The Late Archaic-Early Woodland Transition In Southeastern Minnesota

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By

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Chapter 1
Introduction

Between approximately 3,500 and 1,800 years before present, indigenous societies inhabiting southeastern Minnesota experienced a profound cultural transformation. During this time period a combination of environmental changes, technological innovations and socio-cultural shifts stimulated lifeway alterations among people of the Archaic Tradition to those of the Woodland Tradition. In eastern North America the classic criteria delineating Archaic from Woodland include the use of ceramics and domesticated plants and construction of burial mounds by Woodland peoples and the lack of these traits by Archaic peoples. The occurrence and elaboration of these traits represent major changes in technology, economy and social organization. However, in southeastern Minnesota, reliance on the classic tripartite criteria to distinguish Archaic and Woodland cultural signatures from the existing data is problematic. For example, Late Archaic groups in southeastern Minnesota used domesticated plants while ceramics and burial mounds appear in Late Archaic contexts in various areas across the upper Midwest. Although Early Woodland ceramics are present, albeit with uncertain timing of their appearance, there is no firm evidence that Early Woodland groups constructed burial mounds or used domesticated plants in southeastern Minnesota. However, in adjacent regions, Early Woodland mounds and domestic plant use are documented. In southeastern Minnesota, it is not until approximately 1,800 years before present, during the Middle Woodland, that evidence for the full tripartite criteria is manifest. How then, is the transformation from Archaic to Woodland discerned in the archaeological record of southeastern Minnesota? What factors stimulated Late Archaic inhabitants to transform their lifeways? What is the nature of Early Woodland in southeastern Minnesota? How was the transition achieved? These questions frame basic research problems that this study will attempt to explain.

Numerous studies across eastern North America and in the upper Midwest have contemplated Late Archaic and Early Woodland problems. For example, in the adjacent areas of northeastern Iowa and southwestern Wisconsin, as well as at the American Bottom in west-central Illinois, understanding of the Late Archaic and Early Woodland archaeological record is more complete, with well defined chronologies, diagnostic materials, settlement and subsistence patterns and social organization. With some exceptions, such as the American Bottom and western Illinois, the mechanisms and impacts of culture change are less well understood. However, various aspects of Late Archaic, Early Woodland, and the transition period remain under debate, as illustrated by contending models explaining differences in, and causes for, culture change. For instance, in addition to the tripartite model, other models include: gradual in-situ incorporation of new traits with minor adjustments; punctuated replacement of Late Archaic groups by immigrants or intrusive groups with superior technology and different cultural habits with radical lifeway alterations; climate change with its various ramifications; and population expansion causing the collapse of crucial resources and leading to warfare.

Despite a long history of archaeological investigations in southeastern Minnesota, few studies have explored aspects of the Late Archaic or Early Woodland and the transition has remained vague. Some factors responsible for this situation include a dearth of archaeological sites with Late Archaic and Early Woodland components that have been excavated and researched, a preponderance of traditional presumptions defining Late Archaic and Early Woodland cultures, uncertain conceptual underpinnings of what constitutes Early Woodland, and the timing of when Woodland traits appear in southeastern Minnesota and generally across Minnesota. Notably, an indistinct notion of Early Woodland holds and some researchers question if Early Woodland, as a concept, applies to Minnesota at all.

This study examines the Late Archaic-Early Woodland transition period in southeastern Minnesota (Figure 1.1). This portion of the state is defined by political boundaries that roughly coincide with an area not covered by ice during the Wisconsin glaciation. The study reviews existing archaeological and environmental data. It presents a revised perspective of Late Archaic and Early Woodland societies in southeastern Minnesota and the transformation of the one into the other through a comparative analysis that highlights regional environmental and cultural variability. The fundamental goals of this research are to define the Late Archaic and Early Woodland temporally, materially, and culturally, and to formulate a model characterizing the Late Archaic-Early Woodland transition in southeastern Minnesota.

It is hoped that this research will illuminate relationships, diminish vagaries, and change the perceived dichotomy between the Late Archaic and Early Woodland societies in southeastern Minnesota. Chapter 2 discusses the environmental background of the study region to include the Late Holocene environment and presents macrophysical climate models constructed by the author. Chapter 3 reviews the culture history of the study region and compares the evidence with that of adjacent regions. Chapter 4 presents the archaeological record of the study region and discusses the methodology and interpretations concerning the information. Chapter 5 examines environmental and cultural relationships between Late Archaic and Early Woodland sites to discern settlement and subsistence patterns. Chapter 6 offers a discussion, presents a model for the Late Archaic-Early Woodland transition in southeastern Minnesota and provides remarks on future research.

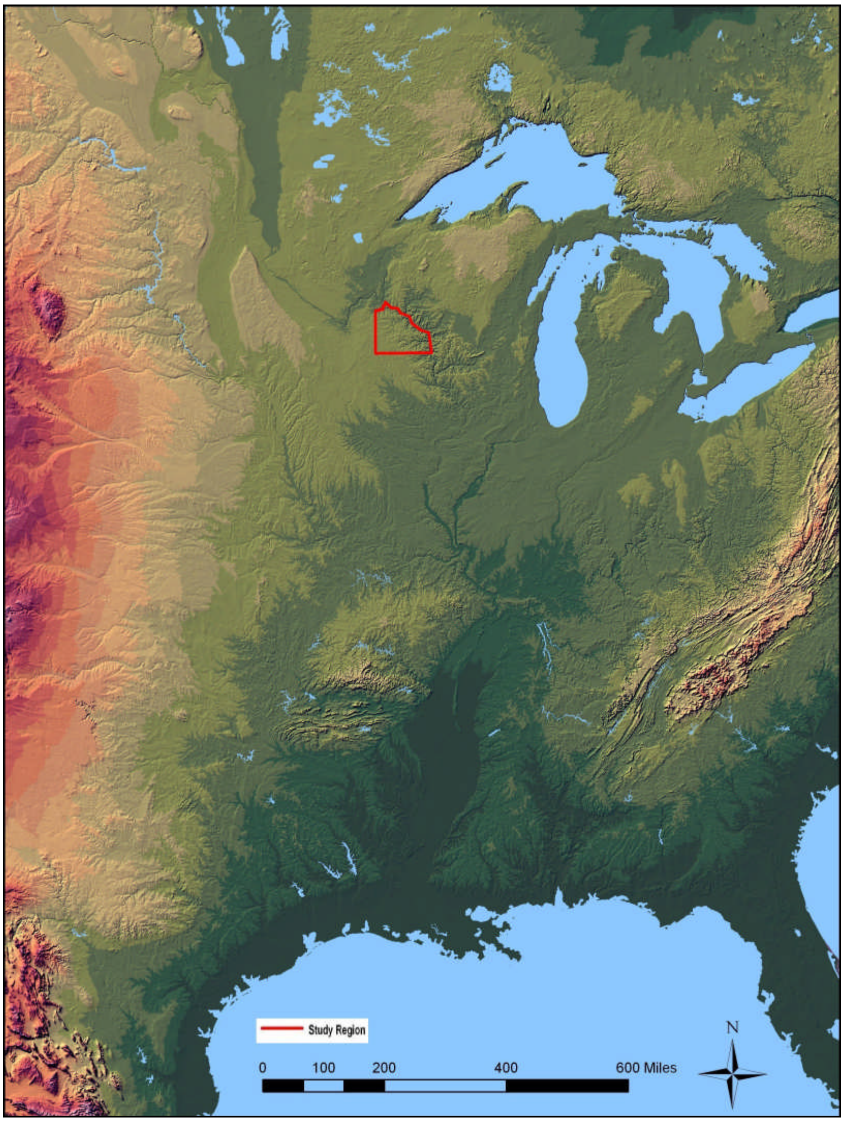

Figure 1.1. Location of the Study Region in the Upper Midwest (USGS 2002).

Chapter 2
Environmental Background

Southeastern Minnesota is an environmentally unique region within the state. The natural environment of the region developed from a complex sequence of climatic, geomorphic, and vegetational events. Mostly underlain by deeply dissected, flat-lying limestone and sandstone bedrock, the region consists of an erosional surface that was not covered with ice during the Wisconsin glacial period. The landscape ranges from broad hills and narrow valleys in the west to deeply incised valleys with steep slopes and a mature drainage network in the east. The combination of diverse topography and ecosytems supported a variety of rich resources, including terrestrial and aquatic plants and animals, lithic raw materials and productive soils. Currently, the region enjoys a continental climate with warm, humid summers and cold, dry winters. While at present agricultural lands dominate the study region, it hosted a mosaic of tall-grass prairie, oak savanna, floodplain forests and a variety of other vegetation types during the Late Archaic-Early Woodland Transition. Major streams include the Mississippi, Cannon, Root, Whitewater and Zumbro rivers that are fed by numerous smaller drainages. Natural lakes and wetlands away from the larger river's floodplains are largely absent. On the whole, the region offered a favorable location for human occupation.

The study region includes eight counties in southeastern Minnesota: Dodge, Fillmore, Goodhue, Houston, Mower, Olmsted, Wabasha and Winona (Figure 2.1). The political boundaries of these counties roughly coincide with the region's physical characteristics, an area not covered with ice during the Wisconsin glaciation (Hobbs and Goebel 1982). Although this portion of the state is sometimes incorrectly referred to as the Driftless Area, the region is known as the Rochester Till Plain physiographic area (Wright 1972a) (Figure 2.2). At its widest, the region is approximately 90 miles (145 km) wide from west to east and 80 miles (129 km) long from north to south, encompassing approximately 5,130 square miles (13,287 square km). The edge of the western portion of the region is coincident with the eastern margin of the Owatonna moraine of the Des Moines lobe, which is roughly equivalent to the western borders of Goodhue, Dodge and Mower counties. The northern border of Goodhue County is the northern limit of the study region, with the Cannon River serving as a convenient border. Just north of the Cannon River is the Emerald phase ice-margin of the Superior lobe. The eastern portion of the study region is the Mississippi

River. The southern extent of the study region is the Iowa border with Mower, Fillmore and Houston counties.

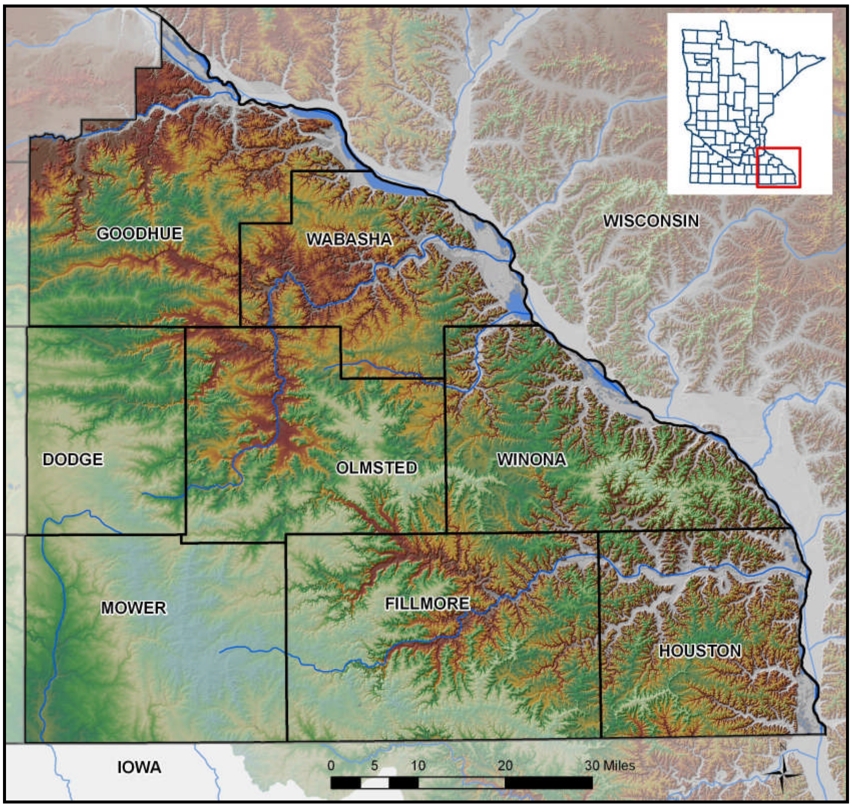

Figure 2.1 Counties Included in the Study Region (USGS 2002).

On a broad scale, southeastern Minnesota has a homogeneous natural environment. However, distinct variations in climate (i.e., temperature and precipitation gradients), geomorphology (e.g., landforms), vegetation (i.e., prairie, oak savanna, floodplain forest, wetlands and rivers) and fauna occur across the region. For example, the Mississippi Valley contains a suite of complex geomorphologic features (e.g., terraces, fans, natural levees, side channels, wetlands, backwater lakes), whereas the western third of the region is a relatively featureless plain. Also, past climate changes affected vegetation patterns, such as the establishment of oak savanna, and fluvial responses, with periods of stability, erosion and sedimentation during the study period. These and other differences affected the natural resources and thereby had profound influences on the lifeways of the Late Arcahic and Early Woodland occupants. To illustrate these differences, the study region is divided into three sub-regions based on physiographic and other natural characteristics: Gray Drift, Weathering Residuum, and the Mississippi Trench (Figure 2.2).

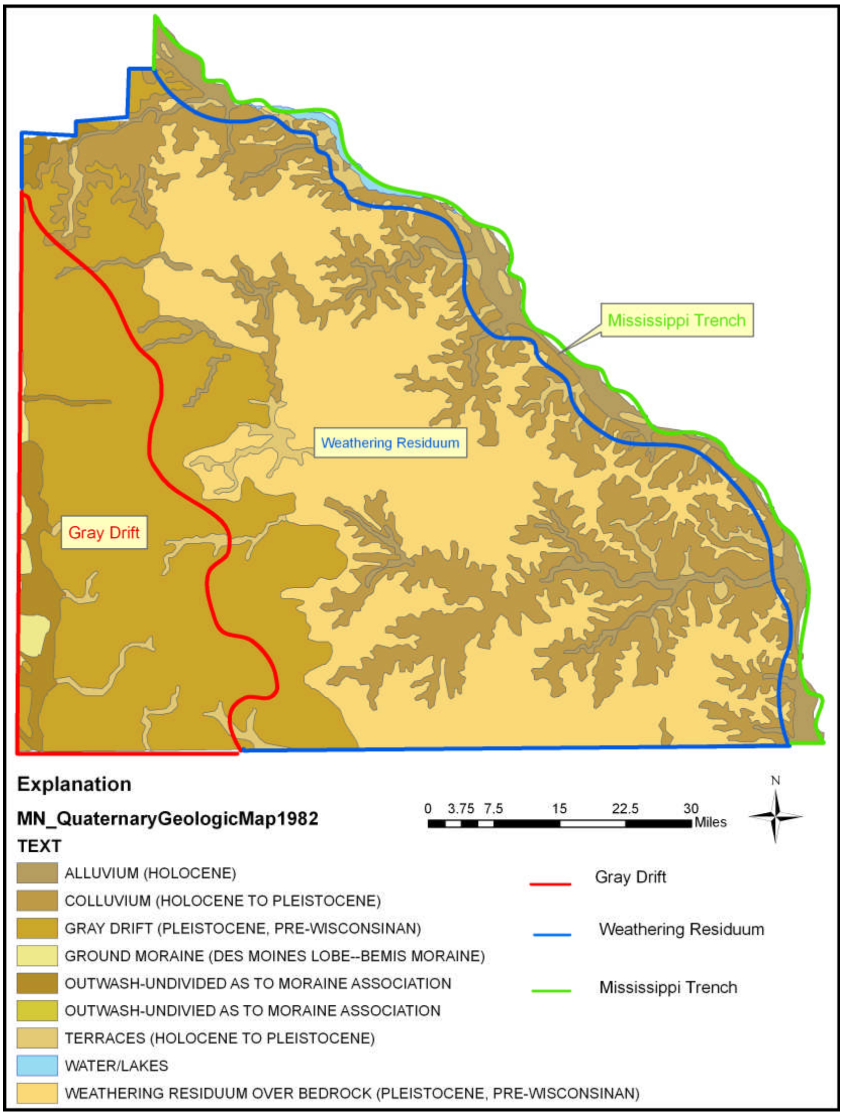

Figure 2.2. Physiographic Sub-Regions of the Study Region (Hobbs and Goebel 1982).

Basic information on the natural environment of the study region is pertinent to this study, with an emphasis on environmental variables that likely influenced the lifeways of Late Archaic and Early Woodland groups. Key environmental factors include climate, bedrock, geomorphology, drainage network, soils, vegetation, fauna and climate. These factors are considered at various scales (e.g., macropatterns, vegetation zones and individual landforms) and are used to compare the nature of the existing environmental variability within the sub-regions across the study region. This is followed by a discussion of the Late Holocene history of the study region during the Late Archaic-Early Woodland transition.

Current Environment

Climate

Climate is the driving force behind a variety of environmental effects, such as air movement, temperature, precipitation and other atmospheric conditions that are determined by a global system. Regional weather patterns are influenced by a variety of integrated mechanisms that differ from one time to another (e.g., Bryson and Hare 1974). Importantly, climate influences the development of soils, vegetation, attendant fauna, and fluvial and other geomorphic processes.

Minnesota’s climate is determined by its position in North America, which is east of the Rocky Mountains within the Central Lowlands of the Interior Plains. Climate in the state is controlled by the movement of three dominant air masses. Westerly winds bring dry Pacific air, southerly winds bring warm and humid air form the Gulf of Mexico, and northerly winds bring cool and dry air from the Arctic (e.g., Bryson and Hare 1974). As a result, extreme fluctuations in temperature and precipitation occur from the interaction of these air masses. In the study region, the climatic gradients influenced the ecological communities. Prairie areas developed under warm and dry conditions dominated by Pacific air and deciduous forests developed under warm and moist conditions brought on by Gulf of Mexico air. The position of the climatic gradients shifted during the Late Holocene, as discussed below.

The modern climate of the study region is characterized as continental, with warm, humid summers and cold, dry winters. The average summer temperature is 68.5°F (20.3°C) and the average winter temperatures is 16.3°F (-8.7°C). The annual precipitation ranges from 28 to 34 inches (711-863 mm), with higher rainfall in the southeastern portion of the study region. The average growing season (frost-free days) is 160 days, with the length of the growing season increasing to the east and south (e.g., Baker and Strub 1963; Baker and Kuehnast 1978; Baker et al. 1985). Figure 2.3 presents modern average summer temperatures, precipitation and growing days. Table 2.1 is a comparison of modern climate characteristics by sub-region.

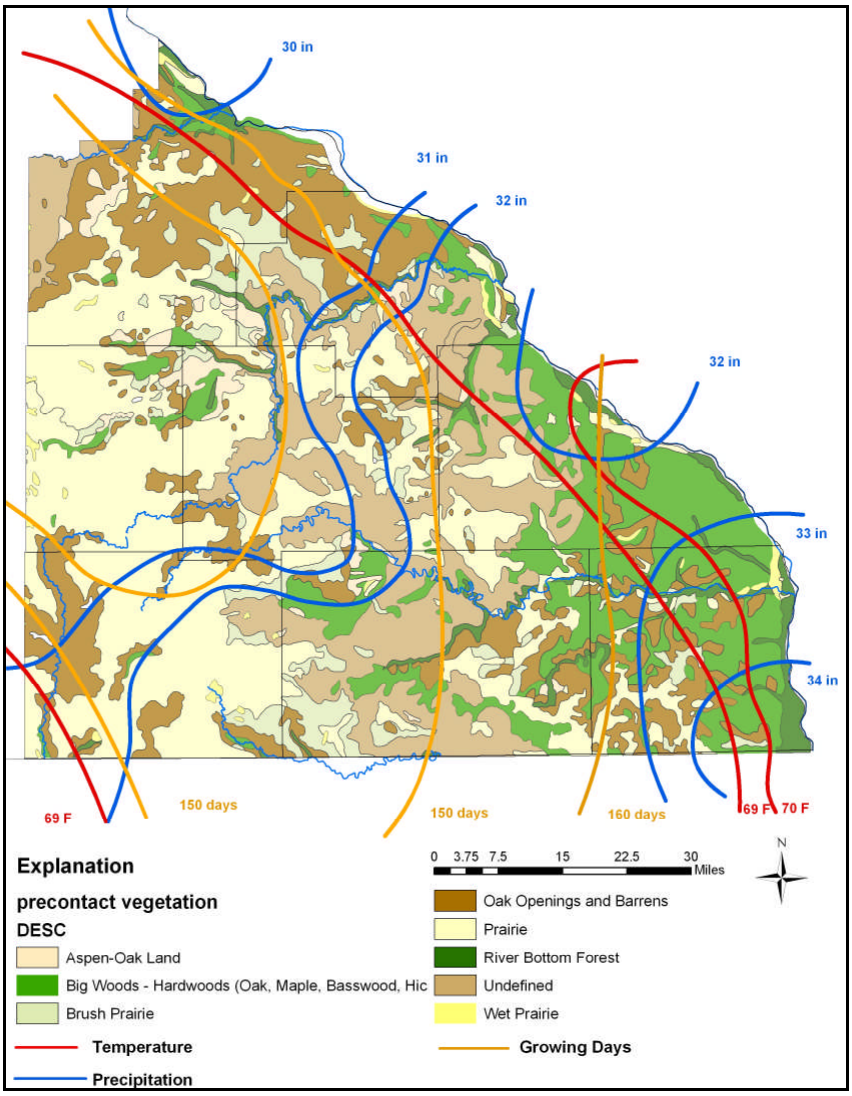

Figure 2.3. Modern Temperature, Precipitation and Growing Days of the Study Region (Baker and Strub 1963; Baker and Kuehnast 1978; Baker et al. 1985, Marschner 1974).

Table 2.1. Modern Climatic Characteristics of Southeastern Minnesota Sub-regions.

Sub-region	Annual Summer temp ºF /ºC	Annual Winter temp ºF /ºC	Annual precipitation in/mm	Average growing season (days)
Gray Drift	68/20	16/-8.9	30-32/762-813	150
Weathering Residuum	68/20	17/-8.3	28-34/711-864	160
Mississippi Trench	69.5/20.1	16/-8.9	28-34/711-864	170

Bedrock

Bedrock geology plays an important role in landscape formation. It helps shape the landscapes of the region and provides a variety of uses to the local inhabitants. The general bedrock units for the study region are depicted in Figure 2.4. Overall, Paleozoic sedimentary rock layers consisting of sandstone, dolomite, limestone, and some shale deposited in the Hollandale Embayment underlie southeastern Minnesota (e.g., Mossler 1972; Sims 1970). The more easily eroded sandstone units formed gently sloping interfluves and valley flats, while the more resistant limestone and dolomite units usually produced steep slopes and cliffs. The bedrock is covered by various thicknesses of glacial drift and loess, is exposed in isolated outcrops, or is continuously exposed. Caves, rockshelters, sinkholes and springs with karst topography are common in limestone and dolomite areas (e.g., Ojakangas and Matsch 1982). Some of these voids were used for habitation and other activities, such as a medium for rock art (e.g., petroglyphs and paintings) (e.g., Dudzik 1995; Sprengelmeyer 2006; Wilford 1937, 1954; Winchell 1911).

Importantly, limestone and dolomite formations contain a variety of chert available for stone tool manufacture. Local cherts available from bedrock exposures or near-surface lag deposits in the region utilized by precontact people include Prairie du Chien, Cedar Valley, Galena, Grand Meadow, Shell Rock and Maquoketa (e.g., Bakken 1997; Gonsior 1996; Myster 1996; Trow 1981). The flaking quality of these materials ranges from good to poor; some may be improved through heat-treating. Some of these cherts may also be found as streambed cobbles (e.g., Kliwiter 2001). The local cherts may also be obtained from glacial drift across the region in addition to a variety of non-local lithic raw materials, such as Swan River Chert, Siltstone, Jasper Taconite, Tongue River Silica and quartzite (e.g., Bakken 1997). In addition, some sandstone units in the region may contain silicified deposits or orthoquartzites that are suitable for tool manufacture (e.g., Boszhardt 1998).

Glacial outwash and drift may also contain basalt, granite and other non-sedimentary rocks used for ground stone tool manufacture and other expedient purposes, such as grinding and chopping. Additional use of cherts and other rocks include ceramic temper, ornaments and hearth, storage pits, and burial and structural elements.

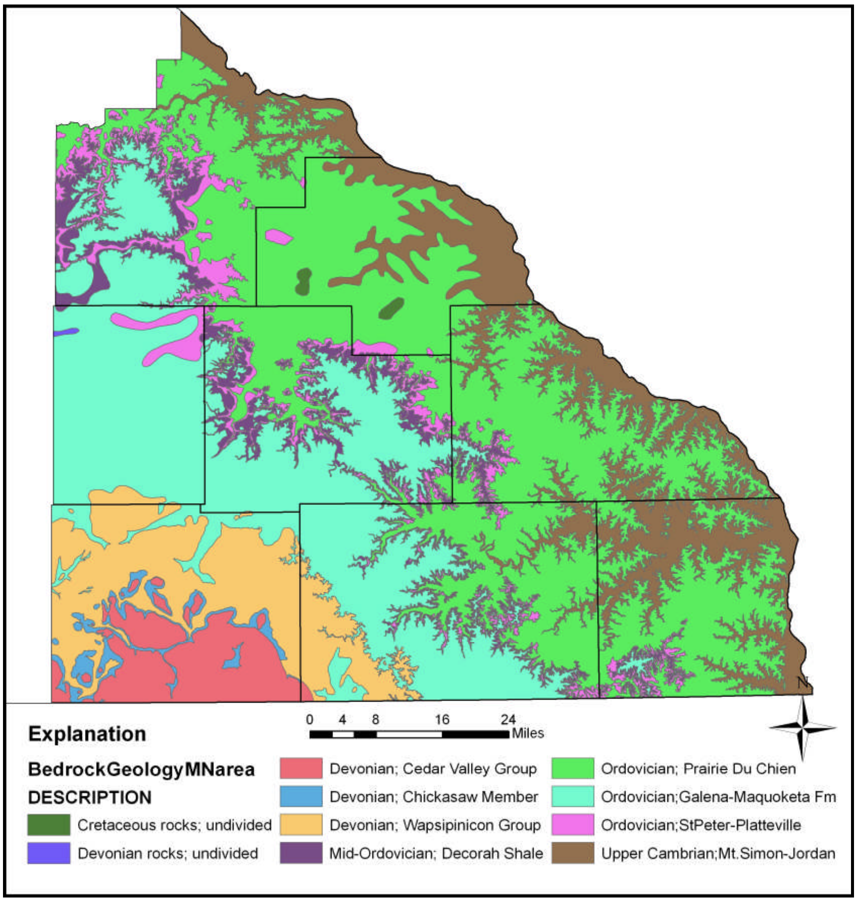

Figure 2.4. Bedrock Geology of the Study Region (Morey and Meints 2000).

Geomorphology

Between the Appalachian Mountains to the east and the Rocky Mountains to the west, the study region is within the Central Lowlands of the Interior Plains, an area repeatedly covered with glacial ice during the Pleistocene (e.g., Wright 1972b). More specifically, the region falls within the Rochester Till Plain physiographic area, an erosional surface characterized by a mature drainage network with heavily dissected topography (Wright 1972a:577-578). It is similar in appearance to the adjacent areas of northeastern Iowa's Paleozoic Plateau and southwestern Wisconsin's "Driftless Area" (Martin 1965; Prior 1991).

Although a series of pre-Illinoian continental glaciers covered southeastern Minnesota, the most recent glaciation, the Wisconsin (ca. 60,000-12,000 BP), did not penetrate most of the study region (e.g., Halberg 1980; Hobbs 1995; Knox and Attic 1988; Meyer 2000; Morey and Meints

2000; Prior 1991; Wright 1972a, 1972b). However, the region was shaped by late Wisconsin and subsequent Holocene events, including a periglacial climate, continued erosion, weathering, loess deposition, degradation and aggradation of river valleys (e.g., Knox et al. 1982; Wright 1972b, 1983, 1987). Because previous tills (e.g., Gray Drift), paleosols, and loess were largely removed, leaving weathered bedrock residuum, southeastern Minnesota is sometimes incorrectly referred to as the "Driftless Area" (e.g., Hobbs 1995; Jacobs et al. 1996; Knox and Attic 1988; Ruhe 1983; Wright 1972a).

Landscape-forming processes have different sequences and expressions across the study region. Based on broad landscape similarities, three distinct sub-regions are identified: Gray Drift, Weathering Residuum, and Mississippi Trench (Figure 2.2). The following provides a general description of the current geomorphic setting of the three sub-regions.

The Gray Drift sub-region occupies the western portion of the study region. It exhibits a mature, undulating topography mostly developed on pre-Wisconsin drift (Carlson 1989; Cowles and Harms 1961; Poch 1976). Although relief across the sub-region is low, averaging around 20 feet (6 m) with slope steepness between 0-12 percent, it contains the highest elevations within the study region at approximately 1,440 feet above sea level (fasl) (439 m) (Figure 2.5). Several relatively un-incised streams draining to the south and east begin in this area.

The Weathering Residuum sub-region covers the central portion of the study region. This region has a mature, gently rolling topography of broad uplands that become narrow ridges with steep, deeply dissected terrain to the east (Farnham 1958; Lueth 1984, 1994; Poch 1976, 1980). This landscape developed on highly eroded pre-Wisconsin drift and slopewash sediments of an ancient plain (Dodgeville peneplain) that has been dissected by an intricate pattern of creeks and rivers that become deeply entrenched to the east, in some places resembling canyons as they enter the Mississippi River valley. Here, relief ranges from a low of approximately 60 feet (18 m) in the west up to around 500 feet (152 m) in the east, along the Mississippi River Trench (Figure 2.5).

Upland areas have from 2-12 percent slope steepness, while the slope steepness of deeply dissected areas ranges from 6-45 percent. Between 0 to 2 percent slope steepness occurs within the floodplains of the major streams. Elevations range from approximately 1,400 fasl to 1,250 fasl (427-381 m). As the rivers and streams debouch at the Mississippi River, elevations are approximately 700 fasl (213 m) in the north and approximately 600 fasl (183 m) in the south.

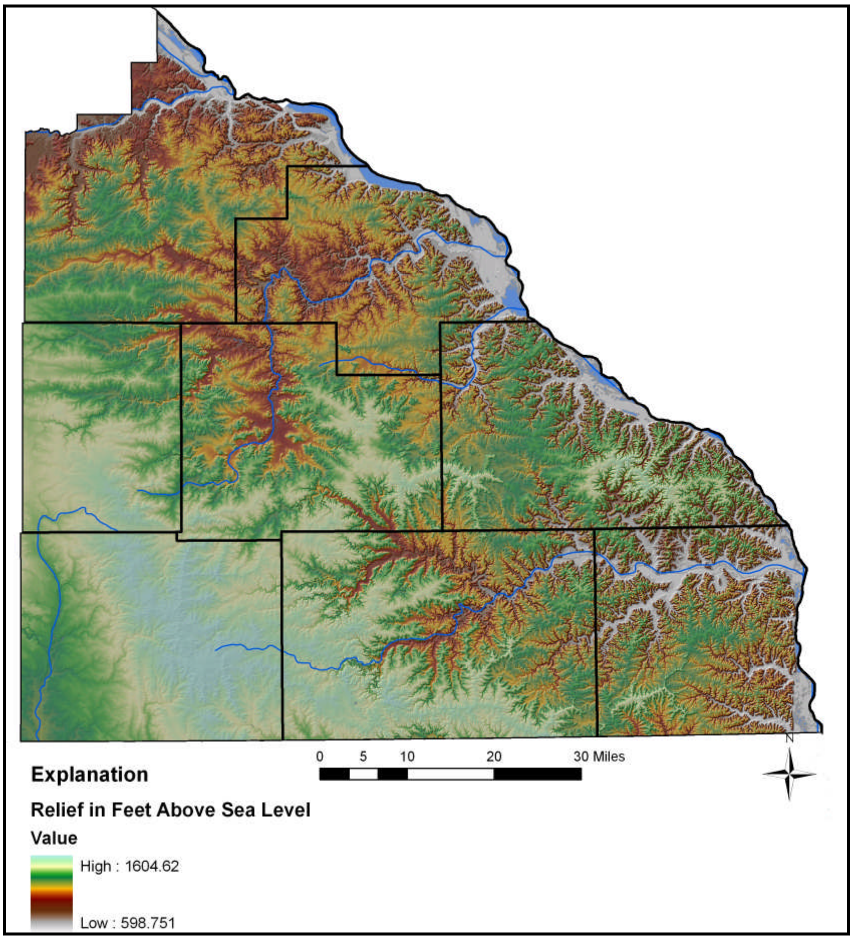

Figure 2.5. Topographic Relief of the Study Region (USGS 2002).

The Mississippi Trench sub-region includes the eastern portion of the study region adjacent to and within the Mississippi River floodplain. This area contains diverse geomorphology and landforms, including uplands, valley slopes, terraces, fans, dune fields, islands, natural levees, backwater lakes, ponds, marshes, channels, sloughs and other surface features (Harms 1965; Lueth 1984, 1994; Poch 1976). These landforms developed on Pleistocene and Holocene outwash sediments through a complex sequence of events (e.g., Bettis et al. 2008; Wright et al. 1998). Several medium and large tributaries and numerous smaller drainages enter the sub-region at various points. Relief from uplands to the floodplain can extend 600 feet (183 m) (Figure 2.5). Relief in the floodplain is relatively low, although some natural levees are prominent and terrace scarps can be up to 80 feet (24 m). Except for the valley slopes, most of the sub-region has from 0 to 2 percent slope steepness. Elevations on the Mississippi River floodplain are approximately 700-600 fasl (213-183 m).

Drainage Network

The region's drainage network developed from a variety of hydrological factors (e.g., precipitation) that influenced various geomorphological processes (e.g., erosion and sedimentation) and fluvial behavior (e.g., flow) (e.g., Butzer 1993; Leopold et al. 1964; Tester 1995; Waters 1992). Springs, streams, and wetlands provided sources of water for various human uses and their surrounding environs afforded a variety of other materials, such as clay for pottery, supported and attracted a wide variety of flora and fauna (productivity), and served as transportation corridors (e.g., Anfinson 2003; Fremling 2005; Waters 1977).

Major drainages within the study region include the Mississippi, Cannon, Zumbro, Whitewater, Root and Cedar rivers (Figure 2.6). The Cannon, Zumbro, Whitewater, and Root rivers drain to the north-northeast and east and enter the Mississippi River within the study region. These stream valleys are relatively narrow in the western area of the study region. As they move east, the streams become deeply incised and broaden with more frequent terraces before terminating at the Mississippi. The Cedar, Upper Iowa and Wapsipinican rivers are narrow and relatively un-incised at their headwaters in the study region; they flow south and southeast and join the Mississippi in Iowa. Smaller rivers and creeks may be fed by springs and occasionally enter sinkholes to underground channels. In addition, some wetlands and wet prairies are present in various areas.

The Mississippi River is the master stream in the region. The width of the Mississippi Valley varies along its course through the study region from a few miles to seven miles in places. Within the Mississippi floodplain, abundant side channels, natural levees, alluvial fans, islands, lakes, sloughs and wetlands exist. However, much of this landscape has been altered due to the installation of the lock and dam system, which resulted in erosion, sedimentation and inundation of various landforms (e.g., Dunn 1996; Fremling 2005). Numerous streams and rivers originating in the Gray Drift and Weathering Residuum sub-regions terminate here (e.g., the Cannon, Root, Whitewater and Zumbro rivers), as well as drainages from Wisconsin. Several prominent terraces exist along the Trench. They range from relatively narrow to broad expanses and include several different steps, according to their depositional sequence.

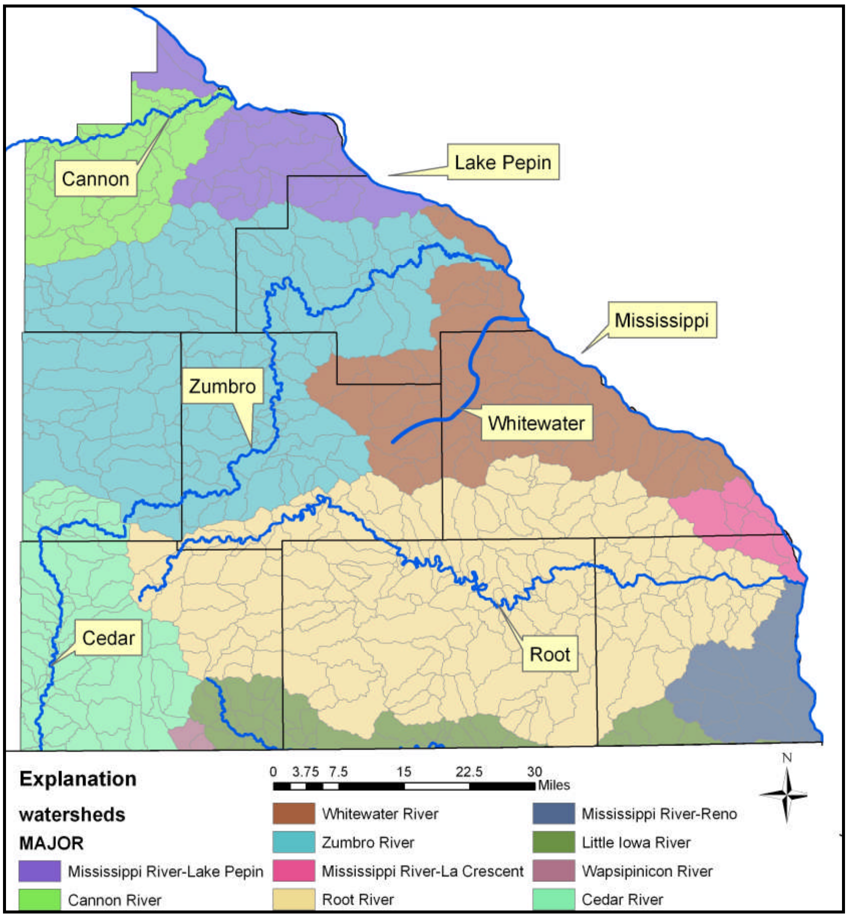

Figure 2.6. Major Watersheds within the Study Region (USGS 2009).

The region does not contain any glacial lakes, because the region was not covered with ice during the Wisconsin glaciation. Any lakes formed during previous glaciations in upland areas have naturally drained and filled with sediment. However, numerous small backwater floodplain lakes and some shallow depressions formed by solution of the underlying Paleozoic carbonate rock exist (Wright et al 1998). The growth of Lake Pepin, a large river lake formed by alluvial deposits from the Chippewa River, submerged a series of earlier lakes formed above the fans of tributaries (e.g., Cannon River) and eventually reached St. Paul. The Mississippi River delta reached Red Wing, in the northeast portion of the study region, ca. 1,400 BP (Blumentritt et al. 2009).

Soils

Soils are important environmentally and archaeologically. Soils form over time through interactions with parent material, climate, plant and animal life, and landscape setting (i.e., relief and aspect) (e.g., Birkeland 1984). Soil is the medium where most archaeological data are recovered. As such, understanding the dynamic character of soils (and other natural and cultural processes) is important in determining an area's suitability for settlement and subsequent site deposition, post-depositional disturbances and other variables (e.g., Bettis and Hajic 1995; Butzer 1993; Holliday 1992; Waters 1992).

A broad range of soils exist in the study region, as detailed in Figure 2.7 (Carlson 1989; Cowles and Harms 1961; Farnham 1958; Harms 1965; Lueth 1984, 1994; Poch 1976, 1980). They are generally moderately-fine to medium-textured loams and silts and course-textured sands, and range from poorly drained (e.g., on floodplains) to well drained (e.g., on terraces), depending on their landscape position and other factors. Clays are constituents of several soil series identified throughout the sub-region. Overall, the soils are dominated by mollisols and alfisols that primarily developed under prairie and deciduous forest vegetation, although oak savannah formed over both soil orders at various times (e.g., Soil Survey Staff 1999). Smaller areas of localized entisols (e.g., dune areas) and various hydric soils of wetlands are present under various plant communities. In general, mollisols are more frequent in the western portion of the region while entisols and alfisols are more prevalent in the east and within river valleys.

Various geomorphic processes may create a series of buried soils (former stable surfaces), such as alluvial, colluvial and eolian sedimentation (e.g., Birkeland 1984; Butzer 1993; Holliday 1992; Hudak et al. 2002; Monaghan et al. 2006; Soil Survey Staff 1999; Waters 1992). Several areas within the study region, particularly within river valleys, contain buried soils of various Holocene ages. Further, historic land use practices, such as logging and agriculture, have increased erosion of upland and other areas, depositing various amounts of post-settlement alluvium (PSA) across many floodplains (e.g., Baker et al. 2001; Hudak et al. 2002; Knox 2006; Kolb et al. 2009; Monaghan et al. 2006; Wright et al. 1998). Some of these now buried soils contain a sequence of cultural deposits of various ages (e.g., Boszhardt 1995; Moffat et al. 1996; Neumann 1984; Perkl 2002; Peterson et al. 1988; Tumberg and McFarlane 1998).

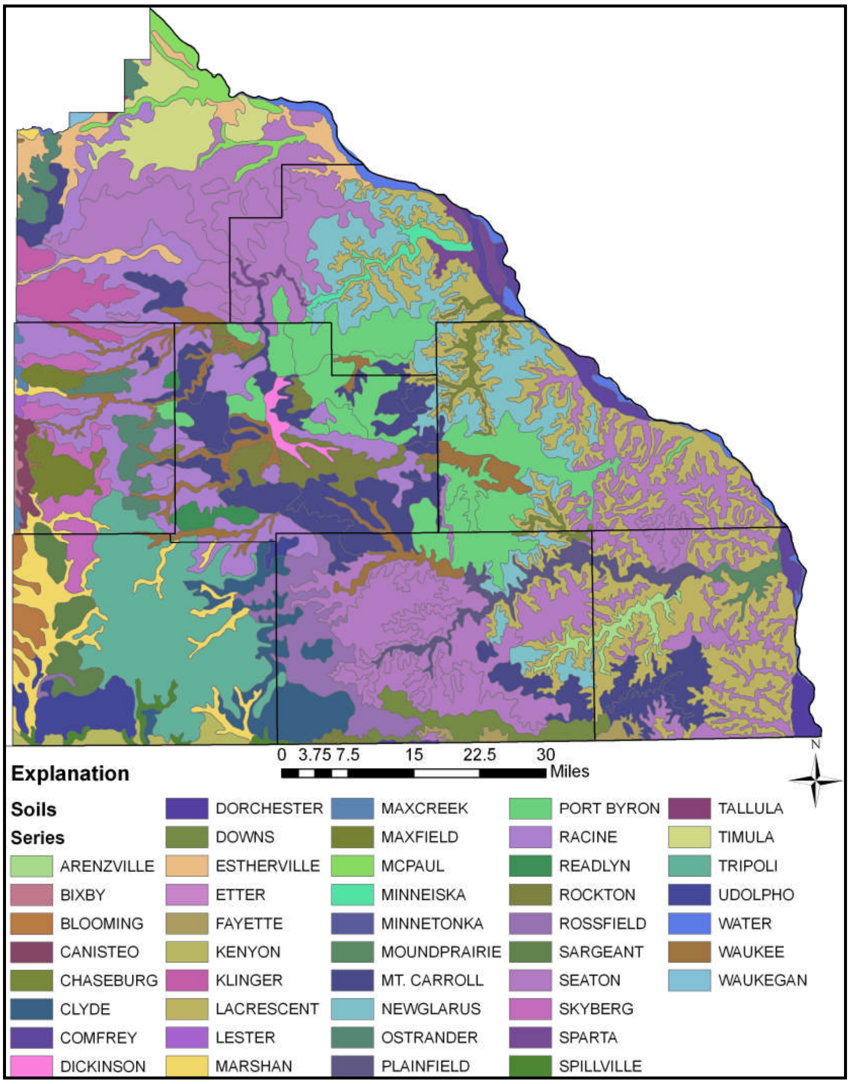

Figure 2.7. Major Soils in the Study Region (USDA 2004).

Vegetation

Vegetation is important in terms of plant productivity, animal biomass, and interrelationships between humans and plants (e.g., Butzer 1993; Minnis 2003; Tester 1995). Beyond subsistence (e.g., fruits, nuts, sap, leaves, seeds and roots), woody and herbaceous plants provide materials for construction and tools, fuel, fibers for clothing, containers and other crafts, components for medicine and adornment, as well as numerous other sociocultural items and symbols. Figure 2.8 illustrates the precontact vegetation of the study area (Marschner 1974).

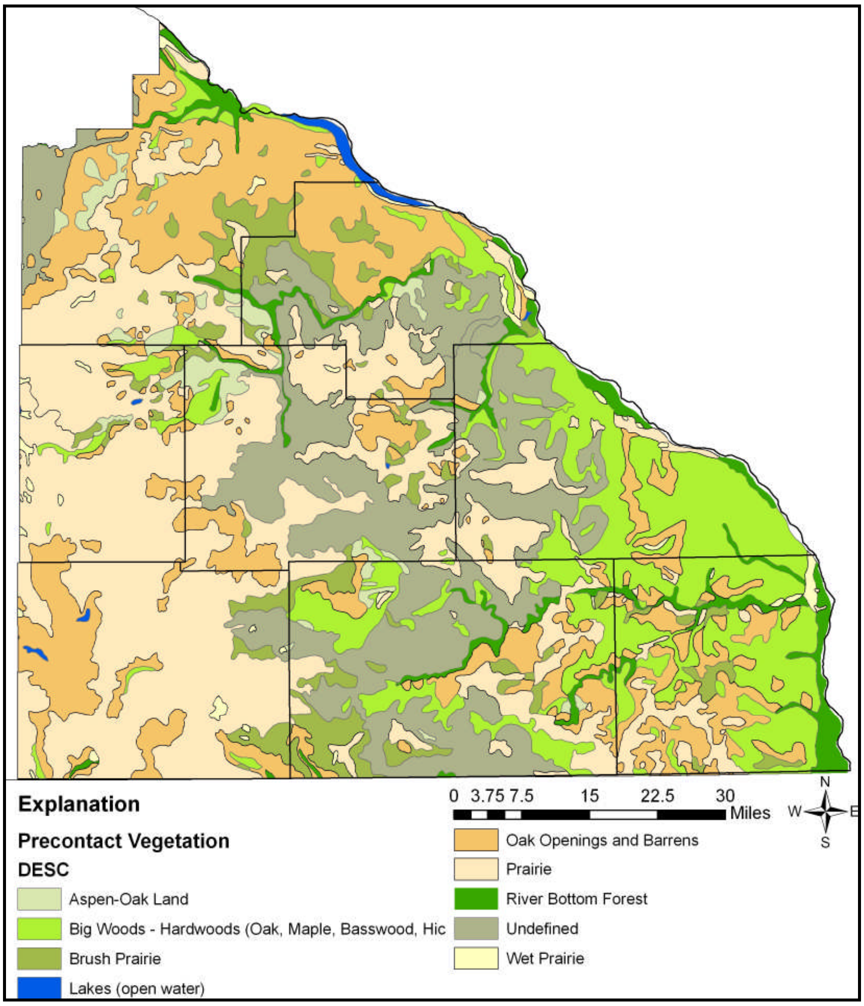

Figure 2.8. Precontact Vegetation of the Study Region (Marschner 1974).

The study region is intermediately positioned between grasslands of the Central Lowlands Province to the west and south and deciduous forests of the Lake Plains Province to the north and east (e.g., Brown and Kerr 1979). During the early and mid-nineteenth century, the region hosted a mosaic of tall grass prairie, oak savanna, brush prairies, deciduous forests (e.g., Big Woods) and floodplain forests (e.g., Marschner 1974). Other vegetation zones with a minor presence exist, such as wet prairies and 'goat prairies' (e.g., Marshner 1974; Tester 1995; Trygg 1964). Current vegetation in the study region largely consists of agricultural plants of row crops and pastures.

In general, the western portion of the study region is dominated by tall-grass prairie with some areas of oak savanna. Together, this area (Gray Drift) offers relatively low plant productivity. In the mid-section of the study region (Weathering Residuum), nearly equal areas of tall-grass prairie and oak savanna are present, typically occupying the drier south slopes of valleys and broad uplands, with mixed deciduous hardwoods on the cool, moist north slopes and floodplain forests in valleys. Here the relative productivity is moderate. The eastern portion of the region (Mississippi Trench) is primarily comprised of floodplain forest and the relative productivity is high. Side slopes and larger terraces may contain tall-grass and other types of prairies, as well as oak savanna and upland woodlands. A variety of wetland vegetation is present in minor extents throughout the region. It supports a variety of sedges and other aquatic plants. Relative productivity of aquatic biomass is high.

Fauna

Fauna composition, abundance, distribution and seasonal availability dictate animal biomass and direct precontact economies (e.g., Butzer 1993; Theler 1987). The study area supports a diverse range of animal resources adapted to each major biome. It included mammals, fish, birds, freshwater mussels, amphibians and reptiles (e.g., Hazard 1982; Janssen 1987; Oldfield and Moriarty 1994; Tester 1995). As with various plant products, animal resources provide materials for construction, fuel, tools, fibers for clothing, containers and other crafts, components for medicine and adornment, and numerous other sociocultural items and symbols.

Common resident fauna of tall-grass prairies included mammals (e.g., bison, elk, gophers, badgers, rabbits, skunks, coyotes), birds (e.g., raptors), amphibians (e.g., toads), and reptiles (e.g., snakes). The dominance of large-and medium-sized mammals provided a high animal biomass for prairies. Within oak savanna and brush prairie areas, prairie-adapted creatures mingled with woodland-adapted species, such as white-tailed deer, squirrels, raccoons, various birds, amphibians and reptiles. Despite the overall diversity, animal biomass in savanna areas is judged as moderate. Floodplain forests supported deer and a variety of smaller mammals and other fauna. Animal biomass was on the whole, relatively small. Fish, freshwater mussels, aquatic mammals (e.g., muskrat), birds (e.g., raptors, waterfowl), amphibians, and other creatures were available in the streams, backwater lakes, ponds and wetlands throughout the region. Aquatic biomass was generally high.

Summary of the Current Environment

On the whole, the environment of the study region provides a broad and diverse resource base. Variability on a sub-regional scale affected resource availability from west to east across the study region. This variability is best understood as a product of the geomorphology of the three sub-regions that affect seven key environmental characteristics (landform, bedrock, hydrology, soils, vegetation patterns, fauna and climate). The region's environmental variability is summarized in Table 2.2.

The Gray Drift Sub-region exhibits an undulating low relief landscape dominated by tall-grass prairie and large mammals. Several streams and rivers originate in this sub-region, although the valleys are relatively narrow and not incised. The availability of lithic raw materials is limited. Vegetation productivity in the sub-region was low with a relatively shorter growing season, while animal biomass was high.

Table 2.2 Principal Environmental Differences of Southeastern Minnesota Sub-regions.

Sub-region	Percent of area	Elevation range	Bedrock exposure/ No. of chert types	No. of major watersheds	Dominant soils	Dominant vegetation/ productivity	Fauna adaptation / biomass
Gray Drift	30	1440-1000	Few: 2	5	Mollisols	Prairie/low	Prairie/high
Weathering Residuum	60	1400-600	Many: 5	8	Mollisols and Alfisols	Oak Savanna/ moderate	Prairie-Woodland/ moderate
Mississippi Trench	10	700-600	Many: 1	-	Alfisols	Floodplain Forest/high	Woodland-Aquatic/ high

The Weathering Residuum Sub-region transitions from a gently rolling to deeply incised landscape once dominated by oak-savanna; it supported a variety of large and small mammals adapted to both prairie and woodland biomes. Streams and rivers become entrenched along relatively narrow valleys where caves and rockshelters may be found. Lithic raw materials are easily obtainable where bedrock is exposed on valley walls and reworked in streams. Vegetation productivity and animal biomass of the sub-region was moderate and the growing season is somewhat longer than that to the west.

Within the Mississippi Trench Sub-region, a diverse landscape is present within the valley. It is dominated by floodplain forest and principally inhabited by woodland and aquatic adapted fauna. The Mississippi River is the main hydrologic feature. It is complimented by a variety of alluvial features. Several caves and rockshelters and present and lithic raw materials are abundant, although restricted to Prairie du Chien chert. Vegetation productivity was high with a relatively long growing season. Although animal biomass was low, aquatic biomass was high.

Late Holocene Environment

While the Late Holocene is typically described as similar to modern environmental conditions, a variety of deviations from modern conditions existed. Late Holocene conditions affected the natural environment and influenced the lifeways of Late Archaic and Early Woodland inhabitants. Significant differences occurred in climate, geomorphology and vegetation.

Climate

In broad terms, cool and moist conditions typify the Late Holocene climate for North America. The climate for the study period (ca. 3,500-1,800 BP) corresponds with the Sub-Boreal III climate episode (ca. 3,500-2,800 BP) and the Sub-Atlantic climate episode (ca. 2,800-1,700 BP) (e.g., Bartlein and Webb 1982; Webb et al. 1983, 1993; Wendland and Bryson 1974; Wright 1992). The climatic episodes roughly align with the Blytt-Sernander sequence for Europe (Zuener 1952), although regional climatic variations existed across North America with time-transgressive boundaries (e.g., Wright 1976). The boundaries denoting periods of climate change may be gradual or relatively short and intense. These changes are attributed to a variety of factors, including: the position of the jet stream and Intertropical Convergence, variations in solar radiation, albedo, regional temperature and precipitation, evapo-transpiration, the effects of aerosols from global volcanism and other conditions (e.g., Bryson 1994, 2005; Bryson and DeWall 2007; Bryson and Wendland 1967; Milankovitch 1941).

Archeoclimatology

To further understand the climate during the study period, macrophysical climate models were constructed for various locations in and around the study region. The Macrophysiscal Climate

Model (MCM) was developed by Reid Bryson and Robert Bryson (Bryson 2005) and implemented through the use of a workbook (Bryson and DeWall 2007) and a compact disc with template files in Microsoft Excel. The main inputs to the models constructed for this study include mean monthly values of temperature, evaporation and precipitation from 1961-1990 climatic normals and monthly average river discharge (Owenby and Ezell 1992; USACE 2009; USGS 2009). Briefly, the model uses non-linear regression equations to calibrate site-specific modern values to determine the local response to centers of action (e.g., position of the Intertropical Convergence) and other factors. The MCM incorporates large-scale dynamics as opposed to small-scale dynamics of General Circulation Models. Outputs provide a hypothetical regional climate at 100-year intervals in calendar years before present (AD 1950).

Several MCM models using temperature, precipitation and stream discharge for various locations in the study region show remarkably similar trends and fluctuations. The slight variations in precipitation and temperature reflect the northwest to southeast climate gradient where areas to the east and south in the study region are typically slightly warmer and wetter. The MCM results for precipitation, temperature and evapotranspiration for Rochester, Minnesota, described below, is representative of the modeled climate for the study region. The MCM result for discharge history of the Zumbro River at Zumbro Falls typifies the discharge history for small and medium streams within the study region. Modeled locations are illustrated in Figure 2.9.

MCM Results for Rochester, Minnesota

The Rochester MCM was run using the National Climatic Data Center 1961-1990 Normals (Owenby and Ezell 1992) as recorded at the Rochester Airport in southwestern Olmsted County (Figure 2.9). Rochester is on an upland area near the border of the Gray Drift and Weathering Residuum sub-regions with an elevation of 1,296 fasl (395 masl). The MCM outputs were calibrated by the author with the following r-squared values: precipitation = 0.983; temperature = 0.964; and evaporation = 0.987. The r-squared values measure the relative predictive power of a model, from 0-1; with 1 being a perfect fit. The accompanying graphs are presented in Figures 2.10, 2.11, and 2.12.

The Sub-Boreal episode (ca. 5,000-2,800 BP) initiates an easing of the warm and dry Atlantic episode (ca. 8,000-5,000 BP) where precipitation increases and temperatures decrease at the beginning of the episode (Sub-Boreal I). Within the study region, the peak in precipitation took place between 4,000 to around 3,900 BP with an excess of precipitation over evapotranspiration. During this interval (Sub-Boreal II), precipitation increased by approximately 67 percent during January and approximately 10 percent in July with a mean annual precipitation of 726 mm (29 in). Mean temperatures dropped by approximately 0.9ºC, from 6.3 ºC (43.3 ºF) to 5.4 ºC (41.7 ºF). This discontinuity is recognized as the *Indus Event*, associated with significant global volcanic activity that resulted in increased storms and precipitation and cooler temperatures in the Midwest (e.g., Bryson 1994). After 3,900 BP, precipitation declined somewhat and temperatures increased slightly.

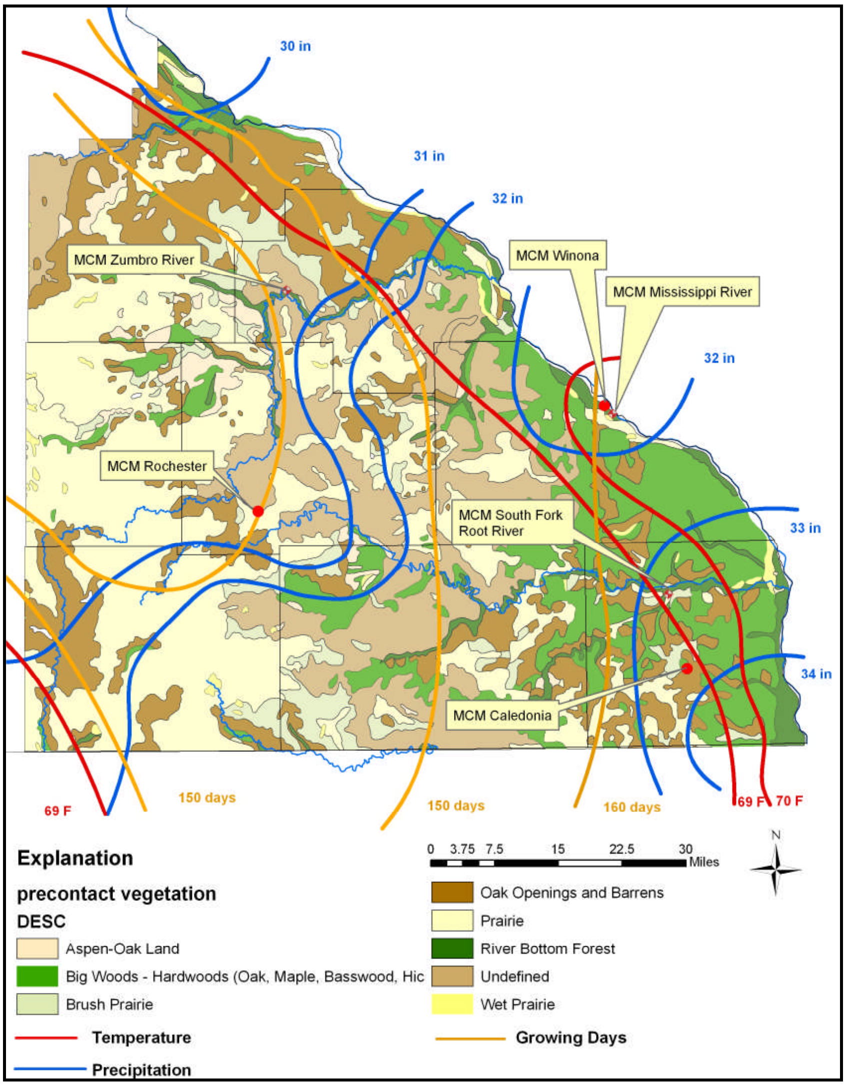

Figure 2.9. Study Region MCM Locations (Baker and Strub 1963; Baker and Kuehnast 1978; Baker et al. 1985, Marschner 1974).

By 3,500 BP (during the Sub-Boreal III ca. 3,500-2,900 BP), the precipitation gradually increased through 2,900 BP, with a mean annual precipitation of 709 mm (28 in). Evapotranspiration remained greater than precipitation and most of the precipitation occurred during the summer months (507 mm/72 percent), with September being the wettest month (contributing 102 mm or 14 percent of the annual total). Temperatures also increased slightly from the previous episode, with the annual mean at 6.5 ºC (43.7ºF). July temperatures were the warmest, at 22.5 ºC (72.5ºF) and January was cold, at -11.9ºC (10.6ºF). Occasional anomalies existed however, such as a slight decrease in annual precipitation (706 mm/27.8 in) with a somewhat drier summer at 2,900 BP. However, a spike of precipitation occurred in both September (107 mm/4.2 in) and January (24.4 mm/1 in). This period had a slight increase in annual temperature at 6.8ºC (44.2ºF).

Model output during the Sub-Atlantic episode (ca. 2,800-1,700 BP) had an oscillating pattern of precipitation and temperature. From 2,800-2,300 BP (Sub-Atlantic I) precipitation continued to increase with an annual mean of 720 mm (28.3 in). Most precipitation occurred during the summer, although September typically contributed the most precipitation. Overall temperatures during this period increased slightly at an annual mean of 6.6 ºC (43.9ºF). July was the warmest month at 22.1ºC (71.8ºF) and January the coldest at -11.8ºC (10.8ºF). From 2,800-2,700 BP evapotranspiration was greater than precipitation, the reverse from 2,600-2,500 BP and from 2,400 to 2,300 evapotranspiration was greater than precipitation once again. By the end of this interval (2,400-2,300 BP) precipitation decreased slightly to an annual mean of 716 mm (28.2 in) and temperature rose slightly to an annual mean of 6.8ºC (44.2ºF). Here, temperatures remained warm in July at 22.3ºC (72.1ºF) although January was colder at -11.5ºC (11.3ºF).

An overall increase in precipitation and decrease in temperatures occurred between 2,200 and 1,700 BP (Sub-Atlantic II) to an annual mean of 735 mm (28.9 in) and an annual mean of 6.3ºC (43.3ºF), respectively. Precipitation was greater than evapotranspiration with summers accounting for most of the overall precipitation and September was typically the wettest month. July remained the warmest month with a mean annual of 21.7ºC (71.1ºF) and January temperatures at -11.7 ºC (10.9ºF). One anomaly is noted at 1,900 BP, where a slight drop in precipitation (to 729.9 mm/28.7 in) and increase in temperature (to 6.6ºC/43.8ºF) occurred. This interval of the later Sub-Atlantic climatic episode corresponds with the *Vandal Event*, approximately 2,500-1,600 BP, and related to significant global volcanicity (Bryson 1994). In the study region, it appears at 2,300 BP and persists through 1,600 BP and is associated with a stormier and snowier period across the Midwest.

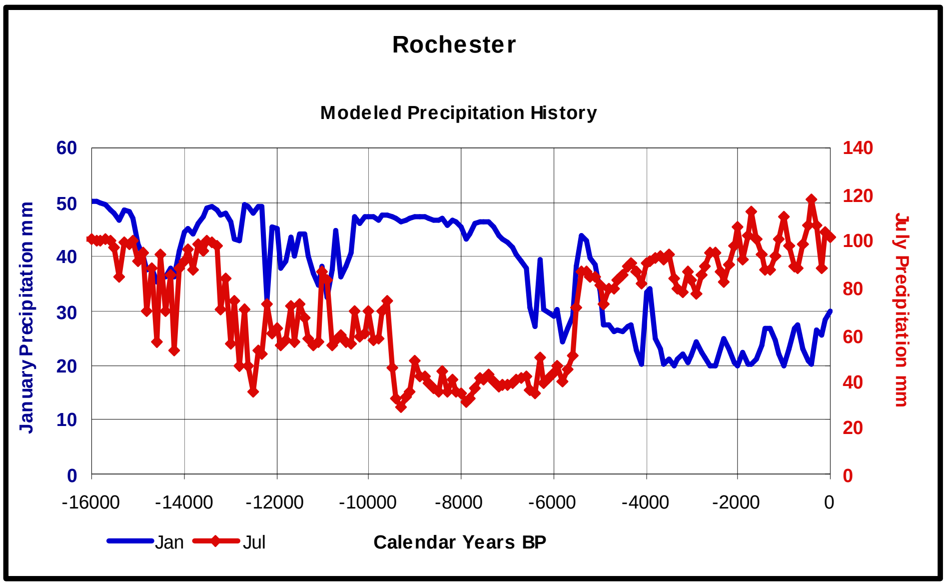

Figure 2.10 MCM Precipitation at Rochester, MN. NCDA 1961-1990; r^2 0.983.

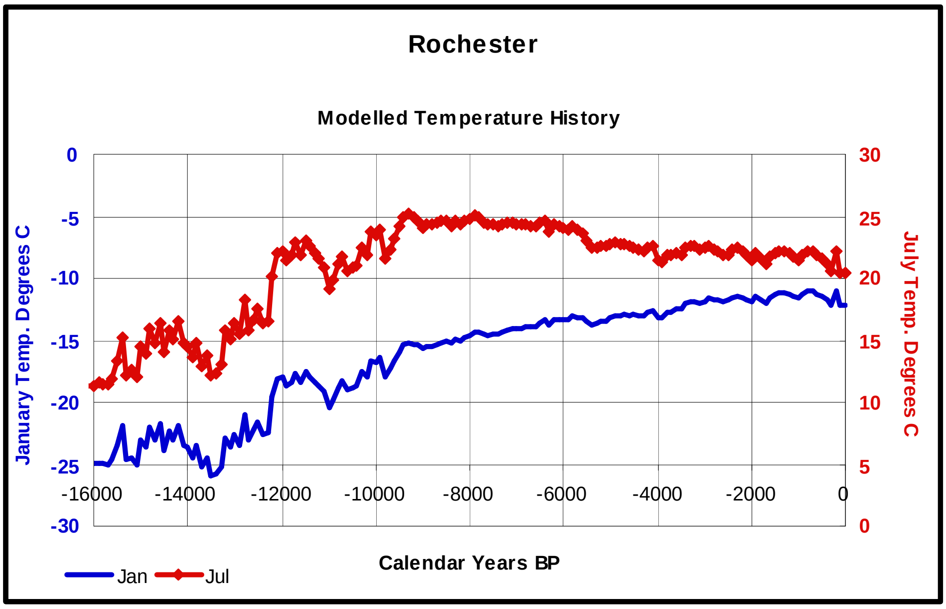

Figure 2.11. MCM Temperature at Rochester, MN. NCDA 1961-1990; r^2 0.964.

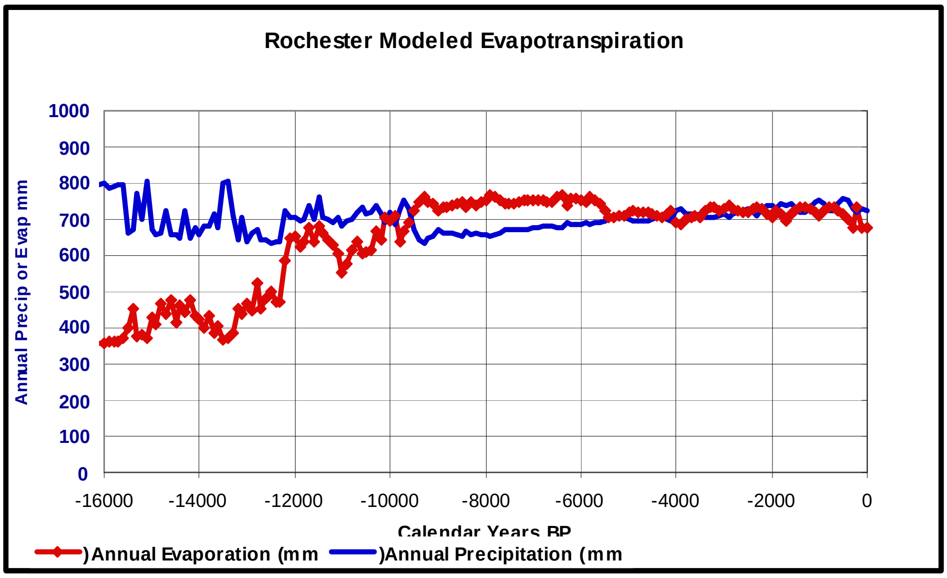

Figure 2.12. MCM Evaporation plus Precipitation for Rochester, MN. NCDA 1961-1990; r^2 0.987.

<u>MCM Results for the Zumbro River</u>

The Zumbro River discharge history was modeled from data recorded from the United States Geological Survey gauge at Zumbro Falls (USGS 2009). The Zumbro River, which flows north through Rochester and Zumbro Falls (west-central Wabasha County), is approximately 26 miles (42 km) north of the Rochester Airport (Figure 2.9). The gauge at Zumbro Falls is at an elevation of 811 fasl (247 masl) and has a drainage area of 2,978 km^2 (1,150 mi^2), although the greater Zumbro River watershed encompasses 3,683 km^2 (1,422 mi^2). The MCM output was calibrated by the author (r^2 = 0.862). The low r-squared value may be attributed to the available data from 1949-1979 (a deviation from the MCM preferred parameters of 1961-1990 normals) as well as influence from human modification to the watershed (e.g., Zumbro Lake is an impoundment along the confluence of the Middle and South Forks) and flood control structures in Rochester. The modeled discharge is shown in Figure 2.13.

During the Sub-Boreal III episode (3,500-2,900 BP), overall discharge rates were increasing in accord with the general trend of increased precipitation. For example, during the preceding Sub-Boreal II episode, mean annual discharge increased from 26.4 cubic meters per second (cms) (932 cubic feet per second [cfs]) at 3,900 BP to 29.2 cms (1,031 cfs) at 4,000 BP. This pattern may relate to the discontinuity of increased precipitation during the *Indus Event*. At 3,500 BP mean annual flows were 27.8 cms (982 cfs). By 3,000 BP, the mean annual flows increased a total of 5.0 cms (177 cfs) to 32.8 cms (1,158 cfs), with a mean annual discharge for the interval at 31.4 cms (1,109 cfs). The highest discharge rates occur during the spring (March-May), with April witnessing the greatest flow levels having an annual mean discharge of 78 cms (2,755 cfs) for the period. Lowest flows occur during February (16.6 cms/586 cfs). Flows diminish somewhat from June through September and increase in October. As with the precipitation and temperature models, anomalies occur in the discharge rates. For example, a slight decrease in annual discharge (31 cms/1,095 cfs) at 3,100 BP correlates with a slight decline in precipitation and at 2,900 BP annual flows increase (33.7 cms/1,190 cfs) reflected by a wet spring, although August flows were low (15 cms/530 cfs). Throughout the period, a spike in discharge during October is noted and appears to reflect the contribution of September precipitation.

The mean annual discharge for the Sub-Atlantic episode from 2,800-2,300 BP (Sub-Atlantic I) is modeled at 34 cms (1,201 cfs), which indicates an increase in flow for the interval. The greatest flow remains in April (annual mean of 82.2 cms/2,903 cfs), although summers are wetter than the previous period and October flows increase somewhat reflecting the overall increase in precipitation and wet Septembers. The lowest flows remained in February with an annual mean discharge for the interval at 16.8 cms (593 cfs). Anomalies in this period include a slight decline in discharge at 2,600 BP where annual mean flows dropped to 31.8 cms (1,123 cfs).

The Sub-Atlantic II episode (2,200-1,700 BP) witnessed a continued trend in increasing discharge rates that correspond with increased precipitation. During this period, the modeled mean annual discharge rate is 35.1 cms (1,240 cfs). February continues to be the lowest month for discharge, at 17.1 cms (604 cfs) and April continues to be the greatest (71.8 cms/2,536 cfs). June and July have high flows, although the expected spike around July-August from increased July precipitation is not apparent. One anomaly occurs at 2,000 BP, with decreased flows throughout the interval. Here the mean annual discharge is 33 cms (1,165 cfs), with a dry winter and spring, although June and July flows were among the highest for the entire period. This episode, coinciding with the *Vandal Event*, is the wettest and coldest interval during the study period and exhibits the highest discharge rates.

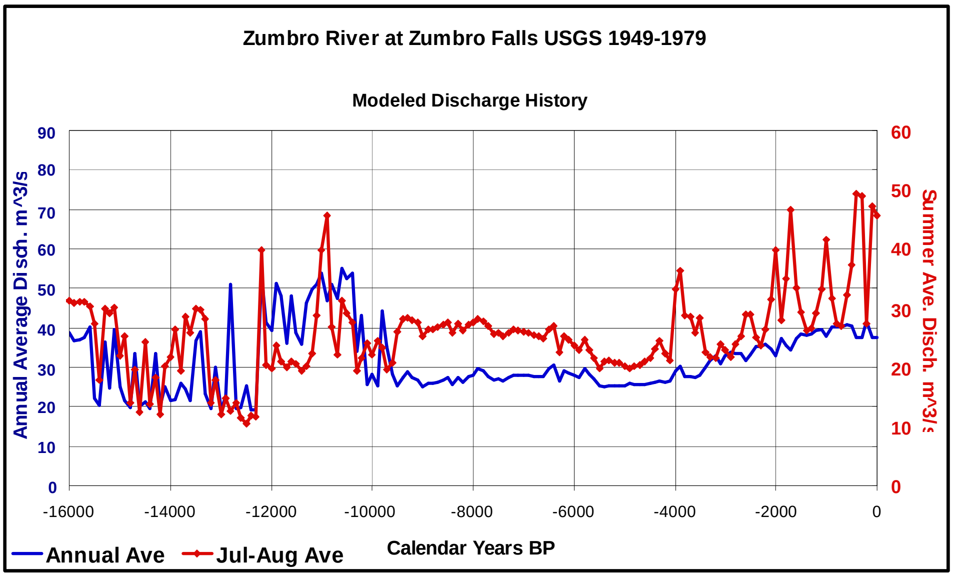

Figure 2.13. MCM Discharge for the Zumbro River at Zumbro Falls, MN. USGS 1949-1979; r^2 0.862.

MCM Generalized Results

All of the MCM models constructed for the study region share the same overall signatures. The main differences between the Rochester and Zumbro River MCMs, and the other modeled locations in the study region, relate to the overall totals in precipitation over drainage areas of various size.

Differences between climate conditions at Rochester, Winona and Caledonia follow the modern and Late Holocene climatic gradients and the overall modeled climatic pattern of the study region (Figures 2.14-2.17). Winona is located on a terrace within the Mississippi Trench sub-region in east-central Winona County, approximately 45 miles (72 km) east-northeast of the Rochester Airport. Caledonia is located in an upland area of the Weathering Residuum sub-region in south-central Houston County, some 54 miles (87 km) to the southeast of the Rochester Airport (Figure 2.9).

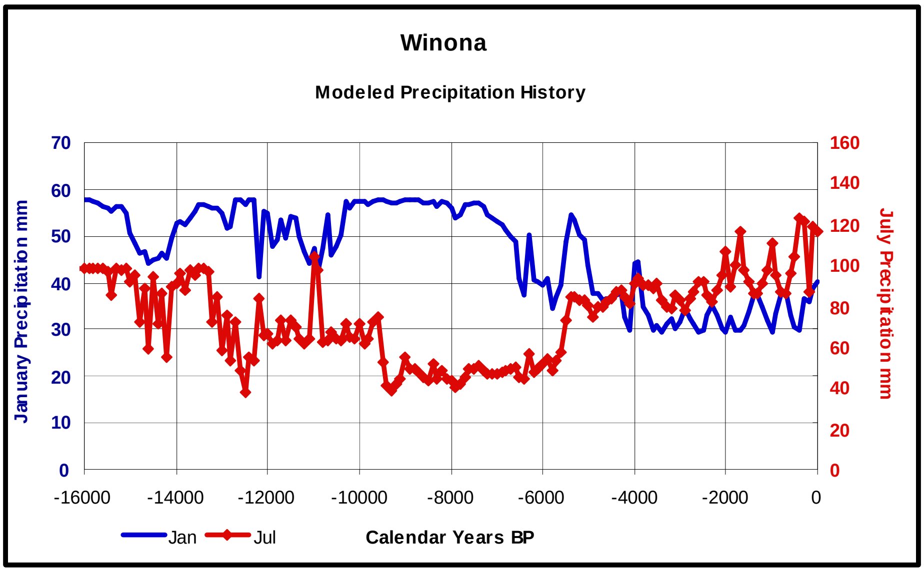

Figure 2.14 MCM Precipitation for Winona, MN. NCDC 1961-1990; r^2= 0.981.

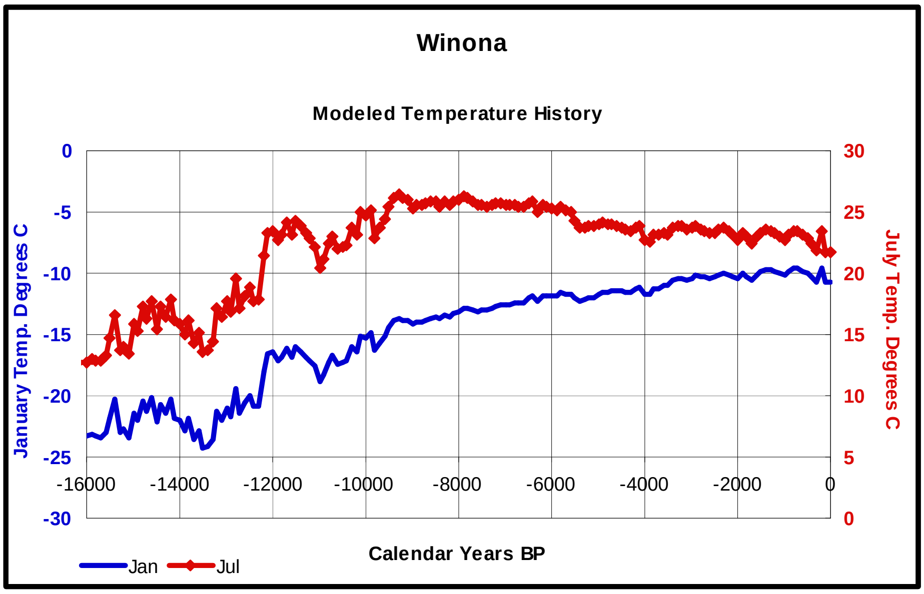

Figure 2.15. MCM Temperature for Winona, MN. NCDC 1961-1990; r^2 = 0.965.

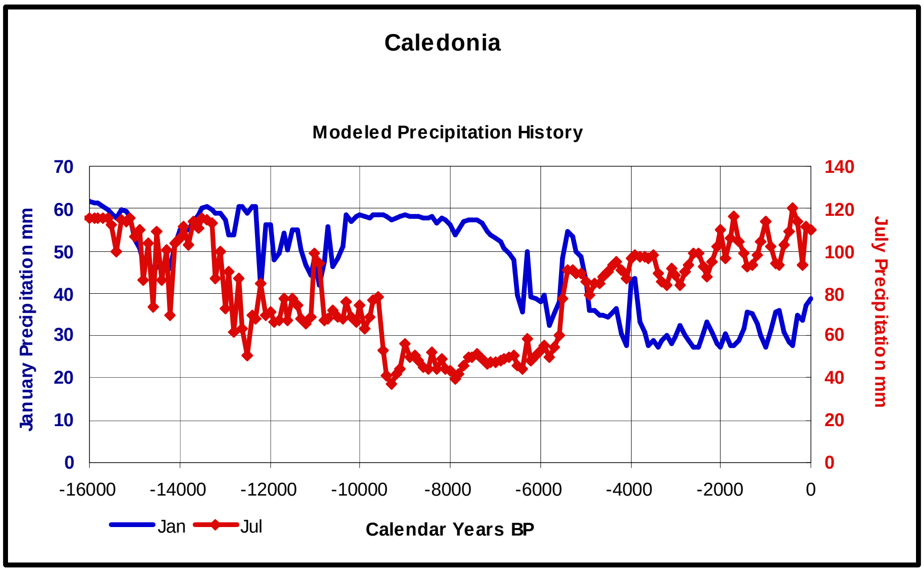

Figure 2.16. MCM Precipitation for Caledonia, MN. NCDC 1961-1990; $r^2 = 0.990$.

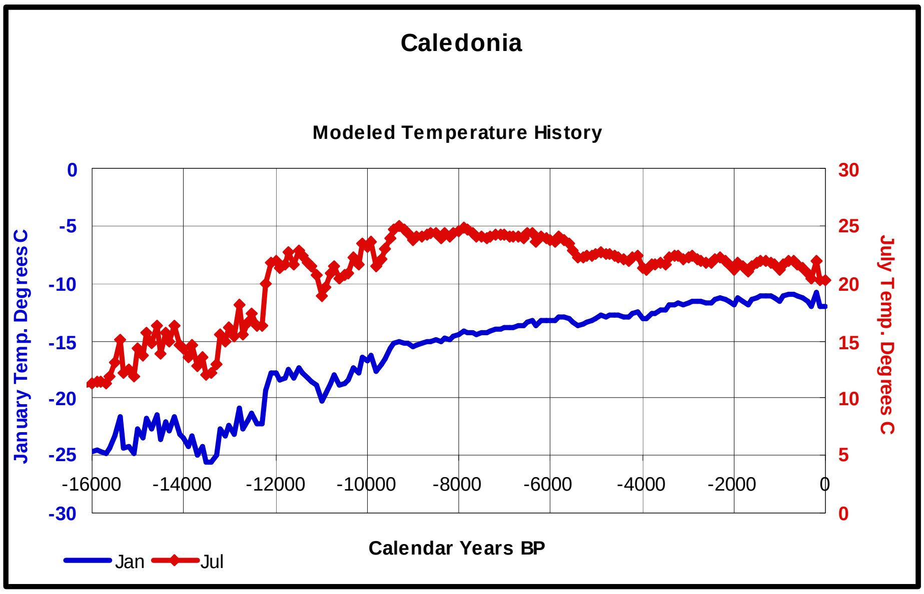

Figure 2.17. MCM Temperature for Caledonia, MN. NCDC 1961-1990; $r^2 = 0.964$.

Table 2.3 presents a comparison of mean annual precipitation and temperature between modern and modeled values for the Sub-Boreal III, the Sub-Atlantic I and the Sub-Atlantic II episodes for Rochester, Winona and Caledonia.

Table 2.3. Comparison of Modern Mean Annual and MCM Mean Annual Precipitation and Temperature Values for the Sub-Boreal III, Sub-Atlantic I and Sub-Atlantic II Climate Episodes at Rochester, Winona and Caledonia.*

Location	Sub-Region	Elevation masl/fasl	Sub-Boreal III P/T**	Sub-Atlantic I P/T**	Sub-Atlantic II P/T**	Modern P/T**
Rochester	Weathering Residuum	395/ 1,296	709 mm (28 in)/ 6.5 ºC (43.7ºF)	720 mm (28.3 in)/ 6.6 ºC (43.9ºF)	735 mm (28.9 in)/ 6.3 ºC (43.3ºF)	753mm (29.6 in)/ 6.4 ºC (43.5ºF)
Winona	Mississippi Trench	199/ 653	780 mm (30.7 in)/ 7.7 ºC (45.8ºF)	792 mm (31.8 in)/ 7.7 ºC (45.8ºF)	809 mm 31.8 in)/ 7.5 ºC (45.5ºF)	827 mm (32.5 in)/ 7.5 ºC (45.5ºF)
Caledonia	Weathering Residuum	358/ 1,175	835 mm (32.8 in)/ 6.4 ºC (43.5ºF)	845 mm/ (33.2 in) 6.4 ºC (43.5ºF)	859 mm (33.8 in)/ 6.2 ºC (43.1ºF)	876 mm (34.4 in)/ 6.3 ºC (43.3ºF)

*MCM outputs calibrated by the author using NCDC 1961-1990 Normals (Owenby and Ezell 1992). Rochester: precipitation $r^2 = 0.983$; temperature $r^2 = 0.964$. Winona precipitation $r^2 = 0.981$; temperature $r^2 = 0.965$. Caledonia: precipitation $r^2 = 0.990$; temperature $r^2 = 0.964$. ** P = precipitation; T = temperature.

In general, precipitation increases from north to south with the greatest increase along the Mississippi River trench. Temperatures increase toward the east with the highest values within the Mississippi River trench, as seen at Winona. This pattern is reflective of a northwest to southeast climate gradient related to seasonal air mass boundaries (e.g., Bryson 1966; Bryson and Wendland 1967). The steepest portion of this gradient marks the transition between the prairie-forest ecotone. It is evident during the modeled climate for the study period and continues into modern times (e.g., Baker et al. 1985; Wright 1992).

As with the modeled climates for terrestrial sites, rivers in the study region also reflect similar patterns in discharge history. Stream discharge varies according to watershed size. The Zumbro River at Zumbro Falls, the Mississippi River at Lock and Dam 5A at Winona (east-central Winona County) and the South Fork of the Root River near Houston (northwest Houston County) illustrate the similarities in discharge patterns and reflect different flow rates related to watershed size as presented in Table 2.4.

Table 2.4. Mean Annual Discharge Histories for the Zumbro River at Zumbro Falls, the Mississippi River at Lock and Dam 5A and the South Fork of the Root River near Houston.*

River**	Elevation masl/fasl	Watershed Area km^{2}/mi^{2}	Sub-Boreal III cms/cfs	Sub-Atlantic I cms/cfs	Sub-Atlantic II cms/cfs	Modern cms/cfs
Zumbro	247/ 811	2978/ 1,150	31/ 1,109	34/ 1,201	35/ 1,240	41/ 1,448
Mississippi	195/ 640	153,327/ 59,200	2072/ 73,172	2120/ 74,867	2125/ 75,044	2,206/ 77,904
South Fork of the Root	207/ 679	712/ 275	126/ 4,450	132/ 4,662	134/ 4,732	143/ 5,050

*MCM outputs calibrated by the author. Zumbro: USGS 1949-1979; Mississippi: NCDC 1961-1990: South Fork Root: USGS 1953-1983 (Owenby and Ezell 1992; USGS 2009). ** Zunbro r^2 = 0.862; Mississippi: r^2 = 0.892; South Fork Root: r^2 = 0.911.

River discharge show an overall increase in flow following the *Indus Event* ca. 4,000 BP (Sub-Boreal II episode). The trend of increasing discharge follows the general trend of increasing precipitation across the study region (Figures 2.13, 2.18 and 2.19). The Mississippi River has a more subdued response, which is interpreted as a reflection of the size of the river, its drainage area, and the floodplain.

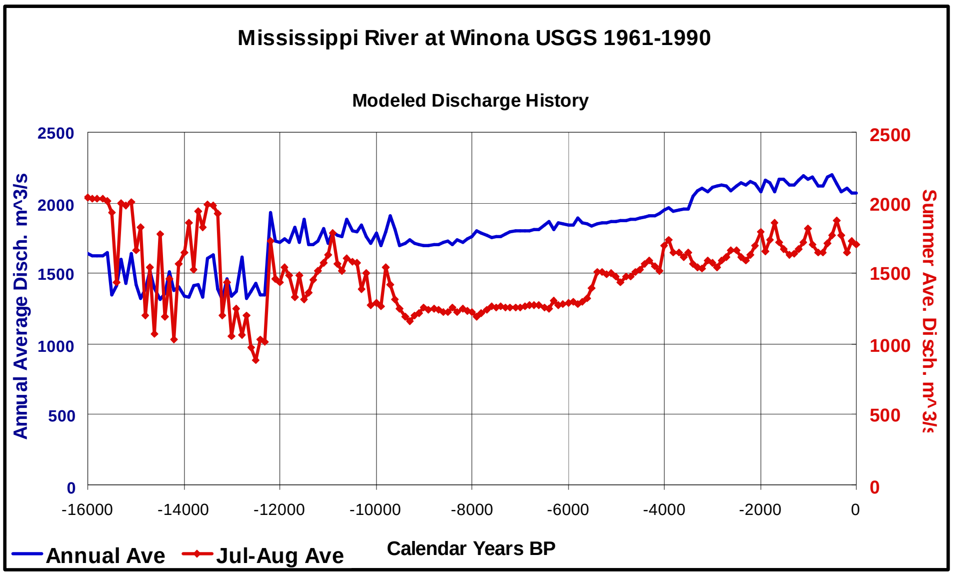

Figure 2.18. MCM Discharge for the Mississippi River at Lock and Dam 5A, Winona, MN. USGS 1961-1990; r^2 0.892.

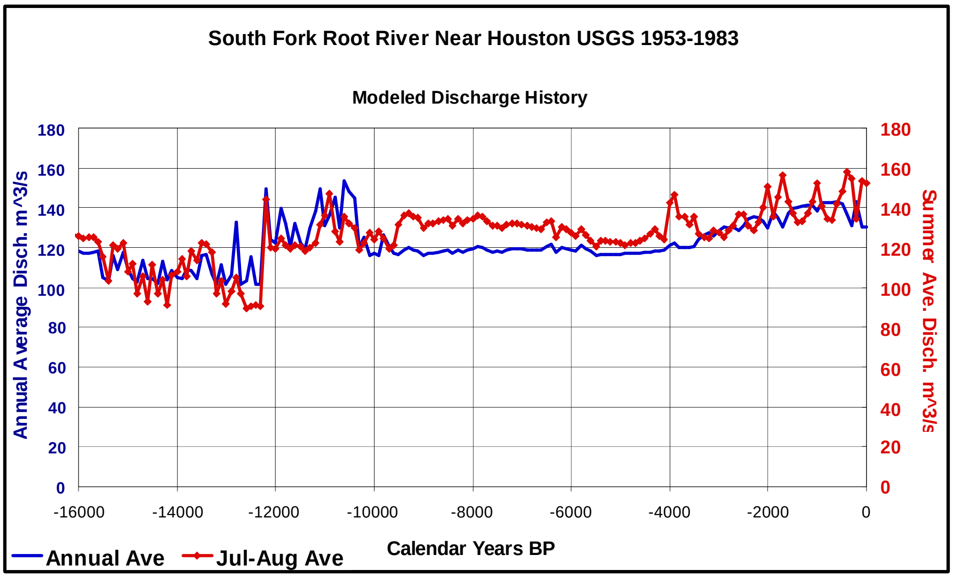

Figure 2.19. MCM Discharge for the South Fork of the Root River Near Houston, MN. USGS 1953-1983; $r^2 = 0.911$.

MCM Conclusions

When compared to the Middle Holocene warm and dry period, the modeled climates of the study period (ca. 3,500-1,800 BP) for the region are cool and moist. Variations during the modeled period are subdivided into episodes of the study period: 1) a relatively warm and dry period during the Sub-Boreal III episode (ca. 3,500-2,900 BP); 2) a relatively warm and moist period during the Sub-Atlantic I episode (ca. 2,800-2,300 BP); and 3) a relatively cool and moist period during the Sub-Atlantic II episode (ca. 2,200-1,700 BP).

Compared with modern conditions, the overall modeled climate for the study period is somewhat warmer and drier. The overall departures in temperature for the study period from modern values range from 0.1 to 1.2ºC (32.1-34.1ºF) with more seasonality. Summers were warmer and winters colder than modern conditions. For example, July annual mean temperatures were between 0.9 and 0.1ºC (33.6, 32.9, 32.1ºF) warmer than modern conditions during the Sub-Boreal III, Sub-Atlantic I and Sub-Atlantic II episodes. January temperatures were between 0.5 and 0.3ºC (32.9, 32.7, 32.5ºF) colder than modern conditions for the respective episodes. Departures in mean annual precipitation for the study period compared with modern values are approximately six percent, four percent and two percent less than modern conditions for the Sub-Boreal III, Sub-Atlantic I and Sub-Atlantic II episodes. Most precipitation occurred during the summers for the study period, although Septembers were typically the wettest months. These changes are relatively modest, although estimates for Holocene mean annual temperature deviations range from 1.0 - 2.0ºC (33.8-35.6ºF) and precipitation from 10-20 percent from modern conditions (e.g., Bartlein et al. 1984; Knox 1993). However, even modest changes are connected to broader air mass boundaries and storm tracks that influence vegetation changes, geomorphic processes and fluvial behavior (e.g., Knox 1985, 1993, 1999, 2000).

The MCM results for the study region are in general agreement with the Late Holocene climate of the upper Midwest, as derived from fossil pollen and other climate proxies (e.g., Baker et al. 1996; Bartlein et al. 1984; Bryson and Harr 1974; Dorale et al. 1992; Hajic 1990; Knox 1988, 1999, 2000; Webb et al. 1983; Wright 1972b, 1981; Wright et al. 1963). For example, similar patterns in precipitation and temperature occur in modeled locations constructed by the author, Dr. Reid Bryson and Katherine McEnaney DeWall for the study region (Red Wing, Zumbrota, Grand Meadow and Preston) and in extra-regional areas (Minneapolis and Mankato in Minnesota, La Crosse and Prairie du Chien in Wisconsin, and St. Louis in Missouri). Similar trends are also evident in modeled rivers throughout the study region and along the Mississippi River as far afield as Clinton, Iowa, St. Louis, Missouri and Vicksburg, Mississippi (e.g., Bryson et al. 2006).

Geomorphology

The landscape of the study region consists of an erosional surface with a mature drainage network. The landscape evolved from a variety of geomorphic processes, including pre-Wisconsin glaciation, fluvial, and eolian effects of Wisconsin ice retreat, periglacial conditions and subsequent climatic influences during the Holocene (e.g., Bettis and Hajik 1995; Bettis et al. 2008; Church 1985; Clayton 1982; Dobbs and Mooers 1991; Fisher 2003; Flock 1983; Hajic 1991; Halberg 1980; Hobbs 1995; Jacobs et al. 1996; Keene and Shane 1990; Knox 1983, 1996, 1999; Knox and Attic 1988; Knox et al. 1981, Knox et al. 1982; Kolb et al. 2009; Martin 1965; Mason and Knox 1997; Meyer 2000; Mickelson et al. 1983; Morey and Meints 2000; Ojakangas and Matsch 1982; Prior 1991; Ruhe 1983; Teller 1987; Teller and Clayton 1983; Wright 1972a, 1972b; Wright et al. 1998; Zumberge 1954). The focus here is on Late Holocene events, when regional meteorological conditions influenced continued geomorphic changes to the landscape with implications on precontact lifeways. In more recent times, European land-use activities drastically altered upland and floodplain settings that impacted the archaeological record.

Conditions from ca. 3,500-3,300 BP

Climatic conditions during this period were relatively warm and dry with zonal westerly (Pacific) air masses dominant (Bartlein and Webb 1982; Bettis and Hajik 1995; Bettis et al. 2008). Sediments slowly accumulated on uplands (e.g., biotic upbuilding) and hillslopes. With less vegetation cover and runoff, it is likely that minor sheetwash and rainsplash erosion and downslope movement increased sediment yields to existing colluvial slopes and alluvial fan deposits during precipitation events.

In floodplain settings, there was a slow aggradation rate, which allowed for relative channel stability that promoted soil formation and peat growth (e.g., Baker et al. 2002; Bettis et al. 2008; Hudak et al. 2002; Knox 1985, 1993, 2000, 2006; Knox et al. 1981). Examination of alluvial stratigraphy in the Driftless Area of southwestern Wisconsin reveals a record of erosional unconformities in the fluvial sequence of small watersheds (e.g., Knox 1983, 1993, 1996, 2000; Knox et al. 1981). Floods result from snowmelt (e.g., March-May), low-intensity and isolated high-intensity rainfall (e.g., April-November), or a combination of the three (e.g., Knox 1988). During the early portion of the study period, small floods of high frequency (of 1-2 year return frequency) and low magnitude (bankfull stage) varied from 10 to 30% smaller than their modern counterparts. Large floods of low frequency (50-500 year floods) and high magnitude (overbank) were extremely rare, with the largest equating to a modern flood expected once every 50 years (e.g., Knox 1985, 1993, 2000). During this regime, lateral channel migration was relatively low. The Mississippi River had by this time stabilized channels and an island-braided pattern and presumably similar conditions existed in the larger tributary valleys.

Conditions from ca. 3,300-1,800 BP.

After 3,300 BP, climatic conditions in the region became cooler and wetter with a shift to meridional circulation regimes dominated by Arctic and Tropical air masses (Bartlein and Webb 1982; Bettis and Hajik 1995; Bettis et al. 2008). While uplands, hillslopes and colluvial slopes were relatively stable, with pedogensis occurring with increased vegetation cover and low sediment yields during runoff, increased precipitation events ended floodplain stability.

Small-and medium-sized tributary streams that had been aggrading began to transport colluvial and alluvial sediments through rapid lateral migration and incision of fans. Some of the sediments were deposited at the distal portions of tributary fans that stabilized by ca. 2,500 BP. Elsewhere, sediments were deposited farther into large valleys, which further aggraded the floodplain, or were accumulated along natural levees (e.g., Bettis and Hajik 1995; Bettis et al. 2008).

Fluvial discontinuities between ca. 3,300-1,800 BP indicate that flooding abruptly increased in both frequency and magnitude. Small floods approached modern bankfull magnitudes. Large floods experienced dramatic increases in magnitudes, with many exceeding overbank magnitudes expected once every 50 years for modern floods. Some reached magnitudes expected once every 500 years for modern floods (e.g., Knox 1993, 2000).

Extensive periods of lateral channel migration and channel-belt widening accompanied large floods in small and large tributaries. Sediments (e.g., older alluvium) were carried out of the channel and deposited downstream in point bars, natural levees (vertical accretion of surfaces), or distal portions of fans and deltas (e.g., Bettis and Hajic 1995; Waters 1992). Presumably, periods of relative stability also occurred, allowing for soil development. For example, along the Root River, radiocarbon samples from wood fragments obtained in geologic cores indicate active channel migration between 2,900 and 2,700 BP (Hudak et al. 2002). In places, these channel fills are overlain by several buried soils, although none have associated radiocarbon dates or archaeological components. However, their pedogenic development suggest that these soils formed under stable conditions following aggradation, perhaps after ca. 2,500 when fans began to stabilize (e.g., Bettis 1992; Bettis and Hajik 1995; Hudak et al. 2002). These previously stable surfaces may be exposed on the modern surface or buried by subsequent Late Holocene alluvium and PSA after ca. 150 BP (Hudak et al. 2002). Other buried soils appear to have developed prior to ca. 3,300 BP and subsequently buried through alluviation during this time. In general, older deposits occur along margins of valleys and are more recent in age closer to active channels within the Root River valley (e.g., Hudak et al. 2002; Monaghan et al. 2006). A similar pattern exists on smaller tributary streams at Money and Pine creeks in south-central Winona County (Hudak et al. 2002; Baker et al. 2001, 2002). This sequence of buried soils is recognized as the Deforest Formation, containing the Gunder Member (ca. 11,500-8,100 BP and 6,000-5,100 BP);

the Roberts Creek Member (ca. 4,400-1,000 BP); and the Camp Creek Member (ca. 150 BP-present) (e.g., Bettis 1992; Baker et al. 2002).

While the extent of Late Holocene lateral channel migration is less well known along the Mississippi River, various geomorphic investigations have identified a series of buried soils and Late Holocene sediments (e.g., Benn and Lee 2005, Blikre and Benn 2008; Florin and Lindbeck 2008; Perkl 2002; Stoltman 2005). The position of Upper Mississippi River channels apparently stabilized by ca. 7,000 BP, with aggradation associated with diminished flows and a shift to an island-braided pattern. It is likely that various floodplain features, such as natural levees, side channels, sloughs, back-water lakes and wetlands, formed during this period (e.g., Bettis et al. 2008; Bettis and Hajic 1995). However, the overall productivity of these backwaters may have been relatively low until after ca. 3,300 BP, when the frequency of bankful and overbank flooding dramatically increased.

With the onset of European land-use practices in the mid Nineteenth Century, which included clearing large tracts of land for lumber and cultivation, extensive erosion occurred that resulted in massive amounts of PSA deposited in floodplains across the region (e.g., Knox 2006; Monaghan et al. 2006; Wright et al. 1998). In some areas, PSA up to four meters thick caps the pre-European ground surface (e.g., Hudak et al. 2002). Accompanying the accumulation of PSA was renewed channel migration. With soil conservation practices adopted in the later portion of the Twentieth Century, the rate of PSA and channel migration has diminished (e.g., Knox 1999, 2006).

Geomorphology Conclusions

The fluvial response during this period served to periodically re-work portions of the previously stable floodplains. Consequently, archaeological deposits predating the Late Holocene within the floodplain on low terraces, fans, and natural levees were likely eroded or deeply buried during Late Holocene climatic events and more recently by European induced activities. However, landforms distal to channels and along the margins of valleys were likely preserved and remained available for occupation (e.g., Bettis and Hajic 1995). Periods of relative stability presumably occurred, allowing for extended use of floodplain settings. However, the exact timing of the stable-unstable periods is vague. Indeed, Knox (e.g., 2000) cautions that the observed discontinuities in the fluvial record lack age control, and the sample floods are inadequate for reliable evaluation of many of the variations. In addition, specific geomorphic processes, such as channel migration, are controlled by internal stream dynamics and are therefore not synchronous throughout a watershed (e.g., Wolman and Leopold 1957). More detailed geoarchaeological investigations are needed to further refine this sequence.

While floods certainly denied or limited use of the floodplain for a period of time, recurrent flooding would create environments favorable for pioneer plant species, including a suite of plants used for human consumption (e.g., Butzer 1993; Smith 1992). Flooding also acts to rejuvenate wetlands, backwater lakes, sloughs and other low-lying areas with surface and ground water and rich sediments that boost overall plant and animal productivity (e.g., Tester 1995). Thus, increased frequencies of flooding potentially created a highly productive environment containing a variety of resources to human populations.

Vegetation

The Late Holocene vegetation sequence is derived from various proxy records from within the study region and nearby sites. Proxy records include pollen, plant macrofossils, carbon and oxygen isotope composition of speleothem calcite and organic samples from geologic cores (Baker et al. 2001, 2002; Hudak et al. 2002; Wright et al. 1998) (Figure 2.20). Correlation of proxy records from nearby sites includes pollen, plant macrofossils and speleothems (e.g., Baker et al. 2002; Camill et al. 2003; Webb et al. 1983, 1993; Wright 1992; Wright et al. 1963). Overall, the Late Holocene vegetation pattern during the study period is not markedly different from that recorded by early European travelers and government surveyors beginning approximately 300 BP.

The vegetation communities in the study region at 3,500 BP were dominated by prairie, deciduous forest and floodplain forest. Minor communities include wet prairies and wetlands. Most of the western portion of the study region consisted of prairie, dominated by warm season tall grasses with C_4 photosynthetic pathways, such big and little bluestem (Baker et al. 2001, 2002). The ecotone between prairie and forest was an irregular zone roughly paralleling the Mississippi River. Deciduous forests occupied a relatively narrow zone west of the Mississippi River. They consisted of various mesic and xeric species, such as oak, walnut and basswood. Floodplain forests, with elm, maple, cottonwood, willow and other species, occupied river bottoms (Wright et al. 1998). Deciduous and floodplain forest trees, shrubs, forbs and cool season grasses use C_3 pathways.

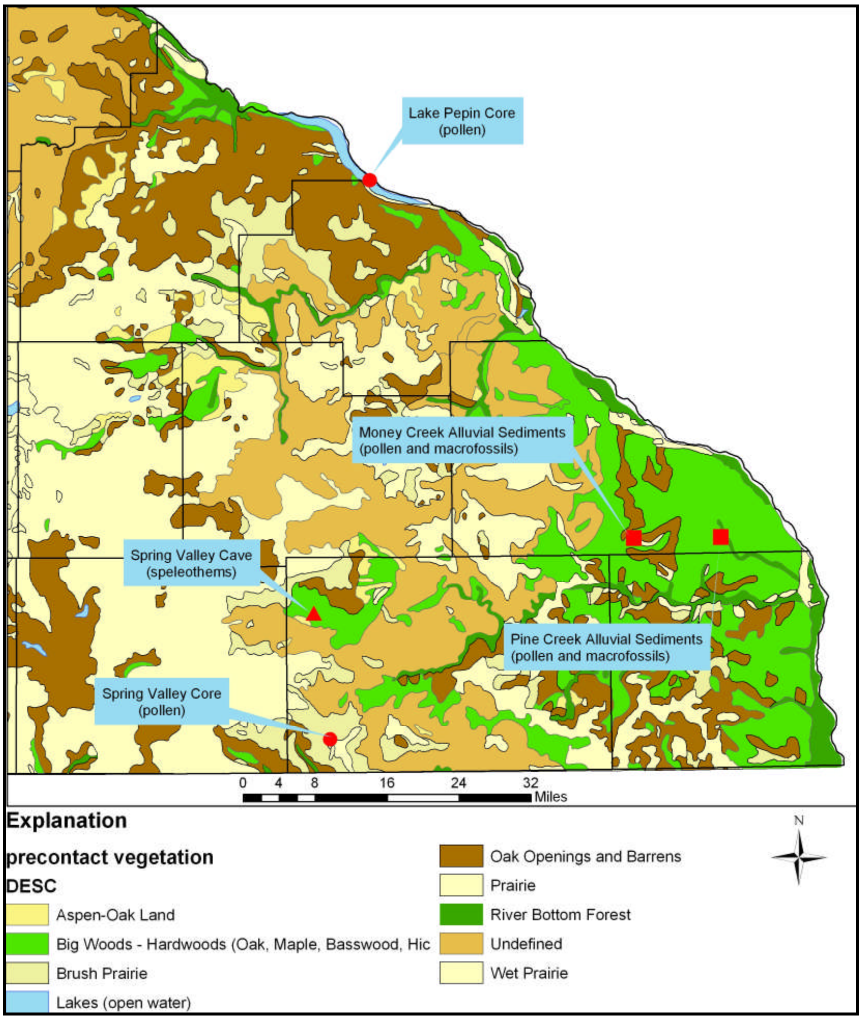

Figure 2.20. Study Region Paleoecological Sites (Marschner 1974).

After ca. 3,500 the prairie-forest ecotone shifted west and reached its approximate modern (ca. 150 BP) position by ca. 3,000 BP (Figure 2.8). Areas previously occupied by prairie were replaced by oak savanna. The shift is represented in speleothem calcite from Spring Valley Cave in northwestern Fillmore County, where carbon isotopes ($\delta^{13}C$) reflect a decrease of C_4 plants while C_3 plants increase. Increased precipitation is also recorded by low oxygen isotope ratios ($\delta^{18}O$). Macrofossils and pollen from Money and Pine creeks in south-central Winona County mark a resurgence in tree, shrub, and forest herbs with prairie plants well represented (Baker et al. 2001, 2002).

Deciduous forests expanded west from their position near the Mississippi River and in other areas where water and topographic breaks provided refuge from fire (Baker at. al. 2001, 2002; Bettis et al. 2008). This expansion included elm, basswood, ironwood, hickory, walnut, maple, and ash, all components of bigwoods taxa (e.g., Grimm 1984). An accompanying increase in fuel production correlates with increased fire severity during this time. However, it does not appear that fire had a significant role in vegetation shift (e.g., Camill et al. 2003).

There do not appear to be significant changes in floodplain forest composition during the Late Holocene. For example, arboreal and non-arboreal pollen percentages remain roughly constant from the Lake Pepin pollen site in Goodhue County (Wright et al. 1998).

Wetland plants are well represented in the Money Creek and Pine Creek macrofossil records. They include cattails, bulrush and arrowhead (Baker et al. 2002). Wetland plants also appear in peat sediment samples from geologic cores obtained along the Root River that date to ca. 3,300 BP (Hudak et al. 2002).

In general, the vegetation sequence in the study region correlates with various paleoecological records from nearby areas, although the timing may be slightly different. For example, at Kirchner Marsh and Sharkey Lake, just north or west of the study region, prairie was established earlier. However, the timing of the return of oaks and other deciduous taxa at those sites is similar (e.g., Baker et al. 2002; Camill et al. 2003; Wright et al. 1963).

Conclusions

The study region is a unique natural region with a variety of resources. Various climatic changes influenced the vegetation patterns and modified the landscape. A significant climate change occurring between ca. 3,500 and 3,000 BP shifted the prairie border westwards, replaced with oak savanna and increased mast production and deer habitat. Along the Mississippi Trench and larger tributary streams, at approximately 3,300 BP, dramatic increases in flooding created environments conducive for pioneer plant species that were used for food by the Late Archaic and Early Woodland inhabitants. Flooding also rejuvenated floodplains, which increased overall productivity. These elements attracted humans to the river valleys and had profound influences on the lifeways of the Late Arcahic and Early Woodland occupants.

Chapter 3
Culture History

During the Late Archaic-Early Woodland transition in southeastern Minnesota, spanning approximately 3,500-1,800 BP, cultural markers defining hunting and gathering focused Archaic groups were replaced by those of the more horticultural based Woodland groups. Differences between these two cultural traditions are discerned through a variety of technological changes and developments, variations in settlement and subsistence patterns, and social organization. The use of ceramics, domesticated plants, and construction of burial mounds by Woodland societies, and the lack of these traits by Archaic societies are the classic delineating criteria (e.g., Ford and Willey 1941:332-334; Griffin 1952:354-356, 1967; Stoltman 1986a, 1997; Willey and Phillips 1958:104-143). Early researchers challenged this tripartite distinction and continued research has demonstrated that Late Archaic groups in the greater Midwest also domesticated plants, buried dead in mounds, and used ceramics (e.g., Alex 2000; Benchley et al. 1997; Esarey 1986; Farnsworth and Emerson 1986; Green and Schermer 1988; Overstreet et al. 1996; Phillips and Brown 1983; Ritzenthaler and Quimby 1962; Theler and Boszhardt 2003) (In a volume on Archaic societies in the Midcontinent [Emerson et al. 2009], published toward the end of completing this study and not incorporated in the dissertation, three research themes are highlighted; 1) chronology; 2) material culture; and 3) relationships between people and the environment [McElrath et al. 2009]. This dissertation examines the third research question). Although unequivocal evidence for the use of ceramics and construction of burial mounds in southeastern Minnesota during the Late Archaic is currently lacking, domesticated plants were used (Perkl 1998). Persistent use of the tripartite criteria has resulted in a fairly rigid taxonomic nomenclature that does not reflect complex social and technological change occurring independently over time and space or from contemporaneous influences from other social groups. Coupled with a perceived general lack of information, uncertainty concerning the content and chronology of Archaic and Woodland signatures persists across the state and within southeastern Minnesota.

Approximately 150 years of archaeological research has been conducted in southeastern Minnesota (e.g., Anfinson 2008; Benchley et al. 1997:50-58; Gibbon 1990:9-10; Johnson 1974:6-7; Madigan and Schirmer 2001:82-84; Perkl 2002:66; Streiff 1972; Theler and Boszhardt 2003; Wilford 1937). Archaeological research in Minnesota has contributed to and coincided with major trends in Amercanist Archaeology (e.g., Gibbon 1981; Kehoe 1998; Trigger 1992; Willey and Sabloff 1993). With the highest density of burial mounds in the state located in the study region, antiquarians conducted most of the early investigations and were primarily interested in the contents of the mounds and who built them (e.g., the Vikings) (e.g., Anfinson 1984; Arzigian and Stevenson 2003:5-38; Silverberg 1968; Thomas 1894; Winchell 1911). Subsequent professional (i.e., academic) research has typically focused on Mississippian/Oneota components, especially around Red Wing in Goodhue County (e.g., Dobbs 1982, 1984, 1985, 1987; Gibbon 1974, 1979, 1982, 1986a, 1991; Gibbon and Dobbs 1991; Wilford 1945). More recently heritage management (a.k.a. Cultural Resources Management), driven by federal and state preservation laws, is the dominant investigative instrument. Here, inquiry is confined to project footprints (e.g., road corridors) forming a dichotomy between "academic" and heritage management as results are generally directed to assessing impacts rather than toward problem-oriented research (e.g., Schiffer and Gumerman 1977). Another relatively late trend is the recognition that various post-depositional processes, such as erosion and deposition, have destroyed or masked archaeological sites (e.g., Benn and Lee 2005; Butzer 1993; Hudak et al. 2002; Jalbert et al. 1996; Monaghan et al. 2006; Perkl 2005).

Despite a long history of research in southeastern Minnesota, few inquiries have focused on the Archaic and Woodland periods. As a result, researches have had difficulty discerning how Archaic and Woodland materials and associated social characteristics compare with the more well known contemporary manifestations exhibited in pan-regional areas, such as northeastern Iowa and southwestern Minnesota. For example, in contrast with other portions of Minnesota where cultural signatures show affinity with those from the Plains and the Northern forests, most researches acknowledge that the Archaic and Woodland periods in southeastern Minnesota exhibit strong similarities with cultures from the south and east and generally fit with those defined as part of the Eastern Woodland Culture Area (e.g., Anfinson 1990, 1997; Benchley et al. 1997; Dobbs 1988; Ford and Willey 1941; Griffin 1952, 1967; Holmes 1914; Johnson 1969; Perkl 2002; Theler and Boszhardt 2003; Wilford 1955; Willey 1966). Both periods are typically subdivided into Early, Middle and Late stages (e.g., Alex 2000; Jalbert et al. 1996; Madigan and Schirmer 2001; Stevenson et al. 1997; Stoltman 1986a, 1997; Theler and Boszhardt 2003). Yet, the supposed general lack of information for these periods caused Dobbs (1988:97) to suggest that subdivisions for the Eastern Archaic may not be appropriate for the state. Under this assumption it is unclear how various aspects, such as projectile point styles and participation in trade and ceremonial patterns, of the Late Archaic compare with that defined in other areas, such as the lower Midwest. Others have questioned if an Early Woodland stage is present in Minnesota at all (e.g. Gibbon 1986b:89). Triggering this assumption is that some of the period markers characterizing such manifestations in adjacent regions, such as thick-ware ceramics, mounds and domesticated plants, are lacking in the study region, or when encountered their contexts are not clear, or they have been associated with Middle Woodland materials (e.g., Dobbs 1988:116; Gibbon 1986b; Griffin 1986:612). This situation has prompted some researchers to subdivide the Woodland into "Initial" and "Terminal" periods (e.g., Dobbs 1988:106; Gibbon 1986b:89, 2003:25; Gibbon et al. 2002; Myster and O'Connell 1997:279).

I address these indistinct notions of Late Archaic and Early Woodland cultural manifestations in southeastern Minnesota, and compare these cultural signatures with comparable assemblages in adjacent areas of northeastern Iowa and southwestern Wisconsin as well as from sites in the American Bottom in west-central Illinois and other portions of the greater Midwest (Figure 3.1). Scrutiny of existing archaeological data demonstrates that cultural signatures indicative of Late Archaic and Early Woodland societies do exist in southeastern Minnesota. This chapter presents a cultural overview for the Late Archaic-Early Woodland period for southeastern Minnesota.

The study region is environmentally similar to the adjacent portions of northeastern Iowa and southwestern Wisconsin, collectively referred to as the "Driftless Area" (Alex 2000:34; Martin 1965; Wright 1972a:577-578), despite it having been formerly glaciated. It is defined as a *region* in terms of archaeological units (Willey and Phillips 1958:19). In Minnesota, historic contexts based on regional environmental characteristics that help delineate the complex environmental conditions and cultural manifestations have been developed, and place the study region within the Southeast Riverine Archaeological Region of Minnesota (e.g., Anfinson 1990; Dobbs 1988).

Humans presumably arrived in the Upper Midwest and to the study region shortly after the Wisconsin glacial ice retreated, around 12,000 years BP. Since this time the region has been continuously inhabited by a series of distinct cultures that adapted to various environments with increasingly sophisticated technological and social complexity. The archaeological record is subdivided into periods that roughly correspond with form concepts possessing distinctive cultural traits that are fairly uniform (e.g., Fitting 1978; Ford and Willey 1941; Griffin 1952; Stoltman 1978; Tuck 1978; Willey 1966; Willey and Phillips 1958). However, the onset of these

these time periods is time-transgressive, as the adoption of new technologies or lifeways did not occur at the same time from region to region. Therefore, distinctive cultural traits (e.g., technology, settlement and subsistence patterns and social organization) may also be classified as *traditions*. These temporal constructs have undergone repeated reformulations based on new information (e.g., Alex 2000; Benchley et al. 1997; Stoltman 1986a, 1997, 2006; Theler and Boszhardt 2003).

The broad time periods/traditions in the study region include: Paleo (ca. 12,000-9,000 BP), Archaic (ca. 9,000-2,400 BP), Woodland (ca. 2,400-850 BP), Mississippian/Oneota (ca. 850-350 BP) and Historic (ca. 350 BP-present) (e.g., Alex 2000; Anfinson 1979, 1990; Benchley et al. 1997; Johnson 1969; Perkl 2002; Stoltman 1997, Theler and Boszhardt 2003; Wilford 1955). The cultural periods/traditions are further subdivided itto sequential stages (i.e., Early, Middle and Late) and named phases and complexes as formal archaeological units denoting a series of cultural complexes that share a specific set of cultural traits (e.g. Willey and Phillips 1958:37). Table 3.1 presents the proposed cultural sequence for the Late Archaic-Early Woodland in the study region.

Table 3.1. Proposed Late Archaic-Early Woodland Sequence in the Study Region.

<table>
<tr><th>Period/Tradition</th><th>Stage</th><th>Phase/Complex</th><th>Ca. Age BP</th></tr>
<tr><td rowspan="4">Archaic</td><td rowspan="4">Late Archaic</td><td>Old Copper Complex</td><td>5,000-3000</td></tr>
<tr><td>Preston</td><td>3,500-3,000</td></tr>
<tr><td>Durst</td><td>3,000-2,400</td></tr>
<tr><td rowspan="2">Red Ochre Complex</td><td rowspan="2">3,200-2,000</td></tr>
<tr><td rowspan="4">Woodland</td><td rowspan="3">Early Woodland</td></tr>
<tr><td>La Moille</td><td>2,400-2,100</td></tr>
<tr><td>Prairie</td><td>2,100-1,900</td></tr>
<tr><td>Middle Woodland</td><td>Sorg</td><td>1,900-1,500</td></tr>
</table>

The proposed scheme is for the most part analogous with that outlined for the Upper Mississippi Valley by Theler and Boszhardt (2003), which essentially follows that established for southwestern Wisconsin, where regional differences in ceramics and projectile points are highlighted. This contrasts with northeastern Iowa, which closely follows the sequence of the American Bottom in southern Illinois and stylistic differences in southwestern and east-central Minnesota that set these groups apart from those living closer to the Upper Mississippi River valley (c.f. Alex 2000; Anfinson 1979, 1997; Bareis and Porter 1984; Benchley et al. 1997; Benn 1978, 1979; Caine 1966, 1974; Dobbs 1988; Logan 1976; Perkl 2002; Stoltman 1986a, 1990, 1997; Theler and Boszhardt 2003; Tiffany 1986; Wilford 1937). The proposed cultural sequence for the study region is based on available information and likely will change with new information.

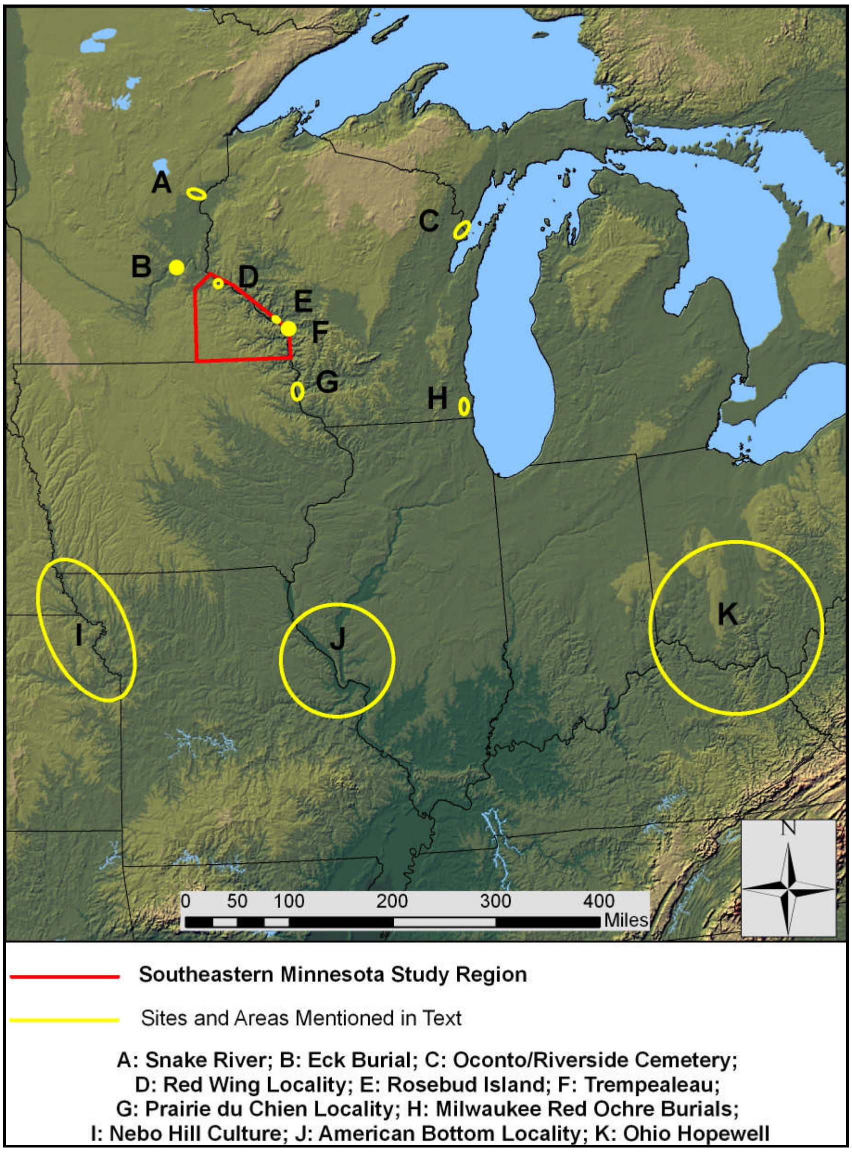

Figure 3.1 Locations of Culture Localities Mentioned in the Text (Background: USGS 2002).

ARCHAIC

In Upper Midwest archaeology, the Archaic Period covers the longest time period during the precontact cultural sequence, spanning approximately 7,000 years from ca. 9,000-2,400 BP (e.g., Alex 2000; Benchley et al. 1997; Mason 1981; McKern 1939; Stoltman 1997; Theler and Boszhardt 2003; Wilford 1937, 1955; Willey and Phillips 1958:104). Traditionally, the entire Archaic Period, or tradition, in the study region and in east-central Minnesota has been classified as Eastern Archaic (e.g., Benchley et al. 1997; Dobbs 1988; Johnson 1969). However, it is apparent that, based on differences in projectile point types, the Archaic Period in the study region be divided into three sequential stages: Early (ca. 9,000-5,000 BP), Middle (ca. 5,000-3,500 BP) and Late (ca. 3,500-2,400 BP) (e.g., Theler and Boszhardt 2003). Coinciding with a sequence of dramatic environmental changes, Archaic groups developed specialized adaptations among diverse habitats as they progressed from nomadic societies that primarily hunted terrestrial game to more semi-sedentary groups practicing a diverse hunting-gathering lifeway. Other technical and cultural manifestations, such as ground-stone tools, changing subsistence patterns and the presence of communal cemeteries serve as chronological indicators. The cultural patterns established during the later portions of the Archaic persist through subsequent Woodland cultural stages.

Middle Archaic Review

The Middle Archaic stage is defined as the time period between ca. 5,000-3,500 BP. While no specific phases are recognized for the Middle Archaic in the study region or for east-central Minnesota, contemporaneous phases in adjacent areas include: Mountain Lake (ca. 5,000-2,200 BP) in southwestern Minnesota; Osceola (ca. 4,200-3,500 BP) in southwestern Wisconsin; and Falling Springs (ca. 5,000-4,300 BP), Titterington (ca. 4,300-3,900 BP) and the early portion of Labras Lake (ca. 3,900-3,000 BP) in northeastern Iowa (Alex 2000; Anfinson 1997; Stoltman 1997). One archaeological manifestation, the Old Copper Complex, is applied across the greater upper Midwest and includes the study region (e.g., Gibbon 1998; Pleger 2000; Ritzenthaler 1957; Stoltman 1997).

The Middle Archaic Stage (ca. 5,000-3,500 BP) is mainly distinguished by diagnostic side-notched projectile points/knives, the manufacture of copper tools and the appearance of ground, polished and pecked stone tools (e.g., fully grooved axes, grinding stones, banner stones) and specialized fishing gear. Common projectile points diagnostic of the Middle Archaic in the study region include Matanzas and Raddatz (e.g., Justice 1995:67-69, 119-120; Boszhardt 2003:49-52; Theler and Boszhardt 2003:75) (Figure 3.2). Matanzas points are medium-to small-sized spear tips/knives with shallow side-notches that are set close to a typically straight base. They are similar to Helton and Price Stemmed points and date to ca. 6,000 BP to 4,000 BP (Boszhardt 2003:49-50). Raddatz points are large-to medium-sized spear tips/knives with U-shaped side-notches placed substantially above typically straight bases. They are morphologically similar to Osceola, Hemphill, Godar, Tama and Madison Side-Notched (e.g., Boszhardt 2003:51-52; Justice 1995:67-69; Morrow 1984:56-57,60; Stoltman 1997:121; Wittry 1959:60-61). Raddatz points and its allies typically appear ca. 5,000 BP and persist until ca 3,200 BP or later and into the early Late Archaic.

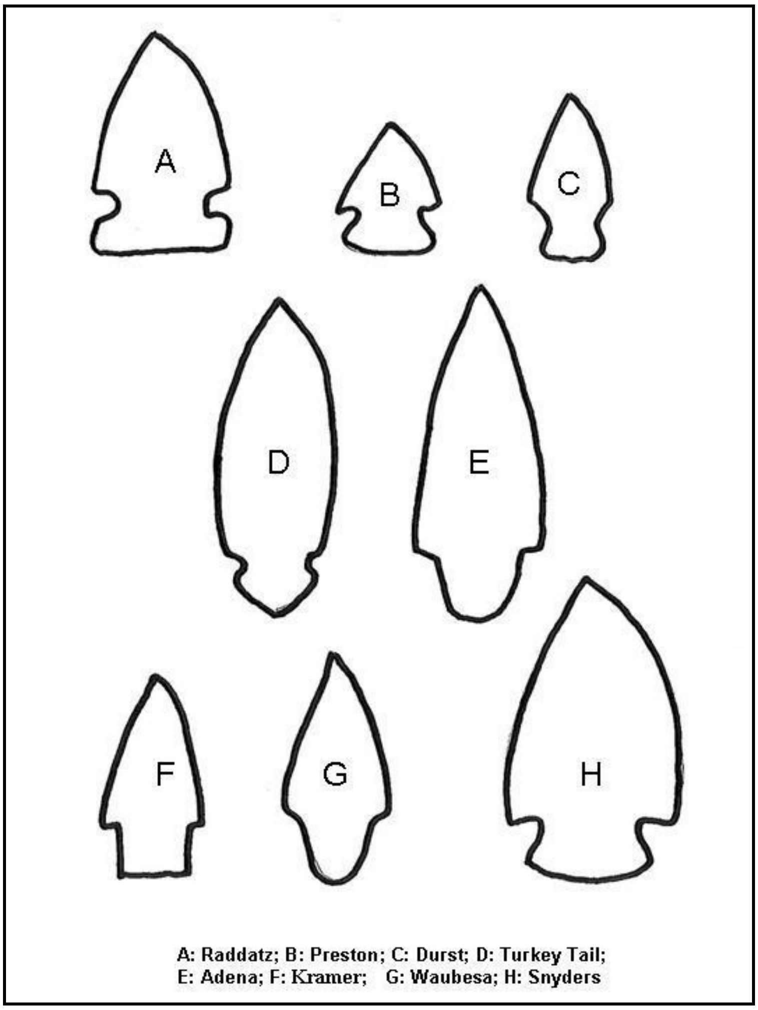

Figure 3.2. Stylized Examples of Diagnostic Archaic and Woodland Projectile Points (Not to Scale).

The Old Copper Complex is envisioned as a metallurgical tradition of the western Great Lakes ranging from Alberta and the Dakotas in the west, to Michigan and Ontario in the east, and including the northern portions of Iowa, Illinois, Indiana and Ohio. A wide range of utilitarian tools, such as spear heads, knives, celts, and awls as well as various ornaments were manufactured from copper quarried from outcrops around Lake Superior or float copper from glacial drift through cold hammering or annealing (e.g., Rapp et al. 1990; Ritzenthaler 1957; Stoltman 1997). Its classic representation appears from ca. 5,000 BP to 3000 BP spanning the Middle to Late Archaic periods (e.g., Gibbon 1998; Pleger 2000:171). Old Copper artifacts are associated with Osceola points in mortuary contexts and Raddatz points elsewhere in southwestern Wisconsin, and Raddatz and Late Archaic Durst Stemmed points from east-central Minnesota (Caine 1974; Ritzenthaler 1967; Stoltman 1997: 127-133; Witry 1959) (Figure 3.2). Overall, copper artifacts in southeastern Minnesota are rare. However, various copper implements indicative of the Old Copper Complex exist in various private collections and museums, such as rat-tailed points (Jenson and Birch 1963:68).

Subsistence during this stage followed a mobile hunting and gathering pattern (e.g., Alex 2000; Benchley et al. 1997; Caldwell 1958; Charles and Buikstra 1983; Stoltman 1997; Theler and Boszhardt 2003). While terrestrial game remained dominant, regional diversification occurred with a greater use of seasonally available plant and aquatic foods. Increased use of aquatic resources may relate to a greater availability of food resources during the warm and dry conditions of the Altithermal (e.g., Theler and Boszhardt 2003; Wright 1992). For example, in other portions of the Midwest, the first direct evidence of freshwater shellfish exploitation and plant domestication occur during this period (e.g., Charles and Buikstra 1983; Smith and Cowan 2003).

Compared with the presence of Paleo and Early Archaic aged materials, a greater number of Middle Archaic sites have been identified, suggesting increased populations. Evidence for regionalization is apparent, such as the use of communal cemeteries by approximately 6,000 BP. Also, multiregional exchange and long distance trade networks were in place, as a variety of exotic materials such as marine shell, copper, and chipped-stone material occur in Middle Archaic contexts (e.g., Brown 1985; Freeman 1966; Jeffries 1995; Stoltman 1997; Pleger 2000). Collectively, these changes suggest trends toward territoriality, sedentism, and greater social complexity where egalitarian hunter-gatherers became more differentiated toward the end of the period.

At a minimum, 16 recorded sites in the study region contain Matanzas and regional variants of Raddatz type projectile points, while other sites with Middle Archaic components are located in adjacent areas of the Upper Mississippi River (e.g., Perkl 1999; Madigan and Schirmer 2001; MNSHPO Files; Theler and Boszhardt 2003). While few Middle Archaic sites have been excavated in the study region, Middle Archaic components are present at the King Coulee and Chally/Turbenson sites (Moffat et al. 1996; Perkl 2002). Several sites with Middle Archaic and Old Copper components have been excavated in southwestern Wisconsin, such as the Raddatz rockshelter, the Price III, Osceola, Tillmont, and Crow Hollow sites and the Levson rockshelter and Buck Creek site in northeastern Iowa (e.g., Freeman 1966; Kuehn 2007; Logan 1976; Ritzenthaler 1946; Stoltman 1997, 2005; Theler and Boszhardt 2003; Twinde 2001; Wittry 1959).

Late Archaic

The Late Archaic is defined as the period spanning approximately 3,500 BP-2,400 BP. It is distinguished by the appearance of small notched and stemmed projectile points, other technological innovations and distinct economic and social patterns. Late Archaic societies continued to expand on previous lifeways with increased hunting and gathering efficiency though with greater diversification and specialization of local resources. A trend toward more non-egalitarian social structure is suggested by burial practices, interregional exchange, and long distance trade with increasing populations that are more sedentary and territorial.

The study region and the east-central portion of Minnesota are generally classified as Eastern Archaic and no phases have been recognized for the Late Archaic (e.g., Benchley et al. 1997; Dobbs 1988; Johnson 1969). However, based on the appearance of diagnostic projectile points that define corresponding phases in southwestern Wisconsin, two phases are proposed for the Late Archaic in the study region: Preston (ca. 3,500-3,000 BP) and Durst (ca. 3,000-2,400 BP) (Stoltman 1986a, 1997). In addition, it is proposed that the Red Ochre Complex (ca. 3,200 BP-2,000 BP) be included in the study region, for one site contains distinctive burial customs and a number of other sites contain a suite of diagnostic implements that define the complex (Ritzenthaler and Quimby 1962). While the time frame for the Old Copper Complex extends into the early portion of the Late Archaic, the use of copper during the Late Archaic generally declines and its use changes from utilitarian tools and implements to adornment (e.g., Benchley et al. 1997; Pleger 2000).

The Preston phase (ca. 3,500-3,000 BP) is defined by small projectile points recovered from a rockshelter in southwestern Wisconsin (Stoltman 1997:134-136). Corresponding extra-regional phases include the later portion of the Mountain Lake phase (ca. 5,000-2,200 BP) in southwestern Minnesota and the Labras Lake phase (ca. 3,900-3,000 BP) in northeastern Iowa (e.g., Alex 2000; Anfinson 1997; Benchley et al. 1997). Preston Notched projectile points are small, diagonal to side-notched forms with angular shoulders that produce an expanded stem appearance (Stoltman 1997:134; Boszhardt 2003:55) (Figure 3.2). Different from Middle Archaic forms, Preston Notched points are thought to have been used on detachable foreshafts of compound spears (Boszhardt 2002:35-67; 2003:55; Theler and Boszhardt 2003:86). They are morphologically similar to Monona Stemmed, Merom Expanding Stem, Trimble Side Notched and Springly (Winters 1969). Preston Notched points were recovered at several rockshelters in southwestern Wisconsin where they were stratigraphically above Raddatz and below Durst levels (Boszhardt 2003:55; Stoltman 1997:134-136; Wittry 1959). Several sites in the study region contain Preston Notched type points.

The Durst phase (ca. 3,000-2,400 BP) is also defined from the appearance of Durst Stemmed projectile points that consistently appeared stratigraphically above Preston and below Woodland levels from rockshelters in southwestern Wisconsin (Stoltman 1986a:227-228, 1997:136-137; Theler and Boszhardt 2003:86-87; Wittry 1959). Contemporary phases in adjacent areas include the terminal portion of the Mountain Lake phase (ca. 5,000-2,200 BP) in southwestern Minnesota and the Prairie Lake phase (ca. 3,000-2,600 BP) in northeastern Iowa (e.g., Alex 2000; Anfinson 1997; Benchley et al. 1997). Durst Stemmed points are small with rounded shoulders and long, slightly expanded stem bases (Figure 3.2). Like Preston Notched points, Durst Stemmed points are believed to represent dart points affixed to detachable foreshafts (Boszhardt 2002:35-67). They are similar to Table Rock, Dustin and Lamoka points (Boszhardt 2003:57; Justice 1987:127-130; Morrow 1984; Ritchie 1932; Ritzenthaler 1967; Stoltman 1986a:227-228, 1997:136; Wittry 1959). Durst Stemmed points are prolific in the study region and occur at several sites along the Mississippi River opposite the study area (e.g., Arzigian 2008; Boszhardt and Kolb 2006; Madigan and Schermer 2001).

The Red Ochre Complex (ca. 3,200-2,000 BP) bridges the Late Archaic and Early Woodland (Cole and Deuel 1937; Esarey 1986; Mason 1981; Phillips and Brown 1983; Pleger 2000; Ritzenthaler and Quimby 1962; Stevenson et al. 1997; Stoltman 1983, 1986). The Red Ochre Complex is a ceremonial burial complex that a series of regional cultures along the Upper Mississippi River area participated in. The study region lies outside and northwest of the complex's traditional core area to the east and south. The hallmark of the complex is communal cemeteries where the dead, typically with flexed burials in natural knolls or other prominent locations and occasionally in mounds, are covered with red ochre (ground hematite) and include exotic items, such as ceremonial bifaces, copper ornaments, marine shell beads, gorgets and bannerstones. Ceremonial bifaces are typically large ovate bifaces manufactured from non-local materials such as obsidian from the Yellowstone area in Wyoming, Knife River Flint from central North Dakota, Hornstone from southern Illinois and Indiana and Burlington Chert from southern Iowa and west-central Illinois. Other associated bifaces include Adena and Turkey Tail points, both thought to hold ceremonial functions (Figure 3.2). Adena blades are large, ovate, contracting stemmed forms associated with the Adena culture of the Ohio River region and typically occur in funerary contexts (Justice 1987:191-196; Stoltman 1997: 146; Theler and Boszardt 2003:90). Turkey Tail blades include several variations that are typically large, incurvate-excurvate with small corner notches on one end creating a stem and are also primarily known from funerary contexts (Justice 1997:173-178; Theler and Boszardt 2003:91). Sites attributed to the early portion of the Red Ochre Complex do not include ceramics and are typically ascribed to the Late Archaic (e.g., Stoltman 1986a, 1997). However, during the terminal portion of the complex, associated artifacts include Marion ware and Kramer Stemmed projectile points (see below) and are classified as Early Woodland (e.g., Stevenson et al. 1997). Several sites in the study region appear to be associated with the Red Ochre Complex, including the appearance of several Kramer Stemmed points, an isolated Turkey Tail point and Adena points associated with the Voight cemetery, and as part of the Ludwig Cache (Fiske and Hume 1963; Jenson and Birch 1963; MNSHPO Files; Theler and Boszhardt 2003:91-92). Other sites with Red Ochre components exist proximal to the study area in western and southwestern Wisconsin and northeastern Iowa (e.g., Alex 2000:79-82; Amick 2004; Boszhardt 1995; Stoltman 2005; Theler and Boszhardt 2003:90-95).

In addition to diagnostic projectile points, a variety of other chipped stone, such as utilized flakes, and ground-stone implements are present in general Late Archaic contexts. Ground-stone artifacts include three-quarter grooved axes and ungrooved celts, matates, bannerstones, gorgets, plummets, and tube pipes (e.g., Alex 2000; Theler and Boszardt 2003). A wide variety of bone implements, such as awls, points, fishhooks, perforated animal teeth, and some copper implements, such as awls, beads and other adornments occur.

No burial mounds with Late Archaic/Red Ochre materials have been identified within the study area (Arzigian and Stevenson 2003:75). Burial mounds have been constructed as early as 7,000 BP in Labrador and 6,000 BP in Louisiana (e.g., Fagan 1991; Gibson 2000). By 2,600 BP, they are present in Missouri, Iowa, Illinois and Wisconsin (e.g., Farnsworth and Emerson 1986; Green and Schirmer 1988; Klepinger and Henning 1976; Overstreet et al. 1996). Several burial mounds in northeastern Iowa (Turkey River and Sny Magill mound groups), eastern Wisconsin (Henschel Mound Group), northern Missouri and several in Illinois contain what are believed to be Red Ochre burials (e.g., Esarey 1986; Green and Schirmer 1988; Logan 1976; Overstreet et al. 1996). Non-mound burials in the study region include the Voight site, where several individuals were interned in a pattern reflective of Red Ochre Complex treatments (Blue 1996; Evans 1961; Fiske and Hume 1963). Associated artifacts include a reported Adena type point, an obsidian end scraper and an un-worked piece of copper, plus a radiocarbon date of 2557±52 BP, attributing the burials to the Late Archaic. Another Late Archaic non-mound burial is located at the Eck site, just north of the study region along the Minnesota River (Dobbs et al. 1998).

The use of ceramics during the Late Archaic in southeastern Minnesota has yet to be conclusively demonstrated. Used for food processing and storage, the earliest ceramics in the mid continent appear in Nebo Hill phase sites along the Missouri River in northwestern Missouri. These ceramics are fiber-tempered, relatively thin and undecorated wares that date to ca. 4,600 to 3,500 BP; they are similar to wares along the south Atlantic coast (Reid 1983; Sassaman 1993). Around 2,600 BP, mineral-tempered Marion Thick ceramics appear in west central Illinois (e.g., Fortier et al. 1984; Farnsworth and Emerson 1986). Marion Thick ceramics and Kramer Stemmed projectile points (see below) are associated with Red Ochre mound burials in Illinois and Iowa (e.g., Esarey 1986; Green and Schirmer 1988). In addition, Durst Stemmed points occasionally are associated with ceramics. For example, a Durst-like point was associated with unidentified grit-tempered, cord-roughened ceramics in the Late Archaic/Early Woodland cultural stratum at the King Coulee site within the study area and with Early Woodland ceramics at the Tillmont Site in southwestern Wisconsin (Perkl 2002:32; Stoltman 2005).

Late Archaic groups moved seasonally across the landscape with increasing efficiency to take advantage of various plant and animal resources unique to particular habitats. For example, elk and occasionally bison were exploited in prairie areas and deer and rabbits along woodland edges. Near wetlands and backwater areas, a variety of aquatic mammals, reptiles, amphibians and waterfowl were procured. Various fishes and freshwater mussels were collected from lakes, streams and rivers. During the spring, roots and tubers were collected, while summer months brought a variety of berries and other plant foods. During the fall, a wide variety of nuts, such as acorn, walnut and hickory were collected along with other plant foods (e.g., Theler 1987; Parmalee 1959; Perkl 2002; Wilford 1954).

During some point around the 1st millennium BC, greater reliance on domesticated plants occurred in the study region. Squash (*Cucurbita pepo*) was cultivated as early as 7,000 BP, marshelder/sumpweed (*Iva annua*) by 4,500 BP and goosefoot (*Chenopodium berlandieri*) by 3,700 BP in areas of the mid continent (e.g., Ash and Ash 1985; Minnis 2003; Smith 1992). Other domesticates appearing during the Late Archaic across the Midwest include sunflower (*Helianthus annuus var. macrocarpus)* and bottle gourd (*Lagenaria siceraria*), the cultigens maygrass (*Phalaris caroliniana*), knotweed (*Polygonum erectum*), and little barley (*Hordeum pusillum*), and wild rice (*Zizania aquatica)* grain. By 2,500 BP, squash is documented in the study region and squash, goosefoot and little barley are present in southeastern Iowa (Dunne and Green 1998:45-88; Crawford and Smith 2003; Perkl 1998).

A more settled lifestyle is implied during the Late Archaic with the appearance of adaptations such as storage pits and structures (e.g., Alex 2000; Benchley et al. 1997; Flannery 2002; Mason 1981; Theler and Boszhardt 2003). For example daub was recovered from a feature in northeast Iowa (Twinde 2001), storage pits are present at several sites along the Upper Mississippi valley and oval-and oblong-shaped structures exist in the American Bottom (e.g., Arzigian 2008; Boszhardt and Kolb 2008; Boszhardt et al. 1985; McElrath et al. 1984:56; Phillips and Gladfelter 1983:200-203). While rockshelters likely served as shelters, no evidence for structures has been identified in the study region (e.g., Wilfrod 1937, 1954). However, several sites contain dense artifact concentrations indicative of more long term, semi-permanent use of particular areas.

Also, rock art is likely to have been created during this period (if not during the Middle Archaic and persisting through the end of the precontact period), for bannerstones and atlatls are represented in various locations, including at La Moille Cave in Winona County (e.g., Lothson 1976; Salzer and Rajnocich 2001; Sprengelmeyer 2006; Winchell 1911). Six rock art sites have been recorded in the study region, although association with Late Archaic (or Early Woodland) has not been confirmed (Dudzik 1997; Winchell).

More common than preceding Middle Archaic sites, a minimum of 43 sites with Late Archaic components are in the study region. The greater number of Late Archaic sites suggests an increase in population. This may have fostered greater sedentism and territoriality, including conflict, with more permanent occupation of certain areas with productive environments (e.g., Theler and Boszhardt 2003, 2006). These factors, combined with interregional exchange, long-distance trade and communal cemeteries point to more complex societal organization, perhaps with more non-egalitarian group structures.

WOODLAND

In this portion of the Upper Midwest, the Woodland Period is typically presented as a time frame spanning approximately 2,500-850 BP that postdates the Archaic Period and antedates the Missippian/Oneota Period (e.g., Alex 2000; Anfinson 1979; Benchley et al. 1997, Stevenson et al. 1997; Fagan 1991; Ford and Willey 1941; Griffin 1946; Johnson 1969; Mason 1981; Stoltman 1990; Theler and Boszhardt 2003; Wilford 1955). Woodland societies continued to refine lifeway patterns established by their Archaic predecessors and incorporated a variety of new technologies and social patterns. As with the Archaic, delineation of cultural traits within the Woodland Period includes Early, Middle and Late stages (Table 3.1). The broad cultural changes are mainly distinguished by the stylistic changes of projectile points and ceramics along with refinements to social organization, settlement and subsistence patterns.

Early Woodland

Within the study area, the Early Woodland is defined as the period between approximately 2,400 BP-1,900 BP. In adjacent areas of Iowa and Wisconsin, the Early Woodland is believed to begin at approximately 2,600 BP, somewhat later in southwestern Minnesota and beginning at approximately 2,800 BP in west-central Illinois (e.g., Alex 2000; Anfinson 1997; Benchley et al. 1997; Farnsworth and Emerson 1986; Mason 1981; Stevenson et al. 1997; Stoltman 1986a, 1986b; Theler and Boszhardt 2003). There are no known Early Woodland ceramic types defined for east-central Minnesota. One Early Woodland phase, La Moille, is recognized within the study region and has tentatively been placed between approximately 2,600-2,300 BP (e.g., Anfinson 1979:17; Anfinson and Wright 1990:214). Based principally on ceramic characteristics, three adjustments to the Early Woodland sequence in the study region are proposed: 1) Adjusting the La Moille Phase to approximately 2,400-2,100 BP, representing the early Early Woodland; 2) Inclusion of the Prairie Phase (ca. 2,100-1,900 BP) as defined in southwestern Wisconsin representing the late Early Woodland; and 3), Inclusion of the later portion of the Red Ochre Complex (ca. 3,200-2,000 BP) as a continuation of this manifestation to include ceramics and mound burials (discussed above). Early Woodland societies in the study region continued to follow and refine the overall lifeway carried over from the preceding Late Archaic trends, although with more intensive use of aquatic resources, and are more sedentary and socially differentiated. It is not clear if Early Woodland groups constructed burial mounds and evidence for the use of domesticated plants during this period remains circumstantial. Early Woodland groups in the study region produced a variety of grit-and sand-tempered ceramics and medium-sized stemmed projectile points.

The La Moille phase (ca. 2,400- 2,100 BP) is defined by the appearance of relatively thick (ca. 1 cm) ceramics, regionally known as La Moille Thick (Anfinson 1979:115-120; Hudak and Johnson 1975; Wilford 1954, 1955) (Figure 3.3). Typologically, La Moille Thick ceramics compare with Marion Thick, Schultz Thick, Indian Isle Punched, Tillmont series and various types of "Early' Fox Lake pottery (e.g., Anfinson 1979:116, 1997: 53-66; Emerson 1986; Fortier et al. 1984; Logan 1976; Munson 1986; Stoltman 1990:242-244, 2005:64-66; Tiffany 1986). These ceramic types align with the regional phases Indian Isle (ca. 2,300-2,100 BP) in southwestern Wisconsin and roughly with Ryan (ca. 2,800-2,400 BP) in northeastern Iowa and Fox Lake in southwestern Minnesota. These thick wares are considered regional variants of the Marion culture (ca. 2,600-2,200 BP) in Illinois and Michigan. In general, thick wares are coarsely grit-tempered with straight walls and flat or conical bases. Decoration, when present, may include finger tip, nail or pinched punctations along the lip or upper rim over exterior and occasionally interior cord-marked surfaces. A diagnostic projectile point for the phase is Kramer Stemmed, which is a straight-stemmed, medium-sized spear point with a long blade and small sloping shoulders (Boszhardt 2003:61; Justice 1987:184-187; Munson 1966) (Figure 3.2). They are characteristic of the Marion culture and are typically associated with Marion Thick ceramics and indicative of the later portion of the Red Ochre complex (e.g., Alex 2000:90-92; Emerson 1986; Esarey 1986; Logan 1976; Munson 1966; Tiffany 1986). Marion Thick and related wares and Kramer Stemmed points appear in well-dated, Early Woodland contexts in adjacent areas along the Mississippi River (e.g., Arzigian 2008; Benn 1978, 1979; Boszhardt et al. 1985; Florin and Lindbeck 2008; Stoltman 1990, 2003, 2005; Theler 1986; Theler and Boszhardt 2003). Examples of La Moille Thick, Fox Lake wares and Kramer Stemmed points occur in the study region.

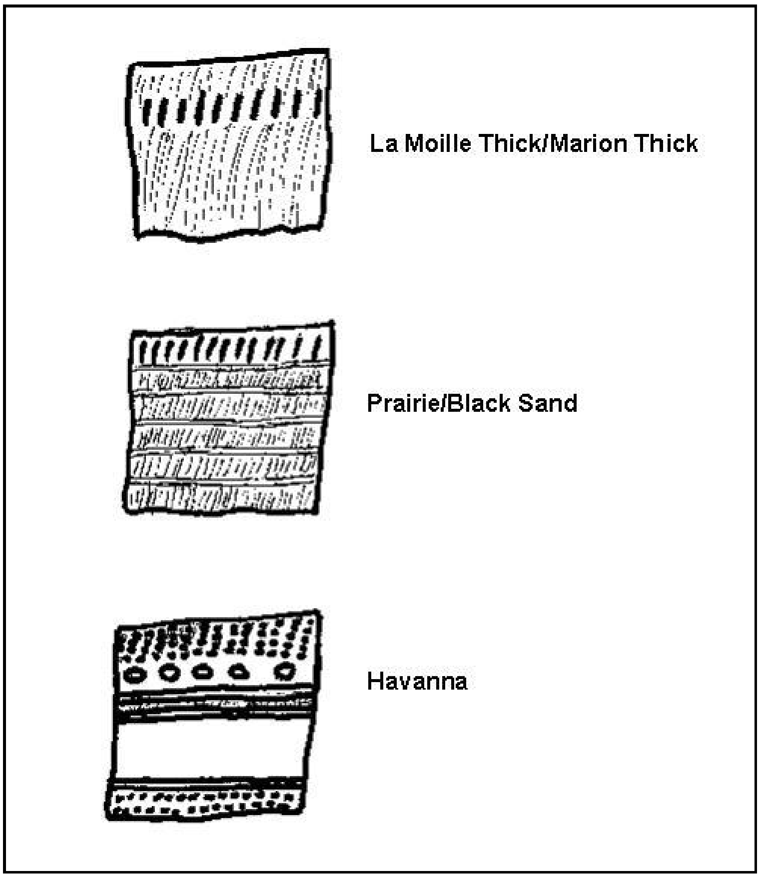

Figure 3.3. Stylized Examples of Diagnostic Woodland Ceramics (Not to Scale).

The Prairie phase (ca. 2,100-1,900 BP) is defined by sand-tempered pottery that is relatively thin (ca. 4-10 mm), typically with rounded shoulders and bases. There are various types of Prairie ware that include a suite of decorations: incising, punctates, bossing, stamping and cord-marking

(Stoltman 1986b, 1990; Theler 1986) (Figure 3.3). Sand-tempered wares are considered regional variants of the Black Sand culture of Illinois (e.g., Farnsworth 1986). The Prairie phase was first described from excavations in the Mississippi River floodplain near Prairie du Chien in southwestern Wisconsin by Stoltman (1986b). In northeastern Iowa, the Prairie phase follows the Black Sand complex (e.g., Alex 2000:92-96). In southwestern Minnesota, various Fox Lake types, such as "Early" Fox Lake Trailed, may equate to this period during the Fox Lake phase (ca. 2,200-1,300 BP (Anfinson 1997:47-74; Benn 1990:117-120). Projectile points diagnostic of the Prairie phase include Waubesa Contracting Stemmed, a medium-sized spear point with rounded stem bases, sloped shoulders and a lanceolate blade (Baerreis 1953; Boszhardt 2003:63-54; Justice 191-196) (Figure 3.2). Waubesa points are morphologically similar to Adena, Belknap, Dickson and Gary points. However, Adena points are larger and are considered ceremonial blades associated with burials (Boszhardt 2003:64; Justice 1997:192). Waubesa-type points are common in the study region and several sites contain Prairie ware ceramics.

The medium-sized Kramer Stemmed and Waubesa type projectile points, which are larger than Late Archaic forms, suggest replacement of compound detachable foreshafts. This arrangement would allow for replacing points while retaining the foreshafts (Boszhardt 2002). Other stone tools common to both phases include an assortment of objects used for routine industries and adornment, such as utilized flakes, choppers, grinding stones, axes/wedges/celts and hammerstones. Also, a variety of bone and shell implements and adornments occur. While the use of exotic materials likely persists during the La Moille Phase with its likely regional participation in Red Ochre ceremonialism, in general, exotics decline during the late Early Woodland Prairie phase.

No Early Woodland burials been recorded in the study region (Arzigian and Stevenson 2003:79-84). However, diagnostic Early Woodland materials have been recovered in surface contexts in areas adjacent to, or over, now destroyed burial mounds in the study region, such as the North Lake, Wabasha III and Whitewater Village groups. The nearest documented mound with an Early Woodland component is at the Buck Creek Mound 1 site in northeastern Iowa, where a burial was associated with Prairie ware ceramics (Collins and Forman 1995:39-85). Elsewhere, the Hilgen Spring Park Mounds in eastern Wisconsin may have been constructed during the Early Woodland, while Black Sand related mounds are identified in Illinois and numerous mounds are associated with the Adena culture (ca. 3,000-1,800 BP) along the upper Ohio River (e.g., Boszhardt et al. 1986:252; Farnsworth and Emerson 1986; Griffin 1967, 1978; Van Langen and Kehoe 1971).

Within the study region Early Woodland subsistence practices point to an inferred seasonal round of exploiting a variety of resources as they become available, although with a more focused adaptation to floodplain environments, in keeping with trends seen in adjacent areas (e.g., Alex 2000; Emerson and Fortier 1986; Farnsworth and Asch 1986; Munson and Munson 2004; Stoltman 1986, 1990; Theler 1987). Although little subsistence information is available in the study region for the period, during the La Moille phase aquatic food resources (e.g., fish) are greater than terrestrial forms (e.g., deer) (e.g., Perkl 2002:108). By the Prairie phase, aquatic food resources are greater than terrestrial foods, with intensified use of freshwater mussels (e.g., Perkl 2002:108; Theler 1987). Evidence for the use of domesticated plants during this period in the study region remains elusive, although an Early Woodland component at the King Coulee site contained a number of yet-to-be identified seeds (Perkl 2002). As squash and marshelder occur in southwestern Wisconsin and other domesticates occur in Iowa and elsewhere across the Midwest during the Early Woodland and use of domesticated plants in the adjacent areas are well documented during the Middle Woodland, it is reasonable to infer that Early Woodland groups inhabiting the study region utilized a variety of domesticated plants (e.g., Asch and Asch 1985; Arzigian 1987; Dunne and Green 1998; King 1985; Minnis 2003; Smith 1992).

Compared with Late Archaic sites, there are fewer Early Woodland sites identified across the upper Midwest. In the study region, 29 sites contain Early Woodland signatures. The decrease in the number of sites suggests a drop in overall populations (e.g., Emerson and McElrath 2001; Fiedel 2001). Social differentiation likely continued during the Early Woodland. Although elaborate mortuary treatments and exotic materials apparently decline during the Prairie phase, an inferred, non-egalitarian social structure may be visible through territorial claims, group membership and status differentiation that may have been important with intensified use of aquatic resources and ceramic manufacture and use.

Middle Woodland Elaborations

Within the study region, the Middle Woodland stage occurs between ca. 1,900 to 1,500 BP, traditionally represented by early and late phases. In the study region, the Sorg Phase, traditionally identified as spanning approximately 2,200-1,700 BP, encompasses the entire Middle Woodland stage (e.g., Anfinson 1979; Anfinson and Wright 1990). Across the upper Midwest, the early Middle Woodland is defined by the Hopewell Interaction Sphere, originating from southern Ohio, and distinguished by various traits, such as shared mortuary practices, extensive mound construction, highly decorated ceramics, shared art motifs and widespread use of exotic materials (e.g., Caldwell and Hall 1964; Griffin 1967; Struever 1968; Theler and Boszhardt 2003:108-113). The regional expression of this cultural phenomenon is known as the Havana tradition centered in the Illinois River Valley (e.g., Griffin 1952; Stoltman 1979; Struever 1964). Interregional correlates for the early Middle Woodland include the McGregor phase (ca. 1,900- 1,800 BP) in northeastern Iowa, the Fox Lake phase (ca. 2,200-1,300 BP) in southwestern Minnesota and the Howard Lake phase (ca. 2,200- 1,700) in east-central Minnesota (e.g., Alex 2000:98-111; Anfinson 1979, 1997; Anfinson and Wright 1990:213-232; Benchley et al. 1997; Benn 1978, 1979; Finney 2000; Logan 1976; McKern 1931; Wilford 1937). The late Middle Woodland denotes a decline in Hopewell-Havana influences, where the use of exotic materials declines and ceramic technology changes and decorations become less ornate. This period is known as the Weaver culture in Illinois with interregional correlates represented by the Allamakee phase (ca. 1,700-1,400 BP) in northeastern Iowa and the later portions of the Fox Lake phase in southwestern Minnesota and the St. Croix phase (ca. 1,500-1,000 BP) in east-central Minnesota (e.g., Alex 2000:98-111; Anfinson 1979, 1997; Benchley et al. 1997; Benn 1978, 1979; Caine 1966; Logan 1976). For southwestern Wisconsin, two phases were traditionally recognized: Trempealeau (ca. 1,900- 1,800 BP) and Millville phase (ca. 1,800- 1,500 BP) (e.g., Benchley et al. 1997; Stevenson et al. 1997; Stoltman 1979, 1990). However, Stoltman (2005:77) has proposed that the Trempealeau and Millville phases may reflect contemporaneous cultural activity and the Trempealeau-Millville phase is proposed to connote different activity sets of the same culture during the Middle Woodland in southwestern Wisconsin.

One of the most visible manifestations of early Middle Woodland groups includes large conical burial mounds, often constructed in groups (e.g., Alex 2000; Benchley et al., 1997; Birmingham and Eisenberg 2000; McKern 1931; Theler and Boszhardt 2003). Typically, they contain multiple individuals in extended burials placed in central log or limestone crypts. Subsequent bundle burials are often placed in or over the mound fill, adding to the overall size of a mound. A variety of exotic items, such as copper and silver ornaments, effigy and platform pipes, bear teeth and projectile points/knives are typical burial goods. The overall preparation and arrangement of burials suggests status differentiation and certain rituals were in place (e.g., Benn 1979; Hall 1979). There are no clear associations of Middle Woodland artifacts recorded in southeastern Minnesota burial mounds (Arzigian and Stevenson 2003:84-85). However, it is probable that numerous mounds in the study region date to this period for early descriptions of mound explorations and excavations denote stone crypts and large conical mounds (Thomas 1894; Winchell 1911). Post-early Middle Woodland (Hopewell-Havana) mounds are typically smaller, conical, linear and effigy forms with fewer burials and exotic items (e.g., Arzigian and Stevenson 2003; Birmingham and Eisenberg 2000; McKern 1931; Stoltman 1979). Non-mound burials are also present during this period across a variety of landforms in adjoining areas (e.g., Dobbs et al. 1998; Freeman 1969; Stoltman 2005).

Together, Hopewell-Havana ceramics are relatively thick (ca. 8 mm), grit/limestone-tempered, generally subconoidal jars with flared rims, rounded bases and a variety of decorations. Common regional types include Sister Creeks Punctate, Havana Plain, Hopewell Zoned, Naples Stamped, Kegonsa Stamped, and Sorg Banded Dentate (e.g., Anfinson 1979; Benn 1978; Johnson 1959; Stoltman 1979, 1990) (Figure 3.3). A wide variety of early Middle Woodland ceramic wares exist in areas north of the study region and in southwestern Minnesota, such as Howard Lake and Fox Lake types (e.g., Anfinson 1979, 1997; Gibbon and Caine 1980). Late Middle Woodland ceramics (i.e., Weaver) include Linn ware, which is typically grit-tempered with thin walls (ca. 5-8 mm), with straight rims that are subglobular shaped. Decorations are less bold than Hopewell-Havana forms and include puntates, dentates, and cord-wrapped stick impressions over typically smoothed surfaces. Common regional types include Levson Stamped, Marquette Stamped and Spring Hollow varieties (e.g., Benn 1978:224-225; Logan 1976; Stoltman 1979, 1990; Stoltman and Christensen 2000:500). Contemporary ceramics to the southwest include “late” Fox Lake types and to the north, St. Croix Stamped (e.g., Anfinson 1979, 1997; Caine 1966, 1974; Gibbon and Caine 1980). Near the end of the period, Lane Farm Cord Impressed occurs with rocker stamps and fabric impressions, indicative of Late Woodland ceramics (Benn 1979:60-65; Logan 1976:99-100; Stoltman 1990:250-252; Stoltman and Christensen 2000:499).

Diagnostic early Middle Woodland projectile points include Snyders Corner Notched and Steuben Expanded Stemmed. Waubesa points may also persist into this period (e.g., Boszhardt 2003:63). Snyders Corner Notched are large ovate shaped with broad corner notches and convex to straight bases (e.g., Boszhardt 2003 67-68; Justice 1997:201-204; McKern 1931) (Figure 3.2). Snyders points are associated with burials and typically manufactured from exotic materials.

They are morphologically similar to Manker Corner notched, a somewhat smaller form and thought to be more utilitarian. Steuben Expanded Stemmed points appear during the late Middle Woodland and are small-to medium-sized excurvate blades with upward curved notches, sharp shoulders and expanding stems with straight to convex bases (e.g., Boszhardt 2003:69-70; Justice 1997:208-211). Steuben points are similar to Monona Stemmed and Lowe Flared Base points (e.g., Baerries 1953; Boszhardt 2003:69-70; Justice 1997:208-211).

Subsistence during the Middle Woodland continued to follow the well established seasonal round of hunting and gathering regimes established in previous periods. Although a focus on riverine exploitation (e.g., fish and mussels) remained strong, a resurgence of upland resources (e.g., deer and elk) is seen, although settlements remain in floodplain and terrace settings (e.g., Benchley et al. 1997; Stoltman 1990; Theler 1987; Theler and Boszhardt 2003). A variety of cultigens-squash, goosefoot, sumpweed, sunflower, knotweed and wild rice, plus nuts and fruits compliment the diet (e.g., Alex 2000; Arzigian 1987, 1993). In addition, storage pits and oval and circular pole frame structures suggest seasonal sedentism or permanent occupations (e.g., Freeman 1969: Stoltman 1990:250).

Middle Woodland sites are more prevalent than the preceding Early Woodland sites, as reflected in State Historic Preservation Office files. For example, in adjacent portions to the study region in southwestern Wisconsin along the Mississippi River, at least 84 sites are identified as having Middle Woodland components (including many burial mound groups) (e.g., Madigan and Schirmer 2001). Within the study region, at minimum, 36 sites contain Middle Woodland components. Many Middle Woodland sites contain dense deposits of cultural material, signaling intense use periods and inferred population growth. Frequently, Middle Woodland deposits overlie Early Woodland and Late Archaic and underlie Late Woodland components, reflecting continuity of cultural patterns (e.g., Perkl 2002; Stoltman 2005).

Conclusions

The Late Archaic-Early Woodland Transition in southeastern Minnesota (ca 3,500-1,800 BP) witnessed a variety of technological changes and developments and variations in settlement and subsistence patterns and social organization. Late Archaic societies may be characterized by distinctive expanding stemmed projectile points, diversified hunting and gathering of specialized resources to include domesticated plants, long-distance and extra-regional trade, and pan-regional ceremonialism. A greater number of sites suggest increased populations that were semi-sedentary, territorial and moving toward a more non-egalitarian social structure. Early Woodland groups are characterized by distinctive straight and contracting stemmed projectile points, diversified hunting and gathering focused on floodplain resources and presumably use of domesticated plants and participated in extra-regional trade. A major technological change includes the use of ceramics. Construction of burial mounds is unclear. Fewer sites suggest a population decline. Early Woodland groups are thought to be semi-sedentary, territorial and non-egalitarian.

Although traditional taxonomy using the tripartite criterion of the use of domesticated plants, ceramics and mound burials to separate Late Archaic from Early Woodland groups provides a general measure of distinction, each of the tripartite elements occur during the Late Archaic in several areas of the upper Midwest. Except for domesticated plants, evidence for the use of burial mounds and ceramics during the Late Archaic in the study region is currently lacking. The use of ceramics that are stylistically Early Woodland occurs in the study region at a time contemporaneous with Middle Woodland forms in areas to south. Burial mounds seem to appear during the Middle Woodland in the study region. Despite these chronological incongruities, it is clear that a variety of material and social characteristics of Late Archaic and Early Woodland groups recognized in the greater Eastern Woodland Culture Area are present in the study region.

At various multi-component sites across the Upper Midwest, stratigraphic mixing of Early Woodland and Middle Woodland ceramics and other materials occur. Coupled with overlapping radiocarbon dates and blended ceramic traits, the result is a number of bewildering attempts to assign the assemblages to various phases (e.g., Farnsworth 1986; Munson 1986; Stoltman 2005; Theler and Boszhardt 2003). Some of the overlap may be attributed to a variety of natural and artificial processes (e.g., bioturbation and excavation techniques/conditions). However, Stoltman (2005, 2006) has articulated an explanatory scenario for southwestern Wisconsin where societies inhabiting the region proximal to the Mississippi River from slightly before 2,000 BP to ca. 1,600 BP are engaged in a continuum of cultural development with intermittent yet persistent interaction with Hopewell-Havana influences. This model envisions pure Early Woodland Prairie assemblages near the beginning of the continuum (ca. 2,100 BP), followed by an admixture of Prairie and Hopewell-Havana assemblages and, after ca. 1,800 BP, Middle Woodland Linn ware dominated assemblages. This scenario appears to fit with the archaeological record observed in the study region.

Chapter 4
The Archaeological Record

This chapter presents the baseline information for Late Archaic and Early Woodland archaeological sites in the study region. A discussion on the methodology concerning information on data sources, location, environmental setting, culturally diagnostic artifacts, site types, perceived functions and limitations precedes the presentation of the site information. Appendix A and B provide site characteristics in tabular form.

METHODOLOGY

Data Sources

Archaeological site information and other site details are derived from a variety of sources, including state archaeological site forms, the Minnesota State Historic Preservation Office (SHPO) and the Office of the State Archaeologist (OSA), universities, private contractors, research institutions and government agencies, such as the National Park Service, the U.S. Army Corps of Engineers (USACE), the U.S. Fish and Wildlife Service (USFWS), published reports and articles, unpublished manuscripts, technical reports, occasional site visits and, when necessary and available, inspection of artifacts and field notes and discussions with archaeologists involved in the site investigations. Accumulated over approximately 150 years of archaeological research, a wide variety of site information is available, from simple representations on a map (e.g., Brower 1903) to detailed site excavations and analysis (e.g., Neumann 1984). Likewise, a wide variety of site types are represented, from single artifact find spots (e.g., projectile points) to multicomponent habitation sites (e.g., the King Coulee Site). The primary sources of data include broad surveys of mound groups, private collections, navigation pools along the Mississippi River, highway surveys and sampling surveys. More site-specific data is derived from field schools and other academic led studies and cultural resource preservation compliance investigations. The information presented below includes basic archaeological site information, including location information, environmental setting, level of investigations and archaeological content.

Location Information

Location information includes the landform, its general surroundings, nearest water feature and viewshed. Basic landform information is derived from information contained in the site forms (e.g., narratives and maps). Other landform information is based on Bloom 1978; Church 1985, Hobbs and Goebel 1982; Leopold et al. 1964; Schoeneberger and Wysocki 2008; Sims and Morey 1972; Tuttle 1970; Waters 1992; Wright 1972 and others. Landform interpretation is inferred from the site's topographic setting, based on United States Geological Survey (USGS) 7.5 series topographic maps. In most cases, sites are positioned on well-defined landforms. Where sites overlap on separate landforms, the dominant landform is used. Hydrological information is gleaned from information published from various sources, such as the Minnesota Department of Natural Resources Geographic Information Systems (GIS) Data Deli, Tester (1995) and Waters (1992). Site locations are classified according to watersheds. Viewsheds are determined by a site's location on the landscape.

Environmental Setting

Environmental data includes the type of soils, vegetation and bedrock exposures when nearby. Soils information is derived from the published soil surveys (Carlson 1989; Cowles and Harms 1961; Cummins et al. 1973; Farnham 1958; Harms 1965; Lueth 1984; Poch 1976, 1980) and augmented by Birkeland (1984) and Soil Survey Staff (1993). In most cases, site locations are positioned on a single soil series. Where sites cover two or more soils series, the dominant soil is used. Broad vegetation information is drawn from Marshner (1974), Tester (1995), Trygg (1964), Upham (1884), Webb et al. (1983), Wright (1972, 1981), Wright et al. (1963), Wright et al. (1998). Specific vegetation at sites is supplemented by information from the soil surveys. Bedrock information is mainly drawn from the soil surveys and supplemented by Bakken (1999), Olson and Mossler (1982), Morey (1993), Morey and Meints (2000), Mossler (1972), Sims (1970) and the topographic maps. At some sites, bedrock is exposed as outcrops, in close proximity to the surface, or nearby (i.e., less than 200 m). Where the proximity of bedrock to individual sites is not known, exposure is inferred from the above references. However, for this analysis, sites where bedrock is exposed, is in close proximity to the surface, or is nearby (i.e., less than 200 m) are classified as having bedrock readily accessible.

Diagnostic Artifacts

The archaeological content includes the type of diagnostic materials present, namely projectile points and ceramics. In some cases, radiocarbon dates compliment the material residue. When available, subsistence remains are included. Site information was scrutinized and only sites with convincing Late Archaic and Early Woodland diagnostic representations are incorporated into this study. Artifacts considered diagnostic for the Late Archaic and Early Woodland are presented in Table 4.1.

Table 4.1. Late Archaic and Early Woodland Diagnostic Artifacts.

Cultural Stage	**Projectile Points**	**Ceramics**
Late Archaic	Raddatz (aff.: Osceola; Godar; Tama; Turin; Madison Side-Notched), Preston (aff.: Monona Stemmed; Merom Expanding Stemmed; Trimble Side-Notched; Springly), Durst Stemmed (aff.: Table Rock; Dustin; Lamoka), Turkey Tail	
Early Woodland	Adena (aff.: Waubesa), Kramer Stemmed, Waubesa Contracting Stemmed (aff.: Adena; Belknap; Dickson; Gary)	La Moille Thick (aff.: Marion; Shultz; Indian Isle; Tillmont; Early Fox Lake) Prairie Ware (aff.: Black Sand; Early Fox Lake)

Site Types and Functions

Historically, the archaeological concept of a site is a relatively generic term denoting locations of "monuments' (e.g., earthworks) and a concentration of "implements" (e.g., arrow heads) (e.g., Thomas 1894). In a more traditional sense, the site is defined as any place where physical evidence of human activity is found (e.g., Fagan 1987). More recently, the concept of what a site is has expanded and its conceptual role in archaeological method and theory is still evolving (cf. Binford 1992; Dunnell 1992; Deetz 1968; Willey and Phillips 1958). For example, Dunnell (1992) argues that the archaeological record reflects the use of landscapes as broad and geographically continuous, rather than as discrete locations, a position recognized in this study.

For this study, a site is defined as a discrete location where physical evidence of human activities provides ways to explore Late Archaic and Early Woodland land use. Site types follow classifications noted on the Minnesota Archaeological Site Forms. Within the study area, they include Single Artifact (Find Spot), Artifact Scatter, Lithic Scatter, Rockshelter, and Cemetery.

Presumed site functions, or the cultural use of a site, is a measure of a society's technological adaptation, environmental setting, social organization, and ideology, as well as other factors, such as the variety and abundance of subsistence remains. Activities at a site are generally envisioned as fulfilling various needs of a society, such as habitation, food preparation and other social functions. To a large degree, site functions are intimately connected to the subsistence strategy a society follows (e.g., Butzer 1993). For this study, two basic site functions are used: Base Settlements (e.g., habitation and village sites) and Specialized Activity Areas (e.g., resource procurement sites and cemeteries).

Criteria used to determine Base Settlements (BS) and Specialized Activity Areas (SAA) are derived from site functions indicated on the site forms or interpreted by the author. Interpretations are based on reported artifact content and other evidence. For example, isolated points (find spots) constitute SAA sites, while a site presenting numerous and varied artifacts (e.g., bone, lithics, ceramics) spanning several cultural periods (e.g., Late Archaic and Early Woodland) are interpreted as BS sites.

Limitations

It is important to note that several limitations are inherent with the available data. Relatively few Late Archaic-Early Woodland sites have been identified, in part due to size of the study area and incomplete survey data. This situation is not because these cultures did not have a presence in the study region. Rather, it is due to the nature of archaeological research. Although archaeological research has been ongoing throughout the study area for approximately 150 years, the methods of research are extremely variable. For example, systematic screening of soil matrix was not always uniform and deep-site testing in floodplains was virtually unheard of until approximately 20 years ago. Another factor is how archaeologists have classified sites. In many instances, sites that contain lithic artifacts that are not diagnostic are noted as Archaic because of the lack of ceramics. In other cases, the materials are misidentified or not recognized as belonging to Late Archaic-Early Woodland forms.

Another factor is that vast portions of the study region have not been comprehensively surveyed. However, in most instances where systematic surveys (e.g., the Root River) or other forms of intensive research (e.g., the Red Wing locality) have occurred, numerous sites have been identified. As Trow (1981:100) points out, Archaic period *"artifacts were found to occupy all aspects of the landscape: blufftops, caves and rockshelters in the valley walls and small knolls within the floodplain"* (Root River). Unfortunately, the site forms do not always provide the diagnostic point types.

Undoubtedly, many more Late Archaic and Early Woodland sites exist in the study area than have been identified. In some cases a variety of site formation processes and post-depositional disturbances, unique to each site, may obscure the settlement and subsistence information. In addition, many types of activity loci do not leave lasting signatures of human behavior, such as certain ceremonial or religious sites.

LATE ARCHAIC AND EARLY WOODLAND SITE INFORMATION

A total of 1,298 archaeological sites have been recorded within the study region (SHPO/OSA files) (Table 4.2). Of this total, 67 sites have been classified as Archaic age sites (seven percent) with 43 sites (64 percent) containing diagnostic artifacts or features that represent Late Archaic components. A total of 396 sites have been classified as Woodland age sites (39 percent) with 29 sites (seven percent) containing diagnostic artifacts or features that represent Early Woodland components. Seventeen sites (two percent) contain both Late Archaic and Early Woodland components. Thus, while the combined total equals 72 sites, the research pool contains 55 sites (Figure 4.1).

Late Archaic site types include artifact scatters, lithic scatters, find spots and a cemetery. They occur on floodplains, an island, ridges, rock shelters, slopes and terraces. A brief synopsis of the Late Archaic sites and their distribution across the landscape are presented alphabetically by county. Information on Late Archaic site function, type and environmental characteristics are presented in tabular form in Appendix A.

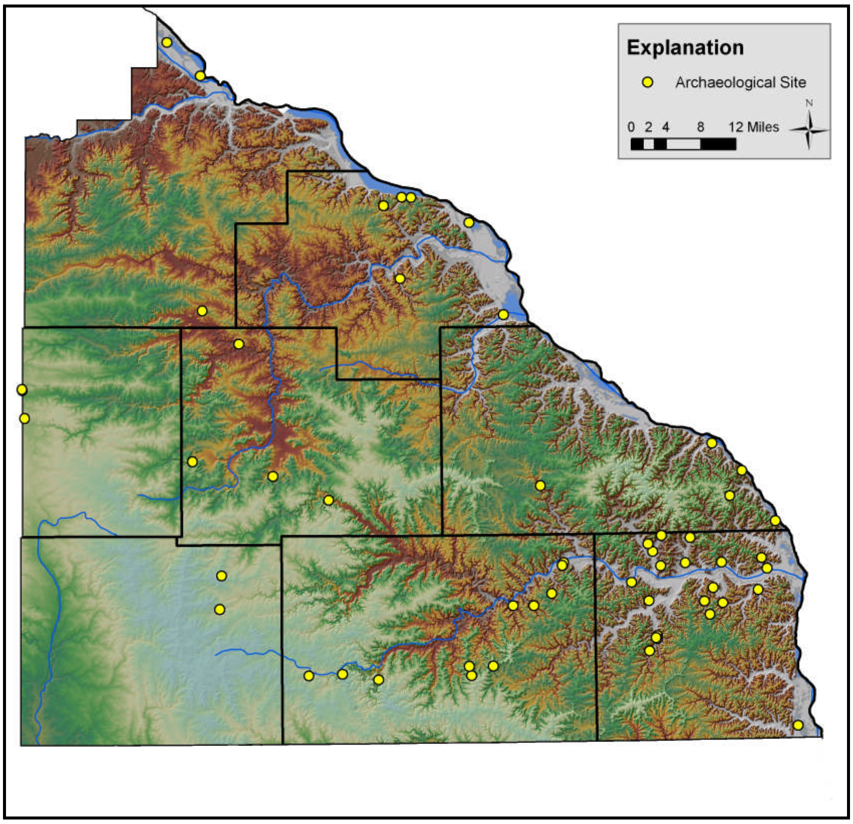

Figure 4.1 Late Archaic and Early Woodland Site Locations in the Study Region (USGS 2002; SHPO/OSA Files).

Table 4.2. Total Sites, Archaic, Late Archaic, Woodland, Early Woodland, Combined Late Archaic and Early Woodland and Total Number of Sites in Research Pool within the Study Region.

County	All Sites/ Pre-contact Sites*	Archaic	Late Archaic	Woodland	Early Woodland	Sites with both Late Archaic and Early Woodland Components	Total Sites in Research Pool
Dodge	46/14	4	3	7	3	3	3
Fillmore	197/148	17	8	50	4	1	11
Goodhue	329/276	10	2	153	2	1	3
Houston	263/219	15	18	65	11	8	21
Mower	104/89	8	2	20	1	1	2
Olmsted	81/54	5	4	10	0	0	4
Wabasha	152/133	4	3	59	5	2	6
Winona	126/72	4	3	32	3	1	5
Total	*1298/ 1005*	*67*	*43*	*396*	*29*	*17*	*55*

* As of September 2009

Early Woodland site types include artifact scatters, lithic scatters and find spots. They occur on floodplains, islands, ridges, a rock shelter, slopes and terraces. A brief synopsis of the Early Woodland sites and their distribution across the landscape are presented below by county. Information on Early Woodland site function, type and environmental characteristics are presented in tabular form in Appendix A.

In this area of North America, archaeological sites are primarily identified by a Smithsonian Institution trinomial designation as well as names. All Minnesota archaeological sites start with the numerical code "21", followed by a two-letter county code and a number reflecting the order of the site in the file (e.g., 21WB56). Site leads, other sites that typically have not been verified by professional archaeologists, follow a similar typology and are designated with small case letters following the state and county code (e.g., 21MWj). Table 4.3 presents the two-letter county code for the study Region.

Table 4.3. Two-Letter County Codes for the Study Region.

County	**Two-Letter Code**
Dodge	DO
Fillmore	FL
Goodhue	GD
Houston	HU
Mower	MW
Olmsted	OL
Wabasha	WB
Winona	WN

Dodge County

Dodge County contains three sites, each containing both Late Archaic and Early Woodland components. They are depicted in Figure 4.2.

Site 21DO2 (Rice Lake) is an artifact scatter located in close proximity to site 21DO7 along the northeastern edge of Rice Lake. A wetland on the eastern part of Rice Lake is the source for the Rice Lake Branch of the South Middle Branch of the Zumbro River. The sites were identified from a large, private artifact collection with a portion of the artifacts now at the Dodge County Historical Society. In 1972, a University of Minnesota field school excavated portions of 21DO2, although the results of this research have yet to be documented. At a minimum, Late Archaic Durst Stemmed, a Turkey Tail and Early Woodland Waubesa projectile points are present among the lithic items, while undefined Fox Lake type ceramics are present (SHPO/OSA files). Site 21DO2 is interpreted as a base settlement located on a gentle slope of a ground moraine. Mapped soils at 21DO2 are Sargent silt loam that developed under grasses and deciduous forest, or oak savannah (Cowles and Harms 1961:29).

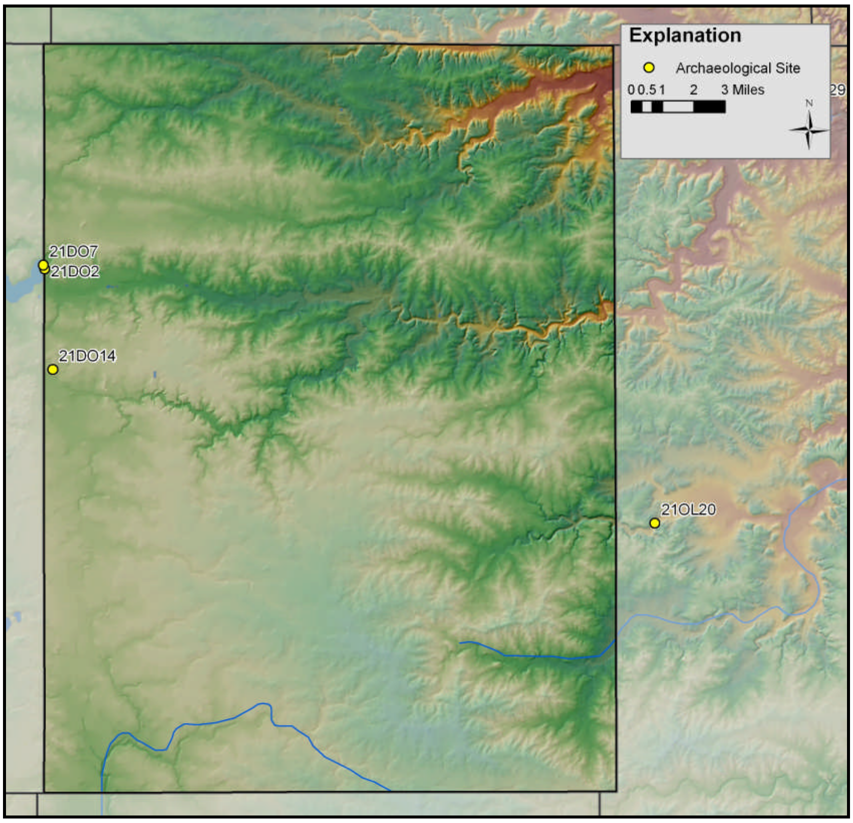

Figure 4.2. Dodge County Site Locations (USGS 2002; SHPO/OSA Files).

Site 21DO7 (Rice Lake State Park) is an artifact scatter situated just off shore of 21DO2 on an island bounded by Rice Lake and a wetland. As with site 21DO2, the site contains Late Archaic Durst Stemmed and Early Woodland Waubesa projectile points and undefined Fox Lake type ceramics recovered during Harrison's 1972 field school (SHPO/OSA files). Site 21DO7 is interpreted as a base settlement. Soils on the island are mapped as Sargeant silt loams that developed under oak savannah (Cowles and Harms 1961:22-23). The nearest bedrock exposures are approximately 10-15 miles to the southwest along the Straight River in Steele County, although glacial cobbles may have been available along streambeds.

Site 21DO14 is a lithic scatter identified during a road construction project and from the landowners' private artifact collection (SHPO/OSA Files). This site, interpreted as a specialized activity area, is on a gentle slope adjacent to a now drained wet prairie that flowed into Dodge Center Creek, a tributary to the South Middle Branch of the Zumbro River. The nearest bedrock exposures are approximately 10 to 15 miles to the southwest along the Straight River in Steele County. Diagnostic artifacts from 21DO14 include Late Archaic Raddatz and Durst and Early Woodland Waubesa projectile points. Mapped soils include various silt loams over glacial till (Cowles and Harms 1961:18-19). They are typified by Kasson silt loam that formed under a mixture of grasses and hardwood forest (oak savanna).

Fillmore County

Fillmore County contains a total of eleven sites. Eight sites contain Late Archaic components, four sites contain Early Woodland materials and one site contains signatures from both. Their locations are depicted in Figure 4.3.

Site 21FL3 (Tudahl Rockshelter) is a base settlement consisting of an artifact scatter located in a rockshelter above an unnamed north-flowing tributary to the Root River, three miles to the north. The rockshelter formed in limestone and contains a natural passage to a chamber, too small to negotiate, below a limestone cliff. The site was identified in 1931 and excavated in 1935 by the University of Minnesota (Wilford 1937). Soils around the rockshelter are classified as Steep Rocky Land, consisting mainly of limestone and sandstone outcrops with precipitous cliffs in places. The thin layer of soil material overlying bedrock lacks characteristics of a soil (Farnham 1958). Where present, vegetation is deciduous hardwoods. A Durst point was recovered in the lower levels of the apparently stratified deposits. Wilford (1937:206) reported that animal bones were 'found everywhere' with many of the bones in small pieces that were discolored or charred. Subsequently, Lukens (1963) identified many of these specimens (n=2,085) as mammal and bird remains. Among the smaller mammals identified, each represented by one to three elements, are eastern cottontail, gopher, beaver, muskrat, raccoon and badger. Woodchuck remains include 15 elements. Medium-sized mammals include one identified element from a black bear and *Canis* sp., which may be coyote, wolf or domesticated dog. Large mammals include Elk (n=9 elements) and white-tailed deer (n=242 elements). None of the bird remains were identified to species and Lukens did not attempt to compile a minimum number of animals for the site. Unfortunately, the distribution of the faunal remains is not recorded and an association with Late Archaic and Early Woodland components is tentative, although it may be safe to conclude that, at a minimum, white-tailed deer are associated with these components.

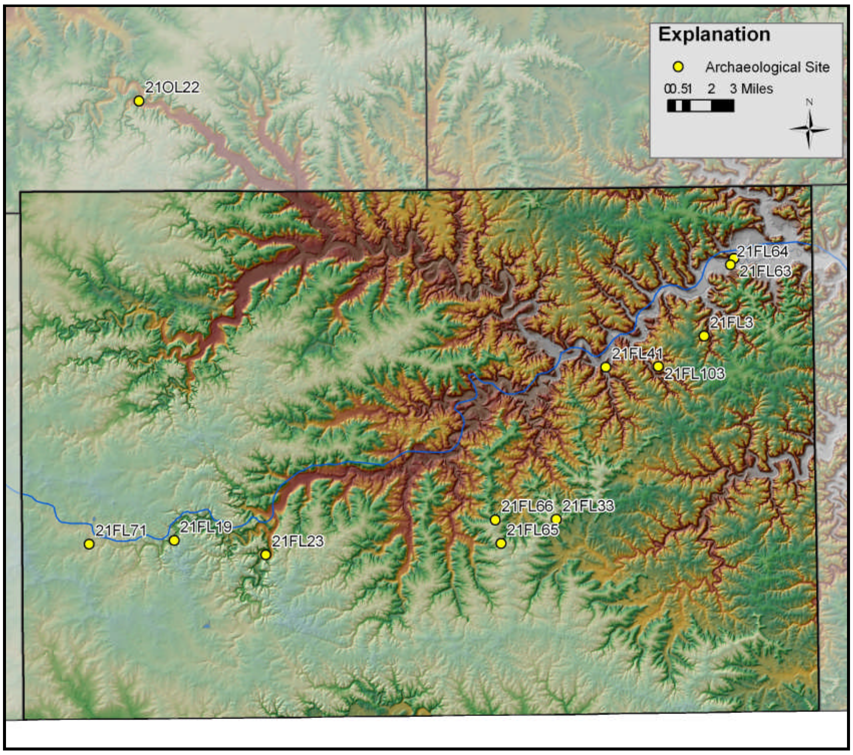

Figure 4.3. Fillmore County Site Locations (USGS 2002; SHPO/OSA Files).

Site 21FL19 (Prohaska) is a base settlement represented by an artifact scatter located on a terrace along the South Branch of the Root River. The site was identified during activities associated with a speleo-archaeological reconnaissance survey of Minnesota caves (Oothoudt 1971). Subsequent excavations were conducted in 1973 through Carleton College, during a Minnesota Statewide Archaeological Survey (MnSAS) of the Root River Basin (Minnesota Historical Society [MHS] 1981), and more recent limited testing and monitoring for the construction of facilities at Mystery Cave Number 1 in Forestville State Park (MHS 1981; Radford and George 1998). Walnut Cave (a sinkhole) is within the site limits, other sinkholes are nearby, and Mystery Cave Number 1 is due east of the site across the stream channel. Soils on the terrace belong to

Fayette silt loam (Farnham 1958). These soils formed under deciduous hardwoods (floodplain forest). Bedrock exposures with Cedar Valley Chert nodules are nearby along the valley slopes. Late Archaic points from the site include Raddatz and Table Rock types. Early Woodland materials from the site include Waubesa points.

Site 21FL23 (Vrieze) is a base camp represented by an artifact scatter located in a rockshelter along Canfield Creek, approximately one mile south of the South Branch of the Root River. The site was identified during a survey of caves in Minnesota (Outhoudt 1971). As the site is located within a rock shelter, no soil information is available. However, on the slopes below the cave are Fayette silt loams that formed under deciduous hardwoods (Farnham 1958). It is not known what type of bedrock the rock shelter formed in, although exposures are at the site. Early Woodland materials from the cave include Waubesa type points.

Site 21FL33 (Bengey) is a specialized activity area consisting of a lithic scatter identified on the surface of a ridge just down from the crest and approximately 1.5 miles north of the South Fork of the Root River. The site was located after the land parcel was selected as a sampling unit by the MnSAS survey (MHS 1981). Soils on the gentle slope are Tama silt loam that developed under prairie vegetation (Farnham 1958). Bedrock along this broad divide is buried, although outcrops appear in the river valley. A Madison side-notched point indicates a Late Archaic component at the site.

Site 21FL41 (Hongerholt) is a specialized activity area consisting of an artifact scatter located on the surface of an alluvial fan along Whalan Creek, just south of its deboucher with the Root River. The site was identified during the MnSAS survey (MHS 1981). Soils on the floodplain are Chaseburg silt loam that formed under floodplain forest vegetation (Farnham 1958). Bedrock is absent, although outcrops appear in the river and creek valleys. This site produced a Durst projectile point.

Site 21FL63 (Levee) is a base camp represented by an artifact scatter located on a natural levee on the north side of the Root River. The site was detected in a buried soil horizon where most (76 percent) of the cultural materials were recovered from sub-surface testing for a bridge replacement project (Peterson and Gonsior 1987). Soils at the site are Waukegan silt loam that developed under prairie (Farnham 1958). Bedrock is nearby along the valley slopes. Early

Woodland materials from stratified deposits include Prairie Incised ceramics. The buried soil contained a possible preceramic feature that may be a 'cache' with partially finished chipped stone tools (Hixton and unidentified chert) and mussel shell. Unidentified animal bone was also present, although details of the fauna and their stratigraphic position are not available from the site write-up. However, is probable that a portion of the bone is associated with the Early Woodland occupation of the site.

Site 21FL64 (Grinde) is a base camp represented by an artifact scatter located on a terrace on the south side of the Root River. The site was detected in a buried soil horizon from sub-surface testing for a bridge replacement project (Peterson and Gonsior 1987). Soils at the site are Waukegan silt loam that developed under prairie vegetation (Farnham 1958). Bedrock is nearby along the valley slopes. Early Woodland materials from stratified deposits include Prairie Incised ceramics. As with the Levee site, most (67 percent) of the artifacts were recovered from the buried soil. Four 'bone' fragments were recovered from the site and no further information is available from the site write-up and, unfortunately, an association of bone with the Early Woodland component of the site is not possible to discern from available information.

Site 21FL65 (Kindem) is a specialized activity area consisting of a lithic scatter identified on the surface of the crest of a ridge between Partridge and Duschee creeks that flow north to the South Branch of the Root River. The site was located during a survey for a highway construction project in 1991 (Gonsior et al. 1994). Soils along the ridge are Fayette silt loam, eroded, that developed under deciduous hardwoods (upland woodland) (Farnham 1958). Although bedrock is not exposed at the site, a nearby ravine east of the site (draining to Daschee Creek) contains a large Galena Chert lag deposit that was likely the source of most of the lithic raw materials worked at the site. Diagnostic projectile points of the Late Archaic recovered from the site include Tama and Durst types.

Site 21FL66 (Tieskotter/Stevens) is a specialized activity area consisting of a lithic scatter located on the surface of a ridge overlooking Camp and Duschee creeks that flow north to the South Branch of the Root River. The site was located during a survey for a highway construction project in 1991 (Gonsior et al. 1994). Soils along the ridge are Fayette silt loam, eroded, that developed under deciduous hardwoods (upland woodland) (Farnham 1958). No bedrock is exposed at the site. However, a ravine just southeast of the site, that drains to Camp Creek, contains a large Galena Chert lag deposit that was the likely acquisition area for most of the lithic raw materials worked at the site. A Raddatz type point was recovered from the site.

Site 21FL71 (Chally/Turbenson) is a base settlement consisting of an artifact scatter located on a gentle slope just west of the South Branch of the Root River. The site was identified during a survey for a highway construction project in 1990. Further investigations took place at the site in 1992 and a data recovery project was completed in 1995 (Gonsior and Myster 1994; Moffat et al. 1996). The prevalent soil at this extensive site is Renova silt loam that developed under deciduous hardwoods (upland woodland) (Farnham 1958). Bedrock outcrops are not available at the site, although extensive amounts of Cedar Valley Chert were worked at the site, apparently derived from eroded till or weathered bedrock. This multicomponent site contains Late Archaic Godar points.

Site 21FL103 (Overland) is a specialized activity area consisting of a lithic find spot consisting of a Late Archaic Raddatz point recovered from the surface of a hilltop (ridge). The site overlooks Diamond Creek to the west, which enters the Root River approximately 1.5 mile to the north of the site. The site was identified during the MnSAS survey (MHS 1981). Soils along the ridge are Fayette silt loam that developed under deciduous hardwoods (upland woodland) (Farnham 1958). Bedrock exposures are nearby along the Root Valley slopes.

Goodhue County

Goodhue County contains three sites, two sites contain Late Archaic material, two sites contain Early Woodland materials and one site contains signatures from both. Locations of Goodhue County sites are depicted in Figure 4.4.

Site 21GD2 (Bartron) is an artifact scatter located on the southern end of Prairie Island, a glacial terrace. The main channel of the Mississippi River is north of the site and Birch Lake, within the Vermillion River floodplain, south of the site beyond a road and railroad embankment. Recognized as a village site since 1903, the Bartron site was located in close proximity to at least 66 burial mounds defined by four other sites and mapped in 1885 (Brower 1903; Winchell 1911:143-150). Investigations of several nearby mounds revealed general Woodland components, although Early Woodland artifacts were not apparent (e.g., Johnson et al. 1969).

Nearly all of these mounds have been destroyed through cultivation and other modern activities. A series of University of Minnesota field schools were conducted at the Bartron site in 1948, 1967, 1968 and 1969 and documented by Gibbon (1979). These investigations revealed a variety of features, including hearths, storage and refuse pits, postmolds, at least two houses and a possible palisade. Various grit-tempered ceramics were present, although it is unclear if Early Woodland vessels are represented. However, the projectile point illustrations reveal Durst Stemmed and Waubesa Contracting Stem varieties (Gibbon 1979:210, Plate 13). Unfortunately, the provenience of the projectile points and their relationships to the features and Woodland ceramics is unclear, perhaps the result of post-depositional disturbances created by the intense Oneota and Middle Mississippian use of the site (Gibbon 1979:118). The Bartron site is interpreted as a base settlement. The prevalent soil at the site is Burkhardt loam developed under tall-grass prairie (Poch 1976). While no bedrock is exposed on the terrace, Oneota limestone crops out less than a mile southeast of the site. A variety of subsistence remains were recovered at the site, although their association with the Late Archaic and Early Woodland materials is not clear.

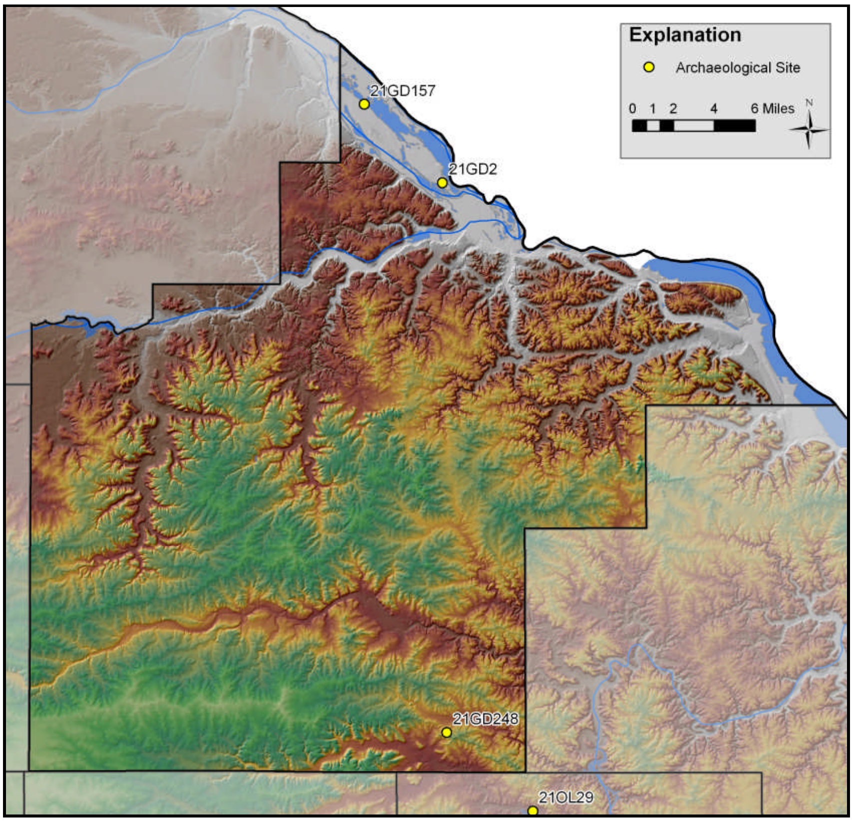

Figure 4.4. Goodhue County Site Locations (USGS 2002; SHPO/OSA Files).

Site 21GD157 (North Lake I) was identified along the shoreline of the eroding terrace on Prairie Island adjacent to North Lake (Pleger 1995). Site 21GD157 is interpreted as a base settlement. It is within the boundaries of 21GD78 (North Lake Mound Group I) that contained 43 earthen mounds that have since been plowed down (Brower 1903). Soils on the terrace belong to Estherville loam that formed under prairie vegetation (Poch 1976). No bedrock exposures are in the vicinity. Included with the artifact scatter are Waubesa points. There is no conclusive evidence associating the projectile points with the mounds.

Site 21GD248 (Goodhue Good View) is a lithic scatter located on a slope near the crest of a hill. From the summit of the hill, the Dry Run Creek valley is visible to the north and to the south, a valley containing the confluence of the North Branch Middle Fork Zumbro River with the Middle Fork Zumbro River-these drainages enter the main stem of the Zumbro River to the southeast of the site. The site was identified from the surface of a cultivated field during a road construction project (Kluth and Hudak 2002). The site is interpreted as a specialized activity area, containing a Late Archaic Turin (Raddatz affinis) projectile point. No bedrock exposures are in the vicinity. Mapped soils belong to Seaton silt loam formed under deciduous hardwoods (upland woodland) (Poch 1976).

Houston County

A total of 21 sites are in Houston County. Eighteen Late Archaic sites, 11 Early Woodland sites and eight sites with both components are represented. Site locations are depicted in Figure 4.5.

Site 21HU30 (Billy Joe Eglinton) is a base settlement represented by an artifact scatter identified on the surface of a terrace. Artifacts from the site were noted during a survey of private artifact collections (Jenson and Birch 1963). The site was officially recorded during the 1979 probabilistic sampling survey by the MnSAS (MHS 1981; Trow 1981). A spring in the center of the artifact scatter located along an unnamed tributary of Mound Prairie Creek that flows north a short distance to the Root River. Soils along the terrace belong to Littleton silt loam that developed under prairie grasses (Lueth 1984). Bedrock exposures are nearby along the valley slopes. Among the Late Archaic artifacts are Raddatz, Durst and Table Rock type points. The Early Woodland component at the site includes Kramer, Waubesa and Dickson point types.

Site 21HU35 (Johnson's Spring) is a base settlement consisting of an artifact scatter located on the surface of a terrace along Beaver Creek. The site was initially identified during the 1979 Root River Basin survey and subsequently accommodated a field school from Syracuse University (MHS 1981; Neuman 1984). This site is also situated around a spring at the base of a hogback ridge. The terrace soil is Arenzville silt loam that developed under deciduous hardwoods (floodplain forest) (Lueth 1984). Bedrock exposures with chert veins (Prairie du Chien Chert) are nearby along the valley slopes. Late Archaic projectile point types include Madison Side-Notched and Durst. Early Woodland materials include Waubesa type points. A variety of faunal and botanical remains were recovered from the site. However, most of the bone is apparently recent and includes *Bos* species (cow), *Sus* species (pig) and several rodents (e.g., skunk, squirrel, vole). Other identified specimens include muskrat. In addition, flotation samples recovered a variety of botanical remains, including nutshell (e.g., acorn and walnut), *Zea mays* (corn) and *Chenopodium* (e.g., goosefoot). Like the bulk of the faunal materials, it appears that most of the botanics are also recent inclusions. Some exceptions include charred oak wood and nutshell, walnut nutshell, and charred *Chenopodium* from the base of a post-hole stain along with some chipped-stone waste flakes. However, it is not conclusive if these represent Late Archaic or Early Woodland contexts. It is unknown what the post-hole stains represent, although Neumann (1984) suggests that they could represent a hide-stretching frame.

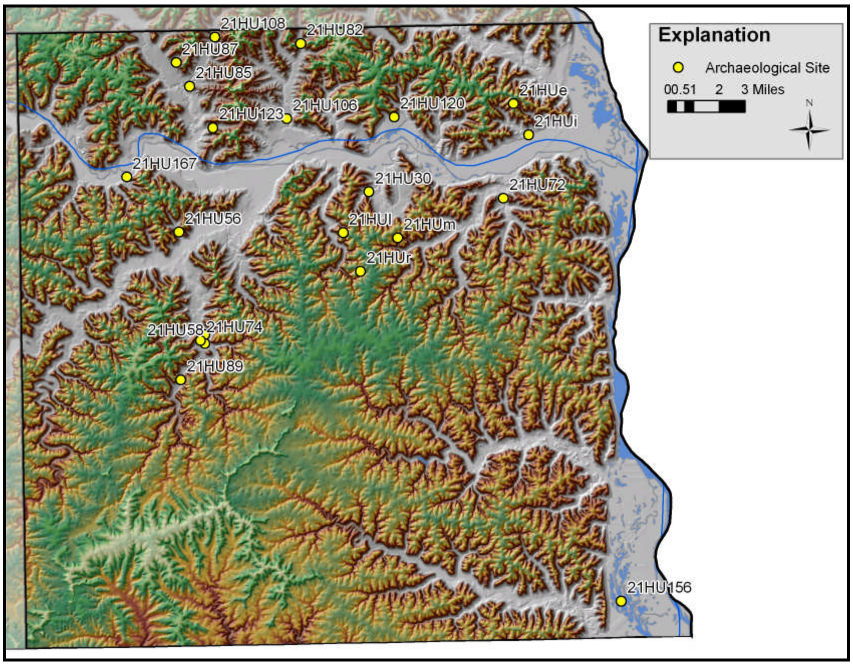

Figure 4.5 Houston County Site Locations (USGS 2002; SHPO/OSA Files).

Site 21HU56 (Thorson) is a specialized activity area consisting of a lithic scatter containing Durst and other Late Archaic points. The site is situated near a spring on a terrace along an unnamed tributary flowing south to the South Fork of the Root River. The site was identified in 1983 on the surface during a survey conducted by the Syracuse field school working at the Johnson's Spring site (SHPO files 2003). The terrace soil is Festina silt loam that developed under deciduous hardwoods and tall-grass prairie (oak savannah) (Lueth 1984). Bedrock exposures are nearby along the valley slopes.

Site 21HU58 (Thompson) is a base settlement represented by an artifact scatter located on the surface of a terrace along Beaver Creek. The site was identified in 1983 on the surface during a survey conducted by the Syracuse field school working at the Johnson's Spring site (SHPO files 2003). Here, soils belong to Richwood silt loam that formed under oak savannah vegetation (Lueth 1984). Bedrock exposures with chert veins are nearby along the valley slopes. Late Archaic artifacts include Durst points. Waubesa type points represent an Early Woodland component.

Site 21HU72 (Davidson I) is a specialized activity area represented by a lithic scatter situated on a terrace of Butterfield Creek, approximately one mile south of the Root River. The site was identified on the surface of a cultivated field (Withrow and Rodell 1984). Soils on the terrace are Festina Silt Loam, formed under deciduous hardwoods and tall-grass prairie (oak savannah) (Lueth 1984). Bedrock is nearby on valley slopes. This site produced a Waubesa point.

Site 21HU74 is a specialized activity area consisting of a lithic scatter located on the surface of a terrace at the foot of a hogback ridge and west of Beaver Creek. The site was identified during a 1984 survey of the Root River (Withrow and Rodell 1984). The floodplain soil is Arenzville silt loam that developed under deciduous hardwoods (floodplain forest) (Lueth 1984). Bedrock exposures with chert veins are nearby along the valley slopes. A Late Archaic Durst projectile point is included among the lithics.

Site 21HU82 (Flatten II) is specialized activity area consisting of a lithic scatter located on the surface of a narrow terrace along Silver Creek. The site was identified during a 1984 survey of the Root River (Withrow and Rodell 1984). Soils along the terrace belong to Littleton silt loam that that developed under prairie grasses (Lueth 1984). Bedrock exposures are nearby along the valley slopes. A Late Archaic Madison Side-Notched point was recovered from this site.

Site 21HU85 (Doblar) is a specialized activity area consisting of a lithic scatter situated on a side slope overlooking the junction of Money and Cambell creeks. A private collector reported the site during a 1984 Root River survey (Withrow and Rodell 1984). Soils on the side slope are La Farge silt loam, developed under deciduous hardwoods (upland woodland) (Lueth 1984). Bedrock exposures are nearby along the valley slopes. Late Archaic points from the site include Raddatz and Durst types.

Site 21HU87 (Seekamp) is a specialized activity area consisting of a lithic scatter located on a broad terrace along Silver Creek. The surface lithics are near the toeslope. The site was identified during a 1984 survey of the Root River (Withrow and Rodell 1984). Soils along the terrace belong to Littleton silt loam that developed under prairie grasses (Lueth 1984). Bedrock exposures are nearby along the valley slopes. A Late Archaic Madison Side-Notched point was recovered from this site.

Site 21HU89 (Beaver Creek West) is a base settlement consisting of a lithic scatter situated on a terrace along Beaver Creek. The site was identified on the surface during a 1984 survey of the Root River (Withrow and Rodell 1984). Soils on the floodplain belong to Comfrey silt loam that developed under oak savannah vegetation (Lueth 1984). Bedrock exposures are nearby along the valley slopes. Late Archaic points from the site include Godar, Osceola, Madison Side-Notched and Durst.

Site 21HU106 (Silver Creek) is a specialized activity area consisting of a lithic scatter located on a terrace along Silver Creek. The site was identified during a 1984 survey of the Root River (Withrow and Rodell 1984). Soils on the terrace are Festina silt loam, formed under deciduous hardwoods and tall-grass prairie (oak savannah) (Lueth 1984). Bedrock is nearby on valley slopes. This site produced a Madison Side-Notched point.

Site 21HU108 (Campbell Valley East) is a specialized activity area consisting of a lithic scatter located on a terrace along Campbell Creek. The site was identified during a 1984 survey of the Root River (Withrow and Rodell 1984). Soils on the terrace are Festina silt loam, formed under deciduous hardwoods and tall grass prairie (oak savannah) (Lueth 1984). Bedrock is nearby on valley slopes. This site produced a Raddatz point.

Site 21HU120 (Prairie Spring) is a lithic scatter interpreted as a specialized activity area located along a terrace near the confluence of Day Creek and the Root River. The site was identified during a 1984 survey of the Root River (Withrow and Rodell 1984). Soils along the terrace, near the toeslope of the upland, belong to Walford silt loam that formed under oak savannah (Lueth 1984). Bedrock exposures are in the vicinity. Late Archaic projectile points include Osceola, Madison Side-Notched, Preston and Durst. Early Woodland projectile points include Kramer and Waubesa.

Site 21HU123 (Mindrum) is a specialized activity area consisting of a lithic scatter located on a north facing side slope along an unnamed tributary of Money Creek and approximately 1.5 miles north of the Root River. The site was identified during a 1984 survey of the Root River (Withrow and Rodell 1984). Soils on the slope belong to Seaton silt loam that formed under deciduous hardwoods (upland woodland) (Lueth 1984). Bedrock is nearby on valley slopes. This site produced Osceola and Godar points.

Site 21HU156 (East Ice Haul Slough) is a base settlement represented by an artifact scatter located on a natural levee on an island within the floodplain of the Mississippi River. The site was identified during a survey of Mississippi River Navigation Pool 9 and was detected from a freshwater mussel shell midden and other artifacts eroding from the shoreline of the island (Boszhardt 1995). Subsequent excavation revealed an intact mussel shell midden containing Early Woodland Prairie phase ceramics. Other Early Woodland materials from the site include Adena and Waubesa point types. Soils on the island belong to Comfrey silty clay loam that developed under floodplain forest vegetation (Lueth 1984). Bedrock exposures are nearby along the valley walls. The initial field survey recovered a representative sample of faunal remains from the middens, including two unidentified “bones” and *Fusconaia ebena* (Ebony shell), *Elliptio dilatata* (Spike) and *Actinonaias ligamentina carinata* (Mucket) mussel shells. Additional investigations (a Phase II evaluation) were conducted at the site, although these data are not yet available. Although the site was identified from artifacts and mussel shell eroding from the banks of the island, there seems little doubt that the Early Woodland materials are associated with the mussel shell middens.

Site 21HU167 (Belongie) is a base camp represented by an artifact scatter located on an alluvial fan created by a small, unnamed tributary to the Root River. The site was identified in a buried soil horizon during sub-surface testing associated with a proposed recreation trail along the Root River (Tumberg and McFarlane 1998). Soils on the fan are Abscota variant sand, developed under deciduous hardwoods (floodplain forest) (Lueth 1984). Bedrock is nearby along the valley slopes. Early Woodland materials from the site include Prairie Incised ceramics in stratified deposits. This site produced a total of 95 faunal specimens, although few specimens are associated with the Early Woodland diagnostics. These include burned vertebrae elements that are unidentifiable to species.

Site 21Hue (Cook/Behrndt) is a specialized activity area consisting of a lithic scatter located on a ridge overlooking intermittent drainages in Pfeffer Valley to the southwest and an unnamed valley to the southeast, both entering the Root River approximately two miles to the southeast. Artifacts from the site were noted during a survey of private artifact collections (Jenson and Birch 1963). Soils on the ridge belong to Blackhamme silt loam, formed under deciduous hardwoods (upland woodland) (Lueth 1984). Bedrock is nearby on valley slopes. Late Archaic projectile points include Preston and Table Rock, while Early Woodland Kramer and Waubesa types are present.

Site 21Hui (Dahlke) is a specialized activity area consisting of a lithic scatter located on the slope of a terrace. The site is at the mouth of Pfeffer Valley with the Root River. The site was noted during a survey of private artifact collections and subsequently recorded during a survey of the Root River Valley (Jenson and Birch 1963; MHS 1981). Soils on the terrace are Timula silt loam that developed under deciduous hardwoods (floodplain forest) (Lueth 1984). Bedrock exposures are nearby along the valley slopes. Late Archaic artifacts include Durst points. Early Woodland artifacts include Kramer and Dickson points.

Site 21Hul (Vetsch/Hegland) is a specialized activity area consisting of a lithic scatter located on a ridge approximately one-half mile east of Crystal Creek. Artifacts from the site were noted during a survey of private artifact collections (Jenson and Birch 1963). The site was subsequently recorded during a survey of the Root River Valley (MHS 1981). Soils on the ridge are Seaton silt loam, formed under deciduous hardwoods (upland woodland) (Lueth 1984). Bedrock is nearby on valley slopes. Within the collection are a Raddatz point and a Turkey Tail point. Early Woodland materials include Kramer type points.

Site 21HUm (Doering) is a specialized activity area consisting of a lithic scatter located on a ridge (Union Ridge) with a view of the confluence of Indian Spring and Thompson creeks approximately three-quarters of a mile to the southeast. Thompson Creek enters the Root River from the south approximately four miles to the northeast of the site. Artifacts from the site were noted during a survey of private artifact collections (Jenson and Birch 1963). Soils on the ridge are Seaton silt loam, formed under deciduous hardwoods (upland woodland) (Lueth 1984). Bedrock is nearby on valley slopes. Projectile points from the collection include Late Archaic Madison Side-Notched and Early Woodland Waubesa types.

21HUr (Rudisuhle) is a specialized activity area consisting of a lithic scatter located on a ridge (Union Ridge). Crystal Creek is approximately one mile to the west. Artifacts from the site were noted during a survey of private artifact collections (Jenson and Birch 1963). Soils on the ridge are Seaton silt loam, formed under deciduous hardwoods (upland woodland) (Lueth 1984). Bedrock is nearby on valley slopes. Projectile points from this collection include Late Archaic Raddatz and Durst types.

Mower County

Mower County contains two sites. Both sites have Late Archaic components and one site contains Early Woodland materials. Their locations are depicted in Figure 4.6.

Site 21MW8 (Grand Meadow) is a specialized activity area consisting of an artifact scatter located on a ridge northwest of Bear Creek. Bear Creek eventually joins the Middle Branch of the Root River to the east in Filllmore County. The site was noticed by a private collector and is briefly described in the 1981 MNSAS report (Trow 1981:102). Among a surface scatter of artifacts are 50-60 large (5 m in diameter) pits, a portion of a much larger quarry field. The pits were excavated up to 3 m deep through weathered limestone to the Rapid member of the Cedar Valley Formation, where chert cobbles (Grand Meadow Chert) were gathered for chipped stone tool manufacture. The dominant soils belong to Racine silt loam, developed under a mixed forest and tall grass prairie (oak savannah) (Carlson 1989). Various Late Archaic projectile points are represented at the site, including Raddatz and Durst types, and Waubesa and Kramer points represent the Early Woodland materials (LeRoy Gonsior, personal communication, 2009).

Site 21MWj is a specialized activity area consisting of a site lead representing a surface scatter on a ridge near the head of Cary's Creek (Root River watershed) (SHPO files). The local soil is Readlyn silt loam that formed under prairie grasses (Carlson 1989). No bedrock exposures are nearby, although like at Grand Meadow, bedrock is near the surface. From the representative projectile points, Late Archaic Durst types are present.

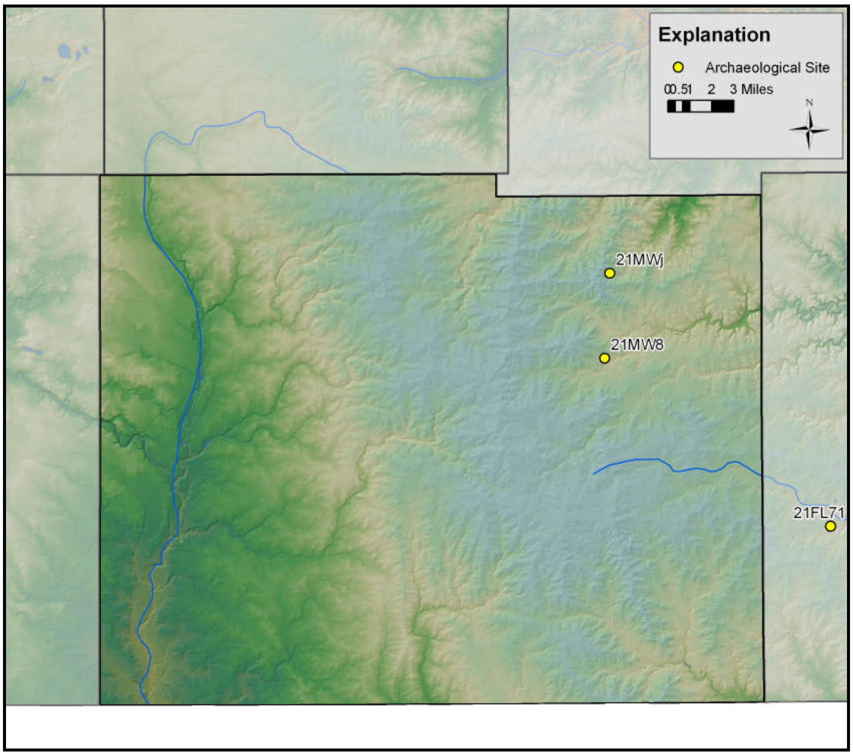

Figure 4.6. Mower County Site Locations (USGS 2002; SHPO/OSA Files).

Olmsted County

Olmsted County contains four sites, all representing Late Archaic components. The site locations are depicted in Figure 4.7.

Site 21OL20 is a specialized activity area consisting of an artifact scatter identified on the surface of a terrace during a survey of the South Branch of the Zumbro River (SHPO files). Soils on the terrace, adjacent to Salem Creek within the Zumbro watershed, are Richwood silt loam that formed under oak savannah (Poch 1980). Numerous limestone exposures are immediately west and north of the site. Notably, the only outcrops (rock type unknown) along Salem Creek in the vicinity are situated just west of the site and extend approximately one mile upstream. Artifacts from the site include "animal bone" and five Osceola projectile points, indicative of the Late Archaic Period. Other artifacts recovered from the site include 'animal bone' with no further details. As the site was identified on the surface, its integrity is doubt, and the faunal remains may well be recent (e.g., cattle, pig, etc.). Thus, it is not certain if these bones are associated with the points or what species they belong to.

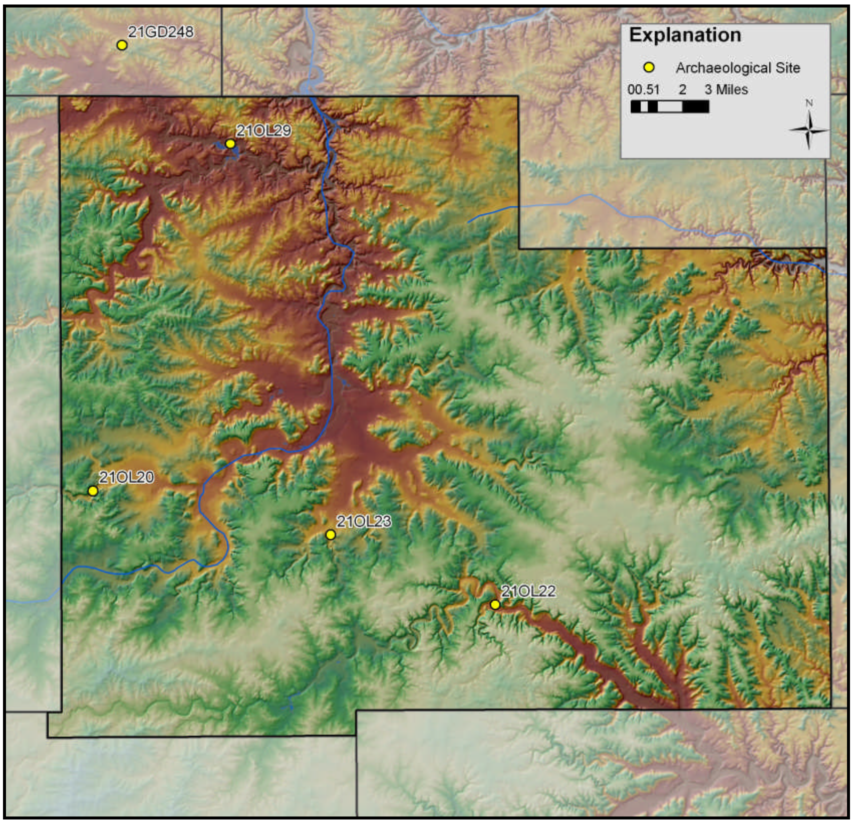

Figure 4.7. Olmsted County Site Locations (USGS 2002; SHPO/OSA Files).

Site 21OL22 (Muenter II) is an artifact scatter interpreted as a base settlement located on a terrace just north of the confluence of Partridge Creek and the North Branch Root River. The site was identified on the surface of a cultivated field during a site verification project (Emerson 1998). A variety of local and non local lithic raw materials is present along with several unidentified grit-tempered ceramics, unidentified burned bone fragments and a Late Archaic Preston projectile point. Bedrock outcrops are nearby. Mapped soils on the floodplain are Littleton silt loam, formed under prairie grass (Poch 1980).

Site 21OL23 is a specialized activity area consisting of a find spot represented by a Durst point. It is situated on a slope along an unnamed tributary to Willow Creek and identified during a road construction project (SHPO files). Soils at the find spot consist of the Brodale Series, developed under prairie vegetation (Poch 1980). There are no bedrock exposures in the vicinity.

Site 21OL29 (Davis) is a specialized activity area consisting of a lithic scatter located on a terrace at the confluence of the South Branch of the Middle Fork of the Zumbro River, the Middle Fork of the Zumbro River, and the Zumbro River. Here, these streams have been impounded and form Shady and Zumbro lakes. The site was identified during sub-surface testing for a road construction project (Kluth and Hudak 2002). Soils on the floodplain belong to Becker loam that developed under oak savannah vegetation (Poch 1980). Bedrock outcrops are nearby. Late Archaic materials from the site include Raddatz and Matanzaz point types.

Wabasha County

Wabasha County contains six sites. Three have Late Archaic materials, five have Early Woodland materials and two sites share signatures of both. Their locations are depicted in Figure 4.8.

Site 21WB4 (Whitewater Village) is a base settlement represented by an artifact scatter located on the surface of a cultivated field on a terrace on the north side of the Whitewater River near its confluence with the Mississippi (SHPO files). The site contains six burial mounds still extant, although they have been “potted,” in a wood line along the eastern edge of the terrace (Winchell 1911:143). Soils on the terrace are Bixby loam, formed under deciduous hardwoods (floodplain forest) (Harms 1965). Bedrock exposures are nearby along valley slopes. Included with the artifact scatter are Waubesa points. There is no conclusive evidence associating the projectile points with the mounds.

Site 21WB33 (Wabasha III) is located on a terrace along the Mississippi River consisting of an artifact scatter and interpreted as a base settlement. The site once contained 11 burial mounds (Winchell 1911:141) that have been completely destroyed through cultivation. During surface reconnaissance of the cultivated field as part of a U.S. Army Corps of Engineers (USACE) dredge material disposal project, a variety of grit-tempered ceramics (Late Woodland), chipped stone debitage, a projectile point (Late Woodland), animal bone and fire-cracked rock were encountered (SHPO files). Two ceramic sherds belong to La Moille Thick, recovered in an area east and south of the mounds. Their relationship to the former mounds is unclear. Some of the faunal specimens included elk and unidentified bird fragments, although their presence on the surface of the cultivated field does not allow for a cultural association. Soils along the terrace are mapped as Meridian sandy loam formed under mixed prairie grasses and deciduous hardwoods (oak savannah) (Harms 1965). There are no bedrock exposures on the terrace.

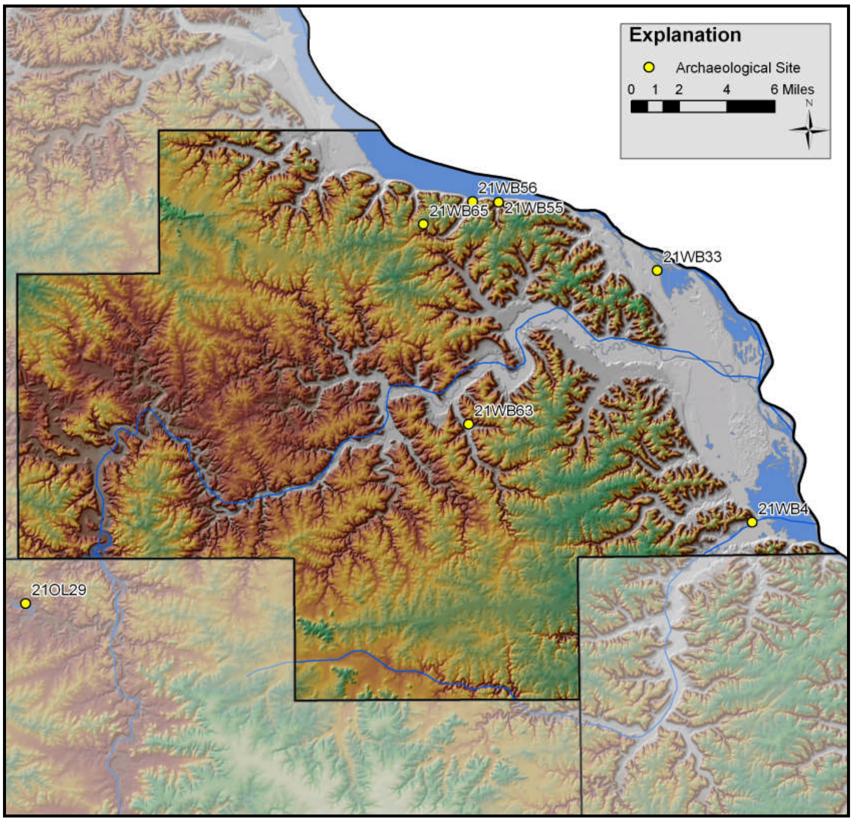

Figure 4.8. Wabasha County Site Locations (USGS 2002; SHPO/OSA Files).

Site 21WB55 (Dutchman Coulee) is located on a slight rise on an alluvial fan at the mouth of an unnamed tributary to Lake Pepin, a Mississippi River flowage. The site, interpreted as a base settlement, was detected during deep site testing for a road bridge replacement project over the drainage (Peterson et al. 1988). The site contains intact, stratified cultural deposits. Based on a cursory examination of the artifacts by the author (a detailed report of the excavations has not been completed), diagnostic artifacts include Late Archaic Madison Side-Notched and Table Rock and Early Woodland Waubesa projectile point types. In addition, possible La Moille Thick and Prairie phase sherds are present. A large amount of faunal and floral remains were also recovered from the site, although these have not yet been analyzed. Mapped soils belong to Chaseburg silt loam that developed under deciduous hardwoods (floodplain forest) (Harms 1965). Limestone bedrock exposures are on the valley walls around the site and there are numerous cobbles of Prairie du Chien Chert present along the creek bed (Klawiter 2001).

Site 21WB56 (King Coulee) is a base settlement consisting of an artifact scatter that is deeply buried on an alluvial fan at the mouth of King's Creek with Lake Pepin (Mississippi River). The site was detected during deep site testing for a road bridge replacement project over King's Creek (Peterson et al. 1988; Perkl 2002). Soils at the excavated portion of the site are Chaseburg silt loam that developed under deciduous hardwoods (floodplain forest) (Harms 1965). Some bedrock exposures (limestones) are on the valley walls around the site and there are numerous cobbles containing Prairie du Chien Chert present along the creek bed (Klawiter 2001). Durst points and radiocarbon dates from stratified contexts represent the Late Archaic component. Early Woodland components at the site include Waubesa points, La Moille Thick, and Prairie Incised ceramics in stratified contexts and several radiocarbon dates. This site contains prolific subsistence remains from deeply buried, stratified Late Archaic and Early Woodland components (Perkl 2002). Over 17,000 faunal and botanical artifacts were recovered from the site, making up 67 percent of the total artifact assemblage. Subsistence remains associated with the Late Archaic component include mammals, reptiles, fish, freshwater mussel shell, nutshell and seeds. Subsistence remains associated with the Early Woodland component includes fish, mammals, freshwater mussels, reptiles, birds, nutshells and unidentified seeds. Unfortunately, the quantities or the minimum number represented for the fauna remains at the sites were not tabulated. Identified mammal specimens include white-tailed deer, elk, canine species, plains pocket gopher, muskrat, beaver, mouse, black bear, raccoon, skunk, woodchuck and a human tooth. The only identified reptile species is turtle and none of the avian remains have been identified.

Identified fish remains include drum, pike, sucker, catfish and bullhead. Two mussel shell varieties have been identified as *Amblicata plicata* (Three-ridge) and *Eliptio dialatata* (Spike). Identified nutshells include acorn, basswood, butternut and walnut. Among a wide-range of seeds, only two types have been identified: *Cucurbita pepo* (domesticated squash) and wild cucumber. Several squash seeds were recovered from Late Archaic contexts and one was radiocarbon dated to 2,530±60 BP (Perkl 1998). Overall, fish remains were the dominant subsistence remains recovered from the site. However, during the Late Archaic, the ratio of fish to mammal remains was almost equal (with fish more prevalent) while fish remains outnumbered all other taxa during the Early Woodland. Among the mammals, white-tailed deer is the most frequently utilized. Also, although some mussel shell was recovered from Late Archaic contexts, this resource becomes more prevalent during the Early Woodland. In general, it appears that Late Archaic peoples utilizing this site obtained a significant amount of food products from upland settings, while the Early Woodland inhabitants were more focused on the riverine habitat. It is important to note that only a cursory examination of the subsistence remains from the site has been conducted and a thorough analysis remains to be undertaken.

Site 21WB63 (Ellinghuysen I) is a specialized activity area represented by a lithic scatter located on the surface of a terrace along East Indian Creek. The Zumbro River is approximately one mile to the north. The site was identified during a road construction project (SHPO files). Soils on the terrace belong to Tell silt loam that developed under deciduous hardwoods (floodplain forest) (Harms 1965). Bedrock exposures are nearby along the valley slopes. An Early Woodland component of the site consists of a Kramer type projectile point.

Site 21WB65 is a specialized activity area containing an isolated Durst projectile point recovered from the surface of a ridge (Hudak et al. 2002). The site was identified during fieldwork associated with the Minnesota Predictive Model project. The ridge is between the heads of Riley and King coulees, both tributaries to the Mississippi River at Lake Pepin. Soils on this portion of the ridge are Fayette silt loam, formed under deciduous hardwoods (upland woodland) (Harms 1965). There are no bedrock exposures nearby, although adjacent streambeds contain chert-bearing cobbles (Klawiter 2001).

Winona County

Winona County contains five sites. Three sites each have Late Archaic and Early Woodland materials and one site with both. Winona County site locations are depicted in Figure 4.9.

Site 21WN1 (La Moille Rockshelter) was a base settlement consisting of an artifact scatter located within a rockshelter at the foot of sandstone bluffs (Franconia Formation) along the Mississippi River. The site was located as road construction equipment removed talus deposits for fill (Wilford 1954). Road construction has subsequently destroyed the site. Although the site was located in sandstone bedrock, the soils in the area are mapped as Norden silt loam formed under deciduous hardwoods (Lueth 1994). Bedrock exposures are nearby along the valley slopes. A Late Archaic assemblage is implied from non-ceramic bearing layers in the deepest excavations as well as a projectile point that resembles the Durst type (Wilford 1954: Figure 1, Plate III). In addition the site is the type site for La Moille Thick ceramics (Hudak and Johnson 1975). Each of the excavated levels contained fish and mammal bone and mussel shell, with fish bones more common in the lower levels. Turtle bone was also common, although apparently not present in all levels. Lukens (1963) examined a total of 3,172 faunal remains, which include 1,961 fish, 25 amphibians, 115 turtle, 225 bird and five human elements. A variety of small mammals are represented by one to seven elements, including mice, shrews, voles, bats, rabbits, squirrels, lemmings, woodchucks, beaver, mink, otter, lynx and fox. The more common small mammals are muskrats (n=19), raccoon (n=15) and an unusual specimen for southeastern Minnesota, one porcupine. The most common identified elements are from white-tailed deer (n=27). None of the fish, mussel shell, bird, amphibian or turtle remains were identified to species. A minimum number of animals were not complied. The human remains were not noted by Wilford and do not appear to represent burials, although the human elements are not identified. As with the analysis for the Tudahl rockshelter (21FL3), the distribution of the faunal remains is not recorded and an association with Late Archaic and Early Woodland components is tentative, although it may be safe to conclude that, at a minimum, white-tailed deer are associated with these components.

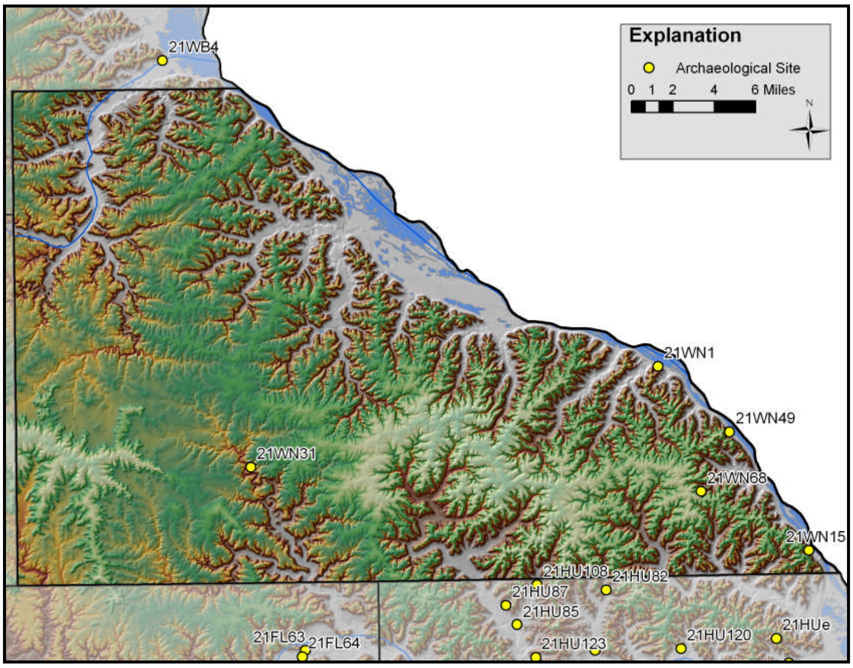

Figure 4.9. Winona County Site Locations (USGS 2002; SHPO/OSA Files).

Site 21WN15 (Voight) was a specialized activity area represented by a cemetery containing eleven individuals in pit burials located on a slope approximately 60 feet above the Mississippi River. The site, previously identified during construction of a house in 1948, was partially excavated prior to its destruction by road construction in 1961 (Evans 1961; Fiske and Hume 1963). Soils at the site were Seaton silt loam, formed under deciduous hardwoods (upland woodland) (Lueth 1994). Bedrock exposures are nearby along the valley slopes. The site is assigned to the Late Archaic on the basis of the absence of ceramics recovered from the excavations, red ochre associated with some of the burials and a radiocarbon date from a bone sample (2557±52 BP) (Blue 1996). In addition, large contracting stemmed points (e.g., Adena) and a piece of un-worked copper were reported from the site, although their provenience and association with the burials is unknown. Also, among the human skeletal remains is a variety of animal bone and freshwater mussel shell. Most of the bone and mussel shell artifacts consist of apparent tools (e.g., antler flakers, fleshers, awls, bone projectile points, shell spoons) that are likely grave goods that were directly associated with many of the burials. Several other bone specimens were un-worked and found in the associated fill. Identified animal bone includes various deer elements, raptor claws, a beaver incisor, and a canine tooth. Identified mussel shell (n=7) includes *Lampsilis ventricosa* (Pocketbook) (n=2), *Lampsilis siliquoidea* (Fat mucket) (n=2), *Anodonta grandis* (Giant floater) (n=1), *Quadula pustulosa* (Pimple back) (n=1) and *Fusconaia flava* (Pigtoe) (n=1).

Site 21WN31 (Rush Creek Rest Area) is a specialized activity area consisting of an artifact scatter located on a ridge overlooking Rush Creek. The site was identified during a road construction project (SHPO files). Although the site area is now occupied by a rest stop, with an udorthent soil, the likely soil during precontact occupation was Seaton silt loam that formed under deciduous hardwoods (upland woodland) (Lueth 1994). Bedrock crops out along the valley slopes of the creek. This site contained several Raddatz points.

Site 21WN49 (Ludwig) is a specialized activity area represented by a lithic scatter located on a terrace along the Mississippi River. Soils on the narrow terrace are Flagler sandy loam, formed under prairie vegetation (Lueth 1994). Bedrock exposures are nearby along the valley slopes. Early Woodland artifacts consist of a cache of seven knives, including three performs and four Adena points. Six of the artifacts are manufactured from Hixton Quartzite and one is made from Hornstone (SHPO files: Theler and Boszhardt 2003).

Site 21WN68 is a find spot consisting of an Early Woodland Kramer projectile point and interpreted as a specialized activity area. The find spot was reported by the landowner and subsequently verified by an archaeologist (SHPO files). The find spot is located on the crest of a ridge overlooking an unnamed tributary that enters Dakota Creek approximately two miles to the northeast. Dakota Creek enters the Mississippi River approximately three mile northeast of the find spot. Mapped soils belong to Nodine silt loam that formed under deciduous hardwoods (upland woodland) (Lueth 1994). Bedrock exposures are nearby.

Chapter 5
Relationships

A wide variety of relationships between human activities with their natural and cultural environment may be explored through settlement and subsistence pattern analysis. However, many aspects of cultural change are largely intangible, such as social organization and ideological constructs. Here, the focus is on tangible aspects of the Late Archaic and Early Woodland, namely material evidence and the composition of the natural environment. This chapter examines a variety of environmental and cultural relationships from a landscape approach.

A fundamental assumption in archaeology is that humans typically behave in patterned ways that are influenced by their societies. Humans, likewise, use the landscape in a spatially ordered manner, leaving patterned signatures. Thus, an archaeological site may be interpreted as a material representation of a cultural pattern. Cultural patterns are influenced by many environmental and social factors, including topography, climate, resource availability, subsistence practices, technology, social organization and complexity, and ideological/religious constructs. A variety of techniques can be applied to analyze settlement patterns, such as reconstructing the environment, spatial analysis, socioecological models and ethnographic analogy.

Subsistence pattern analysis is a means of reconstructing the general lifeway of a culture. This includes the collecting, processing and consumption of food items and essential raw materials. Common questions include what type and parts of animals and plants were consumed, where and when (i.e., seasonality) resources were collected and what technologies were used to support given lifeways. A variety of techniques may be employed to reconstruct subsistence practices, such as making ethnographic comparisons, documentation of environmental data, assembling animal and plant remains, and analyzing artifacts and human skeletal remains. Subsistence patterns are integrally connected to a variety of environmental and social factors, including resource availability, technology, and social complexity, that in turn affect settlement patterns.

The relationships between landscape use and cultural decisions provide insight into some of the mechanisms for lifeway changes (e.g. an apparent increase in social complexity), that occurred during the Late Archaic-Early Woodland transition. This chapter examines a variety of environmental and cultural relationships from a landscape approach. Following a review of methods, baseline settlement information and environmental relationships are presented. Subsistence information and comparisons conclude the chapter.

METHODOLOGY

In analyzing the Late Archaic and Early Woodland settlement and subsistence patterns in southeastern Minnesota, the focus is on site distribution across the landscape. Four basic data controls are utilized for this study (e.g., Parsons 1972): control over site samples; a relative chronology; environmental reconstruction; and a functional interpretation of site activities. Brief discussions of these factors follow.

Sample Control

Archaeological site distribution and subsistence data and other site details are generated from information contained in state archaeological site forms housed at the SHPO and the OSA. Archaeological site information is derived from a variety of archaeological research accumulated over approximately 150 years from avocational and professional parties, as previously discussed in Chapter 4. In effect, a wide variety of site information is available, from simple representations on a map (e.g., Brower 1903) to detailed site excavations and analysis (e.g., Neumann 1984). The primary sources of data include broad surveys of mound groups, private collections, various cultural resource management investigations (e.g., shoreline surveys of navigation pools along the Mississippi River, highway and development surveys, sampling surveys), field schools and other academic led studies. It is not uncommon for information contained in the site forms to be incomplete and to occasionally be inaccurate. When available, technical reports and associated papers were consulted to obtain additional details. In some cases, site visits were made and artifact collections examined.

For each site, the basic information gathered includes location information, such as township, range, section and Universal Transverse Mercator (UTM) coordinates, landform setting, elevation, slope, aspect, material content, and site type (e.g., artifact scatter). A variety of spreadsheets were prepared (see Appendix A and B) to assist with data measurement. Site UTM coordinates were configured into shapefiles for use in ArcMap 9.2 to facilitate GIS analysis.

Chronology

The Late Archaic and Early Woodland are distinguished by a fairly well defined set of artifactual materials diagnostic of each culture. Site information was scrutinized to ensure that the sites contained components from Late Archaic or Early Woodland cultural artifacts or features. Without diagnostic artifacts, placing a cultural component into a cultural or chronological framework is difficult. Another constraint is that, in the study region, only five radiocarbon dates fall within the study period (Blue 1996; Perkl 1998, 2002). Nonetheless, occasionally researchers have classified cultural affiliation based on flimsy evidence. For example, numerous lithic scatters may be included as Archaic, simply due to a lack of ceramics. Similarly, all burial mounds are classified as Woodland. Further, detailed information on the provenience of subsistence remains is lacking at most sites. Therefore, only sites with convincing age representations are incorporated into this analysis.

Environment

The natural environment of the study region as presented in Chapter 2 focuses on broad environmental variables as well as site specific environmental conditions. GIS shapefiles for most environmental variables were overlain on archaeological data for ease of presentation and interpretation.

A summary geomorphic map of the study region (Figure 2.2) includes specific landforms (discrete, natural surface features) hosting a site. These were identified through a variety of published maps (e.g., USGS 7.5 series topographic maps), related studies (e.g., soil surveys and geomorphological investigations) and in some cases by site visits. In most situations, site locations are positioned on well-defined landforms. Where sites overlap landforms, the dominant landform is indicated. Landform definitions are based on Church (1985), Jackson (1997), Tuttle (1970), Waters (1992), Hobbs and Goebel (1982), Schoenberger and Wysocki (2008) and others. Late Archaic and Early Woodland sites exist on seven distinct landforms, as defined in Table 5.1.

Table 5.1. Landform Definitions.

Landform	Definition
Ridge	Long, relatively narrow upland between valleys. May have sharp crest with steep side slopes.
Slope	Sloping upland between a drainage line (e.g., terrace) and a ridge/summit.
Rockshelter	Shallow cave-like opening in a cliff face/slope.
Terrace	Flat landform in stream valley adjacent to stream channel formed by previous stream level (abandoned floodplain). Formed through erosion or deposition. High terraces rarely flooded.
Alluvial Fan	Outspread mass of sediment deposited by a stream. Shaped like an open fan near or at the junction with the main stream. Commonly with Gentle slopes.
Natural Levee	Long, broad ridge formed along stream channels when overflowing water (e.g., floods) deposit coarsest part of sediment load. Highest elevation near the bank with gentle slopes away from the stream.
Island	Elevated area of land surrounded by water.

Bedrock information is drawn from county soil surveys and topographic and geologic maps (Bakken 1999; Olson and Mossler 1982; Morey 1993; Morey and Meints 2000; Mossler 1972; Sims 1970) (Figure 2.4). Limestone, dolostone, sandstone, chert bearing units and some glacial rocks suitable for the manufacture of chipped-and ground-stone tools are present throughout the study region (see Chapter 2). At some sites, bedrock crops out or is near the surface, or nearby (i.e., less than 200 m). Where the proximity of bedrock to individual sites is not known, exposure is inferred from the above references. Sites where bedrock is exposed, is in close proximity to the surface, or is nearby are classified as having bedrock readily accessible.

Site locations are classified according to watersheds (Figure 2.6). Hydrological information is gleaned from information published from various sources and supplemented with topographic and other maps as defined by the USGS and others (e.g., Tester 1995; Waters 1992).

A map depicting general soil types is derived from county soil surveys and published information (Birkeland 1984; Carlson 1989; Cowles and Harms 1961; Cummins et al. 1973; Farnham 1958; Harms 1965; Lueth 1984; Poch 1976, 1980; USDA 2004) (Figure 2.7). In most cases, site locations are positioned on a single soil series. Where sites cover two or more soils series, the dominant soil is used for this analysis.

The broad precontact vegetation is made more specific at sites by information from the soil surveys and other published information (e.g., Marshner 1974; Tester 1995; Trygg 1964; Upham 1884; Webb et al. 1983; Wright 1972, 1981; Wright et al. 1963 and Wright et al., 1998). Vegetation is subdivided into four main communities (Table 5.2). Sub-communities, such as ‘goat’ and wet prairies are not explicitly discussed as major resources, yet are mentioned in the text.

Table 5.2. Principal Vegetation Communities.

Community	Major Components
Prairie	Grass dominated herbaceous communities of the tall grass prairie: big bluestem, little bluestem and switchgrass. Principally in upland settings, although may occur on high terraces.
Oak Savanna	Sparsely treed communities with grass dominated herbaceous communities of the tall grass prairie. Dominated by oaks with aspen, hazelnut and other shrubs. Trees occur as individuals or in small clumps. Transition between prairie and woodlands. Historically maintained through natural and anthro derived fires. Principally in upland settings, although may occur on high terraces.
Upland Woodland	Includes xeric and mesic, deciduous woodland that is patchy or continuous: oak, hickory, walnut, aspen. Also incorporates aspects of the Big Woods (oak, basswood, hickory, maple, ash). Principally includes upland (slopes/ridges) areas, although may occur on high terraces.
Floodplain Forest	Deciduous mesic and riparian forests occasionally or annually flooded: elm, cottonwood, ash, maple and willow in an interrupted to continuous pattern. Groundcover includes various forbs, ferns, grasses, vines and shrubs (e.g., nettle, wild grape, poison ivy). Typically in floodplains although may grade onto terraces.

Subsistence information is derived from the site forms, published reports and in some cases examination of site materials. Additional information is drawn from a variety of sources as presented in Chapters 2, 3 and 4.

Site types and Functions

For this study, the site is defined as a discrete location where physical evidence of human activities occurs. It is used as a point of reference for exploring Late Archaic and Early Woodland land use, assumed proximity to resources or convenient social gathering locations. Site types follow classifications noted on the site forms. Within the study area, they include Single Artifact (Find Spot), Artifact Scatter, Lithic Scatter, Rockshelter and Cemetery.

Rationale for determining site functions is outlined in Chapter 4. For the following analysis, two basic site functions are used: base settlements (BS sites), such as presumed habitation and village sites, and specialized activity areas (SAA sites), such as presumed resource procurement sites and cemeteries.

Limitations

A variety of limitations inherent with the available data have previously been discussed in Chapter 4. To review, relatively few Late Archaic and Early Woodland sites have been identified due to incomplete survey data, variable field methods, unrecognized/misclassified materials and post-depositional disturbances. These factors, in addition to various assumptions (e.g., how BS and SAA sites may be determined) and intangible cultural aspects (e.g., social organization and ideological constructs) act to limit or potentially distort some analysis.

SETTLEMENT PATTERNS

An archaeological settlement can be defined as a local context, or physical locale, where members of a community lived and carried out daily activities (e.g., subsistence and social functions) over a delineated time period (e.g., Chang 1968). A settlement pattern is the distribution of human activities across a landscape. Through settlement pattern analysis, a wide variety of relationships between human activities with their natural and cultural environment can be explored and understood (e.g., Butzer 1993; Chang 1968; Flannery 1976; Hodder 1978; Jochim 1976; Willey 1953). For example, settlement patterns may be used to elucidate important environmental characteristics, social organization and complexity, exchange systems, territoriality and population densities.

A critical assumption is that humans typically behave in a predictable manner and consequently will leave material representations of their activities in patterned signatures (e.g., Hodder 1978, Jochim 1976). Thus, an archaeological site may be interpreted as a material representation of a cultural pattern. A complex suite of interconnected factors determines settlement patterns, including the environment, economic practices, technological skills, population density and social complexity. In turn, these determinants act on several different levels, from small activity areas (e.g., single households and specialized activity areas), to a community layout (e.g., base camps) and the distribution of communities across the landscape (e.g., Trigger 1968). A variety of techniques can be applied to analyze settlement patterns. Some examples include defining the natural environment and its resources (e.g., site catchment analysis); spatial analysis (e.g., central-place theory); socioecological models (e.g., hunter-gatherer and agricultural strategies) and ethnographic analogy (e.g., Butzer 1993; Chang 1968; Flannery 1972, 1976; Hodder and Orton 1976).

Late Archaic and Early Woodland settlement patterns in the study region are presumed to reflect purposeful behavior based on annual cycles of nature. Further, it is understood that there is a close relationship between settlement locations and resources (e.g., Binford 1980). As people moved across the landscape, matching resources with objectives, transforming natural phenomena to meet these objectives and a capacity to objectively think about these processes without actually implementing them, specific activities created different types of sites in different environmental settings (e.g., Bennet 1976).

The subsequent section will draw relationships between site setting and various environmental characteristics. To facilitate intra-regional differences, the study region is divided into three sub-regions based on a variety of environmental characteristics: Gray Drift, Weathering Residuum and the Mississippi Trench (Figure 2.2).

Late Archaic Site Distributions

From a total of 1298 recorded archaeological sites within the study region, 67 have been classified as Archaic age sites (five percent). From this pool, 43 sites (64 percent) contain diagnostic artifacts or features that represent Late Archaic components (Table 5.3). A summary of the environmental characteristics of the Late Archaic sites is included in Appendix A.

Table 5.3. Total Number of Sites, Archaic Sites and Late Archaic Sites Identified in the Study Region.

County	**All Sites***	**Archaic**	**Late Archaic**
Dodge	46	4	3
Fillmore	197	17	8
Goodhue	329	10	2
Houston	263	15	18
Mower	104	8	2
Olmsted	81	5	4
Wabasha	152	4	3
Winona	126	4	3
Total	*1298*	*67*	*43*

* As of September 2009

Late Archaic sites have been identified throughout the study region. The distribution of Late Archaic sites by sub-regions is depicted in Figure 5.1 and presented in Table 5.4.

Table 5.4. Total number of Late Archaic Sites by Sub-Region.

Sub-Region	Number of sites	Percent
Gray Drift	3	7
Weathering Residuum	35	81
Mississippi Trench	5	12
Total	*43*	*100*

The Weathering Residuum sub-region contains 35 (81 percent) known Late Archaic sites, the Mississippi Trench sub-region contains five sites (12 percent) and the Gray Drift sub-region hosts three sites (seven percent)(Table 5.5). Across the study region, four site types are represented. Lithic scatters make up just over half of all sites (54 percent/n=23), artifact scatters include 37 percent (n=16), with three find spots (seven percent) and a cemetery (two percent/n=1).

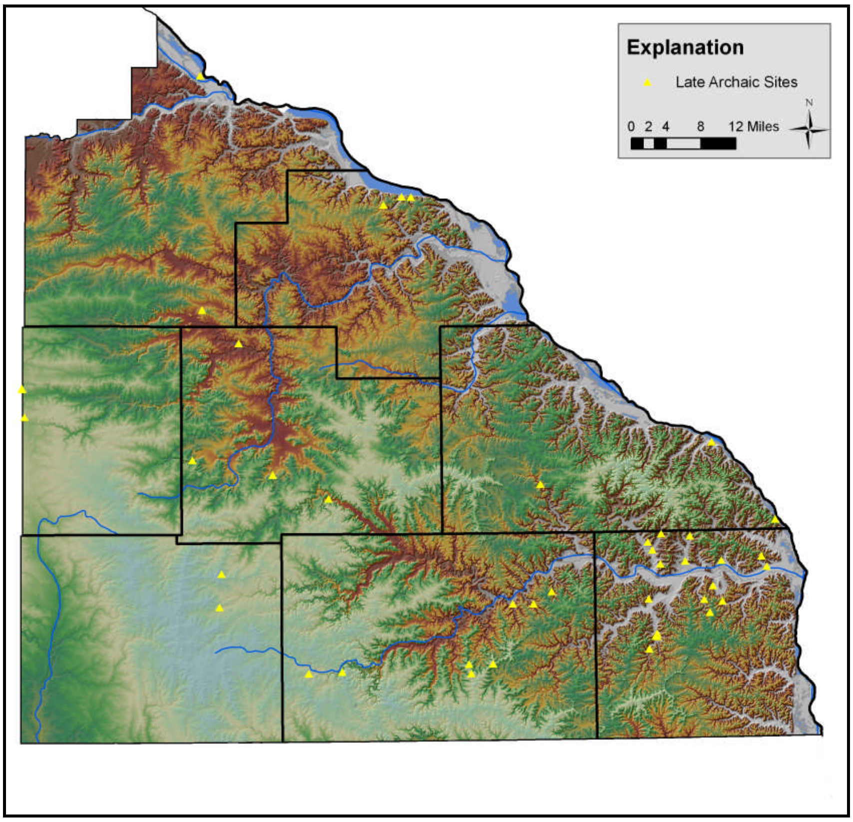

Figure 5.1 Late Archaic Site Locations (USGS 2002; SHPO/OSA Files).

Table 5.5. Late Archaic Site Types by Sub-Regions.

Sub-Region	**Lithic Scatter**	**Artifact Scatter**	**Find Spot**	**Cemetery**	**Total Sites**	***Percent***
Gray Drift	1	2	0	0	3	*7*
Weathering Residuum	22	10	3	0	35	*81*
Mississippi Trench	0	4	0	1	5	*12*
Total	23	16	3	1	43	
Percent	*54*	*37*	*7*	*2*		*100*

Late Archaic sites occur on ridges, slopes, rock shelters, terraces, alluvial fans, and an island (Table 5.6). Of the total sites, 22 sites (51 percent) are situated on upland settings (i.e., ridges, slopes and rock shelters), whereas 21 sites (49 percent) are on lower landforms (i.e., terraces, alluvial fans, an island). Most of the upland sites are situated on ridges, while nearly all of the sites on low landforms are on terraces.

Table 5.6. Late Archaic Landforms by Sub-Regions.

Sub-Region	**Ridge**	**Slope**	**Rock Shelter**	**Terrace**	**Alluvial Fan**	**Island**	**Total Sites**	***Percent***
Gray Drift	0	2	0	0	0	1	3	*7*
Weathering Residuum	12	5	1	16	1	0	35	*81*
Mississippi Trench	0	1	1	1	2	0	5	*12*
Total	12	8	2	17	3	1	43	
Percent	*28*	*19*	*5*	*39*	*7*	*2*		*100*

The distribution of Late Archaic site types across landforms is presented in Table 5.7. Just over half (57 percent/n=13) of the lithic scatters, all of the find spots (n=3) and the cemetery are situated in upland settings. Over half (69 percent/n=11) of the artifact scatters are located in lowland settings.

Table 5.7. Late Archaic Site Types by Landform.

Site Type	**Ridge**	**Slope**	**Rock Shelter**	**Terrace**	**Alluvial Fan**	**Island**	**Total Sites**	***Percent***
Lithic Scatter	9	4	0	10	0	0	23	*54*
Artifact Scatter	1	2	2	7	3	1	16	*37*
Find Spot	2	1	0	0	0	0	3	*7*
Cemetery	0	1	0	0	0	0	1	*2*
Total	12	8	2	17	3	1	43	
Percent	*28*	*19*	*5*	*39*	*7*	*2*		*100*

Late Archaic site functions include 29 SAA sites (67 percent) and 14 BS sites (33 percent)(Table 5.8). Of the SAA sites, 18 (62 percent) are situated on upland landforms, most on ridges, while 11 (38 percent) are located on low landforms with all but one site on a terrace. Ten (71 percent) BS sites occur on low landforms, mostly on terraces. Four BS sites (29 percent) are on upland settings, including the two rock shelters (Table 5.9).

Table 5.8. Late Archaic Site Functions by Sub-Regions.

Sub-Regions	**Base Settlements (BS)**	**Specialized Activity Areas (SAA)**	**Total**	***Percent***
Gray Drift	2	1	3	*7*
Weathering Residuum	8	27	35	*81*
Mississippi Trench	4	1	5	*12*
Total	14	29	43	
Percent	33	67		100

Table 5.9. Late Archaic Site Functions by Landforms.

Site Function	**Ridge**	**Slope**	**Rock Shelter**	**Terrace**	**Alluvial Fan**	**Island**	**Total Sites**	***Percent***
BS	0	2	2	7	2	1	14	*33*
SAA	12	6	0	10	1	0	29	*67*
Total	12	8	2	17	3	1	43	
Percent	*28*	*19*	*5*	*39*	*7*	*2*		*100*

Late Archaic sites are situated on a total of 21 different soil types (Table 5.10). There are no soil classifications for the two rock shelter sites and they are not included in the soils analysis. Of these 21 different soil types, 18 are silt loams, representing 86 percent of all soil types where Late Archaic sites are situated. The basic characteristics for each soil type are presented in Table 5.8.

Table 5.10. Late Archaic Soil Types by Sub-Region.

Sub-Region	**Soil Types**
Gray Drift	Kasson, Sergeant
Weathering Residuum	Arenzville, Becker, Blackhammer, Brodale, Chaseburg, Comfrey, Fayette, Festina, Lafarge, Littleton, Racine, Readlyn, Renova, Richwood, Seaton, Tama, Timula, Walford
Mississippi Trench	Burkhardt, Chaseburg, Seaton

Table 5.11. Late Archaic Site Soil Characteristics.

Soil Type	Slope (%)	Setting*	Texture	Drainage	Fertility	Vegetation
Arenzville silt loam	0-2	Low-T	Medium	Somewhat poor	Moderate	Floodplain forest
Becker loam	0-2	Low-T	Medium	Well	Poor	Oak savanna
Blackhammer silt loam	3-6	Upland-R	Fine	Well	High	Upland Woodland
Brodale loam	12-25	Upland-S	Medium-course	Excessive	Poor	Prairie
Burkhardt loam	0-3	Low-T	Medium	Somewhat Excessive	Low	Prairie
Chaseburg silt loam	0-2	Low-F	Medium	Well	Moderate	Floodplain forest
Comfrey silt loam	0-2	Low-T	Medium	Poor	Moderate	Oak savanna
Fayette silt loam	2-6	Upland-R/Low-T	Medium	Well	High	Upland Woodland/ Floodplain forest
Festina silt loam	0-2	Low-T	Medium	Well	Good	Oak savanna
Kasson silt loam	0-2	Upland-S	Course	Moderately well	Moderate	Oak savanna
Lafarge silt loam	12-20	Upland-S	Medium	Well	Poor	Upland Woodland
Littleton silt loam	0-2	Low-T	Medium	Somewhat poor	Moderate	Prairie
Racine silt loam	0-2	Upland-R	Medium	Well	High	Oak savannah
Readlyn silt loam	0-2	Upland-R	Medium	Somewhat poor	High	Prairie
Renova silt loam	2-6	Upland-S	Medium	Well	Poor	Upland Woodland
Richwood silt loam	0-2	Low-T	Medium	Well	Good	Oak savanna
Sargeant silt loam	0-2	Upland-S/I	Medium	Somewhat poor	Moderate	Oak savanna
Seaton silt loam	6-12	Upland-R	Medium	Well	Moderate	Upland Woodland
Tama silt loam	2-6	Upland-R	Medium	Well	High	Prairie
Timula silt loam	20-40	Low-T	Medium	Well	Poor	Floodplain forest
Walford silt loam	0-1	Low-T	Medium	Poor	Moderate	Oak savanna

* F=Alluvial fan; I=Island; R=Ridge; S=Slope T=Terrace

The distribution of soils by landform is presented in Table 5.12. Of the 21 soil types, Seaton silt loam host the most sites (7/17 percent), followed by Fayette silt loam (5/12 percent) and Littleton silt loam (4/10 percent). Late Archaic sites are located on 12 different soil types in lowland settings (i.e., terrace, alluvial fan and an island) and 11 different soil types in upland settings (i.e., ridge, slope).

Table 5.12. Late Archaic Landforms by Soil Types.

Soil Type	**Ridge**	**Slope**	**Terrace**	**Alluvial Fan**	**Island**	**Total Sites**	***Percent***
Arenzville silt loam	0	0	2	0	0	2	*5*
Becker loam	0	0	1	0	0	1	*2*
Blackhammer silt loam	1	0	0	0	0	1	*2*
Brodale loam	0	1	0	0	0	1	*2*
Burkhardt loam	0	0	1	0	0	1	*2*
Chaseburg silt loam	0	0	0	3	0	3	*7*
Comfrey silt loam	0	0	1	0	0	1	*2*
Fayette silt loam	4	0	1	0	0	5	*12*
Festina silt loam	0	0	3	0	0	3	*7*
Kasson silt loam	0	1	0	0	0	1	*2*
Lafarge silt loam	0	1	0	0	0	1	*2*
Littleton silt loam	0	0	4	0	0	4	*10*
Racine silt loam	1	0	0	0	0	1	*2*
Readlyn silt loam	1	0	0	0	0	1	*2*
Renovia silt loam	0	1	0	0	0	1	*2*
Richwood silt loam	0	0	2	0	0	2	*5*
Sargent silt loam	0	1	0	0	1	2	*5*
Seaton silt loam	4	3	0	0	0	7	*17*
Tama silt loam	1	0	0	0	0	1	*2*
Timula silt loam	0	0	1	0	0	1	*2*
Walford silt loam	0	0	1	0	0	1	*2*
Total	12	8	17	3	1	41	
Percent	*29*	*20*	*42*	*7*	*2*		*100*

The type of soils at BS and SAA sites are presented in Table 5.13. Two BS sites are situated on Chaseburg, Littleton and Sergeant soils. For SAA sites, Seaton soils host seven, Fayette four, Festina three and Littleton two sites.

Table 5.13. Late Archaic Site Function by Soil Types.

Soil Type	BS	SAA	Total Sites	Percent
Arenzville silt loam	1	1	2	*5*
Becker loam	0	1	1	*2*
Blackhammer silt loam	0	1	1	*2*
Brodale loam	0	1	1	*2*
Burkhardt loam	1	0	1	*2*
Chaseburg silt loam	2	1	3	*7*
Comfrey silt loam	1	0	1	*2*
Fayette silt loam	1	4	5	*12*
Festina silt loam	0	3	3	*7*
Kasson silt loam	0	1	1	*2*
Lafarge silt loam	0	1	1	*2*
Littleton silt loam	2	2	4	*10*
Racine silt loam	0	1	1	*2*
Readlyn silt loam	0	1	1	*2*
Renovia silt loam	1	0	1	*2*
Richwood silt loam	1	1	2	*5*
Sargent silt loam	2	0	2	*5*
Seaton silt loam	0	7	7	*17*
Tama silt loam	0	1	1	*2*
Timula silt loam	0	1	1	*2*
Walford silt loam	0	1	1	*2*
Total	12	29	41	
Percent	*29*	*71*		*100*

Key: BS=Base Settlement; SAA= Specialized Activity Areas

The relationship between soil drainage and BS and SAA sites is portrayed in Table 5.14. Although 73 percent of all sites are situated on well drained soils, only 50 percent of BS sites are on well drained soils. However, 83 percent of SAA sites are on well drained soils.

Table 5.14. Late Archaic Site Function by Soil Drainage.

Soil Drainage	BS	SAA	Total	Percent
Well	6	24	30	*73*
Poor	6	5	11	*27*
Total	12	29	41	
Percent	*29*	*71*		*100*

Another soil characteristic to explore is the relationship between fertility and site function (Table 15). Soils with good-to-high natural fertility include 14 (34 percent) of the 21 soils. However, approximately half of all Late Archaic sites are situated on soils with moderate fertility, including 67 percent of the base settlements. Only 22 percent of all sites are located on soils with high fertility with only one of these a BS site.

Table 5.15. Late Archaic Site Function and Soil Fertility.

Fertility	**BS**	**SAA**	**Total**	***Percent***
Low	2	4	6	*15*
Moderate	8	13	21	*51*
Good	1	4	5	*12*
High	1	8	9	*22*
Total	12	29	41	*100*

Key: BS=Base Settlement; SAA= Specialized Activity Areas

Just over half (56 percent) of all Late Archaic sites (excluding rock shelters) are situated on slopes that are nearly level (i.e., 0-2 percent slopes), including 83 percent of BS sites and 45 percent of the SAA sites (Table 5.16). Sites situated on slopes of 2-6 percent include 20 percent of the total.

Table 5.16. Late Archaic Site Function by Slope Percentage.

Slope (%)	**BS**	**SAA**	**Total**	***Percent***
0-2	10	13	23	*56*
2-6	2	6	8	*20*
6-12	0	7	7	*17*
12-25	0	2	2	*5*
20-40	0	1	1	*2*
Total	12	29	41	*100*

Key: BS=Base Settlement; SAA=Specialized Activity Areas

The distribution of vegetation at Late Archaic Sites across the sub-regions is indicated in Table 5.17. Upland woodlands comprise 37 percent of the vegetation at Late Archaic sites with 28 percent in oak savannah, 19 percent in prairie and 7 percent in floodplain forest. All of the upland woodland sites are located on ridges, slopes and rock shelters, while terraces host most oak savanna (67 percent) and prairie (63 percent) sites. Floodplain forest sites are situated on terraces (57 percent) and alluvial fans (43 percent)(Table 5.18). In Table 5.19, it is seen that BS sites are nearly evenly distributed across each vegetation type. Upland woodland vegetation dominates SAA sites with 45 percent.

Table 5.17. Late Archaic Site Vegetation by Sub-Region.

Sub-Region	**Prairie**	**Oak Savannah**	**Upland Woodland**	**Floodplain Forest**	**Total**	***Percent***
Gray Drift	0	3	0	0	3	*7*
Weathering Residuum	7	9	14	5	35	*81*
Mississippi Trench	1	0	2	2	5	*12*
Total	8	12	16	7	43	
Percent	*19*	*28*	*37*	*16*		*100*

Table 5.18. Late Archaic Site Landform by Vegetation.

Vegetation	**Ridge**	**Slope**	**Rock Shelter**	**Terrace**	**Alluvial Fan**	**Island**	**Total**	***Percent***
Prairie	2	1	0	5	0	0	8	*19*
Oak Savanna	1	2	0	8	0	1	12	*28*
Upland Woodland	9	5	2	0	0	0	16	*37*
Floodplain Forest	0	0	0	4	3	0	7	*16*
Total	12	8	2	17	3	1	43	
Percent	*28*	*19*	*5*	*39*	*7*	*2*		*100*

Table 5.19. Late Archaic Site Vegetation by Site Function.

Site Function	**Prairie**	**Oak Savannah**	**Upland Woodland**	**Floodplain Forest**	**Total**	***Percent***
BS	3	4	3	4	14	*33*
SAA	5	8	13	3	29	*67*
Total	8	12	16	7	43	
Percent	*19*	*28*	*37*	*16*		*100*

Key: BS=Base Settlement; SAA=Specialized Activity Areas

Topographic data include site elevation, slope and aspect. Site elevations conform to the overall elevation range for each sub-region and range from upland to floodplain settings. For example, the three sites in Dodge County on the western edge of the study area are around 1260 fasl in an area that has not been heavily dissected. In contrast, some sites along terraces of the Root River are at 780 fasl. Sites with the lowest elevation are at 680 fasl along the floodplain the Mississippi River. Because the region contains broad ranges in elevation from upland to low settings and a relatively small site sample, it did not prove useful to correlate settlement patterns with elevations over such a broad area.

The aspect, or which direction a site is situated by slope, for Late Archaic sites is dominated by western exposures (37 percent of all sites), including 48 percent of SAA sites. For BS sites, five sites have a southern exposure (36 percent)(Table 5.20).

Table 5.20. Late Archaic Site Aspect by Site Function.

Site Function	**North**	**East**	**South**	**West**	**Total**	***Percent***
BS	3	4	5	2	14	*33*
SAA	3	3	9	14	29	*67*
Total	6	7	14	16	43	
Percent	*14*	*16*	*33*	*37*		*100*

Key: BS=Base Settlement; SAA=Specialized Activity Areas

A total of eight (19 percent) Late Archaic sites have access to bedrock (i.e., outcrops, lag deposits) or where bedrock is in close proximity (< 200 m). Of these eight sites, five are SAA sites (63 percent) and three are BS sites (37 percent) (one site is a rock shelter presumably in limestone with unknown chert availability) (Table 5.21).

Table 5.21. Late Archaic Proximity to Bedrock by Site Function.

Site Function	**< 200 m**	**> 200 m**	**Total**	***Percent***
BS	3	11	14	*33*
SAA	5	24	29	*67*
Total	8	35	43	
Percent	*19*	*81*		*100*

Although the sites are situated on a number of different streams, they are all within the major watersheds of the Root, Zumbro and Mississippi rivers. The Root River watershed contains 70 percent (n=30) of the sites, followed by the Zumbro with 16 percent (n=7). The Mississippi River watershed only contains 14 percent of known Late Archaic sites (n=6)(Table 5.22).

Table 5.22. Late Archaic Watersheds by Site Function.

Site Function	**Root**	**Zumbro**	**Mississippi**	**Total**	***Percent***
BS	8	2	4	14	*33*
SAA	22	5	2	29	*67*
Total	30	7	6	43	
Percent	*70*	*16*	*14*		*100*

Early Woodland Site Distributions

From a total of 1298 recorded archaeological sites within the study region, 396 have been classified as Woodland age sites (31 percent). From this pool, 29 sites (seven percent) contain diagnostic artifacts or features that represent Early Woodland components (Table 5.23). A summary of the environmental characteristics of the Early Woodland sites is included in Appendix B.

Table 5.23. Total Number of Sites, Woodland Sites and Early Woodland Sites Identified in the Study Region.

County	All Sites*	Woodland	Early Woodland
Dodge	46	7	3
Fillmore	197	50	4
Goodhue	329	153	2
Houston	263	65	11
Mower	104	20	1
Olmsted	81	10	0
Wabasha	152	59	5
Winona	126	32	3
Total	*1298*	*396*	*29*

* As of September 2009

Early Woodland sites have been identified in all counties of the study region except for Olmsted. The distribution of Early Woodland sites by sub-regions is presented in Table 5.24 and illustrated in Figure 5.2.

Table 5.24. Total number of Early Woodland Sites by Sub-Region.

Sub-region	Number of sites	*Percent*
Gray Drift	3	*10*
Weathering Residuum	17	*59*
Mississippi Trench	9	*31*
Total	29	*100*

The Weathering Residuum Sub-region contains 59 percent (n=17) of known all Early Woodland sites, with the Mississippi Trench Sub-region accounting for 31 percent (n=9) and the Gray Drift Sub-region hosting three sites (10 percent) (Table 5.25). Four Early Woodland site types are present. Artifact scatters dominate the site types, with 18 (63 percent) represented, while ten (34 percent) are lithic scatters and one is a find spot (three percent).

Table 5.25. Early Woodland Site Types by Sub-Regions.

Sub-region	**Artifact Scatter**	**Lithic Scatter**	**Find Spot**	**Total Sites**	***Percent***
Gray Drift	2	1	0	3	*10*
Weathering Residuum	8	8	1	17	*59*
Mississippi Trench	8	1	0	9	*31*
Total	18	10	1	29	
Percent	*63*	*34*	*3*		*100*

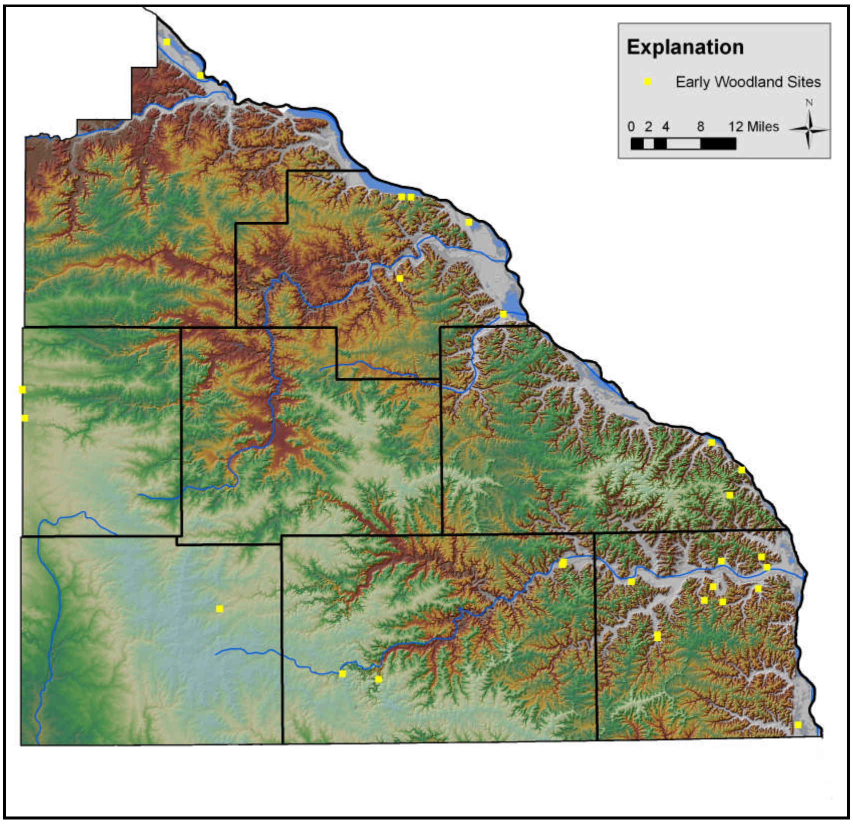

Figure 5.2. Early Woodland Site Locations (USGS 2002; SHPO/OSA Files).

Early Woodland site occur on ridges, slopes, rock shelters, terraces, alluvial fans, natural levees and an island (Table 5.26). No burial mounds associated with the Early Woodland have been definitively identified in the study area (Arzigian and Stevenson 2003). However, Early Woodland artifacts have been recovered in close proximity to mounds at three sites in the study region although the relationship between the mounds and the artifacts is not definitive. Of the total sites, 72 percent (n=21) are situated on lower landforms (i.e., terraces, alluvial fans, natural levees, island) whereas 28 percent (n=8) are on upland settings (i.e., ridges, slopes, rock shelters). Most of the sites on low landforms are terraces while most of the upland landforms are ridges.

Table 5.26. Early Woodland Landforms by Sub-Regions.

Sub-region	**Ridge**	**Slope**	**Rock Shelter**	**Terrace**	**Alluvial Fan**	**Natural Levee**	**Island**	**Total Sites**	***Percent***
Gray Drift	0	1	0	1	0	0	1	3	*10*
Weathering Residuum	5	0	1	9	1	1	0	17	*59*
Mississippi Trench	0	0	1	5	2	1	0	9	*31*
Total	5	1	2	15	3	2	1	29	
Percent	*17*	*3*	*7*	*52*	*11*	*7*	*3*		*100*

The distribution of Early Woodland site types across landforms is presented in Table 5.27. Lithic scatters are divided equally between lowland settings (terraces) and upland settings (ridge, slope). Eighty-nine percent of the artifact scatters are on lowlands settings (terraces, alluvial fans, natural levees, and an island).

Table 5.27. Early Woodland Landforms by Site Type.

Site Type	**Ridge**	**Slope**	**Rock Shelter**	**Terrace**	**Alluvial Fan**	**Natural Levee**	**Island**	**Total Sites**	***Percent***
Lithic Scatter	4	1	0	5	0	0	0	10	*34*
Artifact Scatter	0	0	2	10	3	2	1	18	*63*
Find Spot	1	0	0	0	0	0	0	1	*3*
Total	5	1	2	15	3	2	1	29	
Percent	*17*	*3*	*7*	*52*	*11*	*7*	*3*		*100*

Early Woodland site functions include BS sites (62 percent) and SAA sites (38 percent) (Table 5.28). Of the SAA sites, 55 percent (n=6) are situated on upland settings (ridges, slopes) while 45 percent (n=5) are located on low settings (terraces). BS sites overwhelmingly occur on low landforms (89 percent)(terraces (n=10), alluvial fans (n=3), natural levees (n=2) and an island (n=1). The only BS sites located in upland settings are in the two rock shelters (11 percent) (Table 5.29).

Table 5.28. Early Woodland Site Functions by Sub-Regions.

Sub-Regions	**Base Settlements (BS)**	**Specialized Activity Areas (SAA)**	**Total**	***Percent***
Gray Drift	2	1	3	*10*
Weathering Residuum	8	9	17	*59*
Mississippi Trench	8	1	9	*31*
Total	18	11	29	
Percent	62	38		100

Table 5.29. Early Woodland Landforms by Site Function.

Site Function	**Ridge**	**Slope**	**Rock Shelter**	**Terrace**	**Alluvial Fan**	**Natural Levee**	**Island**	**Total Sites**	***Percent***
BS	0	0	2	10	3	2	1	18	*62*
SAA	5	1	0	5	0	0	0	11	*38*
Total	5	1	2	15	3	2	1	29	
Percent	*17*	*3*	*7*	*52*	*11*	*7*	*3*		*100*

Early Woodland sites are situated on a total of 23 different soil types (Table 5.30). There are no soil classifications for the two rock-shelter sites and they are not included in the soils analysis. Of the 23 different soil types, silt loams are dominant, representing 74 percent (n=17) of all soil types where sites with Early Woodland components are situated. The basic characteristics for each soil type are presented in Table 5.31.

Table 5.30. Early Woodland Soil Types by Sub-Region.

Sub-Region	**Soil Types**
Gray Drift	Kasson, Sergeant
Weathering Residuum	Abscota, Arenzville, Blackhammer, Fayette, Festina, Littleton, Nodine Racine, Richwood, Seaton, Tell, Timula, Walford, Waukegan
Mississippi Trench	Bixby, Burkhardt, Chaseburg, Comfrey, Estherville, Flagler

Table 5.31. Early Woodland Site Soil Characteristics.

Soil Type	Slope (%)	Setting*	Texture	Drainage	Fertility	Vegetation
Abscota variant sand	2-6	Low-AF	Medium	Well	Poor	Floodplain forest
Arenzville silt loam	0-2	Low-F	Medium	Somewhat poor	Moderate	Floodplain forest
Bixby loam	0-6	Low-T	Medium	Well	Moderate	Floodplain forest
Blackhammer silt loam	3-6	Upland-R	Fine	Well	High	Upland woodland
Burkhardt loam	0-3	Low-T	Medium	Somewhat Excessive	Low	Prairie
Chaseburg silt loam	0-2	Low-AF	Medium	Well	Moderate	Floodplain forest
Comfrey silt loam	0-2	Low-NL	Medium	Poor	Moderate	Floodplain forest
Estherville loam	0-6	Low-I	Meduim	Excessive	Low	Prairie
Fayette silt loam	2-6	Upland-R	Medium	Well	High	Floodplain forest
Festina silt loam	0-2	Low-T	Medium	Well	Good	Oak savanna
Flagler sandy loam	0-2	Low-T	Medium-coarse	Excessive	Low	Prairie
Kasson silt loam	0-2	Upland-S	Course	Moderately well	Moderate	Oak savannah
Littleton silt loam	0-2	Low-T	Medium	Somewhat poor	Moderate	Prairie
Meridian sandy loam	2-6	Low-T	Medium	Well	Low	Oak savanna
Nodine silt loam	12-20	Upland-R	Medium	Well	Moderate	Upland woodland
Racine silt loam	0-2	Upland-R	Medium	Well	High	Oak savannah
Richwood silt loam	0-2	Low-T	Medium	Well	Good	Oak savanna
Sargent silt loam	0-2	Upland-S/I	Medium	Somewhat poor	Moderate	Oak savanna
Seaton silt loam	6-12	Upland-R	Medium	Well	Moderate	Upland woodland
Tell silt loam	0-2	Low-T	Medium	Well	High	Floodplain forest
Timula silt loam	20-40	Low-T	Medium	Well	Poor	Floodplain forest
Walford silt loam	0-1	Low-T	Medium	Poor	Moderate	Oak savanna
Waukegan silt loam	2-6	Low-T/L	Medium	Well	Good	Prairie

*T=Terrace; R=Ridge; S=Slope; F=Floodplain, AF=Alluvial Fan, I=Island, L=Levee

The distribution of soils by landform is presented in Table 5.32. From the 23 soils at Early Woodland sites, 21 (78 percent) are located on 18 different soil types on low landforms (i.e., terrace, alluvial fans, natural levees and an island). Five different soil types are represented in upland settings (ridge, slope), accounting for six sites (22 percent). Most of the soils host one site, although Chaseburg, Sargeant, Seaton and Waukegan each have two sites.

Table 5.32. Early Woodland Landforms by Soil Types.

Soil Type	Ridge	Slope	Terrace	Alluvial Fan	Natural Levee	Island	Total Sites	Percent
Abscota variant sand	0	0	0	1	0	0	1	4
Arenzville silt loam	0	0	1	0	0	0	1	4
Bixby loam	0	0	1	0	0	0	1	4
Blackhammer silt loam	1	0	0	0	0	0	1	4
Burkhardt loam	0	0	1	0	0	0	1	4
Chaseburg silt loam	0	0	0	2	0	0	2	6
Comfrey silt loam	0	0	0	0	1	0	1	4
Estherville loam	0	0	1	0	0	0	1	4
Fayette silt loam	0	0	1	0	0	0	1	4
Festina silt loam	0	0	1	0	0	0	1	4
Flagler sandy loam	0	0	1	0	0	0	1	4
Kasson silt loam	0	1	0	0	0	0	1	4
Littleton silt loam	0	0	1	0	0	0	1	4
Meridian sandy loam	0	0	1	0	0	0	1	4
Nodine silt loam	1	0	0	0	0	0	1	4
Racine silt loam	1	0	0	0	0	0	1	4
Richwood silt loam	0	0	1	0	0	0	1	4
Sargent silt loam	0	0	1	0	0	1	2	6
Seaton silt loam	2	0	0	0	0	0	2	6
Tell silt loam	0	0	1	0	0	0	1	4
Timula silt loam	0	0	1	0	0	0	1	4
Walford silt loam	0	0	1	0	0	0	1	4
Waukegan silt loam	0	0	1	0	1	0	2	6
Total	5	1	15	3	2	1	27	
Percent	*18*	*4*	*56*	*11*	*7*	*4*		*100*

The type of soils at BS and SAA sites are presented in Table 5.33. Three soil types-Chaseburg, Sargeant and Waukegan-each host two BS sites, with the remaining BS sites on separate soils. For SAA sites, most are situated on single soil types except for Seaton with two sites. No single soil type hosts a BS and an SAA site.

Table 5.33. Early Woodland Site Function by Soil Types.

Soil Type	BS	SAA	Total Sites	Percent
Abscota variant sand	1	0	1	4
Arenzville silt loam	1	0	1	4
Bixby loam	1	0	1	4
Blackhammer silt loam	0	1	1	4
Burkhardt loam	1	0	1	4
Chaseburg silt loam	2	0	2	6
Comfrey silt loam	1	0	1	4
Estherville loam	1	0	1	4
Fayette silt loam	1	0	1	4
Festina silt loam	0	1	1	4
Flagler sandy loam	0	1	1	4
Kasson silt loam	0	1	1	4
Littleton silt loam	1	0	1	4
Meridian sandy loam	1	0	1	4
Nodine silt loam	0	1	1	4
Racine silt loam	0	1	1	4
Richwood silt loam	1	0	1	4
Sargent silt loam	2	0	2	6
Seaton silt loam	0	2	2	6
Tell silt loam	0	1	1	4
Timula silt loam	0	1	1	4
Walford silt loam	0	1	1	4
Waukegan silt loam	2	0	2	6
Total	16	11	27	
Percent	*59*	*41*		*100*

Key: BS=Base Settlement; SAA= Specialized Activity Areas

The relationship between soil drainage and BS and SAA sites is portrayed in Table 5.34. Overall, 78 percent of all sites are situated on well drained soils. Sixty-nine percent of the BS sites and 91 percent of the SAA sites are on well drained soils.

Table 5.34. Early Woodland Site Function by Soil Drainage.

Soil Drainage	BS	SAA	Total	Percent
Well	11	10	21	*78*
Poor	5	1	6	*22*
Total	16	11	27	
Percent	*59*	*41*		*100*

The relationship between fertility and site function among Early Woodland sites is presented in Table 5.35. Of the 23 soils, 17 soils (74 percent) possess moderate to high natural fertility. A total of 21 Early Woodland sites (78 percent) are situated on these soils, including 12 (75 percent) of the BS sites and four (67 percent) of the SAA sites. While the fertility of soils supporting BS sites is appreciable, only one BS site is situated on a highly fertile soil while three SAA sites enjoy this soil characteristic.

Table 5.35. Early Woodland Site Function and Soil Fertility.

Fertility	**BS**	**SAA**	**Total**	***Percent***
Low	4	2	6	*22*
Moderate	8	5	13	*48*
Good	3	1	4	*15*
High	1	3	4	*15*
Total	16	11	27	*100*

Key: BS=Base Settlement; SAA= Specialized Activity Areas

Most (n=17/63 percent) of all Early Woodland sites (excluding rock-shelters) are situated on slopes that are nearly level (i.e., 0-2 percent slopes), including 69 percent (n=11) of BS sites and 55 percent (n=6) of the SAA sites (Table 5.36). Sites situated on slopes of 2-6 percent include 31 percent of the BS sites. Five SAA sites are on slopes greater than 2 percent.

Table 5.36. Early Woodland Sites Function by Slope Percentage

Slope (%)	**BS**	**SAA**	**Total**	***Percent***
0-2	11	6	17	*63*
2-6	5	1	6	*22*
6-12	0	2	2	*7*
12-20	0	1	1	*4*
20-40	0	1	1	*4*
Total	16	11	27	*100*

Key: BS=Base Settlement; SAA=Specialized Activity Areas

The distribution of vegetation at Early Woodland Sites across the sub-regions is indicated in Table 5.37. Vegetation at Early Woodland sites is more or less evenly distributed across the four communities, although floodplain forests hold a slight edge. Terraces host most of the floodplain forests (56 percent), oak savannas (63 percent) and prairies (83 percent). Most upland woodlands are on ridges (67 percent) (Table 5.38). Most BS sites are in floodplain vegetation (39 percent/n=7), followed by prairie and oak savanna. Only two BS sites (11 percent) are in upland woodlands. Oak savanna and upland woodlands each contain four SAA sites, with two SAA sites in floodplain forest and one in prairie (Table 5.39).

Table 5.37. Early Woodland Site Vegetation by Sub-Region.

Sub-Region	**Prairie**	**Oak Savannah**	**Upland Woodland**	**Floodplain Forest**	**Total**	***Percent***
Gray Drift	0	3	0	0	3	*10*
Weathering Residuum	3	4	5	5	17	*59*
Mississippi Trench	3	1	1	4	9	*31*
Total	6	8	6	9	29	
Percent	*21*	*27*	*21*	*31*		*100*

Table 5.38. Early Woodland Site Landform by Vegetation.

Vegetation	**Ridge**	**Slope**	**Rock Shelter**	**Terrace**	**Alluvial Fan**	**Natural Levee**	**Island**	**Total**	***Percent***
Prairie	0	0	0	5	0	1	0	6	*21*
Oak Savanna	1	1	0	5	0	0	1	8	*27*
Upland Woodland	4	0	2	0	0	0	0	6	*21*
Floodplain Forest	0	0	0	5	3	1	0	9	*31*
Total	5	1	2	15	3	2	1	29	
Percent	*17*	*3*	*7*	*52*	*11*	*7*	*3*		*100*

Table 5.39. Early Woodland Site Vegetation by Site Function.

Sub-Region	**Prairie**	**Oak Savannah**	**Upland Woodland**	**Floodplain Forest**	**Total**	***Percent***
BS	5	4	2	7	18	*62*
SAA	1	4	4	2	11	*38*
Total	6	8	6	9	29	
Percent	*21*	*27*	*21*	*31*		*100*

Topographic data include site elevation, slope and aspect. As previously mentioned, because the region contains broad ranges in elevation from upland to low settings and a relatively small site sample, it did not seem useful to correlate settlement patterns with elevations over such a broad area.

The aspect, or which direction a site is situated by slope, for Early Woodland sites is dominated by eastern exposures (41 percent of all sites), including 38 percent of BS sites. Forty-five percent of the SAA sites are situated on southern exposures (Table 5.40).

Table 5.40. Early Woodland Site Aspect by Site Function.

Site Function	North	East	South	West	Total
BS	5	7	4	2	18
SAA	1	3	5	2	11
Total	6	10	9	4	29
Percent	*21*	*34*	*31*	*14*	*100*

Key: BS=Base Settlement; SAA=Specialized Activity Areas

Three Early Woodland sites (10 percent) have access to bedrock (i.e., lag deposits, outcrops) or where bedrock is in close proximity (< 200 m) (Table 5.41). However, of these three sites, two are rock shelters. One rock shelter (21WN1) was positioned in sandstone, while the second rock shelter (21FL23) may be in dolostone. It is unknown if chert bearing veins are present. Both rock shelter sites are BS sites (11 percent) and the other site (21MW8) is an SAA site (quarry) (nine percent).

Table 5.41. Early Woodland Site Proximity to Bedrock by Site Function.

Site Function	< 200 m	> 200 m	Total	*Percent*
BS	2	16	18	*62*
SAA	1	10	11	*38*
Total	3	26	29	
Percent	*10*	*90*		*100*

Although the sites are situated on a number of different streams, they are all within the major watersheds of the Root, Zumbro and Mississippi rivers (Table 5.42). The Root River watershed contains 52 percent (n=15) of the sites, followed by the Mississippi with 34 percent (n=10) and the Zumbro with four sites (14 percent).

Table 5.42. Early Woodland Watersheds by Site Function.

Site Function	Root	Zumbro	Mississippi	Total	*Percent*
BS	8	2	8	18	*62*
SAA	7	2	2	11	*38*
Total	15	4	10	29	
Percent	*52*	*14*	*34*		*100*

SUBSISTENCE ANALYSIS

Subsistence patterns, the approach of sustaining life with food resources, includes the collecting, processing and consumption of food items and essential raw materials. Subsistence patterns are an integral aspect of human interactions with their natural and social environments and connect the natural environment, resource availability, technology and social complexity. In turn, subsistence patterns influence settlement patterns in a variety of ways, particularly through resource use scheduling (i.e., seasonality) and population levels. A variety of techniques may be employed to reconstruct subsistence practices, such as making ethnographic comparisons, collecting environmental data, examination of animal and plant remains, and analyzing human skeletal remains, artifacts, trade patterns and rock art.

Despite a long tradition of subsistence studies within archaeology as a whole (e.g., Trigger 1992), with the exception of research concerning subsistence of Oneota societies (e.g., Gibbon 1982), few investigations into subsistence patterns have been conducted within the study region. Notable exceptions to this pattern include Luken's (1963) inclusion of fauna remains from the La Moille and Tudahl rockshelter sites in an ethno-zoological study for greater Minnesota and Perkl's (2002) light treatment of subsistence remains from the King Coulee site. The lack of robust subsistence studies for the study region relates to the relative neglect of ante-Oneota research within southeastern Minnesota, as previously mentioned, and a general dearth of excavated and analyzed sites containing subsistence remains. However, a variety of sites await more detailed analysis or additional excavations, such as King Coulee, Dutchman Coulee, La Moille rock shelter, Rice Lake and other sites.

A number of sites in the study area where subsistence data have been recovered and grossly identified are able to provide a rough sketch of subsistence patterns for the Late Archaic and Early Woodland. The following examines the subsistence remains documented at Late Archaic and Early Woodland sites, outlines resource availability in the study region and presents a proxy for generalized Late Archaic and Early Woodland subsistence patterns.

Southeastern Minnesota Subsistence Data

Of the total 72 sites with Late Archaic and Early Woodland components identified within the study region, subsistence remains have been recorded for only 14 sites (19 percent) (Table 5.43; Figure 5.3).

Table 5.43. Late Archaic and Early Woodland Sites with Recorded Subsistence Remains.

Site	Components	Context of Subsistence Remains	Materials	Figure	Reference
21DO2	LA/EW	Unknown	Bone fragments	4.2	SHPO/OSA Files
21FL3	LA	Mixed throughout all levels	Mammal bone	4.3	Wilford 1937, Lukens 1963
21FL63	EW	EW	Animal bone, mussel shell	4.3	Peterson and Gonsior 1987
21FL64	EW	EW	Animal bone	4.3	Peterson and Gonsior 1987
21GD2	LA/EW	Unknown	Mammal, bird, fish, reptile, amphibian, mussel shell, nut shell, seeds	4.4	Johnson et al. 1969, Gibbon 1979
21HU35	LA/EW	Unknown	Animal bone, botanics	4.5	MHS 1981, Neuman 1984
21HU156	EW	EW	Mussel shell midden	4.5	SHPO/OSA Files
21HU167	EW	EW	Animal Bone	4.5	Tumberg and McFarlane 1998
21OL20	LA	Unknown	Animal bone	4.7	SHPO/OSA Files
21WB33	EW	Unknown	Mammal bone	4.8	SHPO/OSA Files
21WB55	LA/EW	LA/EW	Mammal and fish bone	4.8	Peterson et al. 1988
21WB56	LA/EW	LA/EW	Mammal, fish, reptile, bird bone, mussel shell, nut shell, seeds	4.8	Peterson et al. 1988, Perkl 1998, 2002
21WN1	LA/EW	Mixed throughout all levels	Animal bone, mussel shell	4.9	Wilford 1954, Lukens 1963
21WN15	LA	LA	Animal bone, mussel shell	4.9	Blue 1996, Evans 1961; Fiske and Hume 1963

LA= Late Archaic, EW=Early Woodland

In several cases it is difficult to determine exact proveniences of subsistence remains from the published data, although there is confidence that portions of the subsistence remains are associated with Late Archaic or Early Woodland occupations. This is especially apparent at 21FL3 (Tudahl rock shelter) and 21WN1 (La Moille rock shelter), where the stratigraphic positions of artifacts are generally recorded, such as “upper’ and “lower’ levels or ‘found everywhere' (Wilford 1937, 1954). In other cases an association with Late Archaic and Early Woodland horizons is strongly suggested, such as at 21WB55 (Dutchman Coulee). While subsistence remains are noted at other sites, it is not evident that they are associated with Late Archaic or Early Woodland components, such as at 21GD2 (Bartron), where there is a substantial Oneota occupation. In these situations, additional analysis or excavations may determine provenience of subsistence remains. Of the 14 sites, two have reliable provenience information: 21WB56 and 21WN15 (Evans 1961; Fiske and Hune 1963; Perkl 2002).

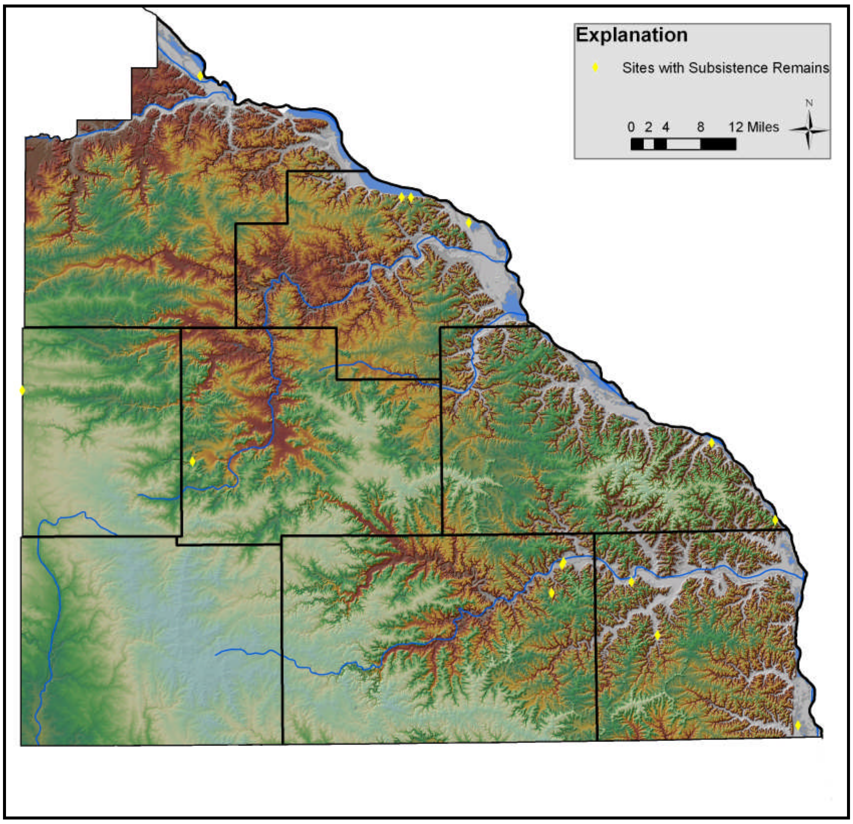

Figure 5.3. Sites in Study Region with Recorded Subsistence Remains (USGS 2002, SHPO/OSA Files).

Table 5.44 presents a list of identified subsistence remains for the above Late Archaic and Early Woodland sites. As mentioned above, caution is advised while examining the following table, as the context for many of the subsistence remains is in doubt at many of the sites (due to the excavation's focus on the extensive Oneota occupation at 21GD2, subsistence remains from this site are omitted).

Table 5.44. Identified Subsistence Remains at Sites with Late Archaic and Early Woodland Components within the Study Region.

Subsistence Remains (Common Name)	Sites	Subsistence Remains (Common Name)	Sites
Mammals		*Bird*	
Eastern Cottontail	21FL3	Raptor	21WN15
Plains Pocket Gopher	21FL3, 21WB56	Unidentified	21WB56
Beaver	21FL3, 21WB56, 21WN1, 21WN15	*Freshwater Mussels*	
Muskrat	21FL3, 21WB56, 21WN1	Pocketbook	21WN15
Raccoon	21FL3, 21WB56, 21WN1	Fat Mucket	21WN15
Woodchuck	21FL3, 21WB56, 21WN1	Giant Floater	21WN15
Badger	21FL3	Pimpleback	21WN15
Black Bear	21FL3, 21WB56	Pigtoe	21WN15
Canine species	21FL3, 21WB56, 21WN15	Spike	21WB56, 21HU156
Elk	21FL3, 21WB33, 21WB56	Three-ridge	21WB56
White-tailed Deer	21FL3, 21WB56, 21WN1, 21WN15	Ebony	21HU156
Mouse	21WB56, 21WN1	Mucket	21HU156
Skunk	21WB56	*Reptiles*	
Shrew	21WN1	Turtle	21WB56, 21WN1
Vole	21WN1	*Fish*	
		Unidentified	21WN1
Bat	21WN1	Drum	21WB56
Rabbit	21WN1	Pike	21WB56
Squirrel	21WN1	Sucker	21WB56
Lemming	21WN1	Catfish	21WB56
Mink	21WN1	Bullhead	21WB56
Otter	21WN1	*Nutshell*	
Lynx	21WN1	Acorn	21WB56
Fox	21WN1	Basswood	21WB56
Porcupine	21WN1	Butternut	21WB56
Seeds		Walnut	21WB56
Squash	21WB56	*Other*	
Wild Cucumber	21WB56	Amphibians	21WB56, 21WN1
Chenopodium	21HU35	Unidentified Animal	21DO2, 21DO7, 21FL63, 21FL64, 21HU35, 21HU167, 21OL20

Eighty-six percent of the sites with subsistence remains are BS sites. Fifty percent are on terraces and another four are on low landforms. Three sites (21 percent), the two rock-shelters and the cemetery (21WN15), are on upland landforms. Half of the sites have slopes of 0-2 percent, 27 percent have slopes from 2-6 percent and three have slopes greater than 6 percent (the two rock shelters and the cemetery). Thirty-seven percent of the sites are in floodplain forest, with prairie, oak savanna and upland woodlands each hosting three sites (21 percent). Where applicable, 75 percent are on well drained soils, 42 percent have moderate fertility, 33 percent have low fertility and 25 percent have good fertility (Table 5.45).

Table 5.45. Environmental Characteristics of Late Archaic and Early Woodland Sites with Subsistence Remains.

Site	Component	Function	Landform	Vegetation	Soil	Drainage	Fertility
21DO2	LA/EW	BS	Terrace	Oak savanna	Sargeant	Well	Low
21FL3	LA	BS	Rock shelter	Upland woodland	n/a	n/a	n/a
21FL63	EW	BS	Terrace	Prairie	Waukegan	Well	Good
21FL64	EW	BS	Terrace	Prairie	Waukegan	Well	Good
21GD2	LA/EW	BS	Terrace	Prairie	Burkhardt	Poor	Low
21HU35	LA/EW	BS	Terrace	Floodplain forest	Arenzville	Poor	Mod
21HU156	EW	BS	Natural levee	Floodplain forest	Comfrey	Poor	Mod
21HU167	EW	BS	Alluvial fan	Floodplain forest	Abscota	Well	Low
21OL20	LA	SAA	Terrace	Oak savanna	Richwood	Well	Good
21WB33	EW	BS	Terrace	Oak savanna	Meridian	Well	Low
21WB55	LA/EW	BS	Alluvial Fan	Floodplain forest	Chaseburg	Well	Mod
21WB56	LA/EW	BS	Alluvial Fan	Floodplain forest	Chaseburg	Well	Mod
21WN1	LA/EW	BS	Rock shelter	Upland woodland	n/a	n/a	n/a
21WN15	LA	SAA	Slope	Upland woodland	Seaton	Well	Mod

Given the available data, only a general representation of subsistence remains can be offered. Further, due to the relatively low sample size, comparisons between Late Archaic and Early Woodland subsistence patterns are tenuous. However, the presence of a variety of seasonally available upland and lowland food resources makes habitation within the study region attractive from spring through fall and likely over the winter months. The available subsistence information from the study area is biased toward lowland resources, most abundant during the warm months. For example, reptiles, many of the mammals (elk, deer, skunk and raccoon), fish and freshwater mussels are available during warmer months. In addition, edible plants are prevalent during warm periods. During the winter, a variety of mammals remain active, such as deer, elk and beaver. Winter occupation is also suggested by the presence of storage pits at several sites and the use of rock shelters. To enhance the available subsistence information, a brief review of resource availability and seasonality follows.

Resource Availability

Resource availability varies throughout the annual cycle across the study region in resource composition (e.g., aggregated and specialized forms in upland prairies and dispersed and varied forms in floodplain forests) and arrangement (e.g., upland vs. lowland flora and fauna). During the annual cycle, a number of "high-yield" resources become available that may be efficiently procured following the principle of least effort and a variety of exploitative strategies, such as generalized or selective resource seizing tactics (e.g., Binford 1980; Caldwell 1958; Pianka 1974; Struever 1968; Weins 1976; Zipf 1949).

A rich variety of flora, fauna, lithics, soils and other resources were present in the study region during the Late Archaic and Early Woodland periods. Four dominant vegetation communities exist within the study area: prairie, oak savanna, upland woodland and floodplain forest (Table 5.46). Prairie dominates vegetation within the Gray Drift sub-region, covering nearly 70 percent of the area, followed by oak savannah (ca. 20 percent) and upland woodland communities (ca. 10 percent), namely Big Woods taxa. In the Weathering Residuum sub-region, approximately 50 percent of the area is oak savanna, with prairie and upland woodlands each around 20 percent and approximately 10 percent floodplain forest along the Cannon, Zumbro, Whitewater and Root rivers. Approximately 50 percent of the Mississippi Trench sub-region is upland woodlands, approximately 30 percent is floodplain forest with oak savanna (ca. 20 percent) and prairie (ca. 10 percent) on prominent terraces. Lesser vegetation communities include wet prairie, goat prairie and other floristic systems, such as patches of pine, cedar and juniper and lichen dominated cliff flora (e.g., Tester 1995).

Table 5.46. Approximate Percentage of Dominant Vegetation Communities by Sub-Region.

Sub-Region	**Prairie**	**Oak Savanna**	**Upland Woodland**	**Floodplain Forest**
Gray Drift	70	20	10	-
Weathering Residuum	20	50	20	10
Mississippi Trench	10	20	50	30

Typically, as one moves east across the study region, ridge tops and south and west-facing slopes harbored prairie, while cooler and moister north and east-facing slopes supported stands of upland forest hardwoods. Wet prairies and wetlands, except along floodplains, are in general rare in the study area. Occasional wet prairies were located in the western portion of the study area, while wetlands were typically located adjacent to larger streams. However, it is important to note that patches of each of these major and minor biotic provinces are found in each of the sub-regions.

Tall-grass prairie was the dominant prairie form in the study area, although some variations existed, such as “goat prairies” located on some south-facing slopes near and along the Mississippi River. Representative tall-grass prairie plant species include big and little bluestem, Indian grass, sideoats gramma, leadplant, and coneflowers. A variety of edible tubers and greens would have been available. Common animal residents included bison, elk, deer, and a variety of smaller mammals (e.g., gophers, coyote), reptiles (e.g., turtles and snakes), and birds (e.g., raptors). A variety of fish species, amphibians and aquatic mammals (e.g., muskrat, beaver) would also have inhabited the streams and larger wetlands. Native Americans maintained prairies by periodic burning to increase forage for ungulates (e.g., deer and elk) (e.g., Curtis 1959). Prairie productivity is low although animal biomass is high.

Oak savannas consist of small and scattered deciduous tree communities (e.g., oak, basswood, ash, hickory and maple) and various shrubs (e.g., prickly-ash, wild plum, hazel, and dogwoods) with prairie beneath. In addition to edible tubers and greens, these settings offer a variety of fruits (e.g., berries) and mast bearing trees and shrubs (e.g., basswood and hazel). Accompanying the prairie flora is a variety of animals common to prairies and woodlands, such as deer, raccoon, squirrel, black bear, reptiles and birds (e.g., turkey). As in prairie settings, variety of fish species, amphibians and aquatic mammals (e.g., muskrat, beaver) would also have been present in the streams and larger wetlands. As with prairies, oak savannas were periodically burned (e.g., Curtis 1959). Here, productivity and animal biomass is moderate.

Upland woodlands include a mix of xeric and mesic trees and associated ground cover (e.g., prairie grasses) that is patchy to continuous. More common trees are oak, hickory and walnut. Other communities include aspen-oak, pine-oak, pine-cedar-juniper and maple forests to include Big Woods taxa. South-and-west facing slopes typically harbor more xeric species (e.g., oak) while north-and-east facing slopes contain mesic species (e.g., maple). Flora resources include edible tubers, mast products, fruits and greens. Fauna include a variety of small animals, deer, birds, reptiles and others. Productivity and animal biomass for this community is moderate.

Floodplain forests are dominated by various xeric and mesic deciduous hardwoods along floodplains and terraces. Common hardwoods include maple, birch, elm, cottonwood, ash, butternut, walnut and willow. Frequent flooding results in a sparse layer of shrubs in the floodplains. Other plants include a variety of herbaceous plants, such as nettle, various flowers and woody vines. A variety of edible plants were present, including tubers, shoots, and greens, fruits and nutmeats. Fauna enjoying the floodplain setting includes deer and smaller mammals (e.g., beaver, muskrat, squirrels, raccoon), a variety of birds (e.g., waterfowl), reptiles and amphibians. Fish, edible plants (e.g., arrowleaf tubers, wild rice) freshwater mussels and other creatures, such as crawfish were available in the streams, backwater lakes and ponds and wetlands. The floodplain ecotone is extremely productive. Although animal biomass is on the whole relatively small, aquatic biomass is generally high.

The diversified animal and plant resources provided various food products important to sustaining life as well as a source for other items necessary for comfort, technological competency and general life sustaining measures. For example, animals, fish and freshwater mussels provided bone, antler and shell tools, utensils, decorations and sinew and hides and other products. Wood was used to construct shelters, other structures, transportation contraptions, tools and tool components and other applications. Plant fibers were available for cordage and other goods, such as clothing and containers. Water for consumption, transportation and other uses was readily available.

Complementing the faunal and floral resources is a variety of productive soils across the study region suitable for planting or encouraging a variety of plants for consumption, such as squash and chenopodium. In addition, numerous floodplain locations harbor clay deposits, a key ingredient of ceramic vessels and other objects of pottery.

A variety of lithic raw materials were present for various functions ranging from boiling stones, hearth construction and the manufacture of chipped and ground stone tools and ornaments. Within the study area, five distinct chert sources occur in limestone bedrock formations and at least seven other chert types may be found in glacial drift.

The above examples, while far from exhaustive in the variety of non-food resources available and their applications, demonstrates that a wide range of resources necessary for virtually all aspects of human life was present in greater or lesser degrees across the study region. Access to and positioning at or near some of these non-food resources, such as certain chert quarries, undoubtedly was a factor for settlement and subsistence decisions by the Late Archaic and Early Woodland inhabitants within the study region.

Seasonality

During the spring, maple sap begins to flow, fish begin to spawn and migratory waterfowl, small and large mammals, reptiles and amphibians are all active. Although deer and elk are active, they are leanest at this time of year. Some tubers and greens are available in upland settings. This is also the time to sow seeds.

Summer brings a productive time, as variety of fruits and berries ripen in upland settings and other plants mature in lowland settings. A variety of animal resources are plentiful during this time, including fish, amphibians, reptiles, freshwater mussels, nesting waterfowl and other birds, small and large mammals and aquatic mammals. Some tending of sown plants and general management (e.g., deliberate burns) of plant resources (e.g., mast stands) is also likely to have occurred during this time.

The late summer and fall become the most productive season for upland and lowland settings. A variety of fruits, nuts and other ripened plants (e.g., squash, wild rice) are available for harvest. Fish, a variety of small mammals, reptiles, amphibians, migratory waterfowl and other birds are active. Freshwater mussel exploitation would peak during the low water season. Larger mammals, such as aggregating bison herds, could be exploited. Other mammals, attracted to mast and other plants, would be gaining weight and prime for consumption, such as deer, turkey and squirrel.

During the winter, few plant foods are available and unless stored, their significance diminishes. However a variety of large (e.g., deer) and small mammals (e.g., rabbit) remain active.

The upland and lowland settings contain a variety of food resources that are available year-round. Lowland (e.g., floodplains) resources are abundant during the warm weather season and peak during the fall. Upland setting resources climax during the fall. However, the diversity and quantities vary among these habitats on a seasonal basis. In response to these seasonal variations, efficient collection of food resources involved scheduling activities that maximized the greatest return following the principles of least effort. In turn, activity scheduling influenced where base settlements and specialized activity areas were located.

From the combined record of subsistence remains and the availability and seasonality of resources across the study region, it is evident that Late Archaic and Early Woodland societies in the study region utilized a variety of upland and lowland flora and fauna resources through the entire seasonal round. While there is little robust data to compare Late Archaic and Early Woodland subsistence patterns and to determine if differences are present, one site-21WB56 (King Coulee)-contains subsistence information with good stratigraphic control.

King Coulee Archaeological Data as a Proxy for Generalized Late Archaic and Early Woodland Subsistence Patterns

At the King Coulee site (21WB56), extensive Late Archaic and Early Woodland materials were encountered (Peterson et al. 1988; Perkl 2002). Allbeit one site, it has the most complete subsistence information excavated so far in the study region. Therefore, information from the site may serve as a proxy for a generalized subsistence pattern for the Late Archaic and Early Woodland. It is recognized that the information has limited utility and that there are no upland sites to compare it with.

The stratigraphic relationships of Late Archaic and Early Woodland components from Test Units 1 and 2, which include a portion of a mussel shell midden, allow for an examination of the difference between subsistence remains among the two groups. Table 5.47 is a compilation of flora and fauna materials, where the Late Archaic deposits are ca. 110-145 cm levels and Early Woodland ca. 70-110 cm levels. Excavated sediments were water-screened through ¼-inch hardware cloth. The totals are number of identified specimens (NISP). From this data, Late Archaic subsistence remains indicate that mammals (e.g., deer, gopher) and fish are near equally represented and some freshwater mussels are present. Reptiles include turtle and botanics include unidentified seeds and nuts. During the Early Woodland, upland resources (e.g., deer, gopher) are present although fish use intensifies along with the use of other lowland species (e.g., muskrat, beaver) and mussels. Reptiles include turtles; botanics include walnut and unidentified seeds and nuts.

Table 5.47. Compilation of Late Archaic and Early Woodland Subsistence Remains at King Coulee (21WB56).

Component	**Mammal**	**Reptile**	**Bird**	**Fish**	**Mussel Shell**	**Botanic**	***Total***
Late Archaic	137	29	3	186	23	17	*395*
Early Woodland	70	43	25	429	105	32	*704*

The subsistence data at King Coulee, and by proxy within the study region, suggest that Late Archaic groups utilized a more or less balanced admixture of upland and lowland resources. During the Early Woodland, a shift to more lowland resources is evident. This circumstance aligns with information from other parts of the Midwest, particularly where Early Woodland peoples concentrate on lowland (e.g., floodplain) resources (e.g., Arzigian 1987; Benn 1980; Farnswoth and Emerson 1986; Stoltman 1986b; Theler 1987, 2000; Theler and Boszhardt 2003). Although tenuously supported, this proxy can serve as a guide for survey strategies and as a target for testing.

Chapter 6
Conclusions

The following provides a synopsis of the environmental, cultural, and archaeological record, explores relationships between site and environmental information, and touches on social characteristics that may have influenced Late Archaic and Early Woodland societies within the study region. It reviews previous models of Late Archaic to Early Woodland culture change and offers a preliminary model for the Late Archaic-Early Woodland transition in southeastern Minnesota. Finally, some thoughts for future research are provided.

Environment

The eight counties of southeastern Minnesota included in the study region host a diverse mosaic of geography, plants and animals. The study region is segregated into three sub-regions in order to most effectively describe the diversity and inter-regional differences. The Gray Drift Sub-region, encompassing approximately 30 percent of the region, is characterized by low relief dominated by tall-grass prairie. The Weathering Residuum Sub-region, which includes 60 percent of the region, contains undulating to deeply dissected terrain on which oak savanna is prevalent. The Mississippi Trench Sub-region makes up ten percent of the region. It is distinguished by diverse floodplain landforms (e.g., terraces, alluvial fans) and a mixture of deciduous forests. Major animal resources include elk for the Gray Drift, deer for the Weathering Residuum and fish for the Mississippi Trench sub-regions. Each sub-region contains varying amounts of the major vegetative communities (i.e., prairie, oak savanna, upland woodlands and floodplain forest), a variety of lesser plant communities (e.g., wet prairies), and other resources (e.g., cherts for chipped-stone tool manufacture).

The paleoclimate for the study period includes the later portion of the Sub-Boreal III and Sub-Atlantic episodes. The constructed MCM indicates that overall conditions were slightly warmer (0.1-1.2ºC/32.1-34.1ºF) and drier (an average of approximately four percent less annual precipitation) compared with modern conditions. Summers were warmer and winters colder with most precipitation occurring during the summer with Septembers the wettest month on average. These changes, and other events, contributed to a dramatic increase in flooding after ca. 3,300 BP and the establishment of oak savanna by ca. 3,000 BP. Flooding likely prompted geomorphic activity, introducing localized and periodic floodplain instability (e.g., channel migration, fan growth, natural levee construction), while rejuvenating floodplain habitats and increasing productivity. Meanwhile, the establishment of oak savanna offered a blend of prairie and woodland edge habitat conducive for thriving deer populations (i.e., acorn mast). It was periodically burned by the human inhabitants to increase forage (e.g. Curtis 1959).

Culture History

While southeastern Minnesota has enjoyed a long history of archaeological research, few studies have focused on Archaic and Woodland components. This lack of attention has resulted in a perceived knowledge deficit concerning the Late Archaic and Early Woodland periods, leaving some researchers wondering how manifestations of these groups fit into more well known cultures in the state and the Midwest in general. However, other researchers have observed similarities between the Archaic and Woodland signatures in the study region with the contemporary cultural record of northeastern Iowa, southwestern Wisconsin and other portions of the Eastern Woodlands. Information presented here affirms similarities in the cultural record of adjacent regions and conforms with a cultural sequence analogous to the Upper Mississippi River (see Table 3.1).

Traditional taxonomy separates the Late Archaic from the Early Woodland using a tripartite criterion wherein the defining characteristics of the Woodland are the use of domesticated plants, ceramics and mound burials. While generally true, each of these elements was incorporated into Late Archaic lifeways in several areas of the upper Midwest. However, currently there is only evidence for domesticated plant use by Late Archaic groups in the study region. Early Woodland societies in the study region used ceramics, although it is uncertain if they constructed burial mounds or used domesticated plants. Based on the evidence from the study region and elsewhere, application of the traditional tripartite scheme should not be used for definitive determinations, although it may provide a general measure of distinction.

Principal diagnostic artifacts for the Late Archaic include side-notched (e.g., Raddatz) and expanding stemmed (e.g., Durst) projectile points. Late Archaic communities followed a diversified subsistence pattern where they used upland and lowland resources in near equal amounts, engaged in long-distance and extra-regional trade and participated in pan-regional ceremonialism (i.e., Old Copper and Red Ochre complexes). A greater number of sites, situated nearly equally between upland and lowland landforms, suggest that increased populations were mobile to semi-sedentary, somewhat territorial and had an egalitarian social structure.

Diagnostic items for the Early Woodland include straight (e.g., Kramer) and contracting stemmed (e.g., Waubesa) projectile points, and ceramics (e.g., La Moille Thick, Prairie wares). A diversified subsistence pattern focused on floodplain resources. Communities were engaged in extra-regional trade and pan-regional ceremonialism (i.e., Red Ochre complex). Although sites are fewer, they suggest a population decline or at least congregation in lowland areas. Peoples are thought to be semi-sedentary to sedentary, more territorial and non-egalitarian.

Archaeological Record

Of the 1298 archaeological sites have been recorded in the study region, 1005 contain precontact components (SHPO files 2009). Of these, 67 sites (seven percent) are listed as "Archaic" and 43 of these (64 percent) contain Late Archaic components (see Figure 5.1). A total of 396 sites (39 percent) are recorded as "Woodland" with 29 sites (seven percent) containing Early Woodland components (see Figure 5.2). Seventeen sites (two percent) contain both Late Archaic and Early Woodland components (Figure 5.3). Thus, while the combined Late Archaic and Early Woodland sites include 72 sites, the research pool contains a total of 55 sites (Table 6.1, Figure 4.1). Cultural and environmental data for the combined Late Archaic and Early Woodland sites is presented in Appendix A and B.

Table 6.1. Distribution of Late Archaic and Early Woodland Sites, Sites with Both Late Archaic and Early Woodland Components and Total Number of Sites in Research Pool, by County, within the Study Region.

County	**Late Archaic**	**Early Woodland**	**Sites with both Late Archaic and Early Woodland Components**	**Total Sites in Research Pool**
Dodge	3	3	3	3
Fillmore	8	4	1	11
Goodhue	2	2	1	3
Houston	18	11	8	21
Mower	2	1	1	2
Olmsted	4	0	0	4
Wabasha	3	5	2	6
Winona	3	3	1	5
Total	*43*	*29*	*17*	*55*

* As of September 2009

Late Archaic sites account for four percent and Early Woodland sites comprise three percent of the identified precontact sites within the study region. While it is fairly common for temporal indicators not to be present or recovered, a variety of factors account for the relatively few sites with Late Archaic and Early Woodland signatures. Some factors include: limited survey coverage (i.e., large areas remain un-surveyed); variable field methods (e.g., surface reconnaissance, limited test unit excavations, and few deep site testing projects); inaccurate analysis (e.g., not recognizing/misidentifying diagnostic materials); funding constraints (e.g., no budget for radiocarbon dating or more detailed studies); adherence to accepted theoretical constructs (e.g., initial/terminal Woodland, Archaic tradition does not include ceramics, domesticated plants or burial mounds); and cultural differences in settlement patterns (e.g., larger and less numerous sites, variable rates for discarding materials), subsistence patterns (e.g., use of nets and traps rather than spearing) and technological patterns (continual use of projectile points through time). For these and other reasons, the archaeological record may be skewed, yet there also appears to be a decline in sites from the Late Archaic to Early Woodland times in the study region. Similar trends are observed in other portions of the Eastern Woodlands (e.g., Fiedel 2001; Kidder 2006; Klinger 1978). The continuous occupation of 17 (31 percent of sites in the research pool) where both Late Archaic and Early Woodland materials are present suggests important/productive resources were on hand or nearby that may reflect similar subsistence strategies, a measure of territorialism and key congregating areas to facilitate trade, ceremonies and other sociocultural functions.

Relationships

The following presents relationships and trends of Late Archaic and Early Woodland site distributions to elucidate settlement and subsistence patterns. The data below stem from information presented in Chapter 5.

Coarse Site Distributions

Figure 6.1 provides the total number of Late Archaic and Early Woodland sites by sub-regions. The Gray Drift Sub-region contains six percent, the Weathering Residuum Sub-region contains 76 percent, and the Mississippi Trench Sub-region contains 18 percent of identified Late Archaic and Early Woodland sites. Site distributions across the sub-regions may reflect variable levels of research (e.g., survey coverage and methods) conducted across the study region and other factors mentioned above rather than choices by Late Archaic and Early Woodland groups.

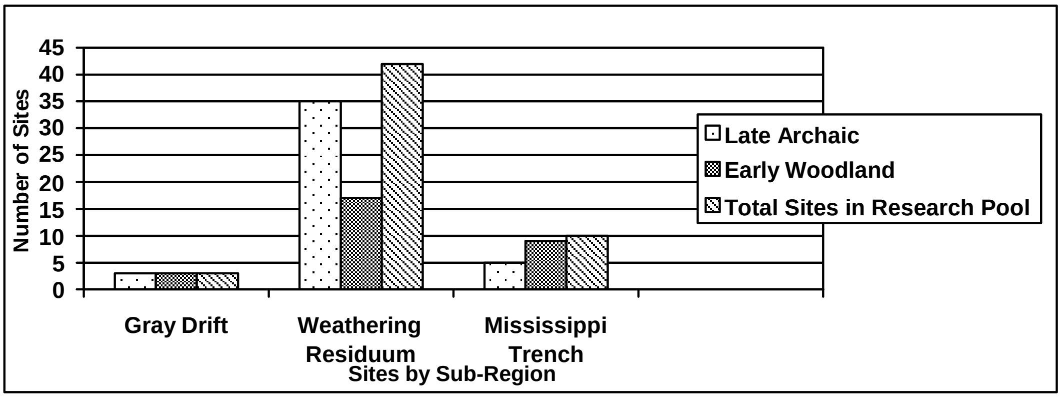

Figure 6.1. Total Number of Sites by Sub-Regions.

Conversely, while these data should be viewed with caution, the distributions across the sub-regions may indicate broad trends in landscape use and availability of important resources. For example, encompassing 30 percent of the study region, the expected number of sites in the Gray Drift Sub-region is 16.5, yet only three sites are identified. For the Weathering Residuum Sub-region, making up 60 percent of the study region, 33 sites are expected and 42 are present. The Mississippi Trench Sub-region includes ten percent of the study region and contains ten sites while only 5.5 are expected.

The expression of variable survey coverage may also be represented in Figure 6.2 showing site distributions by major watersheds. For example, the Root River has been subjected to several surveys, unlike the Cannon, Zumbro and Whitewater rivers that have similar characteristics as the Root River in certain stretches.

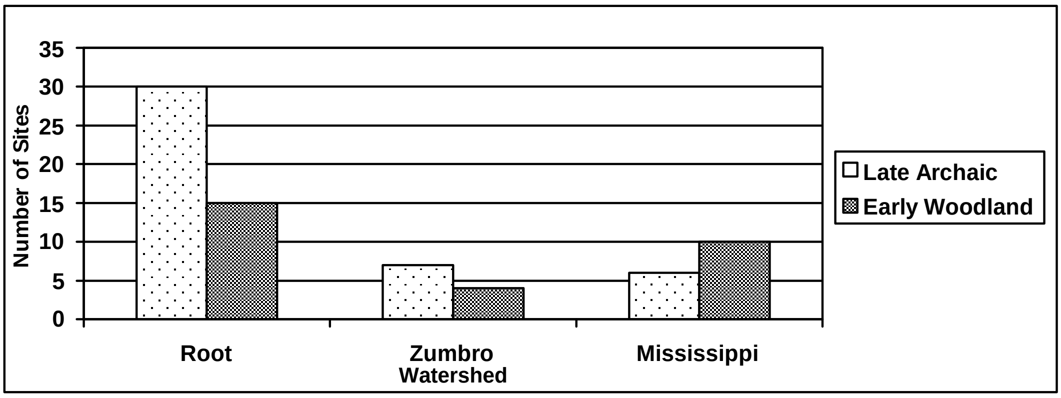

Figure 6.2. Late Archaic and Early Woodland Sites by Major Watersheds.

Site Types and Functions

Most Late Archaic sites are lithic scatters (54 percent), while most Early Woodland sites are artifact scatters (63 percent) (Figure 6.3). The distribution of site types also correlates with trends in the distribution of site functions that are interpreted as Specialized Activity Areas (SAA) or Base Settlements (BS) (Figure 6.4). Sixty-seven percent of Late Archaic sites are SAA sites, while 62 percent of Early Woodland sites are BS sites. This indicates that more Early Woodland sites contain a greater variety of materials, were more intensively used (e.g., domestic activities/habitation) and used for longer durations at certain sites pointing to a less mobile society.

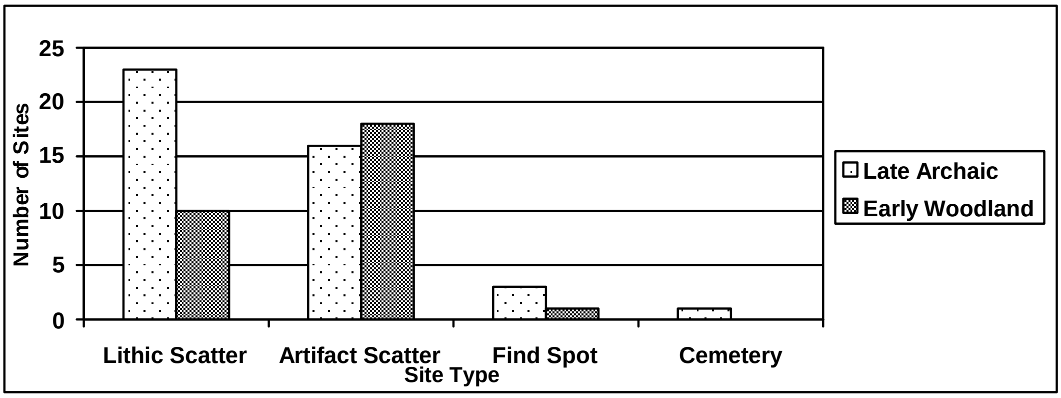

Figure 6.3. Late Archaic and Early Woodland Site Types.

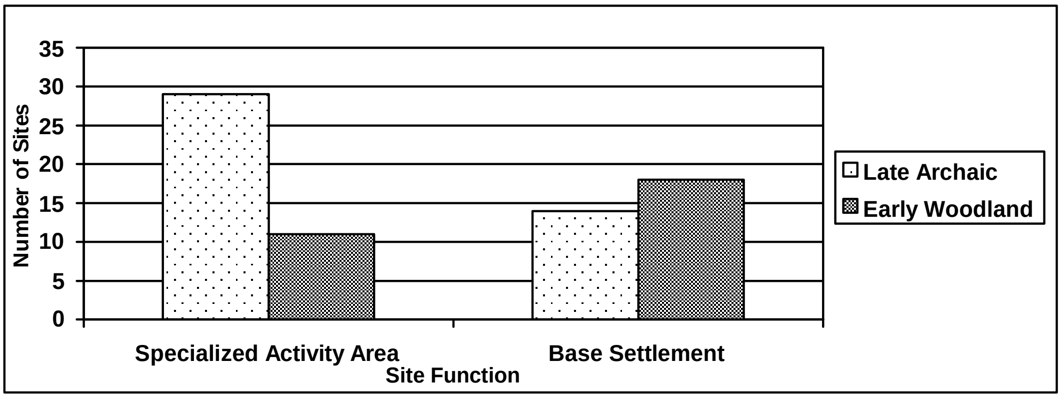

Figure 6.4. Late Archaic and Early Woodland Site Functions.

Landforms

The overall comparison between Late Archaic and Early Woodland site locations by landform is presented in Figure 6.5. Forty percent of Late Archaic sites and 52 percent of Early Woodland sites are situated on terraces. However, 51 percent of Late Archaic sites are situated on upland landforms (e.g., ridges, slopes, rock shelters) whereas 72 percent of Early Woodland sites are located on low landforms (e.g., terraces, alluvial fans, natural levees, island) (Figure 6.6).

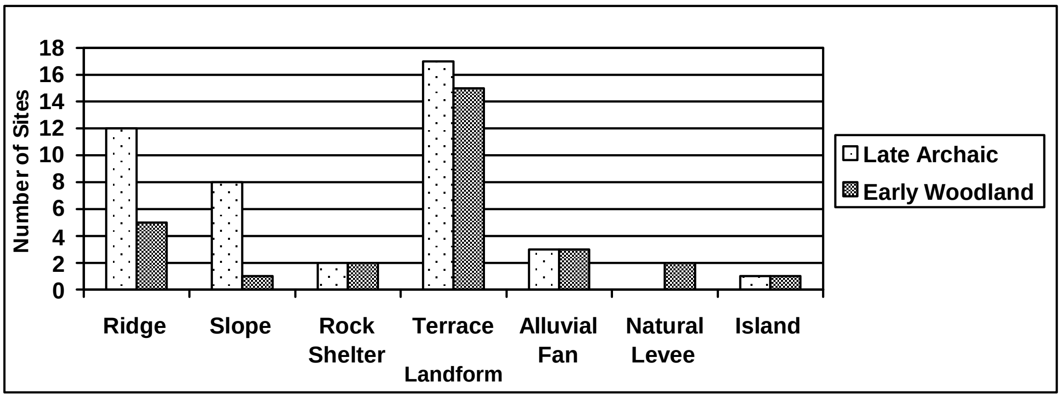

Figure 6.5. Late Archaic and Early Woodland Landforms.

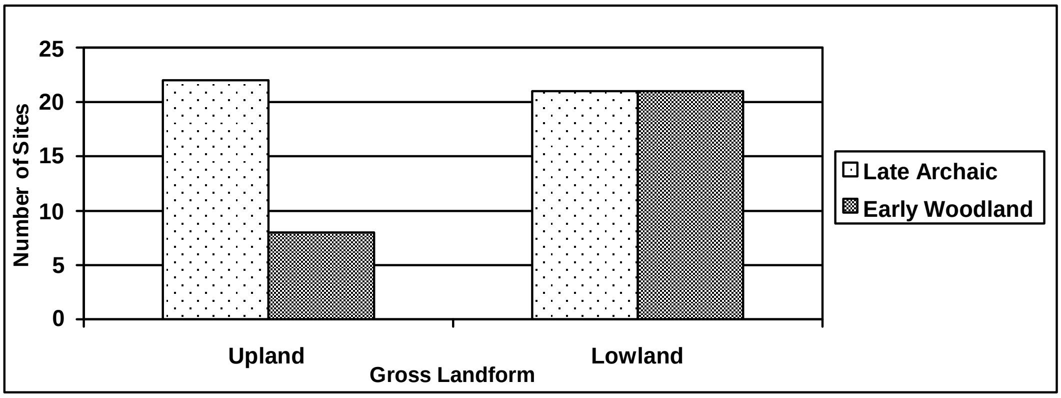

Figure 6.6. Late Archaic and Early Woodland Gross Landforms.

To further illustrate these relationships and trends, Figure 6.7 depicts Late Archaic and Early Woodland BS and SAA sites across landforms. The overall distribution of site locations on gross landforms suggests that Late Archaic groups were utilizing the landscape and resources in a more equal fashion. Conversely, as most Early Woodland sites are situated on lowlands, a marked shift in landscape and resource use occurred, with a focus by Early Woodland groups on lowland resources. For example, with the exception of rockshelters, all of the Early Woodland BS sites are on low landforms with terraces prevalent. While 40 percent of Late Archaic sites are also on terraces, only seven sites (41 percent) are BS sites. For the Early Woodland, ten BS sites (67 percent) are on terraces. These results align with other portions of the upper Midwest, specifically along the Mississippi River where Late Archaic sites are located in near equal balance among upland and lowland landforms whereas Early Woodland sites are concentrated in lowland settings (e.g., Bettis et al. 2008; Munson 1986; Stoltman 1986; Theler 1987, Theler and Boszhardt 2003, 2006).

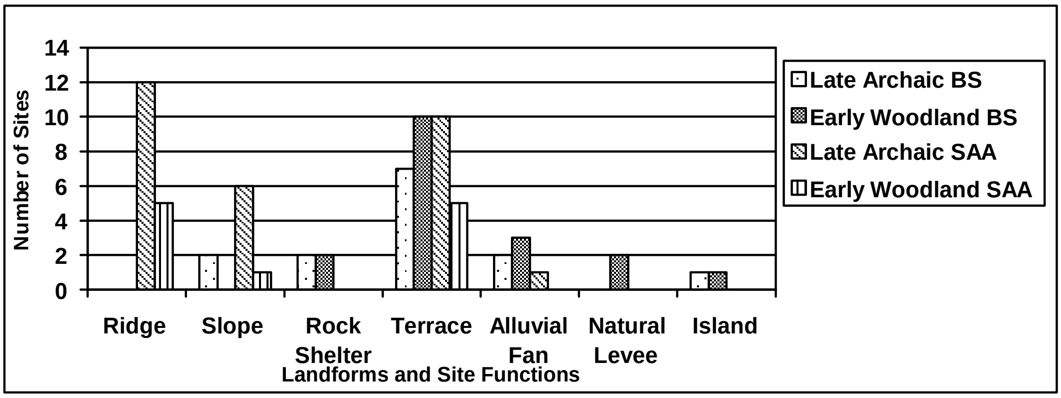

Figure 6.7. Late Archaic and Early Woodland Landforms and Site Functions.

Site locations in respect to aspect are presented in Figure 6.8. The direction that a site faces has implications for exposure to the sun and warmth. Seventy percent of the Late Archaic sites and 45 percent of Early Woodland sites have southern and western exposures where the benefits of sun exposure are most pronounced, especially in the colder months. These results imply that Late Archaic groups took greater advantage of exposure, especially at SAA sites that may have been open-air transient camps. Conversely, exposure does not appear as great a concern for Early Woodland groups, perhaps a result of more permanent habitations and other factors, such as positioning behind windbreaks, and access to resources. In addition, for both groups, socio-cultural constraints may be at work, such as territory claims and clan preferences or restrictions.

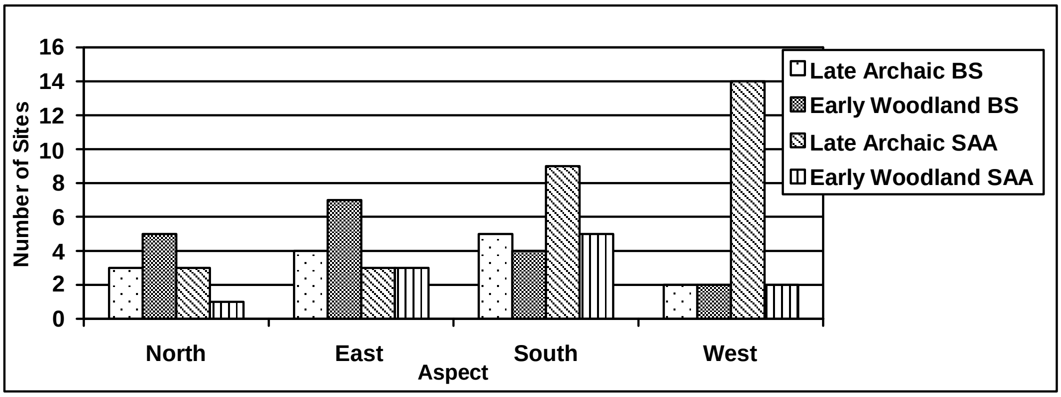

Figure 6.8. Late Archaic and Early Woodland Aspect.

For both Late Archaic and Early Woodland groups, positioning sites in close proximity to bedrock (i.e., less than 200 m) does not appear to be a major criteria with 19 percent (n=8) of Late Archaic sites and ten percent (n=3) of Early Woodland sites located in close proximity to bedrock (Figure 6.9). This is not surprising as bedrock exposure and chert-bearing veins are readily available for most of the study region with the exception of the Gray Drift Sub-region. Some of the sites near bedrock are quarries (SAA sites) and rock shelters (BS sites).

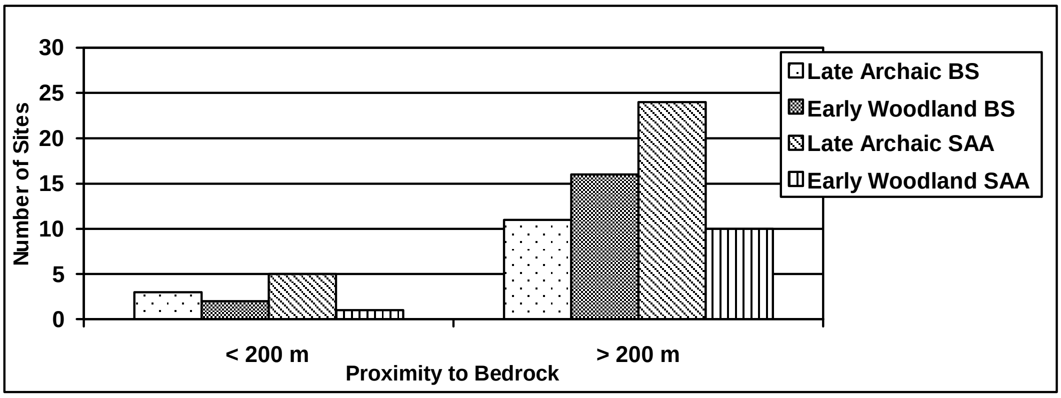

Figure 6.9. Late Archaic and Early Woodland Proximity to Bedrock.

Soils

Across the study region, silt loams are the dominant soil texture (69 percent). These include a total of 111 unique silt loams defined and named (soil series) across the eight counties that increase in extent to the east and south (e.g., Goodhue County contains 68 percent silt loam soils while Houston County contains 83 percent silt loam soils). Eighty-six percent of Late Archaic sites are situated on 18 different silt loam soils. Seventy-six percent of Early Woodland sites are situated on 17 different silt loam soils. Figure 6.10 depicts the soil textures by component.

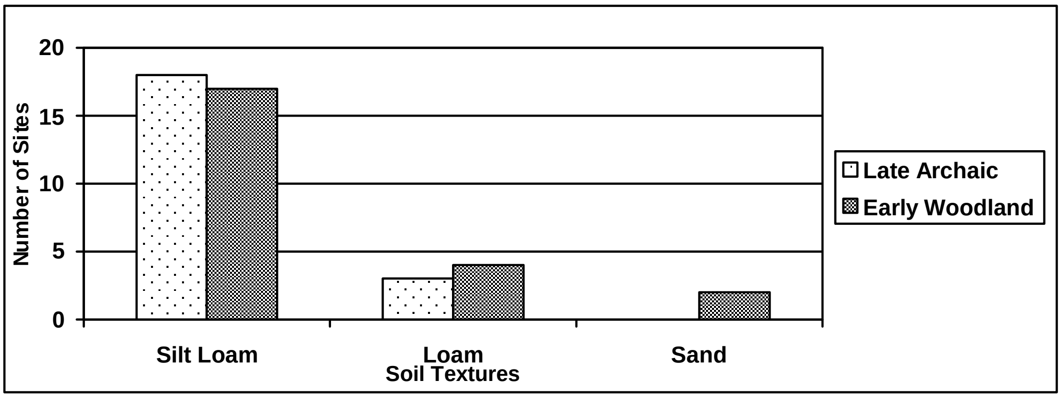

Figure 6.10. Late Archaic and Early Woodland Soil Textures.

Despite a high proportion of silt loam soils, a statistical correlation can be demonstrated. A one-sample chi-squared test of the distribution of Late Archaic sites on the 18 silt loam soils is 119.62, with a probability that this distribution is due to chance of $\alpha = 0.001$ (119.62 > 40.79) with 17 degrees of freedom. A one-sample chi-squared test of the distribution of Early Woodland sites on the 17 silt loam soils is 76.59, with a probability that this distribution is due to chance of $\alpha = 0.001$ (76.59 > 39.25) with 16 degrees of freedom. From these data, it appears that Late Archaic and Early Woodland groups preferred to conduct activities and live on silt loam soils.

Another aspect of soils is their natural drainage (Figure 6.11). Well drained soils would be suitable for year-round occupation. Late Archaic BS sites are equally located on well (n=6) and poorly (n=6) drained soils, although 24 SAA sites (83 percent) are on well drained soils. Most of the Early Woodland BS (n=11/69 percent) and SAA (n=10/91 percent) sites are on well drained soils. The occurrence of sites on poorly drained soils likely reflects seasonal occupation when these areas are not saturated or inundated during the late summer, fall and winter. That most Early Woodland BS sites are on well drained soils suggests more permanent occupations during this period.

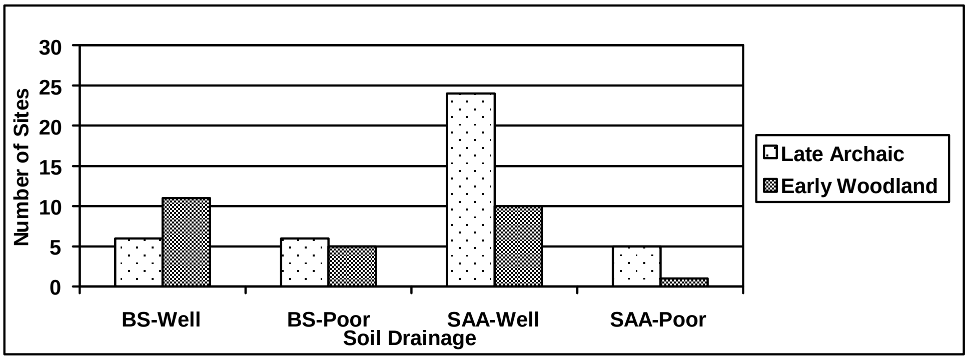

Figure 6.11. Late Archaic and Early Woodland Soil Drainage.

Soils with low to moderate natural soil fertility host 83 percent (n=10) of BS sites and 59 percent of SAA (n=17) sites for the Late Archaic and for the Early Woodland support 75 percent (n=12) of BS sites and 64 percent of SAA (n=7) sites (Figure 6.12). Relatively few Late Archaic (n=2/17 percent) and Early Woodland (n=4/25 percent) BS sites and less than half of the Late Archaic (n=12/41 percent) and Early Woodland (n=4/36 percent) SAA sites are situated on soils with good to high natural soil fertility. Although the natural fertility for silt loams range from low to high, sites located on other than silt loams (e.g., loam, sand) have only low to moderate natural fertility. While the natural fertility of a site's soils appear to be a factor in selecting site locations, a site's position and nearby areas with higher fertility values are suitable for sustaining certain plants (e.g., mast bearing trees, domesticates) and supporting various fauna. Consequently, positioning site areas away from locations with higher natural soil fertility would tend to preserve productive resource zones. The trend of locating a site where soils other than good to high are present appears to be a strategy adopted by both groups, although it is more prevalent during Early Woodland times.

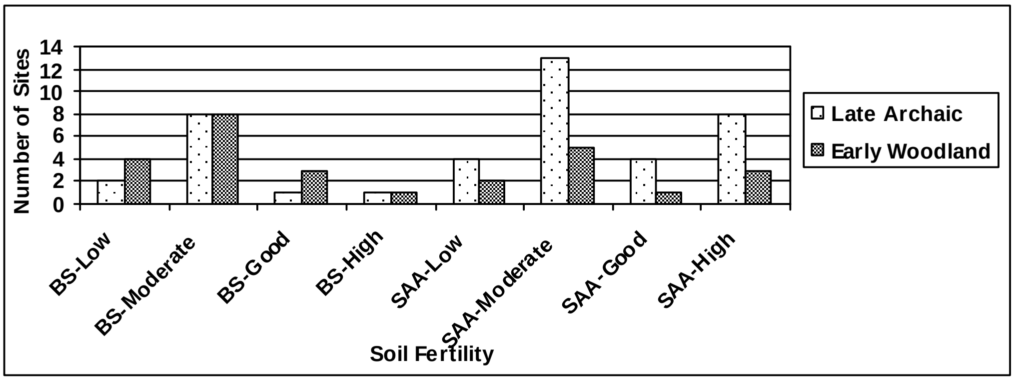

Figure 6.12. Late Archaic and Early Woodland Natural Soil Fertility.

Sites located on nearly level (0-3 percent) to gently sloping (1-8 percent) ground are suitable for various domestic and social activities, such as hide preparation, cooking, ceremonies, placement of living structures and sleeping that would be anticipated at BS sites. All of the Late Archaic and Early Woodland BS sites and 67 percent of Late Archaic and 64 percent of Early Woodland SAA sites have slopes form 0-6 percent (Figure 6.13). Sites with slopes greater than six percent (strongly sloping to steep) constitute SAA sites where resource extraction pursuits occurred that do not require more level surfaces (e.g., hunting).

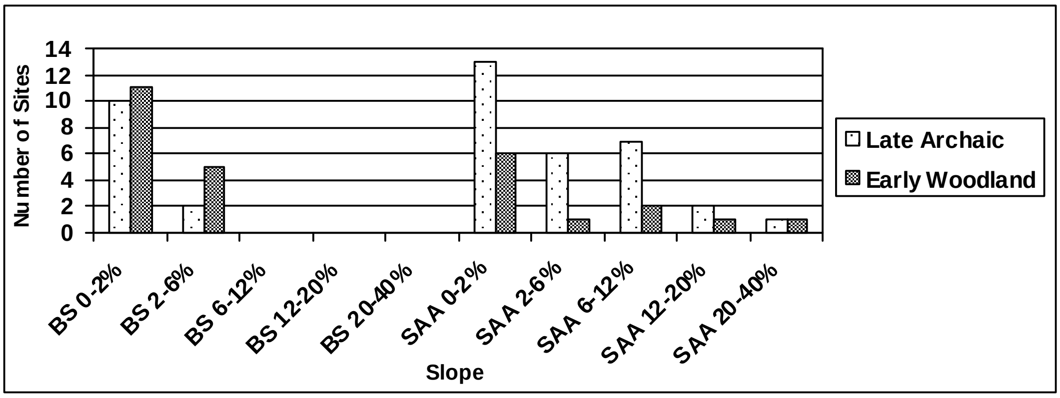

Figure 6.13. Late Archaic and Early Woodland Slope Gradient.

Vegetation

The distribution of vegetation at Late Archaic and Early Woodland sites is presented in Figure 6.14. Sites situated among prairie and oak savanna are nearly equal between both groups, with 47 percent of Late Archaic and 48 percent of Early Woodland sites located in these habitats. The major difference lies in 37 percent (n=16) of Late Archaic sites located in upland woodland (21 percent/n=6) of Early Woodland sites) and 31 percent (n=9) of Early Woodland sites located in floodplain forest (16 percent/n=7) Late Archaic sites) habitats. It appears that Late Archaic groups concentrated activities among oak savanna and upland woodland areas, whereas Early Woodland groups focused activities in oak savanna and floodplain forest areas. In general, these results reinforce conclusions that Late Archaic groups were more dispersed across the landscape and the Early Woodland groups were focusing on floodplain resources.

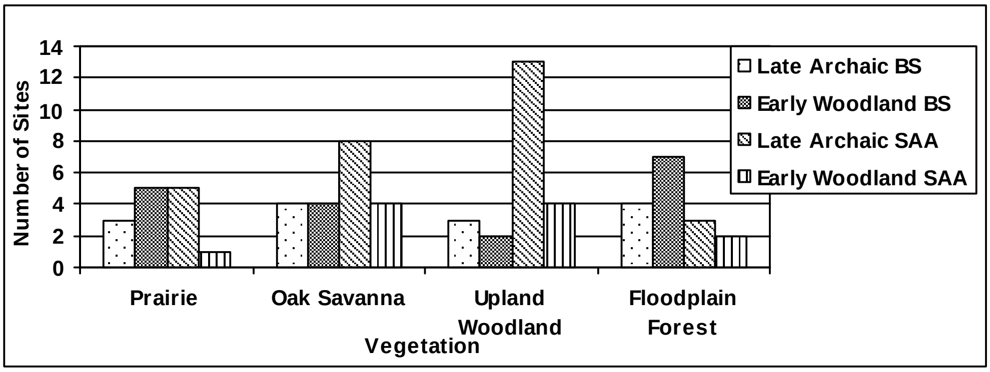

Figure 6.14. Late Archaic and Early Woodland Vegetation.

Subsistence Patterns

The archaeological record for Late Archaic and Early Woodland societies in the study region offers little subsistence information, with only 14 (19 percent) sites containing such information. Of this, even fewer sites afford substantial information. However, from a review of the natural environment of the study region, a wide variety of food resources would have been available. Some resources would be available throughout the year (e.g., deer) and others available seasonally (various plants). Available evidence indicates that Late Archaic and Early Woodland groups exploited resources from Spring through Fall. The general pattern for Late Archaic societies points to a more balanced use of upland (e.g., mammals) and lowland (e.g., fish) resources. During the Early Woodland a shift to the use of more lowland resources is apparent. The King Coulee site exemplifies this (Figure 6.15).

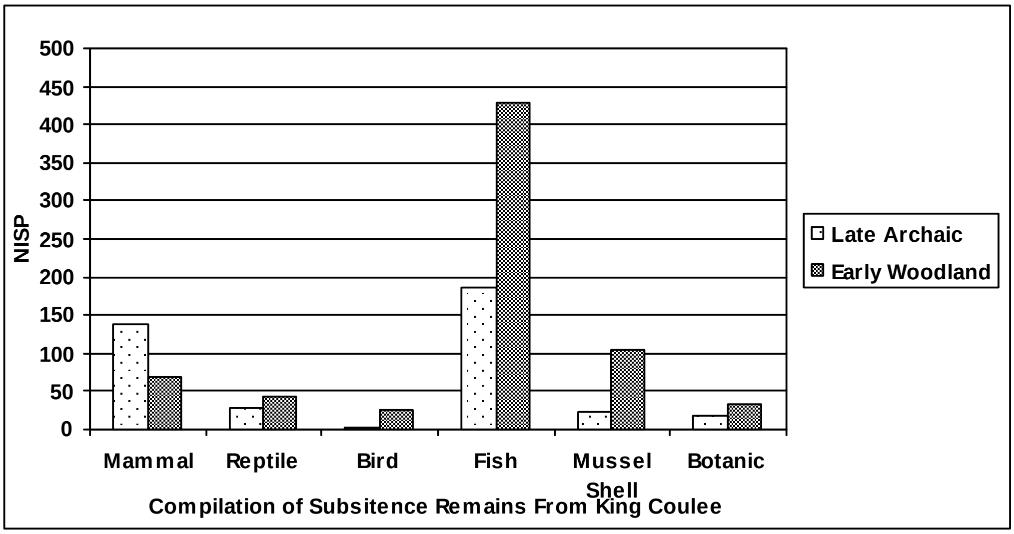

Figure 6.15. Compilation of Late Archaic and Early Woodland Subsistence Remains at King Coulee (21WB56).

Socio-Cultural Considerations

As environmental characteristics perceived by archaeologists constitute a set of determinants, so too are a myriad of social factors that influence settlement and subsistence patterns. Human social systems strongly influence patterning and variability in the archaeological record (e.g., Binford 1972; Hodder 1991; Renfrew 1984). Changes in social behavior affect material culture and have been described by Schiffer (e.g., 1987) as ‘c-transforms.’ The social environment in relation to settlement patterns is typically examined in terms of resource spaces (e.g., subsistence strategies) and a series of social constraints (e.g., Butzer 1993). Some key social factors include perception, technology, social organization, and complexity. However, many aspects of cultural change are largely intangible, such as ideological constructs (e.g., Hawkes 1954). Other important factors influencing culture change include population, territoriality, trade and exchange. The following is intended to briefly introduce some of the important social factors that may have been at work during the Late Archaic-Early Woodland transition in southeastern Minnesota.

Socioecological Models

Settlement location, function and seasonal use are determined in part by hypothesizing that subsistence strategies presume activities are carried out at locations designed to minimize effort (energy) to complete specific tasks following combinations of "the principles of least effort" (Zipf 1949), "the law of minimum effort" (Lösch 1954) and the "minimax model" (Plog and Hill 1971). Following traditional criteria, Late Archaic societies may be envisioned as primarily following a gathering-fishing-hunting (GFH) subsistence strategy. Early Woodland societies more likely practiced an agriculture-gathering-fishing-hunting (AGFH) subsistence strategy. However, based on information from the study region and adjacent regions, both Late Archaic and Early Woodland societies incorporated a gathering-fishing-hunting-agriculture (GFHA) subsistence regime. Each strategy likely shifted in various proportions in response to resource availability, effort and other constraints (e.g., territorial access) at various times throughout the season or for longer durations.

The functions of sites following variants of a GFHA subsistence pattern include base camps (e.g., habitation sites) to include family and village settlements (e.g., artifact scatters) and specialized activity areas (e.g., lithic scatters and cemeteries). Theoretically, a specific range of artifacts should accompany each site type. For example, ceramics would not necessarily be expected at specialized activity sites, such as lithic procurement sites (e.g., quarries). Typically, the range of artifacts often overlaps with each site type and this factor should not be construed to indicate one subsistence strategy over another.

Base camps and specialized use areas may be permanently or seasonally occupied. In addition, several sites contain multicomponents and undoubtedly were occupied over long time periods. Similarly, base camps may mask sites that were initially specialized use areas. Further, archaeological investigations, which typically examine only small portions of sites, may derive different functions for sites due to a lack of comprehensive site information.

Social complexity

A variety of terms have been used to define social complexity, such as segregation, centralization, heterogeneity and inequality (e.g., Flannery 1972; McGuire 1983). Here, social complexity is defined as the interrelation of many parts, or factors, resulting in an increase in differentiation and specialization among societies (e.g., Service 1978). In general, a common assumption explaining change in human societies is derived from a reaction to stress, with the path of least resistance followed to resolve stress (e.g., Flannery 1972). For example, many of the elements of social complexity arise from the intensification of a variety of interconnected factors, such as resource availability, sedentism, technological changes, population changes, territoriality, exchange systems and status differentiation (e.g., Price and Brown 1985).

The behavioral framework of social complexity has traditionally been derived from anthropological models that draw heavily on ethnographic studies that have hampered efforts to identify social complexity in precontact societies (e.g., Price and Brown 1985). For example, a common presumption is that humans have undergone a series of evolutionary changes reflected in technological and social stages progressing from simple to complex (e.g., Fried 1967; Service 1971). The general conceptual scheme is based on a four-stage system of bands, tribes, chiefdoms, and states combined with a degree of hierarchy classified as egalitarian, ranked or stratified. However, few models exist for societies in transition from bands to tribes, although Hayden (1995) has conceptualized a transegalitarian model based on the development of political leaders known as "aggrandizers." Here, three evolutionary stages that increase in complexity begin with Despot Communities followed by Reciprocator Communities and end with Entrepreneur Communities. The Late Archaic may correlates with Despot Communities while the Early Woodland may be seen as Reciprocator Communities.

It may be useful to describe the process of social complexity along three major themes that examine conditions, consequences and causes (Price and Brown 1985). Conditions that foster complexity include circumscription, abundant resources and higher populations. Consequences include decisions focused on productivity, settlement and authority. Causes are varied and typically include environmental, demographic and social factors.

Implicit in the Late Archaic-Early Woodland is a transition from band to tribal social organization. Late Archaic societies are typically envisioned as having been organized into egalitarian bands based on cooperative hunting and gathering. Bands are conceptualized as consisting of extended families (e.g., less than 100 individuals) with a fluid and achieved leadership. Settlement patterns are envisioned as consisting of small, temporary and seasonal encampments situated around key resources over relatively broad areas. Early Woodland societies, by virtue of an implied reliance on agriculture, are typically seen as tribes with ranked hierarchy and may include a few thousand individuals. Leadership in tribal societies would have been obtained through economic competition enhanced by the accumulation of surplus which would garner prestige through exchange networks. Tribal societies would have followed subsistence patterns based on agriculture and supplemented by hunting and gathering. Settlement would have been in politically linked sedentary or semisedentary villages situated near key resources (e.g., Service 1962).

Results of this research generally are consistent with the above hypothetical cases. For example, Late Archaic sites are more equally distributed across the landscape (near equal use of upland and lowland areas) and greater SAA sites suggest greater mobility and organized in egalitarian bands. Fewer Early Woodland sites exist in the study region, are concentrated on low landforms (i.e., floodplains) and have more BS sites suggesting semi-sedentary villages organized in proto-tribes. One difference is that Late Archaic groups utilized domesticated crops.

Population

Population levels potentially influence settlement patterns in a manner similar to environmental and other sociological factors. In effect, all of the determinants of settlement patterns affect one another in a more or less symbiotic fashion. Because of numerous intangible variables, such as cultural ideologies, fluctuations in biophysical productivity and an incomplete archaeological record, absolute population levels of Late Archaic and Early Woodland societies in southeastern Minnesota cannot be estimated with the current data.

Several techniques have been proposed to derive approximate population levels for various archaeological cultures. For example, mathematical formulas for rates of midden formation, living space for individuals and families, how many people may populate households and estimates of food consumption based on faunal and floral remains have been attempted with various degrees of success (e.g., Fagan 1988). However, few attempts (none rigorous) to actually calculate population levels have been undertaken in the study region or surrounding area for the time period under scrutiny. South of the study region, populations stabilized by the Late Archaic and were at equilibrium throughout the Middle Woodland (e.g., Lewis 1983). Woodland population levels in Iowa have been described as “moderate but dispersed” (Logan 1976).

Farther south along the lower Illinois River/American Bottom area, Early Woodland populations were lower than during both the Late Archaic and Middle Woodland (e.g., Asch et al. 1979; Evans et al. 2000). Outside of these sites, there are few excavated archaeological features (e.g., house floors), subsistence remains, mortuary data or other data available for the study area from which to draw somewhat more definitive population data.

Despite the absence of definitive population data, a general trend of increasing population is evident during the Late Archaic period across the Eastern Woodlands (e.g., Brown and Vierra 1983; Fagan 1991; Price and Brown 1985). Late Archaic population growth is implied by the number of Late Archaic sites identified in the study region. The increase in population may be attributed to a variety of factors, including abundant resources, more sedentism that allows for greater surplus, and other factors (e.g., social organization and technological developments). In turn, increased populations (e.g., packing threshold) may have resulted in stress (e.g., over-hunting, reduced resources) on traditional subsistence strategies, forcing changes to these strategies (e.g., "starvation food," increased specialization), reduced mobility and increased conflict that influenced settlement patterns (e.g., Binford 2001, Theler and Boszhardt 2006).

During the Woodland period, the rate of population growth across the Eastern Woodlands was further accelerated (e.g., Fagan 1991). However, the record for Early Woodland population growth is somewhat cloudy. In general, Early Woodland sites are rare across the upper Midwest region (e.g., Evans and Evans 2000; Lewis 1986). The Early Woodland data available for the study region are in line with a decreased Early Woodland population. Several explanations may account for this phenomenon. For example, the Early Woodland has a relatively brief duration compared with the Late Archaic and Middle Woodland, "diagnostic" traces may not be broad enough, and the adoption of new technologies/ideology may be time-lagged with other regions of the Upper Midwest. Also, if subsistence resources declined and a compensating shift was long to develop, it is conceivable populations would have starved, migrated, had reduced births or committed infanticide, etc. Conversely, if groups successfully broadened resource procurement, overall populations may not have declined and may be masked by congregated settlements.

Despite insufficient data to assess Late Archaic and Early Woodland population levels, Binford's (2001) population packing model may offer a tended appraisal. At a packing threshold of 9.1 persons per 100 km^2, the eight-county study region (13,287 km^2) would have supported a population of approximately 1,209 people during the Late Archaic. The Late Archaic population may have reached this packing threshold by approximately 2,400 BP. Under this scenario, Late Archaic groups may have organized into five bands claiming the major river valleys (i.e., Cannon, Zumbro, Whitewater, Upper Cedar and Root). For the Early Woodland, while an initial decline in population may have occurred, increased specialization on aquatic foods (e.g., mussels) and perhaps reliance on domesticated crops may have increased population again. Coupled with storage techniques (e.g., ceramics) and other changes wherein people congregate in localized areas with constricted territories, any increase in population may be masked by a decrease in the number of sites. Here, perhaps proto-tribes emerged in the study region.

Territoriality

The emergence of territoriality, or the tendency to occupy exclusive areas, can be traced to the Middle Archaic with the appearance of formal cemeteries in prominent locations (e.g., placed on bluffs overlooking major sites). It is believed that formal cemeteries coincided with the availability of abundant and diverse resources that led to a more sedentary mode of subsistence and corporate behavior, the passing of resources through kin organizations, where groups of individuals are autonomous with their resource environment (e.g., Charles and Buikstra 1983; Williams 1974).

Corporate behavior may be interpreted as a form of territorial behavior that evolves from resources occurring in fixed and predictable areas where groups focus their activities. Rights-of-use and control of resources may have been legitimized through religion and rituals, that would have culminated in the establishment of permanent burial areas for specific kin groups located on land controlled by the group. Thus, there is a relationship between cemeteries and resource catchment areas, or territories (e.g., Charles and Buikstra 1983).

The pattern of creating formal cemeteries in prominent locations continues through the Late Archaic and persists through the Woodland Period. It may be an example of a permanent territorial marker (e.g., Charles and Buikstra 1983; Fagan 1991). Other territorial markers may be indicated in projectile point styles, the form and decoration of ceramic wares, rock art and other media.

There is little evidence denoting specific territorial boundaries in the study region. Only one cemetery, the Late Archaic Voight Site (21WN15), has been identified. No Early Woodland burials are definitively recorded within the study region (Arzigian and Stevenson 2003). Furthermore, the projectile points and ceramics found are likely technologies that various groups adopted through interaction with the inhabitants of adjacent regions, rather than indicators of their own groups. However, the lack of clear evidence does not preclude the possibility that specific groups may have established territorial attachments to particular portions of the study region, such as along segments of river valleys through various behaviors that may not be archaeologically detected. In a broader context, the groups occupying the study region appear to represent the northwest extremity for many of the diagnostic objects in use, such as Durst and Waubesa point types and Marion and Prairie Phase ceramics.

Competition for resources may have resulted in conflict to various extents. Boundary maintenance is a common cause for conflict and warfare among complex hunter-gathers (e.g., Ember 1978). Currently, there is no clear evidence for conflict during the Late Archaic and Early Woodland in the study region. Mortuary evidence from the Voight Site does not indicate a traumatic end for the mostly adolescent and young adult individuals exhumed (Fiske and Hume 1963; Blue 1996). However, there is evidence for traumatic ends for several Late Archaic individuals at the Price III site near the mouth of the Wisconsin River with the Mississippi River and at the Convent Knoll site near Milwaukee (Freeman 1966; Theler and Boszhardt 2003).

Trade and Exchange

Trade connections and exchange systems affect social organization and may influence settlement decisions as well as subsistence strategies (e.g., Fagan 1991). Trade occurs when people desire goods and services not available within their catchment area. The exchange system incorporates the relationships and interactions between goods, services, ideas and people. Exchange may take many forms through internal and external operations, such as bartering, communal hunts, ceremonies and social alliances. Through time, exchange systems tend to transform social organization and contribute to the development of more complex societies (e.g., Price and Brown 1985). For example, exchange systems create occasions for the process of social differentiation, such as reciprocity and debt (e.g., Bender 1985). The establishment of regular exchange networks involving goods coincides with the exchange of information and ideas (e.g., Flannery

1972). Thus, archaeological materials believed to be the result of trade imply information networks.

Perhaps the most visible archaeological evidence for trade and exchange appears with the recovery of exotic materials. Although procurement of exotic items may be through a group's annual movement across the landscape or from specific expeditions organized to obtain such items, it seems likely that at least some of the exotic materials present at sites within the study region were exchanged.

A wide variety of exotic items, in finished or raw forms, originating from various regions across North America appear at archaeological sites throughout the upper Midwest (e.g., Birmingham et al. 1997). A greater degree of trade and exchange coincided with increasing societal complexity during the Late Archaic. During the Early Woodland, this process may have intensified (e.g., Fagan 1991).

A variety of non-local and exotic items are present at Late Archaic and Early Woodland sites across the study region (Figure 6.16). The most common exotic artifacts within the region include chipped-stone raw materials. In addition, some copper is present and some ceramics may have originated outside of the region, although no trace element studies have been conducted. For example, lithic debitage and tools made from Knife River Flint (west central North Dakota), orthoquartzites (west central Wisconsin), Jasper Taconite (northern Minnesota) have been recovered from Late Archaic sites (e.g., Perkl 2002). Materials from central Iowa (Burlington Chert) and Texas (Alibates Chert) occur in Late Archaic sites in the greater region. Adena point types manufactured from Obsidian (e.g., Wyoming) and Hornstone (southern Indiana/western Kentucky), as well as Knife River Flint and orthoquartzite tools and debitage have been recovered at several Early Woodland sites, such as at the Ludwig Cache (21WN49). In addition, a piece of unworked copper (Lake Superior region) and an Adena type point manufactured from Obsidian were reportedly recovered from the Voight cemetery prior to professional excavation (Fiske and Hume 1963). Elsewhere, within the Mississippi River floodplain near Prairie du Chien, Wisconsin and just south of the study region, obsidian from Obsidian Cliff in Yellowstone National Park (Wyoming) was recovered in Early Woodland contexts (Stoltman and Hughes 2004). However, there appears to be differences in raw materials for utilitarian chipped-stone tools. Late Archaic groups used local cherts (e.g., Prairie du Chien) and non-local material (e.g., orthoquartzite) is common. Early Woodland chipped-stone tools tend to be manufactured from local sources. This implies a reduction in extra-regional trade and territorial constraints for Early Woodland groups (e.g., Perkl 2002; Theler and Boszhardt 2003).

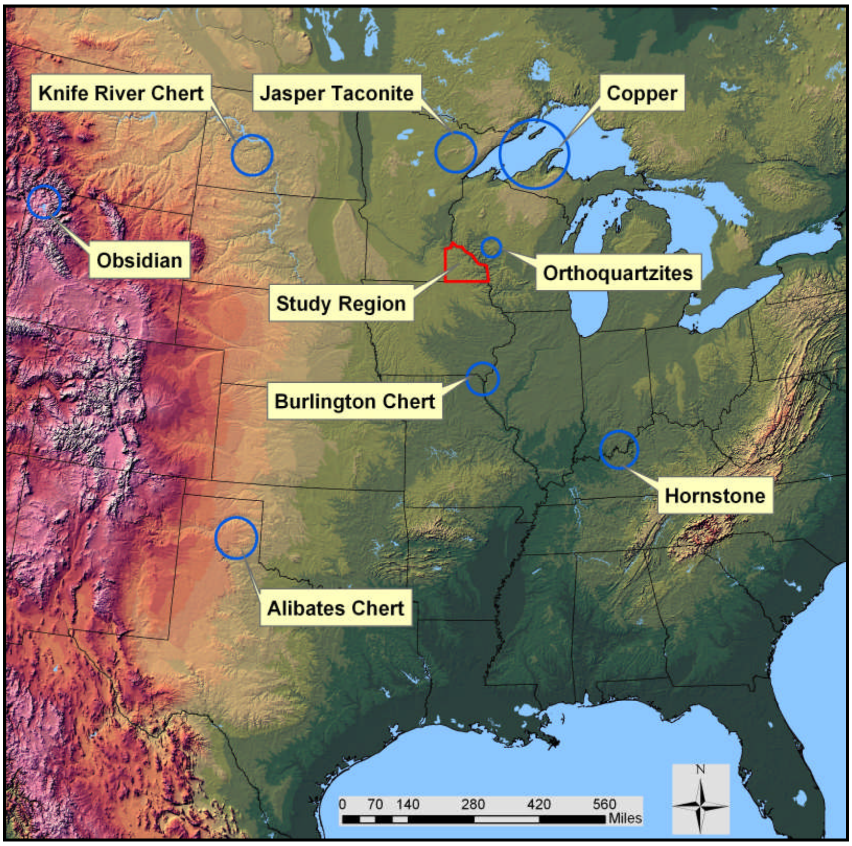

Figure 6.16. Source Areas of Exotic and Non-Local Materials (USGS 2002).

The effects of trade and exchange systems on the settlement patterns for the Late Archaic and Early Woodland within the study region appear to have correlates to social organization, settlement location and subsistence practices. The 17 sites (31 percent of the total sites in the research pool) with both Late Archaic and Early Woodland materials were likely repeatedly visited by both groups (Figure 6.17). These sites may have been coveted locations that facilitated control of the flow of goods, services and ideas, such as places for ceremonies, rituals and “rendezvous” as well as rich resource zones.

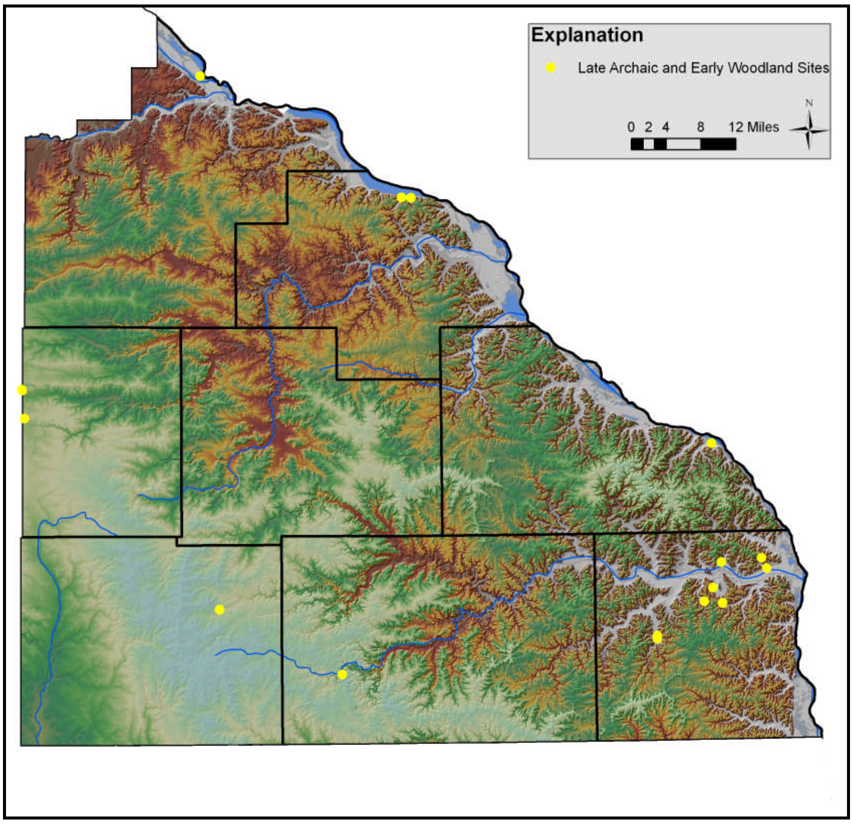

Figure 6.17. Site Locations with both Late Archaic and Early Woodland Components (USGS 2002; SHPO/OSA Files).

Ideology

Ideology is mentioned here solely to bring awareness of this factor and its influences on settlement and subsistence patterns. One of the more profound social factors likely to have influenced both settlement and subsistence patterns is manifested by the ideology that Late Archaic and Early Woodland societies may have embraced. As elucidated by Hodder (1991:72), ideology is a framework wherein "resources are given value, inequalities are defined and power is legitimated". However, as intended here, ideology is be defined as a way in which humans "create" their social and natural world by defining and explaining "reality". This definition is envisioned to capture overarching Late Archaic and Early Woodland society's conceptions of their 'reality,' and includes more broad ideas, such as religion, philosophy, and taboos. This approach differs from the traditional role that ideological studies of precontact societies have followed, which were principally formulated for hierarchical societies (e.g., Mississippian Chiefdoms), which have been heavily influenced by Marxist approaches (e.g., Emerson 1997).

Unfortunately, ascertaining material expressions of ideology for Late Archaic and Early Woodland societies in the study area is difficult, arresting a vast amount of important insight that might be obtained from such signatures. For example, were certain landforms avoided, or favored based on ideological grounds? Were certain animals and other resources sacred, and as such, strictly forbidden or especially sought after? However, near the end of the Late Archaic and the beginning of the Early Woodland it appears that inhabitants of the study region participated in the Red Ochre ceremonial burial complex. A relative lack of artifacts and mortuary data in the study area that can be related to ideology with any certainty hinders constructive attempts to unveil this intriguing aspect of Late Archaic and Early Woodland societies.

CONCLUSIONS

The above discussion provides a synopsis of various environmental factors and a cursory examination of various social characteristics that may have influenced Late Archaic and Early Woodland societies within the study region. The environmental factors include an MCM for the study region and a variety of physical relationships between site locations. Due to a variety of reasons (e.g., incomplete surveys, limited geomorphic and paleoclimate studies), certain aspects of the environment and social organization for these societies have not been adequately explored and the assumptions are tentative. However, from the available information, a number of conclusions on the Late Archaic to Early Woodland transition can be made. Following a review of previous models for the Late Archaic to Early Woodland transition, the environmental and sociocultural aspects are summarized in the model below.

Previous Models for Late Archaic to Early Woodland Transition

A number of models have been proposed to characterize the Late Archaic to Early Woodland transition. Explanations based on socio-cultural considerations include gradualist and replacement models. The gradualist model advocates for steady in-situ change with gradual incorporation of new traits (i.e., ceramics, burial mounds, domesticated plants) through diffusion of people and ideas from core areas (e.g., West-Central Illinois) and with little changes to overall lifeways (e.g., Emerson 1986; Farnsworth 1986; Lewis 1986, Tiffany 1986). The replacement model argues for punctuated equilibrium by replacement of Late Archaic groups by immigrant or intrusive groups with superior technology (e.g., ceramics), subsistence knowledge (e.g., domesticated plants), social organization and cultural habits (e.g., burial mounds) leading to radical lifeway changes (e.g., Emerson and Fortier 1986; Emerson and McElrath 1983, 2001).

Several models are based on climate change. One involves cooler temperatures and increased winter precipitation for portions of eastern North America that caused resource shortages and placed increased stress on Late Archaic societies necessitating changes to settlement and subsistence patterns and social reorganization (e.g., Emerson and Fortier 1986; Fiedel 2001). Another climate change model equates temperature and precipitation changes leading to increased flooding frequencies and magnitudes between ca. 3,000-2,600 BP in the Mississippi River watershed as one cause for the shift from Late Archaic to Early Woodland (Kidder 2006). For portions of the lower Mississippi River (i.e., northeastern Louisiana), flooding contributed to the demise of Poverty Point culture and the abandonment of the area for several hundred years. Flooding during this period is also suggested as a contributing factor in the Late Archaic-Early Woodland discontinuity for portions of the central Mississippi River (e.g., Hajik 1990; Evans and Evans 2000). In the American Bottom region, flooding resulted in terminal Late Archaic abandonment of portions of the floodplain. During the Early Woodland, mobility increases and population density declines.

A final model formulated for the Late Woodland to Oneota transformation in the Upper Midwest that may provide insight for the Late Archaic to Early Woodland transition correlates a collapse of crucial resources with culture change (Theler and Boszhardt 2003, 2006; Theler 1987). This model contends that as Late Woodland populations increased and packed the landscape, deer, firewood and other important resource shortages disrupted the seasonal round leading to warfare, settlement amalgamation, subsistence changes, abandonment of broad areas and cultural transformation into Oneota.

A Model for the Late Archaic-Early Woodland Transition in Southeastern Minnesota

Environmental conditions in the study region during the Late Archaic to Early Woodland transition were on average slightly warmer and drier than modern conditions, although wetter and cooler than the middle Holocene warm and dry period. Relative conditions during the Late Archaic were warm and moist. During the Early Woodland cool and moist conditions are associated with stormier and snowier period during the *Vandal Event*. Variations to these trends occurred throughout the period of study with certain conditions imparting significant changes to the vegetation and landscape across the study region. After approximately 3,300 BP flooding increased in frequency and magnitude. By approximately 3,000 BP oak savanna was replacing prairie. These two factors contributed to highly productive environments in oak savanna habitats, allowing deer to thrive, and rejuvenating aquatic habitats in floodplains. Geomorphic changes associated with flooding modified various landforms through erosion, created scoured areas conducive to pioneer plant species that included a suite of domesticates, and formed new depositional features, such as natural levees. A variety of other habitats (e.g., upland woodlands and floodplain forests) provided additional resources. On the whole, the study region contains diverse topography and ecosystems that are environmentally unique. During the period of study, it offered a favorable location for human occupation.

Late Archaic diagnostic artifacts include large to small side-notched (e.g., Raddatz and Preston), small expanding stemmed (e.g., Durst) projectile points. Utilitarian lithic objects were manufactured from local (e.g., Prairie du Chien chert) and non-local (e.g., orthoquartizites) raw materials. Exotic materials (e.g., copper, obsidian and Hornstone) were mainly reserved for ceremonial purposes.

Late Archaic groups were accustomed to the established (i.e., prairie, upland woodlands, floodplain forests) and relatively recent (i.e., oak savanna, rejuvenated floodplain) habitats, exacting further changes by maintaining oak savannas through periodic burning to increase forage and facilitate game drives. Subsistence strategies followed a seasonal round based on a cooperative gathering-fishing-hunting-agriculture (cf. horticulture) regime roughly balanced between upland and lowland resources. Upland resources (e.g., deer, nuts) were exploited during the late Fall, Winter and early Spring. During the late Spring, Summer and early Fall lowland resources (e.g., fish and mussels) were available. Flooding would temporarily exclude activities in floodplains, although the after effects spurred productivity (e.g., fish spawning) and newly scoured areas were conducive to pioneering and domesticated plants.

Late Archaic groups would have been typically organized in kinship related, egalitarian bands. Leadership was achieved and informal. Extra and intra-regional trade networks were maintained. During the early portion of the period they participated in the Old Copper metallurgical tradition and in Red Ochre burial ceremonialism during the later portion of the period. Following a seasonal round, settlements and activity areas were situated around key resources over relatively broad areas. Mobile to semi-sedentary microband camps were typically dispersed in upland settings during the late fall, winter and early spring. During the late spring, summer and early fall, microbands congregated (forming macrobands) in semi-sedentary camps in lowland settings of larger stream valleys for social activities and to harvest a wide range of resources. This mobile to semi-sedentary pattern explains the greater number of SAA sites, with just over half of all sites in upland settings. BS sites are fewer and mostly located in lowland settings. With an expanding population toward the end of the period, the landscape may have become packed resulting in a decline of important resources (e.g., deer) through over-exploitation. Increased population and resource stress provoked territorial tendencies and occasional conflict.

Near the end of the Late Archaic period important resources were becoming depleted from packed populations resulting in less mobility, territorial claims and increased conflict. As a result, subsistence began to shift to more localized use of domesticated and wild plants and aquatic resources. Groups began congregating in lowland settings and increased their reliance on stored foods. A change in climate likely exacerbated the subsistence, settlement and socio-cultural shifts. Between approximately 2,500-2,300 BP an inordinate number of large floods occurred with an onset of cool and moist conditions coinciding with the *Vandal Event*, bringing stormier and snowier conditions. At least three floods exceeded overbank magnitudes expected once every 50 years for modern floods and one exceeding the 500 year magnitude, as reflected in a spike in the MCM stream discharge rates (see Figures 2.13, 2.18 and 2.19). Such flooding may have disturbed lifeway routines in lowland settings by disrupting access to resources and resource production for prolonged periods. In the uplands, snowier conditions may have caused declines in resources (e.g., deer, hides) and hunting access. In response, use of aquatic and plant resources, territorialism, conflict, and the use of stored foods were intensified. The adoption of ceramics allowed for more efficient plant food processing. Technological change in projectile points, from spears to darts, increased hunting (and warfare) efficiency. Egalitarianism gave way to hierarchies. Ceremonialism may have increased to reestablish the natural world order (e.g., Turkey Tail and Adena points). However, such conditions may not have been uniform across the study region: some groups may have experienced little effects from socio-cultural or climatic changes; others may have migrated out of the region (partial regional abandonment) or merged with kin or political allies. Meanwhile, interaction with non-local groups introduced additional stress of various forms (e.g., warfare, technologies, ideas). Following these adjustments, groups archaeologically identified as Early Woodland emerged.

Early Woodland diagnostic artifacts include medium sized straight stemmed (e.g., Kramer) and contracting stemmed (e.g., Waubesa) projectile points. Although some non-local raw materials were used for utilitarian lithic objects, most raw materials derive from local sources. As with the Late Archaic, Early Woodland exotic materials were mainly reserved for ceremonial purposes. In addition to lithic items, grit and sand-tempered ceramics include La Moille/Marion Thick and Black Sand/Prairie wares.

Early Woodland subsistence strategies contained the same elements as their Late Archaic predecessors although with an emphasis on aquatic resources. While a seasonal round of gathering-fishing-hunting-agriculture (cf. horticulture) was maintained, lowland resources (e.g., fish, mussels) were heavily exploited and stored foods may have been relied on over the colder months.

Early Woodland groups were organized in kinship and politically linked, non egalitarian proto-tribes. Leadership was competitive and nominal. While extra-regional trade declined, intra-regional trade continued and during the early portion of the period participated in Red Ochre burial ceremonialism. Settlement and activity areas continued to be located near key resources. However, settlements tend to be semi-sedentary to sedentary villages (cf. hamlets) congregated in lowland settings. Fewer SAA sites exist and they are nearly equally distributed between upland and lowland settings. BS sites are more numerous and most located in lowland settings. Population levels may have declined in the early portion of the period and stabilized or rebounded thereafter. Conflict was likely common for these groups and established territories were in place.

In summary, a variety of environmental and socio-cultural changes invoked a change from people following a Late Archaic lifeway to those of Early Woodland. Significant changes include shifts from balanced upland and lowland resource use to a focus on aquatic environments. Concomitant changes include mobile and dispersed populations to congregating semi-sedentary to sedentary settlements, technological changes and societal reformulation. A summary of characteristics between Late Archaic and Early Woodland groups in the study region is provided in Table 6.2.

Table 6.2. Summary Characteristics of Late Archaic and Early Woodland Cultures in the Study Region.

Characteristics	**Late Archaic**	**Early Woodland**
Climate	Warm and moist Oak savanna replacing prairie Floods increase in magnitude and frequency	Cool and moist Oak savanna in place Floods continue, *Vandal Event* associated with increased storms/snow
Diagnostic artifacts	Side-notched points (Raddatz, Preston) Expanding stemmed points (Durst)	Straight stemmed points (Kramer) Contracting stemmed points (Waubesa) Grit and sand tempered ceramics (LaMoille/Marion Prairie wares/Black Sand)
Subsistence	Seasonal round Relative balance between terrestrial and aquatic resources Some mussel use Domesticated plants	Seasonal round shifts to focus on aquatic resources Increased mussels use Domesticated Plants
Settlement	Camps Mobile to semi-sedentary Sites distribution nearly equal between upland and lowland settings Greater number of SAA sites and most in uplands Fewer number of BS sites and most in lowlands	Villages Semi-sedentary to sedentary Site distribution favors lowland settings Fewer number of SAA sites and balanced between upland and lowlands Greater number of BS sites and most in lowlands
Population	Dispersed Expanding and Packed ca. 2,500 BP	Congregation Declining or stabilizing
Interaction	Extra and intra-regional trade Local and non-local lithic raw materials used for utilitarian objects Becoming more territorial Minor conflict	Intra-regional trade, decline in extra-regional trade Increased reliance of local lithic raw materials for utilitarian objects Territorial Increased conflict
Social complexity	Bands Kinship linked Egalitarian Achieved informal leadership	Proto-tribes Kinship and politically linked Non-egalitarian Competitive nominal leadership
Ideology	Participated in Red Ochre ceremonial burial complex near end of period Corporate cemeteries	Participated in Red Ochre ceremonial burial complex at beginning of period Corporate cemeteries

Future Research

This research has presented a wide variety of environmental and socio-cultural characteristics that influenced and define Late Archaic and Early Woodland societies in the study region. A variety of additional, multidisciplinary research is needed to elucidate the Late Archaic and Early Woodland archaeological record. Some examples include: Broad and comprehensive surveys, to include appropriate methods to detect deeply buried sites in depositional settings; more detailed investigations involving test unit excavation, fine-scale recovery methods and geomorphological analysis will enhance the stratigraphic record, chronological sequences and site formation processes; proper analysis of materials is needed to recognize diagnostic items, including reexamination and completion of analysis and reporting for existing sites and materials. Additional paleoecological studies (e.g., pollen, speleothems and stream sediments) will enhance knowledge of the paleoenvironment. Additional studies exploring socio-cultural relationships are needed. Re-thinking accepted theoretical constructs, such as the tripartite distinction, is in order. Finally, while focusing some of the above and other elements of multidisciplinary research on any archaeological site, region or problem will enhance our understanding of past societies, directing such efforts at a well-preserved, multicomponent site will gather information to address a wide variety of research questions. Perhaps this research will further such future research and understanding of the archaeological record in southeastern Minnesota and beyond.

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Appendix A

Cultural and Environmental Characteristics of Late Archaic Sites in the Study Region

Site	Diagnostics	Site Function	Site Type	Landform	Elev.	Bedrock Exposure	Watershed	Soil Series	Dominant Vegetation
				Gray		**Drift**			
21DO2	Durst/ Turkey Tail	BS	Artifact scatter	Slope	1250	No	Zumbro	Sargeant silt loam	Oak savannah
21DO7	Durst	BS	Artifact scatter	Island	1239	No	Zumbro	Sargeant silt loam	Oak savannah
21DO14	Raddatz/ Durst	SAA?	Lithic scatter	Slope	1270	No	Zumbro	Kasson silt loam	Oak savannah
				Weathering		**Residuum**			
21FL3	Durst	BS	Artifact scatter	Rock shelter	1050	Yes	Root	-	Upland woodland
21FL19	Raddatz/ Table Rock	BS	Artifact scatter	Terrace	1250	No	Root	Fayette silt loam	Floodplain forest
21FL33	Madison SN	SAA	Lithic scatter	Ridge	1320	No	Root	Tama silt loam	Prairie
21FL41	Durst	SAA	Artifact scatter	Alluvial fan	790	No	Root	Chaseburg silt loam	Floodplain forest
21FL65	Tama/ Durst	SAA	Lithic scatter	Ridge	1300	Yes	Root	Fayette silt loam	Upland woodland
21FL66	Raddatz	SAA	Lithic scatter	Ridge	1290	Yes	Root	Fayette silt loam	Upland woodland
21FL71	Godar	BS	Artifact scatter	Slope	1370	No	Root	Renova silt loam	Upland woodland
21FL103	Raddatz	SAA	Find spot	Ridge	1100	No	Root	Fayette silt loam	Upland woodland
21GD248	Turin/ Madison SN	SAA	Lithic scatter	Slope	1140	No	Zumbro	Seaton silt loam	Upland woodland
21HU30	Raddatz/ Durst/ Table Rock	BS	Artifact scatter	Terrace	710	No	Root	Littleton silt loam	Prairie
21HU35	Madison SN/ Durst	BS	Artifact scatter	Terrace	750	No	Root	Arenzville silt loam	Floodplain forest
21HU56	Durst	SAA	Lithic scatter	Terrace	780	No	Root	Festina silt loam	Oak savannah

Cultural and Environmental Characteristics of Late Archaic Sites in the Study Region, Continued

Site	Diagnostics	Site Function	Site Type	Landform	Elev.	Bedrock Exposure	Watershed	Soil Series	Dominant Vegetation
				Weathering		**Residuum**			
21HU58	Durst	BS	Artifact scatter	Terrace	770	No	Root	Richwood silt loam	Oak savannah
21HU74	Durst	SAA	Lithic scatter	Terrace	780	No	Root	Arenzville silt loam	Floodplain forest
21HU82	Madison SN	SAA	Lithic scatter	Terrace	780	No	Root	Littleton silt loam	Prairie
21HU85	Raddatz/ Durst	SAA	Lithic scatter	Slope	780	No	Root	La Farge silt loam	Upland woodland
21HU87	Madison	SAA	Lithic scatter	Terrace	780	No	Root	Littleton silt loam	Prairie
21HU89	Godar/ Osceola/ Madison SN/ Durst	BS	Lithic scatter	Terrace	780	No	Root	Comfrey silt loam	Oak savannah
21HU106	Madison SN	SAA	Lithic scatter	Terrace	780	No	Root	Festina silt loam	Oak savannah
21HU108	Raddtaz	SAA	Lithic scatter	Terrace	780	No	Root	Festina silt loam	Oak savannah
21HU120	Osceola/ Madison/ Preston/ Durst	SAA?	Lithic scatter	Terrace	750	No	Root	Walford silt loam	Oak savannah
21HU123	Osceola/ Godar	SAA	Lithic scatter	Slope	780	No	Root	Seaton silt loam	Upland woodland
21HUl	Raddatz/ Turkey Tail	SAA	Lithic scatter	Ridge	1180	No	Root	Seaton silt loam	Upland woodland
21HUi	Durst	SAA	Lithic scatter	Terrace	700	No	Root	Timula silt loam	Floodplain forest
21HUe	Preston/ Table Rock	SAA	Lithic scatter	Ridge	1200	No	Root	Black-hammer silt loam	Upland woodland
21HUm	Madison SN	SAA	Lithic scatter	Ridge	1140	No	Root	Seaton silt loam	Upland woodland
21HUr-	Raddatz/ Durst	SAA	Lithic scatter	Ridge	1190	No	Root	Seaton silt loam	Upland woodland
21OL20	Osceola	SAA	Artifact Scatter	Terrace	1110	Yes	Zumbro	Richwood silt loam	Oak savannah

Cultural and Environmental Characteristics of Late Archaic Sites in the Study Region, Continued

Site	Diagnostics	Site Function	Site Type	Landform	Elev.	Bedrock Exposure	Watershed	Soil Series	Dominant Vegetation
				Weathering		**Residuum**			
21OL22	Preston	BS	Artifact Scatter	Terrace	1060	Yes	Root	Littleton Silt loam	Prairie
21OL23	Durst	SAA	Find spot	Slope	1140	No	Zumbro	Brodale	Prairie
21OL29	Matanzas/ Raddatz	SAA	Lithic scatter	Terrace	970	No	Zumbro	Becker loam	Oak savannah
21MW8	Raddatz/ Durst	SAA	Lithic scatter	Ridge	1310	Yes	Root	Racine silt loam	Oak savannah
21MWj	Durst	SAA	Lithic Scatter	Ridge	1360	Yes	Root	Readlyn silt loam	Prairie
21WB65	Durst	SAA	Find spot	Ridge	1130	No	Mississippi	Fayette silt loam	Upland woodland
21WN31	Raddatz	SAA	Artifact Scatter	Ridge	1140	No	Root	Seaton silt loam	Upland woodland
				Mississippi		**Trench**			
21GD2	Durst	BS	Artifact scatter	Terrace	700	No	Mississippi	Burkhardt loam	Prairie
21WB55	Durst	BS	Artifact scatter	Alluvial fan	680	No	Mississippi	Chaseburg silt loam	Floodplain forest
21WB56	Durst	BS	Artifact scatter	Alluvial fan	680	No	Mississippi	Chaseburg silt loam	Floodplain forest
21WN1	Durst	BS	Artifact scatter	Rock shelter	700	Yes	Mississippi	-	Upland woodland
21WN15	Adena	SAA	Cemetery	Slope	760	No	Mississippi	Seaton silt loam	Upland woodland

Appendix B
Cultural and Environmental Characteristics of Early Woodland Sites in the Study Region

Site	Diagnostics	Site Function	Site Type	Landform	Elev.	Bedrock Exposure	Watershed	Soil Series	Dominant Vegetation
				Gray		**Drift**			
21DO2	Waubesa/ Fox Lake C	BS	Artifact scatter	Terrace	1260	No	Zumbro	Sargeant silt loam	Oak savannah
21DO7	Waubesa/ Fox Lake C	BS	Artifact scatter	Island	1239	No	Zumbro	Sargeant silt loam	Oak savannah
21DO14	Waubesa	SAA?	Lithic scatter?	slope	1270	No	Zumbro	Kasson silt loam	Oak savannah
				Weathering		**Residuum**			
21FL19	Waubesa	BS	Artifact scatter	Terrace	1250	No	Root	Fayette silt loam	Floodplain forest
21FL23	Waubesa	BS	Artifact scatter	Rock shelter	1130	Yes	Root	-	Upland woodland
21FL63	Prairie Incised	BS	Artifact scatter	Natural levee	740	No	Root	Waukegan silt loam	Prairie
21FL64	Prairie Incised	BS	Artifact scatter	Terrace	740	No	Root	Waukegan silt loam	Prairie
21HU30	Kramer/ Waubesa/ Dickson	BS	Artifact scatter	Terrace	710	No	Root	Littleton silt loam	Prairie
21HU35	Waubesa	BS	Artifact scatter	Terrace	750	No	Root	Arenzville silt loam	Floodplain forest
21HU58	Waubesa	BS	Artifact scatter	Terrace	770	No	Root	Richwood silt loam	Oak savannah
21HU72	Waubesa	SAA	Lithic scatter	Terrace	720	No	Root	Festina silt loam	Oak savannah
21HU120	Kramer/ Waubesa	SAA?	Lithic scatter	Terrace	750	No	Root	Walford silt loam	Oak savannah
21HU167	Prairie Incised	BS	Artifact scatter	Alluvial fan	680	No	Root	Abscota variant sand	Floodplain forest
21HUl	Kramer	SAA	Lithic scatter	Ridge	1180	No	Root	Seaton silt loam	Upland woodland
21HUi	Kramer/ Dickson	SAA	Lithic scatter	Terrace	700	No	Root	Timula silt loam	Floodplain forest

Cultural and Environmental Characteristics of Early Woodland Sites in the Study Region, Continued

Site	Diagnostics	Site Function	Site Type	Landform	Elev.	Bedrock Exposure	Watershed	Soil Series	Dominant Vegetation
				Weathering		**Residuum**			
21HUe	Kramer/ Waubesa	SAA	Lithic scatter	Ridge	1200	No	Root	Black-hammer silt loam	Upland woodland
21HUm	Waubesa	SAA	Lithic scatter	Ridge	1140	No	Root	Seaton silt loam	Upland woodland
21MW8	Kramer/ Waubesa	SAA	Lithic scatter	Ridge	1310	Yes	Root	Racine silt loam	Oak savannah
21WB63	Kramer	SAA	Lithic scatter	Terrace	780	No	Zumbro	Tell silt loam	Floodplain forest
21WN68	Kramer	SAA	Find spot	Ridge	1220	No	Mississippi	Nodine silt loam	Upland woodland
				Mississippi		**Trench**			
21GD2	Waubesa	BS	Artifact scatter	Terrace	700	No	Mississippi	Burkhardt loam	Prairie
21GD157/ 21GD78	Waubesa	BS	Artifact scatter/ Mounds	Terrace	680	No	Mississippi	Estherville loam	Prairie
21HU156	Adena/ Waubesa Prairie Incised	BS	Artifact scatter	Natural levee	610	No	Mississippi	Comfrey silty clay loam	Floodplain forest
21WB4	Waubesa	BS	Artifact scatter/ Mounds	Terrace	740	No	Mississippi	Bixby loam	Floodplain forest
21WB33	La Moille	BS	Artifact scatter	Terrace	700	No	Mississippi	Meridian sandy loam	Oak savannah
21WB55	Waubesa	BS	Artifact scatter	Alluvial fan	680	No	Mississippi	Chaseburg silt loam	Floodplain forest
21WB56	Waubesa/ La Moille/ Prairie Incised	BS	Artifact scatter	Alluvial fan	680	No	Mississippi	Chaseburg silt loam	Floodplain forest
21WN1	La Moille	BS	Artifact scatter	Rock shelter	700	Yes	Mississippi	-	Upland woodland
21WN49	Adena	SAA	Lithic scatter	Terrace	720	No	Mississippi	Flagler sandy loam	Prairie