May 2016

The Prehistoric Economics of the Kautz Site: a Late Archaic and Woodland Site in Northeastern Illinois

Peter John Geraci
University of Wisconsin-Milwaukee

THE PREHISTORIC ECONOMICS OF THE KAUTZ SITE: A LATE ARCHAIC AND WOODLAND SITE IN NORTHEASTERN ILLINOIS

by

Peter J. Geraci

A Thesis Submitted In

Partial Fulfillment of the

Requirements for Degree of

Masters of Science

in Anthropology

at

The University of Wisconsin-Milwaukee

May 2016

ABSTRACT

THE PREHISTORIC ECONOMICS OF THE KAUTZ SITE:
A LATE ARCHAIC AND WOODLAND SITE IN NORTHEASTERN ILLINOIS

by

Peter J. Geraci

The University of Wisconsin-Milwaukee, 2016
Under The Supervision of Robert J. Jeske, Ph.D.

The Kautz Site (11DU1) is a multi-component archaeological site located in the DuPage River Valley in northeastern Illinois. It was inhabited at least six different times between the Late Archaic and Late Woodland periods ca. 6000-1000 B.P. The site was excavated over the course of three field seasons between 1958 and 1961, but the results were never made public. This thesis seeks to document the archaeology of the Kautz Site in order to better understand the site's economic history. An environmental catchment analysis was conducted to evaluate the level of time and energy needed to acquire important resources like water, food, wood, and chert. A macroscopic analysis of the lithic assemblage provided information about the lithic economy at the site. The results of the landscape analysis suggest that the site was located in an economically efficient location, however the macroscopic analysis suggests that a source of raw materials for chipped stone tools was not easily accessible and as a result the inhabitants practiced a number of common adaptive strategies to cope with resource scarcity.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to thank first and foremost my parents Mark and Maureen for their continual support and love. My family and friends for keeping me honest and optimistic about the future. Khris, for pushing me and comforting me during the most difficult times. I would like to give a special thanks to my advisor Dr. Robert Jeske for believing in me and providing support and guidance throughout this process. I would like to thank my other committee members Dr. John Richards and Dr. Brian Nichols for their insight and expertise. I would also like to extend my gratitude to the staff of the Illinois State Archaeological Survey for providing materials, knowledge, and a skillset that enabled me to complete this thesis to the best of my abilities.

Chapter 1: Introduction

"The world presents people with options and constraints, people make choices, and those choices alter the world." – Bruce D. Smith

Background to the Problem

The Kautz Site (11DU1) is located in DuPage County, in northeastern Illinois (Figure 1). Northeastern Illinois was largely ignored by the archaeological community prior to the 1970s. The region was far less interesting to local archaeologists than the Illinois and Mississippi River valleys lined with monumental architecture (Cole and Deuel 1937; Henrikson 1965; Struever 1964; Winters 1961). As a result, archaeology in the region prior to 1970 tended to be focused upon earthen mounds and larger village sites around Chicago (e.g., Bluhm and Fenner 1961; Bluhm and Liss 1961; Langford 1927; Neumann 1931). Northeastern Illinois is still peripheral to Illinois archaeology; we just don't really know a great deal about the archaeology of the region.

It was only after the enactment of several environmental and cultural heritage laws between 1966 and 1990 that significant portions of northeastern Illinois were actually surveyed (e.g., Doershuk 1988; Early 1971, 1972a, 1972b; Ferguson 1995; Hart et al. 1989; Hart and Jeske 1987, Jeske 1986, 1987, 1988, 1990; Jeske and Hart 1988; Jeske and Lurie 1989; Lurie 1987, 1989a, 1990; Lurie and Jeske 1989). During this period of time, systematic surveys and excavations the Fox River and Fermilab National Accelerator Laboratory (Early 1971, 1972; Jeske 1987, 1990; Jeske and Lurie 1989), and survey and excavations within the Illinois and Michigan Canal National Heritage Corridor (Hart and Jeske 1987; Jeske and Hart 1988) provided critical data needed to establish the region's culture history. These surveys also provided an opportunity to formulate and test largely processual theories regarding cultural processes and adaptive strategies such as raw material acquisition, mobility, technological

organization, and social organization (Demel 2000; Emerson 1999; Ferguson and Warren 1992; Jeske 1989, 1992, 2002; Jeske and Lurie 1993).

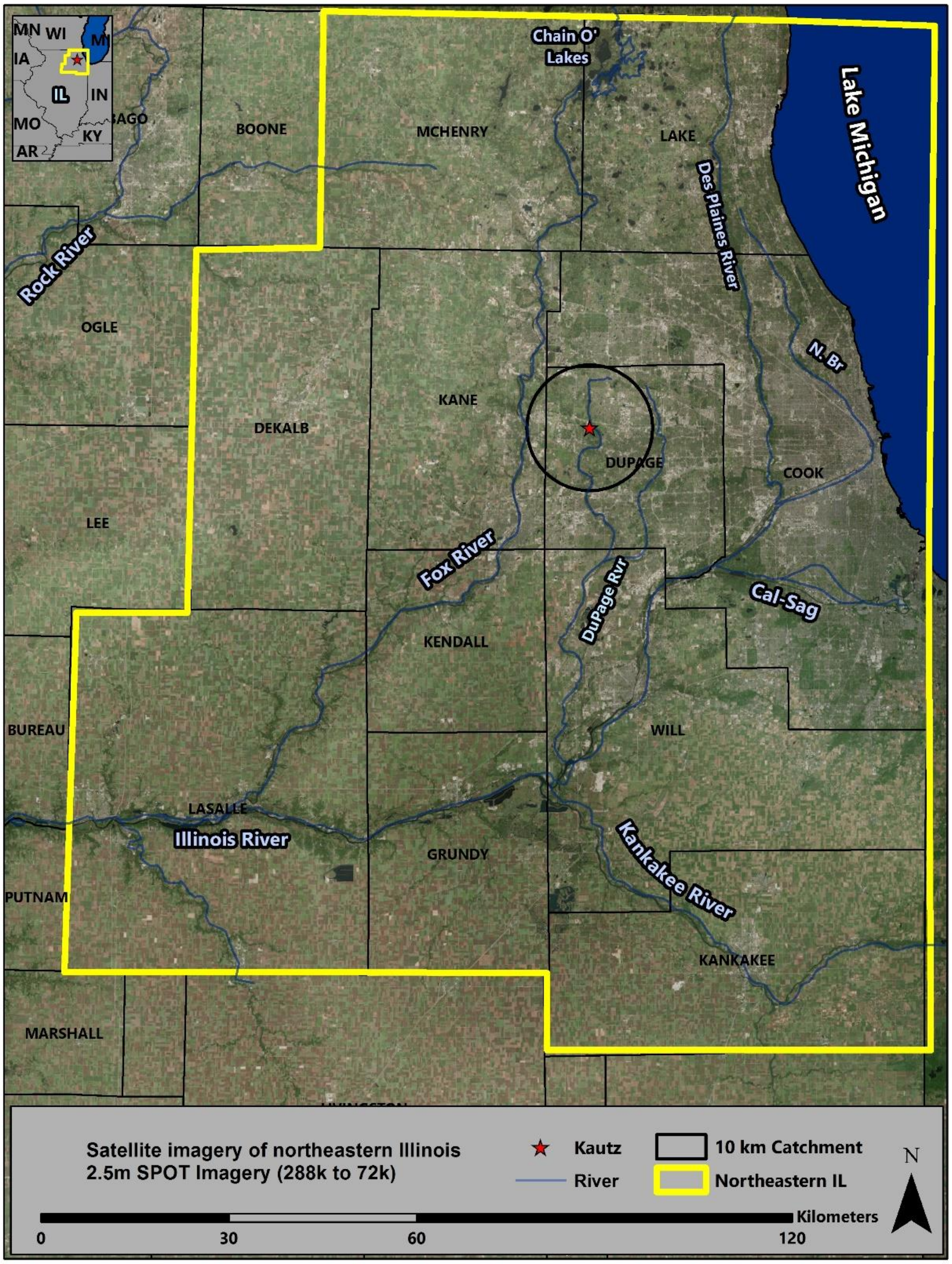


Figure 1. Satellite imagery of northeastern Illinois.

The vast majority of archaeology conducted in the region is relatively recent. The Illinois Inventory of Archaeological and Paleontological Sites (IIPAS), which is curated by the Illinois State Museum (ISM), contains the records for archaeological surveys reported to the state archaeologist or the Illinois Archaeological Survey. Although a rough estimate, approximately 60% of all the recorded archaeological surveys from northeastern Illinois occurred between 1990 and 2015. Over 1700 square kilometers of northeastern Illinois were surveyed. During the same period, 10,355 sites, or roughly 80% of all known archaeological sites in northeastern Illinois were reported (IIAPS 2015).

The archaeological survey boom of the 1990s produced a tidal wave of information that has yet to be used to its potential. The only documentation of many of these sites and surveys are the original site forms and cultural resource management (CRM) reports submitted to the Illinois Historic Preservation Agency (IHPA). These records require significant effort to extract information needed to make statements about the archaeology of the region as a whole. Many of the records are incomplete or inaccurate. The most recent syntheses of any kind of archaeology in northeastern Illinois consists of two limited chapters in edited volumes (Emerson and Titelbaum 2000; Lurie et al. 2009) and a book written in 1991 (Markman 1991). Although these chapters and book do provide some much needed synthesis and detail on the region, significant gaps in our understanding of the archaeological record still remain.

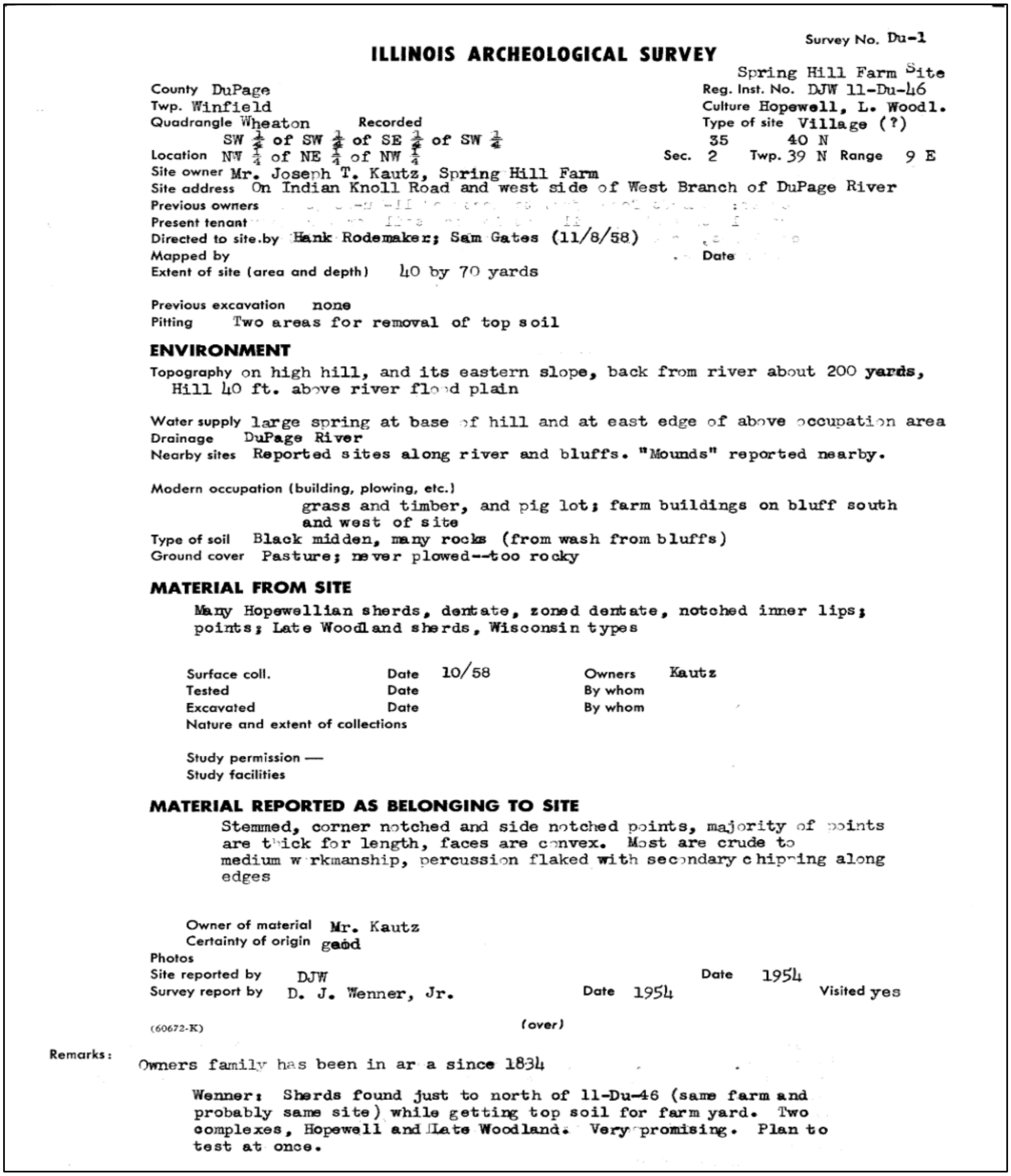
In particular, there is a lack of data and synthesis from excavated sites in the region. According to the IIAPS (2015), only 154 sites or roughly 1.5% of recorded sites have been excavated in the region as a whole. Fewer than ten sites in DuPage County have been investigated beyond a basic Phase I survey, which is important because data recovered from an excavated site can provide a great deal more information about the past than a scatter of artifacts

collected during a pedestrian survey. Controlled excavations allow for the examination of stratigraphy and the study of the spatial relationship of individual artifacts and artifact classes across the site. Controlled excavation often results in more artifacts and artifact classes being collected via the use of screens and an incremental approach of removing sediment. Finally, excavated sites provide the opportunity to study the distribution of harder to identify traces of human behavior such as subterranean pits, post-holes of a wooden building, burials, and other phenomenon. When large enough portions of a site are excavated, whole village imprints can be reconstructed (Renfrew and Bahn 2008).

The Kautz Site is one of the very few multi-component archaeological sites in northeastern Illinois that has been subjected to controlled subsurface investigations, but the data recovered from the excavations have never been made public. For the past sixty years, the extent of our knowledge about this site has been restricted to the original site form submitted by David J. Wenner in 1958, three years before the last excavation unit was closed (Figure 2). According to the site form, the Kautz Site is located on a high hill and slope on the west side of the West Branch of the DuPage River on the border between the SW ¼ of Section 35 and NW ¼ of Section 2 in Winfield Township in DuPage County, IL (Figure 3). However, the location of the excavation units and exact boundaries of the site were unclear, and have been updated as a result of the research conducted for this thesis.

The Kautz Site excavations can add significantly to our understanding of the archaeology of the region. This thesis is focused on the economic relationship between the site’s location and material culture recovered from the Kautz Site using a GIS-based catchment analysis and macroscopic attribute analysis of the lithic assemblage. Data recovered from an MNI and NISP

analysis of the faunal assemblage as well as a general description of the rough rock and ceramic assemblage will aid in this process also.



Survey No. Du-1

ILLINOIS ARCHEOLOGICAL SURVEY

Spring Hill Farm Site

County DuPage
Twp. Winfield
Quadrangle Wheaton Recorded
Location SW $\frac{1}{4}$ of SW $\frac{1}{4}$ of SE $\frac{1}{4}$ of SW $\frac{1}{4}$ / NW $\frac{1}{4}$ of NE $\frac{1}{4}$ of NW $\frac{1}{4}$
Reg. Inst. No. DJW 11-Du-46
Culture Hopewell, L. Woodl.
Type of site Village (?)
Sec. 35 / 2 Twp. 40 N / 39 N Range 9 E
Site owner Mr. Joseph T. Kautz, Spring Hill Farm
Site address On Indian Knoll Road and west side of West Branch of DuPage River
Previous owners
Present tenant
Directed to site by Hank Rodemaker; Sam Gates (11/8/58)
Mapped by Date
Extent of site (area and depth) 40 by 70 yards

Previous excavation none
Pitting Two areas for removal of top soil

ENVIRONMENT

Topography on high hill, and its eastern slope, back from river about 200 yards, Hill 40 ft. above river flood plain

Water supply large spring at base of hill and at east edge of above occupation area
Drainage DuPage River
Nearby sites Reported sites along river and bluffs. "Mounds" reported nearby.

Modern occupation (building, plowing, etc.) grass and timber, and pig lot; farm buildings on bluff south and west of site
Type of soil Black midden, many rocks (from wash from bluffs)
Ground cover Pasture; never plowed--too rocky

MATERIAL FROM SITE

Many Hopewellian sherds, dentate, zoned dentate, notched inner lips; points; Late Woodland sherds, Wisconsin types

Surface coll. Date 10/58 Owners Kautz
Tested Date By whom
Excavated Date By whom
Nature and extent of collections

Study permission —
Study facilities

MATERIAL REPORTED AS BELONGING TO SITE

Stemmed, corner notched and side notched points, majority of points are thick for length, faces are convex. Most are crude to medium workmanship, percussion flaked with secondary chipping along edges

Owner of material Mr. Kautz
Certainty of origin good
Photos
Site reported by DJW Date 1954
Survey report by D. J. Wenner, Jr. Date 1954 Visited yes

(60672-K) (over)

Remarks: Owners family has been in area since 1834

Wenner: Sherds found just to north of 11-Du-46 (same farm and probably same site) while getting top soil for farm yard. Two complexes, Hopewell and Late Woodland. Very promising. Plan to test at once.

Figure 2. Original Illinois Archaeological Survey Form for the Kautz site (11DU1).

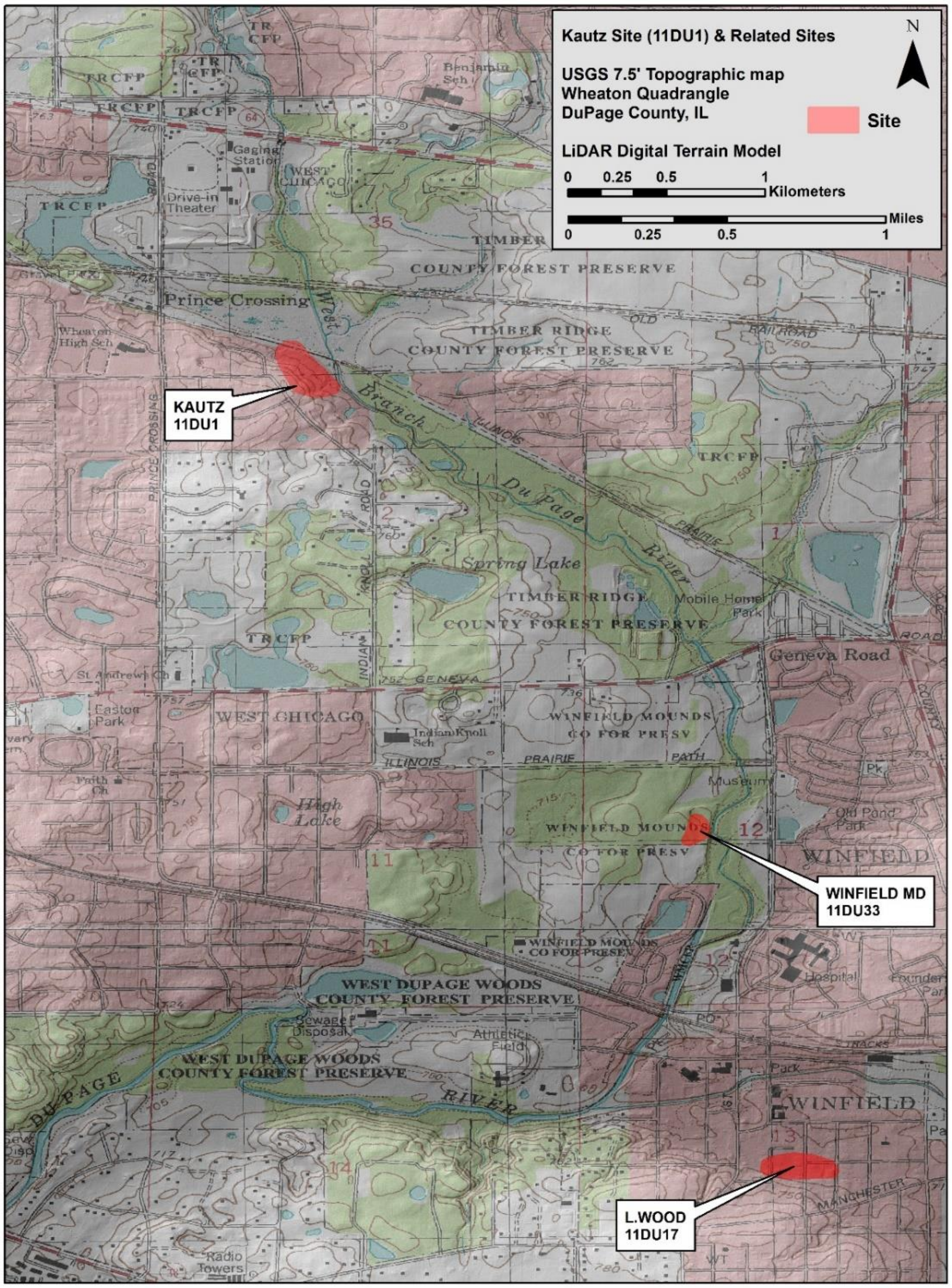


Figure 3. Location of the Kautz Site.

Expectations

The dominant vegetation type in this region is prairie and is part of a larger ecological zone known as the Prairie Peninsula (Transeau 1935). The Prairie Peninsula is thought to be a

result of persistent warm and dry conditions that have favored the colonization of grass habitats over forests since the Middle Archaic (King 1981). In northeastern Illinois, the expansive prairie is mixed with upland and lowland wetland environments, as well as Oak Savannas (Kilburn 1959; Moran 1980) (Figure 4).

A number of general models for prehistoric settlement have been established for the northern portion of the Prairie Peninsula (Brown 1965; Curtis and Berlin 1980; Early 1970, 1972; Ferguson 1995; Goldstein 1981, 1982; Hart and Jeske 1987; Jeske 1986, 1987; Lurie 1987, 1989; Lurie and Jeske 1989; McGimsey et al. 1986; Roper 1979a; Springer 1985; Weston 1981). All of these models follow the same basic assumptions; sites are not randomly located, the materials found within sites reflect past cultural behavior, and sites will be located as to minimize the amount of time and effort needed to acquire life necessities; a concept based on the principle of energetic efficiency as it applies to Optimal Foraging Theory (Judge 1971; Goldstein 1979, 1981; Hewitt 1983; Keene 1983; Roper 1979b; Winterhalder 1983).

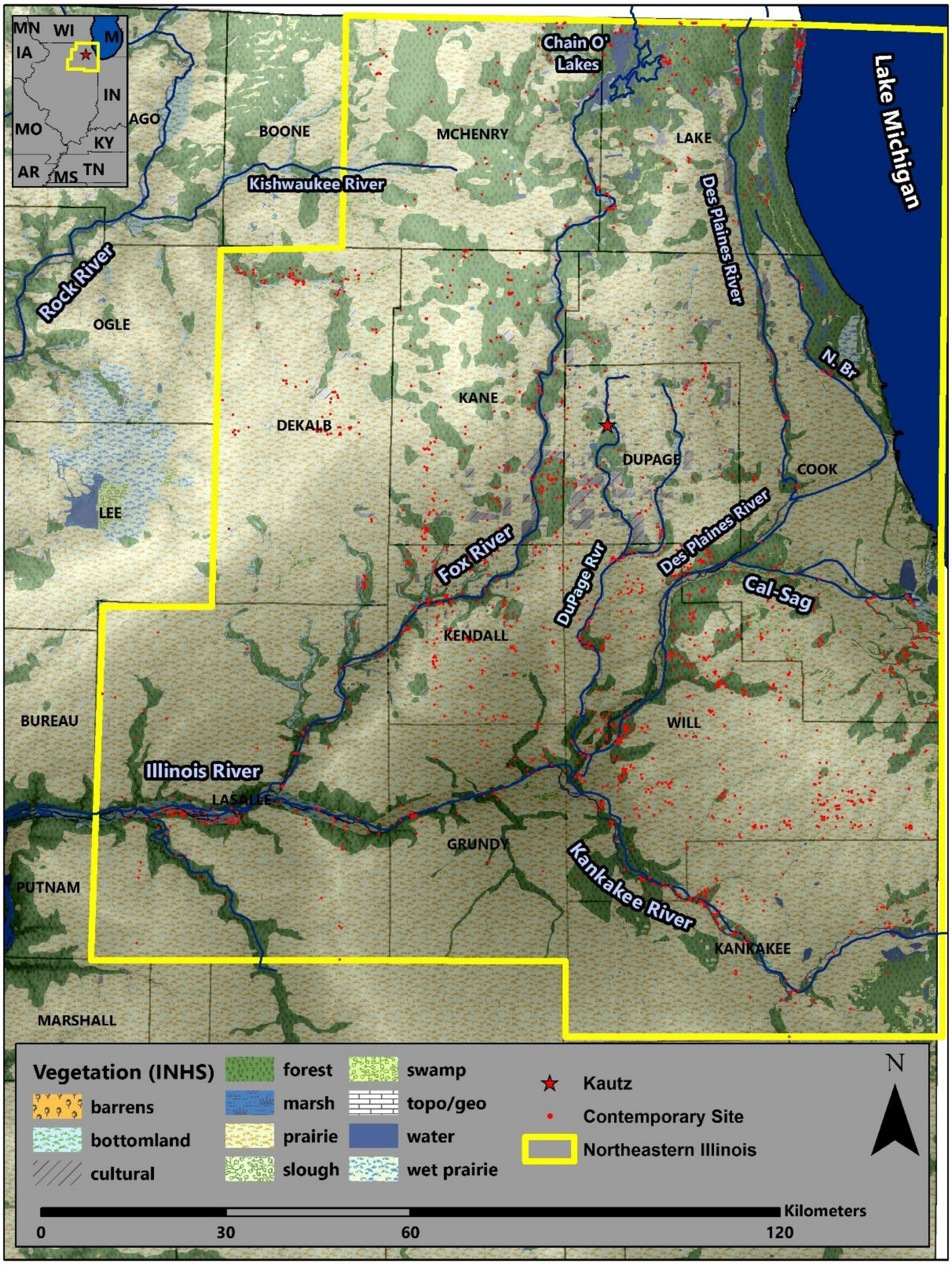


Figure 4. Pre-settlement vegetation in northeastern Illinois.

The Prairie Peninsula brings together different resources that could be acquired in close proximity to one another, such as a forest edge near riverine or upland depression wetland

habitats (Goldstein 1979; Jeske 1986; Weston 1981). A prehistoric site in this region should be located in a place that is productive year-round but more productive at certain times of the year. This location should also be located in an elevated location on soils with good drainage, fertility and general plant productivity (Hart and Jeske 1987, 1989). Lastly, this location should be situated near a source of raw material for tools, either a high-quality primary source or a secondary source where lesser-quality nodules can be obtained.

Based on the previous assumptions, we might expect that the Kautz Site was occupied because it provided a wide-range of adaptive benefits to its inhabitants including a central location from which to exploit a diverse set of ecological patches, access to clean drinking water and water for other uses, wood for making tools and fire, and a source of good quality raw material for making chipped stone tools. Based on human physiology and ethnographic accounts, all of these resources should have been available within a maximum daily foraging range of ten kilometers (R. Kelly 1995). To test these expectations, I conducted a GIS-based catchment analysis to determine if all of the above-mentioned resources were available within a 10-km circular catchment.

The Kautz Site material culture inventory consists of a wide range of prehistoric items dating between the Late Archaic and Late Woodland periods (ca. 6000 and 1000 B.P.) including chipped stone artifacts, ceramic sherds, rough rock, and faunal material. These material classes were examined to varying degrees. The chipped stone and faunal assemblage received the most attention while the ceramic and rough rock assemblages received only cursory examinations due to time limitations and the relative lack of information they offered to the main thesis of the project.

The lithic assemblage was examined to determine if there is evidence that supports or denies the results of the catchment analysis. Attributes identified on chipped stone tools and the corresponding lithic debris can provide a wealth of information about the technological organization and raw material procurement strategies practiced at the site. Technological organization and raw material procurement strategies practiced at the site are influenced by a cadre of factors that span from environmental to social. Some of these factors include: cultural tradition (Boeda 1995; Montet-White 1968; Vierra 1983); group size and mobility (Binford 1980; Morrow and Jefferies 1989; Parry and Kelly 1987; M. Shott 1986); circumstances of production such as anticipated or unanticipated tasks (Koldehoff 1999; Tomka 2001; Wurz 2002); site function, location, distance (Binford 1979, 1980; Jeske 1989, 2003); availability of raw material (Bamforth 1986, 1991; Hayden 1989; Kuhn 1994; Lurie 1989b); and individual agency (Dobres and Hoffman 1994; Jeske n.d.; Nassaney and Pyle 1999). Therefore, we should expect the nature of the lithic assemblage from the Kautz site to be at least partially contingent on the results of the landscape analysis and the typological analysis of the ceramic assemblage and diagnostic chipped stone tool assemblage.

For example, if chert was not accessible within 10-km of the site, raw material would have been restricted and we should expect to find evidence within the lithic assemblage of efforts to cope with this shortfall. As a forager's encounter rate with high profitability resources, in this case chert, declines there is a need for more efficient energy-gathering tools (Bleed 1986; Jeske 1989; Odell 1994; Torrence 1989) as well as a more economic approach to the production and utilization of tools. Biface technology is seen as one way to maximize the amount of utility per unit of stone because of its durability, predictability, and flexibility (Jeske 1989). Blade core technology is seen as a way to maximize the amount of cutting edge per unit of stone. Increasing

resource breadth is another economizing strategy that is used when preferred materials are scarce or access is limited. If good-quality materials are hard to come by, then we would expect lesser quality or more expensive materials to be used in greater frequencies at the Kautz Site.

Paper Outline

This thesis is organized into six chapters and appendices. In Chapter 2, I provide some historical context for the Kautz Site. The first section discusses the history of archaeological research in the region beginning with the first scientific explorations shortly after the end of the Black Hawk War in the 1830s and ending with a summary of all the areas surveyed and sites recorded. The second section describes the prehistoric context of the Kautz Site by documenting important shifts in technology, settlement, subsistence, and ideology over time.

Chapter 3 introduces the reader to the Kautz Site. This chapter includes the circumstances of the site's discovery and the problems with identifying the actual location of the Kautz site and its excavation units. A description of the excavation and documentation methods and cultural material recovered from the site is also provided in this section. Questions addressed include: What types of artifacts were recovered from this site? What is their temporal affiliation? What artifact class is best represented? Where are the densest concentrations of artifacts within the site? What types of artifacts were found together? Are there any noticeable concentrations of diagnostic artifacts? Are there any culturally distinct features or stratigraphic horizons?

Chapter 4 is a reconstruction of the physical and social landscape using a wide range of data sources. The goal is to test if the Kautz Site was chosen because of its central location to a number of important economic resources such as fresh water, food, and raw material for chipped stone tools. A GIS-based catchment analysis will be used to answer a number of questions

regarding various economic aspects of site placement including the importance of access to natural resources (e.g., water, stone, wetland/forest/prairie resources, culture cores). Four catchments will be analyzed, each representing different levels of effort needed to exploit certain resources. Questions addressed include: What types of natural resources would have been available within the site's catchment? What proportions of forest, wetland, and prairie are located within the catchment? How far away are the sources of raw materials identified in the lithic assemblage? How many culturally affiliated sites are located within the catchment and what are the closest affiliated burial sites in relation to this site?

Chapter 5 is an assessment of the lithic assemblage. The goal is to test hypotheses about the relationship of the distance to raw material and the nature of chipped stone tools at a site. A macroscopic analysis of the lithic assemblage including the tools and debitage will be used to answer questions about the raw material procurement, tool production and maintenance and discard strategies used at the site. Questions addressed include: What types of chert were used at the site? How much of each chert was used and in what form where they found? What types of tool forms are present at the site? What does the debitage assemblage tell us about the reduction strategies used? Does the lithic assemblage at the site suggest chert was a restricted resource throughout time or only certain periods of time?

Chapter 6 will be a discussion of the results from the lithic and landscape analyses and possible explanations for any disparities between the archaeological record of the Kautz Site and the settlement and subsistence models tested in this thesis. I will also provide some suggestions for future avenues of study and reiterate the potential benefits of applying new methods and theory to previously unused or unknown archaeological datasets such as the Kautz Site.

Appendix A are the results of Megan Leigl's faunal analysis. It is organized as a self-contained research paper with methods, results, interpretation and references. Appendix B is the lithic documentation schema used for the macroscopic and spatial analysis of the debitage and tool assemblages. The schema includes the coding system used to quickly record each artifact's attributes. Appendix C is the raw data from the debitage analysis. It includes all meaningful attributes for every artifact. Appendix D is the raw data from the chipped stone tool analysis. Appendix E is raw data from the ceramic analysis and Appendix F is the raw data from the rough rock analysis. Finally, Appendix G is a detailed distribution map of diagnostic artifacts recovered from the site. This map includes pictures of most if not all diagnostic or otherwise important artifacts found in each excavation square. It can be used as a guide throughout.

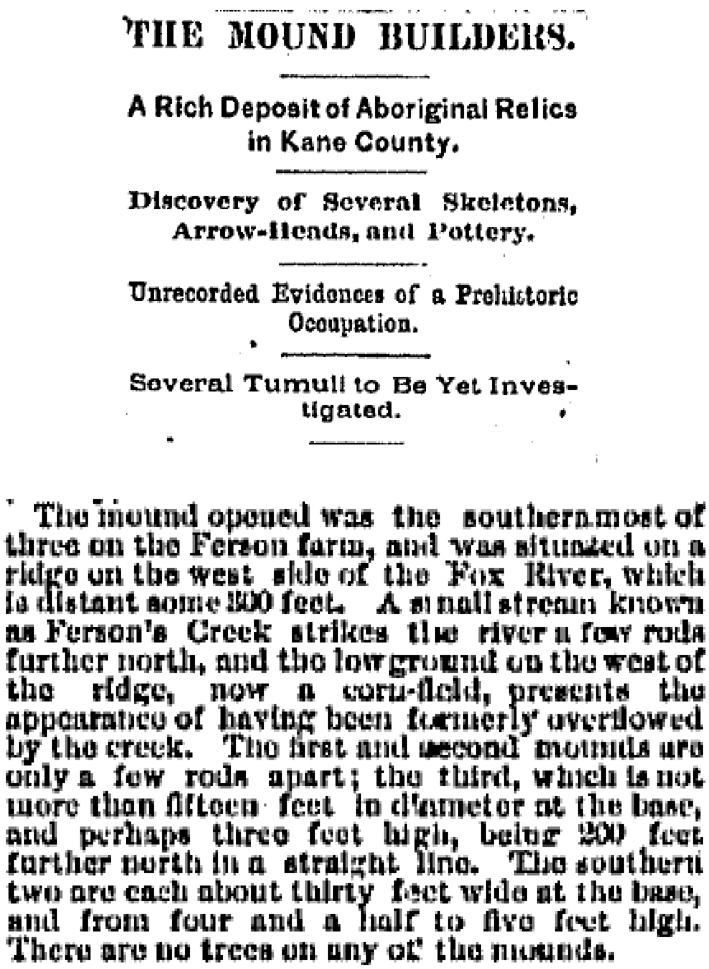
CHAPTER 2: HISTORICAL BACKGROUND

The History of Archaeological Research in Northeastern Illinois

In many ways the history of archaeological research in northeastern Illinois is representative of the history of archaeological research in North America. Many of the advancements in the development of archaeological methods and theory such as early mapping techniques and processual theory were first applied to the archeological record of this region (Willey and Sabloff 1993).

In northeastern Illinois, interest in prehistoric Native American sites increased in the 1830s as easterners began to settle into the region after the Black Hawk War ended and the Treaty of Chicago was signed in 1833 (Tanner and Pinther 1987). European settlers were well aware of the many earthen mounds dotting the landscape and soon began to excavate into them out of curiosity or desire to discover buried treasure. The collective works of early antiquarians like Squier and Davis, Increase A. Lapham, and Cyrus Thomas are crucial for two reasons. First, many of the earthworks they recorded no longer exist and they are the only record of them. Second, their work helped resolve the debate on whether or not the mounds were built by the ancestors of the contemporary Native Americans (Silverberg 1968).

One of the earliest documentations of excavations into Native American mounds in the study area occurs in a surprisingly well-detailed article in the Chicago Daily Tribune dated September 6th, 1877. The article describes the efforts of a group of curious local residents, including several medical doctors, conducting a weekend excavation of a group of mounds along the west bank of the Fox River on John Ferson's property north of St. Charles (Chicago Daily Tribune 1877, Figure 5).



THE MOUND BUILDERS.

A Rich Deposit of Aboriginal Relics in Kane County.

Discovery of Several Skeletons, Arrow-Heads, and Pottery.

Unrecorded Evidences of a Prehistoric Occupation.

Several Tumuli to Be Yet Investigated.

The mound opened was the southernmost of three on the Ferson farm, and was situated on a ridge on the west side of the Fox River, which is distant some 300 feet. A small stream known as Ferson's Creek strikes the river a few rods further north, and the lowground on the west of the ridge, now a corn-field, presents the appearance of having been formerly overflowed by the creek. The first and second mounds are only a few rods apart; the third, which is not more than fifteen feet in diameter at the base, and perhaps three feet high, being 200 feet further north in a straight line. The southern two are each about thirty feet wide at the base, and from four and a half to five feet high. There are no trees on any of the mounds.

Figure 5. Excerpts from Chicago Daily Tribune Article, September 6th, 1877.

The 1872 plat map of St. Charles Township in Kane County shows the location of James Ferson's, (father of John Ferson), property in the extreme SE ¼ of Section 21 and extreme NE ¼ of Section 28 in T40N R8E (Figure 6).

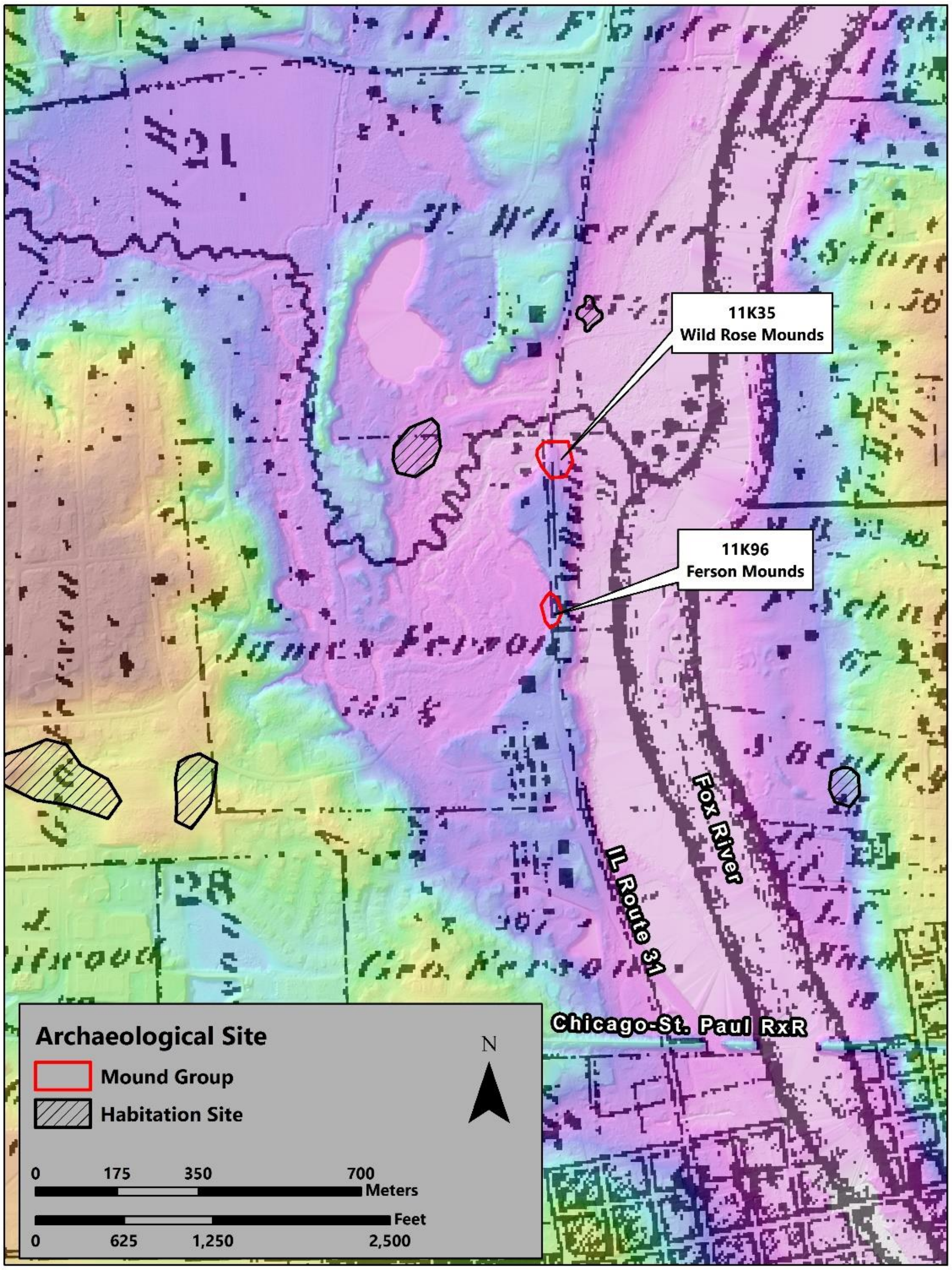


Figure 6. Ferson mounds map on an 1872 plat map overlaid on LiDAR imagery.

Figure 6 shows the location of the Ferson mounds group (11K96) and the Wild Rose mounds (11K35) on a long, thin ridge on the west bank of the Fox just south of its confluence with Ferson Creek (also see Early 1973, Foley Winkler 2011). The author of the article mentions

in detail the many skulls and bones that were collected from the mounds as well as the soil type within and below the mound. He also mentions the many artifacts recovered from the mound including shell, flint pieces, and imperfect arrowheads.

Charles Dilg (1903), Albert Scharf (1901), and Charles Peet (1888) were some of the first people to attempt to systematically document archaeological resources in the Chicagoland area (Joseph 2009; McManamon et al. 2009). Albert Scharf for example, was an avid cyclist and historian. On his free time he mapped numerous foot trails, campsites, and burial tumuli throughout Chicago and its collar counties including DuPage. With the aid of the Chicago Historical Society, he published his maps in 1901 (Scharf 1901). His notes and maps have been a valuable source of information to modern archaeologists; many of the sites he recorded have now been ground-truthed and entered into the Illinois Inventory of Archaeological and Paleontological Sites (IIAPS) maintained by the Illinois State Museum (IIAPS 2015).

Although initially lacking professional affiliation, George Langford (1876-1964) was one of the most important archaeologists in northeastern Illinois Archaeology and is responsible for some of the earliest salvage archaeological projects in the state. As early as 1906, Langford and a friend had begun to investigate some of the burial mounds at the Fisher site in the Des Plaines River Valley (Figure 7). Many of the mounds at Fisher were in imminent danger of modern plowing equipment and were later lost to gravel mining operation. Over several years he excavated and documented a number of them before they were destroyed. What differentiated Langford from other people who were excavating into mounds at the time was that he actually published his findings in scientific journals (Langford 1919, 1927). Langford was heavily involved with classifying and documenting the history of Illinois and was a leader in the

movement away from speculation to a more historical and scientific approach to studying the past.

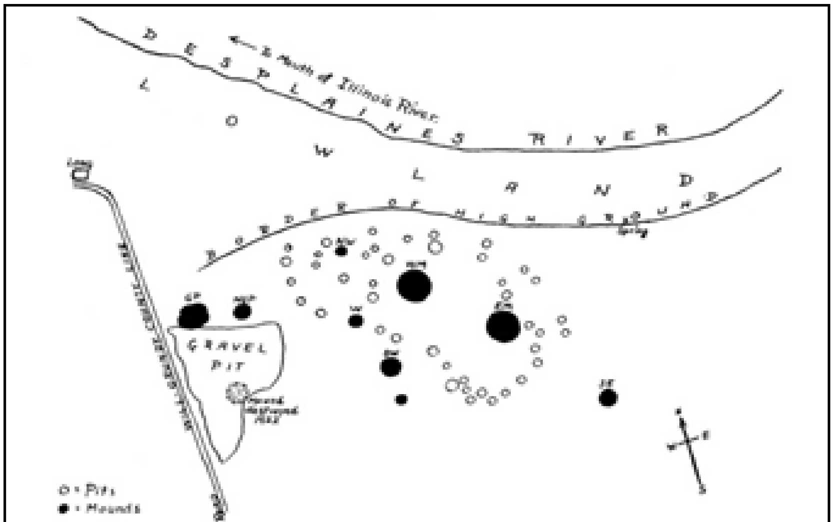


Fig. 1
The Fisher Mound Site, Will County, Illinois. Scale 1" = 150 feet.

Figure 7. Fisher Mound plan map (adapted from Langford 1927).

In 1925, University of Chicago began an archaeological reconnaissance of Illinois. The University began its survey in Jo Daviess County and then focused their attention on other areas such as the Central and Upper Illinois Valley (Cole and Deuel 1937). During the late 1920s and early 1930s a number of important Upper Illinois Valley mounds sites were investigated in advance of their imminent destruction. In 1929, Percy Hodges, who was then under the direction of William K. Moorehead and Dr. A. R. Kelly, excavated several mounds affiliated with the Utica mound group in Utica, Illinois (Henrikson 1965). In the same year, George Langford, with the assistance of Dr. Wilton Krogman of the University of Chicago and some of his students conducted salvage excavations at Adler Mounds near Joliet (Winters 1961). A few years later in 1931, graduate students from the University of Chicago including George K. Neumann, Fred Eggan, and a young J.B. Griffin investigated nearby Winfield mounds, also known as Player

Mounds (Kullen 1988; Neumann 1931). Despite the importance of these sites in establishing a local chronology for the Upper Illinois valley, the salvage work at sites like Utica, Winfield, and Adler Mounds were largely ignored until the 1960s (Henriksen 1965; Winters 1961).

In 1939 W.C. McKern published his taxonomic method called the "Midwestern Taxonomic System" in the fourth volume of *American Antiquity*, one of the first academic journals focused solely on American archaeology (Alton 1997; McKern 1939). In this important step towards standardization in chronology, McKern used terms such as focus, aspect, phase, and pattern to differentiate between specialized local types of culture manifestation and more general and broadly influential types (McKern 1939). The same year McKern published his manifesto, William K. Moorehead passed away. Throughout the 1920s and 1930s Moorehead had conducted countless surveys and excavations throughout the Illinois River Valley and Griffin et al. (1941) compiled and published his unfinished work in *Contributions to the Archaeology of the Illinois River Valley* (Griffin et al. 1941). After World War II, a combination of new technology and ideas and an explosion of housing and commercial development in the suburbs led to one of the most exciting eras in Illinois archaeology.

In 1951, Elaine Bluhm of the University of Chicago refined the cultural sequences of the Woodland period in Illinois and in 1952 J.B. Griffin expanded on this sequence (Bluhm 1951; Griffin 1952b). In 1956, Dr. John C. McGregor created the Illinois Archaeological Survey (IAS), an organization of archaeologists in the state focused on conducting salvage work in the wake of increasing development. David J. Wenner and Sanford Gates, early members of the IAS, surveyed along the DuPage River drainage and recorded the first 15 sites in DuPage County including the Kautz Site. Their survey results were published in *Chicago Area Archaeology*, an IAS bulletin edited by Elaine Bluhm (Gates 1961). *Chicago Area Archaeology* is one of the few

publications focused solely on Chicago area archaeology to date and is still the only formal documentation of the Adler Mounds excavations and the Bowmanville complex.

Despite the passing of the Archaeological Salvage Act of 1960, the National Historic Preservation Act of 1966, and the National Environmental Policy Act in 1970 (ACHP 2015), no significant archaeological work was conducted in DuPage County until 1970. In 1970, Ann Early began work at the Fermilab National Accelerator Laboratory (FNAL) and a decade later several more surveys occurred on the property (Early 1970, 1971, 1973; Jeske 1987; Lurie 1987, 1989a; Lurie and Jeske 1989). Several other large-scale surveys occurred in the area during the 1980s including portions of the Illinois and Michigan Canal National Heritage Corridor (Hart and Jeske 1987, 1988), Argonne National Laboratory (Curtis and Berlin 1980), the Joliet Army Ammunition Plant (Doershuk 1988; Hart et al. 1989), and the Chain O'Lakes State Park in nearby McHenry County (Jeske 1988). The data recovery, analysis, and interpretation conducted for these projects relied heavily on new methods and theory developed by processual and post-processual archaeologists in the 1960s through 1980s. One result of these studies was the development and testing of predictive models that used correlations between site location and environmental features such as elevation, soil permeability, distance to water and transitional habitats to determine where sites were likely to be and why (J. Brown 1981; Hart and Jeske 1987; Jeske 1988).

Many of the smaller surveys conducted in the area during this time period were for subdivisions, strip malls, and infrastructure improvements (IIAPS 2015). As of January 2014 roughly 20% (43,706 acres) of DuPage County has been surveyed and 593 archaeological sites have been discovered. The bar graph in Figure 8. Displays the number of sites recorded in the corresponding decade, demonstrating the increase in the number of recorded sites in the 1990s.

This anomaly is coincident with a boom in development as well as the strengthening of Illinois' preservation laws including the passage of the Human Skeletal Remains Protection Act (20 ILCS 3440) in 1989 and the Archaeological and Paleontological Resources Protection Act (20 ILCS 3435) and Illinois State Agency Historic Resources Preservations Act (20 ILCS 3420) in 1990. The subsequent drop off of recorded sites in the 2000s is likely coincident with the lack of infrastructure projects occurring in DuPage County during that decade.

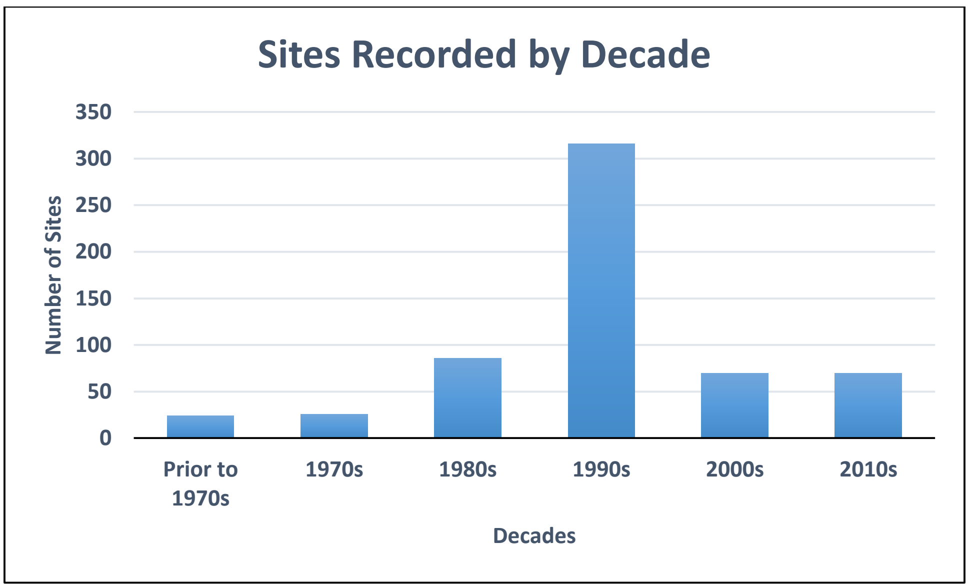


Figure 8. Bar graph displaying recorded sites in DuPage County by decade.

Although DuPage County has been subject to more than a century of archaeological investigations, only 20% of the county has been surveyed. The remaining 80% of the county that has not been surveyed is largely unsurveyable due to modern development leaving only 12% with any potential for archaeological resources (IIAPS 2015) (Figure 9). Fortunately, the 12% of

land left relatively undisturbed is owned and managed by the Forest Preserve District of DuPage County (FPDDC) and is not in any imminent danger of development.

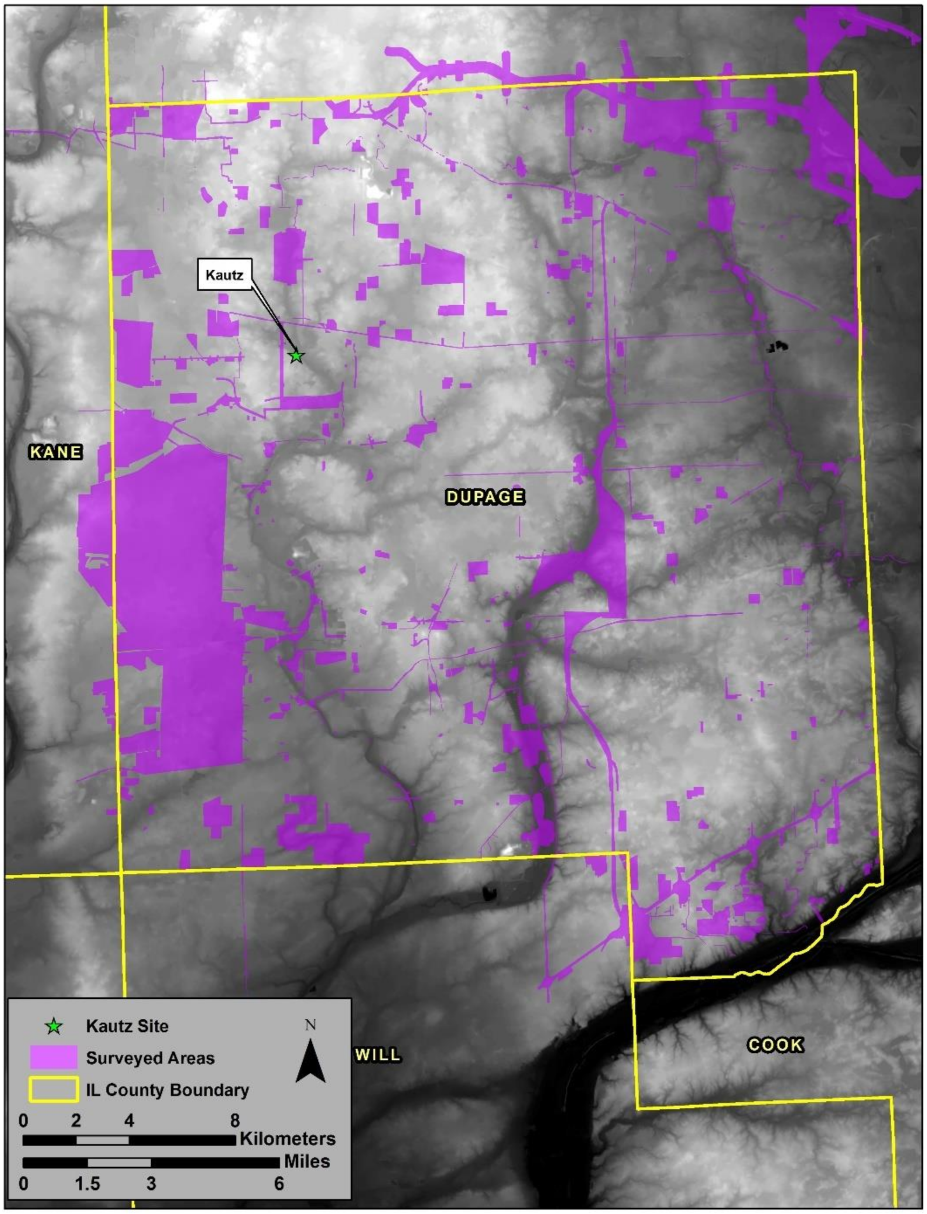


Figure 9. Surveyed areas in DuPage County (Dec. 2015).

The more than a century worth of archaeological investigations in the state has provided us with a wealth of information about the prehistory of this region. From the nefarious activities of grave robbers and complacent farmers to the establishment of chronology and the application of critical theory and the scientific method, Illinois has been at the forefront of American archaeology. The following section summarizes current knowledge of the prehistory of this region and incorporates information from multiple sources such as site and survey reports, peer-reviewed journals, books, and the Illinois Inventory of Archaeological and Paleontological Sites (IIAPS 2015).

The IIAPS is a very powerful tool. The IIAPS is a GIS-based dataset that incorporates attribute and locational data collected from site and survey reports submitted to the Illinois State Museum in the form of GIS shapefiles and corresponding attribute table. It provides the ability to search through the entire state site file database and query for cultural and physical attributes within seconds, allowing for quick and easy analysis of large portions of the state. Prior to the advent of GIS, this process would have taken months or even years to complete. The IIAPS is useful also for identifying survey biases, landform preferences over time, areas with a high or low density of sites, and measuring distances from sites to landscape features such as water. Although the IIAPS GIS database is a powerful tool, the database must be used with caution. The locational information for sites is often based on best guesses from descriptions in site forms and unreliable GPS hand-held units and there are numerous inconsistencies with attribute data such as landform types and temporal affiliations. Other issues with the IIAPS include potential problems with coordinate systems and projections, outdated and incorrect information, survey biases, and the fact that many known and unknown archaeological sites have yet to be submitted to the database.

The following section is organized into four smaller sections coinciding with the four major development stages: Paleoindian, Archaic, Woodland and Mississippian (Griffin 1967). The Archaic and Woodland stages are further broken down into substages and when applicable specific traditions, phases, and horizons will be briefly described.

Northeastern Illinois Prehistory

Paleoindian Period (12,000-10,000 B.P.)

The first people to inhabit this landscape were likely highly mobile hunting and foraging Clovis groups. The presence of Clovis/Gainey bifaces made from non-local cherts at sites like Ambler and Hawk's Nest suggest that people were traveling hundreds of kilometers a year, possibly to intercept migrating Caribou herds (Loebel 2005). Ambler and Hawk's Nest likely represent a pattern of selecting places on the landscape well suited for monitoring and intercepting game such as bluff crests and morainal ridges near stream intersections (Figure 10). The first signal of change in Paleoindian behavior is represented by the appearance of new projectile point type forms. New forms such as Folsom, Agate Basin and Scottsbluff/Eden are affiliated with the Cody complex and appear on the landscape sometime around 10,000 B.P. Cody complex point forms are often associated with bison kill sites further north and west and suggest a shift in climate and possibly diet (Andrews et al. 2008; Mason 1997).

The end of the Paleoindian period is marked not just by a shift in projectile point technology but a much larger shift in settlement patterns. The Dalton horizon represents a break from the Paleoindian pattern and signifies the beginning of the Archaic tradition (Koldehoff and Loebel 2009).

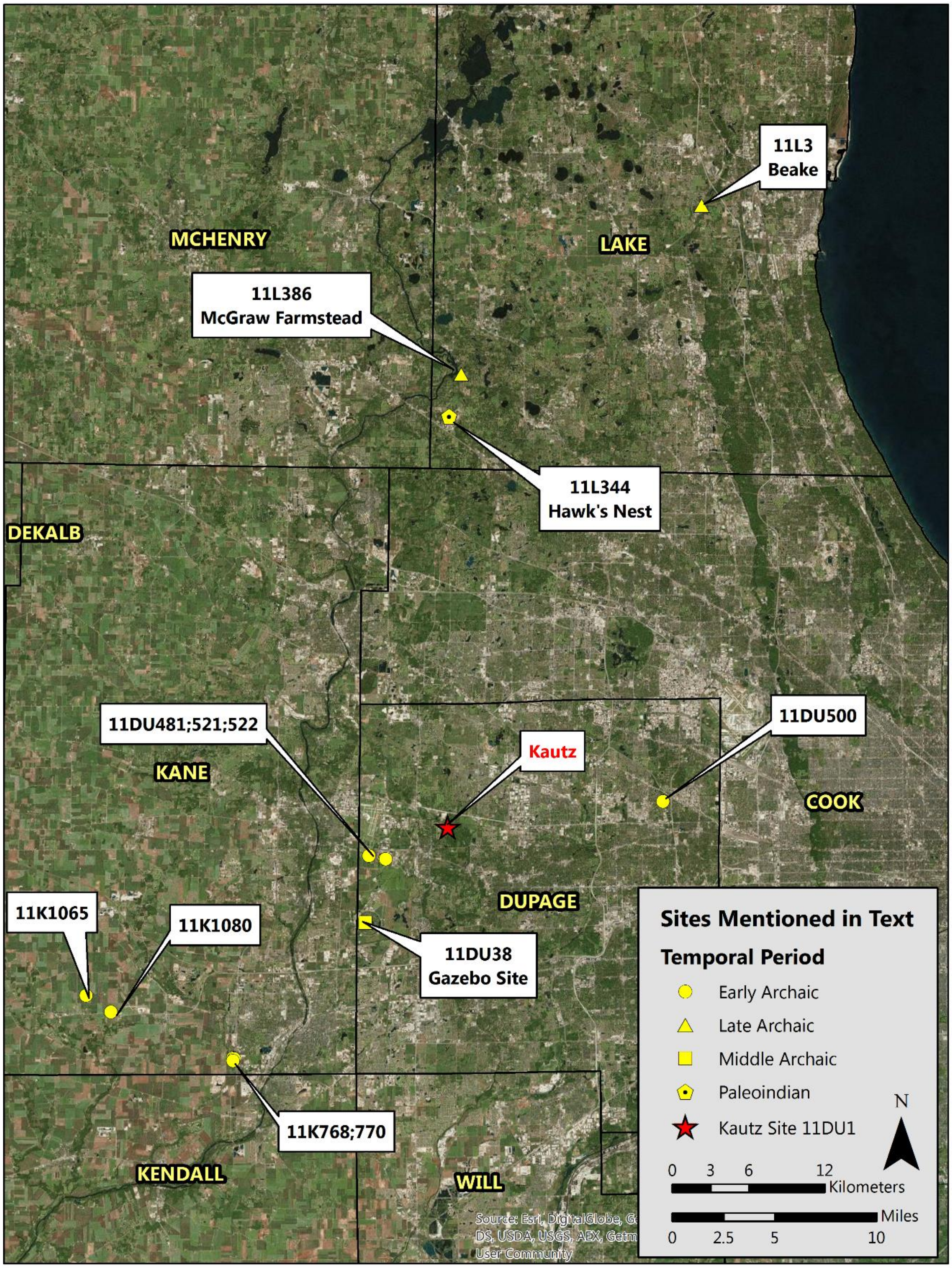


Figure 10. Paleoindian and Archaic sites in northeastern Illinois.

The Archaic Period (10,000-3,000 B.P.)

The Archaic period is a far more complex entity than originally thought (McElrath et al. 2009). The period has been traditionally divided into three stages characterized by dynamic environmental processes, fundamental changes in technology, settlement and subsistence strategies, socio-political organization, expression of ideological beliefs, and level of inter-regional communication (Price and Brown 1985). However, with new data produced over the last few decades, it seems as though these changes happened on a continuum over long periods of time and space making it difficult to make generalizations. Lurie et al. (2009) have provided the most up to date synthesis of the region's Archaic archaeological resources and was a major contributor to this review of the Archaic period in northeastern Illinois.

Table 1. Number of Archaic sites in NE Illinois by Landform

Table 1. Number of Archaic Sites in NE Illinois by Landform		
Landform	**Count**	**% of Total Sum**
Bluffbase	38	1.64%
Bluffcrest	211	9.09%
Bluffslope	104	4.48%
Floodplain	209	9.00%
Island	2	0.09%
Lake Michigan Beach	3	0.13%
Other Upland	1226	52.80%
Terrace	169	7.28%
Unknown	16	0.69%
Upland Closed Depression	25	1.08%
Upland Ridge	319	13.74%
Total	**2322**	**100.00%**

Early Archaic sites are typically found in a wide range of environmental contexts suggesting a reliance on a number of resources distributed widely across the landscape. Sites in Illinois have been found in upland intermittent streams (Ferguson and Warren 1991), upland closed depressions (Carmichael 1977), rock shelters (Fowler 1959), abandoned terraces (Roper

1979a), and fan deposits of major rivers (Wiant et al. 1983). In DuPage County, sites are found on a variety of landforms but the most common landform noted on site forms is ‘other upland’, a vague designation but one that nonetheless suggests a broad use of the landscape (Table 1). Early Archaic technology is characterized by its large bifacial point industry. Early Archaic bifaces are diverse and archaeologists have collected several varieties in DuPage County such as Kirk Corner Notched (11DU500; 11K768), Hardin Barbed (11DU481), St. Charles (11K1080), St. Albans (11K1065), Thebes (11K770), and Fox Valley Barbed (11DU521, 522; 11K772). Examples of these point types can be found in *Stone Age Spear and Arrow points of the Midcontinental and Eastern United States: A modern survey and reference* (Justice 1987).

The Middle Archaic coincides with a major shift in regional climate that occurred between 8,000 B.P. to 5,000 B.P. called the Hypsithermal or xerothermic period (King 1981). During this time period, the prairie expanded into areas previously occupied by forest and forced animals such as white tail deer and people to adapt to the loss of habitat. Evidence of changes in mobility are apparent during this time period and in some instances groups concentrated in the best parts of the environment. Most Middle Archaic sites like the Gazebo site (11Du38) are directly adjacent to a water source. The Gazebo site is located in the middle of the accelerator ring of the Fermi National Accelerator on the north end of a large upland depression and is one of only a few Archaic sites that have been investigated in northern Illinois (Jeske 1990; Lurie 1990) (Figure 10). The lithic assemblage consists of Matanzas and Raddatz hafted bifaces, debitage, expedient tools, and some possible fire cracked rock (FCR). Associated with the lithic assemblage and FCR was a carbonized nutshell found in a possible hearth dated to 5,090 ± 50 B.P., (cal. 3980 to 3770 B.C.) which coincides with the very tail end of the Hypsithermal (Lurie et al. 2009).

Late Archaic

During the Late Archaic period, a cooler and wetter climate similar to the modern climate provided the needed moisture for forest edge communities to regenerate (Bowles et al. 1998; King 1981). In response, there was an increase in settlement outside of the major river valleys for the first time since the Early Archaic. Based on projectile point attributes recorded for the South Suburban Airport sites, Harris (1998) has demonstrated a shift in social interactions from the south during the Middle Archaic period, to areas north and east during the Late Archaic (Harris 1998), however this shift in social interaction orientation is not well understood. There seems to have been several different Late Archaic groups living in the region and due to the lack of well-preserved sites and radiocarbon dates, parsing out the details has been difficult. According to Markman (1991), two similar but different Late Archaic burial traditions overlapped in northern Illinois, Old Copper from the north and the Red Ochre/Glacial Kame cultures in the south (Markman 1991). Pleger and Stoltman (2009) view the Old Copper Industry as a series of regional Middle and Late Archaic-stage cultures that shared a basic copper fabrication technology (Pleger and Stoltman 2009). The Old Copper Industry is well represented in eastern Wisconsin and is only represented in northern Illinois by a few isolated copper objects found near Lake Michigan. In the Red Ocher tradition, the dead were covered in red ocher and buried in conspicuous areas on the landscape with burial goods including copper celts, beads and long bifaces with a distinctly notched contracting stem base known as Turkey Tails. The sites are often found on bluff spurs in the Illinois River valley and high morainal ridges in northern Illinois (Charles 1992; Cole and Deuel 1937; Porubcan and Lurie 1998). The Red Ocher tradition is not well represented in DuPage County. The nearest examples of Red Ocher sites are the Beake site (11L3) and the McGraw Farmstead, however there are numerous other Late Archaic

sites identified by the presence of Raddatz, Merom, and Trimble biface forms (Figure 10). Both Merom and Trimble biface forms are abundant in the Riverton Complex further south along the Wabash (Winters 1969) and the presence of these points at the Kautz Site might suggest similar lifestyles and cultural affinities.

The Woodland Period

Towards the end of the Red Ocher tradition some of the dead were interred with ceramic vessels and this has led to some confusion regarding the timing and nature of the Archaic to Woodland transition (Montet-White 1968). In northeastern Illinois, Early Woodland sites are often identified solely on the presence of Kramer or Waubesa points, but this is problematic because these point forms are present at Late Archaic as well as early Middle Woodland sites. Generally, though, the Woodland Period is characterized by changes in social structure and technology rather than wide scale changes in response to climate change. Climatologists have shown that the overall climate remained stable during the Woodland period (King 1981) leading archaeologists to believe social dynamics may have led to many of the important changes that occurred during the Woodland period rather than environmental drivers like climate change (Emerson et al. 2000).

Ceramic technology allowed for better storage and cooking, as well as a vehicle to express one's beliefs and identity (Rice 2006). The ceramic ware most commonly affiliated with Early Woodland sites in Illinois is Marion Thick, which closely resembles pottery types found Ohio Adena sites (Griffin 1952). Marion thick wares are conoidal in shape, tempered with coarsely ground rock or grit, and typically decorated with cordmarking on the outer surface--although sometimes it can be on the upper portion of the interior surface (Farnsworth 2006). Later versions of this ware have incised lines and/or annular punctates that closely resemble

designs seen on Black Sand ware, which is found primarily in major river valleys (Farnsworth 2006).

Early Woodland sites in DuPage County and are mostly concentrated along the East Branch of the DuPage River. However, not one of the Early Woodland sites recorded at Fermilab was associated with Early Woodland pottery (Figure 11). To find examples of Early Woodland pottery in northeastern Illinois, the closest and best representations were found at the Bowmanville Village site. Bowmanville village is located on a sandy ridge paralleling the north branch of the Chicago River and Lake Michigan approximately 25 miles east of Kautz. Early Woodland ceramic types found at Bowmanville include Marion Thick, Black Sand Incised, Sisters Creek Punctate, and Morton Incised (Fenner 1961).

Middle Woodland Period

The Middle Woodland period in northeastern Illinois was influenced by the development of the Havana Tradition in the Central Illinois Valley sometime around 2100 B.P. This period is characterized by an intensification of behavioral patterns established during the preceding Early Woodland and Late Archaic periods. Specifically, people began constructing large, complex conical burial mounds with internal astrological alignments, crafting highly decorative personal items and ceramic vessels, producing bladelets and oversized stylistic bifaces, and participating in a pan-regional trade network called the Hopewell Interaction Sphere (HIS) (Cole and Deuel 1937; Griffin 1952b; Montet-White 1968; Struever 1965).

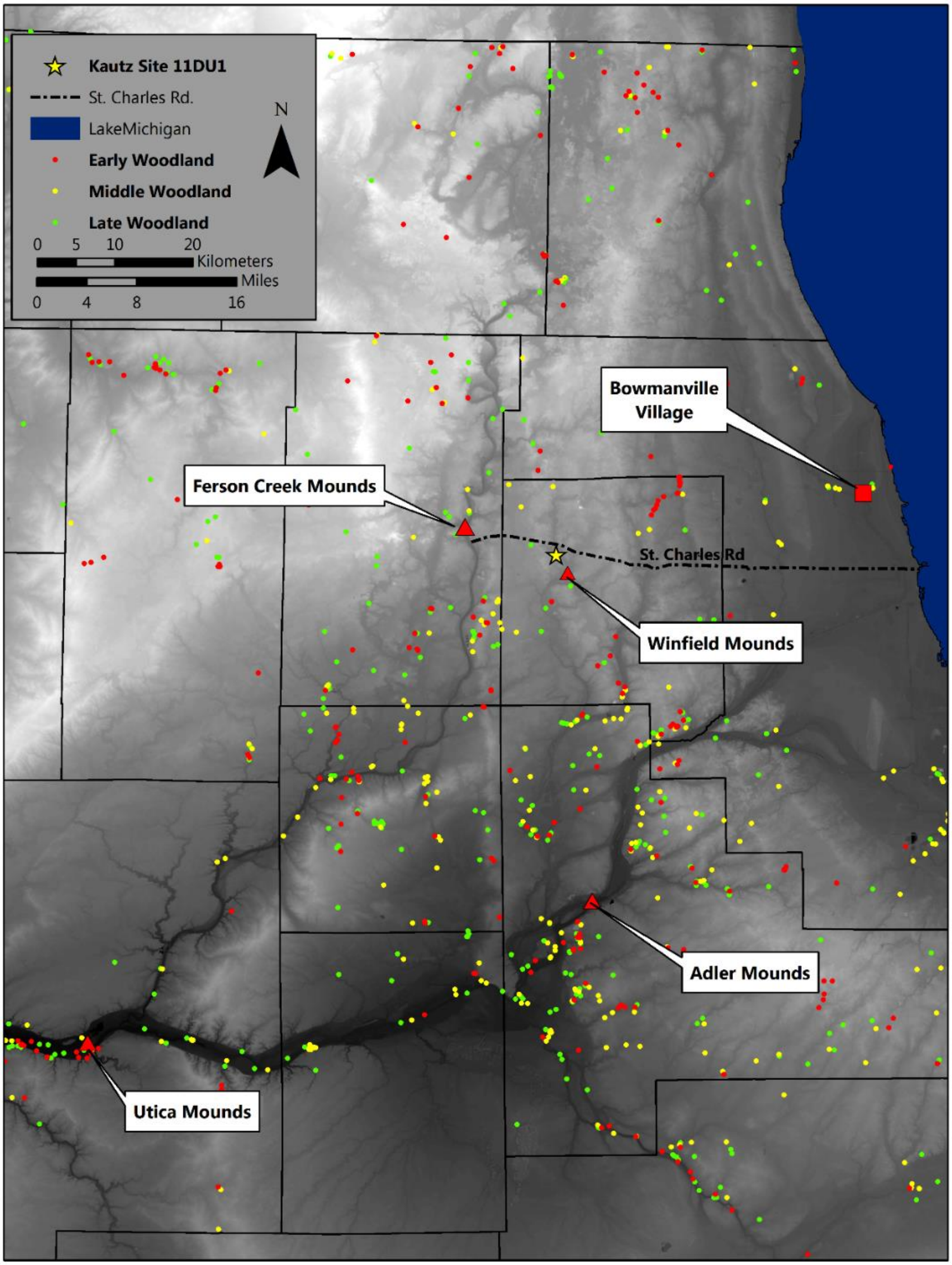


Figure 11. Woodland sites in northeastern Illinois.

There have been many attempts to define what the Hopewell Interaction Sphere is (Beck Jr and Brown 2011; Brose and Greber 1979; Caldwell and Hall 1964; Carr and Case 2005; Charles and Buikstra 2006; Cole and Deuel 1937; Jeske 2006), however two of the best definitions come from Carr and Case (2005) and Jeske (2006). Case and Carr (2005) choose to see the Hopewell Interaction Sphere as, "A set of relationships that facilitated the flow of raw materials, finished products, people, and ideas" (Case and Carr 2005). While Jeske (2006) sees it as "a vaguely defined ideological network of localized polities adapting to local social and physical environments, expressed in pan-regional stylistic motifs, raw materials, and artifact forms." His interpretation is not too different from the ideas of Carr and Case (2005), however it does allow for the investigation of the nonsymmetrical participation in the Hopewell Interaction Sphere within and across regions.

Trade was a very important aspect of Middle Woodland life, and it was likely the mechanism in which lineage groups mediated conflict and created social ties to offset future risks. Fie (2008) has examined the temper of Havana pots and has shown that there was a significant trade of domestically made pots between villages and proposes that not only status goods were being traded but domestic goods as well (Fie 2008).

There is evidence from domestic contexts outside of the Havana Hopewell core area that regional Middle Woodland groups participated within the Hopewell Interaction Sphere but it is not clear to what extent. Jeske (2006) suggests that communities who lived in the periphery may have practiced similar subsistence strategies, a mixed hunting, gathering, and horticulture economy, but had a much different settlement strategy, likely practicing a more residential mobility. A survey of known prehistoric sites in DuPage County demonstrates that the area was used periodically by Middle Woodland communities, but nowhere near as intensively as areas

along the Illinois River or secondary streams such as the Spoon or Fox River. Only 20 sites in DuPage County were found to have a Middle Woodland component, many of them being small lithic scatters consisting of a few broken projectile points that may or may not be Middle Woodland in origin. The site survey also found that there are only two known burial sites in DuPage County; Winfield Mounds and the Butler Mound, both are questionable as to their origin (Figure 12).

The Late Woodland Period

The Late Woodland period is represented in the archaeological record by a number of traits including thin, grit-tempered, cordmarked and smoothed over cordmarked pottery with little to no decorative features; small triangular and notched projectile points and expedient stone tool tradition; grinding stones; simple, flexed and bundled burials in small, low conical and linear mounds, and a heavy reliance on horticulture (Yerkes 1988). It is differentiated from the preceding Havana Hopewell tradition by the lack of Hopewell symbolism and trade materials, the discontinuation of certain types of mound building, a change in hafted biface morphology, and a much wider distribution of habitation sites on the landscape (Emerson et al. 2000; Stevenson et al. 1997).

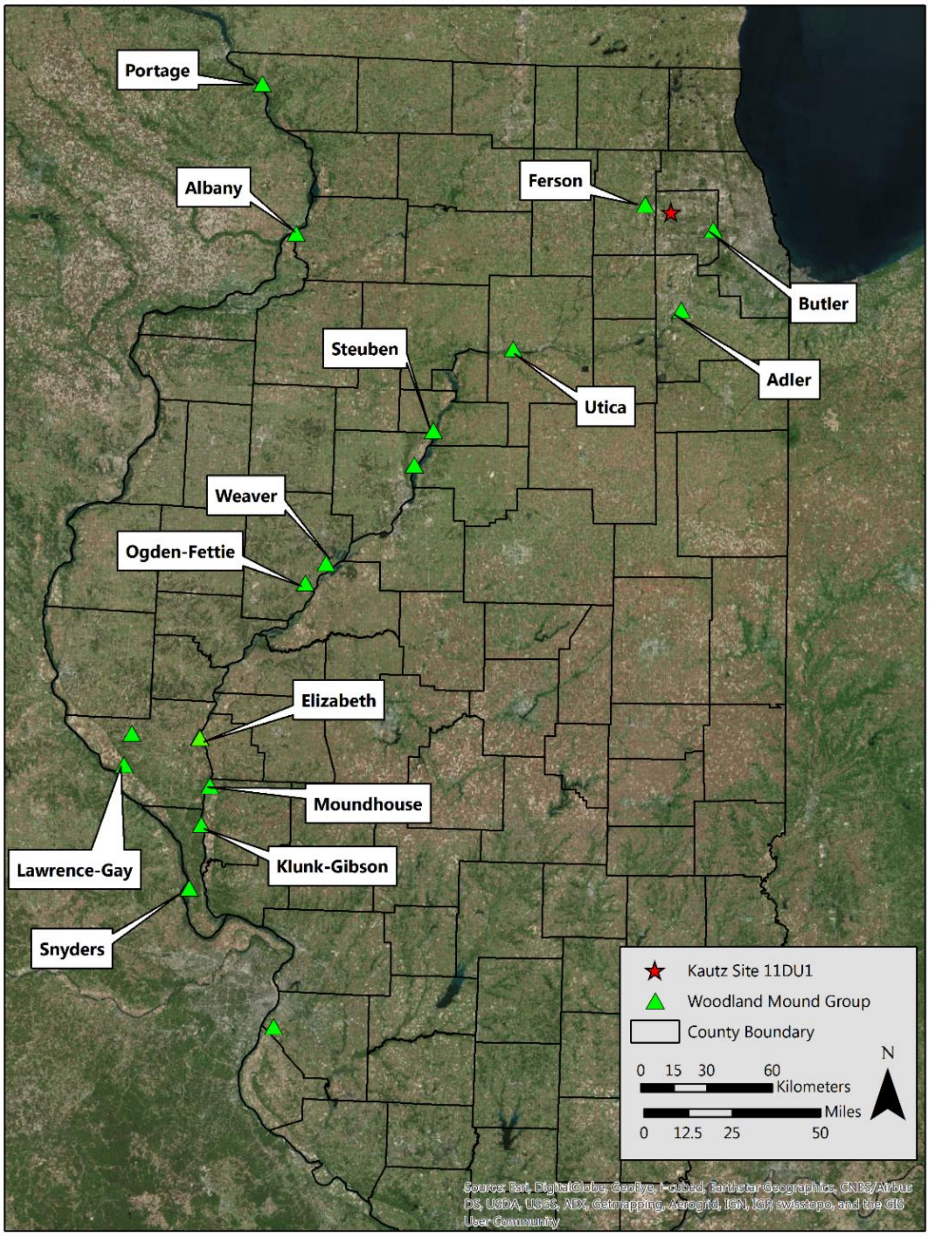


Figure 12. Mortuary sites in Illinois.

Three significant transformations occurred during the Late Woodland period including changes in technology, social structure, and diet, which all contributed to the emergence of complex, hierarchical societies in some regions during the Mississippian period (Emerson et al. 2000). In the study area there is a complex history of Late Woodland societies suggesting that there was a considerable amount of movement of people through the area with influences coming

from all directions. Pottery styles and hafted biface morphology are the two best indicators for temporal change and group identity during the Late Woodland period.

Late Woodland ceramic traditions in northeastern Illinois have historically been understudied. We know that Havana ware was the most commonly used ware and persisted until the 4th century when they were replaced by the Steuben ceramic tradition but it is not clear if the adoption of the Steuben ceramic tradition was as widespread as the preceding Havana ware (Wolforth 1995). Steuben wares were eventually replaced in northeastern Illinois by the Madison Cord-impressed tradition. The Madison Cord-impressed ceramic tradition, associated with the Late Woodland Des Plaines Complex persisted until late in the late Late Woodland period between ca. A.D. 800-1100 (Emerson and Titelbaum 2000). In some cases Madison Cord-impressed pottery is found in association with an older ceramic tradition known as Starved Rock Collared ware, dating ca. A.D. 950-1100. Collared wares are likely the predecessor of the Langford ceramic tradition, an early Upper Mississippian ceramic tradition (J. Kelly 2002).

The adoption of the bow and arrow was a transformative event that occurred in the middle of the Late Woodland period but there is a lack of data regarding how it was introduced into the area, how it was initially received by local groups, and the effects the new technology had on inter-group politics and subsistence strategies. The accepted date for the adoption of the bow and arrow is around A.D. 650 to 700 in the southwestern portion of the state (Emerson et al. 2000). Numerous studies of Late Woodland subsistence have focused on the role of maize within Woodland horticultural economies in the Midwest (Simon 2000). Maize may have been traded as a specialty item within the Hopewell Interaction Sphere, but maize agriculture is not visible in the archaeological record until the 8th century, nearly 400 years after the Havana Hopewell tradition dissolved (Riley et al. 1990; Riley et al. 1994). Archaeological evidence such as deep

storage pits is supported by stable-carbon isotope analysis; studies have shown there is no significant amount of C4 plants in the diet of individuals until circa A.D. 750 (Stothers and Graves 1985). This would mean that Late Woodland groups living throughout the region were still primarily utilizing local domesticated plants when maize was introduced. A large Late Woodland pit was excavated at the LaSalle County Home site as part of Jeske and Hart's work along the I&M canal in LaSalle County (Hart and Jeske 1988). In Feature 18, they found evidence for multiple uses including a couple of construction episodes and a capping of earlier material with a sandy silt. The top layer was dated to AD 753 and a corn cupule was found during floatation suggesting mixing occurring in the top layer. In the bottom layer wood charcoal from several different tree species as well as some nutshell were found in association with wild seeds, large bodied fish bones, and large mammal bones. Dates from this layer put the deposition of these materials and several unidentifiable black grit-tempered ceramic sherds and Madison Triangular point at AD 938.

Upper Mississippian Period

The Upper Mississippian period for northeastern Illinois is represented by four ceramic "traditions" – the early Langford and Fisher (circa A.D. 1000 – 1450), and the later Huber and Danner (circa A.D. 1500 – contact) (Baltus 2013; J. Brown 1971; Brown et al. 1967; Emerson 1999; Jeske 1990, 2000). The Langford tradition is represented by ceramic wares that retain the mafic grit temper and cord-marking found in Late Woodland collared pottery, but with formal and stylistic characteristics similar to Grand River Oneota ceramics (J. Brown 1967, 1971; Jeske 1990, 2000). The Washington-Irving site in the Fox River valley, is represented by lithic debris, ceramic sherds and other artifacts were recovered in association with pits, hearths, post molds,

and 27 house basins (Figure 13). Excavations at the site indicate a year round occupation where people subsisted on a mixed economy of cultivated crops and a wide array of wild flora and fauna. Maize, squash, hickory and hazel nuts, acorns, lotus, and blueberries were consumed with the bulk of the meat coming from deer (Jeske 2000). Late prehistoric groups were assumed to follow a settlement/subsistence pattern that was seen among contact-era Native groups in the region: seasonal occupation of a large, semi-permanent agricultural village with smaller extractive or wintering camps (Brown and O'Brien 1990; Emerson 1999; Jeske 1990).

When settlement patterns were examined by Jeske (2000) he found that “The organization of settlements seems to have been somewhat hierarchical, with large, semi-permanent (or perhaps permanent) villages of 2-5 ha in the larger valleys (e.g. , Fisher, Plum Island, Zimmerman); smaller, seasonally occupied sites of ~2 ha found in smaller valleys and adjacent uplands (e.g., Robinson Reserve, Cooke, Reeves); and very small (circa 100-300 m^2) special activity or extractive camps arc found in marginal, inter-fluvial upland environments (e.g., Kuzwon, Kuzteau, Gazebo). Washington Irving is somewhat of an exception, in that it is a 4-ha site located on a small creek, approximately 2 km from a major river” Jeske (2000:265). The Joe Louis Site (11CK284) is a Fisher site at the confluence of a small creek and the Little Calumet River that was occupied throughout the year. Bison were an important component of their diet and technology (Baltus 2013).

Large, semi-permanent encampments were orientated towards the wetland areas and major river valleys because of their easily tillable soil and a huge array of wild resources, whereas more short-term hunting camps were more likely to be located in the uplands (Hart and Jeske 1987; Jeske 1990; Springer 1985). Sites such as Fisher, Robinson Reserve, and Hoxie

exemplify the large, semi-permanent encampments with cemeteries often nearby or incorporated into the encampments (Markman 1991).

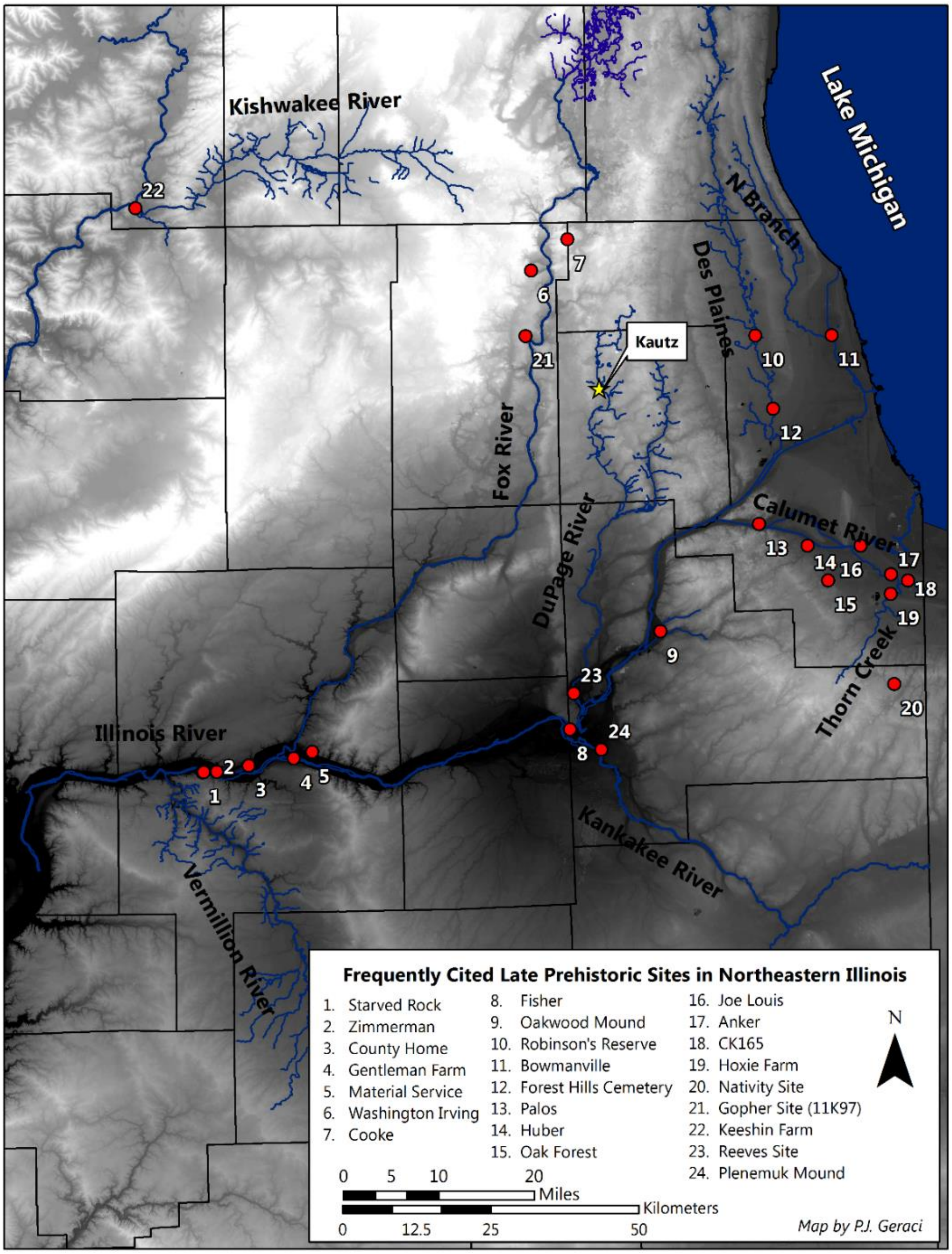


Figure 13. Frequently cited Late Prehistoric sites in northeastern Illinois.

CHAPTER 3: THE KAUTZ SITE

Physical Setting

The Kautz site is located in northeastern Illinois, a region defined here as the land north of the Illinois/Des Plaines River valley and south of the Illinois-Wisconsin border east of the big bend and west of Lake Michigan (Figure 14). Politically this region is composed of Cook County and its collar counties including Lake, McHenry, DuPage, Kane, Will, and outlying DeKalb, Kendall, Kankakee, Grundy and LaSalle counties. Geographically this region is located in the Wheaton Morainal Country of the Great Lakes Section of the Central Lowland Province (Willman 1971). The Central Lowlands is a low, broad formerly glaciated area that extends east from the Great Plains to the Appalachian Plateaus and from the Superior Upland south to the Interior Low and Ozark Plateaus (Leighton et al. 1948). The central lowlands are subdivided into two sections, the Great Lakes section and the Till Plains section. The portion of the Great Lakes section in Illinois consists of the Chicago Lake Plain and Wheaton Morainal Country.

The Kautz site is located on the far western end of the Wheaton Morainal Country approximately two miles east of the boundary with the Bloomington Ridged Plain of the Till Plains Section (Figure 14). The surficial topography of the Wheaton Morainal Country is entirely composed of glacial tills, glacial outwash sands and gravels, and glacial lake deposits (Piskin and Bergstrom 1975). These deposits overly Silurian Niagaran dolomite which only crops out in areas where post-glacial floods have removed the glacial deposits and carved into the bedrock (Schwegman 1973; Willman and Frye 1970; Worthen 1870; Zeizel et al. 1962).

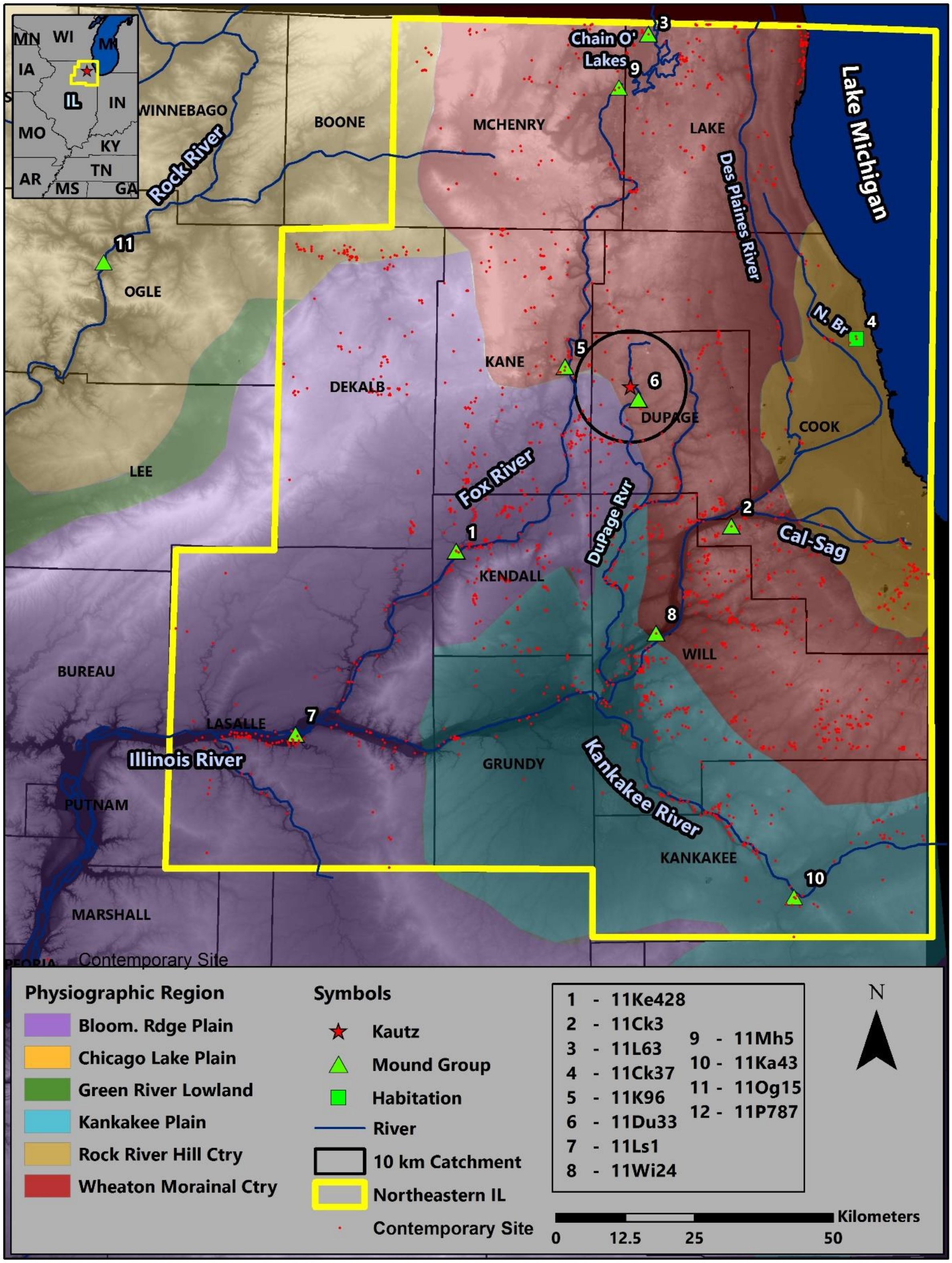


Figure 14. Northeastern Illinois drainages and physiographic divisions

Some of the prominent features of this region include the Lake Michigan plain, the Fox River Valley and Chain O' Lakes area, the Des Plaines and Illinois River Valleys and the series of end moraines and inter-morainal valleys that form a ring around the Lake Michigan basin. The Kautz site is located within the intermorainal valley of the West Chicago and Wheaton Moraines which is drained by the West Branch of the DuPage River.

The West Branch of the DuPage River is part of the West Branch watershed which consists of 127 square miles and 17 tributaries. The main channel is approximately 32 miles or 51 kilometers long before it joins together with the East Branch to form the main branch of the DuPage River (Figure 14). Major tributaries contributing to the West Branch include Kress Creek, Klein Creek, and Winfield Creek. Kress creek is the largest and enters the West Branch near Blackwell County Forest Preserve 6 km south of the Kautz Site. The East Branch has a deeper and wider valley than the West Branch and travels 10 fewer kilometers than the West. The headwaters of the East Branch are located 2.5-km southeast of Bloomingdale in DuPage County and the headwaters of the West Branch are located to the northwest in Campanelli Park in Schaumburg, Illinois. The two branches meet in Knoch Knolls Park in southern Naperville approximately 20 km south of Kautz and travels another 35-km south to its confluence with the Des Plaines River just northeast of the mouth of the Kankakee River.

The nature of the West Branch has changed considerably since European Settlement in the mid-19th century. Prior to an influx in European settlement in the 1850s, the West Branch could move to where it needed to. Now the West Branch is controlled by dams and channels have been cut to drain wetlands, lakes, and ponds. Evidence of past channels can be seen in elevation models produced from Lidar imagery (Figure 15). Just north of the Kautz site a channel can be seen rerouting an old meander in order to effectively straighten the stream before it travels

underneath the old train tracks to avoid erosion problems. There has also been a significant altering of the landscape from 20th century farming practices and forest clearing which has led to hillslope erosion and the movement of top soil into river channels (Mapes 1979).

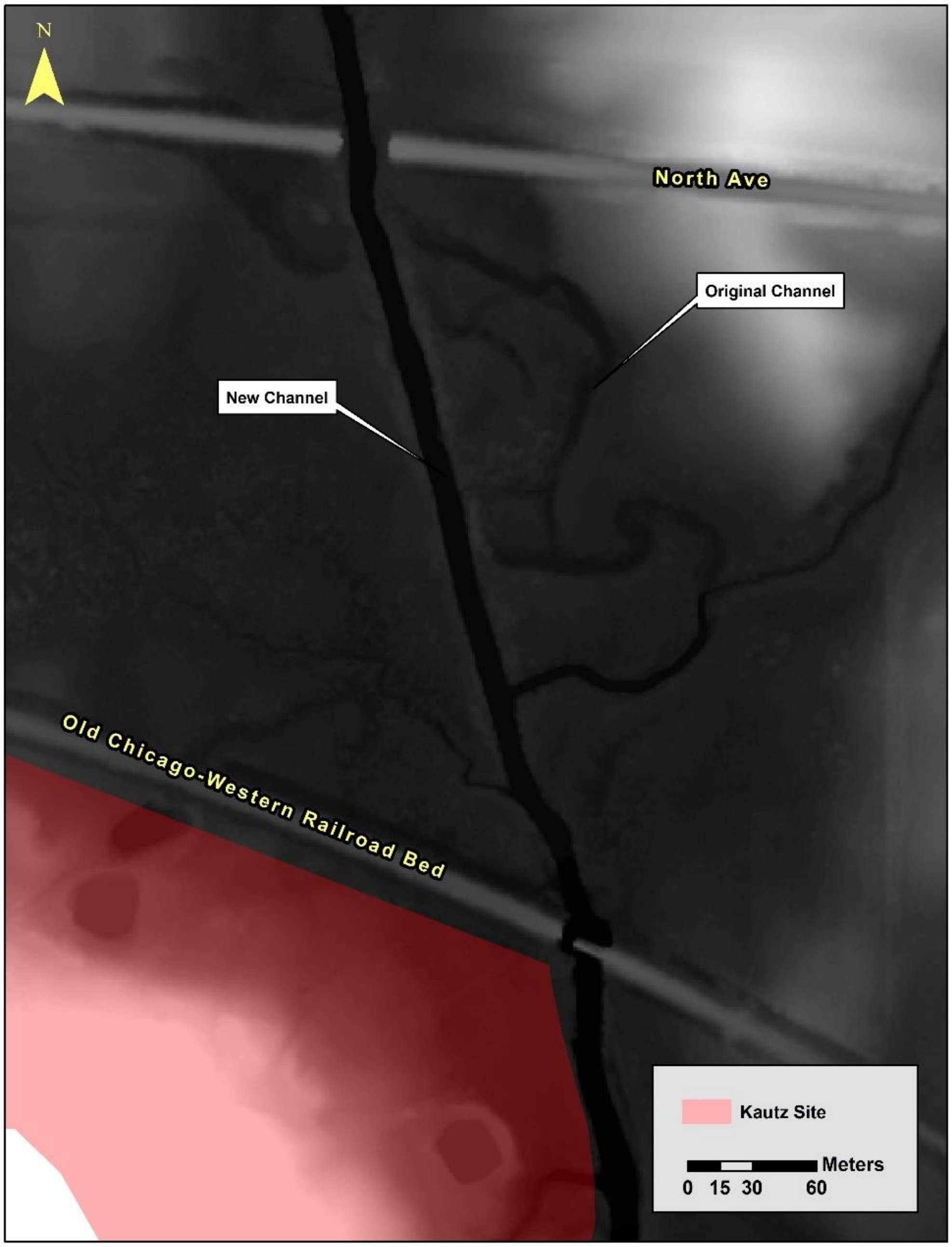


Figure 15. LiDAR imagery of the West Branch of the DuPage River near the Kautz Site.

Ecologically, the site is located in the northeastern extension of the Prairie Peninsula, a vast mosaic of grassland interspersed with Oak-Hickory forests and wetlands (Transeau 1935). The diversity in topography and hydrology of the Morainal section of the Northeastern Morainal Division creates diversity in plant and animal communities in the otherwise homogenous landscape of the Prairie Peninsula (Leighton et al. 1948) (Figure 16). The distribution of these habitats is largely dependent on a number of factors including climate, elevation, slope, soil, and hydrology; however the influence of human activity on the distribution of these communities cannot be disregarded (R. C. Anderson 1970; Bowles and McBride 2002; Gleason 1922; Transeau 1935).

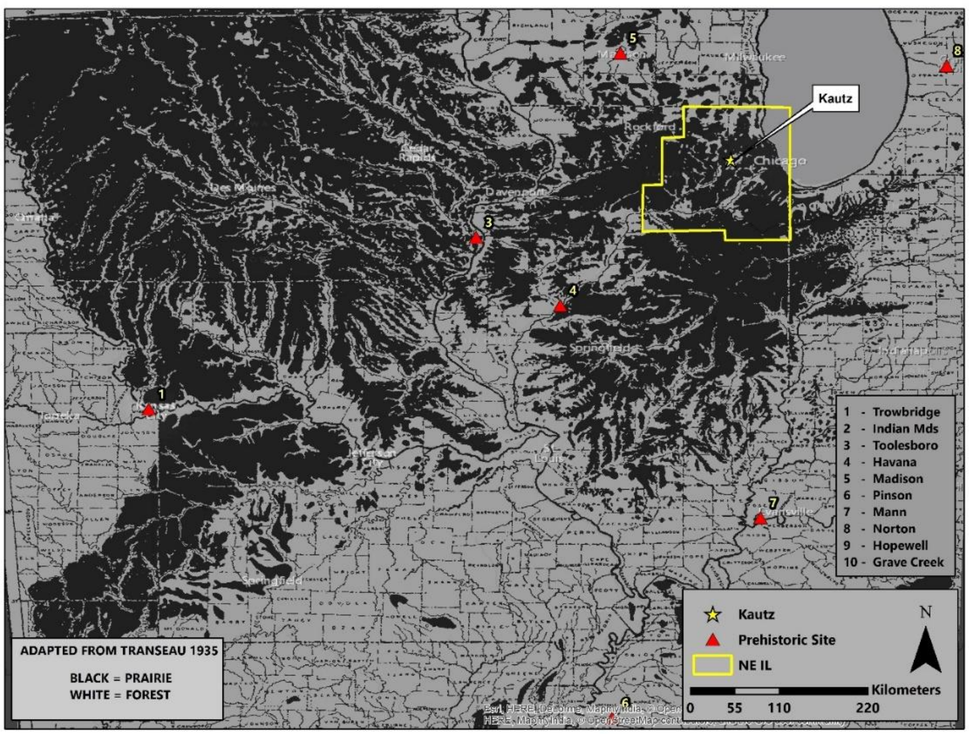


Figure 16. The Kautz Site in relation to the Prairie Peninsula.

Forest management through the use of fire and selective felling allowed nut-bearing trees to thrive along prairie-timber margins which in turn boosted nut masts for humans as well as

important prey species; deer and turkey (Abrams and Nowacki 2008; Gremillion et al. 2008; McClain and Elzinga 1994; Munson 1986; B. Smith 2007). Transplantation, the method of collecting wild food plants scattered across the landscape and replanting them closer to a commonly used habitation site, is another method of niche construction which cuts down on foraging time as well as increases food security over the long-term (B. Smith 2011; E. Smith 2013). Broadcast sowing is a simple but effective practice of taking harvested seeds from seed-bearing annuals and planting them in new areas. Asch et al. (1979) suggest that these methods of niche construction, particularly broadcast sowing, may have been used by people during the Middle Woodland period to increase the prevalence of starchy grain and oily-seed plants in the Illinois River Valley (Asch et al. 1979). It is feasible then that these strategies were practiced elsewhere such as northeastern Illinois.

Circumstances of the Site's Discovery

The Kautz site was originally discovered by the landowner Joseph T. Kautz and his family, who over the course of several years had collected a number of prehistoric artifacts like stone tools and ceramic sherds from the barnyard area of their farm. The site remained unknown to the archaeological community until the early 1950s when the Kautz family was approached by local archaeologists Sanford Gates, David Wenner and Hank Rodemaker. The exact circumstances of how they approached the Kautz family is unknown however they were actively documenting sites along the DuPage River at that time and it is likely they contacted him while surveying or were referred to them by a friend or acquaintance (Gates 1961).

Several years after Wenner was first informed of the site, Joseph Kautz unearthed several additional artifacts on a different portion of his farm whilst excavating with heavy machinery. In response, Wenner and crew surface collected the disturbed area and collected several artifacts

including Hopewellian sherds with dentate, zoned dentate and notched inner lips; “Wisconsin-type” Late Woodland sherds, and hafted bifaces (IIAPS 2015). He further noted that the bifaces were stemmed, corner notched, or side notched and the majority of which were thick for length with convex faces. Wenner was intrigued by the presence of Hopewellian artifacts at the site and planned to start excavations at the site as soon as possible. The crew was made up of a number of volunteers including students at the University of Chicago and local enthusiasts, some being family members of Gates and Rodemaker. They began excavations in the late fall of 1958, and it is believed that it was at this time Wenner submitted the current site form because the earliest excavations at the site are dated to 11/16/1958 in the notes that were associated with the collection and there is only mention of plans to excavate at the bottom of the site form submitted to the IAS in 1958 (Figure 2, p.4). The site was not formally recorded to an institution until several years after they first became aware of the site because at the time there was no statewide institution to which it could be recorded. The University of Chicago and University of Illinois had been recording sites in Illinois since the 1930s and 1920s, however it wasn’t until John C. McGregor of Illinois State Museum and other archaeologists working in Illinois established the Illinois Archaeological Survey (IAS) in 1956 that archaeological sites were formally recorded and catalogued into a single database.

Site Location

The site is located east of Indian Knoll Road in Winfield Township, Illinois in portions of the SW ¼ of the SW ¼ of the SE ¼ of the SW ¼ of Section 35, T40N, R9E (Highlighted in Yellow) and the NW ¼ of the NE ¼ of the NW ¼ of Section 2, T39N, R9E (Highlighted in Teal) in Figure 17. It occupies a small knoll on a bench above the floodplain, approximately 200 yards

west of the West Branch of the DuPage River. A large spring is located to the south and east on the west side of the river valley. Unfortunately due to contradictory information and an unclear datum point in the notes the exact boundaries of the site and excavation units is something of a mystery. The issue came to light as I was comparing information in the original site form and the site's shapefile in the IIAPS GIS database. The site form claims that the site is only 70 x 40 yards; however the size of the site's shape file is much larger, measuring 340 x 150 yards and extends well beyond the quarter sections listed in the site description.

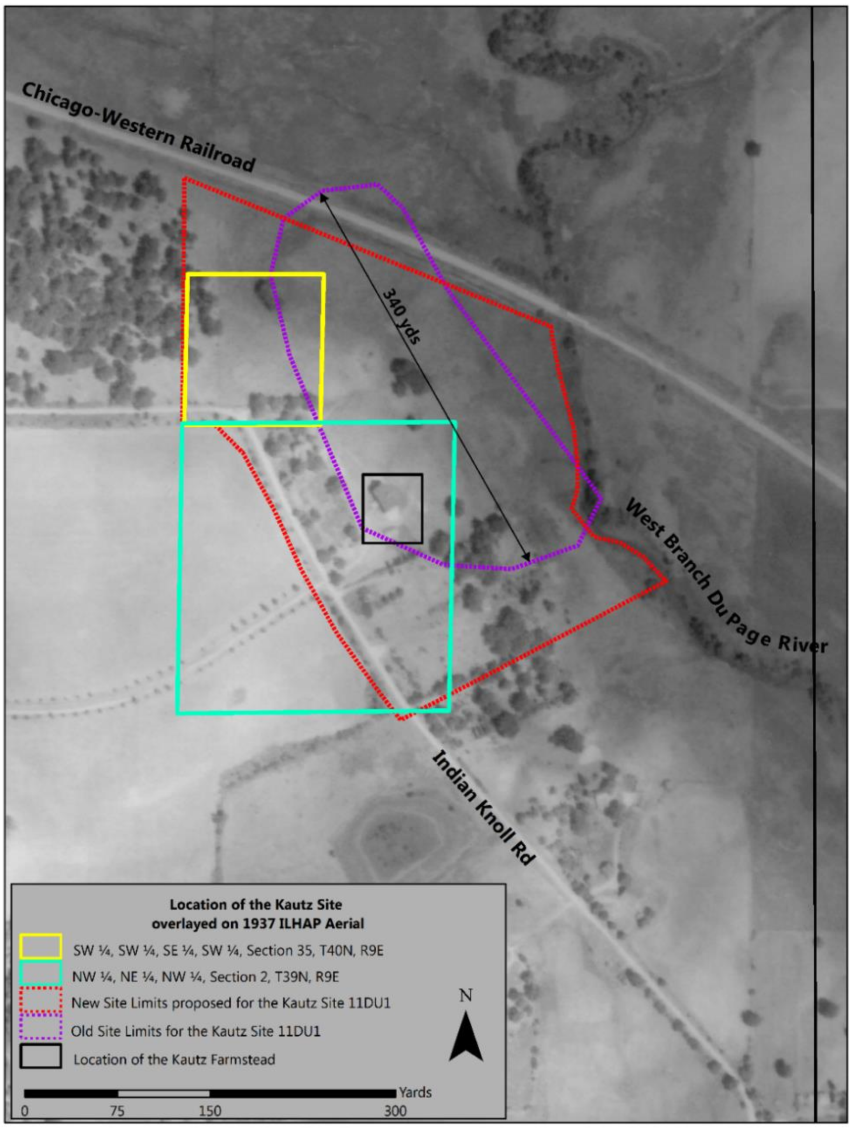


Figure 17. 1937 aerial photograph of the Kautz site and its proposed boundaries

According to Nick Klobuchar at the ISM, when the original site files were translated into GIS shapefiles many of the sites were drawn based on best guesses and are likely not exact. The site likely consists of a much larger area (Dotted Red Line, Figure 18) that includes both the location of the excavation units (red square, Figure 18), the barnyard area that was originally identified in 1954 (black square, Figure 18), and portions of the floodplain based (James A. Brown, personal communication, 2014). It is obviously impossible to determine the real extent of this site without returning to the site and conducting a subsurface investigation, however with the preceding lines of evidence a more realistic picture of its boundaries is possible.

Like the site's boundaries, there is also an issue with the location of the excavation units. The exact location of the excavation units was not documented properly in the notes, but the most likely location is on the north end of the site just west of current site limits (Solid Red Box, Figure 18). The first clue comes from Wenner's notes at the bottom of the site form. He states that, "Shards were found just to north of 11-Du-46 (same farm and probably same site) while getting top soil for farm yard. Two complexes were identified, Hopewell and Late Woodland". Additionally he notes that the area is "very promising and plans to test at once". This suggests that the 40 x 70 yard area only refers to the location of the artifacts first recorded by Wenner in 1954 which were likely found near the farm building (Solid Black Box, Figure 18) in Section 2. The sherds found just north of 11-DU-46 were likely those found in the location of the excavation units placed in the area Wenner et al. surface collected in 1958 in the southern portions of section 35, based on a similar note in the field notebook referring to the disturbed area. The final piece of evidence comes from an aerial photograph taken in 1961 that shows an area that has been obviously disturbed in the location where the excavation notes suggest the excavation units should be just north of the farm building (Figure 18).

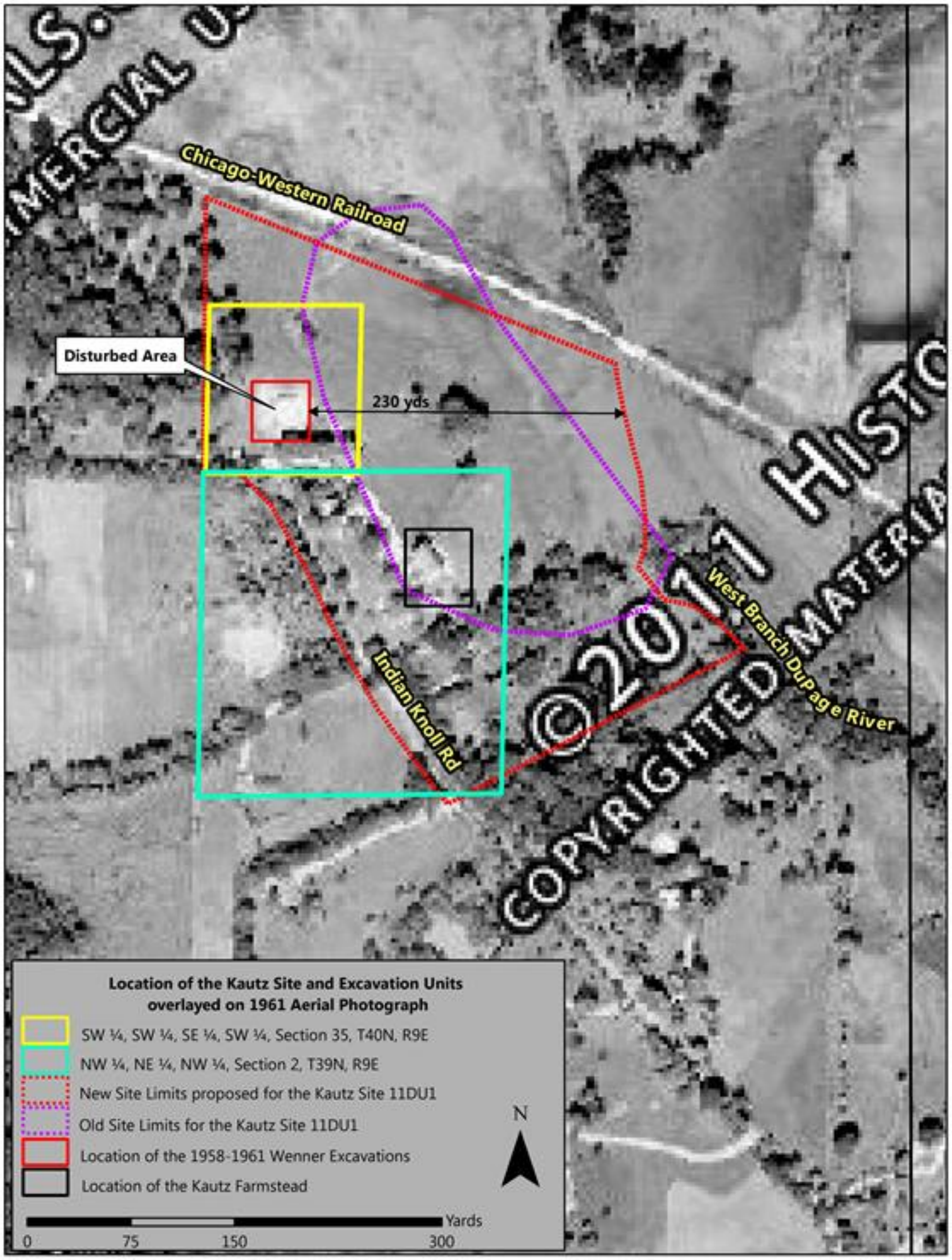


Figure 18. 1961 aerial photograph of the Kautz Site and its proposed boundaries.

Excavation and Documentation Methods

Over the course of three years Wenner and crew excavated fifty-5-x-5-ft. squares, and five-1-x-5-ft. squares from Unit 1. They also excavated six-5-x-5-ft. squares from Unit 2. The excavation squares were excavated in two stratigraphic levels based on soil color and texture. Artifacts were found in the first 10 inches below the surface; however, some were concentrated in a three inch midden level approximately 7-10 inches below the surface. The dark black midden (buried A-horizon) sat above a transitional grey clay layer on top of the original moraine deposit of brownish-yellow clay and gravel (Bt Horizon). The lack of poorly sorted sand and gravel layers suggests that the site was never disturbed by any fast-flowing or violent flooding and that the materials were most likely buried from slope wash (Mapes 1979). There is also evidence of historic mixing based on the presence of historic domesticated animal bone (sawed bone) and rodent burial (Appendix A) as well as some historic ceramics and metal.

According to the associated notes, the first units to be excavated were 10E65N, 10E50N, 10E35N, and 10E20N and a cache of artifacts were found in F1 and F2 within 10E20N (Figure 19). The excavators noted that the site was approximately 6-8 inches deep after the top three inches of sod were removed. Features extended to 10-13 inches below the surface and had rounded bottoms. Excavations continued until the end of November 1958 and were resumed again 6/13/1959. Work then continued on the 10E transect and was extended to the 5E and 15E transect. An E-W trench was also excavated to subsoil for the purpose of profiling the site. Worked ceased until 8/2/1959 when a second excavation unit was started on Excavation Unit 2, which according to the notes, is supposedly on the east side of the spring. Worked continued until late September of 1959 and excavation units were placed along the 0E and 5W transects of Unit 1 as well as additional units along the other transects. Work did not continue at the site until

7/24/1960 when an 18” trench was dug along the northern edge of 30E-50E, 50N. The notes from the excavation stop at this point and it is assumed that this was the last of the excavations that took place at the site.

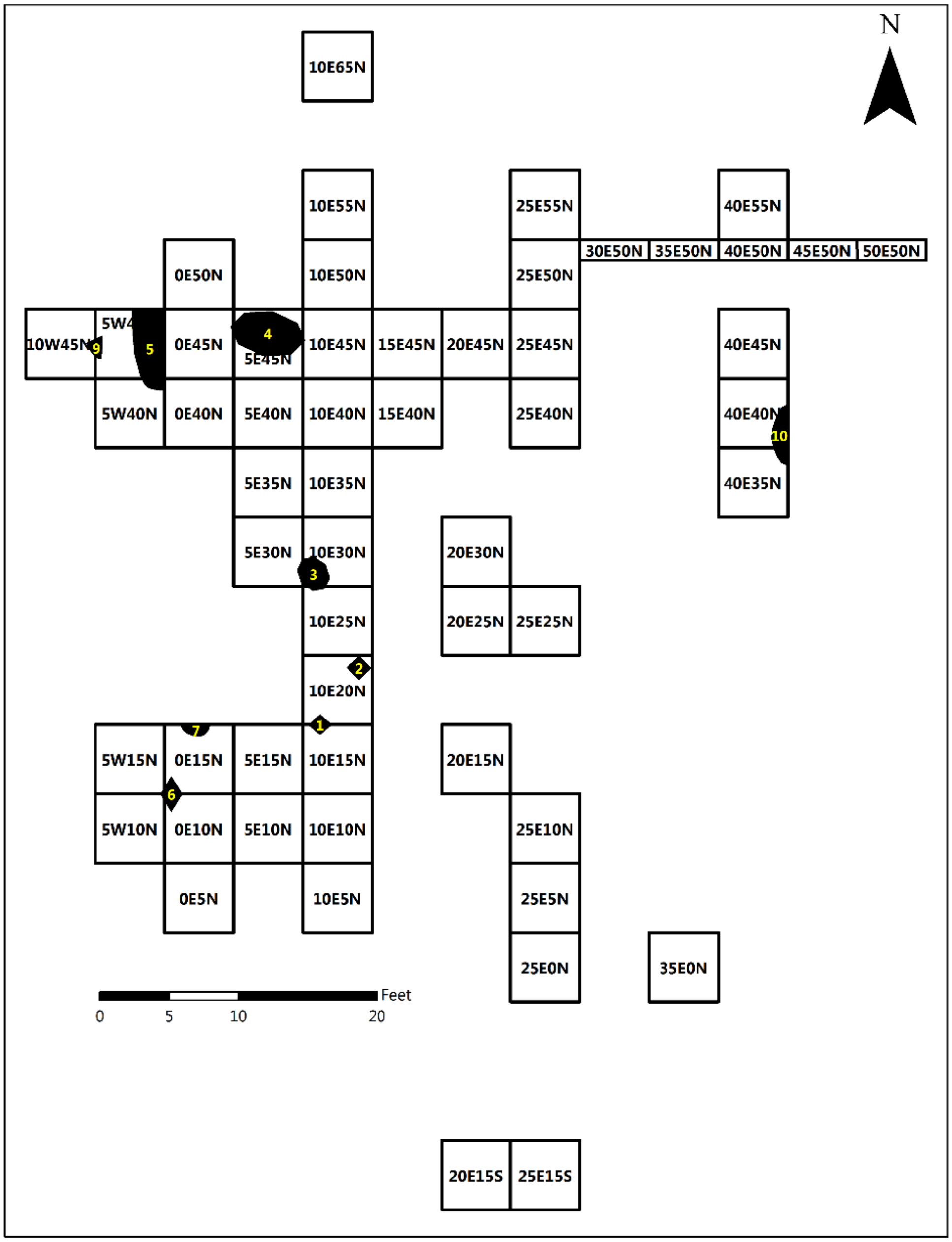


Figure 19. Plan map of excavation Unit I.

Material Culture

A wide variety of material culture was recovered from the excavations at Kautz. Artifacts include chipped stone tools, debitage, ceramic sherds, rough rock, faunal material and even a few historic artifacts such as sawed bone and square nails (Figure 20). The lithic assemblage will be addressed in Chapter Five and the faunal assemblage was analyzed by Megan Leigl and is included in this thesis as Appendix A. Due to time constraints and the minimal amount of information they contribute to the overall thesis, the ceramic and rough rock assemblages will not be analyzed in full, instead they will be briefly described in the following overview.

Figure 20: Sample of the chipped stone tool and ceramic assemblage.

Chipped Stone Assemblage

The chipped stone tool and debitage assemblage consists of hafted and non-hafted bifacial tools, flake tools, multifaces, drills, perforators, and a few unifacial tools. Debitage from the assemblage ranges in size from very large to very small; many of the flakes were not

complete and were considered to be shatter. Chipped stone tools were made from several types of chert including local and non-local raw materials. Raw materials were considered non-local if their point of origin is greater than 50 km following Jeske and Brown (2013). Some of the non-local material identified in the assemblage such as Burlington chert, Wyandotte, and Knife River Flint originate hundreds of kilometers from the site. Hafted bifaces in the assemblage are diagnostic of the Late Archaic, Early Woodland, Middle Woodland and Late Woodland periods.

Ceramic Assemblage

The ceramic assemblage consists mostly of small body sherds that cannot be identified and therefore the assemblage was not formally analyzed. Instead, the ceramic assemblage was subjected to a mass analysis in which all ceramics were counted and weighed and temper and surface treatment were recorded for each sherd larger than 25 mm.

Ceramic sherds were ubiquitous throughout the site. A total of 1,923 ceramic sherds weighing 4,836 grams were recovered from all 54 excavation squares in Unit 1 and four of the excavation squares in Unit 2. The majority of the ceramics were recovered in Level 1 and 2, however fifty-one ceramic sherds weighing 203.4 grams were recovered from six features in Unit 1. The provenience of some sherds was lost and others were found in wall scrapes, in which case their provenience was (ALL). Over half of the number of sherds (61%) and 55% of the ceramics in weight were recovered in Level 1 of Unit 1 (Table 2).

Table 2. Ceramic total count and weights by unit and level

Table 2. Ceramic total count and weights by unit and level			
Unit	**Level**	**Count**	**Weight**
1	1	1122	2591.79
	2	598	1651.07
	ALL	126	502.7
	Total	1846	4745.56
2	1	57	67
	Total	57	67
Total	1	1179	2658.79
	2	598	1651.07
	ALL	126	502.7
	Total	1903	4812.56

All of the ceramics that were whole enough to determine temper type were made with grit temper although temper type for 7% of the sherds could not be identified. Surface treatment was recorded for 399 sherds; the remaining 1,524 sherds were too small to identify surface treatment. The mass analysis identified three types of surface treatment: none/smooth, cordmarking, and smoothed-over-cordmarking. Ceramic body sherds with a smooth surface treatment were found in 35 excavation squares in Unit 1 and one square in Unit 2. Smooth surface body sherds (n=143) compose 36% of the total sherds with identifiable surface treatments. Cordmarked body sherds were found in 36 excavation squares in Unit 1 and 3 squares in Unit 2. Cordmarked body sherds (n=216) compose 54% of the total sherds with identifiable surface treatments. Body sherds with a smoothed-over-cordmarked surface treatment were distributed across 16 excavation squares in Unit 1. Smoothed-over-cordmarked surfaces appear on 40 body sherds, about 10% of the total sherds with an identifiable surface treatment.

A total of 15 rim sherds were recovered from the site, they were found in 11 excavation squares scattered throughout Unit I and Unit II. Only seven of the rim sherds exhibit any decorative features. Those decorative features include: cord-wrapped stick impressions (20E15S), incising (25E55N), and lip notching (5W15N) (Figure 21).

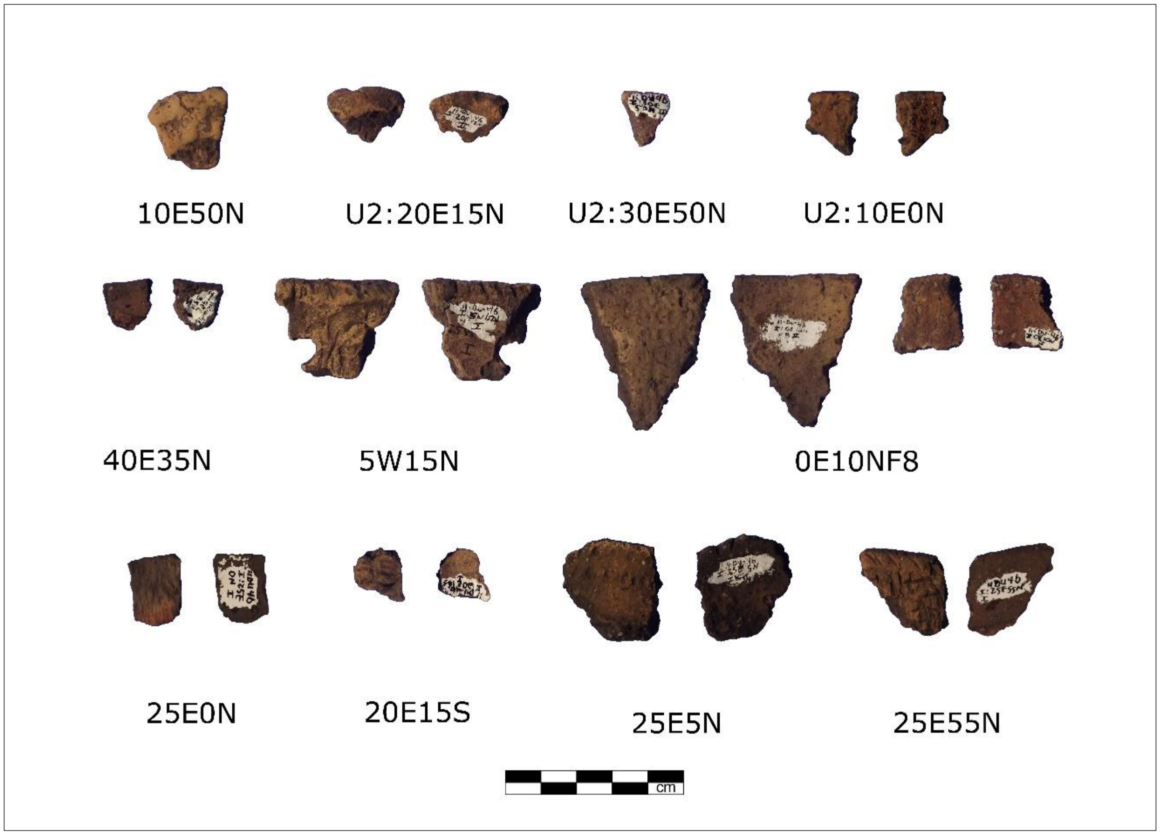


Figure 21. Ceramic rim sherds

Forty decorated body sherds were recovered from 23 excavation squares in Unit 1, no decorated body sherds were recovered from Unit 2. Decoration is present on 5% of the ceramic assemblage but they are distributed throughout half of the site and equally prevalent in level 1 and 2. Decorations present on the sherds include cord-wrapped-stick impressions, zoning, incising, dentate stamping, and finger-nail impressions (Figure 22). These decorations are found in different patterns and frequency on a wide range of ceramic types spanning the entire Woodland period 3000-1000 B.P. (Griffin 1952a). The combination of decorative motifs present on the ceramic sherds recovered from Kautz suggests that the majority of the ceramics are likely Naples Stamped Dentate, a variety of Havana ware. Ceramics that predate Havana ware may also be present at the site, a few sherds including a rim sherd are decorated with fingernail impressed

oblique and horizontal lines similar to Black Sand Incised or Prairie-incised decorations. Importantly, no ceramic sherds recovered from the Kautz site were tempered with shell, suggesting the site was probably not occupied by Fisher or Huber Oneota populations.

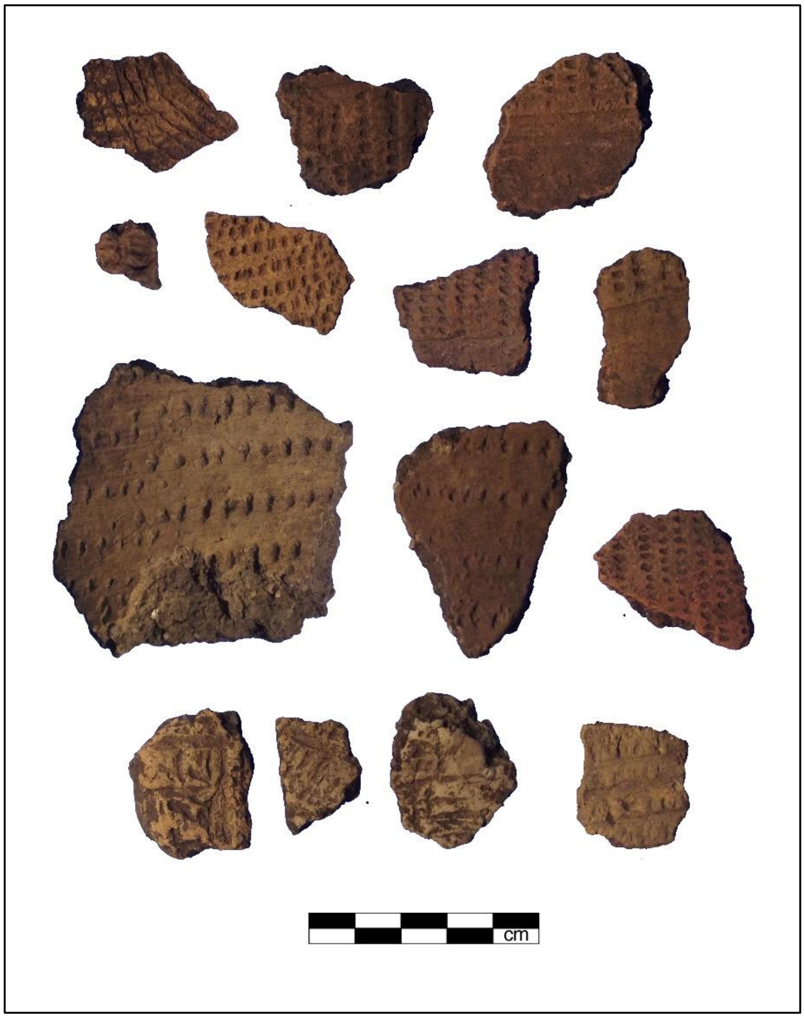


Figure 22. Decorated body sherds

Rough Rock Assemblage

The rough rock assemblage was also subjected to a mass analysis but not included as part of the formal thesis. Results from the mass analysis found that the rough rock assemblage consists of fire cracked rock (FCR), anvils, abraders, hammerstones, and pebbles. FCR was by

far the most common rough rock artifact recovered and several types of materials were identified such as igneous metamorphic rocks, limestone, sandstone, and hematite and limonite. Woodworking tools like abraders, axes, or adzes were nearly non-existent; only one sandstone abrader was recovered.

Faunal Assemblage

Kautz yielded a medium sized faunal assemblage of almost 1000 fragments. The faunal assemblage was identified and analyzed by Megan Leigl as part of a graduate-level archaeological analysis class taught by Robert Jeske at UW Milwaukee (Appendix A). UW Milwaukee anthropology professor Dr. Jean C. Hudson supervised the identifications made by Leigl. The analysis identified mammal, bird, and reptile bone in the assemblage. Mammal species include deer, beaver, woodchuck, badger, raccoon, fox, muskrat, and skunk, as well as historic animal bone such as pig and horse. Deer was the most common mammal bone recovered. Other faunal material collected from the site includes numerous pieces of turtle carapace, mollusks, and an unidentified leg bone from a large bird. The results suggest a broad-spectrum diet geared towards forest and wetland species.

Chapter 4: Landscape Analysis

Introduction

There are over 12,000 prehistoric archaeological sites recorded in northeastern Illinois. Less than 1% of these sites were occupied more than once over the past 12,000 years. Even fewer are like the Kautz Site, with over six distinct cultural components that span close to 5,000 years. This makes the Kautz Site incredibly important, but why was the Kautz Site occupied so many different times? The number of occupations seems to suggest that there was some kind of pull to this location, but what kind? We know that habitation sites act as economic hubs where resources are either collected, processed, consumed, or discarded and therefore it is fair to assume that there may have been some kind of economic advantage to occupying this location. There is certainly precedent for explaining site distribution or settlement patterns or settlement systems with economic justifications (Binford 1980, 1990; Binford 1983; Hart and Jeske 1987, 1989; Roper 1979a, 1979b; Ruby et al. 2005; Weston 1981). The most common approach typically involves some use of the concept of energetic efficiency as it pertains to Optimal Foraging Theory also called the mini-max strategy or least-cost strategy (M. Brown 1981). The concept essentially argues that an organism will tend to act in ways that optimizes the ratio between energy expended and energy collected while foraging (Winterhalder 1980, 1983). Therefore, when applied to human foraging, it is assumed that humans would have foraged in a way that minimized the amount of time and energy needed to acquire the resources they needed to survive like water, food, wood, and stone. One of the best methods for minimizing the amount of time and energy needed to acquire resources is to locate the main economic hub central to as many good-quality resources as possible. Central Place Foraging models have helped explain shellfish gathering methods in the Torres Strait Islands (Bird and Bliege Bird 1997), acorn and

mussel gathering in California (Bettinger et al. 1997), piñon nuts in Owens valley (Bettinger 1989), and hunting strategies in the Great Basin (Zeanah 2004).

If the Kautz Site was central to a number of key resources it may help explain why the site was routinely inhabited but it cannot completely explain why. The problem with the optimality approach is that it often ignores the importance of social, political, and spiritual factors that also influence the way people use their environment. These may include taboos, competition from neighbors, or important geographical features such as caves, cliffs, waterfalls, springs and even some seemingly mundane places that may have had some level of historical importance (Carmichael et al. 1994; Feld and Basso 1996; Hirsch and O'Hanlon 1995; L. Johnson 2000; C. Tilley 1994; Ucko and Layton 1999).

The social landscape and the perception of that landscape is constantly changing. Identifying specific social motives in the selection of a habitation site can be difficult archaeologically, especially when there are no overt symbols identifying their location like a monument or rock art. For this reason I chose to focus my attention on the economic aspects of the site, however this does not mean that the economic landscape described in this thesis is devoid of social meaning. I will search for possible signs of social meaning by using the archaeological record to identify any mortuary sites or places that were repeatedly occupied like Starved Rock, Bowmanville, and the Kautz Site. I will also search for patterns in these site's locations and their relationship to potentially important natural cues such as pilgrimage trails and natural features like river confluences, overlooks, springs, rock faces, canyons and caves. If any of these commonly socially charged landscape features are located within the catchments it's possible they may have drawn people to this location even if the local environment was not economically productive as I hypothesized.

Based on the concepts derived from optimal foraging theory, we might expect that the Kautz Site was occupied because of the economic advantages it provided to its inhabitants as well as a number of other adaptive benefits such as protection from wind and flooding, potential access to an overland travel route, a physical representation of the underworld etc. An adaptive benefit is something that enhances the fitness of an organism or group and provides a benefit either by increasing the organisms energy intake, decreasing energy expenditure, reducing the vulnerability of the organism or group to predation, or increasing the likelihood of finding a mate. In sum, I hypothesize that the site's location was centrally located to key resources allowing for an optimal foraging strategy that increases the amount of energy intake while reducing the amount of energy expended. I also hypothesize that this site was reoccupied due to economic as well as social reasons, perhaps its proximity to important landscape features.

We can test that hypothesis by investigating the site's proximity to a number of key resources such as rivers, lakes, wetlands, forest, prairie, rock outcroppings, overland trails, ecotones, and other contemporaneous camps, villages, and mortuary sites through the use of a catchment analysis. The following section will discuss the methodology, methods, and materials utilized in this analysis.

Methodology

A GIS-based catchment analysis was conducted in order to measure the level of energy needed to acquire key resources such as water, food, wood, and, chert. Catchment analysis is a methodology that relates an archaeological site to the surrounding physiography and simultaneously defines the "limits of influence" of an archaeological site (Hunt 1992). The limits of influence of an archaeological site are directly related to the ease of movement and form of mobility utilized by a particular group. For example, the area of influence for modern Americans

is much greater than that of prehistoric hunter-gatherers due to their access to automobiles and infrastructure such as roads, bridges and highways. With the help of automobiles, modern Americans have the ability to forage dozens of kilometers from their home within a single day whereas the maximum daily foraging radius for pedestrian hunter-gatherers is typically no more than 10-km (R. Kelly 1995).

The catchments used in this analysis are based on concepts of energetic efficiency as it pertains to Optimal Foraging Theory (OFT). The theory assumes that humans, like other organisms, will behave economically and efficiently in their subsistence tasks in order to exploit the most resources with the least amount of time, energy, or risk (Smith et al. 1983; Winterhalder 1983). Energetic efficiency is related to the evolutionary concept of reproductive success. More efficient organisms are expected to have an advantage over inefficient organisms for accessing resources related to raising offspring. A related concept is Central Place Foraging Theory (CPF), which operates on the assumption that foragers seek to maximize resource utility relative to procurement, transport and processing costs when operating from central places (Orians and Pearson 1985). At their most basic level, CPF models see that the benefit of transported food is derived from the calories they contain and that a large cost to foragers operating logistically is travel time, which is a function primarily of distance. This concept should be applicable to non-food resources as well, especially those resources that are associated with women's tasks (Roper 1979b).

Settlements not only fulfill subsistence-related needs they also fulfill other adaptive needs such as protection from the elements or a rival group, a place to conduct social or religious activities, or convenient waypoint along a travel route. None of these needs are mutually exclusive and it is hypothesized that the locations that would have been highly valued would

have fulfilled more than one of these needs. Since the Kautz site was occupied several times throughout prehistory it is hypothesized that its location should have fulfilled at least one if not more than one of these needs. This hypothesis will be tested by measuring the distance between a number of important subsistence related resources including food, water, fiber, stone, and medicine as well as scanning for possible non-subsistence related resources.

Methods and Data

The following catchment analysis will incorporate data from three complimentary sources: the archaeological record, geological record, and the ecological/historical record. The archeological record will provide information about the distribution of archaeological sites and will identify any sites that may have been related to Kautz. The geological and ecological/historical records will be used to reconstruct the physical environment including the original plant and animal communities, landforms, and location of rivers and lakes. Together they compose a reconstructed cultural landscape from which we can test our current models of understanding about Late Archaic and Woodland subsistence culture and technology.

Geographic Information Science

The preceding hypotheses will be tested using data captured, managed, and analyzed within ESRI's ArcMap 10.2 GIS software. The software was also used to display the geographically referenced information used in this study. The GIS for this project was set up with a NAD 1983 Universal Transverse Mercator projected coordinate system in order for the data to be displayed in reference to a universal datum rather than an arbitrary datum. The use of UTM coordinates has the added benefit of a familiar and easily interpreted base unit of meters compared to other systems that use latitude and longitude or the imperial measurement system.

The following sections will discuss the methods and methodology behind creating the catchment area, reconstructing past vegetation patterns, and creating and analyzing other social environmental data used to answer questions about the site's importance.

Establishing the Catchment Area

The first step of this analysis was to establish what the catchment should represent and if multiple catchments were needed to answer the questions posed in this thesis. The size of the catchment should reflect the questions being asked. If a catchment analysis is seeking to understand regional settlement then it should be large enough to include the entire region. Likewise, if an analysis like this one is seeking to understand the daily logistic foraging range linked to a specific location then the catchments should reflect that.

Most studies of this nature base their catchments on ethnographic evidence, which can be useful starting point but should be used with caution (Wobst 1978). Utilizing ethnographic evidence and basic physical concepts of foot travel, Kelly suggests that the maximum distance traveled comfortably by foot on varied terrain is thought to be around 20-30 km or about 8 hours a day (R. Kelly 1995, 2003). Binford's ethnographic study of hunter-gatherer groups roughly supports that assessment (Binford 2001). He found that hunter-gatherer groups typically forage for 5 to 10 hours with 5 hours being the average, therefore if a person was traveling at an average speed of 4 km/h they could feasibly travel up to 20 km. These models are good starting points however foraging range differs dramatically between gender, season, terrain and resource (R. Kelly 1995).

For example, based on an average of 12 hours of daylight, five hours of foraging time would allow for plenty of time to rest, agree on strategies and carry out searches for large prey

like deer or elk. Unfortunately these models fail to take into consideration the fact that a large chunk of that time, assuming food was captured, would be taken up by handling and processing. Marin Arroyo (2009) calculates that for a red deer (equivalent to an Elk or Wapiti) the handling time may take up to two hours with another 1-2 hours of processing time which would only allow for roughly 2.5 hours of travel time (Arroyo 2009). If only 2.5 hours of travel time is allowed then the real foraging range would be more like 5-km to allow for travel to and from the base camp.

In the case of a fixed resource such as acorns, a resource hypothesized to be an important economic item in the Prairie Peninsula (J. Brown 1967), processing time and weight are important components when modeling foraging range (Bettinger et al. 1997; Metcalfe and Barlow 1992; Morgan 2008). Working from ethnographic and experimental data Bettinger et al. (1997) suggest that the maximum distance for acorn gathering is roughly 5-km from the base camp. Any greater distance from grove to camp would benefit from onsite processing and storing in caches. Morgan (2008) tested this hypothesis using sites in the Great Basin and his data supports a 5-km foraging range as well. Therefore if people were collecting, processing, and consuming acorns at the Kautz Site it is likely that they either collected them within 5-km of the site or were using a logistical cache somewhere outside of a 5-km catchment.

In the case of another fixed resource, chert, foraging distance can be significantly increased due to the lack of handling time needed (Bettinger et al. 1997). If no handling time and no processing time was required, we could hypothesize that for chert the foraging range may be up to 9 km or likely further. Processing is important to consider however it is not the same as in hulling nut mast because the hull or excess stone perceived to be dead weight may actually be

wanted, flakes removed from bifaces may be needed as much as the biface (Beck et al. 2002; R. Beck 2008).

For the purpose of this study, I have chosen to study four overlapping catchment areas representing increasing levels of utilization and management. A 1-km catchment will represent the area where the most essential of resources would be needed including firewood and water. The 5-km catchment is the area where most other resources including the majority of the foodstuffs such as deer, nuts, and small game would be acquired. The 10-km catchment represents an area where non-essential resources were acquired while residing at Kautz, these resources might be additional pelts, minerals, and exchange goods. Areas beyond the 10-km catchment would likely require special purpose trips camps or an entire residential move to be efficiently exploited (R. Kelly 1995). Any resources that are identified in the material culture analysis that cannot be accounted for in the catchments established in this study will serve to question the adequacy of the catchments or could be suggestive of behaviors not related to the central foraging concept such as embedded procurement or down the line trade. The fourth and largest catchment is the region of northeastern Illinois. The purpose of this catchment is to provide a cultural and ecological context and help visualize behavior that occurred outside of the daily foraging range.

The three smallest catchments used in this study were created by converting the IIAPS polygon shapefile of the site into a centroid using the Feature to Point tool in the features tool box in the Data Management Toolbox. Once a centroid was created a 1, 5 and 10-km circular buffer polygon shapefile was created with the Buffer Tool in the proximity toolbox in the Analysis Toolbox. The point shapefile created from the Kautz Site polygon was the input feature, an output feature class was named 1, 5 or 10-km Catchment, and the foraging radius of 1, 5 or 10

was entered into the distance field and kilometers was chosen for the linear unit. The results were three perfect circles representing the area within a 1, 5 or 10-km foraging radius around the Kautz Site. The corresponding areas for these catchments are 3.16 km^2, 79.16 km^2, 316.64 km^2 respectively. Northeastern Illinois was drawn based on county boundaries and important ecological and geographical boundaries such as Lake Michigan and the Illinois River. The overall area for northeastern Illinois is 17747.54 km^2.

Vegetation Reconstruction

A reconstruction of pre-European settlement vegetation is a critical aspect of this catchment analysis because it provides a general framework within which we can view prehistoric site placement (Jeske 1988). The pre-settlement vegetation and corresponding animal resources of northeastern Illinois have been reconstructed by a number of authors for a variety of reasons (Bowles et al. 1998; Early 1973; INHS 2014; Jeske 1987; Kilburn 1955, 1959; Moran 1980) (see Jeske (1988) for full discussion). The main source of data used by these authors and in this study come from the Public Land Survey System (PLSS), using the maps, notes and bearing tree data from the surveys by the General Land Office (GLO), conducted between 1821 and 1840. Each township in every county was mapped after completion of its survey, showing the distribution of timber, prairie, watercourses, and other landscape features (Bowles et al. 1998). This data source is one of the best available sources for identifying pre-settlement vegetation, and is certainly more useful than using modern land-use maps, but it should be used with caution. The pre-settlement vegetation recorded in the early 19^{th} century was not the same throughout all of prehistory. Even though the climate has remained relatively stable over the past 6,000 years, the ratio between grassland and forest did fluctuate (Lurie et al. 2009). Jeske (1988) also points out that the surveyors' original notes were hand-copied around 1870 and mistakes in

copying can, and did, occur. For example, Kilburn (1955, 1959) indicates "B. Oak" had been used as an abbreviation by the copier. The original notes show that B. oak could mean either mean Bur oak (*Quercus macrocarpa*) or Q. *macrocarpa* or Black oak (Q. *velutina*), but the notes in the state database are not the originals.

Although there has been a significant amount of work done with the GLO maps in regards to reconstructing pre-settlement vegetation in northeastern Illinois (Early 1973; Jeske 1987, 1988; Kilburn 1955, 1959; Moran 1978, 1980), the Illinois Natural History Survey (INHS) and Morton Arboretum studies were chosen to be incorporated into the catchment analysis because their data is relatively accurate and has been digitized and transformed into GIS polygon features. This does not mean that these other studies were not consulted, only that the data incorporated into the GIS was solely from the INHS and Morton Arboretum (Bowles et al. 1998; INHS 2014).

The Illinois Natural History Survey combined all of the Government Land Office (GLO) maps and drew GIS polygon features over the georeferenced maps using GIS software (INHS 2014). Each shapefile represents a unique land cover including areas of timber, bottomland, prairie, and slough among others (Table 3). This study is useful because it provides this information on scale that covers the entire state which allows me to determine the average distribution of land cover for the primary study area of northeastern Illinois. One problem with this data set is the scale issue; the data become less and less accurate as the study area shrinks, especially at the 1 and 5-km catchment levels. As important, the GLO data are subject to the same problems as the archaeological site file data-mistakes in digitizing are to be expected. Another problem is that the INHS study does not take into consideration the surveyor's notes regarding bearing tree data or tree densities. For that reason, I have also included data produced

from a study of the GLO documents and maps conducted by a team of researchers from the Morton Arboretum (Bowles et al. 1998).

The Morton team analyzed the GLO data transcribed from microfilm copies of the copies made from the original notes. These data were compared with corresponding GIS maps of landscape vegetation pattern made from the GLO notes and maps. GIS software was used to map the four primary vegetation types (prairie, timber, scattering timber, and barrens) with layers for section lines with woody undergrowth, bearing trees, and section and quarter-corners identified by either savanna, woodland, or forest tree density classes. Features of European settlement, such as fields, were not included in their GIS maps or landscape analysis and the natural land cover for those areas were extrapolated.

Their model not only describes the pattern and structure of vegetation present at that time, it determined its relationship to landscape fire processes. Fire is an extremely important component to the ecology of the Prairie Peninsula. Fire promotes plant diversity and productivity, creates new habitats, and facilitates travel by clearing travel routes through dense timber (Boyd 2002). The Morton study confirms the findings of previous research conducted by Kilburn (1955, 1959) and Moran (1980); firebreaks like steep elevation changes and water courses were the most deciding factors in the distribution of prairie and timber in the DuPage area.

The results of their study found that 80% of DuPage County was prairie prior to European settlement; the remaining 20% consisted of woody vegetation such as timber, scattering timber, barrens, brush, and hazel thickets. Woody vegetation is almost always situated next to streams, and was dominated by white oak, bur oak, red oak, and hickory, which are considered fire-tolerant. Maple, basswood, ash, and elm, which are less fire-tolerant, were

infrequent and essentially restricted to areas of timber on the eastern sides of water courses. Woody vegetation was classified based on bearing tree densities into four categories: open savanna (>0-10 trees/ha) savanna (>10-50 trees/ha), woodland (>50-100 trees/ha) and forest (>100 trees/ha). Among these groups, savanna was the predominant and most widespread type of timber, and was oak-dominated. The reconstruction efforts by the Morton team found that only 2% of the landscape was covered in Prairie wetlands. Although wetlands compose such as small percentage of the vegetation of the surrounding area, they were distributed throughout the county suggesting a landscape of small upland depressions and slow-moving streams and sloughs.

One of the biggest problems with reconstructing the vegetation from the GLO surveys is that small wetland areas were oftentimes not recorded by GLO surveyors and are likely under-represented in both the Bowles et al. (1998) and INHS studies. In order to ascertain the full presence of wetlands in the study areas, I supplemented these studies with data from soil surveys (USDA 2015) and the National Wetland Inventory (NWI) produced by the U.S. Fish and Wildlife Service (INHS 1987). Although the NWI is an inventory of modern wetland areas it serves as our best proxy for where wetland areas may have been in the past.

Other Environmental Factors

Chert

Sources of chert viable for stone tool production can be acquired either through direct or indirect procurement (embedded or indirect) (Andrefsky 2009; Binford 1979; Jeske 2003; Odell 2000). In order to determine whether the chert used at this site could be acquired directly within the daily foraging radius, I must first identify what material could hypothetically be acquired and within what context it could be found. Chert can be acquired from primary sources or secondary

sources. Primary sources of chert are natural exposures of chert-bearing bedrock that have been exposed by erosion.

In this portion of Illinois, the underlying bedrock consists of limestone and dolomite layers, some of which contain nodules of Silurian-aged chert. However almost all of the bedrock is buried beneath several to dozens of meters of glacial deposits (Willman 1971; Willman et al. 1975; Worthen 1870). Identifying possible chert quarry sites was accomplished by consulting a number of historical and geological descriptions of the area. County histories, newspapers, geological handbooks, geologic GIS datasets, elevation models, topographic maps and aerial photography were all used to identify the most likely areas of natural occurring outcrops of chert (ISGS 1994, 1995; Kolata 2005; Luman et al. 2003; Thompson 1985; Willman 1962; Willman et al. 1975; Zeizel et al. 1962). Identifying specific secondary sources of raw material is more difficult and it will be assumed that any area where the underlying glacial till is exposed has the potential to produce glacially-born chert nodules. The most likely areas for secondary deposits are streambeds and areas with a steep enough slope to expose the bedrock underlying glacial till. A slope mask was created by extracting the percent slope of the area from the digital elevation models using the slope tool in the 3D analyst toolbox. Areas with the greatest slope were shaded blue while areas with gentler slope were shaded in red or yellow. Areas of obvious modern human disturbance were ignored and slope areas were only modeled and not quantified.

Elevation

Elevation models provide a three dimensional aspect to vegetation modeling which helps in determining if a particular area within a vegetation zone like a mesic forest will contain a stream, lake, or wetland area. Elevation maps also illustrate slope, which is an important aspect to consider when modeling settlement behavior because some slope may be beneficial however

too much can be a problem. Slope is also one of the most important determinants for vegetation makeup in any environment. Two digital raster elevation data sets were used to model slope and elevation in this study. A 30m Digital Elevation Model (scale 1:500,000) acquired from the Illinois State Geological Survey (ISGS) GIS Database (Luman et al. 2003) was used to model the elevation within the larger 10km catchment and northeastern Illinois region. A digital surface model (dsm) produced from LiDAR imagery derivatives provided by the ISGS as part of the Illinois Height Modernization Program (ILHMP) was used to model the elevation of the smaller 1km and 5km catchments (ISGS 2006). The maximum, minimum, and average elevation of each catchment was calculated by generating topographic contours from the 1m and 30m digital elevation models using the contour tool in the spatial analyst toolbox. Modern human disturbances such as the railroad bed just north of the site and landfill mounds in the northern portion of the 10-km catchment skew the average elevation of the catchment. I manually removed obvious aberrant elevations by eliminating their contours from the shapefile. To identify the maximum, minimum, and average elevations of the catchment I used the calculations provided by the statistics tool then queried for those elevations using the select by attribute table.

Water

Water is a crucial resource that all organisms depend on therefore it is important to establish a campsite near a source of water. Water sources can vary too, water can be found in streams, lakes, wetlands, and springs and all can be used for a variety of reasons. It is hypothesized here that a higher diversity of water resources would have been economically beneficial therefore the site would have been oriented to minimize the amount of effort needed to exploit a diverse array of resources. Water resources will be identified and quantified by combining two data sets in a GIS. A vector line shapefile displaying all of the streams, rivers,

and open water within DuPage County produced by LiDAR data was used to model all streams and rivers within the catchment (ISGS 2006). A vector polygon shapefile representing the NWI wetland inventory was also used to model wetland areas within the catchment. I will determine the type and quantity of water resources present in each catchment by calculating the area of each type of NWI wetland designation in square kilometers and the total length of streams and rivers in meters.

Ecotones

I hypothesized that the Kautz Site was occupied because it was centrally located to a diverse set of plant and animal resources. The most diverse and productive areas for plants and most animals tend to be the boundaries between two or more plant communities called ecotones. If the Kautz site was centrally located to a diverse array of resources, then the area within the catchments should consist of large areas of ecotones and ecotones with high levels of diversity such as three or more plant communities.

To test this hypothesis, I utilized the reconstructed vegetation map created by Bowles et al. (1998) to locate and create the ecotones within the 1, 5, and 10-km catchments. To create a buffer zone that would represent ecotones in the catchments I converted the polygon features of pre-settlement vegetation communities to a polyline feature using the feature to line tool in the data management toolbox. I then created a 250-meter buffer using the buffer tool in the analysis toolbox. This process created hundreds of unique polygons, most overlapping with one another due to the small size and proximity of the vegetation communities.

The first step to eliminate overlapping areas and create a single weighted surface was to clip the ecotone layer to only include the area within the ten-kilometer catchment. Creating a

buffer area with just the polygons within the 10-kilometer catchment creates unnecessary and misleading polygons along the boundary since there is no data corresponding with the areas along the edge of the catchment.

The next step was to identify how many different vegetation communities were located within each ecotone. This was done by using the select by location tool to identify which vegetation communities were located in each of the 344 individual ecotone areas. New columns were created in the attribute table of the ecotone feature to record the type and number of communities present. Once a tally of communities in each ecotone was completed, I extracted new polygon features composed of features with the same diversity ranking i.e. all ecotones with two communities. In order to overlapping layers of similar ecotones, I enlisted the dissolve tool in the data management toolbox to create single polygons from multiple overlapping polygons. This was done for each diversity ranking. To deal with the overlapping issue between diversity levels I used the clip tool to remove overlapping areas that consisted over lower values. For example, if a location was covered by an ecotone with a diversity rank of 2 and an ecotone with a diversity level of 4, the area of the lesser diversity level was removed using the clipping tool.

Once all overlapping areas were removed, the individual layers were merged together into a single shapefile and visualized using a black to white scale, with black being the most diverse and white being the least. The area of each ecotone rank was calculated for the 1, 5, and 10-km catchments using the calculate geometry tool in the attribute table view.

Social Factors

<u>Illinois Inventory of Archaeological and Paleontological Sites (IIAPS)</u>

The IIAPS is the main repository for all information pertaining to known archaeological and paleontological sites in the state of Illinois (IIAPS 2015). The IIAPS is maintained by the Illinois State Museum (ISM) and access and information dissemination is managed by the Illinois Historic Preservation Agency (IHPS) under stipulations of the Archaeological and Paleontological Resources Protection Act (APRPA) (20 ILCS 3435/10) and its accompanying rules (Ill. Admin. Code, Ch. 6, Part 4190). The IIAPS consists of information about the site's location, cultural affiliation, and history of discovery. This information has been transformed into a digital database of vector data that can be visualized, queried, and analyzed in a GIS. The IIAPS database was used to determine if there are other related archaeological sites within the two catchments as well as to identify their cultural affiliation and function. As mentioned in earlier chapters this data set is large, but not very accurate and should be used with caution and realistic expectations.

The Albert Scharf Collection

Albert Scharf was a Chicago resident who is best known for his map titled "Indian Villages in the Chicago area" which was published in 1901 (Scharf 1901). Along with a series of maps were his associated notes which included descriptions of the sites location, materials, and other useful information. As it turns out, there were artifacts also associated with his notes and maps. They were once curated at the Field Museum of Chicago which were donated by the Chicago Historical Society. The maps he produced have been georeferenced and will be used to identify sites that may not have been recorded with the ISM. The map will also be used to identify locations of trails throughout the region.

1830s Trail Map

An 1830s trail Map from the DuPage County Roots publication illustrates the locations of the most commonly used land trails in the county along with the location of rivers and early land holders. The map was copied from the Web version of DuPage County Roots (Thompson 1985) and imported into ArcMap. From there the raster file was georeferenced so that it could be projected in the same coordinate system as the other site data. Once the map was georeferenced, I saved the transformations by updating the georeferencing. Distances to these trails from the site were determined by using the measuring tool and all distances were recorded in meters.

Now that the methods and methodology have been discussed, the following section will present the results of the landscape analysis. The results are organized by catchment. The first catchment to be described is the largest, the northeastern Illinois catchment is described as one part of a series of larger catchments that are mentioned but not discussed as they are largely irrelevant to this analysis, although important to the larger picture. Subsequently, the 10-km, 5-km, and 1-km catchments will be described in order of largest to smallest. Because of the nature of the data, the format of the data description for each catchment may be slightly different; however, standardization was maintained when possible.

Results of the Catchment Analysis

The Region of Northeastern Illinois

The region of northeastern Illinois as a unit of analysis, includes all areas within the area north of the Illinois/Des Plaines River valley and south of the Illinois-Wisconsin border, east of the big bend past LaSalle-Peru and west of Lake Michigan (Figure 23). Its boundaries have been defined by similarities in ecology, shared drainage of the Upper Illinois River and fairly uniform prehistory (Hart and Jeske 1987). More realistically, the cultural-ecological region of

northeastern Illinois extends into portions of southeastern Wisconsin and northwestern Indiana. Unfortunately, due to the lack of access to certain cultural, ecological, and geological GIS data and compatibility issues, it was not feasible to include data from these states into the study area.

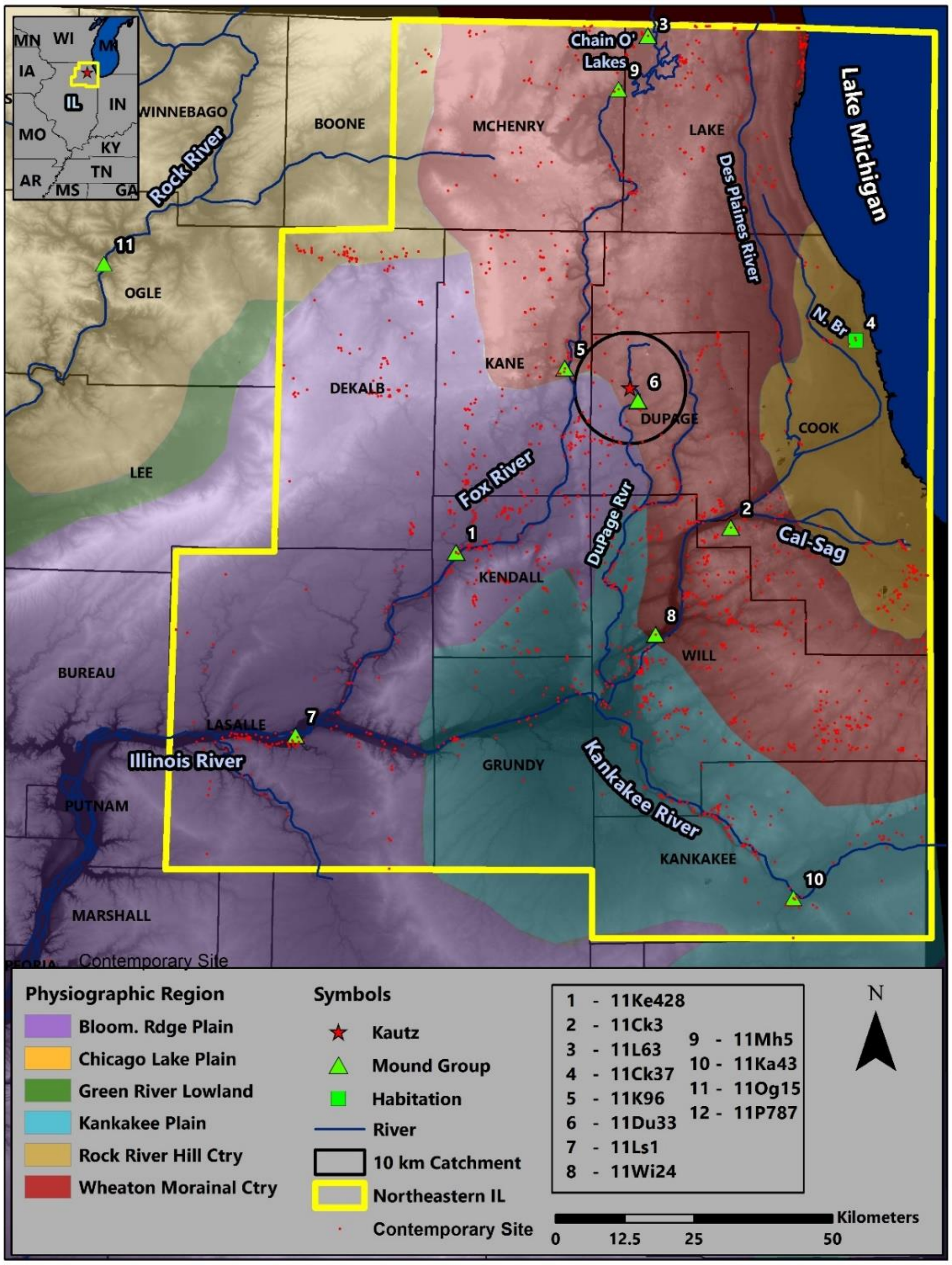


Figure 23. The physiographic regions and contemporaneous sites in northeastern Illinois

Northeastern Illinois (Figure 24; yellow box) is located in the middle of the Midcontinental United States, a geopolitical region that consists of the middle of the North American continent (Figure 24; grey area). The Midcontinental United States is made up Illinois and 11 other surrounding states (Schroeder 2004). In Figure 25, a number of important Archaic and Woodland sites and cultural areas in the Midcontinental United States are designated by red triangles. These sites include the Havana and Hopewell sites, two of the most important Middle Woodland sites in the region.

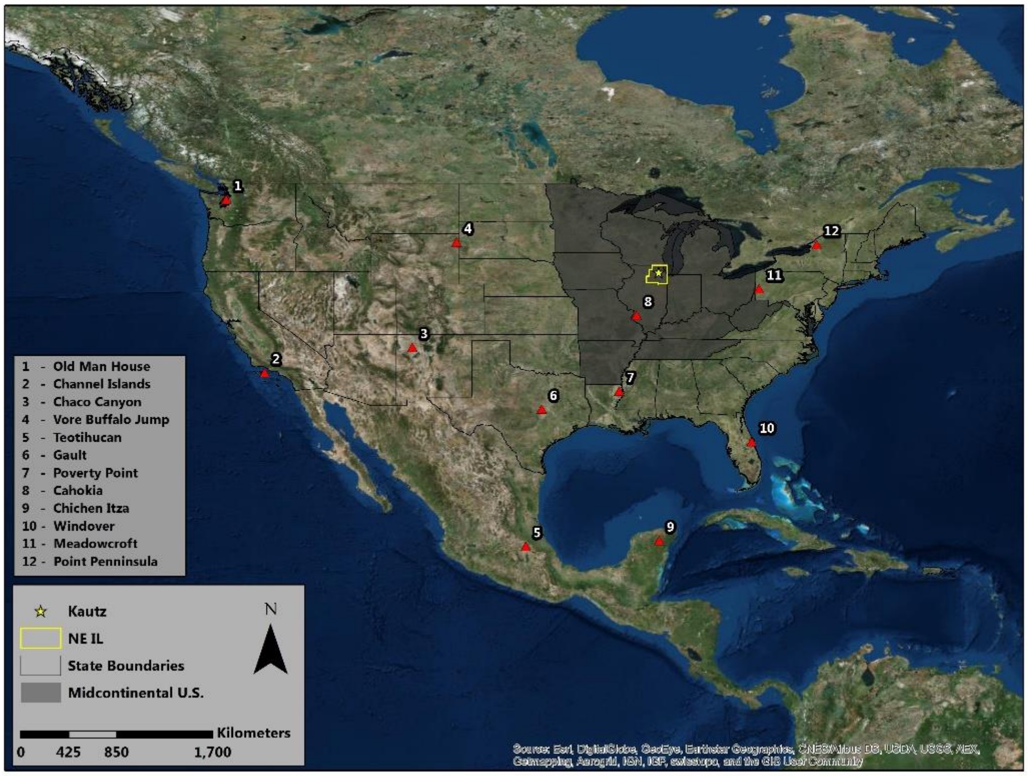


Figure 24. Important archaeological sites in North and Central America.

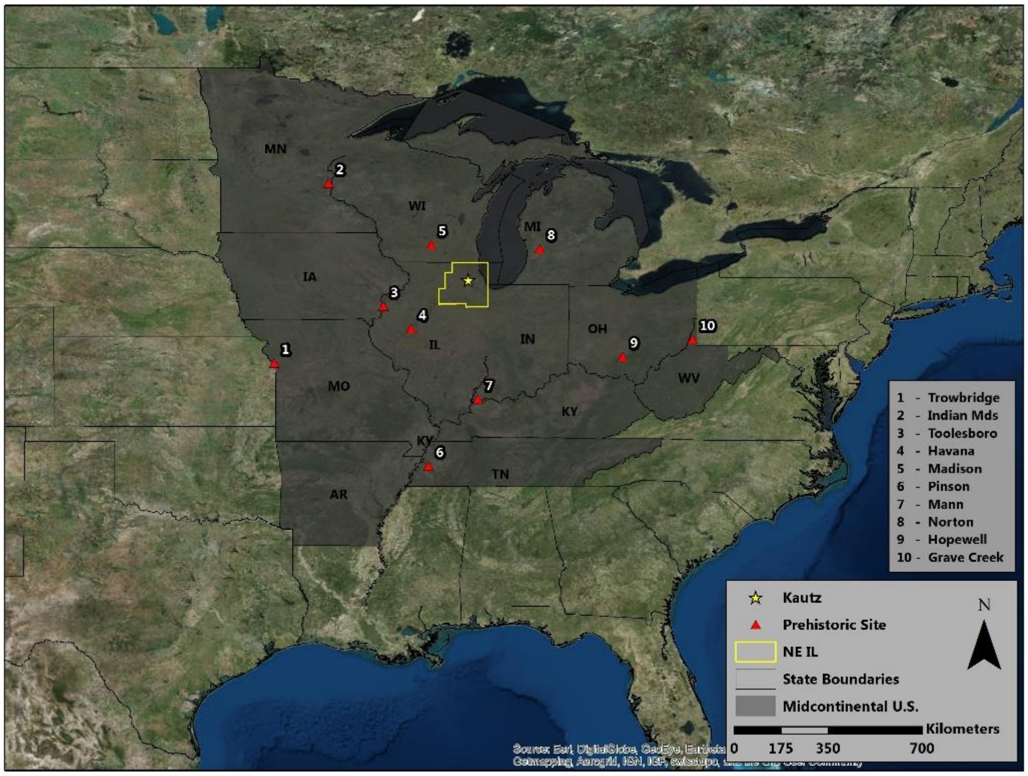


Figure 25. Important Middle Woodland and Hopewell Sites in North America.

Politically this region is composed of Cook County and its collar counties including Lake, McHenry, DuPage, Kane, Will, and outlying DeKalb, Kendall, Kankakee, Grundy and LaSalle counties (Figure 23). Geographically this region is located in the Wheaton Morainal Country of the Great Lakes Section of the Central Lowland Province (Willman 1971). The Central Lowlands is a low, broad formerly glaciated area that extends east from the Great Plains to the Appalachian Plateaus and from the Superior Upland south to the Interior Low and Ozark Plateaus (Leighton et al. 1948). The central lowlands are subdivided into two sections, the Great Lakes section and the Till Plains section. The portion of the Great Lakes section in Illinois consists of the Chicago Lake Plain and Wheaton Morainal Country.

The Kautz site is located on the far western end of the Wheaton Morainal Country approximately two miles east of the boundary with the Bloomington Ridged Plain of the Till Plains Section. The surficial topography of the Wheaton Morainal Country is entirely composed of glacial tills, glacial outwash sands and gravels, and glacial lake deposits (ISGS 1994). These deposits overlie Silurian Niagaran dolomite which only crops out in areas where post-glacial floods have removed the glacial deposits and carved into the bedrock (Schwegman 1973; Willman and Frye 1970; Worthen 1870; Zeizel et al. 1962).

Some of the prominent features of this region include the Lake Michigan Plain, the Fox River Valley and Chain O' Lakes area, the Des Plaines and Illinois River Valleys and the series of end moraines and inter-morainal valleys that form a ring around the Lake Michigan basin. The Kautz site is located within the intermorainal valley of the West Chicago and Wheaton Moraines is drained by the West Branch of the DuPage River, one of the many north-south trending rivers that cut through this region.

The West Branch of the DuPage River is part of the West Branch watershed which consists of 329 km^2 and 17 tributaries. The main channel of the West Branch is approximately 51 kilometers long before it joins together with the East Branch to form the main branch of the DuPage River (Figure 26). Major tributaries contributing to the West Branch include Kress Creek, Klein Creek, and Winfield Creek. Kress creek is the largest and enters the West Branch near Blackwell County Forest Preserve 6 km south of the Kautz Site. The East Branch has a deeper and wider valley than the West Branch and travels ten fewer kilometers than the West Branch (Post 2001). The headwaters of the East Branch are located 2.5-km southeast of Bloomingdale in DuPage County and the headwaters of the West Branch are located to the northwest in Campanelli Park in Schaumburg, Illinois. The two branches meet in Knoch Knolls

Park in southern Naperville approximately 20-km south of Kautz and travel another 35-km south to its confluence with the lower Des Plaines River just northeast of the mouth of the Kankakee River.

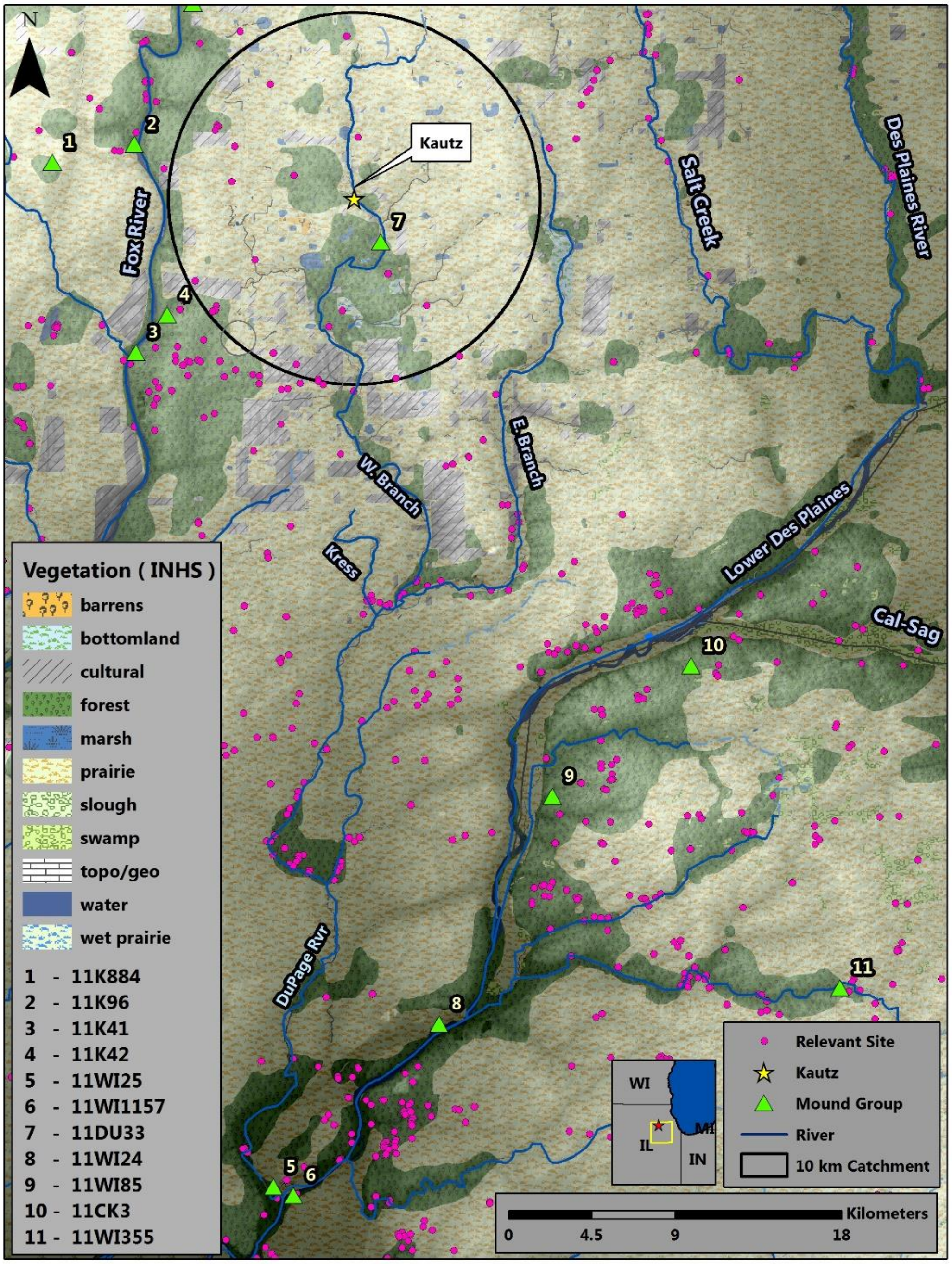


Figure 26. The DuPage River drainage and landscape.

The nature of the West Branch has changed considerably since European Settlement in the mid-19th century. Prior to an influx in European settlement in the 1850s, the West Branch could move to where it needed to. Now the West Branch is controlled by dams and channels have been cut to drain wetlands, lakes, and ponds. There has also been a significant altering of the landscape from 20th century farming practices and forest clearing which has led to hillslope erosion and the movement of top soil into river channels, a process called post-settlement alluviation (PSA) (Mapes 1979).

Ecologically, the site is located in the northeastern extension of the Prairie Peninsula, a vast mosaic of grassland interspersed with Oak-Hickory forests and wetlands (Transeau 1935). The diversity in topography and hydrology of the Morainal section of the Northeastern Morainal Division creates diversity in plant and animal communities in the otherwise homogenous landscape of the Prairie Peninsula (Leighton et al. 1948). The distribution of these habitats is largely dependent on a number of factors including climate, elevation, slope, soil, and hydrology; however, the influence of human activity on the distribution of these communities cannot be disregarded (Anderson 1970; Bowles and McBride 2002; Boyd 2002; Gleason 1922; B. Smith 2011; Transeau 1935).

Forest management through the use of fire and selective felling allowed nut-bearing trees to thrive along prairie-timber margins which in turn boosted nut masts for humans as well as important prey species; deer and turkey (Gremillion et al. 2008; McClain and Elzinga 1994; Munson 1986; B. Smith 2007). According to the INHS study of the Public Land Surveys, prairie was the dominant plant community in northeastern Illinois, followed by forest and smaller areas of bottomland, marsh, slough, swamp, wet prairie and barrens (Table 3).

Table 3. Distribution of vegetation by catchment area (INHS data).

Table 3. Distribution of vegetation by catchment area (INHS data)								
	Catchments							
	NEIL		10-km		5-km		1-km	
Vegetation Type	Km²	%	Km²	%	Km²	%	Km²	%
Barrens	0.6998	<0.1%	0.6998	0.2210%	0.6998	0.8840%	0.0000	0.0000%
Bottomland	220.3880	1.2418%	1.1435	0.3611%	0.2577	0.3256%	0.1555	4.9121%
Cultural	274.6951	1.5478%	26.8852	8.4903%	4.1290	5.2159%	0.1155	3.6475%
Forest	3962.9689	22.3297%	57.3269	18.1038%	26.1338	33.0125%	1.1329	35.7821%
Marsh	65.2357	0.3676%	6.0620	1.9144%	2.5070	3.1669%	0.0079	0.2482%
Other Wetland	7.8093	0.0440%	0.0352	0.0111%	0.0352	0.0445%	0.0000	0.0000%
Prairie	12701.3363	71.5667%	221.0024	69.7922%	44.3668	56.0446%	1.6876	53.3016%
Slough	18.6478	0.1051%	0.8623	0.2723%	0.4233	0.5347%	0.0000	0.0000%
Swamp	177.9338	1.0026%	0.0027	0.0008%	0.0000	0.0000%	0.0000	0.0000%
Topo/Geo	5.7428	0.0324%	0.0000	0.0000%	0.0000	0.0000%	0.0000	0.0000%
Water	264.8953	1.4926%	1.4223	0.4492%	0.5296	0.6690%	0.0668	2.1085%
Wet Prairie	47.1915	0.2659%	1.2153	0.3838%	0.0811	0.1024%	0.0000	0.0000%
Total	**17747.5442**	**100.0%**	**316.6576**	**100.0%**	**79.1634**	**100.0%**	**3.1662**	**100.0%**

Forest was concentrated along waterways and the Lake Michigan shoreline in the northern portion of the region, however there is a mosaic of forested areas west of the Fox River west of the Kautz site that are not directly associated with a major stream (Figure 27). As mentioned in the methods the number and area of wetlands are thought to be under-represented in the INHS study however when the National Wetlands Inventory (NWI) is consulted the number is about the same as the INHS study predicted (Table 4).

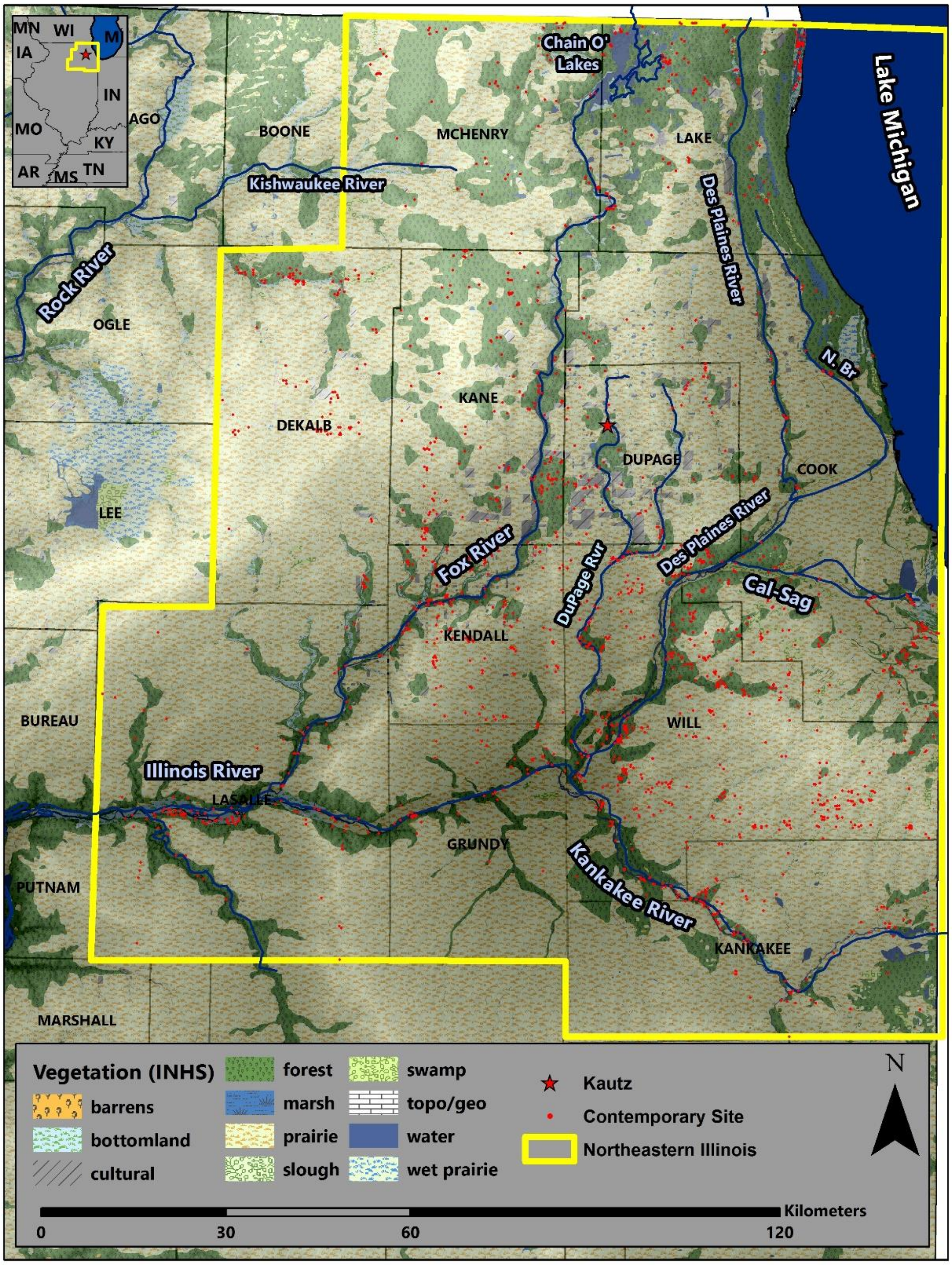


Figure 27. The pre-settlement vegetation in northeastern Illinois.

These wetland areas include Shallow Marsh/Wet Meadow, Deepwater Lake, Bottomland Forest, Open Water Wetlands, Deep Marsh, Perennial Deepwater River, Shallow Lake, Shrub-Scrub Wetlands and others (Table 4).

Table 4. Distribution of wetland areas by catchment (NWI data).

Table 4. Distribution of wetland areas by catchment (NWI data)								
	NE IL		10-km		5-km		1-km	
Wetland Type	**Km^2**	**%**	**Km^2**	**%**	**Km^2**	**%**	**Km^2**	**%**
Bottomland Forest	140.64	13.20%	2.48	7.63%	1.56	27.33%	0.16	28.25%
Deep Marsh	68.33	7.22%	1.20	4.41%	0.17	2.94%	0.00	0.00%
Deepwater Lake	145.81	1.35%	1.45	1.05%	0.27	4.78%	0.00	0.00%
Intermittent Riverine	0.01	0.01%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Lake Shore	1.00	0.16%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Open Water Wetlands	82.81	33.91%	3.86	38.56%	1.00	17.65%	0.04	7.42%
Perennial Deepwater River	61.54	0.83%	0.29	0.21%	0.06	1.13%	0.00	0.00%
Perennial Riverine	0.11	0.12%	0.00	0.00%	2.53	44.37%	0.00	0.00%
Shallow Lake	30.49	0.09%	0.28	0.07%	0.00	0.00%	0.00	0.00%
Shallow Marsh/Wet Meadow	231.77	39.64%	11.59	44.44%	0.00	0.00%	0.36	64.33%
Shrub-Scrub Wetlands	23.88	3.15%	0.80	3.50%	0.09	1.50%	0.00	0.00%
Swamp	0.58	0.08%	0.02	0.07%	0.02	0.30%	0.00	0.00%
Other	0.38	0.23%	0.01	0.07%	0.00	0.00%	0.00	0.00%
Total	**787.35**	**100.00%**	**21.96**	**100.00%**	**5.69**	**100.00%**	**0.56**	**100.00%**

As of 5/1/2015 a total of 12,790 archaeological sites have been recorded in the northeastern Illinois region, however only 9,584 sites have been designated prehistoric in age. Of those roughly 9,500 sites, 1,821 sites have been identified as Late Archaic, Early Woodland, Middle Woodland or Late Woodland in age is based on the presence of at least one diagnostic artifact. A few of these sites have multiple components, including components earlier or later than the timeframe of the Kautz Site (Figure 28). The most common prehistoric component is Late Archaic (n=840) followed by Late Woodland (n=481) and Middle Woodland (n=344). Some of the more important and pertinent sites within this region include 11CK37, 11K96, 11LS1, and 11WI24 as well as seven others identified by green triangles or squares in Figure 27. 11CK37 aka the Bowmanville Village Site is one of the only archaeological sites in the Chicago

Lake Plain that has a significant Middle Woodland component. Ceramic and chipped stone artifacts recovered from 11CK37 are very similar to the Kautz Site and like Kautz was occupied throughout the Archaic and Woodland periods (Fenner 1961; Geraci 2015).

The Adler Mound Site (11WI24) is another rare Middle Woodland site in northeastern Illinois and it too shares similar material culture including Havana ware var. Naples Stamped Dentate and Snyders and Manker points. The site is located close to the confluence of the DuPage River and the lower Des Plaines River. The Utica Mound (11LS1) site is another Havana mounds site located near the confluence of the Fox River and the Illinois River. It too shares similar material culture to the Kautz Site like Adler and these mound sites may represent places where people living at the Kautz Site came to exchange goods, worship, and bury their dead. Late Woodland site 11K96 is located on the west bank of the Fox River and the Late Woodland hafted bifaces recovered from that site are similar in morphology and raw material suggesting they share similar cultural backgrounds and resource areas.

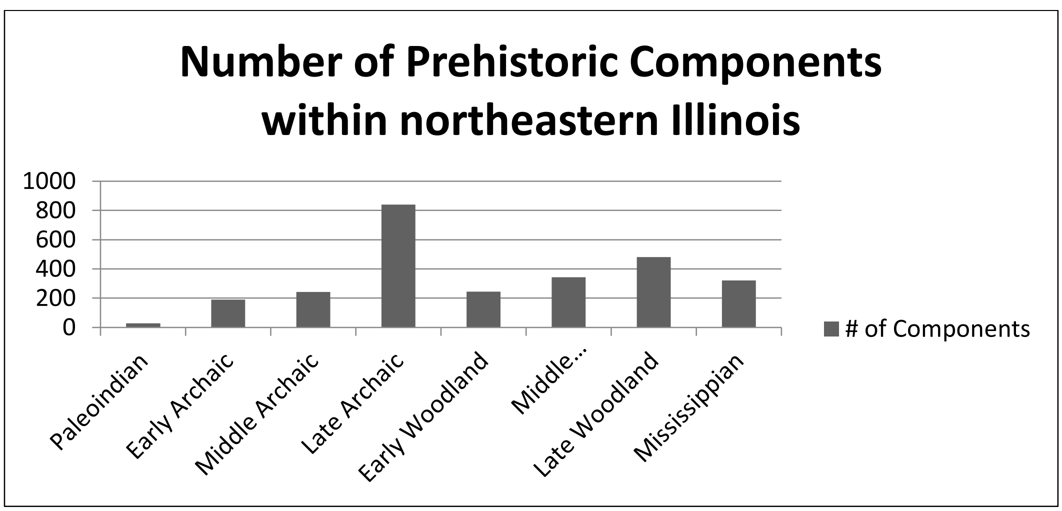


Figure 28. Bar Graph displaying number of prehistoric components within NE Illinois.

Sites within the northeastern Illinois catchment are situated on multiple landforms, the majority of which are located in the uplands or floodplains and terraces (Table 5). The average elevation of a site with a Late Archaic-Late Woodland component in this region is 207 masl and the average elevation of the region as a whole is 227 masl.

Table 5. Number of prehistoric sites by landform in NE Illinois.

Table 5. Number of prehistoric sites by landform		
Topography	**Sum**	**% of Total Sum**
Bluff crest	161	8.8%
Bluff base	60	3.3%
Bluff slope	87	4.8%
Floodplain	299	16.4%
Island	4	.2%
Lake Michigan Beach	8	.4%
Other upland	747	41.0%
Terrace	196	10.8%
Unknown	14	.8%
Upland Closed Depression	19	1.0%
Upland Ridge	226	12.4%
Total	**1821**	**100.0%**

Archaeological sites were found on 27 different soil associations, 16 are associated with Prairie vegetation and 11 are associated with Forest vegetation. Sites are most frequently located on Morley-Blount-Beecher soils which are associated with forests (n=356) followed by Varna-Elliot-Ashkum (n=157), a prairie soil association. Overall sites are distributed across prairie and forest soils proportionate to one another with a slight majority lying in forest soils (Table 6).

Table 6. Number of prehistoric sites in NE Illinois by soil association.

Table 6. Number of prehistoric sites in NE Illinois by soil association			
Soil Associations		**# of Sites**	**% of Total Sum**
Dark and Moderately Dark (Prairie)	Catlin-Flanagan-Drummer	23	1.3%
	Channahon-Dodgeville-Ashdale	46	2.5%
	Griswold-Ringwood	1	.1%
	Houghton-Palms-Muskego	52	2.9%
	Jasper-LaHogue-Selma	38	2.1%
	Lawson-Sawmill-Darwin	101	5.5%
	Lorenzo-Warsaw-Wea	54	3.0%
	Martinton-Milford	32	1.8%
	Plano-Proctor-Worthen	153	8.4%

	Saybrook-Dana-Drummer	110	6.0%
	Sparta-Dickinson-Onarga	72	4.0%
	Swygert-Bryce-Mokena	11	.6%
	Symerton-Andres-Reddick	22	1.2%
	Tama-Muscatine-Sable	5	.3%
	Varna-Elliott-Ashkum	157	8.6%
	Wenona-Rutland-Streator	6	.3%
	Total	**883**	**48.5%**
Light and Moderately Dark (Forest)	Birkbeck-Sabina-Sunbury	33	1.8%
	Casco-Fox-Ockley	147	8.1%
	Derinda-Schapville-Elroy	29	1.6%
	Dodge-Russell-Miami	72	4.0%
	Fayette-Rozetta-Stronghur	2	.1%
	Kidder-McHenry	10	.5%
	Morley-Blount-Beecher	356	19.5%
	Oakville-Lamont-Alvin	71	3.9%
	Ritchey-New Glarus-Palsgrove	32	1.8%
	St. Charles-Camden-Drury	120	6.6%
	St. Clair-Nappanee-Frank	43	2.4%
	Total	**915**	**50.2%**
Other	N/A	9	.5%
	Water	14	.8%
	Total	**23**	**1.3%**
Total		**1821**	**100.0%**

A spatial analysis of sites and the INHS vegetation reconstruction produced similar results, 45% of the sites are located in forest, while 42% are located in prairie (Table 7).

Table 7. Number of prehistoric sites in NE Illinois by vegetation type (INHS data)

Table 7. Number of prehistoric sites in NE Illinois by vegetation type (INHS data)		
INHS Vegetation	**Count**	**% of Total**
bottomland	93	5.11%
cultural	28	1.54%
forest	823	45.19%
marsh	32	1.76%
prairie	781	42.89%
slough	1	0.05%
swamp	24	1.32%
topo/geo	1	0.05%
water	35	1.92%
wet prairie	3	0.16%
Total	**1821**	**100.00%**

It has been hypothesized by Jeske (1988) and others that forest edges and opening were important economic targets for hunter-gatherer societies because almost all of the fauna would be most abundant in these areas (Benchley and Billeck 1977; M. Brown 1981; Goldstein 1979; Jeske 1988; Roper 1979a). If humans were attracted to forest edges they should organize themselves on the landscape to most efficiently exploit them, which means minimizing the distance needed to travel.

To test whether or not sites are more likely to be located near forest edges, I measured the shortest distance from each site to the reconstructed forest edges in the region. The results from the spatial analysis seem to confirm the hypothesis that an optimal location for a habitation site would be within 1-km of a forest edge. Sites are more likely to be located within 1-km than not. Approximately 70% of all the sites tested in northeastern Illinois were less than 1-km from a forest edge. When the distance is decreased to 500 meters, the percentage decreases to just above fifty percent. When the distance is decreased to below 100 meters, the percentage drops to 13% (Table 8).

Table 8. Number of sites within selected distances to historical forest edges.

Table 8. Number of sites within selected distances to forest edges		
Distance (m)	**# of Sites**	**% of Sites**
1000	1241	68.0%
500	981	54.0%
250	720	40.0%
125	443	24.0%
62.5	241	13.0%

One explanation for why there are so few sites within 100 meters of a forest edge may be the fluidity of forest edges over time. Forest edges fluctuate due to many factors including climate change and human intervention. This is exemplified by the difference in the distribution

of forest soils to historic forest boundaries in Figure 29. Light and moderately dark forest soils identified in the General Soils Map drawn by Fehrenbacher (1982) are represented by a dark red color and the historic boundaries of timber identified by the INHS from the PLSS surveys is represented by a dark green. Notice how the two do not always overlap, particularly along the Valparaiso Morainal System just west of the Chicago Lake Plain, east of the Kautz site.

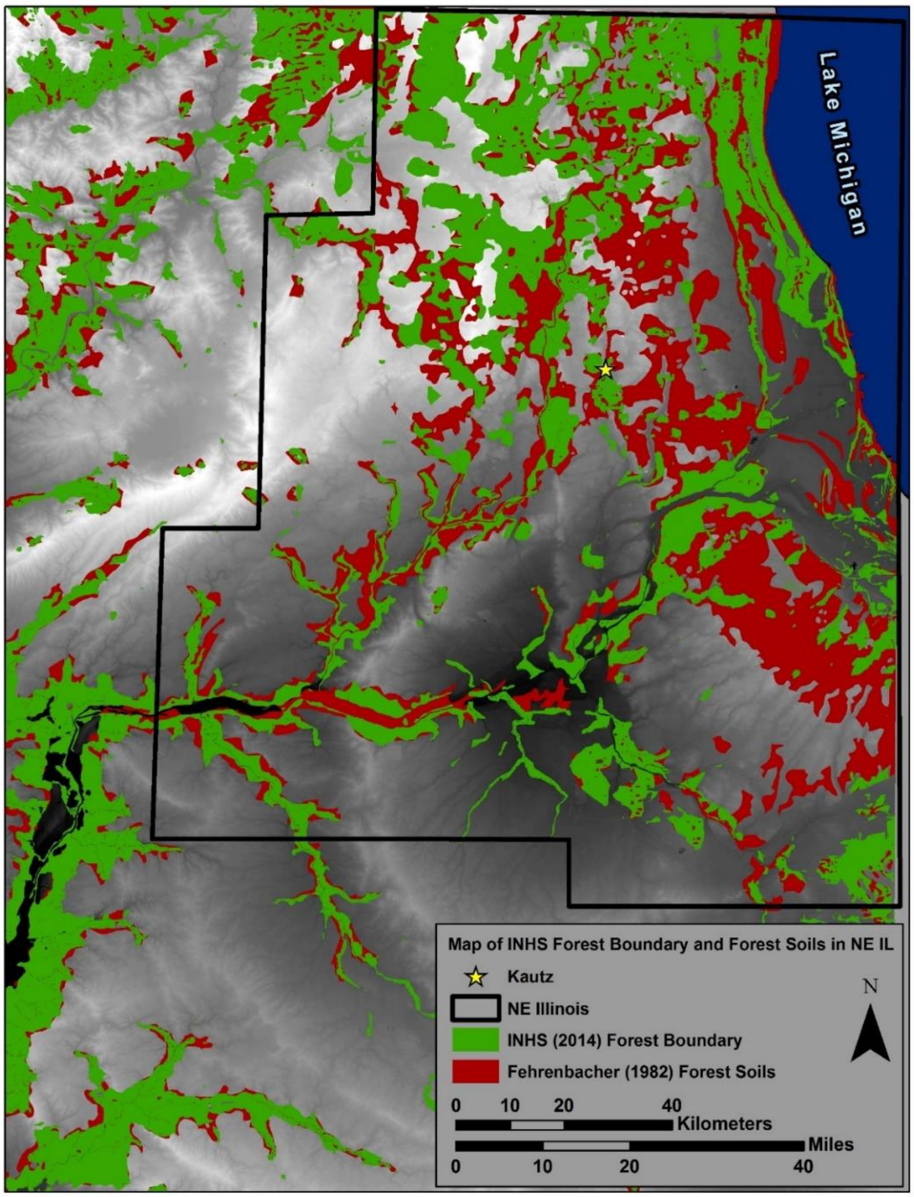


Figure 29. Distribution of INHS forest boundary and forest soils in northeastern Illinois.

A number of different types of raw material for chipped stone tools such as chert and other cryptocrystalline materials are available in primary and secondary contexts in northeastern Illinois (Figure 30). The most common material is chert, a cryptocrystalline quartz which occurs as nodules or lenses in a parent rock such as limestone or dolomite (Andrefsky Jr. 2001). Chert has been identified in several different geologic systems, groups and formations in northeastern Illinois (Baumann 2010; Bretz 1939; Culver 1923; Ferguson and Warren 1992; Piskin and Bergstrom 1975; Trowbridge 1912; Willman 1962; Willman and Kolata 1978; Willman and Payne 1943; Willman 1971; Willman et al. 1975; Worthen 1870).

The most prevalent chert in northeastern Illinois archaeological assemblages is Joliet Silurian chert (Figure 31). This material occurs as nodules and lenses within the dolomite of the Niagaran Series of the Silurian System (Willman et al. 1975). Primary sources of Joliet Silurian chert occur where portions of the Niagaran Dolomite bedrock are exposed at the surface. Since the majority of the bedrock in northeastern Illinois is buried by over fifty feet of glacial till, bedrock only outcrops in places where streams have cut through the till (Piskin and Bergstrom 1975; Willman and Frye 1970). According to a number of sources, Joliet Silurian chert outcrops in northeastern Illinois along portions of the Des Plaines River valley and a few areas along the Fox River in Kane County (Bretz 1939; Culver 1923; Ferguson and Warren 1992; Willman 1962). One location that has been confirmed by the author is located in Dellwood Canyon adjacent to the Des Plaines River valley in Will County (Figure 30). Here, large portions of the bedrock are exposed and layers of the white-grey, fine-grained cherts can be found embedded in a chalky matrix of dolomite (Figure 32).

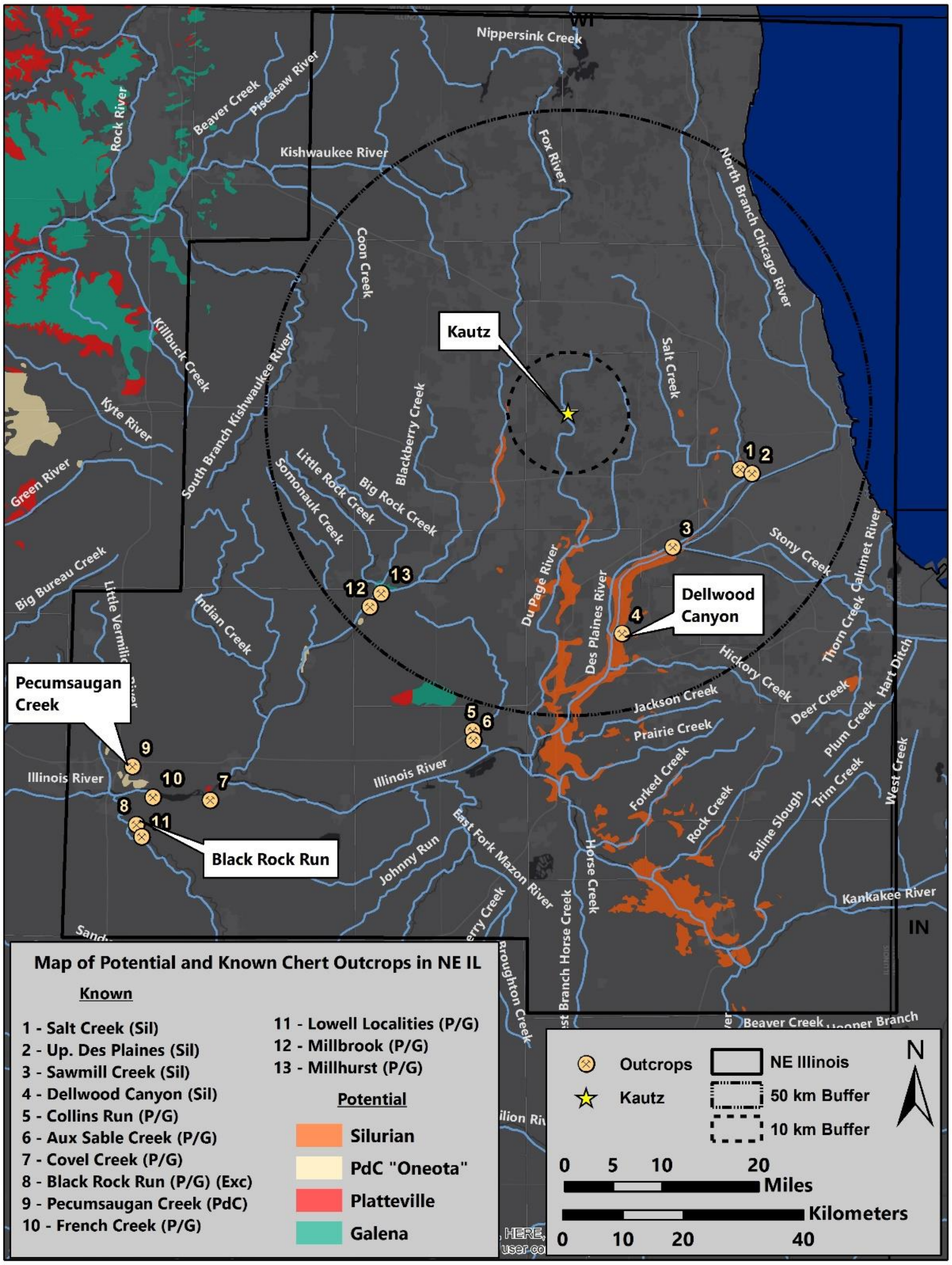


Figure 30. Map of chert sources in northeastern Illinois

Figure 31. Sample of Joliet Silurian chert collected from Dellwood Canyon, Will Co. IL

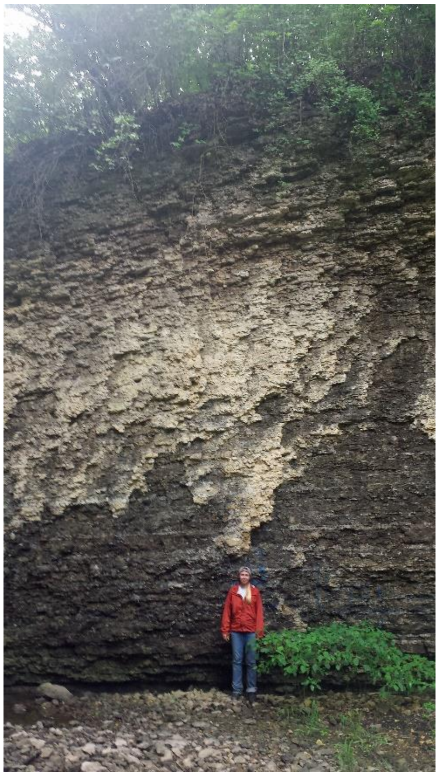


Figure 32. Joliet Silurian chert within Dolomite matrix in Dellwood Canyon, Will Co. IL

Another common chert available in northeastern Illinois is the Platteville-Galena type, which has been referred to in the literature as Pecatonica and as Platteville or Galena. Platteville-Galena is a conflation of cherts that occur in nodule form in several different members and formations of the Platteville and Galena groups in the Champlainian series of the Ordovician System. The reason for the conflation is due to the poor understanding of the geological stratigraphy and origin of different types of chert from these formations. Ferguson and Warren (1992) identify two different types of Platteville-Galena cherts, Pecatonica and Everett. Pecatonica is a darker colored chert while Everett is a lighter variety, however when identifying these cherts in archaeological assemblages it is difficult to distinguish between them due to wide range of natural variation in the chert and the lack of in depth study (Figure 33).

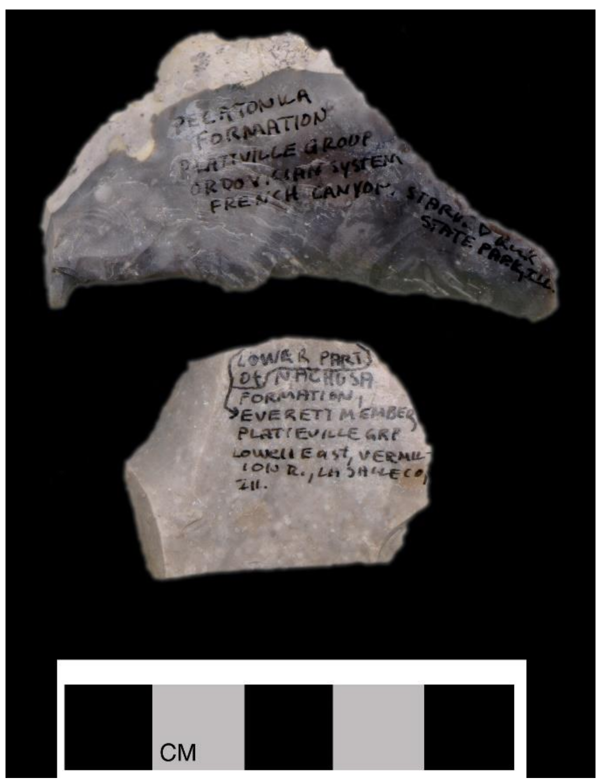


Figure 33. Platteville-Galena cherts (adapted from Stelle and Duggan 2003)

Platteville-Galena cherts have been recovered in primary context in a few places in the southern portion of northeastern Illinois, primarily in the Upper Illinois River Valley (Figure 30). One confirmed location is Black Rock Run along the Vermillion River, Baumann (2010) identified Platteville-Galena chert in the eastern portion of this small canyon (Figure 34).

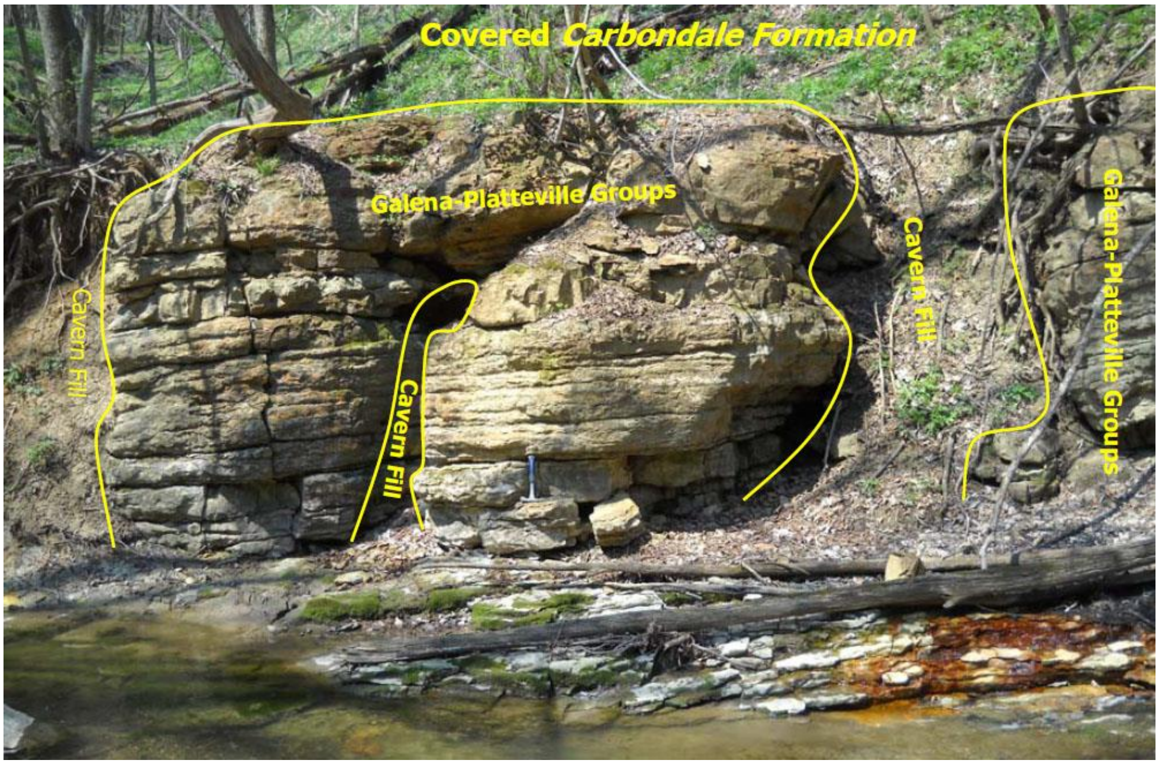


Figure 34. Platteville-Galena outcropping in Black Rock Run, LaSalle County, (Baumann 2010).

Another chert that outcrops in northeastern Illinois is Oneota chert also known as Starved Rock chert. Oneota chert occurs in a dolomite matric in the Oneota formation of the Prairie du Chien group of the Canadian series of the Ordovician system. Oneota is known for its white to gray to yellowish and orange color and characteristic swirls and banding. Oneota cherts is only available in the Upper Illinois valley and there is only one documented natural outcropping of this material located along Pecumsaugan creek south of I-80 (Figure 30). Thomas Loebel recently visited this location and photographed large boulders of chert in a dolomite matrix

eroding into the creek (Figure 35). Other cherts that occur in small amounts in the Starved Rock area are Excello Shale, a fossilized tree, and Shakopee which is found along with Oneota chert in some places like Pecumsaugan Creek (Loebel 2016)

Figure 35. Oneota chert occurring in boulder form in Pecumsaugan Creek, LaSalle Co. Illinois.

In order to expand upon the current literature, a spatial analysis of bedrock geologic units and drift thickness was conducted to find additional chert outcrops in northeastern Illinois. Results of the analysis found potential locations concentrated along the major waterways of the region. Sources of chert located in Prairie Du Chien and Platteville groups can be found near the Starved Rock area in the southwestern portion of the region. Sources of chert found in the Galena group could potentially outcrop in southern Kendall county and northwest DeKalb county. Sources of chert in Silurian system can be found along the Des Plaines, lower DuPage, Fox and Kankakee Rivers. Unfortunately, many of these areas identified in the model have yet to be ground-truthed and should only be used as rough estimates of where chert may outcrop in this region (Figure 30).

Ten Kilometer Catchment

According to the INHS study of the GLO survey, the 10-km catchment is composed of a mixture of prairie, timber and wetland habitats, similar to the region as a whole (Figure 36).

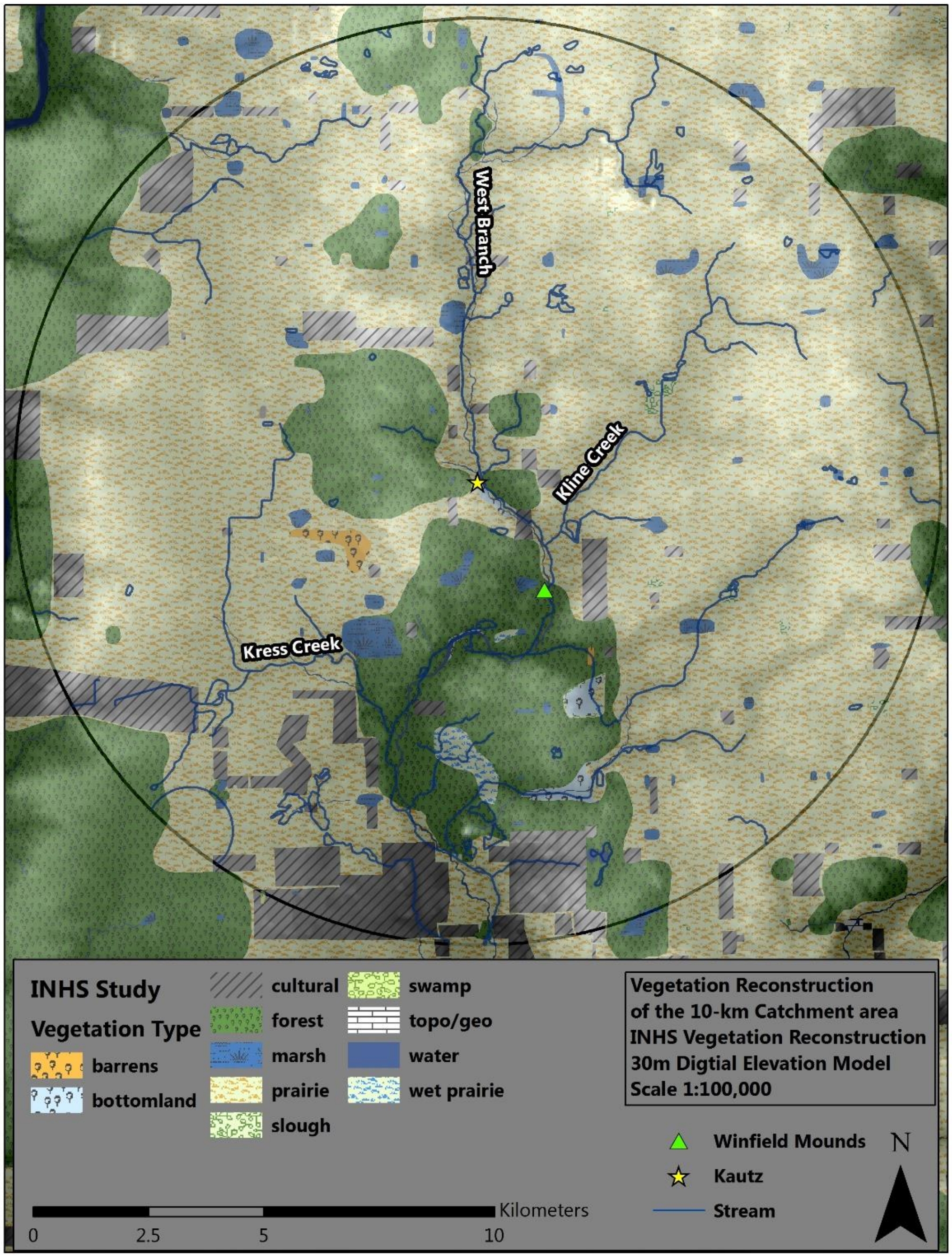


Figure 36. Distribution of pre-settlement vegetation within 10-km catchment (INHS data).

According to the INHS study, approximately 70% of the 10-km catchment is prairie and 18% is forested. The remaining 12% is divided between cultural areas (which are mostly located in prairie), marsh, wet prairie, bottomland, barrens and slough (Table 3). A spatial analysis of the NWI found that wetlands compose closer to 10% of the 10-km catchment compared to the 3.5% suggested by the INHS study.

The Bowles et al. (1998) study found that the natural vegetation of the 10-km catchment was composed of approximately 76% prairie and 15% timber, a slightly different proportion than the INHS study found (Figure 37, Table 9). The remaining 9% is divided between scattering timber, barrens, wet prairie, slough, rivers, creeks, brush/thicket, ponds and lakes.

Table 9. Distribution of vegetation types by catchments (Bowles et al. 1998 Study)

Table 9. Distribution of vegetation types by catchments (Bowles et al. 1998 Study)						
	10-km Catchment		**5-km Catchment**		**1-km Catchment**	
Vegetation Type	**km²**	**%**	**km²**	**%**	**km²**	**%**
Prairie	242.6696	76.63%	44.6951	56.46%	2.0227	63.89%
Timber	47.4338	14.98%	16.5389	20.89%	0.9290	29.34%
Scattering Timber	13.9088	4.39%	10.9392	13.82%	0.2144	6.77%
Marsh	6.1267	1.93%	2.1369	2.70%	0.0000	0.00%
Barrens	3.7619	1.19%	3.7619	4.75%	0.0000	0.00%
Wet Prairie	1.2090	0.38%	0.3014	0.38%	0.0000	0.00%
Slough	0.9439	0.30%	0.5861	0.74%	0.0000	0.00%
River/Creek	0.3838	0.12%	0.1392	0.18%	0.0000	0.00%
Brush/Thicket	0.1249	0.04%	0.0648	0.08%	0.0000	0.00%
Pond/Lake	0.0956	0.03%	0.0000	0.00%	0.0000	0.00%
Grand Total	**316.6580**	**100.00%**	**79.1634**	**100.00%**	**3.1661**	**100.00%**

A total of 171 bearing trees were recorded within the 10-km catchment, 43% were Bur Oak, 29% White Oak, 16% Red Oak, and 8% Hickory. The remaining 4% was composed of Ash, Basswood, Black Oak, Elm, and Red Haw (Table 10). The average diameter of a bearing tree in the catchment is 14”, which according to the Missouri Department of Conservation (MDC) means the trees were relatively young, approximately 70 years old (MDC 2016). Tree densities were measured in trees/hectare and were assigned arbitrary vegetation types based on

distinctions made by (Bowles and McBride 1994). Vegetation types included: open savanna (>0-10 trees/ha) (closed) savanna (>10-50 trees/ha), woodland (>50-100 trees/ha) and forest (>100 trees/ha).

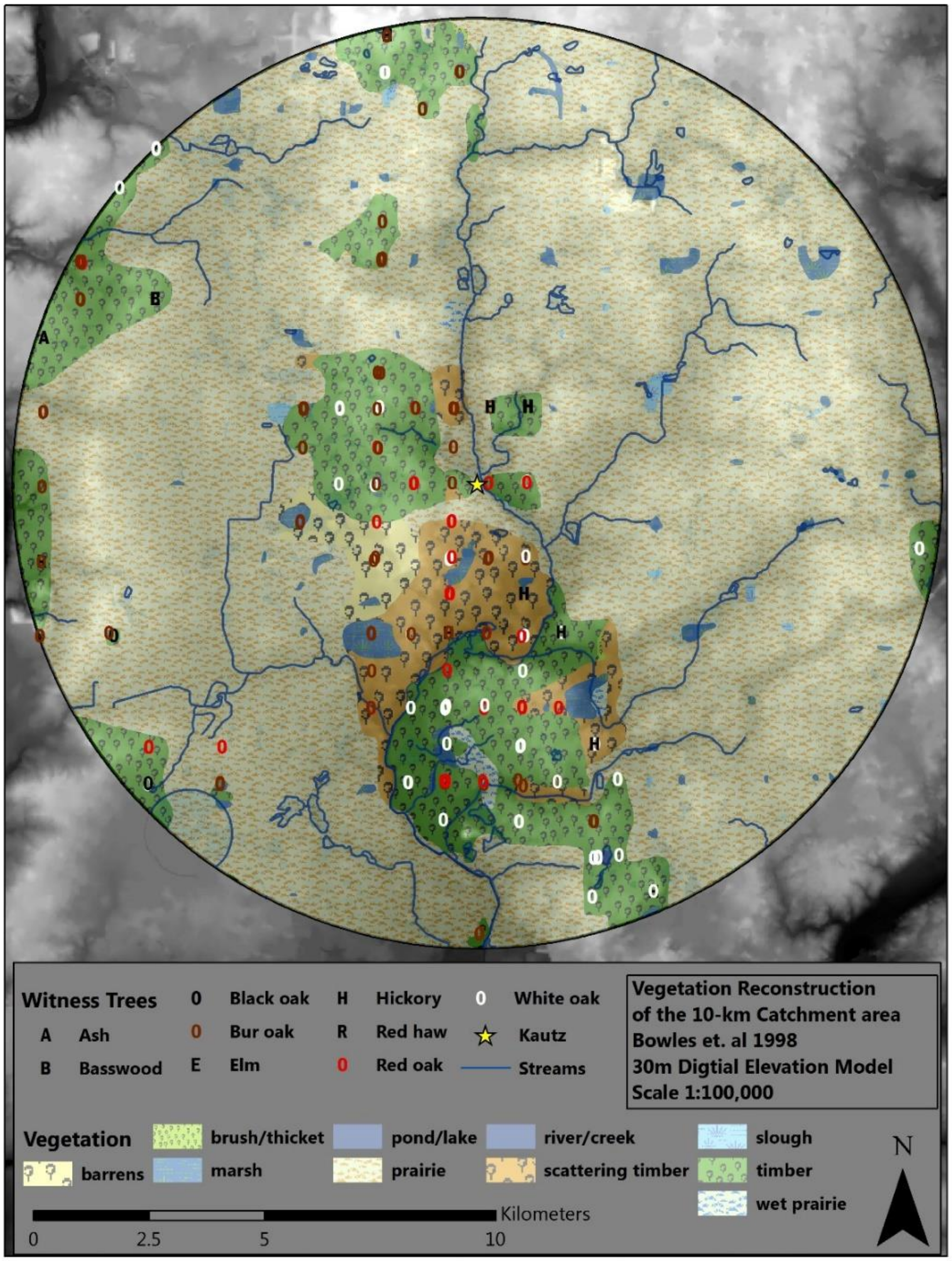


Figure 37. Witness trees within the 10-km catchment.

Table 10. Number and type of bearing trees per catchment.

Table 10. Number and type of bearing trees per catchment.						
	10-km		5-km		1-km	
Tree Type	**Sum**	**%**	**Sum**	**%**	**Sum**	**%**
Ash	2	1.17%	0	0.00%	0	0.00%
Basswood	1	0.58%	0	0.00%	0	0.00%
Black oak	2	1.17%	0	0.00%	0	0.00%
Bur oak	73	42.69%	34	40.96%	2	33.00%
Elm	1	0.58%	0	0.00%	0	0.00%
Hickory	13	7.60%	9	10.84%	0	0.00%
Red haw	1	0.58%	0	0.00%	0	0.00%
Red oak	28	16.37%	19	22.89%	3	50.00%
White oak	50	29.24%	21	25.30%	1	17.00%
Grand Total	**171**	**100.00%**	**83**	**100.00%**	**6**	**100.00%**

Results show that the overall average tree density in the 10-km catchment is 53 trees/ha. Based on bearing tree densities 30% of the bearing trees were in open savanna, 39% closed savanna, 16% woodland, and 15% forest. These results suggest that the distribution of savanna-like conditions may have been much greater than the Public Land Survey proposes because tree densities were only taken from bearing tree locations located in areas deemed Timber, Scattering Timber, or Barrens (Figure 38). Water resources within the catchment are varied, according to the National Wetland Inventory (NWI) there are approximately 22 km^2 of wetland and open water habitat in the catchment and 256 linear kilometers of streams and rivers. Open water habitats include deep marshes, deep-water lakes, open water wetlands, shallows lakes, and swamp. Wetland habitats include shrub-scrub wetlands and shallow marsh/wet meadows, which compose 44% of all wetland areas (Table 4). The West Branch of the DuPage River is the primary source of river water and essentially bisects the catchment into a west and east half (Figure 38). Other water resources within the catchment include spring-fed lakes like Spring Lake, and smaller streams like Brewster and Norton Creeks in the northwest and Kress Creek and Spring Brook in the south. Two major sources of water are located just outside of the

catchment; these include the Fox River in the west and the East Branch of the DuPage River in the east. The most significant water resources are the springs located within the site boundaries. Today they have been excavated into two small ponds, historically they would have been small pools sustained by a constant seep from the edge of the low bluff.

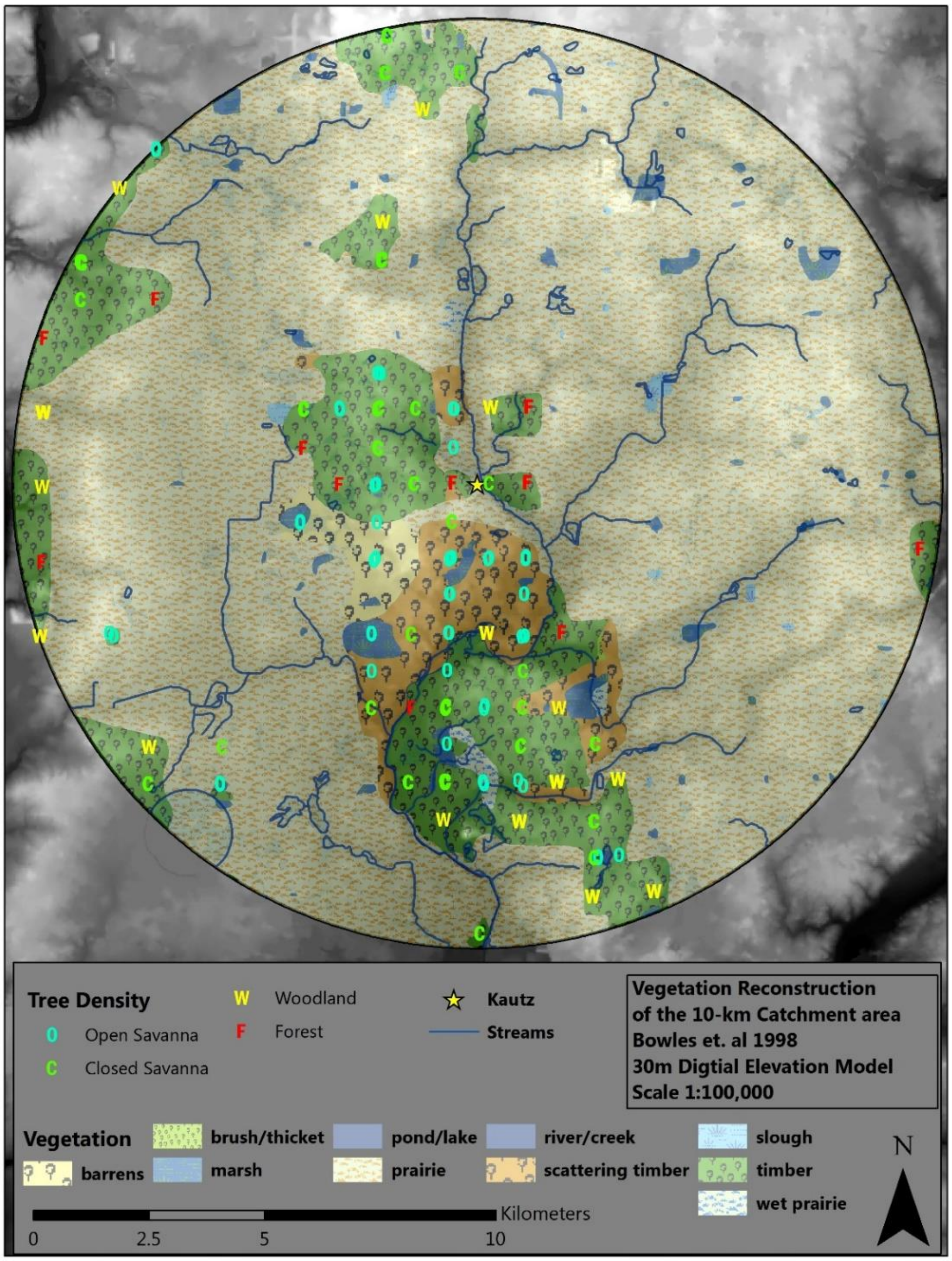


Figure 38. Pre-settlement vegetation and tree density within the 10-km catchment.

An important aspect of this thesis was diversity and the analytical unit, ecotone, was created as a way to identify the places within the catchments that were likely to produce the most diverse plant and animal resources. This was measured by determining how many different vegetation types were found in the same area. The spatial analysis found that most of the 10-km catchment (69%) consisted of homogenous grassland or timbered areas (Table 11, Figure 39). The remaining 30% of the catchment is considered to be ecotone consisting of two overlapping communities such as prairie-marsh or prairie-timber. In the southern portion of the 10-km catchment, there are two strips of land where six different communities overlap including river/creek, timber, pond/lake, marsh, slough, and prairie (Figure 40). The analysis also found that the percentage of diversity increased as the catchment decreased in size. Roughly 40% of the 5-km catchment and 75% of the 1-km catchment consist of ecotones. The level of the diversity within the smaller catchments increases as well, 50% of the 1-km catchment consists of ecotone with more than four overlapping communities.

Table 11. Ecotone area by diversity ranking in catchments.

Table 11. Ecotone area by diversity ranking in catchments													
		Diversity Rank											
		6		5		4		3		2		**Total %**	
Catchment	**Total km**	km	%	km	%	km	%	km	%	km	%	Ecotone	Single
10-km	316.66	5.45	2	12.71	4	19.49	6	14.86	5	43.54	14	31	69
5-km	78.54	0.00	0	8.41	11	12.36	16	4.61	6	8.77	11	43	57
1-km	3.17	0.00	0	0.45	14	0.98	31	0.14	4	0.81	26	75	25

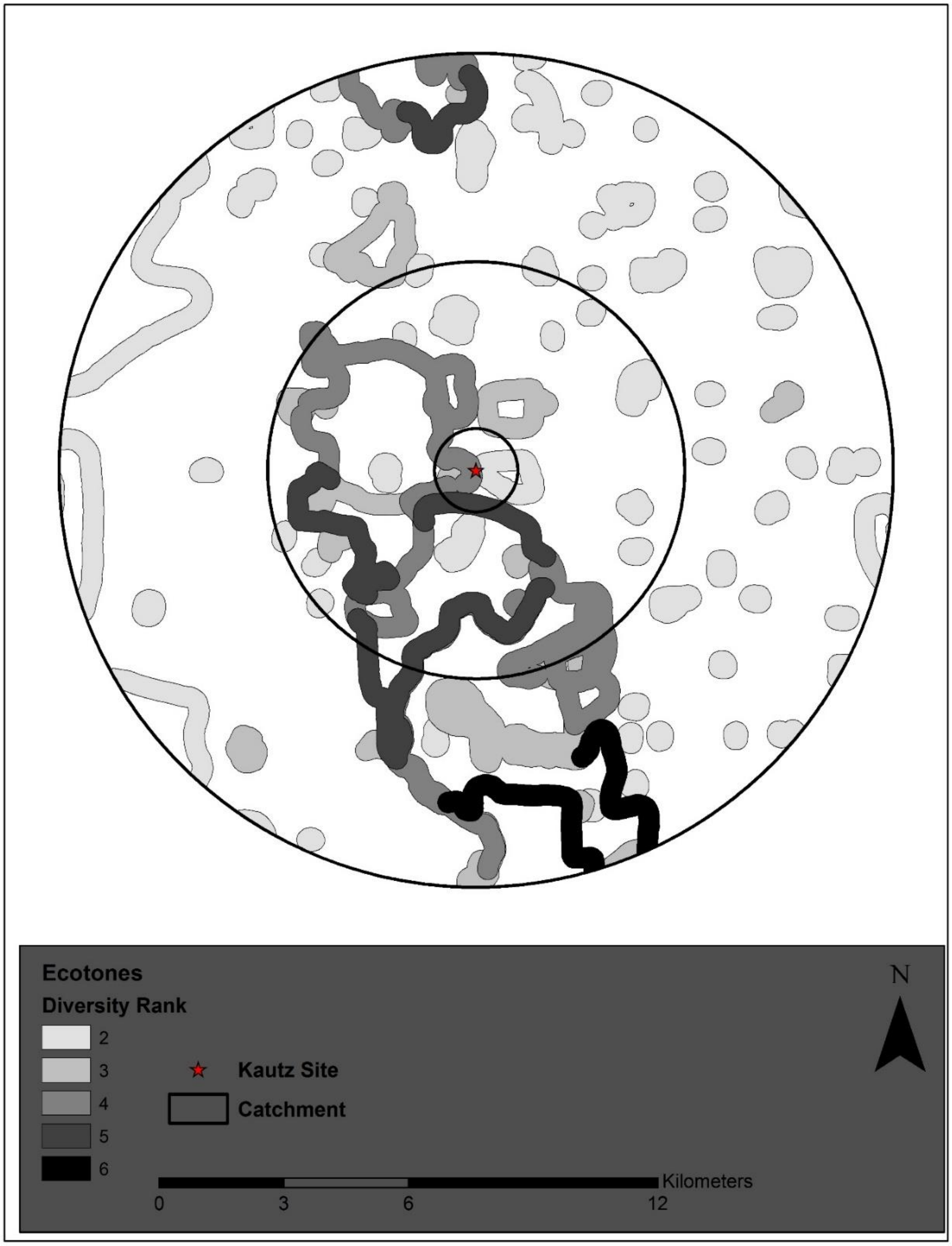


Figure 39. Ecotone location and diversity rank within the 10, 5, and 1-km catchments.

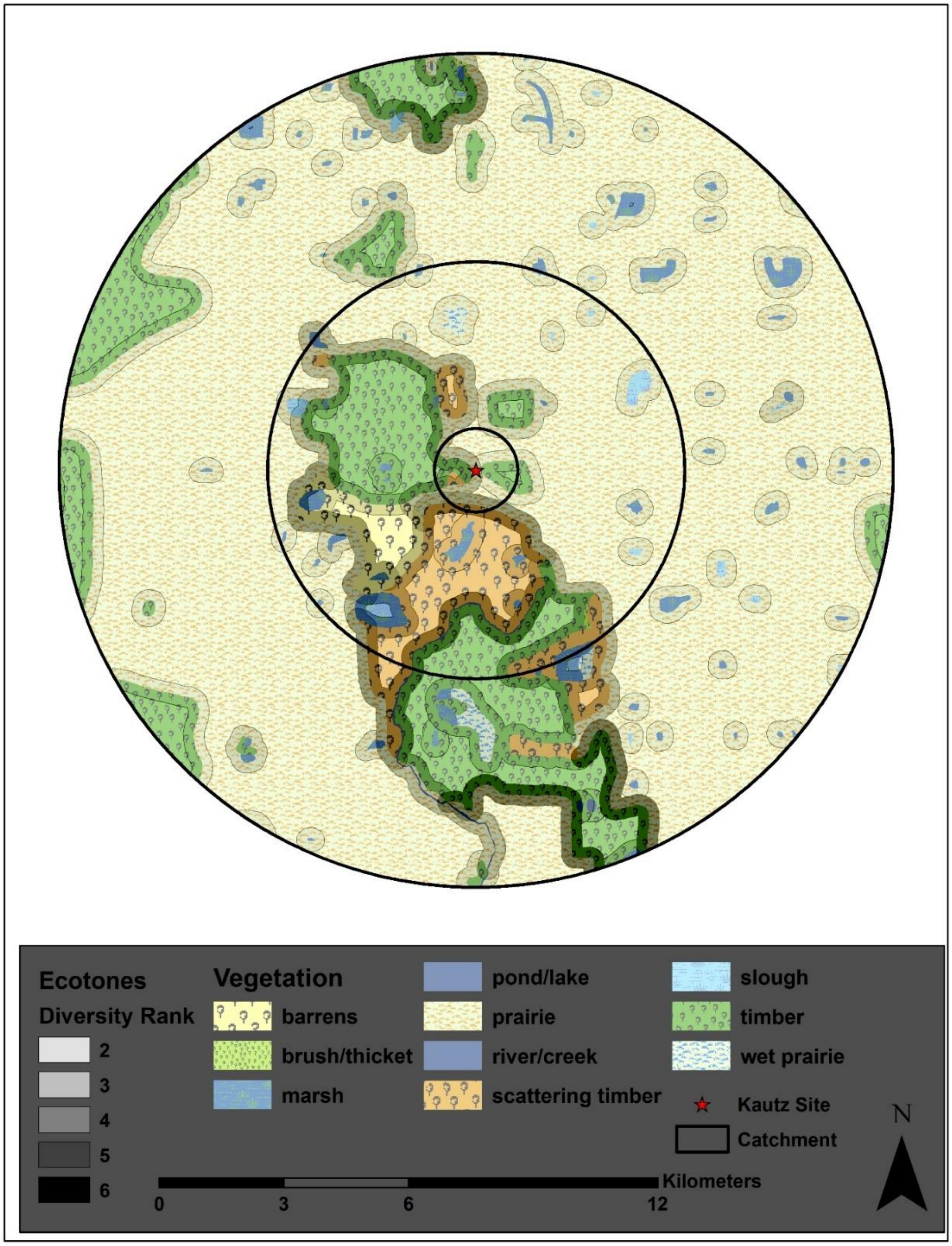


Figure 40. Ecotone diversity with corresponding vegetation communities.

The mean and range of elevations within the 10-km catchment can only be roughly estimated due to severe changes in the landscape during the modern era. To account for some of

the anomalies such as the landfill hills of Mallard Lake in the northern part of the catchment, they were removed from the dataset before the calculations were conducted. After anomalous elevations such as the 20 meter-high landfill hills were removed from the dataset, the average elevation within the 10-km catchment was determined to be 230 masl (Figure 41).

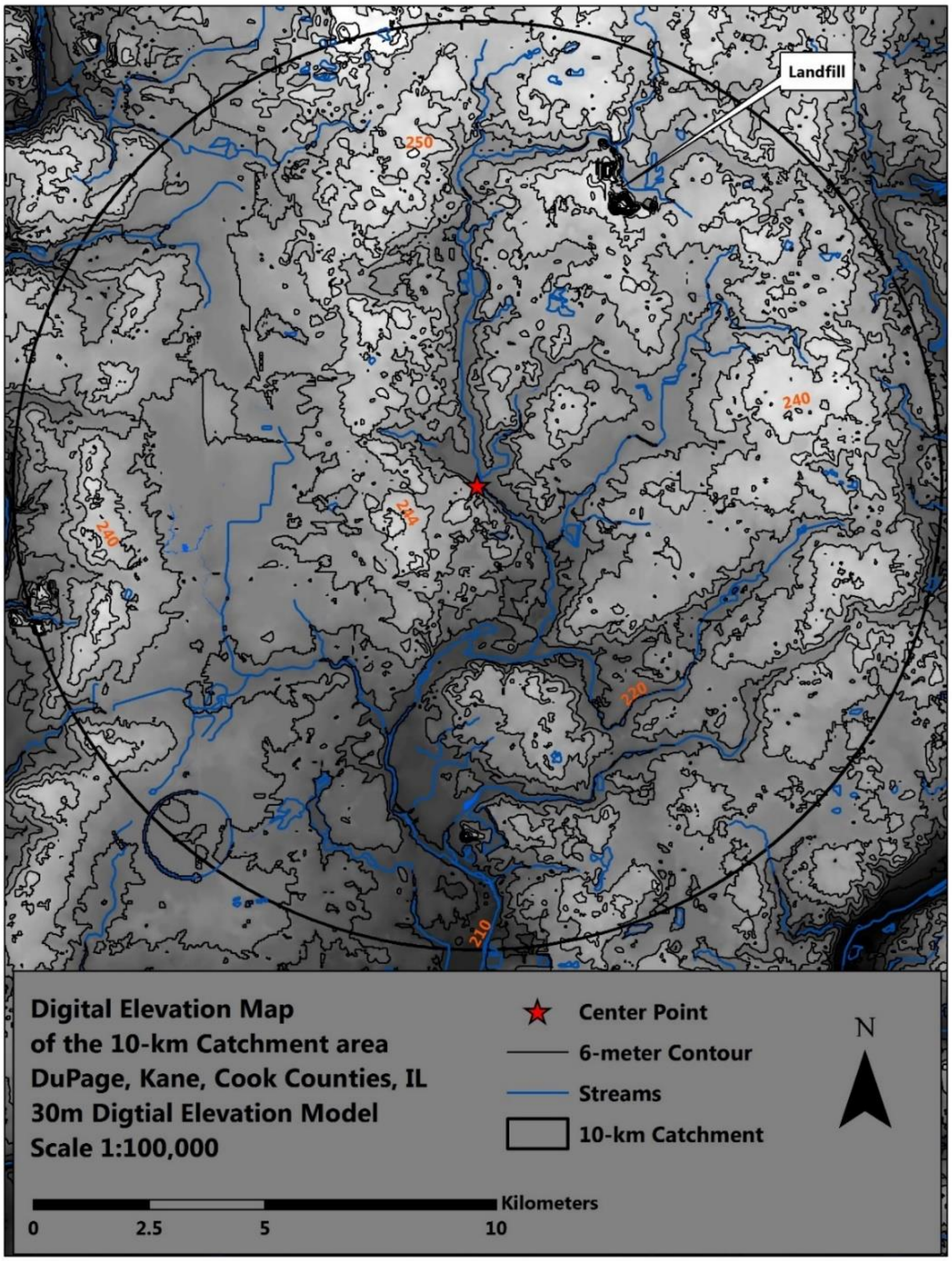


Figure 41. Digital Elevation Model (DEM) of the 10-km catchment.

The highest natural points in the catchment have an elevation of 250 masl, these areas are located in the northern portion of the catchment along the West Chicago morainal ridge. The lowest natural points are located along the West Branch in the far southern reaches of the catchment and have an elevation of around 210 masl. Although there is a 40-meter differential across the 10-km catchment the general slope is gradual and no areas were steep enough to act as major barriers to movement.

The literature review has identified a number of areas within and near the catchment that could have been primary sources of chert; however, none of these locations have been ground-truthed. The closest possible primary source identified during the review is located approximately 7.5 kilometers south of Kautz in what is now Blackwell County Forest Preserve (Box 1, Figure 42). The area was used historically as a quarry for Niagaran Dolomite and it is possible that prior to Euro-American efforts the area was a natural outcropping (Thompson 1985). Just south of Blackwell is another possible location within the Warrenville Grove Forest Preserve. A recent description of the park notes that there are “natural stone outcrops for wildlife viewing” (FPDDC 2012). The other two possible outcrops are located on the far edge of the catchment and are most likely just outside of it. Worthen (1870) mentions a number of potential outcroppings further south along the DuPage and along the Des Plaines and Fox Rivers, which Willman et al. (1975) confirm in their analysis as belonging to the Markgraf Member of the Joliet Formation of the Niagaran Series of Silurian System in northeastern Illinois.

A potential source of Joliet Silurian chert is located on the east bank of the Fox River just outside of Geneva, Illinois where an old quarry once operated and is now Fabyan County Forest Preserve (Box 2, Figure 42). Another possible location is Churchill Woods in Glen Ellyn on the

far eastern edge of the catchment along the East Branch of the DuPage River (Box 3, Figure 42), which is just north of St. Charles Road, a historic land trail.

There are also a few areas just outside of the catchment that may have also been utilized but may have required more than a day's trip, but are still worth mentioning. One area is along Salt Creek in Elmhurst (Box 4, Figure 42) and the other is further south along the West Branch in Naperville (Box 5, Figure 42). Worthen (1870) describes the stone outcropping in Naperville as "an even textured, regularly bedded light drab or buff limestone, about six feet of which is exposed in the excavation, nodules of chert, of irregular flattened forms, are quite frequent in the upper part of this bed, but less abundant below, where the layers also appear to be thicker and more adapted for building." Other locations Worthen (1870) notes as having similar chert include an area just south of Montgomery along the Fox River in Kane County (Box 6, Figure 42) and much further north near a bend in the Fox River in South Elgin (Box 7, Figure 42).

The bedrock outcrop model developed by Loebel and Geraci (2015) only identified one potential chert-bearing outcrop within the 10-km catchment (Loebel and Geraci 2015). This location (Box # 8, Figure 42) is just west of Rt. 25, west of Good Templar Park in Geneva, Illinois on the far western end of the catchment. The model predicts that Silurian bedrock outcrops along the small drainage that flows into the Fox River. A small portion of the potential outcrop area was ground-truthed by the Stephen and Rachel Jankiewicz in April 2016. They examined areas near Bennett and River Bank Park on the east bank of the Fox River but saw no evidence of outcropping or chert gravels.

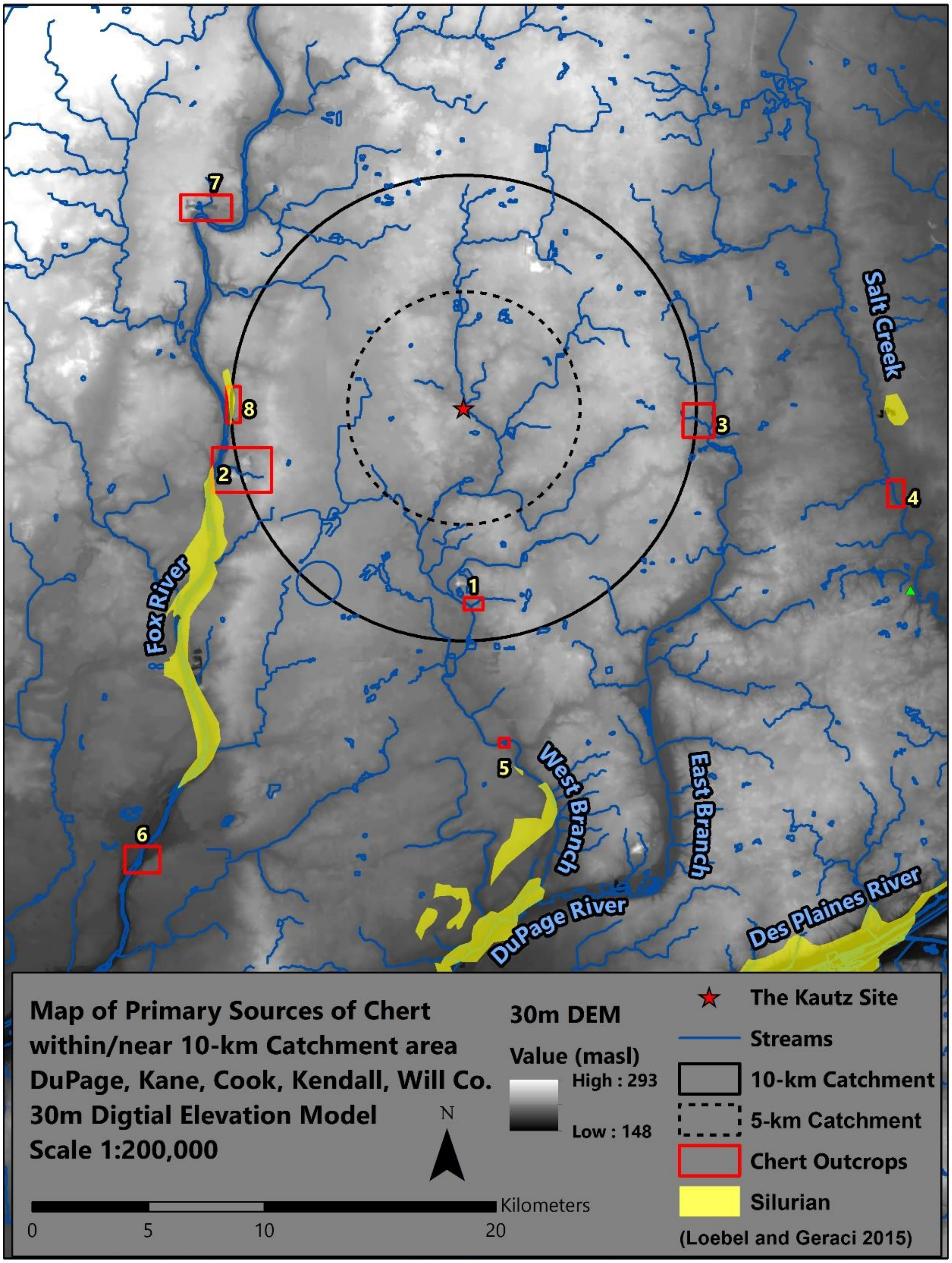


Figure 42. Potential primary chert sources near the 10-km catchment.

Cultural Resources

Cultural resources are prevalent within the 10-km catchment (Figure 32). There are currently 238 known archaeological sites within its limits; however, only 99 (42%) have a prehistoric component. Table 12 shows the number of prehistoric components identified in the IIAPS, it is important to state that some sites have multiple components while others only have a generic prehistoric component.

Table 12. Number of temporal components by catchment.

Table 12. Number of temporal components by catchment			
	Catchments		
Temporal Components	**10-km**	**5-km**	**1-km**
Paleoindian	2		
General Archaic	15		
Early Archaic	13		
Middle Archaic	6	1	
Late Archaic	9	1	
General Woodland	6		
Early Woodland	1		
Middle Woodland	7	1	1
Late Woodland	6	3	1
Mississippian	8		
General Prehistoric	46	6	
Total	**119**	**12**	**2**

There are 24 sites with similar prehistoric components as the Kautz Site (Figure 43). Nine of these sites have a Late Archaic component, six are generic Woodland, one is Early Woodland, six are Middle Woodland, and five are Late Woodland. Site 11DU144 is a Late Archaic site located near an upland depression south of Kautz on the West Chicago ground moraine. Artifacts collected from this site include Late Archaic bifaces, groundstone tools, debitage, and FCR (Kullen 1989).

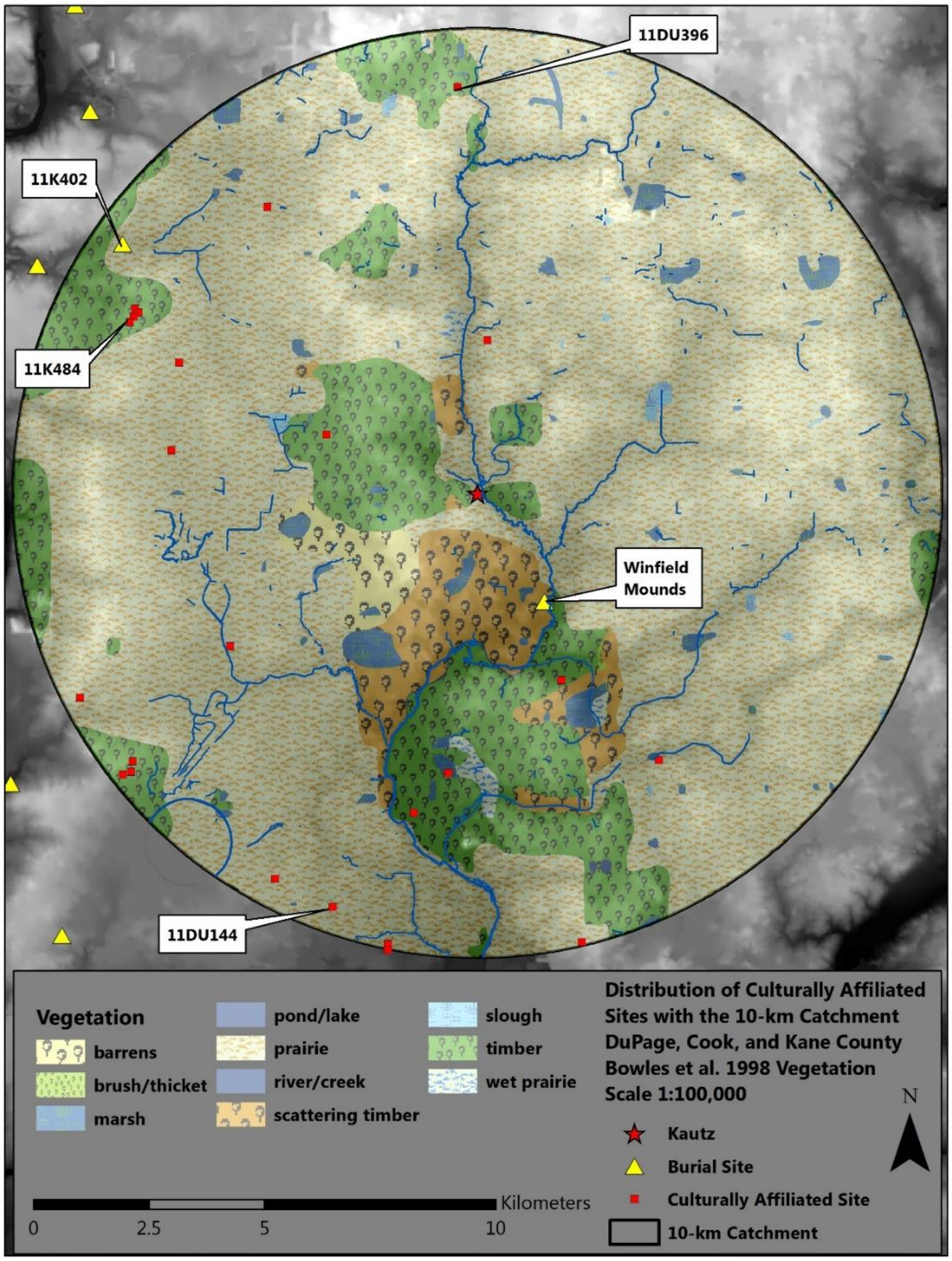


Figure 43. Culturally affiliated sites with the 10-km catchment.

Site 11DU396 is a Middle-Late Woodland site north of Kautz along the West Branch. Artifacts were collected from a 10-20 cm below the surface via shovel test. Some of the artifacts recovered from 11DU396 include grit-tempered pottery fragments, biface fragment, debitage, FCR, burnt bone and a groundstone tool. Some of the ceramic sherds had interior lip notching

characteristic of the Weaver tradition and one rim sherd had possible vertical trailing akin to Havana Zoned (Kullen and Greby 1997). Site 11K484 is a small site 1.5 kilometers south of 11K402 on the crest and upper slope of a large hill east of the Fox River. Artifacts collected from this site include biface fragments, one grit-tempered sherd and debitage (Greby 1996).

Sites were overwhelmingly found within the upland settings, 20 sites were found in the uplands (83%), one near an upland closed depression, two near the base of a bluff, and one on a floodplain. The average elevation of a site within the 10-km catchment is 230 masl, the same as the average elevation of the catchment. The maximum elevation of a site in the catchment is 246 masl (11DU396) and the minimum is 214 masl (11K22), both were found in an upland setting and are separated by a 16 km distance (Figure 43).

There are nine different soil associations within the catchment, six of which are prairie soils and three are forest. Prairie soils compose 70% of the catchment in area. However, 75% of the archaeological sites were found within forest soils. The majority of the sites (63%) were found within Morley-Blount-Beecher soils (Figure 44). Morley-Blount-Beecher soils occur on nearly level to very strongly sloping uplands in northeastern Illinois and occupy 657,000 acres or 1.8 percent of the state. These light-colored and moderately dark-colored, moderately to moderately strongly developed soils, have formed under forest or mixed forest and prairie vegetation in thin, medium-textured material on silty clay loam, silty clay, and clay till or drift (Fehrenbacher 1982).

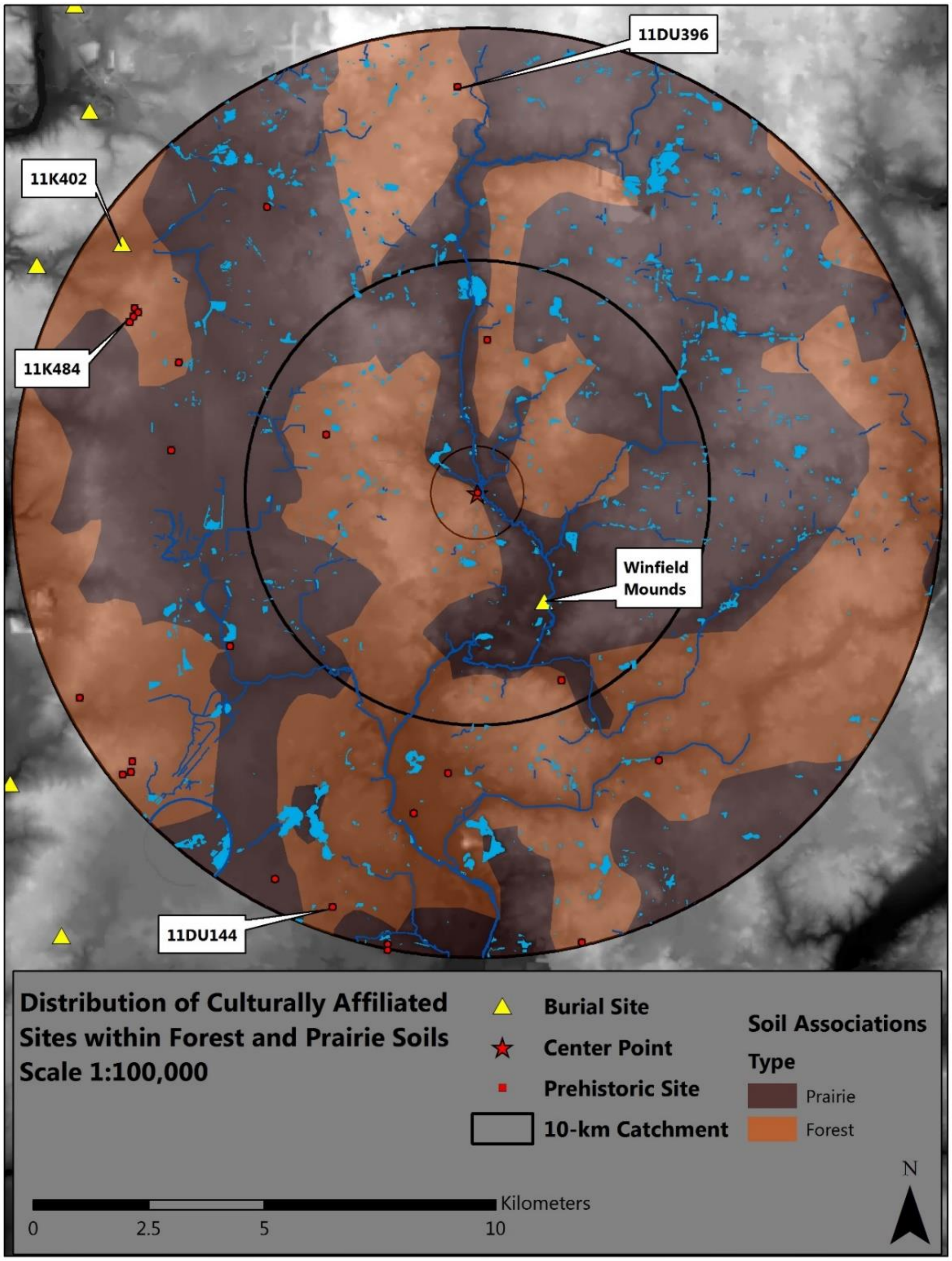


Figure 44. Culturally affiliated sites within forest and prairie soils in the 10-km catchment.

A potentially important resource within the catchment would have been an east-west travel route that linked the Fox River near St. Charles to Lake Michigan near the Chicago River inlet. A map of historic trails in Thompson (1985) suggests the Kautz Site is just south of this

trail (Figure 45). This trail lines up relatively well with the St. Charles trail, which in many of the histories of DuPage county was referred to as an ancient “Indian” trail or “age-old” buffalo trail (Scharf 1901; Thompson 1985). Later in history this trail was transformed into a stage coach line called St. Charles Wagon Road, and then St. Charles Road which still exists today (dotted pink line in Figure 45 and 46) (Richmond and Valette 1857). Coincidentally, this trail connects Ferson Mounds along the Fox River to the Bowmanville Village on the Lake Michigan shoreline, as well as other sites along the way.

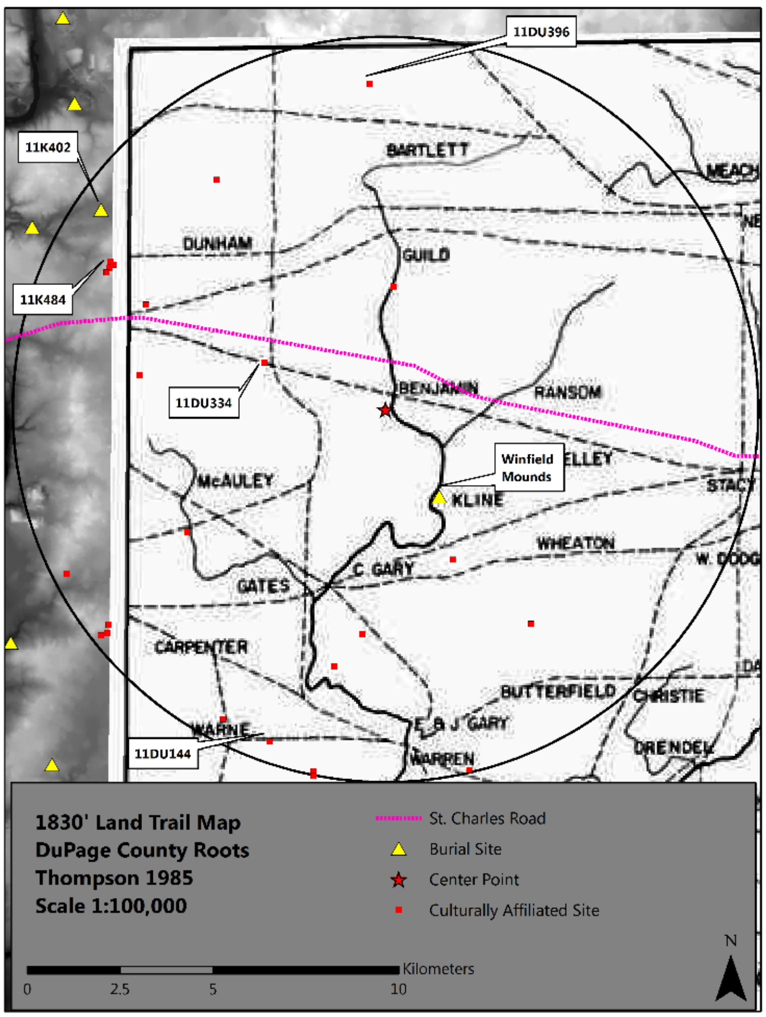


Figure 45. 1830s land trail map of DuPage County (Thompson 1985).

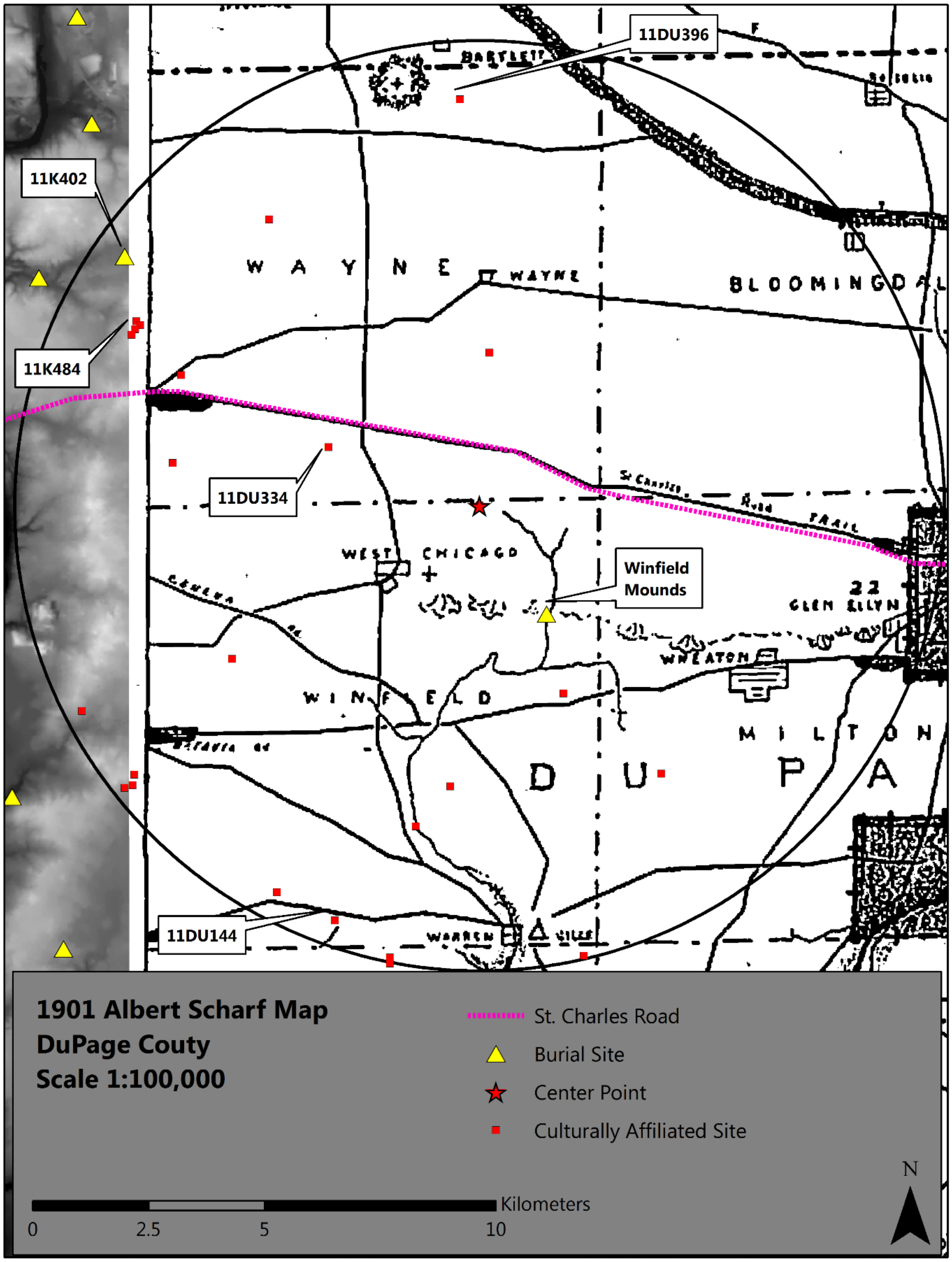


Figure 46: Albert Scharf (1901) map covering areas of the 10-km catchment area.

Five Kilometer Catchment

According to the INHS study of the GLO, the 5-km catchment is composed of a slightly different mixture of prairie, timber and wetland habitats than the 10-km catchment and region as a whole. The percentage of prairie shrinks from 70% to 56% while forested areas increase from 18% to 34%. The remaining 10% is divided into small portions of wetland habitats and culturally disturbed areas which are largely located in prairie (Table 3). A spatial analysis of the NWI found that today wetlands compose around 7% of the 10-km catchment, slightly less than the INHS study suggests (Table 4) and slightly more than the Bowles et al. 1998 study found (4%) (Table 9).

The Bowles et al. 1998 study found that the natural vegetation of the 5-km catchment was composed of approximately 56% prairie and 21% timber (forest), a slightly different proportion than the INHS study found. The remaining 23% is divided between scattering timber, barrens, wet prairie, slough, rivers, creeks, brush/thicket, ponds and lakes (Table 9) (Figure 47). A total of 83 bearing trees were recorded within the 5-km catchment, 41% were Bur Oak, 25% White Oak, 23% Red Oak, and 11% Hickory. None of the bearing trees in the 5-km catchment were identified as Ash, Basswood, Black Oak, Elm, and Red Haw (Table 10). The average diameter of a bearing tree in the catchment is 14". The average tree density within the catchment is 50 tree/ha. Results show that 36% of the bearing trees were in open savanna, 40% closed savanna, 5% woodland, and 19% forest (Table 10). Like the 10-km catchment results suggest; the distribution of savanna-like conditions may have been much greater than the GLO surveyors proposed. That being said, there certainly were heavily forested areas within the catchment. For example, the large section of timber west of the site had an average tree density of 55 trees/ha with the maximum density exceeding 200 trees/hectare. If the average density was 55 tree/ha and

the timber area was 980 hectares then that area would have contained approximately 54,000 trees with an average diameter of 14".

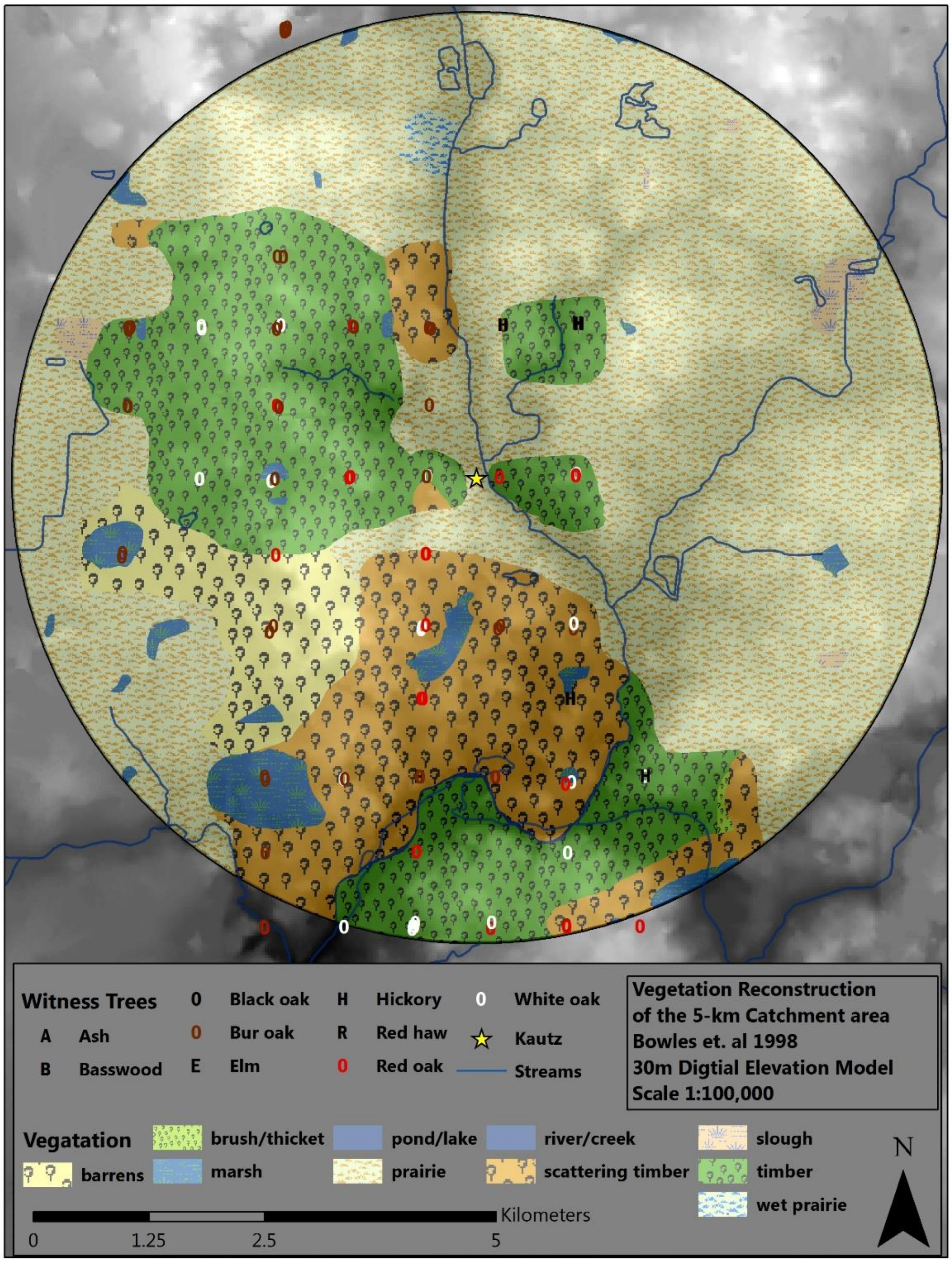


Figure 47. Pre-settlement vegetation within the 5-km catchment (Bowles et al. 1998).

Water resources within the catchment are varied, according to the National Wetland Inventory (NWI) there are approximately 5.7 km^2 of wetland and open water habitat in the catchment. Open water habitats include deep marshes, deep-water lakes, open water wetlands, and swamp. Wetland habitats include shrub-scrub wetlands, shallow marsh/wet meadows, which compose more than half of all wetland areas (Table 4). The West Branch of the DuPage River is the primary source of river water and essentially bisects the catchment into a west and east half (Figure 47). Other water resources within the catchment include spring-fed lakes like Spring Lake, and smaller streams like Klein in the east and Kress Creek in the west.

Chert resources would have only existed as secondary deposits in river beds, bluff slopes, or eroded surfaces in the 5-km catchment. The results of the 10-km chert outcrop study clearly show no areas of chert outcrops (Figure 42). With this knowledge it is fair to assume that the Kautz Site was not chosen for its direct association with a primary chert source.

Culturally Affiliated Sites

There are four sites within the 5-km catchment that share similar cultural traits as the Kautz Site: 11DU465, 11DU334, 11DU17, and 11DU1 (IIAPS 2015) (Figure 48). Site 11DU465 is an isolated Late Archaic point that may or may not belong to the Middle or Late Archaic period. Site 11DU334 is also an isolated Late Woodland point, it was recovered by a Northern Illinois University survey in 1994. Site 11DU17 is a small scatter of lithics recorded by Wenner in the late 1950s. The site is composed of chert debitage and crudely notched Late Woodland points. Site 11DU33 is a multi-component Woodland site with three low circular earthworks and evidence of habitation. Historically, 11DU33 has been referred to as The Player Mound Group (Neumann 1931), Winfield Mounds, 11DU1 (Wenner) or more recently Winfield Mounds and Village site (Kullen 1988). The long list of names is the result of the site having a very long and

complex history of investigation. The site has been known to the public for at least 90 years and all three have been partially or completely excavated by pothunters and archaeologists (Kullen 1988). The numerous excavations into the mounds and nearby campsite suggest two occupations. Once during the Havana Hopewell tradition and another time during the early Late Woodland period.

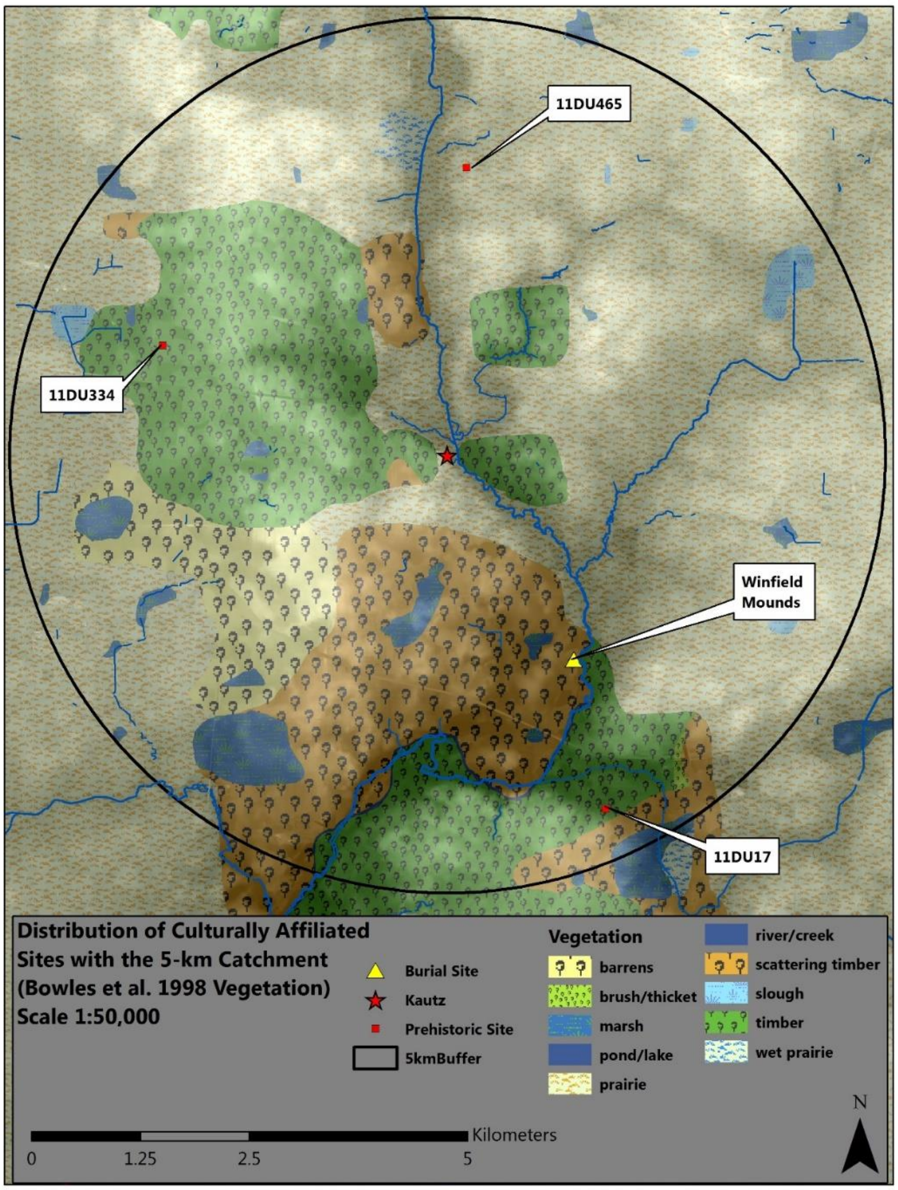


Figure 48. Culturally affiliated sites within the 5-km catchment.

The first professional survey and excavation of the mound group was conducted by James B. Griffin, Fred Eggan, and George K. Neumann with the help of students from Dr. Fay-Cooper Cole's archaeology class from University of Chicago in August of 1931. When the mounds were surveyed by the University of Chicago team, each mound measured about 30 x 30 feet wide and 2-3 feet high (Figure 49) (Neumann 1931).

Mound #	Height	Length N-S	Width E-W	Pitting
Du1	2.2'	35'	30'	Pit in center. Was 2.5' deep.
Du2	1.5'	32'	28'	T-shaped trench. Was 1.5' deep.
Du3	3.0'	36'	35'	Large pit: 13-9 ft. Was 5-6' deep.

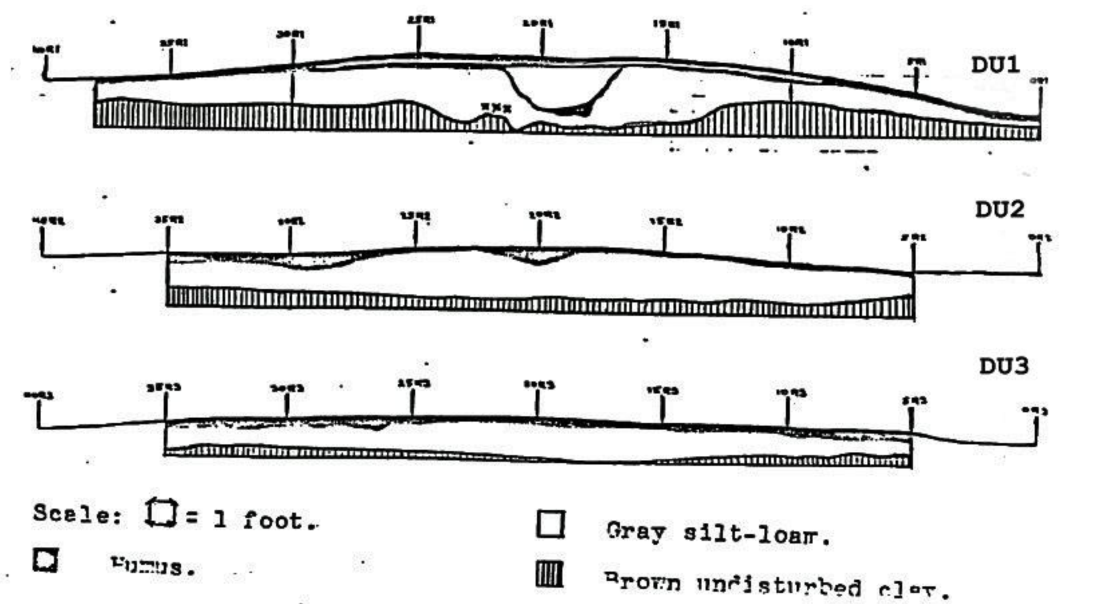


Figure 49. Dimensions and profiles of the Winfield Mounds
(Adapted from Neumann 1931)

When the Chicago team excavated the largest mound they recovered one skeleton in the grey silt loam, about six inches below the original ground surface. Just above the burial was burned earth, beads, and shell. Based on the position and condition of the bones, the excavators deemed it to be a bundle burial, unfortunately the bones were in such poor condition they broke

apart while excavating and were not collected (Neumann 1931). Bundle burials became a common human burial practice in the Late Woodland period. They have been found in Havana Hopewell mounds as intrusive burial as well as in low circular and linear shaped mounds like the Winfield Mounds.

Material culture found in the mounds was minimal, the excavators recovered one 2-x-3-inch undecorated potsherd in the mound fill. The sherd was about 5-mm thick, buff to brick colored on the exterior and dark grey in the interior. The sherd was tempered with coarse quartz fragments, some of which were approximately 1/8’’ in diameter. Based on the sherd shape it is thought to have originated from a pot 6’’ in diameter and 5’’ high with a rounded bottom. The exterior was rough and probably partially smoothed over with the hand (Neumann 1931).

In the 1970s, Wheaton College excavated a portion of Mound 3 and placed excavation units near the bluff line east of mounds. Their excavations recovered Middle and Late Woodland artifacts such as Middle Woodland Havana type pottery including plain, cordmarked, and stamped and Early Late Woodland Cord-roughened Madison-type pottery (Kullen 1988). These distinct pottery types were separated horizontally rather than vertically at the site with the Middle Woodland occupation only identified in the northern half. Hafted biface forms range from small side-notched, expanding stem, and triangular suggesting Late Archaic through Late Woodland, similar to Kautz (Figure 50).

Figure 50. Sample of artifacts recovered from the Hoglund excavations in 1978.

Like many of the boundaries in the IIAPS, the site boundary for 11DU1 is not accurate or representative. The location of the mounds described by Neumann (1931) and the location currently drawn in the IIAPS (2015) do not correspond. LiDAR imagery clearly shows that the current shapefile does not encompass all of the mounds (Figure 51). Two of the mounds are outside of the current site limits and one is essentially bisected by the site boundaries. Further, when the locations of the anomalies are compared to the location of the mounds recorded in Neumann’s sketch map, they line up almost exactly (Figure 52). In Figure 52, the yellow-dotted line is the old site boundaries, the purple-dashed line is the proposed new site boundaries, the red circles denote the location of the LiDAR anomalies and the red box is the likely location of the 1975 Wheaton College excavations of the village portion of the site.

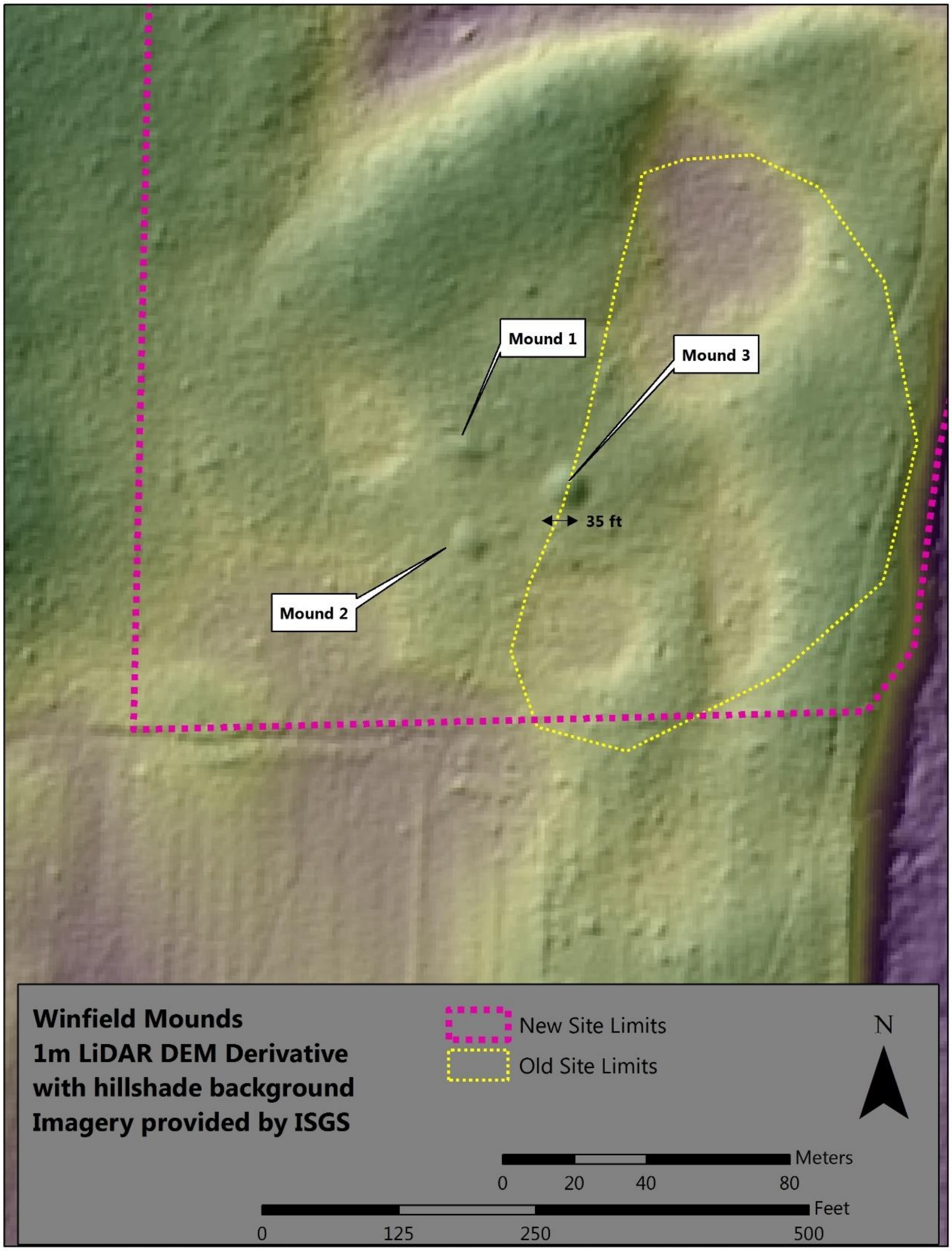


Figure 51. LiDAR imagery showing the location of the three Winfield mounds.

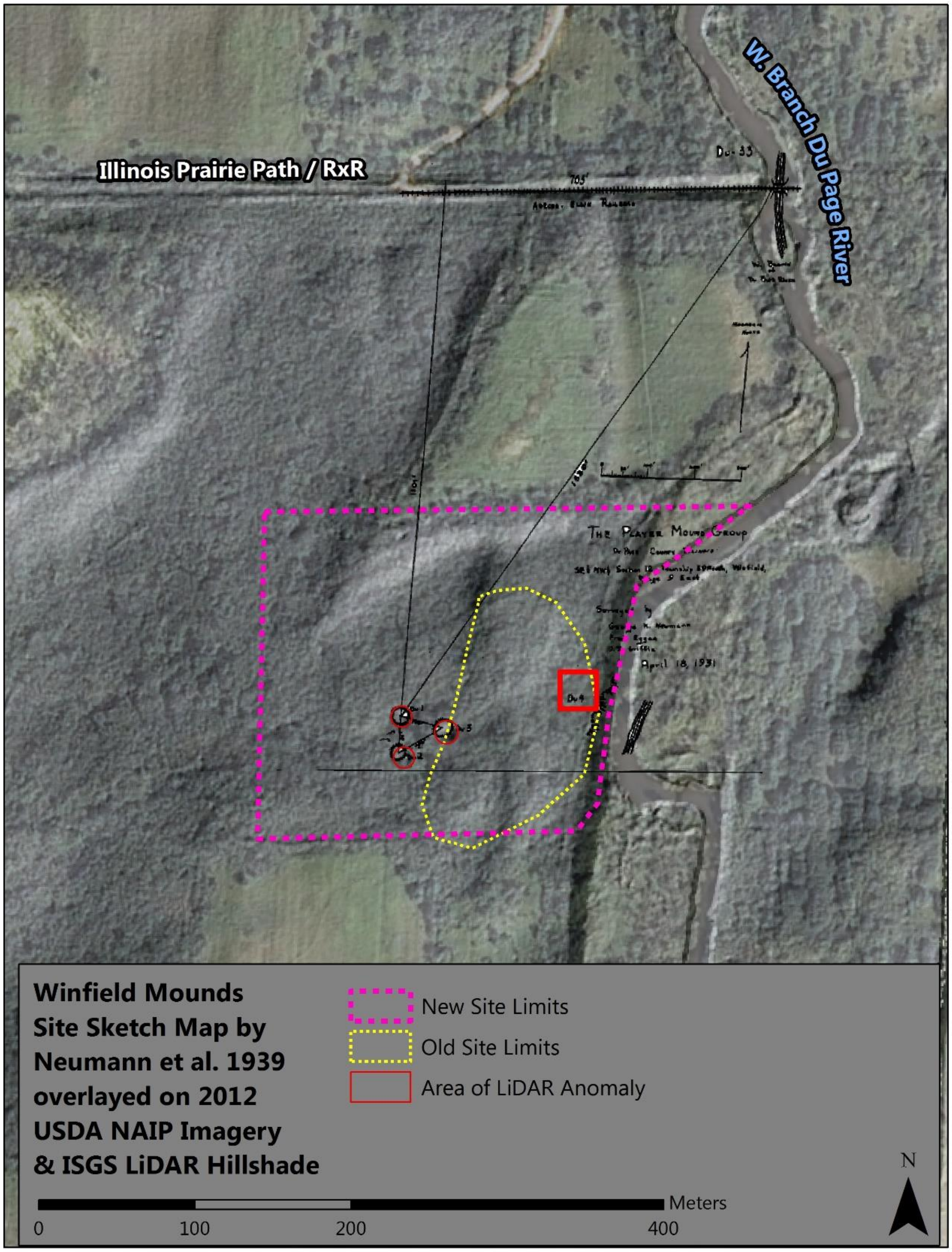


Figure 52. Updated sketch map of Winfield Mounds (Adapted from Neumann 1931).

There is one other possible culturally affiliated burial site within the 10-km catchment. Site 11K402 is located approximately 9.5 kilometers northwest of the Kautz site and is situated along Norton Creek, 3 km east of the Fox River (Figure 48). Several suspected mounds were tested at the site. Posthole testing yielded a single decortication flake from one suspected mound. A profile taken from the mound shows that the mound was made from a dark brown loam over a buried A horizon suggesting it is not natural (Evans and Harris 1998).

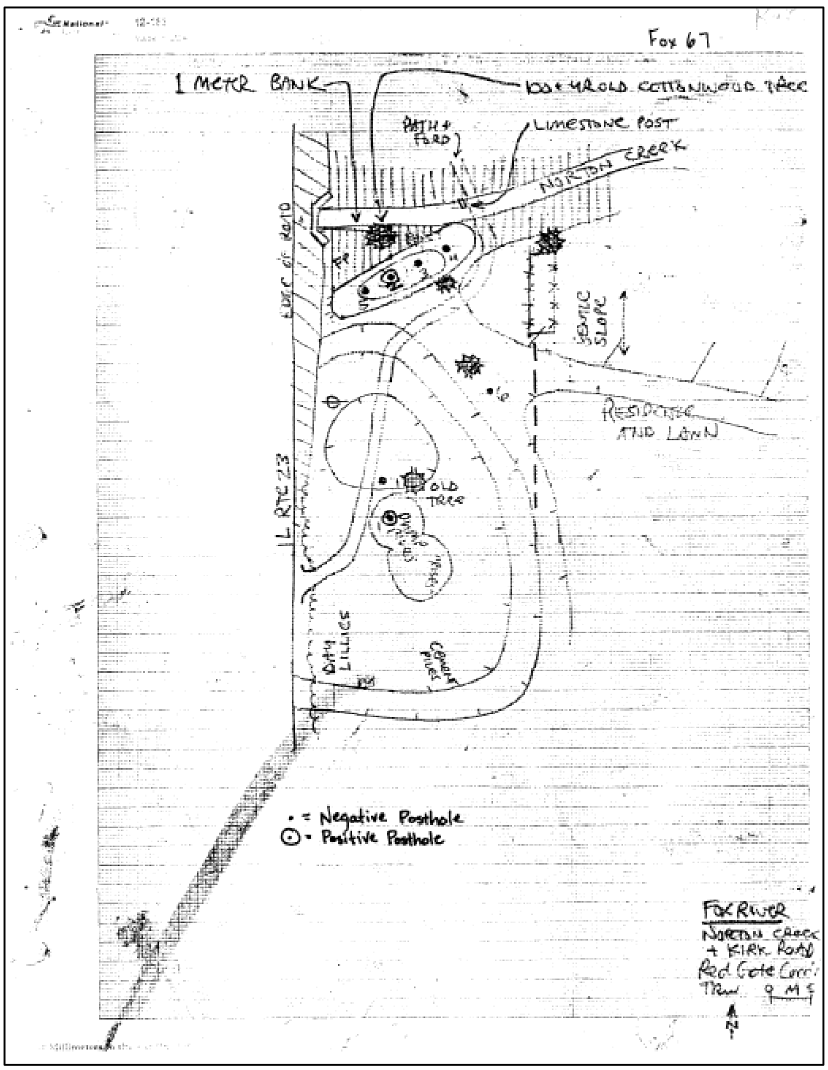


Figure 53. Sketch map of mound site 11K402 (adapted from Evans and Harris 1998).

One Kilometer Catchment

According to the INHS study, vegetation within the 1-km catchment is composed of approximately 50% prairie, 35% forest, 5% bottomland, and smaller portions of wetlands and open water (Table 3). There are also two tracts of farmland cut into the prairie within the 1-km catchment, making the percentage of prairie more like 55-60%. The large tract is located southwest of the site and the small tract is located within the new site limits for Kautz and likely belonged to the Benjamin family, who owned a number of parcels in that location in 1862 Plat map (Figure 54) (Bennett et al. 1862). The Bowles et al. 1998 study found that the 1-km catchment was composed of approximately 2 km^2 of prairie (64%), 1 km^2 of timber (29%), and 0.2 km^2 of scattering timber (7%), (Table 9, Figure 55).

Surprisingly no wetland areas are designated in the 1-km catchment, whereas in the INHS study bottomlands and wetland areas are both present. As mentioned earlier in the results, wetlands are underrepresented in these vegetation studies and wetlands or at least wet prairie are likely to have existed within the 1-km catchment, particularly along the west branch.

A total of six bearing trees were recorded in four locations within the 1-km catchment, 50% of trees are Red Oaks, 33% Bur Oak, and 17% White Oak (Table 10). The average diameter of a bearing tree in the catchment is 16”. The average tree density within the catchment is 79 tree/ha. According to the Bowles et al. study, 33% of the bearing trees were in forest and the remaining 67% were located in open savanna. Like the 10-km catchment results suggest; the distribution of savanna-like conditions were likely much greater than the Public Land Survey proposed. That being said, there certainly were heavily forested areas within the catchment. For example, the section of timber west of the site had a tree density of 200 trees/ha.

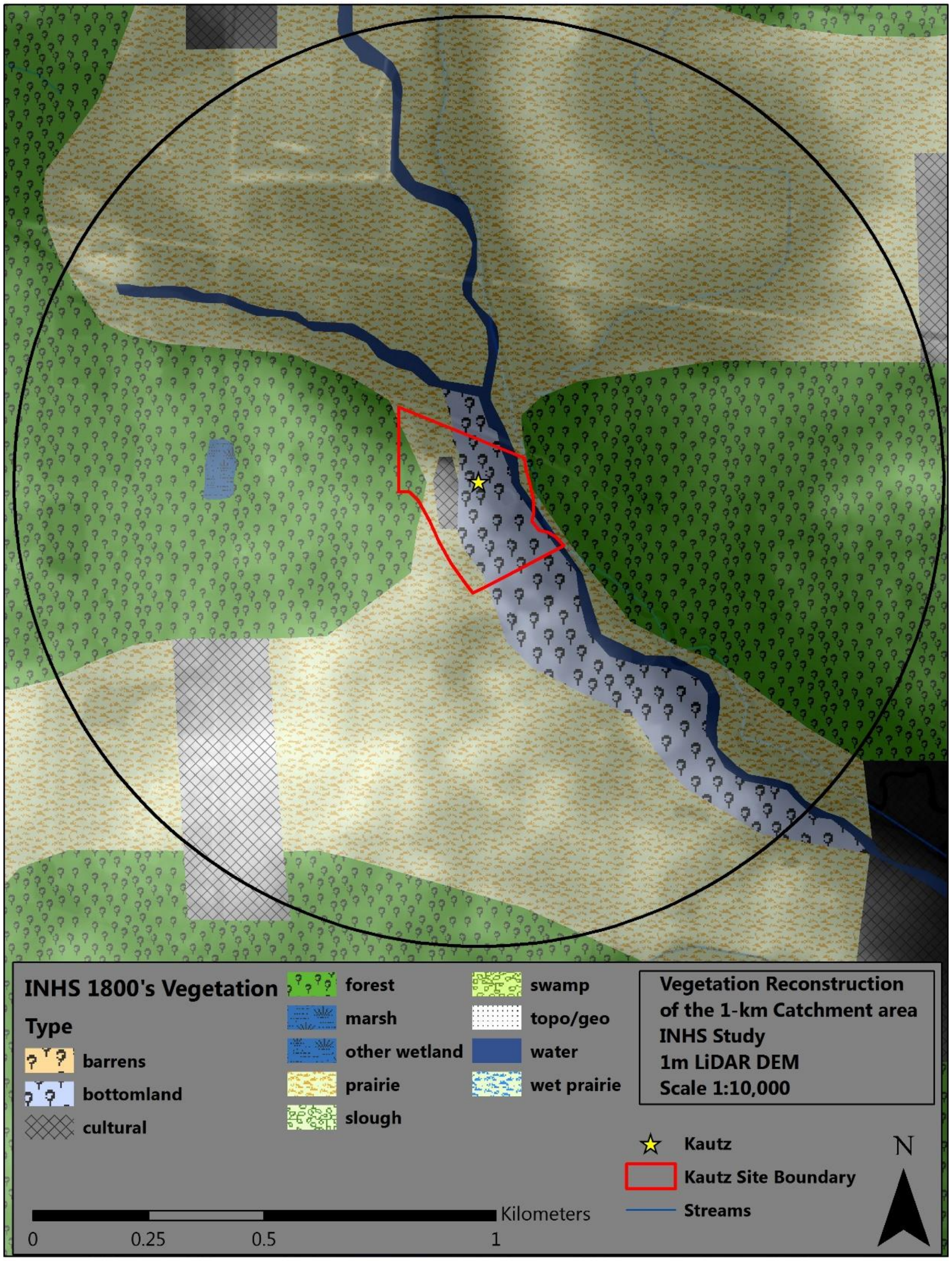


Figure 54. Pre-settlement vegetation within the 1-km catchment (INHS).

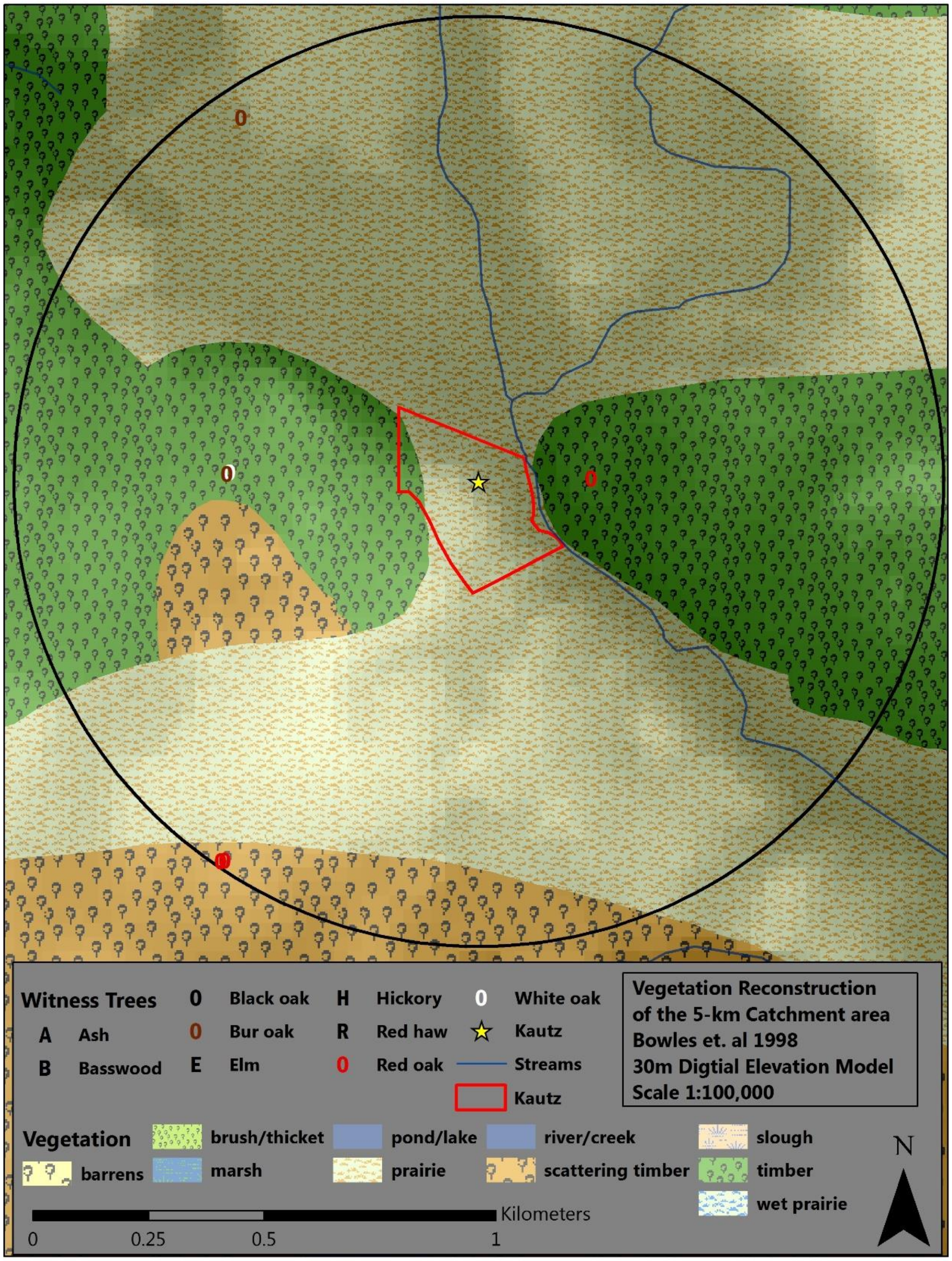


Figure 55. Pre-settlement vegetation within the 1-km catchment (Bowles et al. 1998).

The Bowles et al. 1998 study found no wetland resources within the 1-km catchment; however, the National Wetland Inventory (NWI) has identified 0.55-km^2 of wetland and open water habitat in the catchment. Habitats include bottomland forest, open water wetlands, and shallow marsh/wet meadows (Table 4). The West Branch of the DuPage River is the primary source of river water and essentially bisects the catchment into a west and east half (Figure 55). Other water resources within the catchment include spring-fed lakes like Spring Lake, and smaller streams like Klein in the east and Kress Creek in the west.

The average elevation within the catchment is 229 masl and the site has an average elevation of 224 masl. The highest point within the catchment is 241 masl located west of the site on the West Chicago morainal ridge and the lowest point is 218 masl located within the river valley on the very southern edge of the 1-km catchment (Figure 56).

Chert sources would have been restricted to secondary deposits within the 1-km catchment. The landscape analysis has not identified any areas where bedrock would have been exposed at the surface. Even if chert-bearing dolomite was present within the catchment, the average depth of glacial till in the area is approximately 33-66 meters thick (Piskin and Bergstrom 1975). With a maximum elevation difference of only 23 meters, the availability of a primary chert resource is highly improbable.

Cultural Resources

Cultural resources within the 1-km catchment are restricted to the Kautz Site and one historic farmstead (11DU421) which is irrelevant to this study (IIAPS 2015). That said, only 0.2 km^2 or 6% has been surveyed and the potential for additional prehistoric sites in the catchment is

possible in places that have not been developed such as Timber Ridge Nature Preserve across the river.

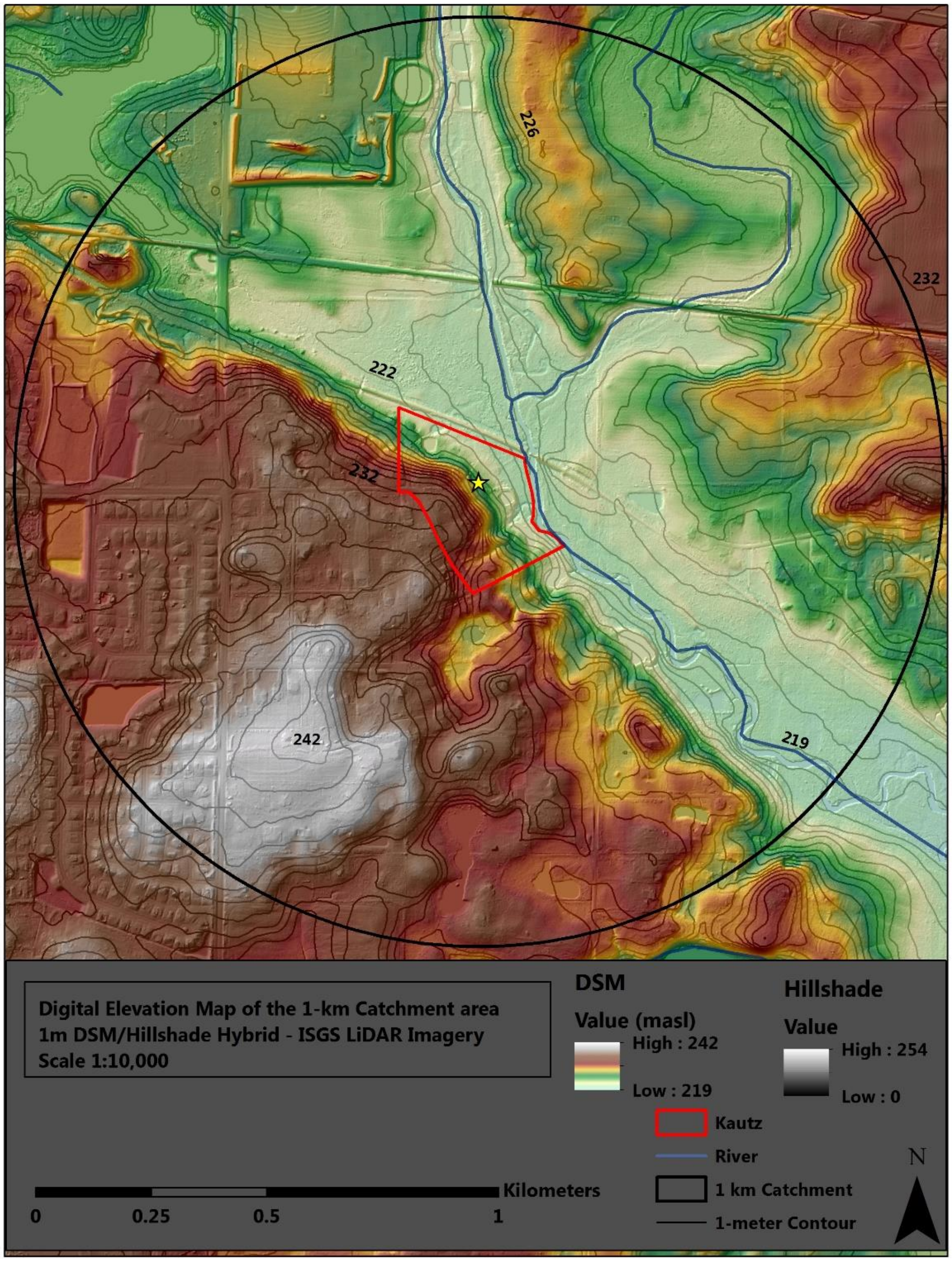


Figure 56. Digital Elevation Model of the 1-km catchment area.

Discussion

The results of the landscape analysis support the hypothesis that the Kautz Site was centrally located to key resources and resource areas such as timber, prairie, and wetlands. All three primary ecosystems in northeastern Illinois are present within 1-km of the site. The landscape analysis also found that the Kautz Site is located in a prairie-forest ecotone, as predicted by settlement and subsistence models (Goldstein 1979; Jeske 1988, 1990; Weston 1981). The ecotone analysis found that the amount and level of diversity increased as the size of the catchment decreased, lending support to the hypothesis that this location was chosen because it is located in a very productive economic location on the landscape. Ecotones also seem to be good indicators of potential prehistoric site locations. Approximately 30% of the prehistoric sites in the 10-km catchment were located within an ecotone, a little better of a predictor than the 250-meter buffer around water sources used as a measure of archaeological potential. When these two predictive models are combined they successfully predicted the location of about 40% of prehistoric sites. Perhaps the ecotone model developed in this study can be applied to the whole state and then combined with the water model to make for a more solid and inclusive model.

In addition to access to resources, the site is well-protected from westerly winds due to the low bluff and forest to the west and is situated alongside a navigable stream and known overland trail. Plant and animal resources available from the Kautz Site would have included several important species including nut-bearing trees, cattails, and white-tailed deer. A full list of all the natural resources available within prairie, forest, and wetlands can be found here (Jeske 1988). A short list of edible plants and animals available within the maximum daily foraging range can be found in Table 10 with corresponding nutritional information.

Table 13. Common wild foods in northeastern Illinois and their dietary information.

Table 13. Common wild foods in northeastern Illinois and their dietary information							
Type	**Food**	**Measure**	**Protein (g)**	**Carbs (g)**	**Fat (g)**	**Cal.**	**Totals**
Fish	Channel Catfish (Baked)	1 oz (28.4 g)	5.23	0	0.8	30	36
Fruit	Plum (Raw)	1 oz (28.4 g)	0.1	2.1	0.05	9	11.25
Fruit	Mulberry (Raw)	1 oz (28.4 g)	0.4	2.7	0.1	12	15.2
Grain	Wild Rice (Boiled)	1 oz (28.4 g)	1.2	6.05	0.1	29	36.4
Grain	Corn Meal (Dry)	1 oz (28.4 g)	2.8	18.8	0.9	94	116.5
Grain	Amaranth (Boiled)	1 oz (28.4 g)	4	19	1.8	106	130.8
Grain	Chenopodium (Roasted)	1 oz (28.4 g)	3.7	20	1.2	106	130.9
Meat	Venison (Roasted)	1 oz (28.4 g)	8.6	0	0.9	45	54.4
Meat	Turkey (Roasted)	1 oz (28.4 g)	8	0	2.1	54	64.1
Meat	Turtle (Roasted)	1 oz (28.4 g)	6.6	0	1.84	44.6	53.04
Meat	Squirrel (Roasted)	1 oz (28.4 g)	8.7	0	1.3	49	59
Meat	Bison Steak (Roasted)	1 oz (28.4 g)	7.9	0	1.6	48	57.5
Meat	Elk Steak (Roasted)	1 oz (28.4 g)	8.6	0	0.5	41	50.1
Meat	Goose (Roasted)	1 oz (28.4 g)	7.1	0	6.2	86	99.3
Meat	Duck (Roasted)	1 oz (28.4 g)	6.66	0	3.17	57	66.8
Meat	Raccoon (Roasted)	1 oz (28.4 g)	8.2	0	4.1	72	84
Meat	Duck Egg (Raw)	1 oz (28.4 g)	3.6	0.4	3.9	53	60.9
Meat	Mussels (Raw)	1 oz (28.4 g)	3.4	1	0.6	24	29
Nut	Black Walnuts	1 oz (28.4 g)	6.8	2.8	16.8	175.5	201.9
Nut	Hazelnuts (Dried)	1 oz (28.4 g)	4.3	5	17.7	183.5	210.5
Nut	Hickory Nuts	1 oz (28.4 g)	3.6	5.2	18.3	186.6	213.7
Nut	Chestnuts (Dried)	1 oz (28.4 g)	0.6	8	0.4	37	46
Nut	Acorns (Dried)	1 oz (28.4 g)	2.3	15.2	8.9	144.6	171
Other	Maple Sugar	1 oz (28.4 g)	0	25.8	0	97	122.8
Seed	Pumpkin Seed (Roasted)	1 oz (28.4 g)	6.7	0.85	11.15	129	147.7
Seed	Sunflower Seeds (Roasted)	1 oz (28.4 g)	5.5	6.8	14.1	165	191.4
Vegetable	Pumpkin (Boiled)	1 oz (28.4 g)	0.2	1.4	0.02	6	7.6

Vegetable	Dandelion (Raw)	1 oz (28.4 g)	0.7	2.6	0.2	13	16.5
Vegetable	Acorn Squash (Roasted)	1 oz (28.4 g)	0.3	4.1	0.04	16	20.4
Vegetable	Lotus Root (Boiled)	1 oz (28.4 g)	0.5	4.5	0	19	24
Vegetable	Arrowhead Root (Raw)	1 oz (28.4 g)	1.2	4.5	0	21	27

Water Resources

What may set Kautz apart from other sites in similar localities is the series of freshwater springs that seep out of the adjacent hillside. Artesian springs are formed when the side of a hill, a valley bottom or other excavation intersects a flowing body of groundwater at or below the local water table, below which the subsurface material is saturated with water (Kolata 2005). Springs offer many benefits to the people, plants, and animals that use them. The major benefit is predictability. Springs typically flow year round because they are heated by the natural heat of the earth and are less susceptible to freezing over in the winter. Spring water is also excellent drinking water because it is largely free of contaminants such as insect larvae, plant and animal detritus, sand and sediment. Another added benefit to humans is that predictability and good drinking water are also sought out by a variety of plants and animals that can also be harvested to provide important calories, vitamins and minerals and other beneficial compounds.

Cultural Resources

There are several cultural resources within the 10-km catchment and beyond that share cultural affinities with the Kautz Site (Figure 43). The most intriguing site may be 11DU1, which is located less than 3 kilometers downstream from the Kautz Site. This site is one of only a few known burial sites in the region, however based on what we know about the burials it was only used as such during the Late Woodland period (Neumann 1931). Located adjacent to the three

low mounds at 11DU1 is what seems to be a village site, or at least some form of habitation area (Kullen 1988). In the 1970s, Keith Hoglund and students from Wheaton College excavated portions of the habitation area and found Middle and Late Woodland artifacts (Hoglund 1978). This suggests that the site was occupied at least twice and by people utilizing very similar material culture to that found at the Kautz Site. It seems clear that the Kautz Site and 11DU1 and other nearby Woodland sites were part of a larger system of sites on the cultural landscape that were utilized throughout Woodland period.

Chert Resources

The resource that is perhaps the most limited within the three overlapping catchments is chert, the primary material used to create hunting and processing tools such as spear and dart points, knives, scrapers, drills, and choppers (Andrefsky Jr. 1998). A landscape analysis was conducted to determine if there were any potential prehistoric quarry sites within a maximum daily foraging range of 10 kilometers. Unfortunately, the results of the landscape analysis were inconclusive. I was able to identify a number of potential quarry sites but have not been able to confirm that they were used prehistorically. Therefore, at this point in the research it is not possible to say with any certainty that there was a chert quarry within a maximum daily foraging range of 10 kilometers. It was hypothesized that the site was occupied because it conferred a great deal of adaptive benefits to its inhabitants, if chert was not available within the 10-km catchment, then why did people still make it their base camp?

There are two potential answers to this question. The first is simple, there is a prehistoric quarry site within the 10-km catchment, but the landscape analysis failed to identify or confirm it. The second explanation is that there is no quarry and the original assumption that chert needs to be located within 10 kilometers of a base camp for it to confer an adaptive advantage to its

inhabitants is false. If chert was not available within the 10-km catchment, people would have had to either bring enough material to support themselves for the length of time they stayed there, traded for it, or made special purpose trips periodically to obtain material. Either way, acquiring raw material would have cost more to obtain than other resources like water, food, and wood. Optimal foraging models predict people will use economizing strategies in lithic procurement and use when raw material becomes expensive. If chert was not available within the 10-km catchment, then we should expect to see some economizing strategies within the lithic assemblage at the Kautz Site.

CHAPTER 5: LITHIC ANALYSIS

The Kautz Site was located within 10 kilometers of key resources like water, food, and firewood; however, no evidence of a good-quality primary source of chert located within 10 kilometers of the site has been found. I suggested that there could be two possible explanations for the results. A prehistoric quarry does exist within the maximum daily foraging range of 10 km but the landscape analysis failed to identify it, or the landscape analysis was correct, but the lack of chert within 10 km of the site wasn't enough to dissuade people from occupying this location. I intend to clarify this issue by examining the lithic assemblage for indicators of stress in the lithic economy of the site. If the lithic economy of the Kautz site was one that was under stress due to resource scarcity we should see evidence of common coping strategies found at comparable sites such as Washington Irving, a few kilometers to the north (D. Bamforth 1986; Jeske 1989, 1992). It has been shown that bipolar reduction and other lithic efficiency and economizing strategies are indicators of stress on the energy budgets of human populations, therefore, we should expect to see these and other indicators at the Kautz Site if chert was expensive.

Expectations

If a prehistoric quarry of high quality chert does exist within the 10-km catchment, then raw material would have been relatively inexpensive to acquire and therefore there should be no need to employ short-term coping strategies. If chert was not located within 10 kilometers of the site, then we should expect there to be evidence of these coping strategies being employed by the inhabitants of the site. According to Jeske (1989), when raw material becomes more expensive because of an increase in energy expenditure or risk, two major consequences will be observed. The first is the achievement of a greater economy in consumption of raw material and the second

is greater standardization of artifact form. Greater economy can be obtained by extending the use of material through maintenance, e.g. curation or recycling (Bamforth 1986). Greater economy can also be achieved by standardization. Standardization reduces the overall amount of waste during production and has an added benefit for hafted tools. Bifacial technology is an excellent example of a technology that conserves material, maximizes the amount of useable edge, and has a long and flexible use-life. If raw material was difficult to obtain from this location, we should expect to see evidence of curation and recycling in the biface assemblage (Jeske 1989).

Increasing resource breadth is another example of a resource coping strategy. MacArthur and Pianka's (1966) famed prey model assumes that foragers exploit the most profitable resources first, then add less and less profitable resources to their diet as needed. When the most profitable resources are restricted, people are motivated to use less and less profitable resources. Less profitable resources may be poor-quality but abundant materials or very high-quality materials but expensive to obtain. Evidence for poor-quality but abundant materials includes the presence of fair or poor-quality materials with high percentages of cortex and the production of expedient technology from free-hand or bipolar core reduction, blocky fragments and shatter.

If raw material was a restricted resource, we should expect to see evidence of hoarding at the site. Caching of artifacts, ready to use cores (preforms), and raw material is a great way to prevent resource scarcity in places where raw material is available but access becomes restricted from time to time by environmental factors, social factors, or both (Bamforth and Woodman 2004).

The protecting strategy will be employed when a resource is available but limited. It is difficult to recognize the protection of a specific source location in the archaeological record, however the restriction of use of higher quality materials (e.g. enforcing a taboo) as a way to

conserve a dwindling resource may be one possible avenue of study. For example, if more expensive materials were only used for specific tools (hafted bifaces for example), it may suggest a form of protection of an endangered resource (Jeske 1989; 1992).

If access to raw material is really restricted and the previous strategies cannot mitigate the expense, people will be motivated to make uneven exchanges, or make unfair claims on neighbors through coercion. When the overall costs eventually outweigh the benefits of a location, people will often relocate the entire basecamp to a more productive area e.g., residential mobility (Rennie et al. 1996). Since these strategies are difficult to identify archaeologically they will not be tested directly in the following analysis but will be discussed in the conclusion. The next section will describe the methods used to test the expectations listed above. This section will list the attributes recorded for each artifact class as well as the attributes used to identify raw material qualities and culturally diagnostic artifacts within the tool assemblage.

Methods

The following analysis was conducted with the aid of the Lithic Documentation and Schema developed by Lurie and Jeske (1990) (Appendix B). The scheme includes both an individual and mass analysis for debitage and tools although only the individual analyses were utilized in this study. Each variable recorded within the individual analysis allows for the opportunity to test assumptions about various technological and social aspects of resource procurement, prehistoric technology, subsistence, and mobility. The following section will discuss what attributes were recorded for each artifact class and how they will be used to support my thesis

Debitage Analysis

Debitage is the by-product of stone tool production or core reduction and is the most common artifact recovered from prehistoric sites in the Midwest. It is essentially any piece detached from a core during the reduction process that was never modified or used (Andrefsky Jr. 2005). Debitage comes in many forms such as flakes, shatter, spalls, blocky. Hundreds if not thousands of pieces of debitage are created during the process of creating a single biface and it is extremely resistant to weathering processes unlike ceramics or faunal material (Dibble and Whittaker 1981).

Debitage can be an extremely rich source of information when examined in detail. Debitage contains clues or attributes that can be used to reconstruct the organization of technology of a site (Andrefsky Jr. 2001). Debitage attributes such as weight, surface area, platform thickness, dorsal scar count, presence or absence of cortex can be used to determine if tools were being fabricated or just maintained at the site. This knowledge can then be used to reconstruct raw material procurement strategies and mobility patterns (Cowan 1999; Morrow and Jefferies 1989). When combined with provenience information debitage can be used to identify activity areas at an intra-site level or even recognize the handedness of the knapper (Cahen and Keeley 1980).

In this thesis the debitage will be analyzed for clues about raw material procurement and use, signs of site structure and organization, and testing for evidence of economizing strategies at the site. Debitage will not be used to make culture specific statements. Debitage is not in itself diagnostic of a particular time-period or culture, and since there has been a significant amount of mixing within the site, identifying component specific traits in the debitage is not possible at this time.

Each piece of debitage has a unique provenience which denotes the excavation block, square, and level it was collected from. This information was used to plot the distribution of debitage across the site in ArcGIS in order to identify potential activity areas as well as to study the distribution of specific raw materials across the site.

Platform categories were identified based on a number of attributes such as size, facet count, presence of cortex, and angle. For example, debitage with small, angled platforms with multiple facets and characteristic lip were considered bifacial/complex (Bradbury and Carr 1995; Cotterell and Kamminga 1987). Debitage with few facets and multiple flat platforms were considered bipolar (Jeske and Lurie 1993). Other platform categories include flat, cortical, other, unprepared, indeterminate, and collapsed.

Bulb of percussion is thought to be related to flake size (Shott et al. 2000) and to a degree the stage of reduction (Cotterell and Kamminga 1987). The bulb of percussion for each flake was described as being pronounced, diffuse, multiple, or absent. The size of the bulb of percussion is seen as being directly related to the amount force applied to the core; hard hammers used early in the reduction sequence will produce larger bulbs than soft hammers utilized later in the reduction sequence (Crabtree 1972).

Flake size is generally believed to be directly related to the size of the objective piece, and therefore can provide a good indication of the size of the objective piece (Andrefsky 1998). Flake size, combined with other attributes, is also thought to be related to the stage of production in which the flake was removed from its core (Prentiss 1998). Flake size was measured in weight and surface area. Flakes were weighed using a portable digital scale which measured up to $1/100^{th}$ of a gram; this process was the same for tools as well. Surface area was calculated by

placing each piece of debitage ventral side down onto a piece of paper with pre-measured circles ranging in size from < 8mm, 8-12.5mm, 12.5-25mm, and >25 mm.

Ventral surface attributes such as rippling and éraillure scars can provide information about the amount and type of force used to detach the flake. Rippling was recorded as present or absent as well as if the rippling was pronounced or diffuse. The ventral surface was also inspected for the presence or absence of an éraillure scar.

The dorsal surface of each flake was inspected to determine how many previous flake scars were present, dorsal flake scar counts are thought to increase on flakes removed from bifacial cores as they become more refined (Andrefsky 2001). Flake terminations were characterized as being feathered, hinged, stepped, outrepassé, shattered, or crushed.

A combination of attributes including presence/absence of striking platform, bulb of percussion, concentric rings of force, and flake terminations were used to determine flake form. There are four categories in which a piece of debitage could fall within, they are: flake, flake-like, non-flake, and a Cannot Determine category. Full descriptions of these flake forms can be found in the Chipped Stone Debris Schema in Appendix (B).

The advantages of conducting an individual analysis of the debitage assemblage are many fold, and far outweigh the benefits of short-shifting or ignoring the debitage altogether. This process is one that is relatively easy to replicate and works well for large as well as small assemblages. When data from the debitage analysis is combined with the data collected from the analysis of the tool assemblage an even stronger picture of the economy and technology of the site can be realized.

Chipped Stone Tool Analysis

Chipped stone tools are by definition an artifact that has been intentionally modified by retouch or unintentionally modified by usewear (Jeske and Lurie 1990). Chipped stone tools come in many forms and serve many different functions during their use-life. Although chipped stone tools are durable, they become dull or break while they are used. The morphology of a tool can change drastically over the course of its use-life by systematically removing pieces until the desired tool form is obtained.

Tools, like debitage, are also imbued with clues about reduction strategies, raw material procurement, activity areas, and economizing strategies. A number of technological variables provide data concerning cultural affiliation, overall tool morphology and the manufacturing process. The technique of manufacture variable identifies the type of core the original objective piece the modified tool was removed from; tools were classified as being manufactured from a free-hand core or bipolar core. The basic form variable classifies tools as one of several types based on the location of retouch. Tools were identified as being edge or functional unit only, unifacial, bifacial, multifacial, non-facial, prismatic bladelet, or unknown, detailed descriptions of these categories can be found in the Chipped Stone Tool Analysis Schema in Appendix (B).

Edge modification characterizes the location of retouch, types of modification include unifacial, bifacial, and in some cases tools can exhibit both forms of retouch. The method of modification details the way an edge was modified, edges were modified from flaking, battering, both, or just from use. The type and method of modification of the tool variables not only identify these aspects, but suggest whether the tools discarded at the site were made for short-term tasks or whether they were made for long-term use. Based on the principles of optimal foraging, the greater amount of time invested in a tool, the more likely that that tool was made for extended use (Jeske 1989). Therefore, tools with a minimal amount of retouch are considered

expedient while tools that have been flaked as well as heavily retouched are considered to be curated (Andrefsky Jr 1991; Bamforth 1986; R. Kelly 1988; Parry and Kelly 1987). This distinction is complicated by several other factors such as raw material availability, shape, and function which also influence the type and extent of retouch applied to a tool (Andrefsky 1994; Bamforth 1991).

The refinement category is only applicable to bifaces and reflects the concept that bifaces begin as crude or rough blanks and are eventually worked into a refined tool. Categories used in this study are crude, medium, refined, and cannot determine which applies to most non-bifacial tools. Completeness also reflects the notion that bifaces are an ideal tool form and are characterized in this study as being broken, whole, or cannot determine. Refinement and completeness are used together to judge whether the bifaces discarded at the site were roughed out and left at the site for later use or whether they were discarded because they were no longer useful.

The 'elements present' variable refers to the portion of the tool that is being studied, elements are broken down into distal end, proximal end, mid-section, indeterminate end-section, or whole. Reworking details the presence, absence, or possibility of modification after the refined and complete tool has been used or broken. The distal end variable aids in the description of the shape of the distal end and the categories include blunt or pointed and the variable refers only to tools with identifiable distal ends. The position of retouch is classified in this study as end, side, end and side, cannot determine, or not applicable.

The edge configuration was studied using three separate variables. The number of edges were counted to give sense of how many possible functional units were present on the tool. Edge configuration describes the morphology of the edges which can be smooth, serrated, denticulate,

or notched. Edge angle was measured using a goniometer and measurements were taken 5 mm back from the edge. Angles were broken into four categories based on function. Angle categories include: 0-45 degrees, 46-75 degrees, greater than 75 degrees, or not applicable. Bifaces with edge angles greater than 45 degrees were considered heavily reworked.

Hafting was identified as being present, possible, absent, thinned and ground, or not applicable. Projections are defined by intentional retouch or wear on an unretouched area that extends out from the body of the piece. Projections were identified as being present, absent, or marked not applicable. Modification of those projections were also described as being present, absent, or marked not applicable.

Hafted bifaces were then categorized into established types based on size, shape, notching, stemming, flaking, and hafting method and haft preparation. Lastly for identification and comparative reasons, standard metric attributes including max length, width, thickness, and weight were recorded for each tool using a digital caliper; measurements were taken when possible and weight was not taken for broken tools. Unlike debitage, however, some tools do provide information about when they were made and by who. Hafted bifaces have been used to identify specific cultural traditions and when subjected to a raw material analysis can provide information about raw material use and mobility over time.

Raw Material Analysis

A raw material analysis was conducted because certain raw material attributes can provide information regarding the raw material preference, range of mobility, and level of interaction practiced by the site's inhabitants and their neighbors (Andrefsky 2005, 2009). This

information can be used to prove the hypothesis that people who occupied the Kautz site were increasing their resource breadth to cope with cost-driven resource scarcity.

The raw material analysis focused on four individual attributes: geologic type, material quality, presence of heat-alteration, and percentage of cortex. Raw material type, level of quality, presence and level of heat-alteration, percentage of cortex can provide information about where the material was obtained, how and why it was acquired, level of mobility, and whether or not the tools found at the site were produced or maintained at the site (Bamforth 1986, 1990; Binford 1979; Douglass et al. 2008; Morrow and Jefferies 1989; Michael D. Wiant and Hassen 1983). When multiple factors are considered, we can test to see if certain behaviors are economically driven or not. For example, heat-treatment is typically applied to materials that are of lesser quality in order to make them more amenable to knapping (Rick 1978), therefore if a material is consistently being heat-treated it is likely a lesser quality material. However, if a material is consistently being heat-treated but is of high quality, it is possible that the chert was being heat-treated for non-economic/technological reasons.

The amount of cortex is a record of the percentage of cortex or weathered patina found on the dorsal surface of the tool. Cortex percentage has been used in the past to indicate the stage of reduction (Odell 2004); however, its reliability as a predictor for reduction stage by itself is questionable (Bradbury and Carr 1995). Cortex percentage was determined by examining the dorsal surface of each flake and tool; percentages were recorded as 0%, less than 50%, between 50% and 100%, and 100%.

The practice of altering raw material through the application of heat is thought to improve the flakeability of the material (Bleed and Meier 1980; Flenniken and Garrison 1975; Mandeville 1971; Purdy and Brooks 1971); however, there may also be symbolic reasons for the practice,

particularly during the Middle Woodland period in Illinois (Fortier 2008). The identification of heat-treatment in an assemblage or on a particular tool type may suggest that the material is not of good quality or there is a symbolic reason for the alteration of the material. The over-application of heat can also be a sign of poor practices or the accidental introduction of material in hearth areas (Rick 1978). The presence or absence of heat treatment was recorded based on the following variables: luster contrast, degree of luster, heat fracture scars, conchoidal ripples, and changes in color (Ferguson and Warren 1992; Rick 1978). Increase in luster and change in color, often to a shade of pink or red, were the most common indicators of heat treatment although they are largely dependent on chert type.

The raw materials were identified by comparing macroscopic attributes such as color, inclusions, fossils, fracture planes, luster and grain size to known materials within the reference collection at the UWM Archaeological Research Laboratory (UWM ARL) as well as a number of additional sources. Additional sourcing materials include a guide developed by Winkler et al. (2012), chert identification websites (M. L. Anderson and Horgen 2015; Hermann and Baumann 2014; Stelle and Duggan 2003), and other chert identification publications (Deregnaucourt and Georgiady 1998; Ferguson and Warren 1992).

Statistical Software

All data from the macroscopic analysis was originally entered into an excel spreadsheet organized by individual artifact and its respective attributes. After the data was collected it was organized into a number of datasets which were then imported into an IBM SPSS statistical software database. SPSS was utilized to organize and reshape, tabulate and describe the data. It was also used to test relationships between the categorical, ordinal, interval, and nominal data collected during the analysis.

Data from the macroscopic analysis was also entered into an ESRI ArcGIS database. This was done so that spatial relationships between attributes such as raw material type and temporal affiliation could be visualized on the site level. ArcGIS was also used to visualize density levels of certain types of attributes and became a handy tool for showing the ambiguities of displaying data solely by count or weight.

The Kautz Site Lithic Assemblage

The Kautz Site assemblage consists of all the chipped stone artifacts recovered during the 1958-1961 field seasons at the Kautz Site including those artifacts recovered from Unit I and Unit II. The assemblage consists of a total of 2,496 pieces of debitage weighing 3339.74 grams and 181 tools weighing 955.93 grams. The vast majority of debitage in the assemblage were recovered from Excavation Unit I, Level 1 (Table 14). This pattern is also mirrored in the chipped stone tool assemblage (Table 15).

Table 14. Debitage count and weight by unit and level.

Table 14. Debitage Count and Weight by Unit and Level			
Unit	**Level**	**Count**	**Weight**
I	1	1847	1919.10
	1&2	53	56.03
	2	439	741.70
	Total	2339	2716.83
II	1	139	569.55
	2	18	53.36
	Total	157	622.91
Total	1	1986	2488.65
	1&2	53	56.03
	2	457	795.06
	Total	**2496**	**3339.74**

Table 15. Tool count and weight by unit and level.

Table 15. Tool Count and Weight by Unit and Level			
Unit	**Level**	**Count**	**Weight**
I	1	116	573.92
	2	54	336.09
	3	2	6.62
	All	2	13.7
	Total	174	930.33
II	1	6	17.68
	2	1	7.92
	Total	7	25.6
Total	1	122	591.6
	2	55	344.01
	3	2	6.62
	All	2	13.7
	Total	**181**	**955.93**

Lithic artifacts were recovered from all of the excavation squares in Unit I except for 25E25N and 10E55N because data from these units are missing. The highest concentrations of debitage was located in 10E40N, 10E25N, 10E15N, and 20E15N (Figure 57). Debitage forms present include free-hand flakes, flake-like pieces, and non-flakes. The tool assemblage consists of edge-only or function unit tools, unifacial tools, bifacial tools, multi-facial tools, and bladelets. Tools were widely dispersed throughout excavation Unit I. High concentrations of tools were found in 5W10N, 10E10N 10E15N, 25E40N, and 35E0N (Figure 58).

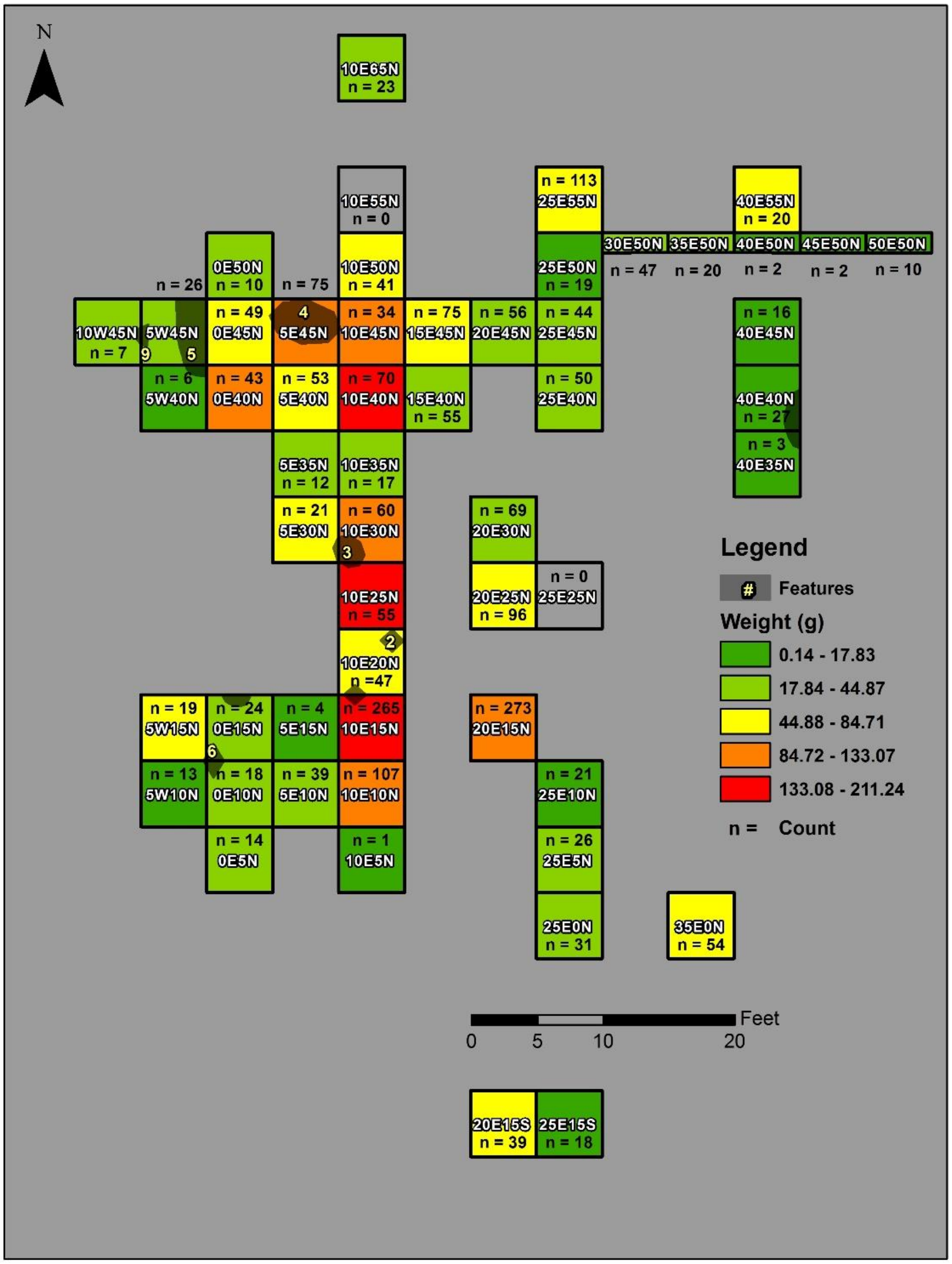


Figure 57. Horizontal distribution of debitage count and weight in Unit I.

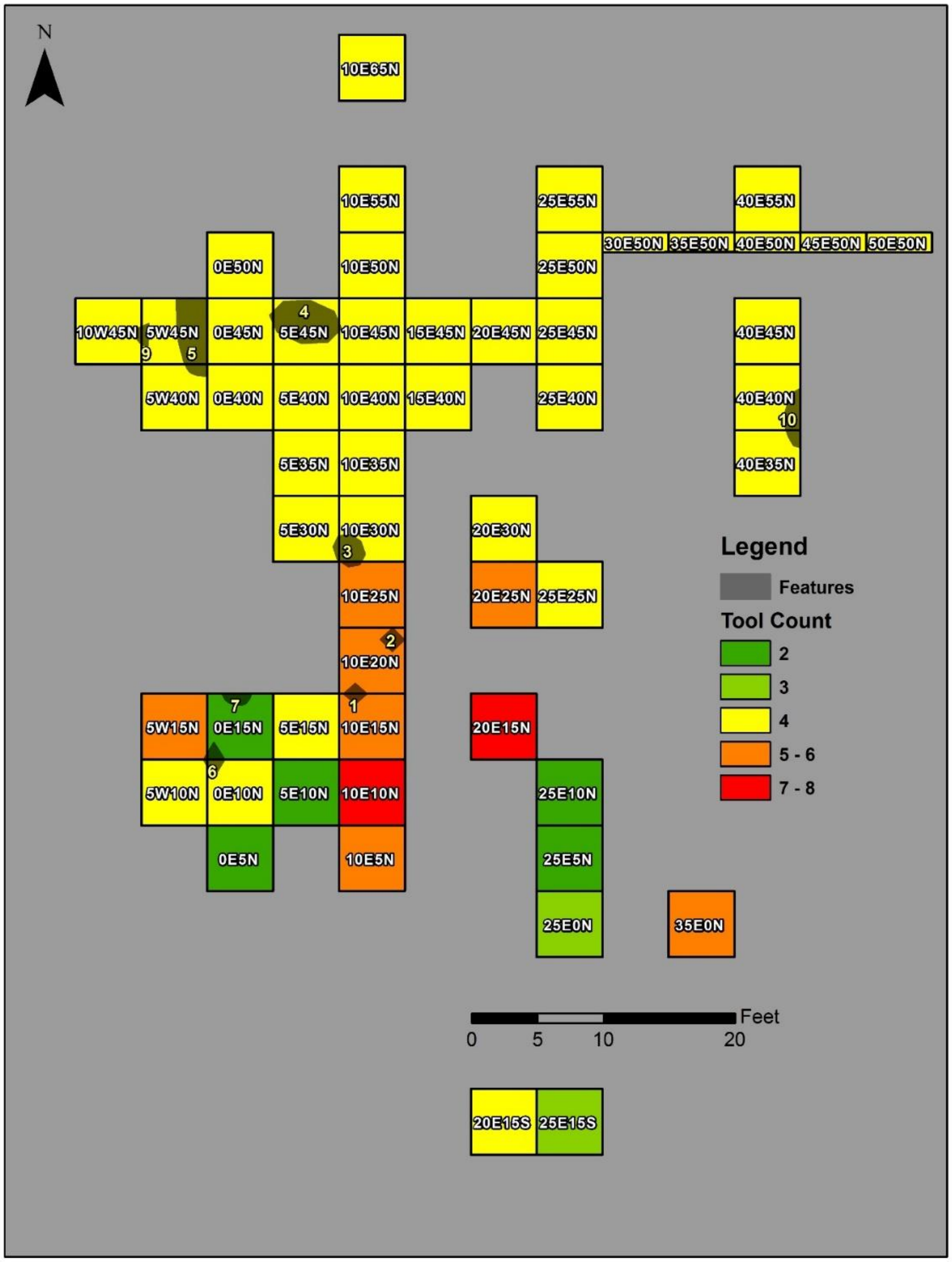


Figure 58. Horizontal distribution of tool counts in Unit I.

The overall debitage to tool ratio is roughly 14:1 and the flake to tool ratio is 7:1. Most of the excavation squares had a similar debitage to tool ratio of 10 to 1 and a flake to tool ratio of 6 to 1 (Figure 59). The Kautz Site's debitage to tool and flake to tool ratios are similar to other

Illinois Woodland sites where very little evidence of primary reduction took place such as Deer Track, Wet Willie, Buffalo, and 11L205 (Jeske n.d). The flake to tool ratio at Deer Track is roughly 4:1 whereas sites where tool manufacture was an important economic activity such as the LaSalle County Home Site, the ratio could be as high as 40:1 (Jeske 2003).

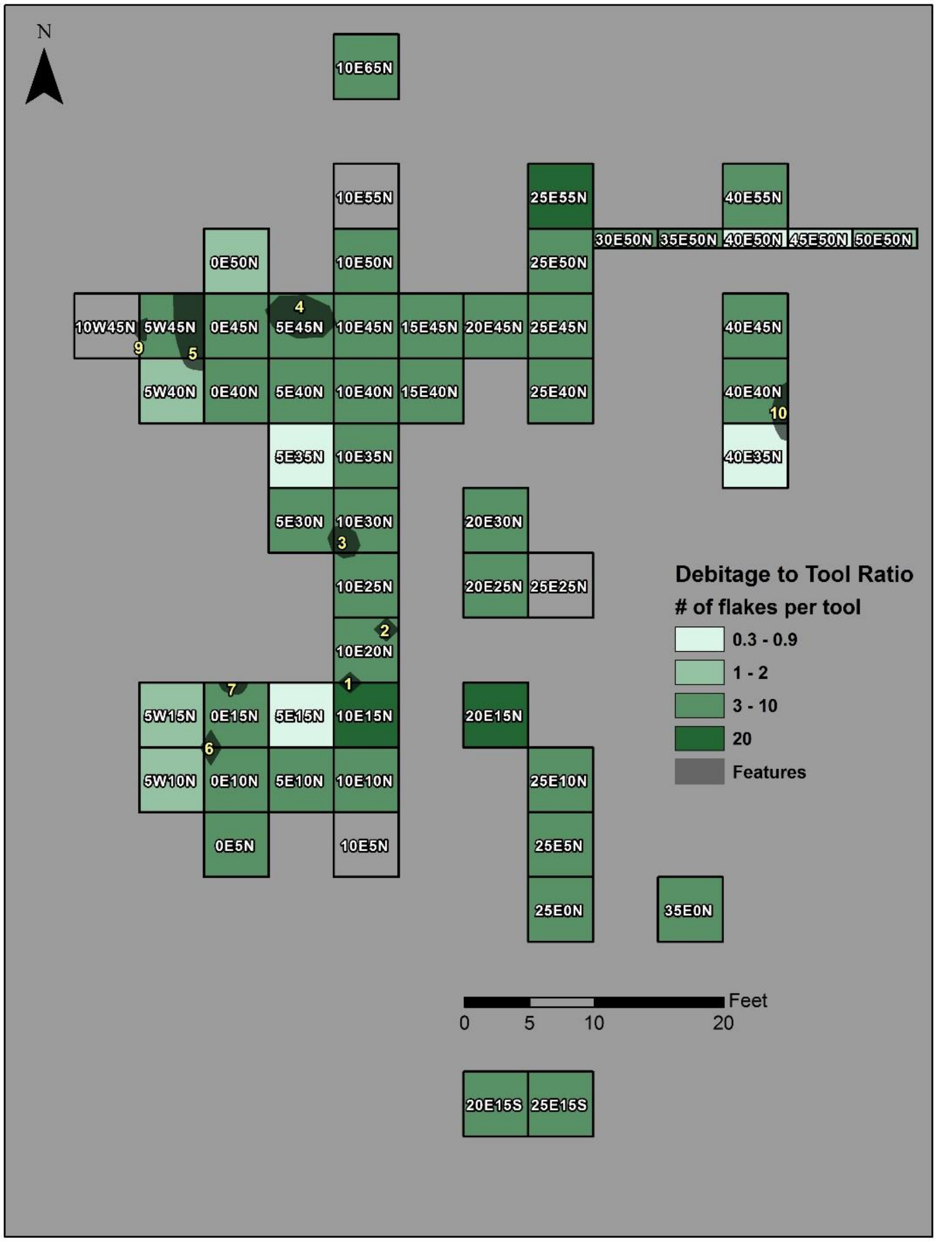


Figure 59. Flake to tool ratio in Unit I.

Raw materials identified in the assemblage include local and non-local materials. Following Jeske and Brown (2013), materials were considered local if they were available within 50 km of site and non-local if not, although Jeske (1989) found that everything beyond 35-km was treated the same (Jeske and Brown 2013). Local materials include Joliet Silurian chert, beach cobble, and other low-quality materials. Non-local materials include Burlington, Cobden, Cochrane, Galena, Knife River Flint, Maquoketa, Oneota, Pecatonica, and Wyandotte.

Twelve types of diagnostic tools were identified in the assemblage, representing cultures dating from the Late Archaic, Early Woodland, Middle Woodland, Late Woodland, and potentially Upper Mississippian periods spanning roughly 5,000 years between 6000-1000 B.P. A description of these tools can be found later in this chapter.

Since the available records of the excavations fail to provide enough information about the location of Unit II in relation to Unit I, and the vast majority of material was recovered from Unit I, the formal analysis of the assemblage only analyzed those tools and debitage recovered from Unit I which includes 174 chipped stone tools and 2,339 pieces of debitage.

Results of the Formal Analysis

It was hypothesized at the beginning of this thesis that the Kautz Site was occupied because it provided a number of economic benefits to the inhabitants including access to a primary source of good-quality chert within a maximum daily foraging range of 10-km. The landscape analysis found a number of potential locations but could not confirm with any certainty that such a source existed. Faced with inconclusive data from the landscape analysis, I turned to the lithic assemblage for clues. I hypothesized that if there was such a source within 10-km of the site then raw material would be relatively inexpensive to procure and therefore there

would be no need to utilize common coping strategies. The results of the analysis reject that hypothesis, there is an overwhelming amount of evidence to suggest that raw material was a restricted resource at the Kautz Site. The following section will present the evidence found during the analysis.

Evidence for Economizing Strategies at Kautz

We expect people to economize when resources are scarce or difficult to obtain (Jeske 1987). Examples tested for in the following analysis include curation, standardization, and the inclusion of less profitable resources into the lithic assemblage. The strategies act to increase efficiency and economy of material within the lithic economy at the site.

Evidence of curation and the use of standardized technology is prevalent in the assemblage. Bifacial tool forms compose roughly two-thirds of the assemblage (Table 16). Bifacial technology acts to increase efficiency through standardization and conserves material by providing a durable, general-purpose tool for many different situations (Jeske 1989).

Table 16. Basic tool form count and weight.

Table 16. Basic tool form count and weight			
Basic Form		**Count**	**Weight**
Edge or Functional Unit Only	Sum	17	83.9400
	% of Total Sum	9.8%	9.0%
Unifacial	Sum	6	16.3800
	% of Total Sum	3.4%	1.8%
Bifacial	Sum	115	306.4700
	% of Total Sum	66.1%	32.9%
Multifacial	Sum	19	501.8700
	% of Total Sum	10.9%	53.9%
Prismatic Blade or Bladelet	Sum	14	17.4600
	% of Total Sum	8.0%	1.9%
Unknown	Sum	3	4.2100
	% of Total Sum	1.7%	0.5%
Total	Sum	174	930.3300
	% of Total Sum	100.0%	100.0%

Bifaces can be reworked and sharpened numerous times. If material were scarce we should expect the presence of reworking on tools from the site. When basic tool forms were examined for evidence of reworking, bifaces were the only tool form where the observed count of reworked tools exceeded the expected value (Table 17). The results of a Chi-square analysis suggest that the difference in reworking between tool forms is significant, X^2 (39.181, N = 171, p > 0.00) (Table 18), which is not really a surprise in itself.

Table 17. Crosstabulation of basic tool form and presence of reworking.

Table 17. Crosstabulation of Basic Tool Form and Presence of Reworking						
			Reworking			
			Present	Possible	Absent	Total
Basic Form	Edge or Functional Unit Only	Count	0	4	13	17
		Expected Count	2.6	5.1	9.3	17.0
	Unifacial	Count	0	1	5	6
		Expected Count	0.9	1.8	3.3	6.0
	Bifacial	Count	25	45	45	115
		Expected Count	17.5	34.3	63.2	115.0
	Multifacial	Count	0	0	19	19
		Expected Count	2.9	5.7	10.4	19.0
	Prismatic Blade or Bladelet	Count	1	1	12	14
		Expected Count	2.1	4.2	7.7	14.0
Total		Count	26	51	94	171
		Expected Count	26.0	51.0	94.0	171.0

Table 18. Results of the chi-square tests for basic form and reworking.

Table 18. Results of the Chi-square tests for basic form and reworking			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	39.181[a]	8	0.000
Likelihood Ratio	50.438	8	0.000
Linear-by-Linear Association	1.352	1	0.245
N of Valid Cases	171		
a. 7 cells (46.7%) have expected count less than 5. The minimum expected count is .91.			

This does prove however, that a) bifaces were being reworked, and b) they were being reworked more often than any other tool form. When a crosstabulation was run to determine if hafted tools were reworked more frequently than non-hafted tools, the results show that a higher

than expected count of hafted tools were reworked and lower than expected count of non-hafted tools were reworked (Table 19). The results of a Pearson Chi-square analysis confirm that hafted tools (bifaces) were significantly more likely to be reworked than non-hafted tools, X^2 (45.652, N = 113, p > 0.000) (Table 20).

Table 19. Crosstabulation of hafting and reworking.

Table 19. Crosstabulation of hafting and reworking						
			Reworking			
			Present	Possible	Absent	Total
Hafting	Present	Count	20	14	10	44
		Expected Count	8.6	11.7	23.8	44.0
	Possible	Count	0	6	5	11
		Expected Count	2.1	2.9	5.9	11.0
	Absent	Count	2	10	46	58
		Expected Count	11.3	15.4	31.3	58.0
Total		Count	22	30	61	113
		Expected Count	22.0	30.0	61.0	113.0

Table 20. Results of the chi-square tests for hafting and reworking.

Table 20. Results of the Chi-square tests for hafting and reworking			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	45.652[a]	4	0.000
Likelihood Ratio	48.441	4	0.000
Linear-by-Linear Association	38.833	1	0.000
N of Valid Cases	113		
a. 2 cells (22.2%) have expected count less than 5. The minimum expected count is 2.14.			

We now know that bifaces were a major part of the Kautz Site's chipped stone tool assemblage and they were being reworked, but is there any evidence that raw material was being brought back to site to be reduced into a bifacial tool? The presence of bifacial thinning flakes in the lithic assemblage confirm that bifacial reduction was taking place at the site, approximately 25% of the 2339 flakes (n = 573) exhibited a bifacial/complex platform (Table 21). However, at what stage in the reduction process were these flakes removed? The average size class weight of these flakes should provide some clues as to when they were removed. Small flakes tend to be

removed from small bifaces and large flakes tend to be removed from large bifaces, there are obviously exceptions, which is why both size and weight were examined (Shott 1994, 1996).

Table 21. Crosstabulation of platform type and size class.

Table 21. Crosstabulation of platform type and size class							
			Size				Total
			< 8 mm	8 - 12.5 mm	12.5 - 25 mm	> 25mm	
Platform	Bifacial / Complex	Count	35	201	321	16	573
		Expected Count	18.1	140.1	355.5	59.3	573.0
	Abraded / Ground	Count	4	40	180	35	259
		Expected Count	8.2	63.3	160.7	26.8	259.0
	Flat	Count	0	21	163	54	238
		Expected Count	7.5	58.2	147.6	24.6	238.0
	Cortical	Count	1	10	70	19	100
		Expected Count	3.2	24.5	62.0	10.3	100.0
	Unprepared	Count	0	1	4	1	6
		Expected Count	0.2	1.5	3.7	0.6	6.0
	Multiple / Bipolar	Count	0	0	9	6	15
		Expected Count	0.5	3.7	9.3	1.6	15.0
	Collapsed	Count	7	77	156	16	256
		Expected Count	8.1	62.6	158.8	26.5	256.0
	Absent	Count	27	222	548	95	892
		Expected Count	28.2	218.1	553.4	92.3	892.0
Total		Count	74	572	1451	242	2339
		Expected Count	74.0	572.0	1451.0	242.0	2339.0

A comparison between platform types and surface area has found that a greater than expected amount of flakes with bifacial platforms were smaller than 12.5 mm and fewer than expected were greater than 12.55 mm. A Pearson Chi-Square Test found that there is a significant difference in average artifact size between platform groups X^2 (204.314, N = 2339, p > .000) (Table 22).

Table 22. Results of the chi-square tests for platform type and size class.

Table 22. Results of the Chi-square tests for platform type and size class			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	204.314[a]	21	0.000
Likelihood Ratio	219.625	21	0.000
Linear-by-Linear Association	2.110	1	0.146
N of Valid Cases	2339		

a. 8 cells (25.0%) have expected count less than 5. The minimum expected count is .19.

Flakes with bifacial platforms are also significantly less heavy than some flakes with other platform types (Table 23). There is a statistically significant difference between groups as determined by one-way ANOVA (F (7, 2339) = 27.295, p > 0.000) (Table 24). A Tukey post-hoc test revealed that the weight of flakes with abraded/ground platforms (.9715 ± 1.0755 g, p = 0.042) flat platforms (1.6578 ± 2.1384 g, p > 0.000), cortical platforms (1.9213 ± 2.3480 g, p > 0.000), multiple/bipolar platforms (7.1867 ± 9.4632 g, p > 0.000), and flakes with no platform (1.5043 ± 3.3707 g, p > 0.000) is significantly heavier than flakes with bifacial/complex platforms (0.4030 ± 0.8585 g) (Table 25). There were no statistically significant differences between the unprepared group (p = 0.941) or the collapsed group (p = 0.616).

Table 23. Descriptives for One-Way ANOVA platform type, artifact weight (g).

Table 23. Descriptives for One-Way ANOVA Platform Type, Artifact Weight (g)								
					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Bifacial / Complex	573	0.4030	0.85851	0.03586	0.3325	0.4734	0.02	17.57
Abraded / Ground	259	0.9715	1.07554	0.06683	0.8399	1.1031	0.05	7.95
Flat	238	1.6578	2.13846	0.13862	1.3847	1.9309	0.03	15.27
Cortical	100	1.9213	2.34801	0.23480	1.4554	2.3872	0.10	10.76
Unprepared	6	1.5800	1.69251	0.69097	-0.1962	3.3562	0.26	4.93
Multiple / Bipolar	15	7.1867	9.46322	2.44339	1.9461	12.4272	1.42	33.98
Collapsed	256	0.7365	1.10883	0.06930	0.6000	0.8730	0.04	9.58
Absent	892	1.5043	3.37072	0.11286	1.2828	1.7258	0.01	58.46
Total	2339	1.1615	2.55031	0.05273	1.0581	1.2649	0.01	58.46

Table 24. Results of the One-Way ANOVA platform type, artifact weight (g).

Table 24. Results of the One-Way ANOVA Platform Type, Artifact Weight (g)					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1152.005	7	164.572	27.295	0.000
Within Groups	14054.525	2331	6.029		
Total	15206.530	2338			

Table 25. Results of Post-Hoc Tukey HSD Test (bifacial platform only).

Table 25. Results of Post-Hoc Tukey HSD Test (Bifacial Platform Only)						
(I) PLATFORM		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Bifacial / Complex	Abraded / Ground	-.56851*	0.18385	0.042	-1.1263	-0.0108
	Flat	-1.25480*	0.18936	0.000	-1.8292	-0.6804
	Cortical	-1.51832*	0.26611	0.000	-2.3256	-0.7110
	Unprepared	-1.17702	1.00768	0.941	-4.2340	1.8799
	Multiple / Bipolar	-6.78368*	0.64225	0.000	-8.7320	-4.8353
	Collapsed	-0.33351	0.18459	0.616	-0.8935	0.2265
	Absent	-1.10128*	0.13146	0.000	-1.5001	-0.7025

The surface area and weight data indicate that most of the flakes with bifacial platforms were removed from refined bifaces and not removed during early-stage biface reduction. This would suggest that bifaces were being brought into the site either partially prepared in the form of preforms or finished tools such as hafted bifaces. Refinement was recorded for all bifacial tools. A case summary found that 56% of the bifaces in the assemblage were refined, 19% medium, and 14% crude suggesting a bias towards later-stage bifaces (Table 26).

Table 26. Case Summary: Level of biface refinement.

Table 26. Case Summary: Level of biface refinement			
Refinement		Count	Weight
Crude	Sum	16	153.5300
	% of Total Sum	13.9%	50.1%
Medium	Sum	22	61.5900
	% of Total Sum	19.1%	20.1%
Refined	Sum	64	91.3500
	% of Total Sum	55.7%	29.8%
Can't Determine	Sum	13	
	% of Total Sum	11.3%	
Total	Sum	115	306.4700
	% of Total Sum	100.0%	100.0%

Evidence of the highly economical blade-core technology is present in the assemblage in the form of bladelets, however there is no evidence that bladelets were being produced on site.

Multifacial tools from this site do not exhibit any signs of being a specially prepared core for bladelet production. Further, most of the bladelets were made on non-local chert and no multifaces made from non-local chert were recovered at the site.

Flaking on the multifacial tools resembled more of an opportunistic approach to core reduction. Edge only tools denote some level of expedient technology, which is a useful technology for non-specialized tasks and are adaptive because they do not require a great deal of time, skill, or good-quality material to produce a useable edge-only tool. The presence of a small percentage of edge-only tools does not necessarily denote resource scarcity, however it might suggest a response to poor quality material in lithic availability.

The other economizing strategy predicted to be in use at the Kautz Site if a raw material source was not available within the 10-km catchment is expanding or increasing resource breadth to include lesser quality materials. The rationale is that if a source of good quality chert was not available lesser quality, but potentially more abundant materials would have been utilized at the site instead. A case summary of the raw material quality variable shows that there is a clear preference for good quality material within the tool assemblage, but there is some evidence of lesser quality material being used to produce tools at the site (10% of tools) (Table 27).

Table 27. Case Summary: raw material quality – tool assemblage.

Table 27. Case Summary: Raw Material Quality – Tool Assemblage			
Raw Material Quality		Count	Weight
Good	Sum	155	704.0000
	% of Total Sum	89.1%	75.7%
Fair	Sum	17	218.3300
	% of Total Sum	9.8%	23.5%
Poor	Sum	2	8.0000
	% of Total Sum	1.1%	0.9%
Total	Sum	174	930.3300
	% of Total Sum	100.0%	100.0%

One possible explanation for the overwhelming preference for good-quality chert may be the fact that the majority of the tools recovered are bifaces, which are typically associated with time-sensitive or high-risk activities that demanded performance and reliability (Jeske 1989). A crosstabulation and Chi-square analysis was run to test if there are any significant differences between the use of varying qualities of raw material and basic tool forms, the results of the chi-square analysis reject that hypothesis X^2 (7.394, N = 171, p = 0.495) (Table 28, Table 29).

Table 28. Crosstabulation of raw material quality and basic tool form.

Table 28. Crosstabulation of Raw Material Quality and Basic Tool Form									
			Basic Form						
			Edge or Functional Unit Only	Unifacial	Bifacial	Multifacial	Prismatic Blade or Bladelet	Total
Raw Material Quality	Good	Count	17	5	101	15	14	152
		Expected Count	15.1	5.3	102.2	16.9	12.4	152.0
	Fair	Count	0	1	12	4	0	17
		Expected Count	1.7	0.6	11.4	1.9	1.4	17.0
	Poor	Count	0	0	2	0	0	2
		Expected Count	0.2	0.1	1.3	0.2	0.2	2.0
Total		Count	17	6	115	19	14	171
		Expected Count	17.0	6.0	115.0	19.0	14.0	171.0

Table 29. Results of the chi-square tests for raw material quality and basic tool form.

Table 29. Results of the Chi-Square Tests for Raw Material Quality and Basic Tool Form			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.394[a]	8	0.495
Likelihood Ratio	10.454	8	0.235
Linear-by-Linear Association	0.006	1	0.937
N of Valid Cases	171		

a. 9 cells (60.0%) have expected count less than 5. The minimum expected count is .07.

One interesting fact that the crosstabulation revealed is that a higher than expected count of multi-faces were made from fair quality chert, this could potentially lend support to the thesis that local, lesser-quality materials were being used to make expedient tools via bipolar core reduction. There are fifteen pieces of debitage that have been confidently identified as being the product of bipolar core reduction. It is a small percentage of the total assemblage (<1%), however the identification process for these types of flakes is difficult, especially within mixed assemblages (Jeske and Lurie 1993). Several of the attributes used to identify bipolar reduction such as twin or ridged bulbs of percussion, the presence of two bulbs of percussion, profusion of step and hinge termination, and irregular outline either do not appear often enough to be archaeologically visible, or appear as often on free-hand materials as on bipolar. It is also possible that variability in the raw material and quality might be affecting the results (Jeske and Lurie 1993).

Another example of increasing resource breadth is including non-local materials in the assemblage. Non-local materials are by definition more expensive to obtain than local materials; however, if access to local materials are restricted for some reason, then people would be forced to trek further from home base to acquire it. If access to local raw material was restricted, then we would expect to see evidence of non-local materials being incorporated into the assemblage. A case summary of the local/non-local variable within the tool assemblage suggests there was an overwhelming preference for local raw materials, Joliet Silurian chert and Beach Cobble. Approximately 71% of all tools were made from local material and outweigh non-local materials by almost 700 grams (Table 30). This pattern is mirrored in the debitage assemblage; however the proportions are even more exaggerated. Approximately 90% of the debitage was made from local raw material, primarily Joliet Silurian chert. As expected, tools made from non-local cherts

were brought in pre-fabricated and were only reworked to a minimal extent while at the site (Table 31). This mirrors what Jeske notes for Mound City (Jeske 1989), for Washington Irving (Jeske 2000), and for LaSalle County Home (Jeske 2003).

Table 30. Count and weight of raw material types in tool assemblage.

Table 30. Count and weight of raw material types in tool assemblage				
Raw Material			Count	Weight
Local	Joliet Silurian	Sum	112	685.4500
		% of Total Sum	64.4%	73.7%
	Beach Cobble	Sum	11	118.1700
		% of Total Sum	6.3%	12.7%
	Total	Sum	123	803.6200
		% of Total Sum	70.7%	86.4%
Non-Local	Galena	Sum	2	
		% of Total Sum	1.1%	
	Maquoketa	Sum	1	6.8100
		% of Total Sum	0.6%	0.7%
	Oneota	Sum	1	4.2000
		% of Total Sum	0.6%	0.5%
	Cochrane	Sum	1	2.4000
		% of Total Sum	0.6%	0.3%
	Burlington	Sum	9	7.8600
		% of Total Sum	5.2%	0.8%
	Wyandotte	Sum	2	
		% of Total Sum	1.1%	
	Pecatonica	Sum	32	104.8300
		% of Total Sum	18.4%	11.3%
	Cobden	Sum	3	0.6100
		% of Total Sum	1.7%	0.1%
	Total	Sum	51	126.7100
		% of Total Sum	29.3%	13.6%

Table 31. Count and weight of raw material types in debitage assemblage.

Table 31. Count and weight of raw material types in debitage assemblage				
Raw Material			COUNT	WEIGHT
Local	Joliet Silurian	Sum	2031	2429.69
		% of Total Sum	86.8%	89.4%
	Quartzite	Sum	3	2.98
		% of Total Sum	0.1%	0.1%
	Beach Gravel	Sum	86	91.90
		% of Total Sum	3.7%	3.4%
	Total	Sum	2120	2524.57
		% of Total Sum	90.6%	92.9%
Non-Local	Galena	Sum	25	31.89
		% of Total Sum	1.1%	1.2%
	Oneota	Sum	6	10.47
		% of Total Sum	0.3%	0.4%

	Basalt	Sum	1	2.28
		% of Total Sum	0.0%	0.1%
	Knife River Flint	Sum	2	0.75
		% of Total Sum	0.1%	0.0%
	Burlington	Sum	17	12.30
		% of Total Sum	0.7%	0.5%
	Pecatonica	Sum	163	131.37
		% of Total Sum	7.0%	4.8%
	Cobden	Sum	5	3.21
		% of Total Sum	0.2%	0.1%
	Total	Sum	219	192.27
		% of Total Sum	9.4%	7.1%

The results of the raw material typology for the debitage assemblage revealed some interesting information about the use of non-local materials. First, Knife River Flint, a material that originates hundreds of kilometers from the Kautz Site is represented in the assemblage by two bifacial thinning flakes. No tools recovered from the site were made from Knife River Flint. The second interesting result is that Pecatonica chert represents 75% of the non-local chert. This fact, coupled with the presence of Oneota chert and other exotic cherts like Burlington and Cobden suggests a strong connection, materially, to the Utica area near the confluence of the Fox and Illinois Rivers.

If there is a primary source of Joliet Silurian chert within the 10-km catchment and people were collecting it during their daily foraging trips, it is assumed that not a great deal of effort would be placed on reducing the raw material at the site of procurement because travel costs would be relatively low, plus waste flakes may be useful. Therefore, if Joliet Silurian chert was available within the 10-km catchment we would expect cortex to be present on the tools and debitage made from this material.

A crosstabulation of the Raw Material Type and Cortex variables in the tool category found that Joliet Silurian chert did not have a significantly higher amount of cortex than any

other raw material which rejects the hypothesis that Joliet Silurian chert was found within the 10-km catchment, X^2 (38.619, N = 174, p = 0.003) (Table 32, Table 33). Interestingly, the one material that did have a higher than expected count of cortex than the other materials is Beach Cobble, which suggests this material was more than likely available within the 10-km catchment.

Table 32. Crosstabulation of raw material type and cortex in tool assemblage.

Table 32. Crosstabulation of Raw Material Type and Cortex in Tool Assemblage

			Cortex			
			0	< 50%	> 50 < 100%	Total
Raw Material	Galena	Count	2_a	0_a	0_a	2
		Expected Count	1.6	0.3	0.1	2.0
	Maquoketa	Count	1_a	0_a	0_a	1
		Expected Count	0.8	0.2	0.0	1.0
	Oneota	Count	1_a	0_a	0_a	1
		Expected Count	0.8	0.2	0.0	1.0
	Cochrane	Count	1_a	0_a	0_a	1
		Expected Count	0.8	0.2	0.0	1.0
	Burlington	Count	9_a	0_a	0_a	9
		Expected Count	7.1	1.6	0.3	9.0
	Wyandotte	Count	2_a	0_a	0_a	2
		Expected Count	1.6	0.3	0.1	2.0
	Pecatonica	Count	26_a	6_a	0_a	32
		Expected Count	25.4	5.5	1.1	32.0
	Joliet Silurian	Count	91_a	18_a	3_a	112
		Expected Count	88.8	19.3	3.9	112.0
	Beach Cobble	Count	2_a	6_b	3_b	11
		Expected Count	8.7	1.9	0.4	11.0
	Cobden	Count	3_a	0_a	0_a	3
		Expected Count	2.4	0.5	0.1	3.0
Total		Count	138	30	6	174
		Expected Count	138.0	30.0	6.0	174.0

Table 33. Results of the Chi-square test for raw material type and cortex.

Table 33. Results of the Chi-square test for raw material type and cortex

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	38.619[a]	18	0.003
Likelihood Ratio	31.761	18	0.023
Linear-by-Linear Association	4.329	1	0.037
N of Valid Cases	174		

a. 24 cells (80.0%) have expected count less than 5. The minimum expected count is .03.

The same test was run on the debitage and a slightly different picture developed. The crosstabulation found that there are significant differences in the amount of cortex between raw material types. Joliet Silurian, Pecatonica, and Beach Cobble types were more likely to have higher than expected levels of cortex than other cherts. This does suggest that Joliet Silurian chert is local but no more local than Pecatonica or Beach Cobble cherts (Table 34, Table 35).

Table 34. Crosstabulation of raw material type and cortex in debitage assemblage.

Table 34. Crosstabulation of raw material type and cortex in debitage assemblage			Cortex				
			0%	< 50%	50 - 99%	100%	Total
Raw Material	Galena	Count	21	3	1	0	25
		Expected Count	16.2	5.3	1.3	2.2	25.0
	Joliet Silurian	Count	1329	415	95	192	2031
		Expected Count	1312.9	432.4	107.7	178.0	2031.0
	Oneota	Count	6	0	0	0	6
		Expected Count	3.9	1.3	0.3	0.5	6.0
	Basalt	Count	1	0	0	0	1
		Expected Count	0.6	0.2	0.1	0.1	1.0
	Knife River Flint	Count	1	0	1	0	2
		Expected Count	1.3	0.4	0.1	0.2	2.0
	Burlington	Count	16	1	0	0	17
		Expected Count	11.0	3.6	0.9	1.5	17.0
	Quartzite	Count	3	0	0	0	3
		Expected Count	1.9	0.6	0.2	0.3	3.0
	Pecatonica	Count	111	38	11	3	163
		Expected Count	105.4	34.7	8.6	14.3	163.0
	Beach Gravel	Count	19	41	16	10	86
		Expected Count	55.6	18.3	4.6	7.5	86.0
	Cobden	Count	5	0	0	0	5
		Expected Count	3.2	1.1	0.3	0.4	5.0
Total		Count	1512	498	124	205	2339
		Expected Count	1512.0	498.0	124.0	205.0	2339.0

Table 35. Results of the chi-square test for raw material type and cortex-debitage.

Table 35. Results of the Chi-square test for raw material type and cortex-debitage			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	123.096[a]	27	0.000
Likelihood Ratio	122.574	27	0.000
Linear-by-Linear Association	1.605	1	0.205
N of Valid Cases	2339		

a. 26 cells (65.0%) have expected count less than 5. The minimum expected count is .05.

Evidence for Hoarding

One of the coping strategies hypothesized to be in use at the Kautz Site is hoarding. There is little in the way of evidence to support the hypothesis that hoarding was an important coping strategy utilized at the Kautz Site. There are a number of non-hafted bifaces in varying degrees of refinement in the assemblage that could have served as preforms for other tools, however to assign function without examining the edges for use is premature (Figure 60).

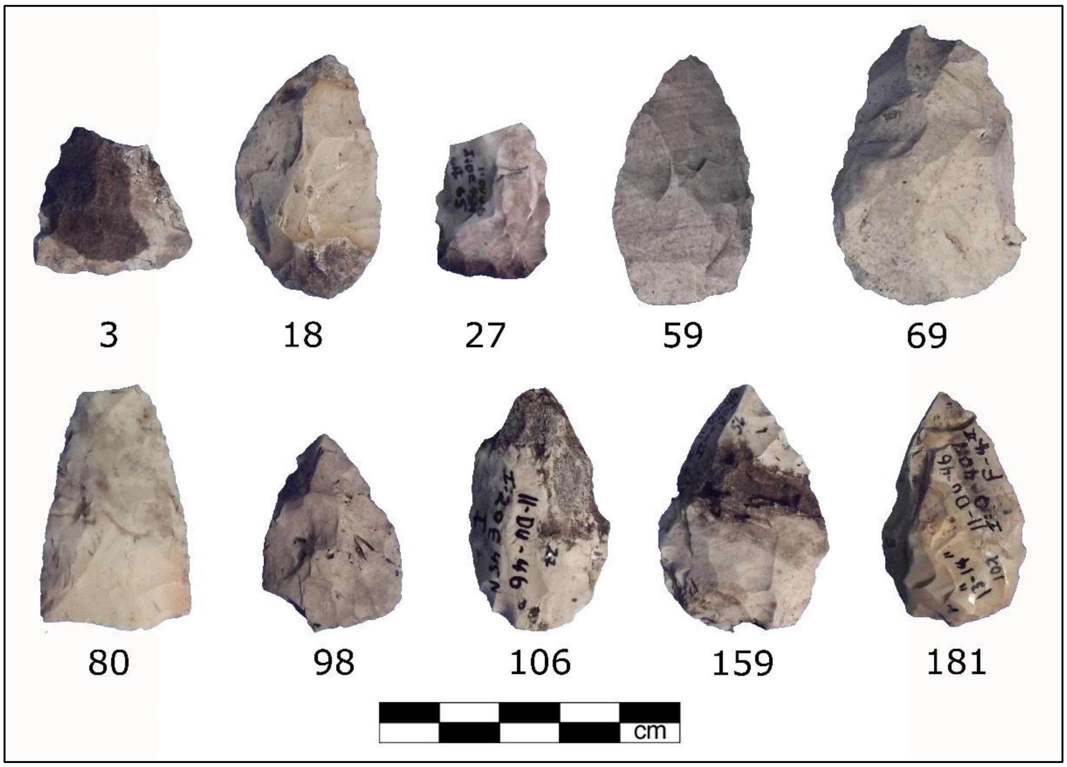


Figure 60. Non-hafted bifaces.

Evidence for Protection

It was hypothesized that if raw material was expensive to procure (i.e., located outside of the 10-km) then there would be evidence of protection as a coping strategy. Protection of the resources available could have taken many forms. One form hypothesized to be present in the

assemblage was the implementation of restrictions on the use of expensive material. If a material is expensive it will be used to make fewer tools but also fewer types of tools. This hypothesis was tested by examining the relationship between tool form and locality. The results of the crosstabulation reveal an interesting pattern but did not find any statistical difference in the number of tool forms made by local or non-local materials X^2 (9.311, N = 171, p = 0.054) (Table 36, Table 37). Non-local materials were generally used to make bifaces or bladelets (76% of tools made from non-local materials) but were used to make other tools such as multifaces, unifaces, and edge only tools. One interesting difference is that only 2 of the 19 multifacial tools were made from non-local material and this material was Pecatonica, which may or may not have been available in cobble form in the catchment.

Table 36. Crosstabulation of raw material locality and basic tool form.

Table 36. Crosstabulation of raw material locality and basic tool form

			Basic Form					
			Edge or Functional Unit Only	Unifacial	Bifacial	Multifacial	Prismatic Blade or Bladelet	Total
Local	Yes	Count	9_a	$5_{a, b}$	$83_{a, b}$	17_b	7_a	121
		Expected Count	12.0	4.2	81.4	13.4	9.9	121.0
	No	Count	8_a	$1_{a, b}$	$32_{a, b}$	2_b	7_a	50
		Expected Count	5.0	1.8	33.6	5.6	4.1	50.0
Total		Count	17	6	115	19	14	171
		Expected Count	17.0	6.0	115.0	19.0	14.0	171.0

Each subscript letter denotes a subset of Basic Form categories whose column proportions do not differ significantly from each other at the .05 level.

Table 37. Result of the Chi-square test for raw material locality and basic tool form.

Table 37. Result of the Chi-square test for raw material locality and basic tool form

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.311[a]	4	0.054
Likelihood Ratio	9.556	4	0.049
Linear-by-Linear Association	0.000	1	0.983
N of Valid Cases	171		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 1.75.

Evidence for Economizing Behavior over Time

Each tool was examined for temporally or culturally time-sensitive attributes such as form, flaking, basal grinding, hafting, size, and shape. These attributes were then compared to a wide-range of examples from reference collections, books, and online media and peer consultation. After each tool type was identified, their condition, raw material types, provenience, and association with other artifacts was described. Diagnostic artifacts have the potential to provide information about technological change as well as raw material preferences over time. It also provides a means of comparison with culturally affiliated sites across the Midwest.

Diagnostic chipped stone tools recovered from this site range from Late Archaic to Late Woodland in age (Table 38). Tools diagnostic of the Middle Woodland such as Manker, Norton, and Gibson points and bladelets represent a large portion of the diagnostic assemblage. Equally prevalent are tools that date to the Late Woodland period, represented by Lowe Cluster and Raccoon Notched bifaces and triangular points. Late Woodland Lowe Cluster points were the single most common diagnostic tool form recovered from the site. Late Archaic biface types such as Table Rock, Lamoka, and Merom, are also well represented in the assemblage.

Overall, diagnostic tools are well-distributed throughout the excavation unit. Figure 61 illustrates the distribution of each diagnostic artifact and type. Diagnostic tools are symbolized by Letters and Colors, the letters represent the specific diagnostic type e.g., Table Rock or Madison Triangular and the colors represent the loose temporal affiliation e.g., Late Archaic or Late Woodland. The distribution map shows that the northernmost diagnostic tool is Lowe Cluster biface and the southernmost tools include a Madison Triangular point, Lowe Cluster point, and Merom cluster point. The easternmost tools are a Madison Triangular point, Waubesa

Point, and a Lowe Cluster point and the westernmost tools are Lowe Cluster bifaces and Waubesa Point. The patterns in this distribution suggests that Archaic and Late Woodland points have the widest distribution and Raccoon Notched, diagnostic of the middle Late Woodland period, has the tightest distribution.

Table 38. Diagnostic type by corresponding temporal period.

Table 38. Diagnostic type by corresponding temporal period			
Temporal	**Diagnostic Type**	**Sum**	**% of Total Sum**
Late Archaic	Bottleneck Stemmed	2	3.80%
	Durst/Lamoka	3	5.80%
	Merom/Trimble	5	9.60%
	Total	**10**	**19.20%**
Early Woodland & Middle Woodland	Motley	2	3.80%
	Waubesa Contracting Stemmed	3	5.80%
	Total	**5**	**9.60%**
Middle Woodland	Norton	1	1.90%
	Bladelet	10	19.20%
	Manker	5	9.60%
	Gibson	1	1.90%
	Total	**17**	**32.70%**
Middle and Late Woodland	Lowe Cluster	12	23.10%
	Total	**12**	**23.10%**
Late Woodland	Raccoon Notched	3	5.80%
	Total	**3**	**5.80%**
Late Woodland and Upper Mississippian	Madison Triangular	5	9.60%
	Total	**5**	**9.60%**
Total		**52**	**100.00%**

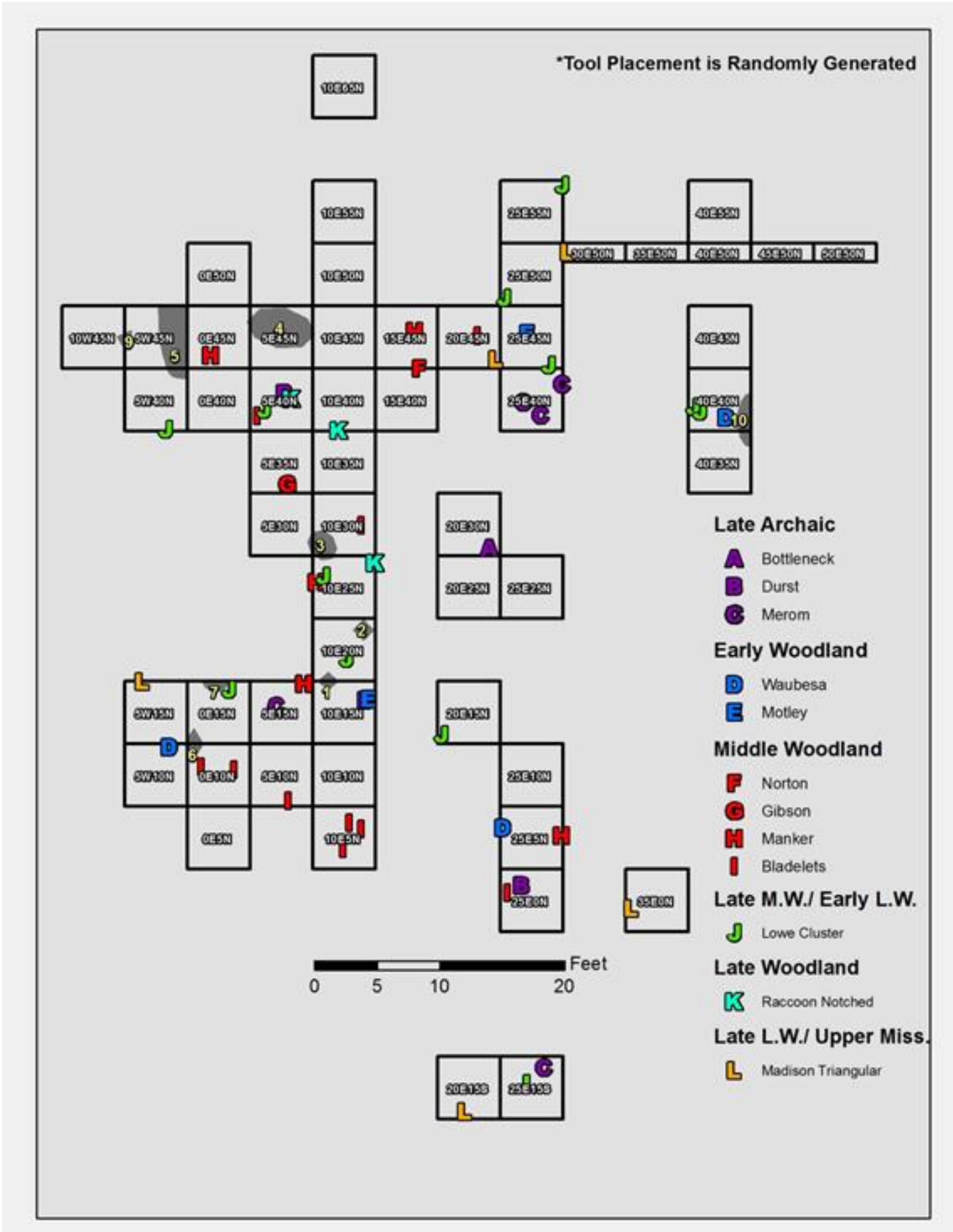


Figure 61. Horizontal distribution map of diagnostic tools.

Vertical distribution of diagnostic tools shows no obvious pattern. Late Archaic tools are mixed together with early, middle and late Woodland tools in many different locations within Unit 1. As far as frequency, the vast majority (67%) of the tools were recovered from Level 1, which is expected because most of the tools and debitage were recovered in Level 1 as well.

Late Archaic Tools

Three unique Late Archaic point clusters are represented at the Kautz Site: Table Rock/Bottleneck, Lamoka/Durst cluster, and Merom cluster (Figure 62).

Table Rock/Bottleneck Stemmed

In the eastern Woodlands the Table Rock/Bottleneck Stemmed cluster is roughly dated to the Late Archaic period ca. 3000 to 1000 B.C. Characteristic features of this point type are excurvate and refined, symmetrical blades, and graceful expanding stem with a straight to slightly convex base (Justice 1987). This point type is colloquially known as Table Rock in northern Illinois however Justice (1987) suggest that in actuality Bottlenecks are the actual type of point we often find in this region. For the purpose of this study both terms are subsumed under the umbrella of the Table Rock cluster.

There are two examples of this point cluster within the Kautz assemblage. Tool #53 was recovered in Unit 1, level 1 of excavation square 20E30N along with 69 pieces of debitage and 5 tools including a broken T-drill (Figure 61). Tool #180 was recovered by itself in Level 1 of 5E20N in Unit 2, the fact that no other tools or debitage is strange and suggests that there may be missing artifacts from this excavation.

The chert that both of the Bottleneck stemmed points were made from is locally obtained, good quality, heat-treated chert. Tool #180 (Figure 62) is made from beach cobble Silurian,

remnants of the characteristic brown cortex can still be seen on portions of the base. Tool #53 is made from a very good quality Joliet Silurian chert with a slightly different pattern and coloring.

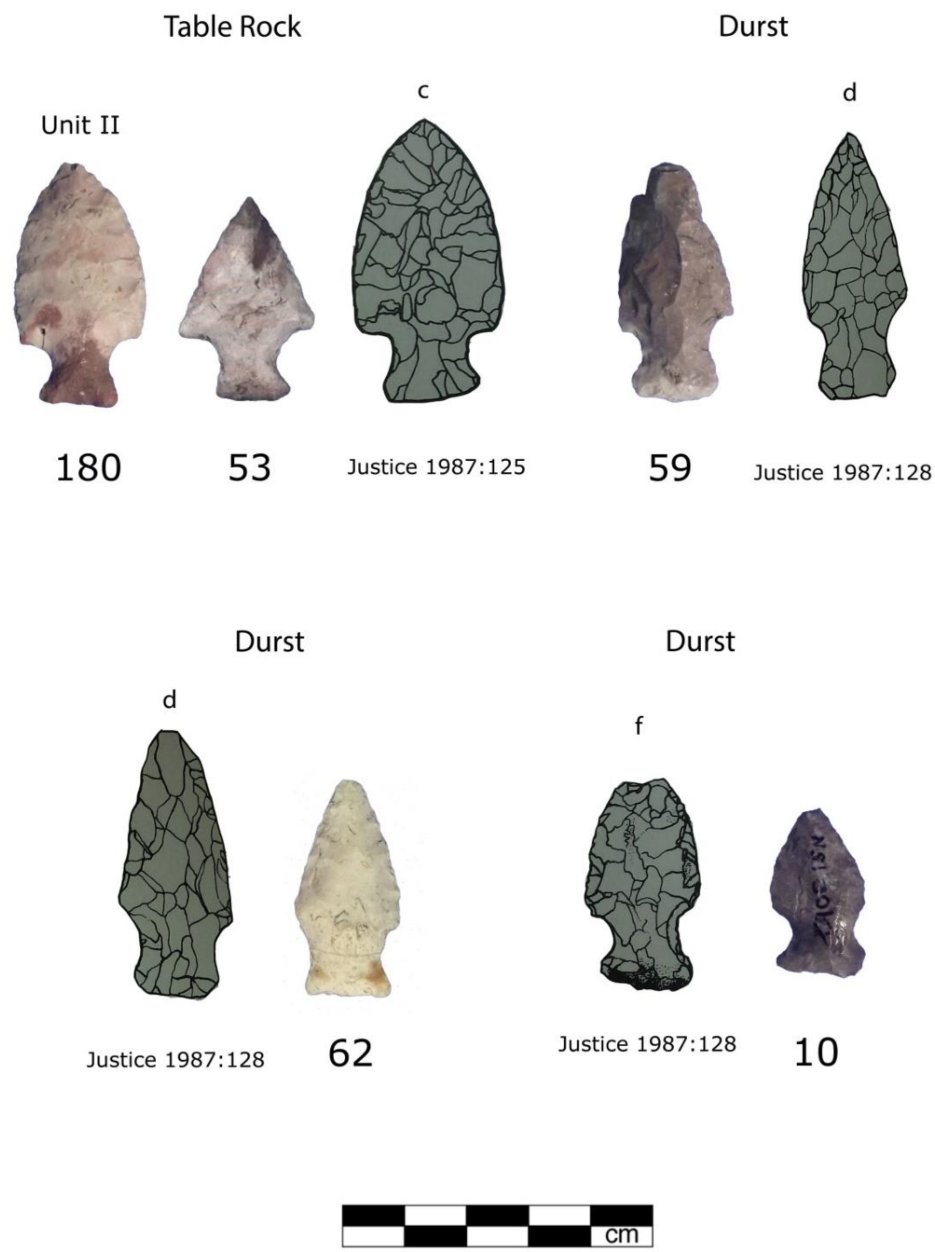


Figure 62. Late Archaic Table Rock and Durst cluster bifaces.

Morphologically, tools #180 and #53 share the similar neck and base style but differ slightly in maximum thickness, and more drastically in edge angle and blade shape (Table 39). Tool #180 is longer and more gracile than #53, it has excurvate blades, thinner cross-section, and more acute edge angle of 0-45 degrees. When compared to an example of this point cluster from Justice (1987:125-c), it is clear that tool #180 more closely resembles the example from southern Indiana than #53. Tool #53 instead is 6 mm shorter, has straight edges, a plano-convex cross-section, and an edge angle of >45 degrees.

Table 39. Metrics for Late Archaic bifaces.

Table 39. Metrics for Late Archaic bifaces								
Temporal Period	**Diagnostic Type**	**Kautz Length (mm)**	**Length Range (mm)**	**Kautz Width (mm)**	**Width Range (mm)**	**Kautz Thickness (mm)**	**Thickness μ or Range (mm)**	**Kautz Weight (g)**
Late Archaic	Bottleneck Stemmed	36.47	29 – 36[1]	21.75	20 – 25[1]	6.87	Jun-81	4.45
	Durst/Lamoka	35.05	38 – 47[1]	17.7	19 – 23[1]	6.89	Jun-71	3.08
	Merom/Trimble	32.09	19 – 36[4]	19.01	11 – 20[4]	6.56	4 – 8[4]	3.23
	Total Mean	33.92		19.17		6.72		3.5
Sources		**[1] Justice (1987); [2] Montet-White (1968); [3] Seeman (1992); [4]Winters (1969)**						

Overall the points from the Kautz assemblage are smaller than the average, likely a result of multiple alterations throughout their use-lives. When compared to samples from Justice (1987); the mean length, width, thickness and weight of the tools from Kautz do not fit well into the Table Rock examples from Missouri, they do fit into the metric range for the Bottleneck Stemmed group however (Table 39).

Lamoka/Durst

The Lamoka/Durst cluster is characterized by small, narrow, and thick forms with hafting elements that vary from expanding stem to straight stem with sloping shoulders (Justice 1987:126). The point cluster is believed to be Late Archaic but the date range is poorly

understood, partially because examples have been found throughout the southern Great Lakes including as far east as New York and Rhode Island and as far west as the Durst Rockshelter in western Wisconsin. Morrow (1984) dates the point cluster at roughly 1000-500 B.C. which is considered terminal Archaic, however, a very similar point cluster termed Lamoka, which is centered further east dates from 3500-2500 B.C. (Justice 1987:129).

There are three examples of the Durst cluster at Kautz, all three points (5, 10, 62) (Figure 62) differ to some degree. Tool #5 has a plano-convex to triangular cross section with a large hump on one side and the edges are very thin from being heavily reworked leaving a series of step fractures. Tool #62 has rounded edges and a biconvex cross-section and it too is heavily reworked. Tool #10 is much shorter than the other two examples and exhibits notches rather than shallow lateral notching typical of the type.

The average length, width, thickness, and weight of a Lamoka/Durst point at Kautz can be seen in Table 39 and lies within the normal range for this point type but is below average in width, possibly as a result of heavy reworking.

Two of the three Durst points were made from local Silurian chert, tools #5 was made from a fair quality material that was heat-treated and #62 was made from a good-quality Silurian and was likely unaltered by heat-treatment (Figure 62). Tool #10 was made from Pecatonica chert and was heat-treated heavily. Cortex was absent on all Lamoka/Durst points.

Two of the three Durst points were found in level 1, tool #5 was recovered in level 2. Tool #5 was found near the center of the site in excavation square 10E15N with an Early Woodland Motley point and eroded grit-tempered ceramics (Figure 61). Tool #62 was recovered in 5E40N along with one Lowe cluster point, 1 bladelet, 1 Raccoon Notched and 2 other tools.

Tool #5 was located in excavation square 25E0N with a large blade-like flake made from medium quality Pecatonica chert and a highly eroded cordmarked ceramic sherd.

Merom Cluster

The Merom cluster is roughly dated from 1600 to 1000 B.C. and is associated with the Riverton Culture, a complex hunting and gathering society that specialized in the collection of mussel shells in the Central Wabash River valley (Winters 1969). The point cluster is identified by its relatively small size, side notched to expanding stems, with triangular blades and unbarbed but well-defined shoulders (Figure 63). The cross-sections are typically biconvex to flat with very little basal grinding.

The mean length, width, and thickness of the five examples of Merom cluster points recovered from Kautz can be seen in Table 39. The mean length, width, and thickness fall within the normal range of Merom clusters points from Riverton sites in the Central Wabash Valley (Winters 1969). All five examples of Merom cluster points were recovered from Unit I, and four of the five bifaces are made from local raw material. Tool #'s 54, 55, and 63 are made from Joliet Silurian chert, tool #38 is made from Pecatonica chert, and tool #35 is made from Oneota chert. Tool #63 was likely over-exposed to heat based on the presence of minor pot-lidding, crazing, and a dramatic shift in color from a white-grey to dark red in some areas (Figure 63).

The four Merom Cluster points were found in excavation squares approximately 30 feet from one another (Figure 61). Three of the four points were found in the same excavation square, 25E40N, although tool #38 and #35 were found in level 2 and tool #55 was recovered in level 1. Tool #54 was recovered in level 1 of 5E15N and tool #63 was recovered in level 1 of 25E15S. The three Lamoka/durst points found in 25E40N were recovered along with 6 other tools

including two multifaces. Tool #54 was found along with 3 other bifaces including a broken Manker point made from Wyandotte chert. Tool #63 was recovered with two other bifaces including one Late Woodland Lowe expanding stemmed biface.

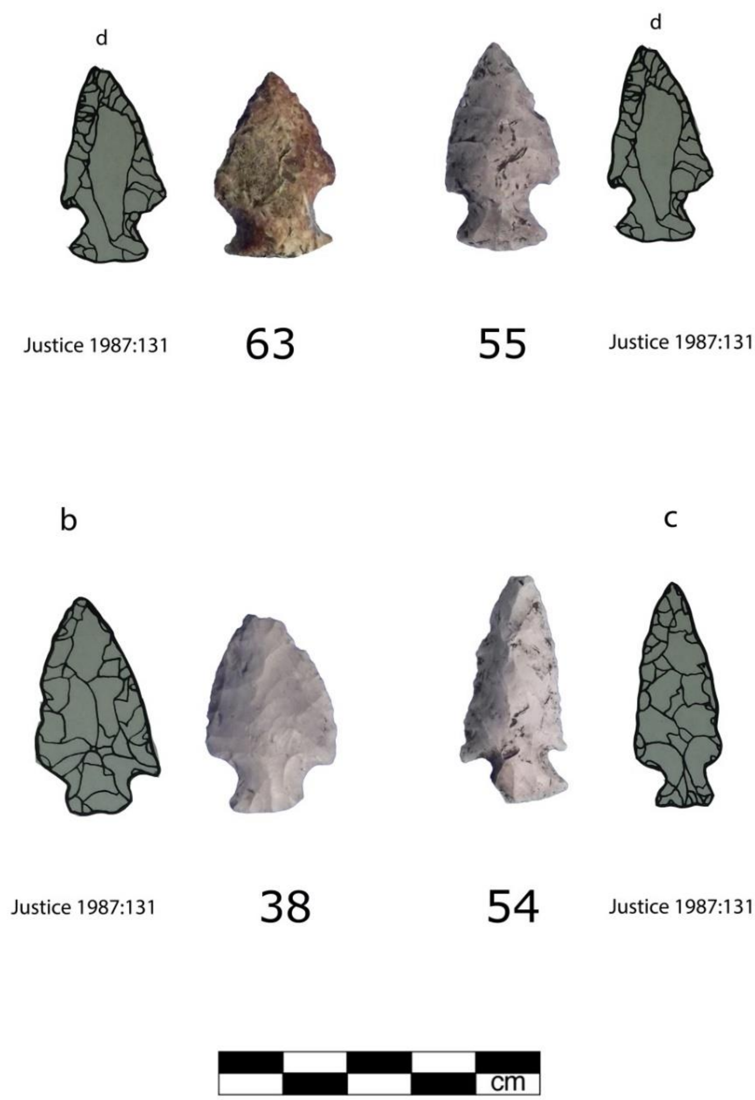


Figure 63. Late Archaic Merom cluster bifaces.

Early Woodland Period

The Early Woodland period (800 B.C. – 250 B.C.) is represented at the Kautz site by three Contracting Stemmed bifaces and two Motley Cluster points (Figure 64).

Contracting Stemmed

The Contracting Stemmed biface marks the transition to the Early Woodland period in Illinois circa 500 B.C. The point type continued to be used in conjunction with notched bifacial forms until roughly A.D. 200. The contracting stem likely originated further south during the Early Woodland period and is associated with Adena populations in Ohio and southern Indiana as early as 800 B.C. (Justice 1987). In the upper Midwest the form has been termed Mason, (Montet-White 1968) and Waubesa (Perino 1971) and is typically associated with thick, heavy grit and grog-tempered Early Woodland ceramics such as Marion Thick as well as later ceramic traditions like Black Sand and Havana.

Characteristic features of this point type include a lanceolate form with even excurvate blades and well ground ovate-base and tapered-stem. The stems are well formed and often exhibit weak side notches or indentations below the shoulder which gives the stem an overall rounded appearance (Justice 1987). The contracting stem is thought to have served to economically combine foreshaft and dart tip attributes designed to facilitate removal from the shaft in order to remain in the target and cause maximum damage and blood-loss (Boszhardt 2002).

Morphologically, tools #67 and #36 resemble the example (#1) from the Havana Site (Montet-White 1968), while tool #176 is slightly different the shorter stem may be a sign of reworking after the original base was broken (Figure 64).

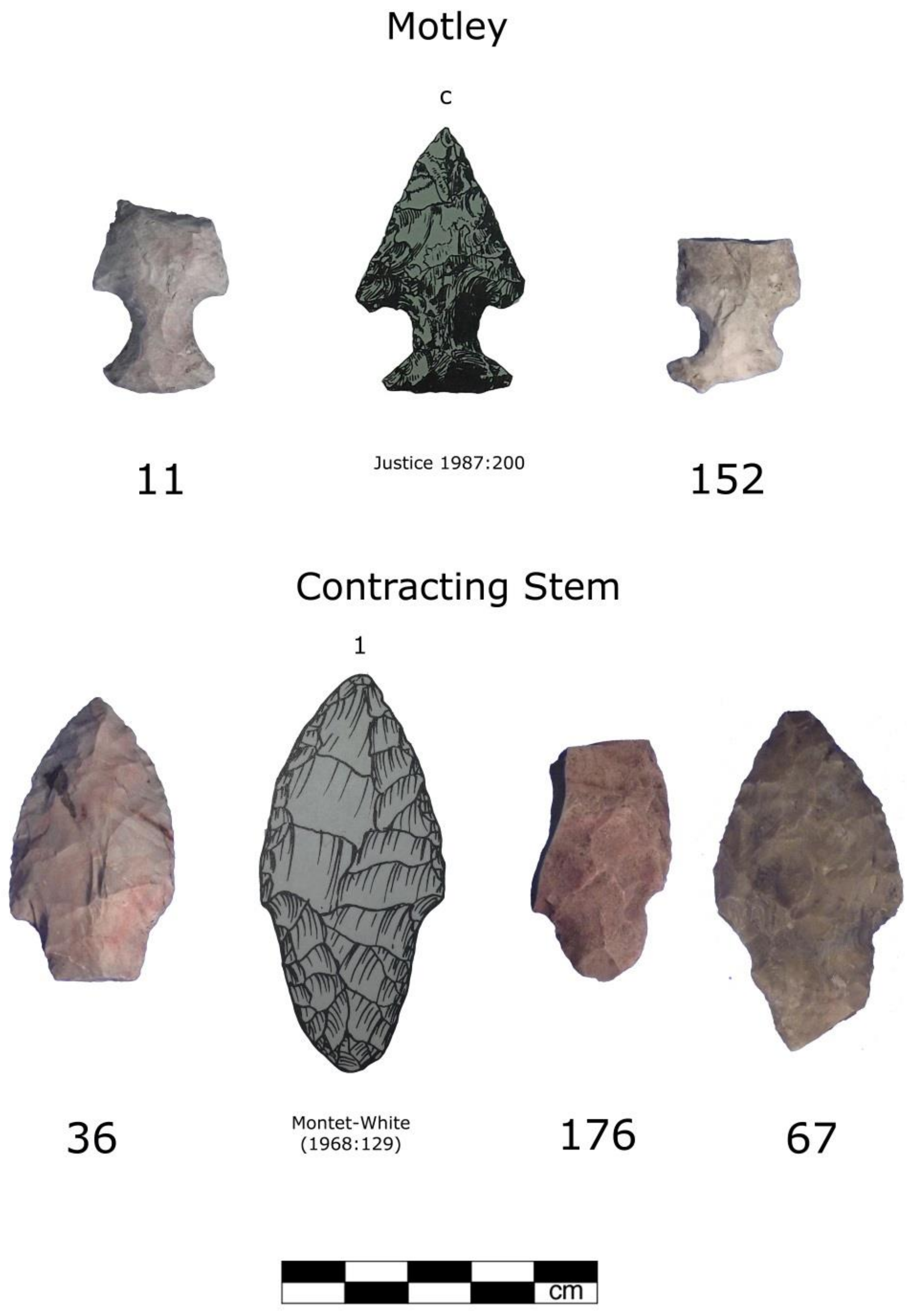


Figure 64. Early Woodland Motley and contracting-stem bifaces.

All three contracting-stem bifaces from the Kautz site are broken to some extent, therefore only width and thickness measurements could be obtained. The average length, width, and thickness of this point type varies considerably, for example max length can vary up to 116 mm and width can vary up to 26 mm (Justice 1987) (Table 40).

Table 40. Metrics for Early Woodland bifaces.

Table 40. Metrics for Early Woodland bifaces								
Temporal Period	**Diagnostic Type**	**Kautz Length (mm)**	**Length Range (mm)**	**Kautz Width (mm)**	**Width Range (mm)**	**Kautz Thickness (mm)**	**Thickness μ or Range (mm)**	**Kautz Weight (g)**
Early Woodland & Middle Woodland	Motley		42 – 120[1]	22.3	25 – 46[1]	6.35	5.81	2.56
	Waubesa Contracting Stemmed		μ = 70.5[2]	28.21	μ = 33.7[2]	9.32	μ = 8.96[3]	
	Total Mean			26.24		8.33		2.56
Sources		**[1] Justice (1987); [2] Montet-White (1968); [3] Seeman (1992); [4]Winters (1969)**						

All three bifaces are made from good quality material, and at least two of the bifaces are made from non-local or exotic chert. Tool #36 is made on Burlington chert, material used commonly throughout the lower Illinois River Valley (Geraci 2011; Rick 1978). Tool #67 (Figure 64) is made from Cobden chert another high-quality material found within Havana assemblages in the lower Illinois River valley. Other tools made from Cobden at this site include Tool #144 and #163 which are both small flake tools.

Contracting-stem bifaces are well-distributed horizontally throughout the site (Figure 61), and were also found in all three levels. Tool #67, the large Cobden contracting stemmed biface in Figure 52 was recovered in Level 1 of 5W10N along with one edge only tool and two other bifaces. Tool #36 was recovered in level 2 of excavation square 25E5N in association with tool #12 a complete and well-made Manker point. Tool #176, a contracting-stem biface with a very

short and thin basal element with round edges was recovered in level 3 of 40E40N by itself (Figure 61).

Motley Cluster

The Motley cluster also dates to the Early Woodland period in Illinois. This hafted biface form is characterized by deep corner notches and straight to slightly convex blade edges. The notching is wide and rounded, leaving a narrow neck and wide shoulders. The basal edge on these forms varies from straight to convex, and the flaking quality is refined with large bifacial thinning flakes producing a biconvex to flattened cross-section. This hafted biface form is easily confused with later Snyders and Manker Corner Notched bifaces however due to a more narrow and lanceolate preform the stem of the Motley cluster is longer and more narrow than later bifaces. Motley points are primarily found in the southern portion of the Mississippi River valley and surrounding areas, however they were recovered from the Twenhafel site in southern Illinois and may have had morphological correlates in northern Illinois or were obtained through trade with groups living in southern Illinois (Justice 1987, pp. 198-199).

At the Kautz site, two Motley bifaces (#11 and #152) were recovered from separate excavation squares in Unit 1. Tool #11 was recovered in Level 2 of 10E15N along with a Late Archaic Merom Cluster point, bifacial tool fragments, and an exhausted core fragment (Figure 61). Tool #152 was found in level 1 of 25E45N, along with the base of a Lowe Cluster biface and zoned, dentate stamped Havana ware.

The Motley bifaces seem to have been moderately reworked before discard, tool # 152 was reworked more than #11 resulting in an edge angle steeper than 45 degrees. Tool #11 is broken and only the proximal or hafted portion was recovered, the broken edge was not

reworked and displays an obvious hinge fracture, possible evidence of an impact fracture of failure due to a prying action (Figure 64). Both Motely points were made from good-quality local Joliet Silurian chert. The average length, width, and thickness of a Motley biface comes from examples from Poverty point and may not be the best for comparison, however according to Ford and Webb (1956) in Justice (1987), the metrics range from 42-120 mm in length, 25-46 mm in width, and 5-8 mm in thickness (Justice 1987) (Table 40). Both of the Motley bifaces from the Kautz site are broken, only width and thickness of tool #11 could be recorded with any confidence.

Middle Woodland Tools

The Middle Woodland period (250 B.C.-A.D. 500) is represented at the site by various types of points from the Affinis Snyder cluster including Norton, Gibson, and Manker as well as bladelets and blade-like flakes (Figure 65).

Norton corner-notched

The Norton corner-notched point is made from a sub-ovate preform and is a long and narrow blade with narrow notches oriented diagonally toward the long axis of the blade. The notching flakes are detached from the corner of the base, similarly to that of the typical Snyders point. This mode of notching is thought to be a way to obtain a medium-sized stem from a wide platform (Montet-White 1968).

One Norton Corner Notched point was recovered in level 2 of 15E40N along with two other bifacial tools (Figure 61). In the square immediately to the west a large sherd of smoothed over cordmarked pottery and a very small Raccoon Notched point were recovered and in the

square immediately north of this point a Manker corner notched and smoothed over cordmarked pottery were found.

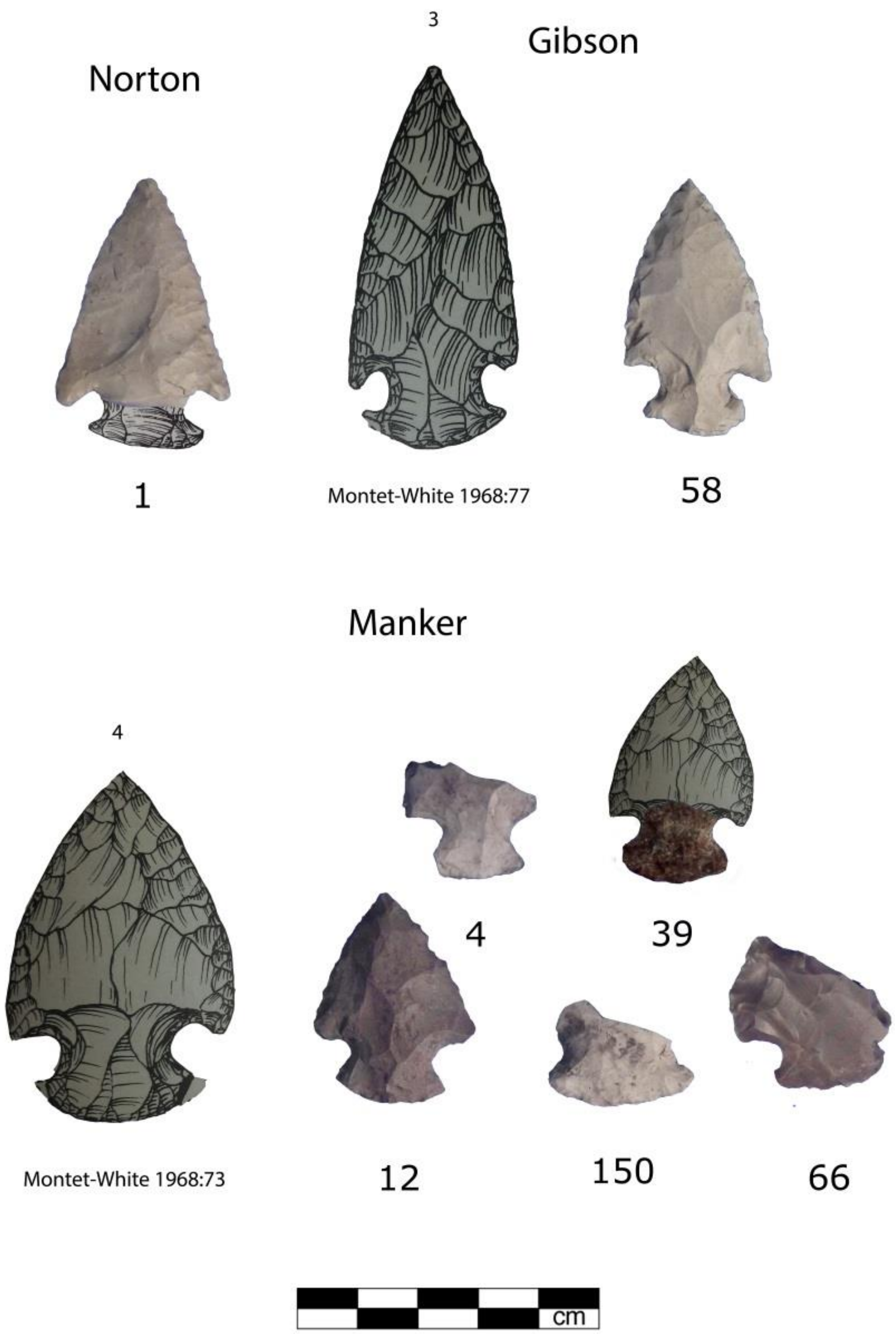


Figure 65. Middle Woodland bifaces

The Norton point is made from good-quality Galena chert that has been intentionally heat-treated. The base was broken off in a slight hinge fracture. A base from an example taken out of Montet-White (1968) was substituted to show what the point would have looked like whole (Tool #1, Figure 65). Compared to the type sample the maximum width of the Kautz example is far below the average. No other dimensions were possible to compare (Table 41).

Table 41. Metrics for Middle Woodland bifaces

Table 41. Metrics for Middle Woodland bifaces								
Temporal Period	**Diagnostic Type**	**Kautz Length (mm)**	**Length Range (mm)**	**Kautz Width (mm)**	**Width Range (mm)**	**Kautz Thickness (mm)**	**Thickness μ or Range (mm)**	**Kautz Weight (g)**
Middle Woodland	Norton		μ = 72.8[2]	32.09	μ = 41.4[2]	5.83		
	Manker		μ = 53.8[2]	22.88	μ = 42.2[2]	7.09		
	Gibson	46.29	μ = 62.2[2]	26.9	μ = 30.6[2]	5.97		6.62
	Total Mean	38.77		21.14		5.49		5.81
Sources		**[1] Justice (1987); [2] Montet-White (1968); [3] Seeman (1992); [4]Winters (1969)**						

Gibson

The Gibson point was named by Scully (1951) from a set of seven points found in association with burials in Gibson Mounds (Justice 1987). The blade is subtriangular with convex to straight lateral edges and a round base. The thickest point on the blade is typically between the two notches, notching flakes are removed obliquely to the longitudinal axis, from the proximal ends of the lateral edges (Montet-White 1968). There are many variants within this form, likely due to the changing morphology as a result of a normal life-cycle.

The one Gibson point (Tool #58) recovered at Kautz is made from good-quality Joliet Silurian chert (Figure 65) and was located in level 1 of excavation square 5E35N along with a fist-size multifacial core of similar material (Figure 61). In the square just north of 5E35N a bladelet made from Burlington chert and several other hafted bifaces including a Steuben

expanding stemmed point were found. The Gibson point is broken and therefore only max width and thickness were recorded. The example from Kautz is also on average much smaller than examples found within Gibson Mounds (Table 41).

Manker corner-notched

Manker corner-notched is a smaller, less refined counterpart to the typical Snyders point. It shares many similarities with the Snyders point such as an ovate preform, even convex lateral edges, expanding stem, and long, well-marked barbs with deep corner notches.

All but one of the Manker points were broken to some extent (Figure 65) and as a result, only width and thickness were recorded for each of these points (Table 41). Manker points were made on both local and non-local materials. Three of the five Manker points were made from local material. Two of the points were made from Joliet Silurian chert, tool #4 was over-exposed to heat and tool #150 was likely intentionally heat-treated. Tool #39 is made from Pecatonica chert and was likely intentionally heat-treated although it is possible that it was also over-exposed based on the drastic color change. Tool #12 and #66 are made from non-local material; #66 is made from unaltered good-quality Wyandotte chert and exhibits no obvious signs of heat-alteration and #12 is made from heat-altered Galena. Wyandotte chert is a good-quality material and most likely did not need to be altered to improve flakeability, plus the chert does not do well when exposed to heat which likely explains why there is no evidence of heat-treatment.

Five examples of Manker points were recovered from Unit 1 at the Kautz site. The Manker points were found in different excavation squares and are generally well-distributed throughout the site (Figure 61). Tool #4 was located in level 2 of excavation square 0E45N along with 2 other bifaces and 1 multiface, and significantly all tools were altered to some degree by

heat. Tool #39 was recovered in level 2 of 10E25N in association with one uniface and four other bifaces including a Raccoon Notched point, Lowe Expanding Stemmed point, and an unifacially retouched flake. Tool #150 was located in level 1 of 15E45N, one bladelet and one piece of cordmarked pottery were recovered in level 2 of the same unit. Tool # 12 was located in level 2 of 25E5N in association with one Waubesa Contracting Stemmed point and a cordmarked body sherd. Tool #66 was recovered in level 1 of 5E15N with three other bifaces including a Merom Expanding Stemmed biface and 1 unidentified tool.

Bladelets and Blade-like flakes

The term bladelet used in this thesis follows Jeske and Brown (2013) and refers to a specific flake tool manufactured from a specially prepared core. Bladelets are typically twice as long as they are wide and have parallel edges and at least one ridge running the length of the dorsal surface of the piece (Montet-White 1968). Bladelets have been referred to in the literature a number of different ways including cutting tools (Squier and Davis 1848), ribbon knife, flake knife (Struever 1968), blade (Pi-Sunyer 1965; Montet-White 1968; Odell 1994), and lamellar flake (McGimsey et al. 1986). Using the term bladelet instead of blade, cutting tools, ribbon knife, or lamellar flake serves to remove any functional connotation and distinguish the tool form from the cutting edge of a bifacial tool

Bladelets can be produced from several different types of cores. In Ohio, the Goslin core type can be found in seven different variations (Harkness 1982), which seem to be influenced more by the shape of the raw material than a particular reduction method (Nolan et al. 2007). In the American Bottom, Fortier (2001) identified eight different variations of cores at Dash Reeves: prismatic, semi-conical, cuboid, tabular, wedge, ball, multidirectional, and nucleated.

Blade-like flakes are similar to bladelets in general morphology but differ in the method of production and are typically less uniform (P. J. Carr et al. 2012; Slain and Goodyear III 2012). They can be removed from bipolar cores, biface preforms, or other free-hand cores. Tool #'s 9-85 are formal bladelets removed from a specially prepared core and tool #'s 113, 158, and 167 were likely removed opportunely from a bifacial or amorphous core (Figure 66).

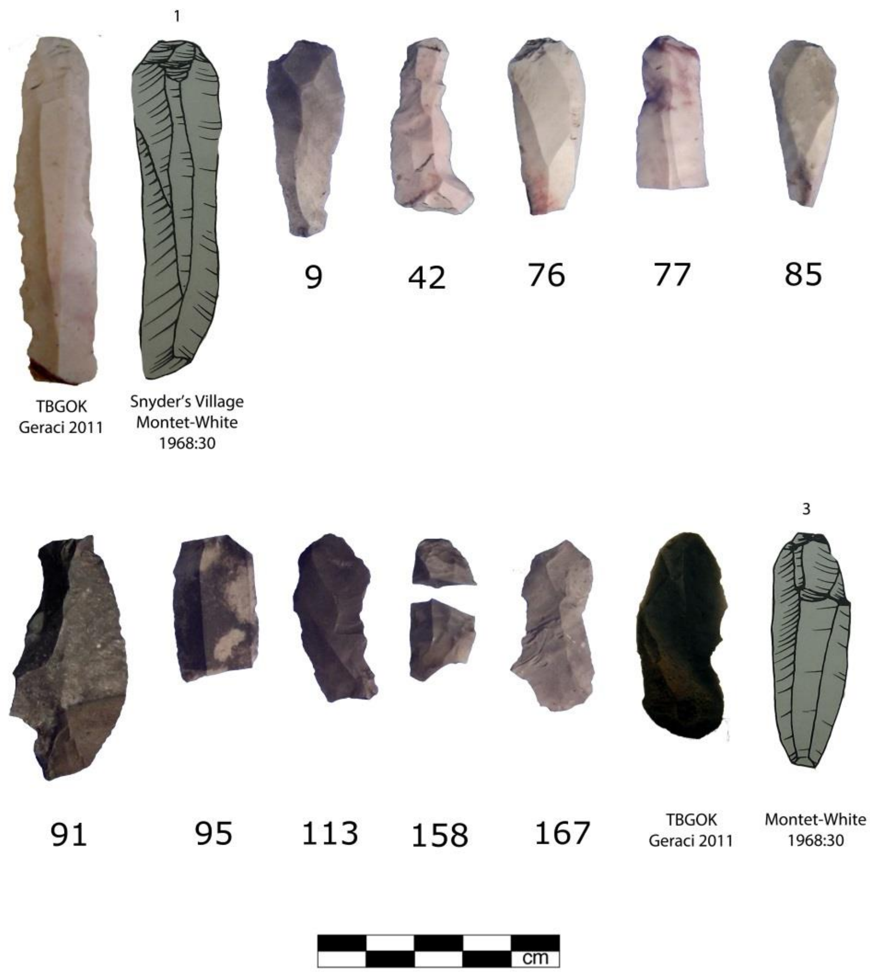


Figure 66. Bladelets and blade-like flakes.

Bladelets and blade-like flakes are hallmarks of the Havana Hopewell horizon, the technology had a wide distribution within the Hopewell Interaction Sphere and have been found in many different social contexts (Odell 1994). Use-wear analysis has shown that bladelets were used for a variety of tasks. The smooth and straight clean edge of bladelets were preferred but some edges were purposely retouched, or notched, and intentional lateral snapping may have been a way to produce more tools and more working edges (Genheimer 1996; Geraci 2011; Jeske 1989; Jeske and Brown 2013; Odell 1985; Yerkes 1990, 2003).

The bladelet and blade-like flakes from the Kautz site were very fragmented and only a handful of the blades were complete enough to record all metrics (Table 42). Tool #91 is an outlier in the group and is on average much larger than any other bladelet, this may be because this tool is not a formal bladelet or it perhaps is one of the initial flakes removed from the core.

Table 42. Metrics for the Kautz Site bladelets.

Table 42. Metrics for the Kautz Site bladelets				
Tool #	**Length (mm)**	**Width (mm)**	**Thickness (mm)**	**Weight (g)**
9	41.8	16.98	4.09	2.35
42		17.07	4.67	
76		16.25	2.48	
77		14.55	3.31	
85	25.45	15.42	3.71	1.9
91	49.31	24.08	4.88	5.06
95		17.71	4.91	
113	47.3	37.64	13.65	2.21
158	25.14	13.79	3.1	1.21
167	36.09	17.67	2.89	1.43
Mean	**37.52**	**19.12**	**4.77**	**2.36**

The bladelets from Kautz are slightly wider and thicker than the average at many other Middle Woodland sites, however the assemblage is very small in comparison with other sites that have been studied so very little can be confidently said about the overall size of these tools (Table 43).

Table 43. Bladelet metrics from Middle Woodland sites compared to Kautz.

Table 43. Bladelet metrics from other Middle Woodland sites					
Site	**Location**	**Length (cm)**	**Width (cm)**	**Thickness (cm)**	**Source**
Dash Reeves	Am. Bottom	2.71	1.24	0.31	Fortier (2001)
Holding	Am. Bottom	3.67	1.61	0.42	Fortier (2001)
Twenhafel	So. Illinois	3.57	1.69	0.38	Fortier (2001)
Mound City	Ohio	4.61	1.53	0.039	Jeske and Brown (2013)
McGraw	Ohio	3.96	0.97	0.22	Fortier (2001)
Trowbridge	Kansas City	4.22-4.8	1.39-1.73	0.34-0.5	Fortier (2001)
Fisher-Gabert	Missouri	4.03	1.35	0.33	Fortier (2001)
Snyders	Lower IL	4.87	1.83	0.38	Fortier (2001)
TBGOK	Lower IL	4.08	1.52	0.37	Geraci (2011)
Kautz	**NE IL**	**3.75**	**1.91**	**0.47**	**Geraci (2016)**

Bladelets were made from a variety of materials, but a large proportion of the bladelets were made from non-local Burlington chert and are also the most similar morphologically to examples found at sites like Snyders Village and The Buried Gardens of Kampsville in the lower Illinois River Valley (Figure 66). Interestingly, the bladelets examined by Jeske and Brown (2013) at Mound City more closely resemble those found at Kautz and other Illinois Hopewell sites than nearby Ohio Hopewell sites like Liberty Earth Works, Garden Creek Mound 2, and Turner (Nolan et al. 2007). The remaining bladelets were made from good quality local materials such as Pecatonica and Joliet Silurian. Interestingly, although other Hopewell Interaction Sphere materials like Cobden and Wyandotte are present in the Late Archaic assemblage, they are not present within the Middle Woodland bladelet assemblage.

The ten bladelets from this assemblage were recovered from seven excavation squares and were largely found within level 1, although a couple were recovered in level 2 (Figure 61). Excavation squares with more than one bladelet include 10E5N and 0E10N, significantly all three of the bladelets from 10E5N were made from Burlington chert. Bladelets were found in association with other tools such as bifaces, flake tools, a Lamoka/Durst point, and Lowe cluster bifaces as well as a cordmarked and dentate stamped ceramic sherd.

Terminal Middle Woodland and early Late Woodland Period Tools

Lowe Cluster Bifaces

The bifaces in Figure 67 represent the poorly understood time period between A.D. 250-700 (Justice 1987). The bifaces are corner notched then retouched along both of the lateral margins creating their characteristic expanding stem. The base can vary from convex to straight and frequently exhibit basal flake scars directed towards the center of the blade. The earlier versions of this point type typically have straight-sided stems, while later versions tend to be much smaller with wide and flaring stems. On average the Lowe Cluster bifaces from the Kautz site are small (Table 44), although Tool # 6 and 8 have normal proportions and if there were two occupations they would have been discarded during the terminal Middle Woodland period based on their similarity with examples from Montet-White (1968).

Eight out of twelve Lowe Cluster bifaces were made from local materials (Figure 67). Six of the bifaces were made Joliet Silurian chert (14, 37, 57), two were made from Beach Cobble (6, 8) and four were made from Pecatonica (60, 61), which may be a quasi-non-local chert. Several points were heat-treated (122, 153) and cortex was present on one (6). Lowe Cluster bifaces have a very wide distribution throughout the Unit and were found in association with Raccoon Notched points, bladelets, Durst points, cordwrapped stick impressed ceramics, and a Snyder point (Figure 61).

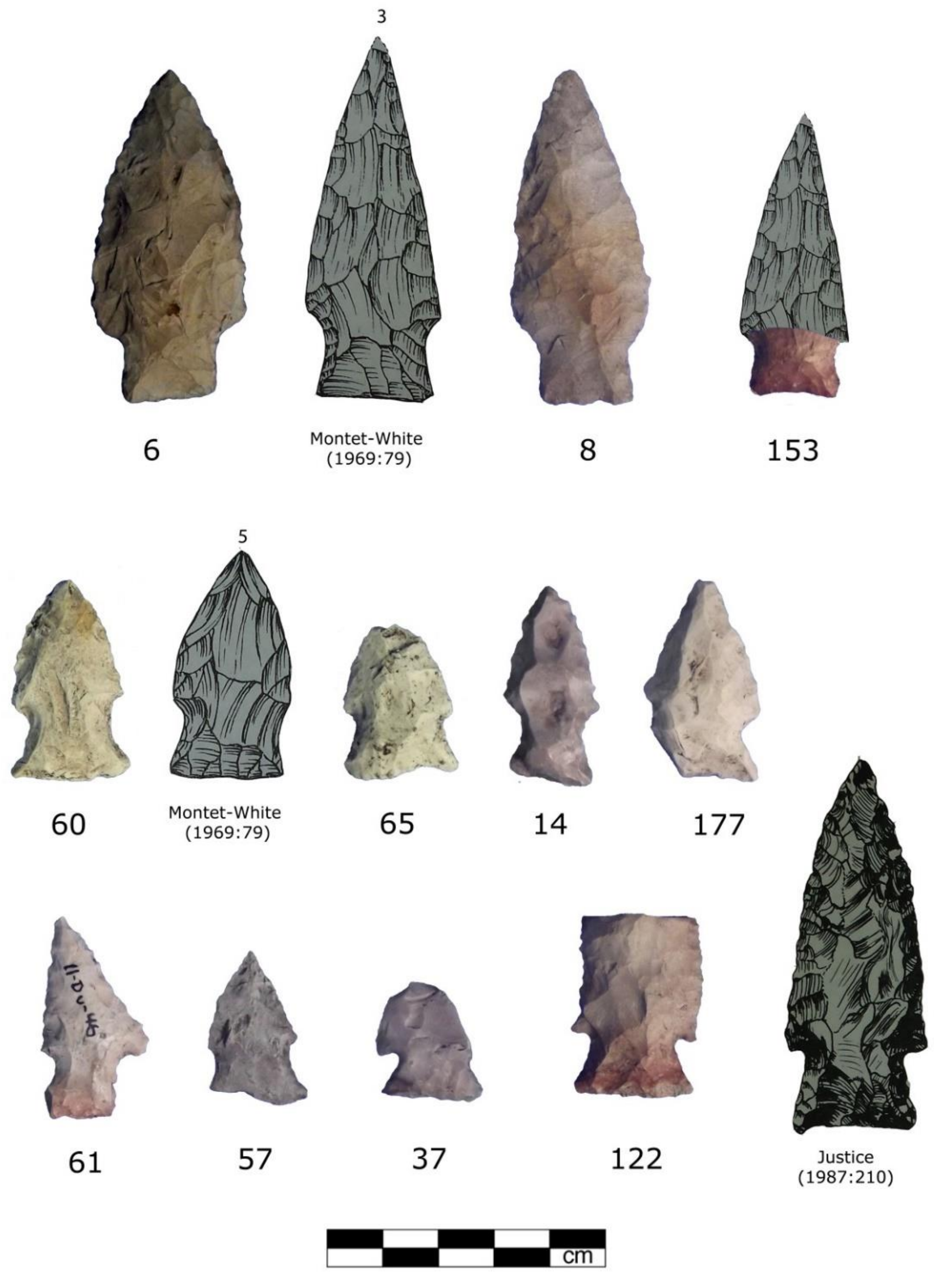


Figure 67. Lowe Cluster bifaces

Table 44. Metrics for Lowe cluster bifaces

Table 44. Metrics for Lowe cluster bifaces								
Temporal Period	**Diagnostic Type**	**Kautz Length (mm)**	**Length Range (mm)**	**Kautz Width (mm)**	**Width Range (mm)**	**Kautz Thickness (mm)**	**Thickness μ or Range (mm)**	**Kautz Weight (g)**
Middle and Late Woodland	Lowe Cluster	40.06	30 - 77[1]	21.77	16 - 28[1]	6.67	5.81	5.95
	Total Mean	40.06		21.77		6.67		5.95
Sources		**[1] Justice (1987); [2] Montet-White (1968); [3] Seeman (1992); [4]Winters (1969)**						

Late Woodland and Upper Mississippian Periods

The terminal Late Woodland and Upper Mississippian periods (A.D. 700-1500) are represented at the Kautz Site by small side notched points such as Raccoon Notched and unnotched Madison Triangular points (Figure 68).

Jack's Reef Cluster

Three Raccoon Notched points from the Jack's Reef Cluster were recovered in Unit I at the Kautz Site. The Jack's Reef Cluster is composed of two varieties, Jack's Reef and Raccoon Side Notched. Raccoon Notched points are thin, broad, and lightweight projectile points with side notches that tend to be square in shape creating characteristic squared ears. Jack's Reef points are more pentagonal in shape and are typically corner notched (Evans and Fortier 2013). The base can be either straight or concave and the basal edge lacks grinding typical of Archaic dart points (Justice 1987). The average metric attributes of a Raccoon Notched point can be seen in Table 45 and are significantly smaller than previous technologies such as the Lowe Cluster points. This difference in overall size marks the introduction of the bow and arrow in some areas (Evans and Fortier 2013; J. E. Kelly et al. 1984; Seeman 1992).

Dates for this point type range from cal. A.D. 650 to 900 in the American Bottom (Evans and Fortier 2013). Examples from this point cluster were found at the bottom of a pit at a Sponemann site in the Vaughn Branch locality that dates to a calibrated date of 565-665 B.C. (Evans and Fortier 2013). The dates suggest early adoption sometime before cal. A.D. 650 which closely mirror those previously compiled for the Intrusive Mound Complex in the Scioto valley ca. 700-900 (Keenlyside 1978 in Seeman 1992).

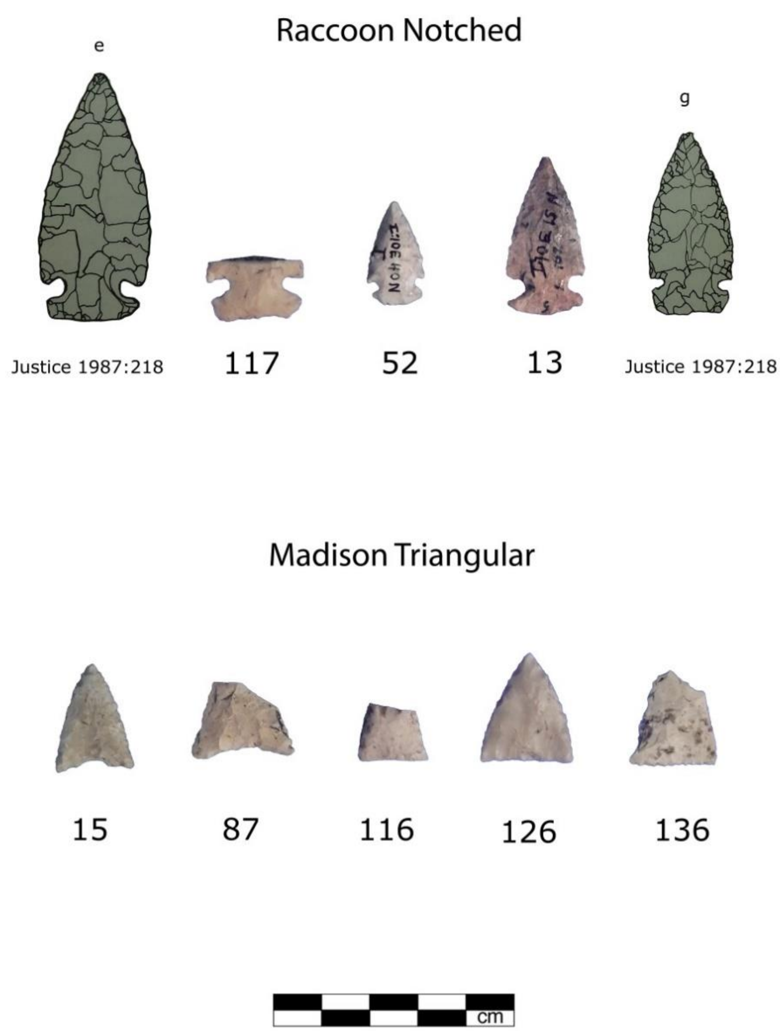


Figure 68. Raccoon Notched and Madison Triangular points.

The three Raccoon Notched points in the Kautz assemblage share similar notching schemes but vary in length and width (Figure 68). On average, the Raccoon Notched points from the Kautz Site are smaller than those found at other sites in the Midwest but the sample is too small to make any declarative statements. Tool # 52 (Figure 68) is less than 2 cm in length, about half of the average length from a sample of 39 points measured by Seeman (1992). It is not outside of the standard deviation, however it is on the very short end of the spectrum (Figure 69). Interestingly the variance in Raccoon Notched point length in his sample was about 1 cm, which, if we extract the length of Tool # 117, is about the same at the Kautz Site.

Table 45. Metrics for Raccoon Notched points.

Table 45. Metrics for Raccoon Notched points								
Temporal Period	**Diagnostic Type**	**Kautz Length (mm)**	**Length Range (mm)**	**Kautz Width (mm)**	**Width Range (mm)**	**Kautz Thickness (mm)**	**Thickness μ or Range (mm)**	**Kautz Weight (g)**
Late Woodland	Raccoon Notched	30.22	μ = 39.62[3]	20.79	μ =24.50[3]	7.07	μ = 5.25[3]	5.17
	Total Mean	30.22		20.79		7.07		5.17
Sources		**[1] Justice (1987); [2] Montet-White (1968); [3] Seeman (1992); [4]Winters (1969)**						

RACCOON NOTCHED (N = 39)

Variable	Mean	Std. Dev.	Variance	Std. Error of Mean	Skewness	Kurtosis
Length (mm)	34.53	9.61	92.32	1.54	.67	2.34
Width	20.44	1.90	3.62	.30	.05	2.18
Thickness	4.87	.55	.30	.09	.27	2.89
Notch width	12.07	1.68	2.82	.27	.39	2.55
Weight (gm)	3.20	1.01	1.01	.16	.30	3.23

Figure 69. Metrics from other Raccoon Notched points in the Midwest (Adapted from Seeman 1992).

Raccoon Notched points are concentrated in the center of Unit I (10E25N, 10E40N, 5E40N). They are associated with Middle and Late Woodland artifacts as well as a Late Archaic point (Figure 61). 10E25N and 10E40N also happen to be the excavation squares with the highest densities of debitage. All three points were made from local Joliet Silurian chert. Two of the Raccoon Notched points exhibit unnatural reddish hues which suggest a sign of heat-treatment. Cortex was not present on any of these points, although the quality of the material used to make Tool # 13 is coarse, as if it was made from material near the chalky cortex.

Madison Triangular points

A total of five Madison Triangular points were recovered from Unit I (Figure 68). Madison Triangular points are essentially straight to excurvate sided triangular arrowheads with straight to concave bases. The edges are typically smooth but at times display retouch for a serration effect. Cross sections are variable and range from lenticular, biconvex, to plano-convex or flat (Justice 1987). The metrics of this point cluster varies but in Illinois at least, they tend to be shorter and thinner (M. Evans et al. 2013; Jeske 1992). The Madison points from the Kautz Site fit the expected metrics presented by Justice (1987) (Table 46). All five points were made from Joliet Silurian chert and all five were heat-treated to some extent (Figure 68). Madison Triangulars were found throughout the unit and were found in association with artifacts dating from the Late Archaic through the Late Woodland period (Figure 61). Surprisingly, no Humpback bifaces were identified in the assemblage, despite the presence of bipolar core reduction and Madison Triangular points found at nearby sites like Oak Forest and Washington Irving (Jeske 1992).

Table 46. Metrics for Madison Triangular points.

Table 46. Metrics for Madison Triangular points								
Temporal Period	**Diagnostic Type**	**Kautz Length (mm)**	**Length Range (mm)**	**Kautz Width (mm)**	**Width Range (mm)**	**Kautz Thickness (mm)**	**Thickness μ or Range (mm)**	**Kautz Weight (g)**
Late Woodland and Up. Miss	Madison Triangular	22.96	17 - 33[1]	19.89	12 - 21[1]	3.82	3.61	1.33
	Total Mean	22.96		19.89		3.82		1.33
Sources		**[1] Justice (1987); [2] Montet-White (1968); [3] Seeman (1992); [4]Winters (1969)**						

A Chi-square analysis was conducted in order to determine if there is a relationship between the use of local/non-local material and temporal period. The results of the test reveal that there is a statistically significant relationship between the use of local/non-local materials and the temporal period in which they were made X^2 (18.362, N = 51, p = .003) (Table 47, Table 48). The results also show that Early Woodland and Middle Woodland period artifacts are more likely to be made from non-local materials than local materials and no lithic artifact dating to the Late Woodland period or younger was made from non-local chert. One explanation for this difference in raw material use is that a combination of socioenvironmental factors such as increasing population pressure, reduced mobility, and new subsistence methods made traditional methods for acquiring raw material maladaptive, thus requiring new methods of procurement and use such as bipolar technology and the incorporation of lower quality but more abundant local materials (Jeske 1992).

Table 47. Crosstabulation of raw material locality and temporal period.

Table 47. Crosstabulation of raw material locality and temporal period									
			Temporal						
			Late Archaic	Early Woodland & Middle Woodland	Middle Woodland	Late Woodland	Middle and Late Woodland	Late Woodland and Up. Miss	Total
Local	Yes	Count	7	1	4	3	8	5	28
		Expected Count	4.9	2.7	9.3	1.6	6.6	2.7	28.0
	No	Count	2	4	13	0	4	0	23
		Expected Count	4.1	2.3	7.7	1.4	5.4	2.3	23.0
Total		Count	9	5	17	3	12	5	51
		Expected Count	9.0	5.0	17.0	3.0	12.0	5.0	51.0

Table 48. Results of the Chi-square tests for raw material locality and temporal period.

Table 48. Results of the Chi-square tests for raw material locality and temporal period			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18.362[a]	5	0.003
Likelihood Ratio	21.845	5	0.001
Linear-by-Linear Association	2.869	1	0.090
N of Valid Cases	51		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is 1.35.

Discussion

The results of the lithic analysis found very little evidence to support the hypothesis that there was a primary source of good-quality raw material within 10 kilometers of the site. It was hypothesized that if there was a primary source of good-quality chert within the 10-km catchment then there should be no evidence of short-term economizing strategies. The analysis found numerous examples of economizing utilized at the site reflected in the heavy reliance on bifacial technology and the high frequency of reworking identified on those bifaces, the lack of evidence for primary reduction reflected in the dearth of large flakes with flat or cortical platforms and lack of cortex, and the use of bipolar reduction on lower-quality chert representing

an increase in resource breadth. The practice of hoarding may be present at the site in the form of several bifacial preforms recovered at the site and the practice of protection can be seen in the use of non-local materials for economic tools like bifaces and bladelets.

Other lines of evidence rejecting the hypothesis that a primary source was available within the 10-km catchment include the large proportion of refined bifaces and very little early stage reduction flakes, lack of cortex on debitage and tools, and the fact that multifacial cores were more likely to made from lower quality material than good-quality material.

The results did find some evidence to support the thesis such as the fact that there was no significant relationship between raw material quality and basic tool form which rejects the hypothesis that good-quality chert was used for different purposes that poorer-quality material. Another fact is that Joliet Silurian, the most common material found at the site, was more likely to have cortex present than other cherts, meaning that the material must not have been obtained so far away that cortex was completely removed in all contexts.

The analysis of the diagnostic tools provided information about economic strategies over time as well as provided a means to compare size across the region and identify contemporary sites within the region. I identified twelve distinct diagnostic tool types belonging to four major temporal periods including the Late Archaic, Early Woodland, Middle Woodland and Late Woodland periods. It is possible that there may be a Mississippian component to this site, however evidence is lacking. A number of triangular bifaces were recovered but other Mississippian cultural material such as humpback bifaces and shell-tempered pottery are absent. The analysis of the diagnostics also found that Late Woodland tools were the most abundant in the assemblage. If Late Woodland types such as Lowe Cluster, Jack's Reef Cluster, and Madison

Triangulars are combined under a single temporal period, they compose 40% of the diagnostic assemblage.

The results of the analysis found that overall tools from the Kautz Site are on the small side. Most tools found on site were shorter, thinner, narrower, and less heavy than their counterparts in regions where raw material was much more available like the Illinois and Spoon River valleys. Raw material procurement strategies seem to have changed over time as well. The analysis found that the use of non-local materials was common throughout the Late Archaic, Early Woodland and Middle Woodland periods, however during the Late Woodland period, the use of non-local material ceased. One explanation for this difference in raw material use is that a combination of socioenvironmental factors such as increasing population pressure, reduced mobility, and new subsistence methods made traditional methods for acquiring raw material maladaptive, thus requiring new methods of procurement and use such as bipolar technology and the incorporation of lower quality but more abundant local materials (Jeske 1992). The use of non-local cherts during the Late Archaic, Early Woodland and Middle Woodland periods is likely representative of inter-regional trade relations. It is possible that materials such as Wyandotte, Cobden, and Burlington were obtained directly but it is much more likely that these materials were obtained as part of an exchange with groups who lived closer to these sources. The fact that the tools made from these non-local materials were found in finished form and there is no evidence of reduction of these materials seems to suggest that they were brought into the site prefabricated and may have even been acquired as finished products. The use of colorful cherts like Cobden, Wyandotte, and heat-treated materials likely represents a form of symbolism and the lack of colorful chert found in Late Woodland assemblages supports the thesis of many

that there was a strong break from Havana Hopewell traditions during the Late Woodland period (Fortier 2008).

In conclusion, the lithic analysis provided some strong evidence to reject the hypothesis that a primary chert source was located within 10 kilometers of the site; however, more study of the lithic assemblage is needed. A microwear analysis could provide some much needed data about the function of many of these tools and could help illuminate the range of activities that took place at the site (Keeley 1980; Odell 1985; Sterner 2012; Yerkes 1990). Another useful analysis that might add some clarity to the problem of where exactly these materials originated from is petrology (Eerkens et al. 2007; Shackley 2008). This approach examines the internal structure and chemical composition of the material and compares archaeological samples to samples taken from known quarries. This approach is useful for some cherts such as Burlington or Cobden but is problematic when applied to chert cobbles and it is also cost-prohibitive.

CHAPTER VI: CONCLUSION

The Kautz Site is one of a few Archaic and Woodland sites in northeastern Illinois that has been subjected to controlled subsurface testing. However, the results of the excavations have never been shared with the public despite having been excavated over fifty years ago. The focus of this thesis was to examine the material culture and landscape of the Kautz Site in order to better understand when this site was occupied and why.

An analysis of the material culture recovered from the excavation revealed that the Kautz Site has a long and consistent record of human habitation spanning 5000 years between the Late Archaic and Late Woodland periods ca. 6000-1000 B.P. Chipped stone tools and decorated ceramic sherds of at least seven distinct cultural horizons have been identified, including a significant Havana Hopewell component. Havana Hopewell items recovered from the site include zoned and punctated grit-tempered pottery and chipped stone tools made from a wide range of non-local interaction sphere materials. The last prehistoric occupation of the site took place at around the time of the adoption of bow and arrow technology ca. A.D. 700-1000. Several early examples of arrow point technology were recovered from this site including notched and triangular points.

The extensive reuse of this location sparked many questions about the function of the site. Why did people regularly reuse this location, what makes it more attractive than other locations nearby? I argued in this thesis that the Kautz Site was routinely occupied because it provided an optimal location to exploit the local landscape. According to past studies, an optimal location for settlement for mixed hunter-gatherer groups in northeastern Illinois was a location central to a number of overlapping ecological patches such as a forest/marsh edge on well-

drained soils protected from harsh winds and floods (Brown 1965; Curtis and Berlin 1980; Early 1970, 1972; Ferguson 1995; Goldstein 1981, 1982; Hart and Jeske 1987; Jeske 1986, 1987; Lurie 1987, 1989; Lurie and Jeske 1989; McGimsey et al. 1986; Roper 1979a; Springer 1985; Weston 1981).

In order to test the theory, I reconstructed the ecological and cultural landscape of the Kautz Site and measured the amount and diversity of resources available within four overlapping catchments. The smallest catchment is a 1-km circular buffer surrounding the center point of the Kautz Site. It represented the area that would have been most intensely exploited. A 5-km catchment represented the area where most of the resources coming into the camp were obtained. A 10-km catchment represented any area that could have been exploited within a single day of foraging. Lastly, northeastern Illinois, consisting of the areas north of the Illinois River and south of the Wisconsin border in between the Rock River and Lake Michigan, was analyzed to get a better idea of the overlying cultural history and ecology of the region.

The catchment analysis confirmed my hypothesis that ample sources of food, water, and timber were available within all of the catchments, but rejected the hypothesis that a primary source of good-quality chert could have been obtained within the maximum daily foraging range of 10-km. The literature review and geological model utilized to identify potential chert sources could not identify with any certainty that there was a source of chert other than secondary source cobbles within the maximum daily foraging range.

Faced with inconclusive data from the catchment analysis, I turned to the lithic assemblage to look for evidence of resource scarcity. I hypothesized that if there was a source of good-quality chert within 10-km of the site then there should be very little evidence of common economizing strategies. Since lithic technology is directly related to economic pursuits it was

assumed that people who have pursued an optimal strategy towards the procurement and use of chert at the site (Bamforth 1986; Jeske 1989, 1992). I hypothesized that bifacial technology would have played an important role in the technological organization of the site and that diversification in the types and qualities of raw material would have been employed to cope with restricted access to chert. I also hypothesized that there should be very little evidence of primary reduction at the site such as the presence of cortex, large, flat or cortical platforms, and large and heavy flakes. The results of the analysis (discussed above) found very little evidence to support my hypothesis that a primary source of good-quality chert was located within 10 km of the site. What the lithic analysis found instead, was that chert was treated as a restricted resource at the Kautz Site. There was evidence for reworking, no evidence of primary reduction of large nodules for bifacial production, and evidence for bipolar reduction of fair quality secondary source nodules. These results suggest that people chose to occupy the Kautz Site because of the other important economic advantages of the site and coped with chert scarcity by employing common coping strategies.

One pattern that appears in the data from the Kautz Site is that the intensity and pervasiveness of these economizing strategies increases over time. The coping strategies recognized in the Kautz Site worked and they increased the fitness of those who employed them. People, seeing the effectiveness of these strategies, passed these behaviors onto their conspecifics and offspring. Over time, these short-term coping strategies became the adaptive strategy recognized as the small tool tradition that was adopted throughout the Eastern Woodlands during the terminal Middle Woodland and Late Woodland periods (Fortier 2000; Jeske 1992). The overall strategy to minimize the amount of material needed to accomplish the tasks at hand reduced the need to rely on inter-regional trade, reduced the amount of time,

energy, and risk involved in acquiring more material, and would have also reduced the overall weight of the tool kit allowing for easier travel. Thus, we can see in the evidence at the Kautz Site that in northeastern Illinois there was an evolution in chipped stone technology towards smaller, less expensive technologies as Jeske (1992) and others have recognized throughout the Midwest.

Beyond Economics

The Kautz Site has been shown to be located in an optimal location from an economic perspective, but what, if any, cultural significance did it hold? We often assume that the places that were intentionally imbued with meaning through the construction of monumental architecture or dramatic art hold the most meaning. However, places that are not marked with obvious markers can hold great importance too (L. Johnson 2000; M. Johnson 2012). The results of the landscape analysis provide a window into the possible cultural significance of the site. First, the series of freshwater springs adjacent to the site may have been seen as more than good sources of fresh water. Springs have a spiritual significance in many Native American belief systems; they often figure prominently in creation myths as a source of life and/or interface between earth and the underworld such as the Winnebago myth of Blue-bear (Radin 1949). Water from certain springs was also used as a remedy. The Creek believed the water from certain springs was good for rheumatism, fevers, backache, headache, pains in the breast or stomach, weak or sore eyes, and had a special value for children (Swanton 1928).

The Kautz Site may have also gained cultural significance over time and become what Sarah Schlanger (1992) notes as a “persistent place”. Communities transform physical spaces into meaningful places through their daily activities, beliefs, and values (Anschuetz et al. 2001). Throughout the year, groups like the Nitsitapii from southern Manitoba, retrace the footsteps of

their ancestors stopping near the landmarks created by their heroes, remembering the names of the places, retelling the associated stories, and repeating the appropriate rituals. To them, the movement across the landscape is more than an annual subsistence round; it is also a pilgrimage designed to promote the renewal of their culture and of their homeland (Oetelar and Oetelar 2007). Such patterned use of the landscape promotes an attachment to the homeland, and creates a sense of place and identity (Basso 1996). Over time, the Kautz site may have become an important part of the local memory, signifying a place that tied them to their ancestors evidenced by their refuse and/or any noticeable improvements made to the surrounding landscape (Tilley 1994). Improvements made to the local environment such as forest clearing activities, prairie burns, and broadcast sowing of economically important plants may have also had long-lasting economic benefits to future inhabitants (Oeteler and Oeteler 2007; B. Smith 2001, 2011).

Future Directions of Study

Due to the constraints of the scope of this thesis, many questions about the Kautz Site and its relationship to other Archaic and Woodland sites in northeastern Illinois and the Eastern Woodlands still remain. The focus of this thesis was to demonstrate the utility of using a combination of GIS-based catchment analysis and an individual attribute analysis of the lithic assemblage to prove that the Kautz Site was occupied because of the adaptive benefits of its location. Future study should be directed towards applying this model to other sites in the region to determine if the same patterns hold true. Is the Kautz Site unique or are other sites located in places like the Kautz Site, where most resources are available but not all resources like chert?

One of the biggest challenges of this study was trying to reconstruct the excavation process and understand the site's vertical and horizontal organization. The notes associated with material culture are unorganized and incomplete and that prevented me from identifying with a

high level of certainty what the site boundaries are, where the actual excavation units were located, and what if any vertical integrity of the site exists today. I propose in the future that a crew revisit the Kautz Site and conduct a shovel probe survey to locate the site boundaries and old excavation units. I also propose new excavation units be opened at the site to retrieve more data, particularly carbon samples so that parts of the site can be dated. In northeastern Illinois, we lack radiocarbon dates from sites of this age severely inhibiting our ability to accurately reconstruct the culture history of the region.

Another avenue of research that should be conducted is examining more of the social factors that led to the occupation of the Kautz Site. This thesis touches on some social aspects such as the importance of the springs adjacent to the site but a more thorough analysis of the social factors should be conducted. It has been shown that economic factors are not the only factors that influence site location, but they are important and easier to identify than social factors, which is why this thesis focused on the economics of the site. However, there may be important aspects to the site that this thesis has overlooked and the overall understanding of the site could benefit from such an examination.

Two material classes recovered from the site were not formally analyzed in this thesis, the ceramic assemblage and the rough rock assemblage. They were not analyzed because they did not provide critical information to the main thesis; however, that does not mean they are not important overall. The ceramics may provide information about mobility, cultural affiliation, and age of the site (Rice 2006). A chemical analysis of residues on the interior of some of the ceramics may also provide important information about the ceramic users at the Kautz Site (Bishop et al. 1990; Crown et al. 2012).

Archaeometry of the chipped stone tools may also be a fruitful avenue of research. The examination of the chert using chemical analyses or microscopy could provide some useful insights into the site's occupant's mobility and function. A usewear analysis on the chipped stone tools may provide useful information about the function of these tools and the overall function of the site in order to support or reject my original thesis (Keeley 1980; Odell 1985; Yerkes 1990). Finally, this analysis could benefit from a pedestrian survey of potential chert sources in northeastern Illinois. We need to have a better understanding of the lithic landscape in order to make stronger arguments about prehistoric mobility and procurement strategies (Loebel and Geraci 2015).

Conclusion

This thesis sought to test the hypothesis that the Kautz Site was occupied because of the adaptive benefits it provided to its inhabitants. The results of the analysis supported some aspects of the thesis but rejected others such as the proximity of a good-quality chert source. This thesis also completed a full review of the history of archaeology in the region, the prehistory of the region, and described as best as possible the history of excavations and excavation methods employed at the site. In addition, the study highlights the usefulness of older collections that have been ignored for decades in understanding prehistoric behavior in the understudied region of northeastern Illinois.

REFERENCES CITED

Abrams, M.D. and G.J Nowacki

2008 Native Americans as active and passive promoters of mast and fruit trees in the astern USA. *The Holocene* 18(7).

ACHP

2015 A Citizen's Guide to Section 106 Review, edited by D. o. Interior. Advisory Council on Historic Preservation, Washington, D.C.

Alton, K. Fisher

1997 Origins of the Midwestern Taxonomic Method. *Midcontinental Journal of Archaeology* 22(1):117-122.

Anderson, Mark L. and Daniel G. Horgen

2015 Chert Drawers. The Office of State Archaeologist, Iowa City.

Anderson, Roger C.

1970 Prairies in the Prairie State. *Tramsactions of the Illinois Academy of Science* 63.

Andrefsky Jr, William

1991 Inferring trends is prehistoric settlement behavior from lithic production technology in the Southern Plains. *North American Archaeologist* 12.

1994 The geological occurrence of lithic material and stone tool production strategies. *Geoarchaeology* 9(5):375-391.

1998 *Lithics : macroscopic approaches to analysis*. Cambridge manuals in archaeology. Cambridge University Press, Cambridge England ; New York.

2001 *Lithic debitage : context, form, meaning*. University of Utah Press, Salt Lake City.

2005 *Lithics : macroscopic approaches to analysis*. 2nd ed. Cambridge manuals in archaeology. Cambridge University Press, Cambridge ; New York.

2009 The Analysis of Stone Tool Procurement, Production, and Maintenance. *Journal of Archaeological Research* 17(1):65-103.

Andrews, Brian N., M. LaBelle Jason and John D. Seebach

2008 Spatial Variability in the Folsom Archaeological Record: A Multi-Scalar Approach. *American Antiquity* 73(3):464-490.

Arroyo, Ana Belén Marín

2009 The use of optimal foraging theory to estimate Late Glacial site catchment areas from a central place: The case of eastern Cantabria, Spain. *Journal of Anthropological Archaeology* 28(1):27-36.

Asch, David L., Kenneth B. Farnsworth and Nancy B. Asch

1979 Woodland Subsistence and Settlement in West Central Illinois. In *Hopewell Archaeology: The Chillicothe Conference*, edited by D. S. Brose and N. o. Greber, pp. xiv, 309 p. MCJA special paper no. 3. Kent State University Press, Kent, Ohio.

Anschuetz, Kurt F., Richard H. Wilshusen and Cherie L. Scheick

2001 An Archaeology of Landscapes: Perspectives and Directions. *Journal of Archaeological Research* 9(2):157-211.

Baltus, Melissa R.

2013 *Archaeological Investigations at Site 11CK284 for the Cal-Sag Channel Trail, 127th Street at Cal-Sag to Burnham Greenway Trail. Archaeological Testing Short Report No. 429*. Illinois State Archaeological Survey, University of Illinois at Urbana-Champaign.

Bamforth, Douglas B.

1986 Technological Efficiency and Tool Curation. *American Antiquity* 51(1):38-50.

1990 Settlement, raw material, and lithic procurement in the central Mojave Desert. *Journal of Anthropological Archaeology* 9(1):70-104.

1991 Technological Organization and Hunter-Gatherer Land Use: A California Example. *American Antiquity* 56(2):216-234.

Bamforth, Douglas B. and P.C. Woodman

2004 Tool hoards and Neolithic use of the landscape in North Eastern Ireland. *Oxford Journal of Archaeology* 23(1).

Baumann, Steven D.J.

2010 *Geology of Black Rock Run at Matthiessen State Park, La Salle County, Illinois, U.S.A. G-042010-1A*. Midwest Institute of Geosciences and Engineering.

Basso, K.H.

1996 *Wisdom Sits in Places: Landscape and Language Among the Western Apache*. University of New Mexico Press.

Beck, Charlotte, Amanda K. Taylor, George T. Jones, Cynthia M. Fadem, Caitlyn R. Cook and Sara A. Millward

2002 Rocks are heavy: transport costs and Paleoarchaic quarry behavior in the Great Basin. *Journal of Anthropological Archaeology* 21(4):481-507.

Beck Jr, Robin A. and James A. Brown

2011 Political Economy and the Routinization of Religious Movements: A View from the Eastern Woodlands. *Archeological Papers of the American Anthropological Association* 21(1):72-88.

Beck, R. Kelly

2008 Transport Distance and Debitage Assemblage Diversity: An Application of the Field Processing Model to Southern Utah Toolstone Procurement Sites. *American Antiquity* 73(4):759-780.

Benchley, Elizabeth and William Billeck

1977 *Final Report on A Predictive Models Survey in The Rock River Drainage, Illinois*. Archaeological Research Laboratory University of Wisconsin-Milwaukee.

Bennett, L.G., E.A. Lyon and H. Brooks

1862 Plat Map of DuPage County, Winfield Township.

Bettinger, Robert L.

1989 The Archaeology of Pinyon House, Two Eagles, and Crater Middens: Three Residential Sites in Owens Valley, Eastern California. *American Museum of Natural History Anthropological Papers No.67*.

Bettinger, Robert L., Ripan Malhi and Helen McCarthy

1997 Central Place Models of Acorn and Mussel Processing. *Journal of Archaeological Science* 24(10):887-899.

Binford, Lewis R.

1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35(3):255-273.

1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.

1983 Hunters in a Landscape. In *In Pursuit of the Past : Decoding the Archaeological Record*, edited by L. R. Binford, J. F. Cherry and R. Torrence, pp. 256 p. Thames and Hudson, New York, N.Y. (500 5th Ave., New York, 10110).

1990 Mobility, Housing, and Environment: A Comparative Study. *Journal of Anthropological Research* 46(2):119-152.

2001 *Constructing frames of reference : an analytical method for archaeological theory building using hunter-gatherer and environmental data sets*. University of California Press, Berkeley.

Bird, Douglas W. and Rebecca L. Bliege Bird

1997 Contemporary Shellfish Gathering Strategies among the Meriam of the Torres Strait Islands, Australia: Testing Predictions of a Central Place Foraging Model. *Journal of Archaeological Science* 24(1):39-63.

Bishop, Ronald L., Veletta Canouts, Patricia L. Crown and Suzanne P. de Atley

1990 Sensitivity, Precision, and Accuracy: Their Roles in Ceramic Compositional Data Bases. *American Antiquity* 55(3):537-546.

Bleed, Peter

1986 The Optimal Design of Hunting Weapons: Maintainability or Reliability. *American Antiquity* 51(4):737-747.

Bleed, Peter and Marlene Meier

1980 An Objective Test of the Effects of Heat Treatment of Flakeable Stone. *American Antiquity* 45(3):502-507.

Bluhm, Elaine

1951 Ceramic Sequence in Central Basin and Hopewell Sites in Central Illinois. *American Antiquity* 16(4):324-329.

Bluhm, Elaine A. and Gloria J. Fenner

1961 The Oak Forest Site. *Chicago Area Archaeology* Illinois Archaeological Survey Bulletin No. 3.

Bluhm, Elaine A. and Allen Liss

1961 The Anker Site. *Chicago Area Archaeology* Illinois Archaeological Survey Bulletin No. 3.

Boeda, E.

1995 Levallois: A volumetric construction, methods, a technique. In *The Definition and Interpretation of Levallois Technology*, edited by H. L. Dibble and O. Bar-Yosef. University of Pennsylvania Press, Philadelphia, Pennsylvania.

Boszhardt, Robert F.

2002 Contracting Stemmed: What's The Point? *Midcontinental Journal of Archaeology* 27(1):35-67.

Bowles, Marlin and Jenny McBride

1994 Presettlement barrens in the glaciated prairie region of Illinois. In *Proceedings of the North American Conference on Savannas and Barrens*, edited by J. S. Fralish, R. C. Anderson, J. E. Ebinger and R. Szafoni. Environmental Protection Agency, Great Lakes National Program Office, Chicago.

2002 *Pre-European Settlement Vegetation of Cook County, Illinois*. Morton Arboretum.

Bowles, Marlin, Jenny McBride and Lisa Bell

1998 *Landscape Vegetation Pattern, Composition, And Structure Of Dupage County, Illinois, As Recorded By The U. S. Public Land Survey (1821-1840)*. Report to the DuPage County Forest Preserve District, Chicago Wilderness, Fish & Wildlife Service & Max McGraw Wildlife Foundation. .

Boyd, Matthew

2002 Identification of Anthropogenic Burning in the Paleoecological Record of the Northern Prairies: A New Approach. *Annals of the Association of American Geographers* 93(2).

Bradbury, Andrew P. and Philip J. Carr

1995 Flake Typologies And Alternative Approaches: An Experimental Assessment. *Lithic Technology* 20(2):100-115.

Bretz, Harlan J.

1939 *Geology of the Chicago Region. Bulletin 65.* Illinois State Geological Survey, Urbana.

Brose, D.S. and N. Greber (editors)

1979 *Hopewell Archaeology: The Chillicothe Conference*. Kent State University Press, Kent, Ohio.

Brown, James A.

1965 The Prairie Peninsula: An Interaction Area in the Eastern United States. Unpublished Ph. D. dissertation, University of Chicago.

1967 *The Gentleman Farm Site*. Illinois State Museum, Springfield.

1971 Introduction. In *Approaches to the Social Dimensions of Mortuary Practices*, Society for American Archaeology, Memoir 25: 1-5, edited by J. A. Brown.

1981 The Search for Rank in Burials. In *The Archaeology of Death*, edited by R. Chapman, I. Kinnes and K. Randsborg, pp. 25-37. Cambridge University Press, Cambridge ; New York.

2014 Personal Communication. Champaign, Illinois.

Brown, James A. and Patricia J. O'Brien (editors)

1990 *At the Edge of Prehistory: Huber Phase Archaeology in the Chicago Area*. Center for American Archaeology, Kampsville, Illinois.

Brown, Margaret K. (editor)

1981 *Predictive Models in Illinois Archaeology: Report Summaries*. Illinois Department of Conservation, Springfield.

Cahen, Daniel and Lawrence H. Keeley

1980 Not Less Than Two, Not More than Three. *World Archaeology* 12:166-180.

Caldwell, Joseph R. and Robert L. Hall (editors)

1964 *Hopewellian studies*. Illinois State Museum Scientific Papers, Vol. 12., Springfield, Illinois.

Carmichael, David L.

1977 Preliminary Archeological Survey Of Illinois Uplands And Some Behavioral Implications. *Midcontinental Journal Of Archaeology* 2(2):219-251.

Carmichael, David L., J. Hubert, B. Reeves and A Schanche (editors)

1994 *One World Archaeology. Vol. 23: Sacred Sites, Sacred Places*. Routledge, London.

Carr, C. and D.T. Case (editors)

2005 *Gathering Hopewell: Society, Ritual and Ritual Interaction*. Springer, New York, New York.

Carr, P.J., A.P. Bradbury and S.E. Price

2012 *Contemporary Lithic Analysis in the Southeast: Problems, Solutions, and Interpretations*. University of Alabama Press.

Charles, Douglas K.

1992 Shading the Past: Models in Archeology. *American Anthropologist* 94(4): 905-925.

Charles, Douglas K. and Jane E. Buikstra (editors)

2006 *Recreating Hopewell*. University Press of Florida, Gainesvillle.

Chicago Daily Tribune

1877 The Moundbuilders. *Chicago Daily Tribune*. Chicago

Cole, F.C. and Thorne Deuel

1937 *Rediscovering Illinois: Archaeological Explorations in and Around Fulton County*. University of Chicago Press.

Cotterell, Brian and Johan Kamminga

1987 The Formation of Flakes. *American Antiquity* 52(4):675-708.

Cowan, Frank L.

1999 Making Sense of Flake Scatters: Lithic Technological Strategies and Mobility. *American Antiquity* 64(4):593-607.

Crabtree, Don E.

1972 *An Introduction to Flintworking*. Occasional Papers of the Idaho University Museum, no. 28, Pocatello.

Crown, Patricia L., T.E. Emerson, Jiyan Gu, W. Jeffrey Hurst, Timothy R. Pauketat and Timothy Ward

2012 Ritual Black Drink consumption at Cahokia. *PNAS* 109(35).

Culver, H.E.

1923 Surficial Geology and Rock Outcrops of the Morris Quadrangle. In *Economic and Geologic Papers, Bulletin 43*. Illinois State Geological Survey, Urbana.

Curtis, Sue Ann and Andrea Berlin

1980 *A Study of the Cultural Resources at the Argonne National Laboratory*. Division of Environmental Impact Studies, Argonne National Laboratory.

Demel, Scott J.

2000 Understanding remnant Archaic settlement along the western coast of Lake Michigan. Ph.D., The University of Wisconsin - Milwaukee, Ann Arbor.

Deregnaucourt, Tony and Jeffrey A. Georgiady

1998 *Prehistoric Chert Types of the Midwest*. Occasional Monographs Series of the Upper Miami Valley Archaeological Museum. Western Ohio Podiatric Medical Center, Greenville.

Dibble, Harold L. and John C. Whittaker

1981 New experimental evidence on the relation between percussion flaking and flake variation. *Journal of Archaeological Science* 8(3):283-296.

Dilg, Charles

1903 *Blue Island and Chicago History*. Charles Dilg Collection, Chicago History Museum, Chicago, IL.

Dobres, Marcia-Anne and Christopher R. Hoffman

1994 Social Agency and the Dynamics of Prehistoric Technology. *Journal of Archaeological Method and Theory* 1(3):211-258.

Doershuk, John

1988 *Plenemuk Mound and the Archaeology of Will County*.

Douglass, Matthew J., J. Holdaway Simon, Patricia C. Fanning and Justin I. Shiner

2008 An Assessment and Archaeological Application of Cortex Measurement in Lithic Assemblages. *American Antiquity* 73(3):513-526.

Early, Ann M.

1970 NAL 1970 Archaeological Survey: The Prehistoric Occupations of the National Accelerator Laboratory Site, Anthropology, Northwestern University, Evanston.

1971 1971 Salvage Excavations. FERMI National Accelerator Laboratory, Batavia, IL.

1972a *An Archaeological Survey of the Lower Fox River Valley*. Illinois Archaeological Survey.

1972b *An Archaeological Survey of the Fox and Des Plaines Rivers Valley in Northeastern Illinois*. Preliminary Report of 1972 Historic Sites Survey Archaeological Reconnaissance of Selected Areas in the State of Illinois Part I Summary Section B. Illinois Archaeological Survey, Champaign-Urbana.

1973 Upper Mississippian Occupation of the Fox River Valley, Department of Anthropology, University of Massachusetts, Amherst.

Eerkens, Jelmer W., Jeffrey R. Ferguson, Michael D. Glascock, Craig E. Skinner and Sharon A. Waechter

2007 Reduction Strategies and Geochemical Characterization of Lithic Assemblages: A Comparison of Three Case Studies from Western North America. *American Antiquity* 72(3):585-597.

Emerson, Thomas E.

1999 The Langford Tradition and the Process of Tribalization on the Middle Mississippian Borders. *Midcontinental Journal of Archaeology* 24(1).

Emerson, Thomas E., Dale L. McElrath and Andrew C. Fortier

2000 *Late Woodland Societies: Tradition and Transformation across the Midcontinent*. University of Nebraska Press, Lincoln.

Emerson, Thomas E. and Anne R. Titelbaum

2000 The Des Plaines Complex and the Late Woodland Stage of Northern Illinois. In *Late Woodland Societies*, edited by T. E. Emerson, D. L. McElrath and A. C. Fortier, pp. 413-425. University of Nebraska Press, Lincoln.

Evans, Madeleine, Ian Ficker, Brenda Beck, Douglas K. Jackson, Stephanie Daniels, Jennifer Howe and Amanda Butler

2013 Lithic Assemblage. In *The Hoxie Farm Site Fortified Village: Late Fisher Phase Occupation and Fortification in South Chicago,* edited by D. K. Jackson and T. E. Emerson. vol. Research Report No. 27. Illinois State Archaeological Survey, Champaign.

Evans, Madeleine G. and A.C. Fortier

2013 The Jack's Reef Horizon: Its Arrival And Distribution During The Late Woodland Period In Illinois. *Archaeology of Eastern North America* 41.

Evans, Madeleine and Wendy G. Harris

1998 *Phase I Archaeological Investigation for Six Proposed Bridge Crossings Across the Fox River*. Illinois Transportation Archaeological Research Program (ITARP).

Farnsworth, Kenneth B. (editor)

2006 *Illinois Hopewell and Late Woodland mounds: The excavations of Gregory Perino, 1950-1975*. Illinois Transportation Archaeological Research Program, Champaign.

Fehrenbacher, J.B.

1982 Illinois Soil Associations Map (500K). Illinois State Geological Survey, Champaign.

Feld, S. and K. H. Basso

1996 *Senses of Place*. School of American Research Press, Santa Fe.

Fenner, Gloria J.

1961 The Bowmanville Site. *Chicago Area Archaeology* Illinois Archaeological Survey Bulletin No. 3.

Ferguson, Jacqueline A.

1995 *Upper Illinois Archaeology: The Cultural Resources of Starved Rock State Park*.

Ferguson, J.A. and R.E. Warren

1991 *Prehistoric Archaeology of the Central Illinois Prairie: the Decatur-Pana Section of the FAP-412 South Highway Corridor*. Quaternary Studies Program, Illinois State Museum Society.

1992 Chert Resources of Northern Illinois: Discriminant Analysis and an Identification Key. *Illinois Archaeology* 4(1).

Fie, Shannon

2008 Middle Woodland Ceramic Exchange in the Lower Illinois Valley. *Midcontinental Journal of Archaeology* 33(1).

Flenniken, Jeffrey J. and E.G. Garrison

1975 Thermally Altered Novaculite and Stone Tool Manufacturing Techniques. *Journal of Field Archaeology* 2:125-131.

Foley Winkler, Kathleen M.

2011 Oneota and Langford mortuary practices from eastern Wisconsin and northeast Illinois. Ph.D., The University of Wisconsin - Milwaukee, Ann Arbor.

Fortier, A.C.

2000 The Emergence and Demise of the Middle Woodland Small-Tool Tradition in the American Bottom. *Midcontinental Journal of Archaeology* 25(2):191-213.

2008 The Archaeological Contexts and Themes of Middle Woodland Symbolic Representation in the American Bottom. *Illinois Archaeology: Journal of the Illinois Archaeology Survey* 20:1-47.

Fowler, Melvin L.

1959 Modoc Rock Shelter: An Early Archaic Site in Southern Illinois. *American Antiquity* 24(3):257-270.

FPDDC

2012 Warrenville Grove. http://www.dupageforest.com/Conservation/Forest_Preserves/Warrenville_Grove.aspx

Gates, Sanford H.

1961 An Archaeological Survey of the DuPage River Drainage. *Chicago Area Archaeology* Illinois Archaeological Survey Bulletin No. 3.

Genheimer, Robert A.

1996 Bladelets are Tools Too: The Predominance of Bladelets Among Formal Tools at Ohio Hopewell Sites. In *A View from the Core: A Synthesis of Ohio Hopewell Archaeology*, edited by P. J. Pacheco. Ohio Archaeological Council, Inc., Columbus.

Geraci, Peter J.

2011 The Lamellar Blade Assemblage from The Buried Gardens of Kampsville, A Havana Hopewell Village in the Lower Illinois River Valley. Paper presented at the Midwest Archaeological Conference, LaCrosee, WI.

2015 *Archaeological Investigations at the Roe's Hill Site (11CK1097) for the City of Chicago Park District's Proposed West Ridge Nature Preserve.* Illinois State

Archaeological Survey, Prairie Research Institute, University of Illinois at Urbana-Champaign.

Gleason, Henry A.

1922 The Vegetation History of the Middle West. *Association of American Geographers Annals* 12:39-85.

Goldstein, Lynne

1979 *An archaeological survey of portions of the Crawfish and Rock River valleys near their confluence in Jefferson County, Wisconsin*. UWM Archaeological Research Laboratory. Report of Investigations, 68.

1981 *A continuing survey of portions of the Rock River drainage in Jefferson County, Wisconsin*. UWM Archaeological Research Laboratory Reports of Investigations, 52, Milwaukee, Wisconsin.

1982 *The Southeastern Wisconsin Glaciated Region: Phase I*. Report submitted to the Historic Preservation Division, State Historical Society of Wisconsin. UWM Archaeological Research Laboratory, Report of Investigations, No. 68.

Greby, Matthew

1996 *Site Form: 11K484*. Illinois Inventory of Archaeological and Paleontological Sites.

Gremillion, Kristen J., Windingstad Jason and Sarah C. Sherwood

2008 Forest Opening, Habitat Use, and Food Production on the Cumberland Plateau, Kentucky: Adaptive Flexibility in Marginal Settings. *American Antiquity* 73(3):387-411.

Griffin, J.B.

1952a Some Early and Middle Woodland Pottery Types in Illinois. In *Hopewellian Communities in Illinois*, edited by T. Deuel. vol. 5. Scientific Papers, Illinois State Museum, Springfield.

1952b Some Early and Middle Woodland Pottery Types in Illinois. *Scientific Papers* 5(3).

1967 Eastern North American Archaeology: A Summary. *Science* 156(3772):175-191.

Griffin, J.B., R.G. Morgan, F.C. Baker, G.K. Neumann, J.L.B. Taylor and University of Illinois

1941 *Contributions to the archaeology of the Illinois River Valley*. The American philosophical society.

Harkness, Barbara M.

1982 *Implications for Ohio Hopewell Polity Suggested by Lithic and Iconographic Analysis (Art, Manufacturing, Heat Treatment).* PhD. dissertation, Union for Experimenting Colleges and Universities.

Harris, Wendy G.

1998 *The South Suburban Airport: Phase I Archaeological Investigations for the Proposed South Suburban Airport, Will County, Illinois*. Research Reports Number 45, Illinois Transportation Archaeological Research Program. University of Illinois at Urbana-Champaign.

Hart, John P., Marlin R. Ingalls, Robert J. Jeske and Rochelle Lurie

1989 *Phase II Archaeological Testing of Sixteen Sites on the Joliet Army Ammunition Plant for the RDX Expansion Project.* MARS Inc. .

Hart, John P. and Robert J. Jeske

1987 *Report on Systematic Archaeological Survey of Portions of the Illinois-Michigan Canal Heritage Corridor, in Cook, Will, DuPage, Grundy, and LaSalle Counties, Illinois. Contract Report submitted to the National Park Service, Midwest Archaeological Center, Lincoln, Nebraska.*

Hayden, Brian

1989 From chopper to celt: the evolution of resharpening techniques. In *Time, Energy, and Stone Tools*, edited by R. Torrence, pp. viii, 124 p. Cambridge University Press, Cambridge.

Henrikson, Harry C.

1965 *Utica Hopewell, A study of Early Hopewellian Occupation in the Illinois River Valley*. Illinois Archaeological Survey.

Hewitt, John

1983 Optimal foraging models for the lower Illinois River valley, Department of Anthropology, Northwestern University, Evanston, Illinois.

Hermann, Edward and Timothy Baumann

2014 Midwest Lithic Repository. Glenn A. Black Laboratory, Indiana University, Bloomington.

Hirsch, E. and M. O'Hanlon (editors)

1995 *The Archaeology of Landscape: Perspectives on Place and Space*. Clarendon Press, Oxford.

Hoglund, Keith

1978 *The Excavations at 11-DU-33: A preliminary report*. Wheaton College.

Hunt, Eleazer D.

1992 Upgrading Site-Catchment Analyses with the Use of GIS: Investigating the Settlement Patterns of Horticulturalists. *World Archaeology* 24(2):283-309.

IIAPS

2015 Illinois Inventory of Archaeological and Paleontological Sites. Illinois State Museum, Springfield.

INHS

1987 National Wetlands Inventory in Illinois, 1987 - Polygons. U.S. Fish and Wildlife Service, Illinois Department of Natural Resources, and Illinois Natural History Survey, Champaign.

2014 Land Cover of Illinois in the Early 1800s. INHS, Champaign.

ISGS

1994 Glacial Drift in Illinois: Thickness and Character. Illinois State Geological Survey, Champaign, IL.

1995 Stack-Unit Mapping of Geologic Materials in Illinois to a Depth of 15 Meters. Illinois State Geological Survey, Champaign, Illinois.

2006 Illinois Height Modernization (ILHMP): LiDAR Data - DuPage County. Illinois State Geological Survey, Champaign.

Jeske, Robert J.

1986 *Results of an Archeological Reconnaissance Survey of the Chain O' Lakes State Park, McHenry and Lake Counties, Illinois*. Northwestern Archaeological Center Contributions No. 3, Evanstion, Illinois.

1987 *The Archaeology of the FERMI National Accelerator Laboratory*. Cultural Resource Management Report No. 20 Midwest Archaeological Research Services, Evanston, Illinois.

1988 *The Archaeology of the Chain O'Lakes Region in Northeastern Illinois*. Illinois Cultural Resources Study No. 5. Illinois Historic Preservation Agency, Springfield, IL.

1989 Economies in Raw Material Use by Prehistoric Hunter-Gatherers. In *Time, Energy, and Stone Tools,* edited by R. Torrence, pp. viii, 124 p. Cambridge University Press, Cambridge.

1990 Environmental and Site Distribution at the Prairie Peninsula Edge: The View from FERMI National Accelerator Laboratory, Batavia, Illinois. *The Wisconsin Archaeologist* 71(3-4):137-171.

1992 Energetic Efficiency and Lithic Technology: An Upper Mississippian Example. *American Antiquity* 57(3):467-481.

2000 The Washington Irving Site: Langford Tradition Adaptation in Northern Illinois. In *Mounds, Modoc, and Mesoamerica: Papers in Honor of Melvin L. Fowler,* edited by S. R. Ahler. vol. 28. Illinois State Museum Scientific Papers, Springfield, IL.

2002 Langford and Fisher Ceramic Traditions: Moeity, Ethnicity, or Power Relations in the Upper Midwest? *The Wisconsin Archaeologist* 84(1 & 2).

2003 Lithic Raw Material Procurement and use within Mississippian Social Networks. In *Theory, method, and practice in modern archaeology*, edited by R. J. Jeske and D. K. Charles, pp. xvi, 392 p. Praeger, Westport, CT.

2006 Hopewell regional interactions in Southeastern Wisconsin and Northern Illinois : a core-periphery approach. In *Recreating Hopewell*, edited by D. K. Charles and J. E. Buikstra. University Press of Florida, Gainesvillle.

N.D. Beyond Mobility: The Effects of Site Function on the Organization of Lithic Assemblages. *In Press*.

Jeske, Robert J. and James A. Brown

2013 Lithic Analysis. In *Mound City: The Archaeology of the Renowned Ohio Hopewell Center, Special Report no. 6*, edited by J. A. Brown. Midwest Archeological Center, Lincoln.

Jeske, Robert J. and John P. Hart

1988 Report on Test Excavations at Four Sites in the Illinois and Michigan Canal Heritage Corridor, LaSalle and Grundy Counties, Illinois.

Jeske, Robert J. and Rochelle Lurie

1989 *Sumary of Phase II Testing of Six Sites and Evaluation of Curated Archaeological Material at Fermi National Accelerator Laboratory, Batavia, Illinois*. Midwest Archaeological Research Services, Inc.

1993 The Archaeological Visibility of Bipolar Technology: A Blind Test. *Midcontinental Journal of Archaeology* 18.

Johnson, Leslie Main

2000 "A Place That's Good," Gitksan Landscape Perception and Ethnoecology. *Human Ecology* 28(2):301-325.

Johnson, Matthew H.

2012 Phenomenological Approaches in Landscape Archaeology*. *Annual Review of Anthropology* 41(1):269-284.

Joseph, F.

2009 *Advanced Civilizations of Prehistoric America: The Lost Kingdoms of the Adena, Hopewell, Mississippians, and Anasazi*. Inner Traditions/Bear, Rochester, NY.

Judge, W. James

1971 An interpretation framework for understanding site locations. In *The distribution of prehistoric population aggregates*, edited by G. J. Gumerman. Prescott College Anthropological Reports 1.

Justice, Noel D.

1987 *Stone Age Spear and Arrow points of the Midcontinental and Eastern United States: A modern survey and reference*. Indiana University Press, Bloomington.

Keeley, Lawrence H.

1980 *Experimental determination of stone tool uses : a microwear analysis*. Prehistoric archeology and ecology. University of Chicago Press, Chicago.

Keene, A.S.

1983 Biology, behavior, and borrowing: a critical examination of optimal foraging theory in archaeology. In *Archaeological hammers and theories*, edited by J. Moore and A. S. Keene. Academic Press, New York, New York.

Kelly, John E., Fred A. Finney, Dale L. McElrath and Steven J. Ozuk

1984 Late Woodland Period. In *American Bottom Archaeology: A summary of the FAI-270 Project Contributions to the Culture History of the Mississippi River Valley*, edited by C. J. Bareis and J. W. Porter. University of Illinois Press, Urbana.

Kelly, J. M.

2002 Delineating the spatial and temporal boundaries of Late Woodland collared wares from Wisconsin and Illinois, Department of Anthropology, University of Wisconsin-Milwaukee, Milwaukee.

Kelly, Robert L.

1988 The Three Sides of a Biface. *American Antiquity* 53:717-734.

1995 *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. Cambridge University Press, New York.

2003 Colonization of New Land by Hunter-Gatherers: expectations and implication based on ethnographic data. In *The Colonization of Unfamiliar Landscapes: The Archaeology of Adaptation*, edited by M. Rockman and J. Steele. Routledge, New York.

Kilburn, Paul D.

1955 The original vegetation of Kane County. Illinois, Ecology, University of Michigan, Ann Arbor.

1959 The Forest-Prairie Ecotone in Northeastern Illinois. *American Midland Naturalist* 62(1):206-217.

King, James E.

1981 Late Quaternary Vegetational History of Illinois. *Ecological Monographs* 51(1):43-62.

Kolata, Denis

2005 Bedrock Geology of Illinois. Illinois State Geological Survey, Champaign.

Koldehoff, Brad

1999 Attica Chert and Clovis Land Use in Illinois. *Illinois Archaeology* 11:1-26.

Koldehoff, Brad and Thomas J. Loebel

2009 Clovis and Dalton: unbounded and bounded systems in the midcontinent of north America. In *Lithic materials and Palaeolithic societies*, edited by B. Adams and B. S. Blades, pp. pp270-287. Wiley-Blackwell.

Kuhn, Steven L.

1994 A Formal Approach to the Design and Assembly of Mobile Toolkits. *American Antiquity* 59(3):426-442.

Kullen, Douglas

1988 *The Archaeology of Winfield Mounds and Village, DuPage County, Illinois*. University of Chicago.

1989 *Site form: 11DU144*. Illinois Inventory of Archeological and Paleontological Sites.

Kullen, Douglas and Matthew Greby

1997 *Phase II Archaeological Testing of the Newton Farmstead (Site 11-KE-174), Oswego, Kendall County, Illinois*. Allied Archaeology.

Langford, George

1919 The Kankakee River Refuse Heap. Evidence of a Unique and Primitive Culture in the Southwestern Chicago Area. *American Anthropologist* 21(3):287-291.

1927 The Fisher Mound Group, Successive Aboriginal Occupations near the Mouth of the Illinois River. *American Anthropologist* 29(3):153-205.

Leighton, M. M., George E. Ekblaw and Horberg Leland

1948 Physiographic Divisions of Illinois. *The Journal of Geology* 56(1):16-33.

Loebel, Thomas J.

2005 The Organization of Early Paleoindian Economies in the Western Great Lakes, Department of Anthropology, University of Illinois-Chicago, Chicago.

Loebel, Thomas J. and Peter J. Geraci

2015 The Lithic Landscape: Using GIS to Model Chert Bearing Outcrop Potential in Illinois. Paper presented at the Midwest Archaeological Conference, Milwaukee.

Luman, Donald, Lisa Smith and Chris Goldsmith

2003 Illinois Statewide 30-Meter Digital Elevation Model. Illinois State Geological Survey, Champaign, IL.

Lurie, Rochelle

1987 *Report on Phase Two Testing of Six Sites and Curating Archaeological Material for Fermi National Accelerator Laboratory, Batavia, Illinois*. Cultural Resource Management Report No. 23, Midwest Archaeological Research Services, Evanston, Illinois.

1989a *Archaeological Survey of Selected Portions of Fermi National Accelorator Laboratory and Test Excavations at the Gazebo Site, Batavia, Illinois*. Cultural Resource Management Report No. 34. Midwest Archaeological Research Services, Evanston.

1989b Lithic technology and mobility strategies: the Koster site Middle Archaic. In *Time, Energy, and Stone Tools*, edited by R. Torrence, pp. viii, 124 p. Cambridge University Press, Cambridge.

1990 *Report on the Wooded Areas Survey, Gazebo Site Testing, Collector Interviews, and Review of Prehistoric Site Status and Location at Fermi National Accelerator Laboratory*. Midwest Archaeological Research Services.

Lurie, Rochelle and Robert J. Jeske

1989 *Summary of Phase II Testing of Six Sites and Evaluation of Curated Archaeological Material at Fermi National Accelerator Laboratory, Batavia, Illinois*. Cultural Resource Management Report No. 33/35. Midwest Archaeological Research Services, Evanston.

1990 Appendix 1: Lithic Recording Scheme. In *At the Edge of Prehistory: Huber Phase Archaeology in the Chicago Area,* edited by James A. Brown and Patricia J. O'Brien, pp. 284-290. Center for American Archaeology Press, Kampsville

Lurie, Rochelle, Douglas Kullen and Scott J. Demel

2009 Defining the Archaic in Northern Illinois. In *Archaic Societies: diversity and complexity across the Midcontinent*, edited by T. E. Emerson, D. L. McElrath and A. C. Fortier. SUNY Press, Albany.

Mandeville, Margaret D.

1971 A Consideration of the Thermal Pretreatment of Chert. *Plains Anthropologist* 18:177-202.

Mapes, D.R.

1979 *Soil Survey of DuPage and Part of Cook Counties, Illinois*. United States Departmnet of Agriculture, Soil Conservation Service, in cooperation with Illinois Agricultural Experiment Station.

Markman, Charles W.

1991 *Chicago Before History: The Prehistoric Archaeology of a Modern Metropolitan Area* Studies in Illinois Archaeology 7. Illinois Historic Preservation Agency, Springfield, IL.

Mason, Ronald J.

1997 The Paleo-Indian Tradition. *The Wisconsin Archaeologist* 78(1/2).

McClain, W.E. and S.L Elzinga

1994 The occurence of prairie and forest fires in Illinois and other Midwestern states, 1679-1853. *Erigenia* 13:79-90.

McElrath, D.L, A.C. Fortier and T.E. Emerson

2009 An Introduction to the Archaic Societies of the Midcontinent. In *Archaic Societies: Diversity and Complexity across the Midcontinent*, edited by D. L. McElrath, A. C. Fortier and T. E. Emerson. State University of New York Press, Albany.

McGimsey, C.R., M.A. Graham, E.K. Schroeder, R.W. Graham, M.D. Wiant and R.Druhot

1986 *Siting the Superconducting Super Collider in Illinois: an Overview and Predictive Model of Cultural and Paleobiological Resources in the S.C. C. Study Area, Northern Illinois*. Illinois State Museum, Springfield, Illinois.

McKern, W. C.

1939 The Midwestern Taxonomic Method as an Aid to Archaeological Culture Study. *American Antiquity* 4(4):301-313.

McManamon, Francis P., Linda S. Cordell, Kent G. Lightfoot and George R. Milner

2009 *Archaeology in America : an encyclopedia*. 4 vols. Greenwood Press, Westport, Conn.

MDC

2016 How Old is that Tree? In *Backyard Tree Care*. vol. 2016. Missouri Department of Conservation.

Metcalfe, Duncan and K. Renee Barlow

1992 A Model for Exploring the Optimal Trade-off between Field Processing and Transport. *American Anthropologist* 94(2):340-356.

Montet-White, Anta

1968 *The Lithic Industries of the Illinois Valley in the Early and Middle Woodland Period*. Museum of Anthropology, University of Michigan. Anthropological papers, no. 35. University of Michigan, Ann Arbor,.

Moran, Robbin

1978 Presettlement vegetation of Lake County, Illinois. *Proceedings of the Proceedings of the 5th Midwest Prairie Conference*. Ames, Iowa.

1980 Presettlement (1830) Vegetation of De Kalb, Kane and DuPage Counties, Illinois, Unpublished Master's Thesis, Southern Illinois University-Carbondale, Carbondale.

Morgan, Christopher

2008 Reconstructing prehistoric hunter–gatherer foraging radii: a case study from California's southern Sierra Nevada. *Journal of Archaeological Science* 35(2):247-258.

Morrow, C.A. and Richard W. Jefferies

1989 Trade or embedded procurement?: a test case from southern Illinois. In *Time, energy and stone tools*, edited by R. Torrence. Cambridge University Press, Cambridge.

Munson, P.J

1986 Hickory Silviculture: a subsistence revolution in the prehistory of eastern North America. In *Emergent horticultureal economies of eastern woodlands*, edited by W. F. Keegan. Southern Illinois University, Carbondale.

Nassaney, Michael S. and Kendra Pyle

1999 The Adoption of the Bow and Arrow in Eastern North America: A View from Central Arkansas. *American Antiquity* 64(2):243-263.

Neumann, Georg K.

1931 *The Excavation of DU1, A Mound in the Player Mound Group, DuPage County, Illinois*.

Nolan, David J., Mark F. Seeman and James L. Theler

2007 A Quantitative Analysis of Skill and Efficiency: Hopewell Blade Production at the Turner Workshop, Hamilton County, Ohio. *Midcontinental Journal of Archaeology* 32.

Odell, George H.

1985 Microwear Analysis of Middle Woodland Artifacts. In *Smiling Dan: Structure and Function at a Middle Woodland Settlement in the Lower Illinois Valley*, edited by B. D. Stafford and M. B. Sant. vol. Research Series 2. Center For American Archaeology, Kampsville, IL.

1994 The Role of Stone Bladelets in Middle Woodland Society. *American Antiquity* 59(1):102-120.

2000 Stone Tool Research at the End of the Millennium: Procurement and Technology. *Journal of Archaeological Research* 8(4):269-331.

2004 *Lithic analysis*. Manuals in archaeological method, theory, and technique. Kluwer Academic/Plenum Publishers, New York.

Oetelaar, Gerald A. and D. Joy Oetelaar

2007 The New Ecology and Landscape Archaeology: Incorporating the Anthropogenic Factor in Models of Settlement Systems in the Canadian Prairie Ecozone. *Canadian Journal of Archaeology* 31(3):65-92.

Orians, G.H. and N.E. Pearson

1985 On the theory ofcentral place foraging. In *Analysis of Ecological Systems*, edited by D. J. Horn, R. D. Mitchell and G. R. Stairs. The University of Ohio Press, Columbus.

Parry, W. J. and R. L. Kelly

1987 Expedient core technology and sedentism. In *The Organization of Core Technology*, edited by J. K. Johnson and C. A. Morrow, pp. 285–304. Westview Press, Boulder, Colorado.

Perino, Gregory

1971 *Guide to the Indentification of Certain American Indian Projectile Points*. Oklahoma Anthropological Society, Special Bulletin No. 4.

Piskin, Kemal and Robert E. Bergstrom

1975 *Glacial Drift In Illinois: Thickness and Character*. ISGS Circular 490. Illinois State Geological Survey, Champaign, Illinois.

Pi-Sunyer, Oriol

1965 The Flint Industry. In *The McGraw Site: A Study of Hopewellian Dynamics*, edited by O. H. Prufer. Cleveland Museum of Natural History, Scientific Publications 4(1), Cleveland.

Pleger, Thomas C. and James B. Stoltman

2009 The Archaic Tradition in Wisconsin. In *Archaic Societies: Diversity and Complexity across the Midcontinent*, edited by D. L. McElrath, A. C. Fortier and T. E. Emerson. State University of New York Press, Albany.

Porubcan, Paula P. and Rochelle Lurie

1998 *Results of Phase III Archaeological Mitigation of the McGraw Farm Site (11-L-386), Cuba Township, Lake County, Illinois*. Midwest Archaeological Research Services, Inc. .

Post, Susan

2001 *The DuPage River Basin: An inventory of the region's resources*. The Illinois Department of Natural Resources Office of Realty and Environmental Planning.

Prentiss, William C.

1998 The Reliability and Validity of a Lithic Debitage Typology: Implications for Archaeological Interpretation. *American Antiquity* 63(4):635-650.

Price, T.D. and James A. Brown (editors)

1985 *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*. Academic Press, New York.

Purdy, Barbara A. and H.K. Brooks

1971 Thermal Alteration of Silica Minerals: An Archaeological Approach. *Science* 173:322-325.

Radin, Paul

1949 *The Winnebago tribe*. University of Nebraska Press, Lincoln,.

Renfrew, Colin and Paul Bahn

2008 *Archaeology: Theories, Methods, ad Practice*. Fifth ed. Thames & Hudson, New York.

Rennie, J. K., Naresh C. Singh and International Institute for Sustainable Development.

1996 *Participatory research for sustainable livelihoods: a guidebook for field projects*. IISD, Winnipeg.

Rice, Prudence M.

2006 *Pottery Analysis: A Sourcebook*. University of Chicago Press, Chicago.

Richmond, C.W. and H.F. Valette

1857 *History of the County of DuPage, Illinois; Containing an Account of Its Early Settlement and Present Advantages, a Separate History of the Several Towns, Including Notices of Religious Organizations, Education, Agriculture and Manufactures, with the Names and Some Account of the First Settlers in Each Township, and Much Valuable Statistical Information*. Scripps, Bross & Spears, 1857, Chicago.

Rick, John Winfield

1978 *Heat-Altered Cherts of the Lower Illinois Valley: An Experimental Study in Prehistoric Technology*. Northwestern Archaeological Program Prehistoric Records 2. Northwestern Archaeological Program, Evanston, IL.

Riley, Thomas J., Richard Edging, Jack Rossen, George F. Carter, Gregory Knapp, Michael J. O'Brien and Karl H. Scherwin

1990 Cultigens in Prehistoric Eastern North America: Changing Paradigms [and Comments and Replies]. *Current Anthropology* 31(5):525-541.

Riley, Thomas J., Gregory R. Walz, Charles J. Bareis, Andrew C. Fortier and Kathryn E. Parker

1994 Accelerator Mass Spectrometry (AMS) Dates Confirm Early Zea Mays in the Mississippi River Valley. *American Antiquity* 59(3):490-498.

Roper, Donna C.

1979a Archaeological Survey and Settlement Pattern Models in Central Illinois. *Illinois State Museum Scientific Papers, Vol. 16* Midcontinental Journal of Archaeology Special Paper No. 2.

1979b The Method and Theory of Site Catchment Analysis: A Review. *Advances in Archaeological Method and Theory* 2(ArticleType: research-article / Full publication date: 1979 / Copyright © 1979 Springer):119-140.

Ruby, Bret J., Christopher Carr and Douglas K. Charles

2005 Community Organizations in the Scioto, Mann, and Havana Hopewellian Regions: a comparitive perspective. In *Gathering Hopewell: Society, Ritual and Ritual Interaction*, edited by C. Carr and D. T. Case. Springer, New York, New York.

Scharf, Albert

1901 Indian Trails and Villages of Chicago and Cook, Dupage, and Will Counties, IL. Chicago Historical Society, Chicago.

Schlanger, Sarah H.

1992 Recognizing persistent places in Anasazi settlement systems. In Rossignol, J., and Wandsnider, L. (eds.), *Space, Time, and Archaeological Landscapes*, Plenum Press, New York, pp. 91–112.

Schroeder, Sissel

2004 Current Research on Late Precontact Societies of the Midcontinental United States. *Journal of Archaeological Research* 12(4):311-372.

Schwegman, J.E.

1973 *Comprehensive plan for the Illinois nature preserves system. Part 2. The Natural Divisions of Illinois*.

Seeman, Mark F.

1992 The Bow and Arrow, the Intrusive Mound Complex, and a Late Woodland Jack's Reef Horizon in the Mid-Ohio Valley. In *Cultural Variability in Context: Woodland Settlements of the Mid-Ohio Valley*, edited by M. F. Seeman. vol. Special Papers #7. MCJA, Kent, OH.

Shackley, M. S.

2008 Archaeological Petrology and the Archaeometry Of Lithic Materials. *Archaeometry* 50(2):194-215.

Shott, Michael J.

1986 Technological Organization and Settlement Mobility: An Ethnographic Examination. *Journal of Anthropological Research* 42(1):15-51.

1994 Size and Form in the Analysis of Flake Debris: Review and Recent Approaches. *Journal of Archaeological Method and Theory* 1(1):69-110.

1996 Stage Versus Continuum in the Debris Assemblage From Production of a Fluted Biface. *Lithic Technology* 21(1):6-22.

Shott, Michael J., Andrew P. Bradbury, Philip J. Carr and George H. Odell

2000 Flake Size from Platform Attributes: Predictive and Empirical Approaches. *Journal of Archaeological Science* 27(10):877-894.

Silverberg, R.

1968 *Moundbuilders of Ancient America: The Archaeology of Myth*. New York Graphic Society Ltd., Greenwich.

Simon, Mary L.

2000 Regional Variations in Plant Use in the Midwest During the Late Woodland. In *Late Woodland Societies: Tradition and Transformation across the Midcontinent*, edited by T. E. Emerson, D. L. McElrath and A. C. Fortier, pp. 37-77. University of Nebraska Press, Lincoln.

Slain, Douglas and Albert C. Goodyear III

2012 A Comparison of Clovis Blade Technologies at the Topper and Big Pine Tree Sites, Allendale County, South Carolina. In *Contemporary Lithic Analysis in the Southeast: Problems, Solutions, and Interpretations,* edited by P. J. Carr, A. P. Bradbury and S. E. Price. University of Alabama Press, Tuscaloosa.

Smith, Bruce D.

2001 Low-Level Food Production. *Journal of Archaeological Research* 9(1):1-43.

2007 The Ultimate Ecosystem Engineers. *Science* 315(5820):1797-1798.

2011 Niche Construction and the Management of Wild Plant and Animal Resources by Small-scale Pre-industrial Societies. *Philosophical Transactions of the Royal Society B* 366.

Smith, Eric Alden

2013 Agency and Adaptation: New Directions in Evolutionary Anthropology. *Annual Review of Anthropology* 42(1):103-120.

Smith, Eric Alden, Robert L. Bettinger, Charles A. Bishop, Valda Blundell, Elizabeth Cashdan, Michael J. Casimir, Andrew L. Christenson, Bruce Cox, Rada Dyson-Hudson, Brian Hayden, Peter J. Richerson, Eric Abella Roth, Steven R. Simms and W. A. Stini

1983 Anthropological Applications of Optimal Foraging Theory: A Critical Review [and Comments and Reply]. *Current Anthropology* 24(5):625-651.

Springer, James W.

1985 Site Distribution, Environmental Adaptation and Envrionmental Change along the Northern Edge of the Prairie Peninsula. *Wisconsin Archaeologist* 66(1).

Squier, E.G. and E.H. Davis

1848 *Ancient Monuments of the Mississippi Valley*. Smithsonian Institution Press.

Stelle, Lenville J. and Thomas P. Duggan

2003 An Archaeological Guide to Chert Types of East-Central Illinois. vol. 2011. Center For Social Research, Parkland College.

Sterner, Katherine M.

2012 Oneota lithics: a use-wear analysis of the Crescent Bay Hunt Club assemblage from the 2004 excavations. Master's Thesis. Anthropology. University of Wisconsin-Milwaukee, Milwaukee, WI.

Stevenson, K.atherine P., R.obert F. Bozschardt, Charles R. Moffat, Phillip P. Salkin, Thomas C. Pleger, James L. Theler and Constance C. Arzigian

1997 The Woodland Tradition. *The Wisconsin Archaeologist* 78(1/2).

Stothers, David M. and James R. Graves

1985 The Prairie Peninsula Co-Tradition: An Hypothesis For Hopewellian To Upper Mississippian Continuity. *Archaeology of Eastern North America* 13.

Struever, Stuart

1964 The Hopewell Interaction Sphere in Riverine-Western Great Lakes Culture History. In *Hopewellian studies*, edited by J. R. Caldwell and R. L. Hall, pp. viii, 156 p., Springfield,.

1965 Middle Woodland Culture History in the Great Lakes Riverine Area. *American Antiquity* 31(2):211-223.

1968 Woodland Subsistence-Settlement Systems in the Lower Illinois Valley. In *New Perspectives in Archaeology*, edited by L. R. Binford and S. R. Binford. University of New Mexico, Aldine Publishing Company, Chicago.

Swanton, John Reed

1928 Religious beliefs and medicinal practices of the Creek Indians. In *Washington, DC: U.S. Govt. Print. Off., 1928. p. 473-672: ill.*

Tanner, Helen Hornbeck and Miklos Pinther

1987 *Atlas of Great Lakes Indian history*. 1st ed. The Civilization of the American Indian series v. 174. Published for the Newberry Library by the University of Oklahoma Press, Norman.

Thompson, Richard A.

1985 *DuPage Roots*. Dupage County Historical Society, Naperville.

Tilley, Christopher

1994 *A Phenomenology of Landscape: Places, Paths, and Monuments*. Berg Publishers, Oxford.

Tomka, Steven A.

2001 The effect of processing requirements on reduction strategies and tool form: A new perspective. In *Lithic Debitage: Context Form Meaning*, edited by W. Andrefsky Jr., pp. 207-225. Univeristy of Utah Press, Salt Lake City.

Torrence, Robin

1989 Re-tooling: towards a behavioral theory of stone tools. In *Time, Energy, and Stone Tools*, edited by R. Torrence, pp. viii, 124 p. Cambridge University Press, Cambridge.

Transeau, Edgar Nelson

1935 The Prairie Peninsula. *Ecology* 16(3):423-437.

Trowbridge, A. C

1912 Geology and geography of the Wheaton Quadrangle. In *Bulletin 19*. Illinois State Geological Survey, Urbana.

Ucko, P.J. and R. Layton (editors)

1999 *The Archaeology and Anthropology of Landscape: Shaping Your Landscape*. Routledge, London.

USDA

2015 USDA NRCS Geospatial Data Gateway. USDA.

Vierra, R.K.

1983 Typology, classification and theory building. In *Essays in Archaeological Typology*, edited by J. A. Brown and R. E. Whallon, Jr. Center for American Archaeology, Evanston, Illinois.

Weston, Bruce R.

1981 Upper Illinois River Unit (II). In *Predictive Models in Illinois Archaeology: Report Summaries*, edited by Margaret K. Brown, pp. 21-32. Illinois Department of Conservation.

Wiant, M.D., Edwin R. Hajic and Thomas R. Styles

1983 Napolean Hollow and Koster Site stratigraphy: Implications for Holocene landscape evolution and studies of Archaic period settlement patterins in the lower Illinois River valley. In *Archaic hunters and gatherers in the American Midwest*, edited by J. L. Phillips and J. A. Brown. Academic Press, New York.

Wiant, Michael D. and Harold Hassen

1983 Stream Deposited Chert Sources: A Closer Look at Lithic Availability and Human Procurement. *Lithic Technology* 12(2):43-45.

Willey, G.R. and J.A. Sabloff

1993 *A History of American Archaeology*. W.H. Freeman.

Willman, H. B.

1962 *The Silurian strata of northeastern Illinois*. Illinois State Geological Survey, Champaign.

1971 *Summary of the Geology of the Chicago Area*. Illinois State Geologic Survey.

Willman, H. B. and John C. Frye

1970 Pleistocene Stratigraphy of Illinois. *Illinois State Geological Survey Bulletin* 94.

Willman, H. B. and D. R. Kolata

1978 *The Platteville and Galena Groups in Northern illinois*. Circular 502. Illinois State Geological Survey, Urbana.

Willman, H. B. and J. Norman Payne

1943 *Early Ordovician Strata Along Fox River in northern Illinois.* Circular 100. Illinois State Geological Survey, Urbana.

Willman, H.B. , Elwood Atherton, T.C. Buschback and Charles Collinson

1975 *Handbook of Illinois Stratigraphy* Illinois State Geological Survey Bulletin 95. Illinois State Geological Survey, Urbana.

Winkler, Daniel M., Dustin Blodgett and Robert J. Jeske

2012 *The Lithic Resources of Wisconsin: A Guide to Lithic Materials that are Recovered on Archaeological Sites in Wisconsin*. UWM Archaeological Research Laboratory, Milwaukee.

Winterhalder, Bruce

1980 Environmental Analysis in Human Evolution and Adaptation Research. *Human Ecology* 8(2):135-170.

1983 Opportunity-Cost Foraging Models for Stationary and Mobile Predators. *The American Naturalist* 122(1):73-84.

Winters, Howard D.

1961 The Adler Mound Group, Will County, IL. *Chicago Area Archaeology* Illinois Archaeological Survey Bulletin No. 3.

1969 *The Riverton Culture: A Second Millenium Occupation in the Central Wabash Valley*. Reports of Investigations, No. 13. Illinois State Museum and The Illinois Archaeological Survey, Springfield, IL.

Wobst, H. Martin

1978 The Archaeo-Ethnology of Hunter-Gatherers or the Tyranny of the Ethnographic Record in Archaeology. *American Antiquity* 43(2):303-309.

Wolforth, Thomas R.

1995 An Analysis of the Distribution of Steuben Punctated Ceramics. *The Wisconsin Archaeologist* 76:27-47.

Worthen, A.H.

1870 *Geological Survey of Illinois* Vol. 4 Geology and Paleontology. State Journal Steam Press, Springfield.

Wurz, S.

2002 Variability in the Middle Stone Age lithic sequence, 115,000–60,000 years ago at Klasies River, South Africa. *Journal of Archaeological Science* 29:1001–1015.

Yerkes, Richard W.

1988 The Woodland and Mississippian Traditions in the Prehistory of Midwestern North America. *Journal of World Prehistory* 2(3):307-358.

1990 Using microwear analysis to investigate domestic activities and craft specialization at the Murphy Site, a small Hopewell settlement in Licking County, Ohio. In *The Interpretive Possibilities of Microwear Studies*, edited by B. Gradlund, K. Knutsson, H. Knutsson and J. Taffinder. Societas Archaeologica Uppsaliensis, Uppsala, Sweden.

2003 Using Lithic Artifacts to Study Craft Specialization in Ancient Societies: The Hopewell Case. In *Written in Stone: The Multiple Dimension of Lithic Analysis*, edited by P. N. Kardulias and R. W. Yerkes, pp. 17-34. Lexington Books, Maryland.

Zeanah, David W.

2004 Sexual division of labor and central place foraging: a model for the Carson Desert of western Nevada. *Journal of Anthropological Archaeology* 23(1):1-32.

Zeizel, Arthur J., William C. Walton, Robert T. Sasman and Tomas A. Prickett

1962 *Ground-Water Resources of Dupage County, Illinois*. Illinois State Water Survey.

APPENDIX A: AN ANALYSIS OF FAUNAL REMAINS FROM THE KAUTZ SITE (11DU1)

BY MEGAN LEIGL

Abstract

The Kautz site (11-DU-46) was excavated in the 1950s by avocational archaeologists using unconventional methods by current standards. It is a multicomponent Woodland site with intrusion by a historic component, specifically a pig lot contemporary to the excavations. Faunal analysis of recovered animal remains was undertaken, revealing an assemblage consisting mostly of mammal remains, but also turtle and few birds. No fish remains were found, however, this might be due to excavation methods.

Introduction

The excavation of the Kautz Site (11-DU-46) in DuPage County Illinois revealed a multicomponent Woodland occupation. It is thought to be associated with several mound groups in the area: Player, also known as Winfield Mounds (11-DU-33), are directly associated with the site and are 3 km south of Kautz. In addition, a mound known as 11K96 that was destroyed by hobbyists in the 1870s might also have been related to the Kautz site (P. Geraci personal communications, 2012). The site itself is located on a terrace of the west branch of the DuPage River. It was unplowed, however, at the time of excavation a pig lot was located on the property. This is evident in the assemblage as there are several pig elements throughout the site.

Kautz yielded a medium sized faunal assemblage of almost 1000 fragments (Table 1). Analysis of the assemblage was focused on identifying species represented as well as recording

quantities of bone, in addition to any burning, gnawing, cut marks or other modification. Bone was recovered throughout the site.

Methods and Methodology

Faunal remains were analyzed using various zooarchaeological reference books (Olsen 1964; Gilbert 1990; Schmid 1972; Elbroch 2006; Post 2004; Hillson 1986) and the comparative specimen collection at the University of Wisconsin-Milwaukee. In addition, Dr. Jean Hudson was consulted for particularly difficult identifications and to verify specimens were identified correctly. Bones that were less than ¼ inch in diameter were weighed and sorted through for small, classifiable elements but otherwise not counted or sorted by taxon, since such identifications would be tenuous at best. Bones were sorted to the species level; if this was not possible they were sorted to a family level, or simply to class. When there was a strong resemblance to a species but not enough landmarks present to confidently classify the bone, the description "compares favorably" (CF) was used.

When counting the final total of unidentifiable fragments, NISP was used. In fragments less than ¼", weight was totaled unless the sample was too light for the scale to register (Appendix), in which case they were not counted to the total.

Bones were tabulated both by number of identified specimens (NISP) and minimum number of individuals (MNI). The NISP has been found to more accurately predict the number of body parts at sites where bones are highly fragmented, in addition to sites where there are small sample sizes (Marshall and Pilgrim 1993, Gilbert and Singer 1982). MNI, on the other hand, is useful to determine the absolute minimum number of carcasses present at the site. Used

in conjunction, the two give a lower and upper boundary of animals represented in the collected sample.

In determining boundaries for MNI counts, Grayson (1973) states that an MNI determined by arbitrary levels within units and features is too narrow a scale because it ignores the cultural stratigraphy present at the site and results in a higher than normal count. On the other hand, an MNI of the entire site is too broad, ignores cultural stratigraphy as well, and ends up in a count which is the lowest of the three possible methods. The last method, which he advocates, is to break down MNI by ignoring arbitrary boundaries, and relying solely on the cultural stratigraphy (e.g., when specimens were found inside features) (Grayson 1973). MNI was tabulated by using the most common element present for a species.

Depositional bias, decay factors and excavation strategies all affect recovery of the available faunal assemblage (Gilbert and Singer 1982). It has also been recognized that meat sharing is a large component of preindustrial cultures' food distribution systems; therefore faunal distribution at sites based on distinct cultural stratigraphy (such as features) can be misleading (ibid). Because the Kautz site was unplowed, and there is evidence of cultural faunal fragments (burning and cut marks on fractured pieces of bone) there will be two counts for the NISP and MNI. A lower boundary will include those specimens identified in features. MNI counts will come from individual features. Since no information is available on zones or levels within most of the features, the entire feature will be counted as one unit. An upper boundary will include the MNI and NISP from the entire site. This maximum count is less reliable because of the historic intrusion; however, because the site is unplowed it is worth tabulating to show possible taxa that would have been available to site inhabitants.

Results

Animal species found at the Kautz site were mostly mammal, with two unidentifiable bird bones, and 50 turtle shell fragments representing reptiles. There were no discernible fish remains, however there were no float samples taken, so it is most likely that any available would have gone through the ¼” screens utilized during excavation. The vast majority of the assemblage was bone fragments, some from large mammal long bones. Being able to designate a fragment as mammal or otherwise was atypical due to the high degree of fragmentation.

Of the identifiable elements at the site coming from features, deer and muskrat were the most represented (Table 1). Using data from the entire site, the most represented species were deer, badgers and raccoons, each with a maximum MNI of 2. Using NISP, deer and turtles were the most common, both counting from features as well as the entire site. One of the unidentifiable mammal bone fragments appeared to be indicative of industrial meat processing: the bone was transected with a smooth, straight cut.

Species Represented

White-tailed deer (*Odocoileus virginianus*)

Deer are large ungulates (90 - 130 kg live weight) and can be easily recognized by the seasonal antlers in males. They live in habitats ranging from forest edge to marsh and wetlands to deep forest in winter. They are also found in around the edges of agricultural fields and woodland (Long 2008). The assemblage contained mostly foot bones from the deer, either calcanei, astragal or phalanges. There was one scapula that was quite robust compared to the museum

specimen, indicating a male. Other indicators of sex include an antler tine, which while it was classified as belonging to the Cervid family, is most likely a white-tailed deer (Appendix).

Canidae (CF Red Fox, *Vulpes vulpes*)

The red fox is an opportunistic species that lives in any natural habitat. It is common in wetlands, marshes, highlands, forests, prairies, forest edges, and even sand dunes. It is valued, at least in modern times, for its beautiful red fur (Long 2008). The classification of this species should be taken cautiously, as the element representing it was a single first phalanx (Appendix). While it is definitely a canid phalanx, and while it looked more similar to *Vulpes* than other canids, it cannot be said that the bone definitely was a red fox. The bone was also burned, which is puzzling for a fur bearer; burning usually implies consumption.

Badger (*Taxidea taxus)*

Badgers live in open, grassy areas. They were once plentiful throughout Illinois, despite being protected there now (Hoffmeister 1989). The badger specimens found at the site consisted of two mandibles and two teeth. Coming from the same unit, it is likely they are from the same animal (Appendix).

Striped Skunk (*Mephitis mephitis)*

Skunks are found in various habitats: wooded areas, banks, near waterways or grassy open countryside (Hoffmeister 1989). There was one mandible fragment found in Feature 5 (Appendix). Skunks may have been trapped for fur in prehistoric times.

Mustelidae

The weasel family was represented by one innominate bone, of which only the acetabulum remained. While the size and shape of the landmark were enough to classify the specimen to family, not enough was there to classify to species. (Appendix)

Woodchuck (*Marmota monax)*

Woodchucks are large, herbivorous rodents weighing up to 14 lbs. They are considered ground squirrels, and utilize a variety of habitats. In Illinois they are found mostly on wooded bluffs, but also occupy any rolling land with grassy cover (Hoffmeister 1989). Considered modern pests, Native Americans would have used them for food in prehistoric times.

Raccoon (*Procyon lotor)*

Raccoons are in the order Carnivora. They are omnivorous, opportunistic animals. They will live anywhere there is food and a nesting site, but reportedly never more than 1,200 ft. from water (Hoffmeister 1989). They are represented in the assemblage by two left radii (Appendix).

Beaver (*Castor canadensis)*

Beavers live along bodies of water, burrowing in banks or building lodges if water depth permits. They prefer wooded areas to be near the water where they make their dens (Hoffmeister 1989). Both Native Americans and Europeans traded beaver pelts; some groups are known to have used them as food also. There was one right tibial epiphysis, suggesting a juvenile (Table 2).

Chipmunk (*Tamias striatus)*

Represented by three specimens, these burrowing rodents are most likely not cultural. They were not burned, nor were they found in a feature; they are too small to have been intentionally brought back. Instead, they were likely commensal with humans at the site, prehistoric or

otherwise. They live in areas with dense underbrush and wooded bluffs and slopes (Hoffmeister 1989).

Muskrat (*Ondatra zibethicus)*

Muskrats, like beavers, are bank dwellers and lodge builders. Small streams and ponds are considered ideal habitat (Hoffmeister 1989). One of the more abundant animals present in the assemblage, there were numerous specimens. There were two humerii, a mandible and some innominate fragments found throughout the site (Appendix).

Pig (*Sus scrofa)*

The pig is used as primarily as a meat animal. The Chicago area was known as a meat-packing hub in the late nineteenth and early twentieth centuries; it is not surprising that there was a pig lot at the site. It is most likely all the pigs at the site were domestic. All specimens represented were teeth; however, none were complete elements (Appendix).

Horse (*Equus ferus caballus*)

The domestic horse is another example of historic industrial or urban disturbance at the site. It was used as a draft animal or transportation. Specimens represented were teeth (Appendix).

Turtle (Testudines)

The only specimens found from turtles were incomplete shell fragments (Appendix). Since the site is located in Illinois, the taxa are assumed to be freshwater species. Turtles were used as a food source by many Native American groups. All of the specimens were shell fragments. Since shell fragments, like bone fragments, could all potentially come from the same animal, the MNI count is most likely a conservative one.

Table 1. Minimum and maximum MNI and NISP counts for the Kautz Site. Minimum counts are from features, maximum counts are from the entire site.

Table 1. MNI and NISP Counts				
Species	**MNI**		**NISP**	
	Min	Max	Min	Max
Chipmunk (*Tamias Striatus*)	1	1	1	1
Woodchuck (*Marmota monax*)	0	1	0	1
CF Beaver (*Castor canadensis*)	0	1	0	1
Muskrat (*Ondatra zibethicus*)	2	1	2	4
CF Red fox (*Vulpes vulpes*)	0	1	0	1
Raccoon (*Procyon lotor*)	2	2	0	2
Badger (*Taxidea taxus*)	1	2	1	5
Striped skunk (*Mephitis mephitis*)	1	1	1	1
White-tailed deer (*Odocoileus virginianus*)	2	2	3	24
CF White-tailed deer	1	1	1	5
Carnivore (Carnivora)	0	1	0	1
Weasel family (Mustelidae)	0	1	0	1
Turtle (Testudines)	2	1	15	50
CF Turtle	1	1	7	1
Large mammal fragments	-	-	1	14
Medium mammal fragments	-	-	0	2
Small mammal fragments	-	-	0	2
UNID mammal fragments	-	-	79	432
Bird fragments	-	-	2	2
Amphibian fragments	-	-	2	2
UNID fragments	-	-	23	372
UNID <1/4” fragments	-	-	4.9g	33.4g
Totals	13	14	135	965

Discussion

The small sample size coming from features makes it hard to draw firm conclusions about the Kautz site. The minimum MNI and NISP counts were close or identical for most of the species found in cultural context. All that we can say conclusively about the people living at the site is that they most likely used different hunting strategies, targeting big game such as white-tailed deer in addition to collecting smaller animals like turtles and woodchucks. Small mammals like chipmunks are most likely sources of bioturbation and not affiliated with any cultural activities.

The presence of mainly foot bones from deer could indicate that butchering was not taking place offsite, or else that the feet were being left on the hides being brought back. If we consider that triangular points made up a large percentage of the lithic assemblage from Kautz, it might be possible that arrow making was an important part of activities at the site (Geraci, personal communication 2012). Glue made from boiled hooves and hide and sinew scraps was essential to make bows in addition to arrows with unnotched tips (Laubin and Laubin 1980). Additionally, leg sinews were the preferred binder of indigenous bows (ibid). It could be that the foot bones are further evidence of bow making at the site.

Pig and horse specimens testify to the historic disturbance at the site. Historic farms would have hosted both of these animals; from field notes, we know that there was a pig lot present at the site during excavation.

Surprisingly, there were no bird bones identifiable to taxon; since the site was near a river, some waterfowl might have been expected.

Table 2. Kautz Site faunal assemblage, sorted by unit and square.

Unit	Sq.	Lev	Fea.	Class	Family	Genus	Species	Ct	Element	Side	Burn	Nt.
I	0E 5N	Lvl I (0-6")	Feature 8	unid				2	fragment		yes	
		Lvl II	Feature 8	unid				0.3 g	<1/4" frag		yes	
			Feature 8	mammal				1	fragment		yes	
			Feature 8	unid				<1g	<1/4" frag			
	0E 10 N	Lvl II	Feature 8	unid				0.1 g	<1/4" frag		yes	
		Lvl II (6-12")		mammal				3	fragment			
				unid				1	fragment		yes	
				unid				1.0 g	<1/4" frag			
		Lvl II	Feature 8	unid				2	fragment		yes	
	0E 15 N	Lvl I & II	Feature 7	mammal				3	fragment			
				unid				0.4 g	<1/4" frag			
		Lvl I (0-6")		mammal				2	fragment		yes	
				mammal				1	fragment			
				mollusk				2	shell frag			
		Lvl II (6-12")		mammal				4	fragment			
				unid				1	fragment			
				unid				7	fragment		yes	
				unid				3 g	fragment		yes	
	0E 40 N	Lvl II (13-	Feature 4	unid				3	fragment			

		14”)										
	0E 45 N	Lvl I (0-6”)		mammal	Cervidae			2	metatarsal frag			
				mammal				5	fragment			
		Lvl II		mammal	Cervidae	*Odocoileus*	*virginianus*	1	antler tine			male
				mammal	Cervidae	*Odocoileus*	*virginianus*	1	calcaneus	left		
				mammal	Cervidae	*Odocoileus*	*virginianus*	1	scapula frag	right		
				mammal				1	fragment			
				reptile	Testudines			3	shell frag			

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	**Square**	**Level**	**Feature**	**Class**	**Family**	**Genus**	**Species**	**Count**	**Element**	**Side**	**Burnt**	**Notes**
I	0E 45N	Lvl II (6-12”)		mammal	Cervidae			1	metatarsal frag			tooth marks
				mammal	Cervidae	*Odocoileus*	*virginianus*	1	calcaneus	right		3 pcs, robust
				mammal	Cervidae	*Odocoileus*	*virginianus*	1	3rd phalanx			
				mammal	Procyonidae	*Procyon*	*lotor*	1	radius	left		Proximal 1/3
				mammal				1	fragment			Tool; high polish
				mammal				22	fragment			
				mammal				13	fragment			
				mammal				6	fragment		yes	
				reptile	Testudines			1	shell frag			
				unid				2	fragment		yes	
				unid				11	fragment			
				unid				3 g	<1/4” frag			

				mammal				1	zygomatic			
	0E 50N	Lvl I & II		unid				1	fragment		yes	
				mammal				1	fragment			
		Lvl I (7-8”)		mammal	Cervidae	*Odocoileus*	*virginianus*	1	scapula frag	right		
				mammal	Cervidae	*Odocoileus*	*virginianus*	1	astragalus	right		
				mammal	Cervidae	CF *Odocoileus*	*virginianus*	1	metatarsal frag			
				mammal	Cervidae	CF *Odocoileus*	*virginianus*	1	tooth frag			
				reptile	Testudines			1	shell frag			
				unid				0.6g	<1/4” frag			
	5E 10N	Lvl I (0-6”)		mammal				1	fragment			
				mammal				3	fragment		yes	
				unid				<1g	<1/4” frag		yes	
		Lvl II (6-12”)		unid				2	fragment		yes	
				unid				<1g	<1/4” frag			
	5E 15N	Lvl I (0-6”)		mammal				2	fragment			
		Lvl II (6-12”)		mammal				8	fragment		yes	calcined
				unid				7	fragment		yes	calcined
				unid				2g	<1/4” frag		yes	calcined

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	**Square**	**Level**	**Feature**	**Class**	**Family**	**Genus**	**Species**	**Count**	**Element**	**Side**	**Burnt**	**Notes**

I	5E 35N	Lvl I (0-6”)		mammal				3	fragment			
				mammal	Cervidae	*Odocoileus*	*virginianus*	1	P4	right		
	5E 40N	Lvl I (0-6”)		mammal	Cervidae	*Odocoileus*	*virginianus*	1	calcaneus	left		cut or shovel marks
				mammal				8	fragment			
				bird				1	fragment			
		Lvl II	Feature 4	mammal	Mustelidae	*Taxidea*	*taxus*	1	mandible	full		3 pcs.
			Feature 4	mammal	Cricetidae	*Ondatra*	*zibethicus*	1	humerus			proximal epiphysis
			Feature 4	lg. mammal				1	fragment			
			Feature 4	reptile	Testudines			13	shell frag			
			Feature 4	CF reptile	CF Testudines			7	shell frag			
			Feature 4	unid				3	fragment			
			Feature 4	unid				<1g	<1/4” frag			
	5E 45N	Lvl I (0-6”)		mammal				1	fragment			
		Lvl II (6-12”)		mammal				4	fragment			
	10E 5N	Lvl I (0-8”)		mammal				2	fragment		yes	
				unid				<1g	<1/4” frag		yes	
	10E 10N	Lvl I		mammal				1	fragment			
				unid				13	fragment		yes	
				unid				2g	<1/4” frag		yes	
	10E 15N	Lvl I		mollusk				5	shell frag			

				unid				49	fragment		yes	
				unid				1.9g	<1/4” frag		yes	
				mammal	Suidae	*Sus*		1	P4	upper		
				mammal	Suidae	*Sus*		1	P3	upper		

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	**Square**	**Level**	**Feature**	**Class**	**Family**	**Genus**	**Species**	**Count**	**Element**	**Side**	**Burnt**	**Notes**
I	10E 15N	Lvl II		mammal				1	fragment			
				unid				7	fragment		yes	
				unid				2g	<1/4” frag		yes	
			Feature 1	unid				3	fragment		yes	
	10E 20N	Lvl II (6-12”)		unid				2	fragment		yes	
	10E 25N	Lvl I (0-6”)		mammal	Cervidae	*Odocoileus*	*virginianus*	3	scapula frag	right		
				mammal				4	fragment			
				mammal				3	fragment		yes	
		Lvl II	Feature 3	mammal				1	fragment		yes	
			Feature 3	mammal				6	fragment			
			Feature 3	unid				6	fragment			
			Feature 3	unid				1	fragment		yes	
			Feature 3	unid				2g	<1/4” frag			
		Lvl II (6-12”)		unid				4	fragment		yes	
	10E 30N	Lvl I (0-6”)		mollusk				2	shell frag			

		Lvl II (6-12")		unid				1	fragment		yes	
	10E 35N	Lvl II		unid				2	fragment			
	10E 40N	Lvl I (0-6")		mollusk				3	shell frag			
				mammal				3	fragment		yes	
		Lvl II (6-12")		mammal	Cervidae	CF *Odocoileus*	*virginianus*	1	calcaneus	right		puncture mark
				mammal				5	fragment			
				reptile	Testudines			2	shell frag			cut marks
				unid				7	fragment			
				unid				2g	<1/4" frag			

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	**Square**	**Level**	**Feature**	**Class**	**Family**	**Genus**	**Species**	**Count**	**Element**	**Side**	**Burnt**	**Notes**
I	10E 45N	Lvl I (0-6")		mammal	Cervidae			1	metatarsal frag			deer/elk
		Lvl II (6-12")		lg. mammal				2	fragment			
				reptile	Testudines			2	shell frag			
				unid				2	fragment			
	10E 50N	Lvl I (6")		unid				1	<1/4" frag			
				unid				3	fragment		yes	
		Lvl II		reptile	Testudines			3	shell frag			
				amphibian				1	fragment			
				unid				1	fragment			
	10E 65N	Lvl II (6-12")		mammal				1	fragment			
				unid				1	fragment			

	15E 40N	Lvl I (0-7")		mammal				7	fragment		yes	
				unid				0.6g	<1/4" frag		yes	
		Lvl II (7-?")		mammal				7	fragment			
				mammal				4	fragment		yes	
				unid				3	fragment			
				unid				<1g	<1/4" frag			
	15E 45N	Lvl I (0-8")		mammal				1	fragment		yes	
				unid				<1g	<1/4" frag		yes	
				mammal	Cervidae	*Odocoileus*	*virginianus*	1	astragalus	left		
				mammal	Cervidae	*Odocoileus*	*virginianus*	1	3rd phalanx	n/a		
				mammal	Sciuridae	*Marmota*	*monax*	1	calcaneus	n/a		
				unid				9	fragment		yes	
		Lvl II (9-13")		mammal				1	fragment			cut marks
				mammal				12	fragment			
				sm. mammal				1	III metatarsal			
				reptile	Testudines			1	shell frag			
				unid				3	fragment		yes	

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	**Square**	**Level**	**Feature**	**Class**	**Family**	**Genus**	**Species**	**Count**	**Element**	**Side**	**Burnt**	**Notes**
I	20E 10N	Lvl I & II (0-12")		unid				0.5g	<1/4" frag		yes	
	20E 15N	Lvl I (0-6")		mammal				1	fragment		yes	
				mammal				3	fragment			

				unid				4	fragment		yes	
				unid				<0.0g	<1/4" frag			
				unid				1.4g	<1/4" frag		yes	
		Lvl II (6-12")		mammal				5	fragment		yes	
				mammal				1	fragment			
				unid				1	fragment			
				unid				4	fragment		yes	
				unid				3 g	<1/4" frag		yes	
	20E 15S	Lvl I (0-6")		mammal				1	fragment			
				mammal				3	fragment		yes	
				unid				1.1g	<1/4" frag		yes	
	20E 25N	Lvl I (0-6")		mammal				2	fragment		yes	
				reptile	Testudines			1	shell frag		yes	
				unid				1	fragment		yes	
				unid				0.8g	<1/4" frag		yes	
		Lvl II (6-12")		mammal				1	fragment			
				unid				3	fragment		yes	
				unid				<1g	<1/4" frag		yes	
	20E 30N	Lvl I (0-6")		mammal				2	fragment		yes	
				unid				1.7g	<1/4" frag		yes	
				mollusk				1	shell frag			
		Lvl II (6-12")		mammal	CF Suidae	CF *Sus*		1	unerupted incisor			
				lg. mammal				1	cranial frag			

				mammal				4	fragment		yes	
				unid				1g	<1/4" frag		yes	

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	Square	Level	Feature	Class	Family	Genus	Species	Count	Element	Side	Burnt	Notes
I	20E 45N	Lvl I (0-6")		mollusk				1	shell frag			
				unid				0.9g	<1/4" frag		yes	
		Lvl II (6-12")		mammal				1	fragment		yes	
	25E 0N	Lvl I (0-6")		mammal				5	fragment			
				mammal				1	fragment		yes	
				unid				0.5g	<1/4" frag		yes	
				unid				5	fragment			
				mammal	Equnidae	*Equus*	*ferus caballus*	1	molar frag	n/a		
		Lvl II (6-12")		mammal	Cervidae	*Odocoileus*	*virginianus*	1	M1 upper	left		
				lg. mammal				2	fragment			
				mammal				7	fragment			
				mammal				6	fragment		yes	
				unid				3	fragment			
				unid				1g	<1/4" frag			
				unid				<1g	<1/4" frag		yes	
	25E 15S	Lvl I (0-6")		mammal				3	fragment		yes	
				unid				1	fragment		yes	

				unid				1.2g	<1/4" frag		yes	
				mammal	Suidae	*Sus*		2	molar frags	n/a		
				mammal				12	tooth frag	n/a		
				mollusk				1	shell frag			
	25E 5N	Lvl I (0-6")		mammal	Cervidae	*Odocoileus*	*virginianus*	1	3rd phalanx	n/a		
				mammal				2	fragment		yes	
				unid				5	fragment		yes	
		Lvl I & II		unid				1	fragment		yes	
	25E 10N	Lvl I & II (0-12")		mammal				1	fragment			cut bone, historic
				unid				1	fragment			
	25E 40N	Lvl I (0-6")		mollusk				1	shell frag			
				mammal				2	fragment		yes	
				unid				0.3g	<1/4" frag		yes	
				unid				2	fragment			

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	Square	Level	Feature	Class	Family	Genus	Species	Count	Element	Side	Burnt	Notes
I	25E 40N	Lvl II (6-12")		mammal	Cricetidae	*Ondatra*	*zibethicus*	1	innominate frag	right		
				mammal				5	enamel frag			
				mammal				3	fragment		yes	
				unid				2	fragment			
				unid				2	fragment		yes	
				unid				<1g	<1/4" frag		yes	

	25E 45N	Lvl I		mammal				1	fragment			
				mollusk				1	shell frag			
				unid				0.5g	<1/4” frag			
		Lvl II (6-12”)		lg. mammal				1	fragment		yes	
				mammal				2	fragment		yes	
				mammal				1	fragment			
				unid				1	fragment			
	25E 55N	Lvl I (0-6”)		mammal				3	fragment		yes	heavily gnawed
				unid				7	fragment		yes	
				mammal				3	fragment			
		Lvl II (6-12”)		mammal	Cervidae	*Odocoileus*	*virginianus*	1	acetabulum	left		
				mammal	Cervidae	*Odocoileus*	*virginianus*	1	distal radius frag	right		
				mammal	Cricetidae	*Ondatra*	*zibethicus*	1	mandible frag	left		
				mammal				1	enamel frag			
				mammal				16	fragment			
				mammal				2	fragment		yes	
				reptile				6	shell frag			
				unid				23	fragment			
				unid				4g	<1/4” frag			
				unid				3	fragment		yes	
				unid				<1g	<1/4” frag		yes	

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	**Square**	**Level**	**Feature**	**Class**	**Family**	**Genus**	**Species**	**Count**	**Element**	**Side**	**Burnt**	**Notes**
I	30E 50N	Lvl I (0-8”)		mammal				1	fragment		yes	

		Lvl II (8-14”)		mammal	Cervidae	*Odocoileus*	*virginianus*	1	naviculo-cuboid	right		
				mammal				2	fragment			
				mammal				6	fragment		yes	
				med mammal				1	metatarsal		yes	
				unid				8	fragment			2 gnawed
				unid				<1g	fragment			
				unid				8	fragment		yes	
				unid				1g	<1/4” frag		yes	
	35E 0N	Lvl I		mammal				4	fragment		yes	
				mammal	Canidae	CF *Vulpes*	*vulpes*	1	3rd phalanx		yes	
				unid				2	fragment		yes	
				unid				2	fragment		yes	
		Lvl II		mammal	Cervidae	*Odocoileus*	*virginianus*	1	astragalus	right		
				mammal				1	fragment			
	35E 50N	Lvl II (8-14”)		mammal	Castoridae	CF *Castor*	*canadensis*	1	tibial epiphysis	right		distal
				med mammal				1	metatarsal		yes	
				sm. mammal				1	zygomatic			
				mammal				10	fragment		yes	
				mammal				14	fragment			
				reptile				5	shell frag			
				unid				11	fragment			
				unid				3	fragment		yes	
				unid				1g	<1/4” frag		yes	

				unid				2g	<1/4” frag			
	40E 35N	Lvl I		unid				6	fragment		yes	
				unid				5	fragment			
				mammal				1	fragment			

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	**Square**	**Level**	**Feature**	**Class**	**Family**	**Genus**	**Species**	**Count**	**Element**	**Side**	**Burnt**	**Notes**
I	40E 40N	Lvl I		mammal				4	fragment		yes	
				unid				3	fragment		yes	
				mammal	Artiodactyla			1	enamel frag			cow or horse
				mammal	CF Suidae	CF *Sus*		1	tooth frag			
				mammal				1	fragment			
				unid				1	fragment			
		Lvl II	Feature 10	unid				1	fragment			
			Feature 10	unid				<1g	<1/4” frag			
				lg. mammal				3	fragment			
				mammal				5	fragment			
				mammal				1	fragment			gnawed
				reptile				1	shell frag			
				unid				7	fragment		yes	
				unid				5	fragment			
				unid				6	fragment			
				unid				<1g	<1/4” frag			
	40E 45N	Lvl I		mammal	Cervidae	*Odocoileus*	*virginianus*	1	incisor			

				unid				3	fragment			
				unid				3	fragment		yes	
		Lvl II		mammal				3	fragment			cut/gnawed
				mammal				1	fragment			
				reptile	Testudines			1	fragment			
				unid				2	fragment			
	40E 55N	Lvl I		mammal				2	fragment		yes	
				unid				6	fragment		yes	
		Lvl I (0-6”)		mammal				1	tooth frag			
				mammal				2	fragment			
				reptile	Testudines			1	shell frag			
				unid				4	fragment			

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	**Square**	**Level**	**Feature**	**Class**	**Family**	**Genus**	**Species**	**Count**	**Element**	**Side**	**Burnt**	**Notes**
I	40E 55N	Lvl II (6-12”)		mammal	Cervidae	*Odocoileus*	*virginianus*	1	unciform	right		
				mammal	Sciuridae	*Tamias*	*striatus*	1	mandible	right		
				mammal	Sciuridae	*Tamias*	*striatus*	1	tibia	right		
				mammal				5	fragment			cut/gnawed
				mammal				7	fragment			
				mammal				3	fragment		yes	
				reptile				3	shell frag			
				unid				19	fragment			
				unid				5	fragment		yes	

				unid				7g	<1/4" frag			
	45E 50N	Lvl II (8-14")		unid				1	fragment			
	50E 50N	Lvl II (8-14")		mammal				1	fragment			
				mammal				3	fragment		yes	
	5W 10N	Lvl I (0-8")		unid				3	fragment			
	5W 15N	Lvl I (0-8")		unid				3	fragment			
				mammal				1	fragment		yes	
				unid				0.9g	<1/4" frag		yes	
	5W 45N	Lvl I (0-6")	Feature 6	mammal				5	fragment			
			Feature 6	mammal	Cervidae	*Odocoileus*	*virginianus*	1	M2	right		Lower
			Feature 6	unid				1.0g	<1/4" frag			
			Feature 6	unid				0.5g	<1/4" frag		yes	
		Lvl II (6-12")		mammal	Mustelidae	*Taxidea*	*taxus*	1	C1			
				mammal	Mustelidae	*Taxidea*	*taxus*	1	M2			
				mammal	Mustelidae	*Taxidea*	*taxus*	2	mandible frag			
				mammal				10	fragment			
				reptile	Testudines			3	shell frag			
				mammal	Mustelidae			1	innominate	right		acetabulum
				mammal				1	fragment		yes	cut
				bird				1	fragment			
				unid				8	fragment			
				unid				1.1g	<1/4" frag			

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	Square	Level	Feature	Class	Family	Genus	Species	Count	Element	Side	Burnt	Notes
I	5W 45N	Lvl II (14-18")		mammal	Procyonidae	*Procyon*	*lotor*	1	radius	left		proximal 1/3
				mammal				1	fragment			
				unid				2	fragment			
				unid				<1g	<1/4" frag			
		Lvl II	Feature 5	mammal	Cervidae	*Odocoileus*	*virginianus*	1	astragalus	left		
			Feature 5	mammal	Cervidae	*Odocoileus*	*virginianus*	1	3rd phalanx			
			Feature 5	mammal	Cervidae	CF *Odocoileus*	*virginianus*	1	2nd phalanx			
			Feature 5	mammal	Cricetidae	*Ondatra*	*zibethicus*	1	humerus	right		medial frag
			Feature 5	mammal	Mephitidae	*Mephitis*	*mephitis*	1	mandible frag	left		
			Feature 5	mammal	Sciuridae	*Tamias*	*striatus*	1	mandible frag	left		
			Feature 5	mammal	Carnivora			1	canine			
			Feature 5	mammal				24	fragment			cut marks on one
			Feature 5	mammal				7	fragment		yes	
			Feature 5	reptile	Testudines			2	shell frag			
			Feature 5	unid				<1g	<1/4" frag			
	5W 40N	Lvl II (6-12")		mammal				2	fragment		yes	
				mammal				15	fragment			
				lg. mammal				1	rib frag			
				unid				4	fragment			
				unid				<1g	<1/4" frag			
	5W 45N	Lvl II		reptile	Testudines			1	shell frag			

		Lvl II (6-12”)		mammal				5	fragment		yes	
				unid				<1g	<1/4” frag			
	5W 10N, 5W 15N, 0E 10N, 0E 15N	Lvl I & II	Feature 6	mammal				15	enamel frag			

Table 2 cont. Kautz Site faunal assemblage, sorted by unit and square.

Unit	Square	Level	Feature	Class	Family	Genus	Species	Count	Element	Side	Burnt	Notes
I	10W 45N	Lvl I		unid				3	fragment			
				unid				0.1g	<1/4” frag	yes		
				mammal				4	fragment			
		Lvl II	Feature 9	mammal				7	fragment			
			Feature 9	unid				2	fragment			
			Feature 9	unid				1.0g	<1/4” frag			
				mammal				1	fragment			
				amphibian				1	fragment			
II	0E 30N	Lvl I (0-8”)		unid				2	fragment			
		Lvl II (8-12”)		mammal				1	rib fragment			
	5E 0N	Lvl I (0-8”)		lg. mammal				1	cranial frag			
	5E 30N	Lvl I (0-8”)		lg. mammal				1	cranial frag			
				lg. mammal				1	limbshaft frag			
				mammal				1	fragment			
				unid				3	fragment			
				mollusk				1	shell frag			
	unknown	unknown		mammal				1	fragment	yes		
	unknown	unknown		mammal	Suidae	*Sus*		3	tooth frag			

References Cited

Elbroch, Mark.

2006 *Animal Skulls: A Guide to North American Species.* Stackpole Books, Mechanicsburg, PA.

Grayson, Donald K.

1973 On the Methodology of Faunal Analysis. *American Antiquity* 38: 432–439.

Gilbert, Allan S. and Burton H. Singer.

1982 Reassessing Zooarchaeological Quantification. *World Archaeology* 14: 21-40.

Gilbert, B. Miles.

1990 *Mammalian Osteology.* Missouri Archaeological Society, Columbia, Mo.

Hillson, Simon.

1986 *Teeth.* Cambridge University Press, New York.

Hoffmeister, Donald F.

1989 *Mammals of Illinois*. University of Illinois Press, Urbana and Chicago, IL.

Laubin, Reginald and Gladys Laubin.

1980 *American Indian Archery*. University of Oklahoma Press, Norman Ok.

Long, Charles A.

2008 *The Wild Mammals of Wisconsin*. Pensoft Publishers, Sofia, Bulgaria.

Marshall, Fiona and Tom Pilgram.

1993 NISP vs. MNI in Quantification of Body-Part Representation. *American Antiquity* 58: 261-269.

Olsen, Stanley, J.

1964 *Mammal Remains from Archaeological Sites*. Papers of the Peabody Museum of Archaeology and Ethnology, Vol. 56, No. 1, Harvard University Press, Cambridge.

Post, Lee

2004 *The Moose Manual: How to Prepare and Articulate Large Hoofed Mammal Skeletons*. Bone Building Books 6. Lee Post, Homer, Alaska.

Schmid, Elisabeth.

1972 *Atlas of Animal Bones: For Prehistorians, Archaeologists, and Quaternary Geologists.* Elsevier Publishing Co., New York.

APPENDIX B: LITHIC DOCUMENTATION AND SCHEMA

University of Wisconsin-Milwaukee Archaeological Research Laboratory
Program in Midwestern Archaeology

Lithic Documentation and Schema for Recording Stone Tools, Individual Debitage Analysis and Debitage Mass Analysis

Robert J. Jeske

April 2015

This recording scheme and rationale is a modification of:

Lurie, Rochelle and Robert J. Jeske
1990 Appendix 1: Lithic Recording Scheme. In *At the Edge of Prehistory: Huber Phase Archaeology in the Chicago Area*, edited by James A. Brown and Patricia J. O'Brien, pp. 284-290. Center for American Archaeology Press, Kampsville.

Acknowledgements
UWM students who have worked with and helped to refine the scheme over time:

Dustin Blodgett
Anne Gaynor
Louise Lambert
Sung Woo Park
Katherine Sterner-Miller
Jon VanBeckum
Daniel M. Winkler

A FIRST-LINE CHIPPED STONE RECORDING SCHEME

The recording scheme for chipped stone tools and debris described here was originally developed in the course of analysing material from the Koster site in the lower Illinois River valley and Mound City, in Chillicothe Ohio between 1980-1982 by Lurie and Jeske (see (Jeske1987, Jeske, 1989 #9; Lurie 1982). In addition to being the basis for both Jeske and Lurie's dissertations, an early revised version of the scheme was published as (Lurie and Jeske 1990) , an appendix to *At the Edge of Prehistory: Huber Phase Archaeology in the Chicago Area* (Brown and O'Brien 1990).

Since then it has undergone many upgrades and has been modified and applied to a wide variety of sites (e.g., (Blodgett 2004; Jeske 1988, 1992, 2003; Park 2004; Winkler 2011). The goal was, and still is, to produce data sets that facilitate comparisons among sites. The variables we chose were influenced by our interests in stone tool economy as well as functional and stylistic concerns. None of the variables are particularly difficult or require great expertise to record.

The fundamental principle is to produce basic data that allow for initial description and for formulation of more complex and situational problems. These basic data sets will enable researchers to address questions about settlement patterns, procurement systems, social networks, and a multitude of other issues that affect raw material acquisition, tool production, tool use and tool discard. The compatibility of data sets also allows the research to make comparisons within or among regions and to identify stability or change through time. Scholars with more focused objectives can then use the basic data set as a foundation for future work (e.g., high powered microscopy, blood residue analysis). See (Jeske and Sterner-Miller 2015; Sterner 2011) for examples.

This scheme was developed to fill multiple requirements:

1.) Accuracy in measurement: how close could we come to measuring what we were interested in measuring).
2.) Precision in measurement: how well could we replicate that measurement).
3.) Relevance of variable selection: were we measuring something worth knowing
4.) Compatibility with traditional lithic typologies. Could others understand our results?

Here we will provide a rationale for a first-line, or initial recording scheme, discuss the relevance of variable selection, and show the need for detailed definitions of variables and attributes. The recording scheme, with detailed definitions of variables and attributes, follows.

Rationale

The origin for this work started with Lurie's frustration over recording lithic material from Middle Archaic horizons at the Koster site. All Koster lithic artifacts were coded and put into computer files as they were brought in from the field according to preliminary variable lists designed by Thomas Cook (1975). Originally working with chipped stone artifacts from Horizon 8B, Lurie found that she could not replicate these preliminary variable scores. Correspondence of scores for almost all variables was only about 50%. This poor result in precision may have been due to one or more of the following reasons: 1) Lack of training with the original data recording scheme, 2) Lack of clarity in the definitions of attributes. Ambiguities in definitions may have allowed the recorders to make inconsistent personal judgements on attributes, 3) Human error and/or inexperienced personnel recording the original data.

Several people had worked with Koster lithics, and there was no way to determine who worked any particular artifact; therefore it was impossible to detect any systematic errors by individuals. No formal testing for reliability had been done with the original recording scheme since it was considered preliminary.

Problems with reliability of data certainly were (and are) not unique to the Koster site. Reanalysis of artifacts often takes place long after the original recorders have left the scene, and often notes on the original processing system are scanty. Yet the reliability and consistency of data is crucial in writing a descriptive report or conducting any higher level analysis. For example, Jeske's analysis of Mound City lithics in 1981-1982 proved a frustrating task (Jeske and Brown 2012). Mound City National Monument in Ohio, excavated, nearly destroyed, rebuilt, and reexcavated since its reporting by Squire and Davis in 1848, is a collage of pot-hunted artifacts, anecdotal reports by early excavators, and systematic excavations. Depending on the rigors of excavation, some artifacts were provenienced to site, mound, excavation unit within the site, or three dimensional coordinate locations. Artifacts were assigned to

morphological types without explanation. Some variables (such as retouch or raw material type) were recorded for some, but not all, artifacts. Accuracy in placing artifacts into distinct categories was impossible, as was replicability of recording data from much of the assemblage. It quickly became apparent that a reliable, replicable, system for the recording of data from the site was necessary if a description, let alone analysis, of the lithic material recovered from Mound City was going to be feasible.

Equally important, intersite comparisons with other Middle Woodland/ Hopewell sites was frustrated due to quixotic reporting of lithic variables in the archaeological literature. Some authors chose a strictly morphological approach (Pi-Sunyer 1965) while others attempted functional analysis (Reid 1976). The recording scheme for Mound City had to be flexible enough to allow for comparisons with other sites reported in the literature, despite the wide diversity of recording systems chosen by other authors. It should be noted that many others have since done more comprehensive work on Hopewell lithics, e.g., (Cowan 2000; Genheimer 1996; Kay and Mainfort Jr. 2014; Lemmons and Church 1998; McConaughy 2005; Nolan, et al. 2000; Odell 1994; Peoples, et al. 2008; Yerkes 2003, 2009). Yet even today the need for a recording scheme that can help us take advantage of the increasing data on lithics in the literature is clear.

Problems such as those discussed above must be taken into account before one applies any classificatory, typological, or grouping procedure to artifacts. No matter how appropriate or elegant these procedures may be, unreliable data will give unreliable answers to archaeological questions. While it is easy to criticize someone else's work, it is harder to find a way to do a better job. Koster 8B was an excellent component to use as a guinea pig for designing a lithic recording scheme. The assemblage is composed of over 907 chipped stone artifacts, and over 15,000 pieces of chipped stone debris. Over 50% of the tools are broken, and the majority do not easily fit into formal tool categories. Debris had not been counted or sorted, 181 utilized flakes were eventually recovered from the debris. Selection of relevant variables for tools and debris and efficiency in recovering data as well as reliability were necessary.

One of the first steps in devising the recording scheme used for the sites in this report was to subject the Koster 8B data to reliability tests (Goodsitt 1980). As a result of these tests attribute definitions were made more explicit. Work with the Mound City material led to further revision and refinement of the scheme. Teaching the scheme to a number of undergraduate, graduate, and

non-professional volunteers enabled us to identify problems of interpretation and clarity. Both accuracy and precision were our major guiding principles in training students.

Further work with large numbers of students over the last 20 years has shown that after several training sessions, the typical student can achieve approximately 90% agreement with other recorders when coding artifacts. It is not perfect agreement, but we keep working on finding new ways to define or measure, and occasionally drop entirely some variables for which we cannot achieve either accuracy or precision.

A second consideration in constructing the new recording scheme was the recovery of the maximum amount of information with the least input of time and energy. As is often the case with large projects, the work to be done outruns the money and personnel available to do the job. Some of the components at the Koster site that required analysis contained over a thousand tools. Similarly, the Crescent Bay Hunt Club assemblage also contains thousands of lithic tools and pieces of debris. A recording scheme that was quick and easy to learn was necessary. With such a scheme one person or several trained to use them could process large quantities of material. With moderate experience a trained student can analyse 10 to 12 artifacts an hour with this scheme.

A third consideration in undertaking this project was a growing concern with the appropriateness of variable selection. Within the last 20 years lithic studies have become much more specialized both in problem orientation and in techniques of analysis. Lithic analysts are increasingly aware that different variables are important for different research problems, and that many variables that are now considered important have not been recorded in the past. In response to this awareness the designers of many recent recording schemes have taken the shotgun approach--record as many variables as you can think of in the hopes that some day someone will use them. Even if the shotgun approach were appropriate, it is often prohibitively expensive and time consuming. What is needed are studies focused enough to be practical, yet general enough that traditional comparisons to other data sets can still be made.

For example, researchers in chipped stone tool function are no longer content with intuitive morphological categories such as end scraper, knife or projectile point. In order to assess a tool's function or functions several macroscopic and microscopic indicators must be taken into

account. The recording of these indicators requires special skills and equipment, and time. As functional studies become more fashionable, these attributes may be recorded even though the researcher is not currently interested in the data and no specific problem has been formulated which would require the data. A great deal of effort may yield little payoff. Even if a functional analysis of chipped stone tools is problem-oriented and carried out by a skilled researcher, he or she may still want to monitor variability (whatever that variability might mean) between the assemblage and one that is reported in traditional morphological tool types and will still need some type of general recording scheme. The chipped stone recording scheme presented here is an alternative to the shotgun approach. It is an initial, first-line recording scheme composed of a limited number of variables explicitly related to problems of technology, function and style in lithic artifacts. These variables are also used to define traditional tool types and allow intelligent sampling for more detailed studies.

Chipped Stone Artifact Variable Selection

Three identification variables are recorded for all artifacts. These include a site designation, a provenience within the site and an individual artifact number. Metric variables (length, width, thickness and weight) are recorded whenever possible. In addition twenty chipped stone variables that reflect manufacture, function and style will be discussed below. The variables refer to either the entire tool or when appropriate to employable or functional units as defined by (Knudsen 1973:17) as

> that implement segment or portion (continuous edge or projection) deemed appropriate for use in performing a specific task, e.g. cutting, scraping, perforating, drilling chipping. The unit is identified by deliberate retouch and/or apparent post-production utilization modification, and its boundaries are defined subject to the analyst's own concept of 'habitual use.'

There is some leeway for an analyst to deem an area appropriate for use. We attempt to keep this leeway as tight as possible, using traditional and recent definitions of terms such as retouch, and habitual use. The goal is to reduce, not remove, subjectivity from the observations. The following schemes are presented as initial steps towards that goal.

Chipped Stone Recording Scheme

A. Provenience: All artifacts are given a unique number that identifies site and location within the site.

B. Catalogue Number: The catalogue number is an arbitrary number assigned as a short code for the provenience.

C. Tool Number: Each tool is given a unique number within its provenience.

D. Raw Material: Raw material is identified using the comparative collection at the UWM archaeological laboratory. Identification is done by visual comparison, with low power magnification (if necessary) to aid in fossil identification for an excellent resource for northern Illinois cherts (Ferguson and Warren 1992), also see (Winkler, et al. 2009).

Raw Material Codes

1. Unidentified
2. Galena
4. Maquoketa
6. Oneota
7. Platteville
8. Cochrane
20. Burlington
23. Wyandotte
26. Pecatonica
28. Joliet Silurian
29. Beach Cobble
30. Cobden

E. Raw material quality: This variable is also defined using comparative samples. Inclusions, fossils, fracture planes, and grain size are used to determine quality.

1. Good
2. Fair
3. Poor
4. Can't Determine.
5. Not Applicable for non-chert flaked artifacts

F. Amount of Cortex: For flake artifacts this variable refers to the percent of the dorsal surface which is covered with cortex or patina. For bifacial and multifacial artifacts the variable refers to the percent of cortex or patina on all surfaces. Patina which has accumulated since the manufacture of the artifact, that is, patination covering flake scars is ignored.

1. 0
2. <50
3. >50, <100
4. 100

G. Heat-Alteration: This variable is recorded for all artifacts. The criteria used to identify heat altered chert are taken from (Rick 1978). It should be noted that Rick's experiments were primarily done with Burlington chert, and that his criteria may not apply to all types of chert. In assessing heat-alteration it is necessary to have samples of both the unaltered and altered materials for comparison. Rick's criteria are as follows:

Luster Contrast. "On an artifact with flaked surfaces produced both before and after heating, a contrast will appear in the luster of the two surface types. Presence of such a luster contrast is near- certain evidence of heat treatment." (p. 57) This criterion is considered most reliable for scoring Burlington chert.
Degree of Luster. An increase in luster is often a result of heat alteration (p. 57).
Heat Fracture Scars. These include crazing and pot lid fractures (p. 58).
Conchoidal Ripples. Conchoidal ripples are more prominent on heat-altered pieces (p. 58).
Color. Pink-red coloration was used as a**n indicator of heat-alteration.** Comparative collections are used to indicate the range of variation in non-heat-altered

Heat- Alteration attributes were scored as follows:

1. Heat Treatment Present.
2. Heat Treatment Possible.
3. Heat Treatment Absent.
4. Burned

5. Can't Determine

H. Basic Form: This variable is recorded for each artifact. Attributes are usually assigned with 10X magnification. Medium power magnification (40x) is used if use wear is suspected.

1. Edge or Functional Unit Only. No attempt has been made to shape the body of the piece, but one or more edges have been retouched and or used. Occasionally a small surface area rather than an edge will be modified through use (usually battering or polish).

2. Unifacial. The body of the piece has been shaped on one side. There must be at least one flake scar which does not originate on the edge on the shaped face. Torrence (personal communication) has suggested the extent of flake scar invasion as an alternate means of assessing body modification.

3. Bifacial. Both faces of the piece have been shaped. There must be at least one flake scar which does not originate on the edge of the piece on both sides of the piece. This flaking usually produces items with lenticular cross-sections.

4. Multifacial. The body of the piece exhibits intentional flake scars creating more than two faces. These pieces often have a blocky appearance. They may or may not have functional units.

5. Nonfacial. These are rounded pieces with no well defined faces or edges. They are usually produced by battering and are often formed through use rather than intentional modification.

6. Prismatic Blade or Bladelet. Flake with parallel edges and at least one ridge running the length of the dorsal surface of the piece. It is usually much longer than it is wide. The piece may or may not show use wear.

7. Unknown. These are fragments that have been flaked or battered on a face of edge, but are too incomplete to assign to any of the above categories.

I. Edge Modification: This variable characterizes the location of retouch or use on an edge. Pieces are considered retouched if: 1.) there are at least three contiguous flake scars or battering 0.5mm or more along the edge of a tool, and 2.) the scars or battering extend more than I mm onto the body of the piece. Pieces are considered used when 1.) microflaking, grinding, polishing or rounding extend 0.5mm along an edge, and 2.) modification does not extend beyond 1mm onto the body of the piece. The extent of use on a projection may be less than 0.5mm. Bag wear and shovel or trowel modification scars are usually recognized by their fresh appearance and acute angle to the edge (Knudsen 1973; Odell 1977)Knudson 1973).

1. **Unifacial**. Retouch scars, battering or use appear on one side of an edge or edge segment.
2. **Bifacial**. Retouch scars or use are on both sides of an edge or edge segment. Modification must occur on both sides of the same edge or edge segment for pieces with more than one edge or edge segment.
3. **Unifacial and Bifacial**. The piece has more than one edge or edge segment. At least one is unifacially modified and one bifacially modified.
4. **Not Applicable**. Pieces without edges are scored not applicable.

J. Method of Modification: Applies to both the edges and bodies of all pieces.

1. **Flaked**. The piece has been intentionally flaked on the body or edge of the piece (See variable J for definition of retouch).
2. **Battered**. An edge or surface has been altered by pounding. It may have been pounded upon or used to pound something else. Pounding will produce flake scars and crushing. When flake scars are not distinct, the alteration is considered battering. Many battered edges have directionality to the remnants of visible flake scars, and it is possible to determine if an edge is unifacially or bifacially modified. Edges formed by battering are often not well defined. There may be a zone of non directional crushing between the sides of an edge. If there are 2mrn or less separating directional pounding on both sides of an edge, the edge is considered bifacial; if there are more than 2mm separating directional battering along a segment, the alteration is considered two distinct edges.
3. **Flaked and battered**. The piece has been altered by both flaking (leaving distinct flake scars) and by battering.
4. **Use-wear Only**. A functional unit (usually an edge) shows traces of use-microflaking, edge grinding, polishing, or rounding. Microflaking will not extend more than 1mm onto the face of the pieces (See variable J).
5. **Retouched and used**.
6. **Not Applicable**. Small problem pieces are scored here.

K. Refinement: This variable applies to pieces scored 3 (bifacial) for Basic Form. Scores for refinement are based on comparison with sample pieces chosen by the author. Size of flake scars along edges, regularity of tool outline and thickness of transverse cross-section were basic criteria for the selection of sample pieces.

1. **Crude**
2. **Medium.**
3. **Refined.**

4. Can't Determine. Pieces are too incomplete to be scored.

5. Not Applicable. Pieces scored something other than 3 for Basic Form.

L. Completeness of Functional Unit: For some studies, particularly functional analysis of tools, the appropriate unit of inquiry is the functional unit rather than the whole tool. This variable records the condition of functional units.

1. Broken. One or more functional units on a tool is interrupted by a break.

2. Whole. All functional units are complete. If there are two functional units, one whole and one broken, the piece is scored as broken.

3. Can't Determine. Sometimes a functional unit will end at a break, but the break may not have interrupted the functional unit; i.e., the functional unit was created after the break occurred and is whole. This situation is difficult to determine in practice. This attribute is assigned to questionable pieces.

4. Not Applicable. fragments without functional units are not scored for this variable.

M. Element Present: This variable focuses on the entire tool. The first three attributes apply to flakes and rectangular-ovoid pieces that have ends. Essentially whole, square pieces, and many small or blocky fragments will be scored as attributes 5, or 4 and 6, respectively.

1. Distal End. The distal end of a flake is the termination end, the end opposite the striking platform and bulb of percussion. For non-flakes the distal end is the working end of the tool if this can be determined. The distal end may contain part of the mid-section.

2. Mid-Section. There is no end present.

3. Proximal End. The proximal end of a flake is the end that contains the striking platform or bulb of percussion. Hafting elements and butt ends of bifaces are considered proximal ends. Proximal ends may contain part of the mid-section.

4. End Section. An end section is present, but it is not possible to determine if it is the distal or proximal end.

5. All elements Present. The tool is essentially whole. Small edge sections may be missing, but the entire outline of the piece can be determined without guess work.

6. Can't Determine.

N. Reworking or Reuse: Tools are often resharpened if an edge becomes dull, or reworked and reused if the tool is broken. Resharpened tools may have remnants of flake scars from the original edge. Tools may become progressively asymmetrical as they are resharpened. Retouch or use on a broken edge and abrupt change in tool outline are also used as indicators of reworking and reuse.

1. Present

2. Possible

3. Absent

O. Distal End Morphology. This variable applies only to those pieces with identifiable distal ends (See variable N for definition of distal end).

1. Blunt. The major portion of the distal end is perpendicular to an axis drawn through the striking platform and bulb of percussion or perpendicular to the longest axis of the piece if platform and bulb are absent.

2. Pointed. Pointed ends may be rounded or accumate.

3. Not Applicable. Pieces without distal ends are scored not applicable.

4. Can't determine.

P. Position of Retouch or Use: Applies to edge modified only and unifacially modified pieces with modified edges. The tools must be complete enough to determine two axes.

1. End. The retouch or use is perpendicular to an axis through the striking platform and bulb of percussion or through the longest axis of the piece if platform and bulb are absent.

2. Side. The retouch or use is parallel to an axis drawn through the striking platform and bulb of percussion, or parallel to the longest axis if platform and bulb are not present.

3. End and Side. A continuous modified edge is both perpendicular and parallel to the axis. If more than one edge exists, at least one perpendicular and one parallel to the axis.

4. Can't Determine.

5. Not Applicable. Pieces scored other than 1 or 2 for Basic Form.

Q. Number of Edges: Records the number of distinct edges identified on the piece. Each edge must conform to the definition given in Edge Modification

R. Edge Angle: Edge angles are measured for all edge functional units. Edges on hafting elements are not measured. If only the hafting element is present, no edge angle is recorded. A piece may have more than one edge functional unit. Three measurements are taken for each functional unit and the mode is taken to represent the edge as a whole. Measurements are taken with a goniometer. Measurements are taken 5mm back from the edge, measuring what Knudsen (1973) has termed the production angle. To assign specific locations for each edge measured, the piece is oriented with the long axis vertical and the short axis horizontal. Starting from the top of the piece (the distal end) and moving clockwise around the piece, each edge is given a letter. Up to four distinct edges can be measured on the form. For pieces with more than four edges, a note is made in Comments.

1. 0-45 degrees.
2. 46-75 degrees.
3. Greater than 75 degrees.
4. Not Applicable. Pieces without edges are scored not applicable.

S. Edge Configuration: Edge configuration in plan view is recorded for all edges except edges on hafting elements. Location assignment for each edge on the piece is done exactly the same as in Edge Angle. Thus, Edge Angle A and Edge Configuration A for any piece refer to the same place on the artifact.

1. Smooth. There are no regular indentations or projections in plan view.
2. Serrated. There are regular indentation along the edge; the indentations are up to 2mm. deep and up to 2mm apart. There must be at least 2 1/2 indentations present.
3. Denticulate. There are regular indentations along the edge; the indentations are greater than 2mm deep and more than 2mm apart. There must be at least 2 1/2 indentations present.
4. Notched. There is a single indentation or a series of non-contiguous indentations on an edge. The indentation(s) must show retouch or use within their boundaries. Notches for hafting are not scored here.
5. Not Applicable. Pieces without edges are scored not applicable.

T. Hafting Element: This variable applies to whole or almost whole pieces (See variable K), and broken pieces with obvious hafting elements.

1. Present. Hafting elements are defined by marked constrictions or notches.
2. Possible. Possible hafting elements are defined by slight constrictions, or wear or polish on the lateral margins toward the base. Pieces with suspected hafting elements were examined v microscopically.
3. Absent. There are no indications of hafting.
4. Not Applicable. Fragments without obvious hafting elements are scored not applicable.
5. Modification for hafting by thinning and/or grinding the tool base.

U. Projections: This variable applies to whole pieces, broken pieces with projections. or projections alone (i.e. broken drill bits). The projections are defined by intentional retouch or by wear on an unretouched area that extends out from the body of the piece.

1. Present.
2. Absent.
3. Not Applicable. Tool fragments without projections are scored not applicable.

V. Modification on Projection: Applies only to pieces with projections (see variable T).

1. **Present**. Projections have been formed by intentional retouch.
2. **Absent**. Projections have been defined on the basis of wear.
3. **Not Applicable**. Pieces without projections are scored not applicable.

The following metric variables are recorded for whole pieces only. Whole pieces are those that were scored 2 for variable J and 5 for variable K. Length, width and thickness were measured to the nearest millimeter.

W. Length: The longest axis of the piece regardless of orientation was measured as length.

X. Width: The longest axis perpendicular to the long axis was measured as width.

Y. Thickness: The greatest axis perpendicular to both length and width was measured as thickness.

Z. Weight: Weight was recorded to the nearest gram.

AA. Comments: Written comments accompany unusual pieces. The comments have been grouped into six categories.

1. **Thinning Flake**. Thinning flakes are flakes exhibiting dorsal flake scars and some sort of edge preparation. These items are usually products of bifacial manufacture and not in themselves shaped for an intentional use. The platforms often have remnants of bifacial edges or are ground. These bifacial edge remnants are not recorded as a working edge on the thinning fake.
2. **Unusual Raw Material**. Any comment about raw material that is not covered in the main body of the scheme is recorded as a written comment on the original recording forms.
3. **Dubious Artifact**. Flake scars may have been caused by some natural agent, and therefore, the item may not be an artifact.
4. **Unusual Artifact Form, General**. The artifact shape is in some way unique. A written descriptive comment can be found on the original recording sheet.
5. **Unusual Artifact Form, Specific**. The artifact shape is similar to a particular form which is in some way characteristic of the site. A written comment can be found on the original recording sheet.

6. Association. The item under consideration is linked to another item. This link may be refitting, items from the same core, or spatial relationship.

7. More than four edges. Edge angle and configuration records for these artifacts can be found on the original recording sheet.

8. Other.

BB. Local Raw Material

1. Yes
2. No

CC. Projectile Point Type:

List those commonly found in your region. See for example (Justice 1995).

1. Bottleneck Stemmed
2. Durst/Lamoka
3. Merom/Trimble
4. Fulton Turkey Tail
5. Motley
6. Kramer
7. Adena
8. Norton
9. Bladelet
10. Manker
11. Micro-Gibson
12. Lowe Cluster
13. Raccoon Notched
14. Madison Triangular
15. Waubesa Contracting Stem
16. Unclassified stemmed
17. UNID
18. Klunk Side Notched
19. Gibson

CHIPPED STONE DEBRIS SCHEME RATIONAL

In recent years archeologists have learned that the study of the debris from artifact manufacture is often more informative than the finished products. Finished tools are often removed from the site of original manufacture and use; deposition is often the result of social factors not easily recognized in the archeological record. Debris is not likely to be removed from the immediate vicinity of artifact manufacture, clean-up activities notwithstanding. In sheer weight and numbers, lithic debris is usually the largest single class of material remains at a site. For spatial, functional, and economic models used in archeological analysis, debris can be the most reliable data set available.

Once cavalierly regarded as waste material, debris is now the subject of many studies designed to identify manufacturing processes, to gauge knapping ability of aboriginal artisans, examine site function, subsistence practices, and settlement patterns (Andrefsky Jr. 2001; Andrews, et al. 2004; Holdaway, et al. 2010; Magne and Pokotylo 1981; Morrow 1997; Odell 1980; Raabe, et al. 1980; Robinson, et al. 2009; Shott 1994; Shott and Sillitoe 2005; Sterner 2011; Winkler 2011; Young and Bamforth 1990). Many variables used in debris analysis are time consuming to record and often a small sample is sufficient to solve specific problems. We suggest that in order to informatively sample debris from a site a first-line level of analysis is necessary. The first-line level of analysis should include information on the form of the debris, raw material, and platform preparation as well as size, weight, and number of pieces per unit.

Chipped Stone Debris Recording Scheme

A. Provenience – This variable identifies the unit, feature, block, etc. and level that a piece of debitage was recovered from.

B. Additional Provenience - This variable is for additional provenience information for each piece of debitage.

C. Debris Number – Each piece of debitage is assigned an individual number within its provenience unit.

D. Form – All debitage is divided into four categories based on the presence or absence of certain flake characteristics.

1. Flake – A flake is defined as an unused piece of stone exhibiting two or more of the following characteristics: striking platform, bulb of percussion, concentric rings of force, or typical flake terminations such as feather, step or hinge.
2. Flake-Like – This category is reserved for pieces of debitage which may be broken (typically free-hand flakes). These pieces must have one of the flake characteristics listed for free-hand flakes.
3. Non-Flake – A non-flake is an item which is an unused piece that does not exhibit any of the characteristics of free-hand or bipolar flakes, but still appears to be cultural. These pieces are usually termed shatter,
4. Cannot Determine

E. Raw Material Type – The raw material of a piece of debitage is identified in this variable. The raw material can be identified by using the lithic raw material comparative collection at the UW-Milwaukee archaeological laboratory, or using the Wisconsin Lithic Resource Guide (Winkler, et al. 2009).

Raw Material Codes

2. Galena Chert
3. Silurian Chert (Niagara Formation)
6. Lower Prairie du Chien Chert (Oneota Formation)
16. Quartz
18. Basalt
19. Knife River Flint
20. Burlington
21. Quartzite
26. Pecatonica
27. Beach Cobble
28. Cobden

F. Raw Material Quality – This variable refers to the flaking quality of the raw material. Inclusions, grain size, and fracture plains are often used to establish the quality of the raw material.

1. Good
2. Fair
3. Poor
4. Indeterminate

G. Thermal Alteration – This variable determines whether the piece of debitage was subjected to thermal alteration (Rick 1978). Characteristics such a color change (usually to red, pink or gray), and increased luster help to determine if the debitage has been thermally altered (Purdy 1974; Purdy and Brooks 1971). Debitage can be checked for thermal alteration by using the comparative collection at the UW-Milwaukee archaeological laboratory, or using the Wisconsin Lithic Resource guide (Winkler, et al. 2009).

1. Thermal Alteration Present
2. Thermal Alteration Possible
3. Burned
4. No Evidence of Thermal Alteration

H. Amount of Cortex – This variable refers to the percent of cortex or patina that is present on the dorsal surface of a piece of debitage. Patina that has accumulated since the production of the piece of debitage is ignored.

1. 0%
2. Less than 50%
3. 50% to 99%
4. 100%

I. Platform – This variable describes the type of platform that is present on the piece of debitage. Non-flakes and pieces of debitage that are broken and do not have platforms are scored "not present".

1. Bifacial / Complex
2. Prepared
3. Unprepared
4. Collapsed
5. Not present

I. Platform Angle – This variable measures the angle of the platform.

1. 0°-45°
2. 46°-90°
3. 91°-135°
4. 136°-180°
5. Greater than 180°
6. Not present / Unknown

J. Bulb of Percussion – This variable determines whether or not a bulb of percussion is present on a piece of debitage.

1. Pronounced
2. Diffuse
3. Multiple
4. Not present

K. Ripples – This variable determines whether or not concentric rings of force are present on a piece of debitage.

1. Pronounced
2. Diffuse
3. Not present

L. *Éraillure* Scar – This variable determines if a piece of debitage has an *éraillure* scar on the piece of debitage. An eraillure scar is a small flake scar on the ventral side of a piece of debitage on the bulb of percussion.

1. Present
2. Not present
3. Indeterminate

M. Termination Type – This variable records the type of flake termination.

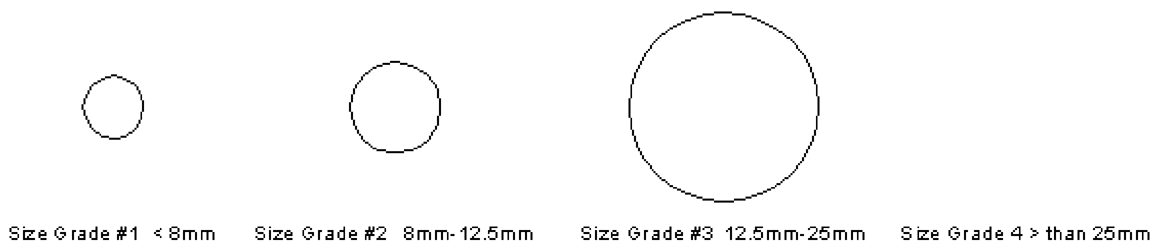
1. Feather
2. Hinge
3. Step
4. *Outrepassé*
5. Shatter/No Termination
6. Crushed
7. Indeterminate

N. Dorsal Flake Scar Count – This variable is the count of flake scars on the dorsal surface of a piece of debitage. Non-flakes are scored NA for this variable.

O. Flake Weight – The weight of the piece of debitage is recorded in grams for this variable.

P. Size Category – The size category for the piece of debitage is recorded for this variable.

1. Less than 8mm
2. 8mm to 12.5mm
3. 12.5mm to 25mm
4. Greater than 25mm



Q. Comments – This space is provided for any additional comments about the piece of debitage.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

R. Site Name

Mass Analysis Schema for Debitage

A. Provenience

B. Additional Provenience

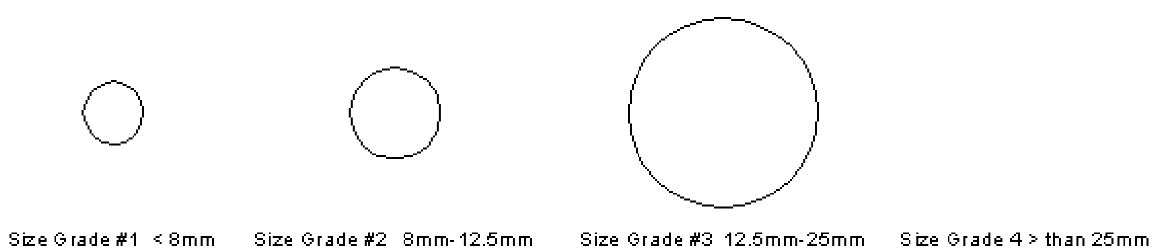
C. Size Grade
  1. Less than 8 mm
  2. 8 mm to 12.5 mm
  3. 12.5 mm to 25 mm
  4. Greater than 25 mm

D. Count per Size Grade

E. Weight per Size Grade

F. Number of Pieces with Cortex per Size Grade

G. Heat Alteration



References Cited

Andrefsky Jr., William

2001 *Lithic Debitage: Context, Form, Meaning*. University of Utah Press, Salt Lake City.

Andrews, Bradford W., Timothy M. Murtha Jr. and Barry Sheetz

2004 Approaching the hatch jasper Quarry from a technological perspective: A study of prehistoirc stone tool production in central Pennsylvannia. *Midcontinental Journal of Archaeology* 29:63-101.

Blodgett, Dustin

2004 The Richter Site: A Lithic Analysis of a North Bay Site on Wisconsin's Door Peninsula. Master's Thesis, Department of Anthropology, Anthropology, University of Wisconsin-Milwaukee, Milwaukee.

Brown, James A. and Patricia J. O'Brien (editors)

1990 *At the Edge of Prehistory: Huber Phase Archaeology in the Chicago Area*. Center for American Archaeology Press, Kampsville.

Cowan, Frank L.

2000 A Mobile Hopewell? Questioning Assumptions of Ohio Hopewell Sedentism. In *Hopewell in the New Millenium*, edited by Jane Buikstra and Jodie O'Gorman. Smithsonian Institution Press, Washington, D.C.

Ferguson, Jaqueline A. and Robert E. Warren

1992 Chert Resources of Northern Illinois: Discriminant Analysis and an Identification Key. *Illinois Archaeology* 4:1-37.

Genheimer, Robert A.

1996 Bladelets Are Tools Too: The Predominance of Bladelets among Formal Tools at Ohio Hopewell Sites. In *A View from the Core: A Synthesis of Ohio Hopewell Archaeology*, edited by Paul J. Pacheco, pp. 92-107. Ohio Archaeological Council, Columbus.

Goodsitt, Rochelle

1980 Designing a Recording Scheme for Large Lithic Assemblages: The Koster site. Paper presented at the Annual Meetings of the Society for American Archaeology, Philadelphia.

Holdaway, Simon, Wendrich Wendrich and Rebecca Phillipps

2010 Identifying low-level food producers: Detecting mobility from lithics. *Antiquity* 84:185-194.

Jeske, Robert J.

1987 Efficiency, Economy, and Prehistoric Lithic Assemblages in the American Midwest. Ph.D. dissertation, Northwestern University, Evanston.

1988 *The Archaeology of the Chain O' Lakes Region of Northeast Illinois*. Cultural Resource Management Study 5. Illinois Historic Preservation Agency, Springfield.

1992 Energetic Efficiency and Lithic Technology: An Upper Mississippian Example. *American Antiquity* 57:467-481.

2003 Lithic Procurement and Use within Mississippian Social Networks. In *Theory, Method, and Practice in Modern Archaeology*, edited by R. J. Jeske and D. K. Charles, pp. 223-237. Praeger Press, Westport, Connecticut.

Jeske, Robert J. and Katherine M. Sterner-Miller

2015 Microwear Analysis of Bipolar Tools from the Crescent Bay Hunt Club Site (47JE904). *Lithic Technology* 40. In press.

Jeske, Robert J. and James A. Brown

2012 Lithic Analysis. In *Mound City National Mounument*, edited by James. A. Brown. National Park Service, Washington, D.C.

Justice, Noel D.

1995 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States.* Indiana University Press, Bloomington and Indianapolis.

Kay, Marvin and Robert C. Mainfort Jr.

2014 Functional Analysis of Prismatic Blades and Bladelets from Pinson Mounds, Tennessee. *Journal of Archaeological Science* 50:63-83.

Knudsen, Ruthann

1973 Organizational Variability in Late Paleo-Indian Assemblages. Ph.D. dissertation, Washington State University, Pullman.

Lemmons, Reno and Flora Church

1998 A Use Wear Analysis of Hopewell Bladelets from the Paint Creek Lake Site #5, Ross County, Ohio. *North American Archaeologist* 19:269-277.

Lurie, Rochelle

1982 Economic Models of Stone Tool Manufacture and Use. Ph.D, dissertation, Department of Anthropology, Department of Anthropology, Northwestern University, Evanston.

Lurie, Rochelle and Robert J. Jeske

1990 Appendix 1: Lithic Recording Scheme. In *At the Edge of Prehistory: Huber Phase Archaeology in the Chicago Area*, edited by J. A. Brown and P. J. O'Brien, pp. 284-290. Center for American Archaeology Press, Kampsville.

Magne and and Pokotylo

1981 A Pilot Study in Bifacial Lithic Reduction. *Lithic Technology* 10:34-47.

McConaughy, Mark A.

2005 Middle Woodland Hopewellian Cache Blades: Blanks or Finished tools? *MidContinental Journal of Archaeology* 30:217-258.

Morrow, Toby A.

1997 A Chip off the Old Block: Alternative Approaches to Debitage Analysis. *Lithic Technology* 22:51-69.

Nolan, David J., Mark F. Seeman and James L. Theler

2000 A Quantiative Analysis of Skill and Efficiency: Hopewell Blade Production at the Turner Workshop, Hamilton County, Ohio. *MidContinental Journal of Archaeology* 32:297-329.

Odell, George H.

1977 The application of micro-wear analysis to the lithic component of an entire prehistoric settlement: methods, problems and functional reconstructions. Ph.D. dissertation, Department of Anthropology, Harvard University, Cambridge.

1980 Towards A More Behavioral Approach to Archeological Lithic Concentrations. *American Antiquity* 45:404-431.

1994 The Role of Stone Bladelets in Middle Woodland Society. *American Antiquity* 59:102-120.

Park, SungWoo

2004 Lithic Technology and Subsistence Change in the Thirteenth through Seventeenth Centuries: An Example from the Zimmerman / Grand Village of the Illinois Site in the Upper Illinois River Valley. Ph.D. dissertation, Department of Anthropology, University of Wisconsin-Milwaukee, Milwaukee.

Peoples, Nicole, Eliot M. Abrams, Ann Corinne Freter, Brad Jokisch and Paul E. Patton

2008 The Taber Well Site (33HO611): A Middle Woodland Habitation and Surplus Lithic Production Site in Hocking Valley, Southeastern Ohio *MidContinental Journal of Archaeology* 33:107-127.

Pi-Sunyer, Oriel

1965 The Flint Industry. In *The McGraw Site: A Study in Hopewellian Dynamics*, edited by O. Prufer, pp. 60-82. Scientific Publications No. 1. Cleveland Museum of Natural History, Cleveland.

Purdy, Barbara A.

1974 Investigations Concerning the Thermal Alteration of Silica Minerals: An Archeological Approach. *Tebiwa* 17:37-66.

Purdy, Barbara A. and H. K. Brooks

1971 Thermal Alteration of Silica Minerals: An Archaeological Approach. *Science* 173:322-325.

Raabe, L. Mark , Robert F. Cande and David W. Stahl

1980 Debitage Graphs and Archaic Settlement Patterns in the Arkansas Ozarks. *Midcontinental Journal of Archeology* 4:167-182.

Reid, Kenneth C.

1976 Prehistoric Trade in the Lower Missouri Valley: An Analysis of Middle Woodland Bladelets. In *Hopewellian Archeology in the Lower Missouri Valley*, edited by A. E. Johnson, pp. 63-99. Publications in Anthropology 8. University of Kansas Lawrence.

Rick, John Winfield

1978 *Heat-Altered Cherts of the Lower Illinois Valley: An Experimental Study in Prehistoric Technology*. Prehistoric Records 2. Northwestern University Archeological Program, Evanston.

Robinson, Brian S., Jennifer C. Ort, William A. Eldridge, Adrian L. Burke and Bertrand G. Pelletier

2009 Paleoindian Aggregation and Social Context at Bull Brook. *Amerian Antiquity* 74:423-447.

Shott, Michael J.

1994 Size and Form in the Analysis of Flake Debris: Review and Recent Approaches. *Journal of Archaeological Method and Theory* 1:69-110.

Shott, Michael and Paul Sillitoe

2005 Use life and curation in New Guinea experimental used flakes. *Journal of Archaeological Science* 32:653-663.

Sterner, Katherine

2011 Oneota Lithics: A Use-Wear Analysis of the Crescent Bay Hunt Club Assemblage from the 2004 Excavations. Master's thesis, Department of Anthropology, University of Wisconsin-Milwaukee, Milwuakee.

Winkler, Daniel M.

2011 Plainview Lithic Technology and the Late Paleoindian Social Organization in the Western Great Lakes Anthropology. Ph.D. dissertation, Department of Anthropology, University of Wisconsin-Milwaukee, Milwuakee.

Winkler, Daniel M., Robert J. Jeske and Dustin Blodgett

2009 *A Guide to Lithic Materials Location and Identification of Wisconsin and Adjacent Regions*. Paper available through authors.

Yerkes, Richard W.

2003 Using Lithic Artifacts to Study Craft Specialization in Ancient Societies: The Hopewell Case. In *Written in Stone: The Multiple Dimensions of Lithic Analysis*, edited by P. N. Kardulias and R. W. Yerkes, pp. 17-34. Lexington Books, Lanham, MD.

2009 Microwear Analysis of Chipped Stone Artifacts from the Excavations. *MidContinental Journal of Archaeology* 34(1):297-329.

Young, Donald and Douglas B Bamforth

1990 On the macroscopic identification of used flakes. *American Antiquity*: 403-409.