide some insight into the possible variables which may have influenced shelter selection, the small sample size may have influenced the results, especially those of shelter aspect. Generally, larger shelter size may have been an important factor in influencing selection. Also, protection from the seasonal flooding of the rivers may have been a deciding factor, especially if shelters were utilized during the winter and early spring. Although not an end in itself, quantification of possible variables that may have influenced natural-shelter selection does provide a model for further testing of human locational strategies (Williams et al. 1973:216).

Table 22. Chi-square test of Watts Bar rockshelter aspect.[a]

	Noncultural		Cultural		
	Obs.	Exp.	Obs.	Exp.	Total
North (271-90)	24	24.22	4	3.784	28
South (91-270)	8	7.78	1	1.22	9
Total	32		5		37

$x^2 = 0.06$ d.f. = 1 $p = 0.05$

[a] Zar (1984:479, Table B.1).

CHAPTER IX

EMPIRICAL TESTING OF PREHISTORIC SITE LOCATION

Introduction

Riverine and riparian environments have become an important focus for the study of cultural development (Binford 1968; Struever 1968; O'Brien 1987). The dynamics of valley aggradation and floodplain stabilization during the Holocene have been argued as important factors influencing changes in prehistoric settlement and subsistence patterns in the eastern United States (Brown 1977). The linear positioning of microenvironmental zones along the meander belt of rivers provided an important area for resource procurement and exploitation with minimal cost expenditure (Smith 1978; Jochim 1976:152). In addition, the rejuvenation of floodplain soils during seasonal flood periods provided fertile areas for the development of horticulture during later prehistoric periods (Smith 1978a).

Understanding the dynamics of the riverine environment and the vast potential for resource exploitation within short distances allows some insight into the attractive nature of this region for prehistoric settlement. While the riverine environment is rich in general, differential distribution of resources, both spatial and temporal, in addition to the technological efficiency of prehistoric groups to exploit these resources, are influential factors in settlement location. The unequal distribution or localization of resources exerts a "pull" upon the location of settlements for the economic exploitation of the available resources (Haggett 1966). "Efficiency of exploitation" (Jochim 1981:148), (or the maximization of net energy return (Smith 1979)), is part of the key to understanding the decision-making process involved in placement of settlements. In this study "efficiency of exploitation" is defined as minimal distance to resources.

Jochim (1976), among others (e.g., Dunnell 1980; Keene 1981), have argued that a predictable relationship exists between features of the environment and patterns of human settlement. Delineation of ecological variables, both in time and space, can provide an important model for understanding human behavioral responses (Keene 1981:7). From this perspective an attempt will be made to delineate patterns of human behavioral responses (i.e., site location) in relation to features of the environment that were important resources for human exploitation.

In order to address the issue of settlement location, several environmental variables were selected. These variables were selected in an attempt to address issues not only of subsistence (see Carr 1981:264), but also of variables in the environment that would discern a location's quality (i.e., exposure)--and resources that would address the needs other than subsistence (e.g., uplands for wood procurement for fuel and shelter). Recently it has been argued that factors other than the natural environment (e.g., cultural institutions) are of equal importance in the development of models for human site location and foraging strategies (Durham 1981:225); however, for this study the main focus is energy expenditure as it relates to tangible environmental variables. A total of 222 tracts was identified and sampled along the Tennessee River, and 66 for the Clinch River.

Environmental variables were obtained from several sources. All measurements were taken from various maps of the region. These included 7.5 minute topographic quadrangles for delineating local relief and exposure (U.S. Geological Survey) and preimpoundment topographic maps of the Tennessee and Clinch rivers (U.S. Army Corps of Engineers 1921-1922; 1924). The preimpoundment quadrangles were important for obtaining the location of gravel bars and shoals as well as secondary water sources and the elevation of the rivers. The soil survey map of Roane County (Swann et al. 1942) was also used for delineating upland areas.

Variables

The initial step in this process was establishing a means by which the site and nonsite locations could be compared. This was accomplished by dividing the river systems into one kilometer sections, then drawing a one kilometer diameter circle along the river bank and numbering them consecutively. Each sample tract was categorized as being site or nonsite by comparing them to maps containing known site locations; in addition, each site was categorized according to its cultural component. From information collected during various surveys of the reservoir, in addition to work conducted in the Tellico Reservoir (Davis 1986), it is assumed that sites located along the river terraces represent multiple activity locations (i.e., major habitation sites). No attempt was made to discern season or length of occupation, and each site was considered of equal importance. To maintain consistency, a central point was positioned in each of the sample units from which measurements were taken to environmental variables.

The temporal period, or cultural component of each site, was an important variable in this study. General patterns of diachronic changes in settlement and subsistence are well known for the region and were a part of the initial classification of the region's culture history (e.g., Lewis and Kneberg 1946). Therefore, changes in subsistence and settlement should be reflected in location of settlements with respect to specific environmental variables.

Distance to resources has been shown to be an important factor in site location strategies ethnographically (Jochim 1976:55; Lee 1972:133), and in prehistoric settlement studies (Kvamme 1985:220). For this study it is assumed that the major river, either the Tennessee or Clinch, was the primary draw for the location on river terraces. Not only was water abundant and readily available, but the river provided other benefits as well, including reparian and riverine food resources, and a transportation system.

Secondary water sources such as tributary streams and springs, probably played a lesser role in settlement location, but may have contributed to site selection. The importance of water is much more apparent in regions where water availability is highly variable (Lee

1972:133). However, dynamic changes in drainage patterns, influenced by changes in climatic regimes during the Holocene, may have periodically influenced site location based on a diminished resource (i.e., periods of drought).

Distance to water resources was measured horizontally on 7.5 minute topographic maps. The value of this variable is highly questionable, due to temporal changes in intermittent stream and spring location and quality. Also, proximity to the resource may not be an accurate assessment in discerning patterns of energy expenditure minimization. Topographic gradients (i.e., vertical distance from water source) have been shown to be of equal, if not more, importance in site location. Kvamme (1985:220) argues that energy expenditure is significantly higher when moving up or down a hill while hauling water than it is to walk on level ground; consequently, in some regions vertical distance is more important than horizontal distance in discerning patterns of energy expenditure. In the Watts Bar region inconsistent information on specific site location and map quality do not lend themselves to the collection of vertical distance.

By convention, archaeological investigations of settlement patterns have attempted to measure the quality of an area for site location by means of topographic slope (i.e., McKelway 1983). Habitation, or extended activity sites, are generally associated with areas of gentle slope (less than 10 percent): although limited or specialized activity sites (e.g., rockshelters) may be located in areas of greater slope. Due to the nature of the region's washboard topography, slope and topographic relief will be considered. Topographic relief represents the difference between the maximum and minimum elevation of each sample tract. By measuring local relief, in addition to slope, it may be possible to form hypotheses about an area's quality as well as its energy expenditure. Greater relief represents greater energy expenditure or transport costs (Haggett et al. 1977:28; Kvamme 1985:224). From this perspective, it would be expected that site locations would be in areas of gentle slope and less relief than non-site areas.

Exposure, aspect, or more directly the shelter quality of a site's location (Kvamme 1985:223), has been argued as an essential consideration for the loci of settlements (Jochim 1976:55). Ecological research in the region verify this contention. Shanks and Norris (1950) have shown that local topographic variables, such as slope aspect, significantly influence temperature. Therefore, it is assumed that southern exposures were more highly favored in response to cold weather when maximum solar exposure would be needed.

Exposure, or aspect, was measured from 7.5 minute topographic maps. The measurement was recorded by noting the prominent direction of the sloping terrain by drawing a line perpendicular to the elevation contours (Kvamme 1985:219).

Distance to upland regions for exploitation of upland regions is another variable considered. Archaeobotanical and faunal assemblages from sites within the region indicate a substantial reliance on upland resources for subsistence and fuel. Upland regions were demarcated by county soil survey maps and the linear distance was measured for each sample tract. It is assumed that sites would be located closer to upland areas.

The final variable to be examined is the distance to river shoals or bars. Location of settlements adjacent to river shoals or bar areas would be an efficient means for exploiting shallow riverine resources, such as mollusks (Warren 1975:145). Ethnographic sources indicate that shoal areas were utilized as natural traps for harvesting fish. By driving fish into shallow or constricted areas they could be trapped behind weirs where they could easily be scooped up (Williams 1930:433-434; Swanton 1946:332-334).

Utilizing preimpoundment maps (U.S. Army Corps of Engineers 1921-1922) the horizontal distance from the sample tract to the shoal or bar area was measured. The expectation is that sites will be located closer to shoal areas then non-site tracts.

Several factors involved in the dynamics of riverine systems may confound the identification of settlement patterns with respect to river shoals. Of particular importance is the degree to which river meandering may have occurred in the past, and thereby had a direct influence on site location. Extrapolating from Delcourt's (1980) work in the lower Little Tennessee River Valley, I would argue that meandering of river channels was minimal due to the constraining effects of the erosion resistant formations of the Ridge and Valley.

All data were coded for computer analysis. Employing the STATGRAPHICS package (Statistical Graphics Corp. 1985) the

Kolmogorov-Smirnov goodness of fit test was utilized in assessing differences between site and non-site distributions. Originally developed for use with continuous data rather than discrete data, the procedure plots the cumulative distribution functions of the two samples and calculates the maximum distance (D-Value) between them. If the maximum deviation falls below 0.05, the two distributions are significantly different from each other at the 5 percent level (Statistical Graphics Corp. 1985).

Results and Discussion

The Archaic period sites from the Tennessee River were grouped together in order to maximize the small sample size (n=10; see Tables 23 and 24). It is assumed that these groups represent a general hunter-gatherer subsistence-settlement pattern.

Topographic relief and slope are the first variables to be reviewed. These two variables will be examined together as they tend to reflect similar aspects of a site's quality. Although relief is not statistically significant, slope among Archaic period sites, in comparison to non-site tracts, evince significant differences. This general trend reflects a probable selection for areas with less slope or relief. This model is consistent with the original assumption.

Distance to upland microenvironmental zones, identified on county soil survey maps by soil types, shows statistically significant difference between site and non-site tracts. However, distance to

Table 23. Descriptive statistics for Archaic period sites.

	Cultural					Noncultural				
	Mean	Minimum	Maximum	SD	N	Mean	Minimum	Maximum	SD	N
Relief	31.06	3.05	77.72	19.01	10	40.07	6.10	112.78	21.33	212
Slope	6.30	4.00	17.00	4.00	10	11.92	4.00	40.00	8.64	212
Shoals	1670.57	228.60	4262.50	1404.09	8	1584.15	76.20	4737.50	1027.75	186
Water	377.00	25.00	925.00	300.53	9	315.49	.00	1250.00	234.94	211
Uplands	217.17	.00	533.40	237.20	4	120.98	.00	411.48	104.21	105

Table 24. Kolmogorov-Smirnov two-sample test results for Archaic period sites.

Variable	D-Value	P
Relief	0.4	0.094155
Slope	5.49528	0.00*
Shoals	0.435484	0.10902
Water	0.98622	1.15303E-7*
Uplands	3.24048	0.00*
Aspect	0.525472	0.0102497*

*Statistically significant difference at an alpha level of 0.05--reject null hypothesis.

upland areas is greater among site tracts, which is contrary to the original assumption. Upland areas and greater relief may indicate the topographic relationship between elevation and uplands. Therefore, this trend may indicate a more important preference for level or nearly level areas for habitation, than proximity to the upland microenvironment.

Shoal areas is another variable that was assumed to be an important environmental feature for resource exploitation, specifically fish and mollusks. The results do not indicate a statistically significant difference between site and non-site locations. However, the trend of sites being located at greater distances than non-site areas may be a reflection of the minor role that shellfish and fish played in the Archaic economy of East Tennessee.

Proximity of sites to secondary water sources is another variable examined. A statistically significant difference between site and non-site locations is indicated; however, the trend is opposite to the assumption that sites would be located closer to water sources. This pattern may be an indication of the ubiquitous water supply in the valley, therefore not a limiting resource to prehistoric peoples. The pattern may also denote the inability of our paleoenvironmental models to discern diachronic patterns of water availability and drainage networks.

Aspect, a feature of the environment that may reflect a location's quality, is the final variable observed. The statistically significant results are in accordance with the expectation that sites would be located in areas that provided maximum exposure to solar radiation (i.e., south facing). Sixty percent of the site areas have a southern exposure (see Table 25). More importantly, this trend may provide clues for seasonal utilization of certain areas.

Comparison of Early Woodland site locations indicates similar trends to the pattern of Archaic site locations (see Tables 26 and 27). Relief and slope are statistically significant, and therefore indicate that site selection was probably based on areas with less relief or slope.

The relation of Early Woodland sites to upland areas is statistically different from non-site locations. Sites are located further from upland areas than non-site areas and may indicate the topographic relationship between elevation and upland environment locations.

Distance to shoal areas among Early Woodland sites does not statistically deviate from non-site locations. As with Archaic sites, Early Woodland sites are located at greater distances from shoal areas than non-site locations. Again this pattern may be indicative of the minor importance of riverine species during this time period.

A statistically significant difference between site and non- site location in relation to secondary water sources is indicated. However, sites are located at greater distances than non-site areas, a possible reflection of the nonessential need of this resource.

The difference between the aspect of site and non-site location is not statistically significant. The pattern is also contrary to the

Table 25. Frequency tabulation for Archaic period site aspect.

Degrees East of North	Cultural			Noncultural		
	Frequency	Relative Frequency	Cumulative Relative Frequency	Frequency	Relative Frequency	Cumulative Relative Frequency
0-90	3	.3	.3	58	.27358	.27358
90-180	3	.3	.6	48	.22642	.5
180-270	3	.3	.9	53	.25	.75
270-360	1	.1	1	53	.25	1

Table 26. Descriptive statistics for Early Woodland period sites.

	Cultural					Noncultural				
	Mean	Minimum	Maximum	SD	N	Mean	Minimum	Maximum	SD	N
Relief	33.44	3.05	77.72	19.11	21	40.27	6.10	112.78	21.45	201
Slope	7.33	4.00	17.00	3.83	21	12.08	4.00	40.00	8.80	201
Shoals	1762.66	225.00	4737.50	1335.53	16	1597.02	76.20	4737.50	1036.68	178
Water	369.11	.00	1175.00	322.34	20	312.14	.00	1250.00	227.96	200
Uplands	229.45	.00	533.40	180.82	9	116.66	.00	396.24	100.95	100

Table 27. Kolmogorov-Smirnov two-sample test results for Early Woodland period sites.

Variable	D-Value	P
Relief	1.00569	0.00+
Slope	2.61407	0.00+
Shoals	0.238764	0.372589
Water	0.445	1.49181E-3+
Uplands	1.43444	0.00+
Aspect	0.30135	0.0632793

*Statistically significant differences at an alpha level of 0.05--reject null hypothesis.

assumption that more sites would be located in areas of southern exposure (see Table 28). Confounding this model may be the seasonality of site utilization or possibly a response to population expansion facilitating the need to inhabit more marginal areas.

Middle Woodland site locations reiterate the trend that sites are located in areas of less relief and slope; a pattern congruent with the expected model (see Tables 29 and 30).

A statistically significant difference does exists between distance of site and non-site locations with respect to upland areas. However, as with Archaic and Early Woodland site locations, there is a greater distance to upland areas.

An interesting association between site locations and shoal areas is apparent during the Middle Woodland. Although not statistically significant, sites are located closer to shoal areas than non-site locations. This pattern may be indicative of a greater reliance on shellfish and fish during this time period. This pattern is reflected in the archaeological record by the significant increase in freshwater mollusk remains from Middle Woodland contexts in the region (see Charles 1973; Parmalee and Bogan 1986).

The distance of site locations with respect to secondary water sources is not statistically different than non-site locations. The pattern is basically the same as seen among other time periods, that site areas are located at greater distances than non-site locations.

Middle Woodland site aspect is contrary to the initial model. A statistical difference exists between site and non-site locations;

Table 28. Frequency tabulation for Early Woodland period site aspect.

Degrees East of North	Cultural			Noncultural		
	Frequency	Relative Frequency	Cumulative Relative Frequency	Frequency	Relative Frequency	Cumulative Relative Frequency
0-90	7	.333	.333	52	.259	.259
90-180	6	.286	.619	45	.224	.483
180-270	4	.19	.81	51	.254	.736
270-360	4	.19	1	53	.264	1

Table 29. Descriptive statistics for Early Woodland period sites.

	Cultural					Noncultural				
	Mean	Minimum	Maximum	SD	N	Mean	Minimum	Maximum	SD	N
Relief	25.74	3.05	73.15	17.19	37	42.45	7.62	112.78	20.95	184
Slope	7.04	4.00	20.00	4.30	37	12.67	4.00	40.00	8.90	184
Shoals	1372.79	76.20	4262.50	925.617	32	1620.39	150.00	4737.50	1056.24	160
Water	407.06	.00	1175.00	274.51	36	300.64	.00	1250.00	226.31	183
Uplands	205.26	.00	533.40	134.64	16	110.61	.00	396.24	101.07	93

Table 30. Kolmogorov-Smirnov two-sample test results for Early Woodland period sites.

Variable	D-Value	P
Relief	0.808754	0.00*
Slope	1.45402	0.00*
Shoals	0.18125	0.345016
Water	0.203097	0.167109
Uplands	0.801747	4.77624E-8*
Aspect	0.284959	0.0134369*

*Statistically significant difference at an alpha level of 0.05--reject null hypothesis.

however, selection is for northern exposure (65%; see Table 31). As previously proposed this pattern may reflect differential seasonal site utilization, or it may indicate a need for the use of less than optimal areas for habitation due to population increase. The extant archaeological record from Watts Bar indicates that Middle Woodland sites are the most prevalent.

The pattern of selection for areas of less relief and slope is reinforced among Late Woodland sites. The pattern of site location at greater distances from upland areas is also true for Late Woodland sites (see Tables 32 and 33).

The pattern of site location in closer proximity to shoal areas than non-site locations, seen among Middle Woodland sites, persisted during Late Woodland times. The continued utilization of riverine species in the Late Woodland period is supported in the archaeological record.

Late Woodland Period sites, as with previously examined periods, are located at greater distances from secondary water sources than non-site locations. Although not of statistical significance, this pattern may be reflective of the gross scale at which paleoenvironmental reconstruction has been done or possibly the inability of modern topographic maps to provide models for pre-contact East Tennessee.

A pattern for Late Woodland site location based on aspect does not indicate statistical preference (see Table 34).

Table 31. Frequency tabulation for Middle Woodland period site aspect.

Degrees East of North	Cultural Frequency	Cultural Relative Frequency	Cultural Cumulative Relative Frequency	Noncultural Frequency	Noncultural Relative Frequency	Noncultural Cumulative Relative Frequency
0-90	16	.432	.432	44	.23913	.23913
90-180	7	.189	.622	43	.2337	.47283
180-270	6	.162	.784	51	.27717	.75
270-360	8	.216	1	46	.25	1

Table 32. Descriptive statistics for Late Woodland period sites.

	Cultural					Noncultural				
	Mean	Minimum	Maximum	SD	N	Mean	Minimum	Maximum	SD	N
Relief	25.31	6.10	73.15	17.43	31	41.69	3.05	112.78	21.07	193
Slope	6.76	4.00	20.00	3.88	31	12.42	4.00	40.00	8.82	193
Shoals	1372.65	76.20	3487.68	903.78	27	1611.72	150.00	4737.50	1058.50	169
Water	370.99	.00	868.68	231.25	30	311.31	.00	1250.00	239.85	192
Uplands	167.64	.00	274.32	91.82	11	122.61	.00	533.40	113.23	100

Table 33. Kolmogorov-Smirnov two-sample test results for Late Woodland period sites.

Variable	D-Value	P
Relief	0.853919	0.00*
Slope	1.80127	0.00*
Shoals	0.188911	0.377057
Water	0.242708	0.0940649
Uplands	1.17182	0.00*
Aspect	0.21043	0.187658

*Statistically significant difference at an alpha level of 0.05--reject null hypothesis.

Table 34. Frequency tabulation for Late Woodland period site aspect.

Degrees East of North	Cultural			Noncultural		
	Frequency	Relative Frequency	Cumulative Relative Frequency	Frequency	Relative Frequency	Cumulative Relative Frequency
0-90	11	.355	.355	51	.26425	.26425
90-180	7	.226	.581	44	.22798	.49223
180-270	7	.226	.806	50	.25907	.7513
270-360	6	.194	1	48	.2487	1

Although diachronic changes in settlement patterns have been suggested (see Davis 1986:410; Schroedl et al. 1985), all Mississippian sites were combined due to inadequate information for discerning temporal differences among sites and a small sample size (n=29; see Tables 35 and 36).

Mississippian site relief and slope reiterate the previous pattern that sites are located in areas of less relief and slope than non-site areas. The distance of sites from upland areas, initially hypothesized to be less than non-site areas, has been shown to be greater.

Location of Mississippian sites in relation to secondary water sources reemphasizes the pattern seen among earlier periods--site locations are at greater distances from water sources than non-site locations.

The pattern of site locations adjacent to shoal areas, first indicated among Middle Woodland sites, and continued into the Mississippian period, may reflect the maintenance of a pattern of the utilization of riffle and shoal areas for the exploitation of riverine species (Bogan and Bogan 1986:369-410).

The selection of site locations based on aspect among Mississippian sites, although not statistically significant, indicates a trend towards northern exposure (62%; see Table 37). This pattern may be reflective of the need for larger tracts of land for horticulture, thereby minimizing the role of aspect in site location. More permanent and substantial structures for year-long occupancy may

Table 35. Descriptive statistics for Mississippian period sites.

	Cultural					Noncultural				
	Mean	Minimum	Maximum	SD	N	Mean	Minimum	Maximum	SD	N
Relief	22.75	3.05	79.25	17.18	29	42.21	7.62	112.78	20.69	193
Slope	5.02	4.00	10.00	1.78	29	12.72	4.00	40.00	8.71	193
Shoals	1251.97	200.00	2990.60	744.48	23	1631.89	76.20	4737.50	1071.70	170
Water	426.60	15.24	1175.00	303.90	28	301.99	.00	1250.00	222.50	192
Uplands	226.70	.00	533.40	131.50	16	106.93	.00	396.24	97.73	93

Table 36. Kolmogorov-Smirnov two-sample test results for Mississippian period sites.

Variable	D-Value	P
Relief	0.990709	0.00*
Slope	1.85689	0.00*
Shoals	0.326087	0.02691*
Water	0.326087	0.0482712*
Uplands	0.801747	4.77624E-8*
Aspect	0.216723	0.187119

*Statistically significant difference at an alpha level of 0.05--reject null hypothesis.

Table 37. Frequency tabulation for Mississippian period site aspect.

Degrees East of North	Cultural			Noncultural		
	Frequency	Relative Frequency	Cumulative Relative Frequency	Frequency	Relative Frequency	Cumulative Relative Frequency
0-90	11	.379	.379	49	.25389	.25389
90-180	4	.138	.517	47	.24352	.49741
180-270	7	.241	.759	50	.25907	.75648
270-360	7	.241	1	47	.24352	1

also have minimized the need for selecting only areas with a southern exposure.

Diachronic trends of settlement and subsistence patterns are also an important issue that has been prevalent in the archaeological literature. By comparing quantitative associations between site location and environmental variables, more adequate models of prehistoric settlement and subsistence may be possible.

The initial comparison was made between Archaic and Mississippian site locations since it is assumed that less complex hunter-gatherer (Archaic Period) societies would have different priorities for site location than those of more complex horticultural societies (Mississippian Period) (see Tables 38 and 39).

Comparison of site relief and slope indicate that Mississippian sites were located in areas of less topographic relief and slope than Archaic sites. This pattern may be indicative of the greater need for Mississippian sites to be located on landforms of less slope and relief due to increased size of the sites and increased dependence on horticulture (i.e., bottomland soils).

Although not statistically significant, the location of Mississippian sites at greater distances from upland areas than Archaic sites, may provide additional evidence for the increased need of Mississippian settlements to be located in areas that contain highly productive and easily tilled soils (Davis 1986:410). This type of soil is only available on floodplain and Recent alluvial terraces, presumably far from upland areas.

Table 38. Descriptive statistics for Archaic and Mississippian period sites.

	Archaic					Mississippian				
	Mean	Minimum	Maximum	SD	N	Mean	Minimum	Maximum	SD	N
Relief	31.06	3.05	77.72	19.01	10	22.75	3.05	79.25	17.18	29
Slope	6.30	4.00	17.00	4.00	10	5.02	4.00	10.00	1.78	29
Shoals	1670.57	228.60	4262.50	1404.09	8	1251.97	200.00	2990.60	744.48	23
Water	377.00	25.00	925.00	300.53	9	426.60	15.24	1175.00	303.90	28
Uplands	217.17	.00	533.40	237.20	4	226.70	.00	533.40	131.50	16

Table 39. Kolmogorov-Smirnov two-sample test results for Archaic and Mississippian period sites.

Variable	D-Value	P
Relief	0.386207	0.217326
Slope	2.36552	0.00*
Shoals	0.320652	0.999013
Water	0.178571	0.178571
Uplands	0.5625	0.263381
Aspect	0.251724	0.999897

*Statistically significant difference at an alpha level of 0.05--reject null hypothesis.

Proximity of sites to shoal areas, although not statistically significant, indicates that Mississippian sites were located closer to shoals than Archaic sites. This pattern may reflect a greater reliance on riverine resources by Mississippian peoples, as suggested by the archaeological record.

Although not statistically significant, Archaic sites are located closer to secondary water sources than Mississippian sites.

Site quality, as inferred from site aspect, may have been a more important consideration among mobile hunters and gatherers of the Archaic period than the more permanent Mississippian groups. Although the difference is not statistically significant, more Archaic sites are located in areas of southern exposure.

A comparison of Archaic groups and Woodland groups, although possibly not as dramatic as between Archaic and Mississippian site location strategies, may yield some important insights. All Woodland Period sites were combined for this comparison, although this grouping may confound interpretations (see Tables 40 and 41).

A comparison of site relief and slope indicates rather conflicting patterns. A statistically significant difference between Archaic and Woodland site locations is evidenced; however, the difference between slope is <u>not</u> statistically significant. The confounding point is that while Archaic sites are located in areas of less topographic relief, the Woodland sites are located in areas of less slope.

Table 40. Descriptive statistics for Archaic and Woodland period sites.

	Archaic					Woodland				
	Mean	Minimum	Maximum	SD	N	Mean	Minimum	Maximum	SD	N
Relief	31.06	3.05	77.72	19.01	10	29.12	3.05	79.25	17.94	71
Slope	6.30	4.00	17.00	4.00	10	7.06	4.00	16.00	4.04	71
Shoals	1670.57	228.60	4262.50	1404.009	8	1670.70	76.20	4262.50	1015.56	62
Water	377.00	25.00	925.00	300.53	9	340.57	.00	1175.00	258.05	70
Uplands	217.17	.00	533.40	237.20	4	197.93	.00	533.40	124.49	39

Table 41. Kolmogorov-Smirnov two-sample test results for Archaic and Woodland period sites.

Variable	D-Value	P
Relief	0.664789	8.63502E-4*
Slope	3.38592	0.00*
Shoals	0.399194	0.208818
Water	0.319048	0.391387
Uplands	0.884615	6.84081E-3*
Aspect	0.33662	0.273649

*Statistically significant difference at an alpha level of 0.05--reject null hypothesis.

Previous tests indicate that Middle and Late Woodland sites are located closer to shoal areas than non-site areas. This pattern may reflect a shift in subsistence exploitation toward an increased reliance on riverine resources. While the pattern is not statistically significant, it does indicate that Archaic sites are located closer to shoal areas than Woodland sites. This model may be confounded by the incorporation of all Woodland sites into one group.

The location of Archaic and Woodland sites with respect to secondary water sources is not statistically significant.

The significant difference between Archaic and Woodland sites with respect to distance from uplands may be related to the more mobile economy of hunters and gatherers of the Archaic Period. Archaeobotanical remains from the region signify a greater reliance on upland species during the Archaic Period and denote a need to be in greater proximity to this microenvironmental area.

Although a statistically significant difference between the aspect of Archaic and Woodland site location does not exist, more Archaic sites (60%) have a southern exposure. This selection of southern exposure for Archaic sites may be reflective of the more temporary, or less substantial nature of Archaic structures.

Comparison of Woodland and Mississippian site selections indicates a rather confusing pattern in relation to site topographic relief and slope. Statistically, Mississippian and Woodland slope are congruent, although the slope of Mississippian sites is less than that of Woodland sites. This may suggest a greater need for large tracts of level land along the river floodplain for horticultural fields and associated villages; however, topographic relief is statistically different, indicating that Woodland sites are located in areas of less relief. This contradictory pattern may be the result of grouping all Woodland period sites, thereby not allowing true diachronic patterns to be revealed (see Tables 42 and 43).

The distance of sites from shoal areas, although not statistically significant, indicates that Mississippian sites are located closer to shoal areas than Woodland sites. This pattern may reflect a greater reliance on shallow water riverine species during the Mississippian period.

The relation of sites to upland areas, also not statistically significant, indicates that Woodland sites are located closer to upland zones than Mississippian sites. This relation may be the result of the larger number of Woodland sites, a possible reflection of population expansion, and the utilization of more marginal areas for occupation.

The distance of Mississippian and Woodland sites from secondary water sources cannot be discerned statistically. However, Woodland sites are located closer to these water sources than Mississippian sites. This trend may also reflect the more ubiquitous nature of Woodland sites in comparison to Mississippian sites.

No statistically significant difference exists between the aspect of Woodland and Mississippian sites. However, the trend suggests more sites with northern exposure for both periods, a model that is in

Table 42. Descriptive statistics for Woodland and Mississippian period sites.

	Woodland					Mississippian				
	Mean	Minimum	Maximum	SD	N	Mean	Minimum	Maximum	SD	N
Relief	29.12	3.05	79.25	17.94	71	22.75	3.05	79.25	17.18	29
Slope	7.06	4.00	20.00	4.04	71	5.02	4.00	10.00	1.78	29
Shoals	1670.70	76.20	4262.50	1015.56	62	1251.97	200.00	2990.60	744.48	23
Water	340.57	.00	1175.00	258.05	70	426.60	15.24	1175.00	303.90	28
Uplands	197.93	.00	533.40	124.49	39	226.70	.00	533.40	131.50	16

Table 43. Kolmogorov-Smirnov two-sample test results for Woodland and Mississippian period sites.

Variable	D-Value	P
Relief	0.243322	0.174539
Slope	0.655658	4.1003E-8*
Shoals	0.256662	0.219043
Water	0.135714	0.999994
Uplands	0.184295	0.999989
Aspect	0.120932	1.0000

*Statistically significant difference at an alpha level of 0.05--reject nullhypothesis.

opposition to the initial assumption of sites areas being selected for southern exposure.

Due to the small sample size among Clinch River sites and the relative lack of temporal information, all prehistoric sites have been grouped together and a general comparison between site and non-site tracts will be conducted. The inconsistent nature of regional maps allowed only the collection of environmental information concerning four variables--slope, topographic relief, aspect and distance to uplands (see Tables 44 and 45).

Clinch River sites reiterate the pattern found among the Tennessee River sites that site location was related to topographic relief and slope. A statistically significant difference exists between non-site and site areas. Basically, sites are located in areas of low topographic relief and slope.

Comparison of prehistoric site location in relation to upland areas indicates a significant difference from non-site tracts. The trend for sites to be located further from uplands than non-site tracts, established previously among Tennessee River sites, is reemphasized among Clinch River sites. This pattern may be more a reflection of geologic and topographic processes than cultural selection.

A comparison between the aspect of site and non-site locations does not indicate a statistically significant difference. The pattern suggested is also contrary to the assumption that sites would be

Table 44. Descriptive statistics for all Clinch River sites.

	Cultural					Noncultural				
	Mean	Minimum	Maximum	SD	N	Mean	Minimum	Maximum	SD	N
Relief	45.68	6.10	103.62	21.64	34	65.95	12.19	146.30	28.27	32
Slope	11.35	4.00	30.00	6.46	34	19.09	4.00	43.00	9.96	32
Uplands	230.15	.00	600.00	150.23	34	136.21	.00	625.00	172.25	29

Table 45. Kolmogorov-Smirnov two-sample test results for all Clinch River sites.

Variable	D-Value	P
Relief	0.39551	0.0116006*
Slope	0.39551	0.0116006*
Upland	0.547667	1.67348E-4*
Aspect	0.273897	0.168499

*Statistically significant difference at an alpha level of 0.05--reject null hypothesis.

located in areas with southern exposure. Sites with an aspect of northern exposure are more frequent (56%; see Table 46).

Conclusions

The quantitative analysis of prehistoric site location with respect to environmental variables indicates that models of selection strategies can be discerned.

While all results are not statistically significant, general trends concerning locational choices can be inferred. Topographic relief and slope are among the most fundamental aspects of the natural environment that have been examined. In general, the preceding tests have shown that sites are located in areas of reduced slope (less than 10 percent).

The location of prehistoric sites in relation to secondary water indicates that sites are located at greater distances than non-site location. This trend is in opposition to the initial model proposed and may indicate that water resources were not a limiting factor in the valley. Another factor influencing the pattern may result from our inability to discern diachronic changes in water resource availability. Soil survey maps utilized provided inconsistent information concerning springs and may be a factor confounding this test.

It was initially proposed that prehistoric sites would be located closer to upland areas in order to more efficiently exploit resources from this ecological community. However, in comparison to non-site tracts, prehistoric sites are located at greater distances from upland

Table 46. Frequency tabulation for Clinch River site aspect.

	Cultural			Noncultural		
Degrees East of North	Frequency	Relative Frequency	Cumulative Relative Frequency	Frequency	Relative Frequency	Cumulative Relative Frequency
0-90	7	.206	.206	6	.1875	.188
90-180	5	.147	.353	15	.4688	.656
180-270	10	.294	.647	3	.0938	.75
270-360	12	.353	1	8	.25	1

areas. In contrast, diachronic comparisons indicate that Archaic sites are located closer to uplands than either Woodland or Mississippian sites. This pattern may reflect the greater dependence of Archaic hunter-gatherers on upland resources. Paleobotanical remains support this trend. A trend for sites to be located adjacent to shoal areas begins in the Middle Woodland and continues into the Mississippian period. This pattern may be reflective of a greater reliance on freshwater mollusks and fish species during these time periods. Archaeological remains from sites in the region indicate an increased reliance on aquatic resources beginning during the Middle Woodland.

The original assumption that site locations would be selected on the basis of exposure has not held true. Only during the Archaic period are more sites located in areas with a southern exposure. This pattern may reflect our inability to discern seasonality of site utilization or possibly the greater need for hunter-gatherers to exploit solar radiation. Increased sedentism, and inferred increased permanence of structures, may allow later prehistoric to ignore southern exposure as a limiting factor in site selection.

Although the preceding tests do not provide unequivocal results, they do provide some insight into the process of site selection. While not an end in itself, the model proposed indicates that sites are not randomly scattered across the landscape and are based on a polythetic set of environmental variables (Williams et al. 1973) that were part of a conscious decision-making process.

CHAPTER X

SUMMARY

The major findings of this study are summarized as follows:

1. There is a general lack of early sites, which is probably indicative of limited deep-site testing strategies.

2. There is a substantial increase in the number of sites during the Woodland periods. This pattern may reflect an increase in population through time (i.e., Griffin 1967; Cohen 1977).

3. The main river floodplains and recent alluvial terraces were the preferred location for habitation sites. These areas are in close proximity to several microenvironmental zones, thereby facilitating efficient resource procurement.

4. Older alluvial terraces along the main river channels were utilized more frequently during the Woodland periods.

5. Upland areas were apparently utilized most frequently for specialized activities (e.g., lithic resource procurement, burial mound location).

6. There is a general pattern for islands to contain deposits of later multicomponent occupation. This may reflect an increased dependence on floodplain and riverine resources.

7. Delineation of patterns for natural shelter utilization indicate that larger sheltered areas are more likely to be utilized.

8. Natural shelters selected for utilization are located further from the main river channel than nonutilized shelters. Recent models for rockshelter utilization argue that occupation was most prevalent during the winter and early spring, also a time of seasonal flooding of the rivers. This pattern may reflect a response to this danger.

9. Prehistoric sites are located in areas of less topographic relief and slope.

10. Beginning during the Middle Woodland period there is a pattern of site location in close proximity to river shoals. This locational strategy may reflect the increased dependence on riverine resources, such as freshwater mollusks and fish, or the result of population expansion.

11. There is a trend for Archaic Period sites to be located in areas with a southern exposure. Although this assumption was originally proposed for all time periods, increased sedentism and population expansion through time may have minimized the need for this locational strategy.

12. Diachronic patterns of site location strategies were also examined. Comparison of Archaic and Mississippian sites indicates that Mississippian sites were located in areas of less topographic relief and slope. This selection pattern may reflect the increased need for Mississippian groups to be located in landforms that could support the increased size of settlements and their horticultural subsistence economy.

13. Archaic settlement selection indicates that sites were located in closer proximity to upland environmental zones than Woodland or Mississippian sites. This pattern may reflect a more diverse pattern of subsistence during the Archaic period. Archaeobotanical remains from the region also indicate a greater reliance on upland species during the Archaic period.

14. Mississippian sites are located closer to shoal areas than either Archaic or Woodland sites. This pattern may be reflective of the greater reliance of riverine species through time.

15. Although not separated temporally, the Clinch River sites reiterate the general patterns found among the Tennessee sites--sites are located in areas of less topographic relief and slope, and sites are located further from upland areas than nonsites.

16. The preceding tests have demonstrated that the distribution of human occupation is not random, but based on a decision-making process with respect to features of the natural environment. Although not an unequivocal method, quantitative analysis of site location in relation to the natural environment can be used as a heuristic device for discerning patterns of human behavior.

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VITA

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